

Technical Memorandum:

Dover High School Sports Complex: A Review and Recommendations on the Reconstruction of the Dover High School Athletics Complex

Community Services Department: Engineering Division

Date: June 11, 2025

As Dover's City Engineer, it is with a deep sense of commitment to our community's well-being that I present this technical memorandum regarding the proposed Dover High School Sports Complex Renovation and Reconstruction. My role with the city is to offer informed and balanced recommendations to our city staff, City Council, City Manager, Joint Building Committee (JBC), and School Board, always with the long-term interests of our residents and vital infrastructure at heart.

This document aims to provide an engineering review of the proposed reconstruction of the Dover High School athletics complex, building upon the work and findings of the Joint Building Committee who prepared their final report titled *"REPORT AND RECOMMENDATION of the DHS Athletics Complex Joint Building Committee"* dated May 21, 2025 (JBC Report). It is undeniable that these athletic facilities have a profound impact on the students, athletes, families, and our community at large and thus I feel obligated to supplement the findings of the JBC Report with additional insights from various documents in support of athletic surfaces that were not ultimately recommended by the JBC. Some of the documents researched and referenced in the preparation of this memorandum including, "Five Ways to Successfully Manage Natural Grass Year-After-Year" by J. Michael Goatley, Ph.D., and the "Artificial Turf: Natural Grass Benefits" fact sheet, identify the means by which a natural grass playing surface can be more beneficial and ultimately offer a superior playing surface than that of a synthetic turf.

My objective with this analysis is to provide the reader with my professional recommendations for a pragmatic approach that thoughtfully balances our city's aspirations for ideal playing surfaces with the pressing demands of our growing community, ensuring the long-term sustainability and vibrancy of our athletic spaces for generations to come.

I. A Complex History

The athletic facilities at Dover High School, specifically Dunaway Field and the adjacent baseball field, were originally constructed and opened in 1967. These facilities have served the Dover community for over 58 years. However, their age is now profoundly evident, marked by significant deterioration and an inability to meet contemporary demands. Since their inception, the landscape of athletic participation in Dover has dramatically shifted. The introduction of girls' sports alone has doubled the number of young athletes, and new programs, such as soccer in the 1970s and lacrosse subsequently, have further intensified field usage. The construction of the Middle School next door, notably without its own dedicated athletic fields, has placed additional strain on the DHS complex. Concurrently, Dover's population has surged from approximately 21,000 residents in 1970 to 33,000 today, and Dover High School's enrollment has increased from around 1,000 to 1,400 students (ref. 1, p. 2).

A critical juncture occurred a decade ago during the demolition of the original 1967 high school and the construction of the new facility. The construction of a new high school unfortunately resulted in a net loss of fields for the school department that would have otherwise provided the ability to reduce stress on

Dunaway Field. It is noted that the rebuilding of Dunaway Field and its track (with a synthetic infield) was initially envisioned as part of that comprehensive new high school project, but it was omitted due to lack of adequate funding. The deferral of this project has, like with many infrastructure project deferrals, exacerbated the existing deficiencies, leading to the current critical state of the complex where facilities are widely regarded as among the worst for Division I schools in New Hampshire (ref. 1, p. 2).

II. Existing Conditions: A Challenge to Safety, Accessibility, and Maintenance

The current state of the Dover High School sports complex presents a formidable challenge across multiple fronts, rendering it largely non-ADA compliant, unsafe for athletes and spectators, and exceptionally difficult to maintain effectively by current field maintenance staff.

A. Dunaway Field:

Dunaway Field, is the primary competition venue for the school with its large grandstands and lighting, is severely underutilized due to its poor condition. It currently accommodates competitive events for fewer than a dozen times annually, primarily for home football games as well as senior nights for soccer and lacrosse (ref. 1, p. 5).

- **Drainage System:** The underlying drainage system on Dunaway Field appears to have failed which results in standing water during and after rain events. This renders the field unplayable due to an increased risk of injury and further damage to the facility.
- **Surface Integrity:** Uneven surfaces and chronic bare patches are prevalent throughout the field which results in an increased risk of injury.
- **Maintenance Challenges:** Despite annual summer closures dedicated to grass regrowth, any success achieved is typically fleeting, often undone by mid-season. This cycle of deterioration and temporary remediation highlights the inadequacy of current maintenance capacity for a natural grass field under such heavy demand. Student athletes have consistently express concerns about sustaining serious injuries due to the field's surface inconsistencies (ref. 1, p. 5).

B. Running Track:

The running track, which received an all-weather rubberized surface over an asphalt base in 2002, is now 23 years old. This exceeds the recommended operational lifespan of 10-12 years for resurfacing.

- **Deterioration and Safety:** The rubberized surface has extensively peeled or worn down to the underlying asphalt in numerous areas. Decades of freezing and thawing cycles characteristic of typical New England winters have left the school's track uneven and hazardous.
- **Functional Impairment:** The severe degradation of the track has rendered it unusable for hosting meets for several years, and recently, it has even been closed for middle school competitions, underscoring its compromised state (ref. 1, p. 5).

C. Additional Problem Areas:

Beyond the primary playing surfaces, the complex suffers from a range of deficiencies impacting its overall functionality, accessibility, and safety:

- **Accessibility and Safety Deficiencies:**
 - **Grandstands:** The grandstands adjacent to the running track and provide seating for events at Dunaway Field are not compliant with the Americans with Disabilities Act (ADA). The failure to comply with this federal law was highlighted by a \$75,000 judgment against the school district following an accident in 2021.
 - **Accessible Pathways:** There are no designated or accessible pathways to the visitor grandstands.
 - **Press Box:** There is a hole in the floor of the existing press box which poses a structural and ongoing safety risk.
 - **Accessible Parking:** Accessible parking for Dunaway field is unavailable, with only temporary dirt parking available. Furthermore, the site's only accessible parking is located adjacent to the existing baseball field in range of errant foul balls presenting opportunities for damage to disabled spectator's vehicles.
 - **Obstacles and Hazards:** Due to the proximity of the two fields to one another there is a persistent concern with foul balls from the baseball field landing on the Dunaway grandstand or track while those facilities are in use (ref. 1, p. 5).
- **Outdated Infrastructure:**
 - **Lighting System:** The facility's lighting system, dating back to the 1980s, is highly inefficient compared to modern LED technologies. One particularly dangerous design flaw is the presence of a light tower situated within the baseball field's third base side foul territory.
 - **Scoreboard:** The Dunaway scoreboard is obsolete, with replacement lightbulbs no longer being manufactured.
- **Inadequate Storage and Maintenance Facilities:** The athletic complex relies heavily on multiple dilapidated sheds and Conex boxes for storage, which are prone to rodent infestations. This has led to the destruction of valuable equipment, such as high jump pits, necessitating costly replacements. The district's main maintenance building, a relic from the 1960s high school construction, is significantly undersized for serving five district schools, lacks adequate heating and ventilation, and features an appalling bathroom, underscoring a broader infrastructural deficit (ref. 1, p. 5).

III. Findings and Recommendations

The Joint Building Committee's comprehensive review established a broad community consensus regarding the urgent need for renovating the Dover High School athletics facility. The JBC Report correctly notes that further delays will only escalate costs and deepen the deterioration of these vital community assets. The Dover School Board, in its January 6, 2025, resolution, supported the project while prudently emphasizing the need to ensure fiscal responsibility and avoid adverse impacts on core educational funding. The Board also acknowledged that the proposed project would necessitate a 20% increase in the district's current debt service (ref. 1, p. 7).

The JBC meticulously evaluated two primary scopes of work:

- **Base Option A ("Just Dunaway"):** This option focuses solely on the replacement of Dunaway Field and the track, with an estimated cost of \$11,614,000 (ref. 1, p. 8).
- **Base Option B (Dunaway + Multi-Sport Baseball Field + Facilities Building):** This comprehensive renovation encompasses all elements of Base Option A, along with the renovation of the baseball field and the replacement of the maintenance building, estimated at \$20,037,000 (ref. 1, p. 8).



A. JBC Recommendation and City Engineer's Endorsement:

The JBC strongly recommends proceeding with the **full scope of work outlined in Base Option B**, which includes a new baseball/multi-sport field and the conversion of both fields to synthetic turf (ref. 1, p. 9). As City Engineer, I concur with the JBC's recommendation for Base Option B as the most comprehensive and ultimately cost-effective long-term solution for the City of Dover. While the initial investment is substantial, the scope of work addresses critical safety, accessibility, and capacity issues that have been unaddressed for decades.

B. The Strategic Imperative for Synthetic Turf: Balancing Idealism with Reality

From an engineering and environmental perspective, my preference for playing surfaces, whenever feasible, would-be natural grass. Natural grass fields offer numerous inherent benefits: they act as natural filtration systems for rainwater, absorb carbon dioxide, provide a cooling effect through evapotranspiration, and contribute to ecological balance (ref. 5, p. 1). However, the extreme high demand for hours of play on the City and school's sports fields far outweighs the number of fields the City and school currently maintain and the capacity of natural grass to withstand such intensive use without significant degradation.

The challenge of maintaining high-performance natural grass playing surfaces that can withstand the constant demands of athletes, musicians (e.g., marching band), and other student organizations (e.g., color guard) is immense. J. Michael Goatley, Ph.D., in "Five Ways to Successfully Manage Natural Grass Year-After-Year," emphasizes that a successful natural grass playing surface ideally requires a dedicated "Sports Field Manager" for each field to make, and implement, consistent decisions for safe, quality surfaces (ref. 2, p. 1). Such a role, with its associated resources, is often beyond the budgetary and operational capacity for every field in a municipal and school district setting.

Goatley further outlines critical management strategies for natural grass, including:

1. **Sport-Specific Requirements:** Each sport dictates specific turfgrass and soil conditions, such as grass cutting height and field crown, necessitating specialized equipment and frequent mowing for lower, faster playing surfaces (ref. 2, p. 1).
2. **Adaptive Management:** Adjusting strategies based on players, use, and weather is crucial. Excessive use, especially in high-traffic zones, leads to worn areas that collect water during rain or become hard and compacted during drought. Continuous play on stressed fields can cause irreversible damage (ref. 2, p. 1).
3. **Climate Adaptation:** Climate profoundly affects grass selection, maintenance activities, irrigation needs, and scheduling. Cool-season grasses, typical for New Hampshire, have specific growing seasons and vulnerabilities (ref. 2, p. 2).
4. **Soil Conditions:** Regular chemical testing of soil to determine pH and nutrient levels is essential for applying correct nutrients and implementing practices like irrigation, fertilization, aerification, and topdressing to achieve optimal growing conditions (ref. 2, p. 2).
5. **Equipment Needs:** Beyond basic mowers, successful natural grass management requires access to soil aeration equipment, spreaders, sprayers, and various hand tools, often necessitating significant budget allocation for purchase or contracting services (ref. 2, p. 2).

The current reality in Dover is that, while Dover does invest some money in the maintenance of its current athletic facilities, its natural grass fields, including Dunaway, consistently exhibit drainage failures, uneven

surfaces, and chronic bald patches, demonstrating that they cannot withstand the existing demand of the growing city (ref. 1, p. 5). The JBC found that high-quality natural grass fields at public high schools in the region are rarely used more than a handful of times a year, often being "roped off" and requiring separate practice fields (ref. 1, p. 21). This starkly contrasts with the need for multi-sport, high-frequency use at Dover High School.

Therefore, while natural grass is preferred, the practical limitations imposed by usage demands and maintenance resources make it unsustainable for all primary competition fields. This is where the strategic inclusion of synthetic turf becomes not just an option, but a necessity for the overall health and capacity of our athletic infrastructure.

C. Rationale for Synthetic Turf:

The JBC's unanimous recommendation for converting only two (2) fields at the High School's property fields to synthetic turf is supported by several factors, which I fully endorse as a pragmatic solution for Dover:

- **Utility and Usage Capacity:**
 - **Playable Hours:** Synthetic turf offers significantly more playable hours than natural grass. Dunaway Field with synthetic turf is projected to yield at least 3.5 times as many uses as grass, and the second multi-sport field would add another 302 potential uses. Combined, two synthetic fields could create at least 766 annual use opportunities, which is 5.8 times more field uses than one grass Dunaway Field could provide, if not more (ref. 1, p. 20).
 - **Resilience:** Synthetic fields are far more resilient to heavy use, allowing for use earlier and later in the year, what some may refer to as the "shoulder seasons". Not only are synthetic turf surfaces more resilient to use, they are resilient to adverse weather allowing use immediately after heavy rainfall and during steady light rains, reducing cancellations and maintaining program schedules (ref. 1, p. 20). The University of New Hampshire (UNH), for instance, uses artificial turf due to the difficulty of maintaining natural grass during playing seasons and for multi-use purposes, enabling up to three practices a day plus games (ref. 9, p. 1). This example of increased capacity is vital for accommodating the diverse needs of high school athletics, youth programs, and community groups.
- **Financial Prudence (Long-Term):** While the initial installation cost of synthetic turf is higher than sod (e.g., marginal costs of \$400,000 for Dunaway and \$585,000 for the baseball/multi-sport field), the JBC concluded that these savings disappear over the 10–15-year lifespan of a turf field due to lower annual maintenance and operating costs (ref. 1, p. 22-23). Synthetic fields eliminate the need for mowing, fertilization, aeration, weed control, irrigation, and in most cases, line striping. The JBC estimates annual synthetic field maintenance costs at approximately \$24,700 for two fields, compared to an estimated \$81,000 for two natural grass fields requiring significant investment to maintain quality (ref. 1, p. 23). The cost-per-use for synthetic turf is significantly lower, estimated at less than one-third of natural grass (\$208 vs. \$668 per use for Dunaway) (ref. 1, p. 23). This long-term financial perspective is critical for responsible infrastructure planning.
- **Consistency and Safety:** Synthetic turf fields provide a consistent playing surface throughout the season, which can reduce the risk of certain types of injuries associated with uneven or degraded natural grass, such as rolled ankles from craters and divots (ref. 1, p. 19; ref. 3, p. 1). While some studies suggest turf can be more slippery, potentially increasing ACL tears, modern turf has evolved to mitigate these risks. UNH even considers the migration to artificial turf to have been a net positive for reduction in the likelihood of concussions (ref. 9, p. 1).

- **Reduced Risk of Failure:** The risk that a natural grass field, even after significant investment, would likely fail within a few years and revert to its current poor-quality state is high given the intense usage demands and budgetary constraints that the city faces. Converting two fields to synthetic turf significantly mitigates this risk, ensuring two durable, high-quality playing surfaces that could allow the remaining natural grass fields the much-needed rest they required to recover (ref. 1, p. 19).
- **PFAS:** The JBC acknowledges community concerns regarding PFAS in synthetic turf especially given its proximity to the Pudding Hill aquifer that was recently taken offline due to PFAS contamination. However, manufacturers of synthetic products like AstroTurf and Shaw Sports Turf can, and have, provided certifications to clients that their products are made without PFAS inputs, and third-party testing has also confirmed concentrations are below detectable limits (ref. 11, p. 1-2). Preliminary risk evaluations, conducted by the firm TRC and summarized in their Technical Memorandum evaluating PFAS in synthetic turf, in other communities have found trace detections in the various turf components (carpet, infill, shock pad) do not represent a significant human health risk to users (ref. 08, p. 1-7).

In addition, a study conducted by UNH with support from the City of Dover and GZA Environmental in 2023 collected samples of rainwater, drinking water sources, and surface waters (streams, brooks, etc.) and tested them for PFAS. The purpose of the UNH study was to determine the background levels of PFAS that currently exist from various sources across the City of Dover. The main observations from this analysis process were:

1. The precipitation falling on Dover contains low levels of PFAS,
 2. The composition of the wastewater samples differs from the composition of the surface water samples, and
 3. All six of the PFAS that the EPA is proposing MCLs for were detected in the surface water samples.
- **Environmental Considerations:** Dover's athletic complex project will be subject to City and State environmental permitting, including stormwater management, ensuring compliance with discharge regulations (ref. 1, p. 24). While natural grass offers environmental benefits like carbon sequestration and cooling, it also requires significant water and often emission-emitting maintenance equipment (ref. 3, p. 1). The JBC is confident that future recycling technologies will mature, allowing for sustainable end-of-life solutions for synthetic turf (ref. 1, p. 24).

D. The Role of One Synthetic Field in Supporting Natural Grass Areas:

The strategic implementation of at least one (1) synthetic turf field (Dunaway Field) within the DHS athletic complex, alongside a renovated multi-sport baseball field that could be either synthetic or natural grass (though synthetic is recommended for maximum utility), offers the City and School the ability to provide much-needed rest to other City grass recreation areas. By absorbing the high-intensity, high-frequency usage that currently overburdens all available fields, the synthetic Dunaway Field would become the primary venue for demanding sports and events, allowing other natural grass fields across the city and school district to be properly managed, rotated, maintained, and most importantly rested.

This approach aligns with best practices for natural grass management, which emphasize the importance of managing field use and rotation to prevent excessive wear and irreversible damage (ref. 2, p. 1). With a dedicated synthetic field handling the bulk of the athletic load, the school department and the City's ground crews could refocus their efforts and limited resources on optimizing the health and playability of

natural grass fields, potentially extending their lifespan and improving their safety. This creates a more sustainable overall athletic field ecosystem for Dover.

E. Key Components of Recommended Base Option B:

Base Option B includes all elements of Base Option A, plus the following significant additions:

- **Baseball Field:** Full replacement, rotating the field nearly 180 degrees for improved solar alignment. The outfield will be expanded to create a second multi-sport field, allowing for two 60-foot softball or youth baseball fields, and will feature synthetic turf, including the infield (ref. 1, p. 11).
- **Lights (Baseball):** New addition of six 90-100-foot-tall towers, with the right field tower shared with Dunaway. These will be no-spill LED lights providing 50 footcandles for the infield and 30 footcandles for the outfield (ref. 1, p. 11).
- **Maintenance Building:** Full replacement, relocated to be more setback from the road, providing a larger, modern space (5,400 square feet plus outdoor storage) (ref. 1, p. 11). This is a critical investment for the entire School District's maintenance operations, irrespective of the athletics project (ref. 1, p. 18).
- **Parking:** A new 25-car, ADA-compliant parking area and a pick-up/drop-off area (ref. 1, p. 11).

F. Recommendation for Shifting Dunaway Field:

While I strongly support the JBC's recommendation to reconstruct both Dunaway Field and the baseball field, I firmly believe there is a more optimal design that avoids the proposed rotation and shifting of Dunaway Field and its accompanying track. The JBC's suggested shift involves moving Dunaway closer to the tree line and encroaching upon the Bellamy River, utilizing space currently occupied by the visitor grandstand. This rotation, while intended to create space for expanding the baseball field into a second multi-sport field and improving solar alignment, incurs a significant marginal cost of \$849,000 due to the necessity of a new retaining wall. The JBC argues that not moving Dunaway from its current configuration would permanently hinder the school's ability to expand the baseball/multi-sport field in the future, thus limiting flexibility and capacity (ref. 1, p. 15).

However, I propose an alternative design that was suggested to the design engineer of record, Tighe & Bond, during an informal Technical Review Committee (TRC) meeting in March of 2025: a complete swap of the baseball field and Dunaway Field. This configuration addresses several critical concerns outlined in my attached comments (refer to "Dover Athletic Complex Questions/Comments," Section 3, "Field configurations"). Swapping the fields could mitigate issues such as foul balls entering Bellamy Road, alleviate multi-purpose field constraints along Bellamy, and reduce impacts on the natural buffer. Furthermore, it offers better access to restrooms and concessions for all sports, with the baseball viewing area adjacent to the home team bleachers, and presents a better possibility for shared lighting between the complexes due to closer proximity of the fields.

This alternative design, which does not appear to have been fully considered in the iterations provided to date, also offers potential cost savings by reducing unnecessary sewer rework and potentially avoiding state permitting if no new structures are added and sewer laterals remain under 300 feet (refer to Section 5, "Utilities"). Moreover, the outfield dimensions for baseball are inherently more flexible than those for football, soccer, and other field sports, which could further help reduce state shoreland buffer impacts and shorten permitting timelines (refer to Section 3c). I recommend that the JBC, School Board, and

Council actively seek and evaluate a design incorporating this field swap to achieve the desired athletic complex improvements more efficiently and effectively.

G. Additional Recommendations for the School District:

The JBC's additional recommendations for the School District are crucial for the long-term financial health and operational efficiency of the new complex, and I fully endorse them:

- **Capital Reserve Account:** Establish a new capital reserve account specifically for future field resurfacing. This proactive financial planning is essential given the predictable lifespan of synthetic turf surfaces (ref. 1 ref. 2, p., p. 9, 30).
- **Rental Income Allocation:** Consider allocating any net rental income from the facilities to these capital reserves. This would create a self-sustaining funding mechanism for future maintenance and replacement (ref. 1, p. 9, 32).
- **External Maintenance Contract:** Secure a new, external maintenance contract for the synthetic fields. While synthetic fields require less intensive daily maintenance than natural grass, specialized care is still necessary to extend their playable lifespan (ref. 1, p. 9, 29). As noted previously in this memorandum, it is anticipated that the maintenance personnel currently employed by the school department would be able to reallocated their labor and resources to ensure proper maintenance of the remaining grass fields.
- **Heat and Humidity Safety Protocols:** Review and revise existing heat and humidity safety protocols as needed, to account for differences between synthetic and natural grass fields. This is a critical safety measure given the higher surface temperatures synthetic turf can reach (ref. 1, p. 9; ref. 7, p. 5-8).

IV. Conclusion

The reconstruction of the Dover High School athletics complex is not merely an upgrade; it is a critical investment in the safety, accessibility, and future capacity of our community's athletic and recreational infrastructure. While my professional preference leans towards natural grass for its inherent environmental benefits, the practical realities of Dover's burgeoning population, increased athletic participation, and limited field availability necessitate a strategic and balanced approach. The extreme demand for playing hours on our existing fields far exceeds their capacity to be maintained as high-performance natural grass surfaces.

The JBC's recommendation for Base Option B, incorporating a primary synthetic turf field and a versatile multi-sport baseball field, offers the most robust solution. This approach will not only provide state-of-the-art facilities for our student-athletes and community but, crucially, will also alleviate the immense pressure on our other natural grass recreation areas. By having a high-capacity synthetic field to absorb the most intensive usage, we can provide the necessary rest and proper maintenance for our natural grass fields, ultimately enhancing the quality and longevity of all our athletic assets across the City. While I have my differences in what the most effective and efficient layout of the facility may be, a comprehensive reconstruction project, such as the one recommended by the JBC, represents a forward-thinking investment that will serve the Dover community for decades to come.

V. References

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3. City of Dover notes from Manchester, NH Parks, Recreation & Cemetery. (2025 May). *Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH: Manchester, NH Information*.
4. PJC Organics response to call with City of Dover. (2025, May 20). *Natural Grass Artificial Turf Workshop_PJC Organics Information*.
5. Safe, Healthy Playing Fields Coalition (2013, June 13). *Artificial Turf: Natural Grass Benefits*.
6. City of Dover notes from Southern New Hampshire University (SNHU). (2025 May). *Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH: SNHU Information*.
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8. TRC. (2022, June 7). *Technical Memorandum: Evaluation of PFAS in Synthetic Turf*.
9. City of Dover notes from UNH. (2025 May). *Artificial Turf versus Natural Grass Workshop_UNH*.
10. City of Dover notes from UNH. (2025 May). *Artificial Turf versus Natural Grass Workshop_UNH2*.
11. Various Manufacturers. (n.d.). *Manufacturers Letters Shaw and AstroTurf*.
12. UNH, GZA, City of Dover. (2023, May 17). *Citywide Background PFAS Sampling Program*.
13. Mavrogeorge email to Technical Review Committee. (2025, Feb 24). *2025.02.24_CE Comments*.

Appendices

REPORT AND RECOMMENDATION
of the
DHS Athletics Complex
Joint Building Committee

May 21, 2025



Committee Members

City Council

Fergus Cullen

Linnea Nemeth

School Board

Michelle Clancy

Craig Flynn

Community

Ernie Clark

Ronan O'Doherty

Consultants

Joe Persechino, Tighe & Bond

Neil Hansen, Tighe & Bond

Preston Hunter, Eckman Construction

INTRODUCTION

Dover High School's Dunaway Field and baseball field opened in 1967 are now 58 years old. They served the community well, but are showing their age. Drainage systems failed. Decades of freezing and thawing left surfaces uneven. There are chronic bald patches. Athletes are concerned they will suffer serious injuries due to field surface inconsistencies.

Since the old high school was built in the 1960s, demand for playing time on the fields more than quadrupled. Girls' sports alone doubled the number of young people playing sports in Dover. We added programs – soccer in the 1970s and later, lacrosse. We built the Middle School next door with no fields of its own. Community youth sports boomed. Dover's population grew from 21,000 in 1970 to 33,000 today. Dover High School enrollment increased from about a thousand to 1,400 students.

Among Division I schools in New Hampshire, Dover High's fields are widely regarded as the worst. Dunaway barely holds up for five home football games a year. The track has deteriorated to the point it cannot be used for meets. The baseball dugouts are exposed. Foul balls often land on the Dunaway grandstand or the track while it is in use.

When Dover demolished the 1967 high school a decade ago and built the new one from the ground up, rebuilding Dunaway and the track (with a synthetic infield) was included in the scope of work. Unfortunately, the athletics component was ultimately cut because it was inadequately budgeted.

The need did not go away. Now it is time to revisit the project.



THAT WAS THEN, THIS IS NOW (Old & New DHS)

Construction of the new DHS resulted in a net loss of playing fields



GUIDING PRINCIPLES

1. No net loss of playing fields

The Dover High School campus is a finite, inflexible parcel, surrounded by a residential area and wetlands. Although we do not have enough playing fields, expansion is not an option. Alternative designs that would have resulted in a net loss of playing fields – such as moving the track across Bellamy Road – were eliminated. Our recommended approach creates a new multi-sport field.

2. Field ready for play Fall of ~~2025~~ 2026

This project is overdue. Every year of delay equates to higher costs and further deteriorating facilities for our athletes. When the committee formed in January 2024, we aimed to build in 2025. Now we hope to complete the project in 2026.

3. Green field approach

We looked at the entire 11-acre parcel behind the school as though it were a new, undeveloped site. We optimized the space without being influenced by the existing layout.

4. Do it right

A community has few chances to build an athletics complex, maybe two times in a century. It should have no regrets about the choices made and the final result.

5. Broad consensus – not unanimity

A project like this has many stakeholders – athletes, coaches, parents, taxpayers, school administrators, elected officials, and other members of our community. We sought to hear all voices while recognizing unanimity is not realistic. Our recommendations reflect compromise and a balance of competing priorities.

6. Users First

While we listened to all feedback, more weight was given to the voices of those who use our athletics facilities: players, coaches, parents, and administrators.

EXISTING CONDITIONS

Dunaway Field, with its grandstands and lights, should be the main competition field and the center of our athletics programming. In reality, field conditions allow Dunaway to be used for competition fewer than a dozen times a year – home football games and senior nights for soccer and lacrosse.

- The field often has standing water during and after rain.
- The center of the field has many chronic bare areas.
- Every year the field is closed for the summer to regrow grass for the fall; any success is generally temporary and undone by mid-season.

The track was renovated in 2002 with an all-weather rubberized surface over an asphalt base. Rubber tracks require resurfacing every 10-12 years.

- The track has not been resurfaced in 23 years. Rubber has peeled up or worn down to asphalt in many areas.
- Years of freezing and thawing have left the track uneven in places.
- Dover High has not been able to host meets for several years due to the condition of the track. This year, the track has been closed for middle school meets as well.

Additional problem areas

- Grandstands are not ADA-compliant.
 - An accident in 2021 resulted in a \$75,000 judgement against the district
- There is no pathway to the visitor grandstand.
- The press box has a hole in the floor.
- No dedicated handicapped parking at the field, just temporary parking on dirt.
- Lights date back to the 1980s. Modern systems are far more energy efficient.
- There is a light tower in baseball's left field, in the field of play.
- Replacement lightbulbs are no longer made for the Dunaway scoreboard.
- Multiple dilapidated sheds and Conex boxes are used for storage.
 - Rodents destroyed high jump pits, requiring the purchase of replacements.
- The district maintenance building dates to 1967.
 - It is significantly undersized for serving the district's five schools,
 - has inadequate heating and ventilation, and
 - a dilapidated bathroom.

Dunaway Field



Mid-season (fall 2024)



Spring

Track



Current Conditions

JAN. 6, 2025 SCHOOL BOARD RESOLUTION

On January 6, 2025, the Dover School Board adopted a constructive resolution identifying its questions, priorities, and guidance. The JBC took this resolution to heart and has attempted to respond to each topic identified by the board in this report

RESOLUTION

RE: THE DOVER SCHOOL BOARD RECOMMENDATION TO CITY COUNCIL ON THE FUNDING OF THE JOINT BUILDING COMMITTEE ATHLETIC COMPLEX PROJECT

- WHEREAS: the City Council has requested the Dover School Board provide a recommendation regarding the funding of the Joint Building Committee (JBC) Athletic Complex project; and
- WHEREAS: the School Board is supportive of the Athletic Complex project and acknowledges its potential benefits to the community and student athletes, but seeks to ensure the project is undertaken in the best interest of the community and in a manner that does not adversely impact the funding for core educational needs; and
- WHEREAS: the School Board recognizes the recommended project would require a twenty percent (20%) increase in the district's current debt service, and should receive careful consideration and thorough analysis to maintain fiscal responsibility and support for the district's primary educational mission;

NOW, THEREFORE, BE IT RESOLVED THAT:

The School Board recommends deferring a final funding decision for the JBC Athletic Complex project until the Fiscal Year 2026 budget is settled and approved, at which time a line item for the new debt will be included in the school budget.

BE IT FURTHER RESOLVED THAT:

The School Board requests the JBC to continue its efforts during this additional time to address the following outstanding questions and considerations:

- Continue to explore the true needs of the community and the athletic complex, prioritizing safety, accessibility, and the replacement of the bleachers and track.
- Continue to examine options for a phased construction approach or alternative, less expensive options.
- Review scientific data and sources to evaluate the safety of synthetic turf versus natural grass, considering environmental impacts, watershed implications, and the future recycling or disposal of synthetic turf materials.
- Investigate scientific data on sports-related injuries associated with synthetic turf versus natural grass.
- Confirm the actual projected rental revenue to be earned from additional field space.
- Confirm and project the maintenance and replacement costs for the fields at 10-year, 20-year, and 30-year intervals.
- Explore establishing a sub-committee of community volunteers to consider fundraising opportunities to offset project costs, including grant funding, community fundraising, and/or sponsorships.

BE IT FINALLY RESOLVED THAT:

The School Board remains committed to supporting projects that enhance the district's athletic facilities and overall student experience while ensuring prudent financial management and the prioritization of educational needs.

BASE OPTIONS

The committee believes there is consensus in the community that renovating the athletics facility at Dover High School is needed and cannot be put off any longer.

The committee narrowed choices down to two scopes of work: Limiting the project to Dunaway Field and the track, or broadening it to include the baseball field.

Base Option A

Replaces the existing Dunaway Field, track, grandstands, lights, and concessions shacks. It does little more than replace what is there now.

Cost: \$11,614,000

Base Option B

Includes everything in Base Option A plus renovating the baseball field, expanding the outfield to create a new multi-sport field. Expanding the baseball field in this manner will require the demolition and replacement of the maintenance building.

Cost: \$20,037,000

Alternatives

Each Base Option offers choices that increase or decrease the scope of work and cost. The main alternatives are:

1. Shift Dunaway Field to allow for the rotation and expansion of the baseball field, which would create the second, multi-sport field.
2. Use of synthetic turf or natural grass for playing field surfaces.

RECOMMENDATION

The JBC recommends the full scope of work contained in Base Option B, including the new baseball / multi-sport field and the conversion of both fields to synthetic turf.

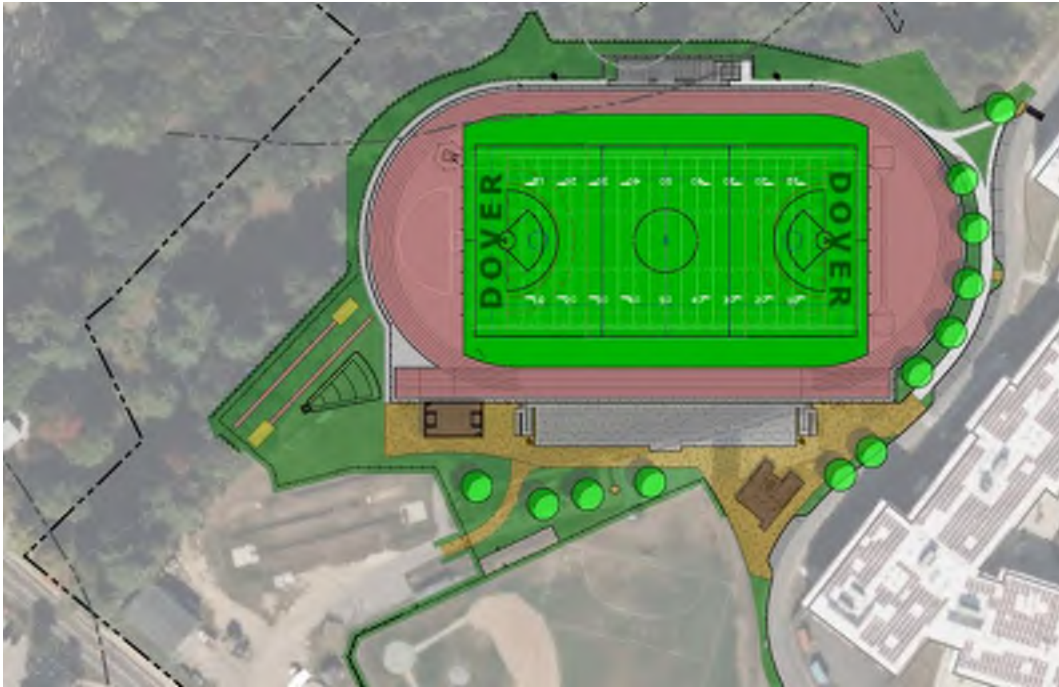
The JBC further recommends the School District:

- Create a new capital reserve account for the purpose of saving for eventual field resurfacing
- Consider earmarking any net rental income for capital reserves
- Enter a new, outside maintenance contract for synthetic fields
- Review its existing heat and humidity safety protocols and revise them, if needed, to reflect differences between synthetic and natural grass fields



Feehan High School in Attleboro, Massachusetts is comparable to the JBC's recommended scope of work. It has a main stadium field, and a multi-sport field within its baseball field. Both fields have synthetic turf with lights.

BASE OPTION A: “Just Dunaway” (\$11,614,000)



Includes:

- Dunaway Field: Full replacement
 - Widens, shifts, and pivots the field, moving it slightly toward the tree line
 - Rebuilds from the bottom up: all new drainage, all new subgrade materials
 - Lined for soccer, lacrosse, field hockey, and football
 - Converts the playing surface to synthetic turf with a shock pad
- Running Track: Full replacement
 - Six-lane oval with an eight-lane straight
 - Rubberized, all-weather surface over asphalt base
 - Field events spaces for the jumps, throws, and pole vault
- Lights: Full replacement
 - Four, 80-100 foot tall towers (two towers on each long side of the field)
 - No-spill LED lights, 50 footcandles of light.
- Grandstands and Press Box: Full replacement
 - Home: ADA-compliant 1,884 seats (current: about 2,100)
 - Visitor: ADA-compliant 500 seats (current: about 1,700)
- Concessions building: Full replacement
 - Includes ADA-compliant bathrooms
- Athletics equipment storage: New structure replaces sheds and Conex boxes

BASE OPTION B: Dunaway + Multi-Sport Baseball Field + Facilities Building (\$20,037,000)



Includes everything in Base Option A, plus:

- **Baseball Field: Full replacement**
 - Rotates baseball field nearly 180 degrees for better solar alignment
 - Expands the outfield to create a second, multi-sport field
 - Allows two, 60-foot softball or youth baseball fields
 - Synthetic turf, including a synthetic infield
- **Lights: New addition**
 - Six, 90-100 foot tall towers (two on each foul line, two in the outfield)
 - Right field tower would be shared with Dunaway, with two clusters of lights
 - No-spill LED lights, 50 footcandles of light for the infield and 30 footcandles of light for the outfield
- **Maintenance building: Full replacement**
 - Relocates building so it is setback more from the road
 - Larger, modern space (5,400 square feet + outdoor storage)
- **New 25-car, ADA-compliant parking and a pick-up / drop-off area**

SUMMARY OF ALTERNATIVES

“JUST DUNAWAY FIELD”

BASE OPTION A: \$11,614,000

“Just Dunaway Field”

INCLUDED

- Synthetic Turf
- 6-Lane Track
- 8-Lane Straightaway

- Musco Lights
- 1,884-Seat Home Stands
- 500-Seat Visitor Stands

- Storage Building
- Concession and Restroom Building

ALT A1: Add \$1,924,000

“Renovate Baseball Field”

INCLUDED:

- New subgrade drainage
- Sod and Irrigation
- New backstop

- New infield fence
- Dugout pad
- Material allowance for dugouts

Excluded:

- Outfield fence
- Batting cages
- Seating
- Lights
- Dugouts

ALT A2: Deduct \$849,000

“Not Pivoting Dunaway Field”

- Would preclude baseball field reconfiguration and multisport use permanently
- Concessions / Restroom building is reduced to concessions only

ALT A3: Deduct \$400,000

“No Synthetic Turf on Dunaway”

Included

- Sod

- Drainage
- Irrigation

“Dunaway Field + Multiuse Baseball Field + Maintenance Building”

BASE OPTION B: \$20,037,000

“Dunaway Field + Multiuse Baseball Field + Maintenance Building”

INCLUDED

- Fully replaces and pivots Dunaway Field
- New reconfigured, synthetic turf multisport baseball field with lights
- New maintenance building and 25 space, ADA-compliant parking lot

ALT B1: Deduct \$2,407,000

“Maintenance Building & Parking Lot”

INCLUDED:

- 5,400sf Maintenance Building
- 25 Space ADA-compliant parking lot
- Material storage bays
- Gravel Pad for outdoor storage / future Pole Barn
- Dumpster enclosure and pad

6

ALT B2: Deduct \$585,000

“No Synthetic Turf on Multisport Baseball Field”

Included

- Sod
- Drainage
- Irrigation

ALT B3: Deduct \$320,000

“No Lighting on Multisport Baseball Field”

- Light tower foundations and conduit are included for future light towers

ALT B4: Deduct \$160,000

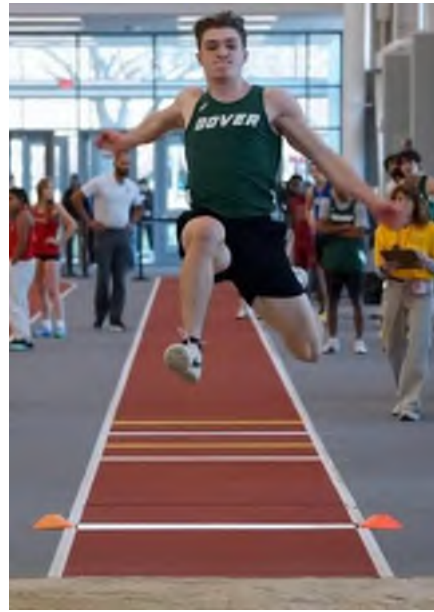
“No Lighting Infrastructure on Multisport Baseball Field”

- No light tower foundations or conduit included for future light towers
- Must also select ALT B3

7

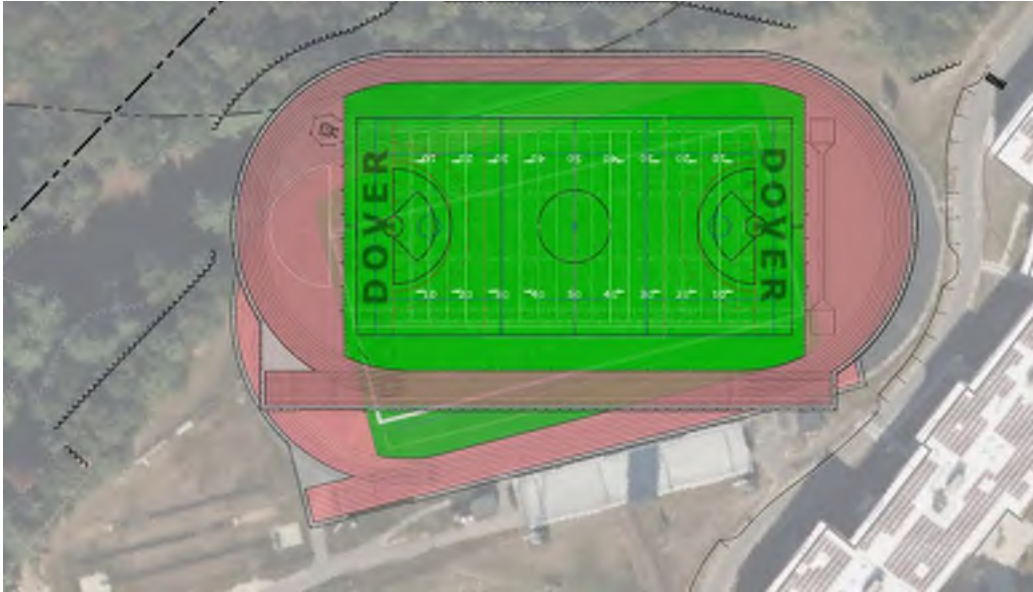
UNDERSTANDING KEY DECISION POINTS:

A CLOSER LOOK AT THE ALTERNATIVES



ALT A2: Shifting Dunaway Field

The first major decision point in the project is whether to shift and pivot the existing footprint of Dunaway Field and the track. This allows a full renovation of the baseball field to include a second multi-sport field, now or as part of a future Phase 2.



This image shows the shifted field overlaid on top of the non-shifted field and the existing field.

The shift is subtle, rotating and moving everything closer to the tree line, using space taken up by the existing visitor grandstand. This shift creates space to rotate and expand the baseball field and to create a second multi-sport field. It also improves the solar alignment on Dunaway, reducing the extent to which players have the sun in their eyes.

If we don't shift the field, the home straightaway will stay where it is now.

In both scenarios, the track would be widened to an IAAF-style track, allowing for a larger infield and a wider playing field for soccer. (Of the field sports, a soccer field has the biggest dimensions.)

Not shifting the field precludes the ability to rotate and expand the baseball / multi-sport field *forever*.

The marginal cost of the shift is \$849,000 which is driven by the need for a new retaining wall at the back edge of the property.

The JBC recommends shifting the location of Dunaway and the track to allow the rotation and expansion of the baseball field to create a new multi-sport field.

ALT A1: Renovating the Existing Baseball Field on its Existing Footprint

Alternative A1 presents a middle-ground option between Base Option 1 (Just Dunaway) and Base Option 2 (The Whole Project). It recognizes the need to improve the existing baseball field.

This alternative would renovate the existing baseball field on its current footprint and orientation. The field would be dug up to install new subgrade, drainage, and irrigation. It would be leveled and resurfaced with natural grass (sod) and a dirt infield.

Without expanding the baseball field, the outfield cannot be used for much more than baseball. If it can't be used for other sports, the main reason to use synthetic – more field uses – goes away. A renovated grass baseball field, even with much improved drainage, would still be vulnerable to rain-outs and soggy, unplayable conditions, especially in March and April, which is half the season.

The marginal cost of this option is \$1,075,000 or \$1,924,000. Why two prices? Because if the decision is made to leave the baseball field on its existing footprint, and thereby forever rule out the possibility of rotating and expanding the field to create the second multi-sport field, the \$849,000 to reposition Dunaway would not be necessary.

Pros: The school would get a renovated baseball field, and the cost is lower than Base Option B.

Cons: No additional multi-sport field; no additional 60-foot softball / youth baseball fields; the baseball field would continue to have poor solar orientation; and the field would continue to have limited useability early in the season and when wet.

The JBC does not recommend Alt A1. If it is worth renovating the baseball field, the field should be rotated and expanded to create a second multi-sport field. The marginal cost of doing it right is worth the value of getting a second multi-sport field.



Lack of basic safety screening in front of dugouts.

ALT B3 and B4:

Lighting the baseball / multi-sport field

If there is an “extra” in the recommended project, the choice of lighting the new baseball / multi-sport field is it.

Lighting a new baseball / multi-sport field involves six towers: two on each foul line, and two for the outfield / multi-sport field. One of the outfield towers (the one in right field) would be installed with the Dunaway portion of the project. This tower would have two light clusters – one directed at Dunaway, one directed at the baseball outfield.

There is a “middle ground” alternative when it comes to lighting the baseball / multi-sport field. That is to install the foundations and conduit (lighting infrastructure) at the time of construction, and install towers at a later date (and at a higher cost).

Alt B4: Install only infrastructure now: \$160,000

Alt B3: Install the towers now as well: \$320,000

Deciding to not light the field at all – don’t include Alt B4 or B3 – would thus save \$480,000.

The JBC recommends including both Alts B3 and B4. The marginal cost of doing the work now, as part of a of a larger project, is comparatively low while the marginal utility of doing the work is high. It allows evening games and many more field uses. Coming back to install lights at a later date as a separate project would have much higher costs.



Dover’s marching band and color guard also use Dunaway Field.

ALT B2: The Maintenance Building and ADA-Compliant Parking

Base Option B – the whole project – requires us to demolish and replace the existing facilities building. The footprint of the expanded baseball field would take up this space.

The existing facilities building serves the School District's five schools and is only peripherally related to athletics. It dates to the construction of the old high school in the 1960s and long ago ceased to be adequate to serve the School District's needs. It is unsightly, poorly heated and ventilated, lacking in storage space for equipment, and has an appalling bathroom. Many Conex boxes and sheds have grown up around the building over the years, like unwanted weeds, to supplement this building.

The cost of demolishing the existing structure, building a new one, and adding a 25-space parking lot is estimated at \$2,407,000 – about 12 percent of the total project. The JBC believes this number can be reduced somewhat through value engineering.

The proposed 25-space parking lot would serve several purposes. First, it would provide dedicated ADA-compliant parking which currently does not exist at Dunaway. Second, it would create a new pick-up / drop-off area for parents, making life easier and safer. The lot could be used for student parking and smaller events such as JV games or a Saturday morning youth baseball game.

The JBC observes replacing the facilities building is a project the School District probably needs to do, irrespective of the athletics project. This expense could be put off if the community limits the project to Base Option 1 ("Just Dunaway"), but the need for a new facilities building capital project does not go away.



ALT A3 and B2: Synthetic Turf or Natural Sod

The choice of playing surface involves weighing many competing factors. Among these are durability, cost, and environmental concerns.

The JBC unanimously recommends converting our fields to synthetic turf. This is the same conclusion the high school construction JBC reached a decade ago.

1. **Utility:** Synthetic offers far more uses than natural grass. We are a field-poor community in desperate need of more playable hours.
2. **Financially prudent:** While the initial installation cost of synthetic is somewhat higher than rolling out sod, when we factor in maintenance costs over the 10-15 year lifespan of a synthetic field, the cost of synthetic is not much higher than grass, and the cost per use is far lower.
3. **Safety:** Turf fields provide a consistent playing surface throughout the season, reducing the risk of injuries.
4. **Reduced risk of failure:** The risk that a natural grass field would fail within a few years, and leave us right back where we are today with poor quality fields we cannot maintain after spending all this money, is too high.

Most of the subgrade work is the same for installing either synthetic turf or sod. The three most important outcomes of this work are drainage, drainage, and drainage. The existing earth will be excavated to a depth of a couple feet. New materials, including crushed stone, will be spread. Synthetic turf will come with a foam shock pad.

Alt A3 reflects the marginal cost of installing synthetic at Dunaway (\$400,000).

Alt B2 reflects the marginal cost of synthetic at a larger baseball / multi-sport field (\$585,000). This would include turfing the baseball infield. Turfing the baseball field would also allow for two, 60-foot softball or youth baseball fields, which grass would not.

Thus, the marginal cost of turfing both fields is about \$1 million.

The JBC did not consider seeding grass instead of rolling out sod. While less expensive than sod, sod needs one growing season to take root while seeding would require three growing seasons (18 months) before use and comes with an increased risk of failure.

DURABILITY AND USAGE CONSIDERATIONS:

The decisive advantage of synthetic turf is durability and usage. **Synthetic on Dunaway yields 3.5 times as many uses as grass.** The second multi-sport field would add 302 more potential uses. Combined, two synthetic fields would create 766 annual use opportunities – 5.8 times more field uses than one grass Dunaway Field could provide.

Turf fields withstand unlimited use and rainy weather. Their superior drainage means they can be used earlier and later in the year, and immediately after even heavy rainfall. Fewer cancellations of practices and games mean more playing time for athletes and allows sports programs to maintain their schedules.

The chart below calculates the number of expected multi-sport field uses per year (excluding baseball uses) in **YELLOW**.

Field Uses Per Year			
		10-Year	
GRASS uses per year		Total	
March 18-June 9 (12 weeks), 1 use per day, 6 days per week	72		
August 19 - Nov 10 (12 weeks), 1 use per day, 6 days per week	72		
Additional night uses, annual (6 spring, 6 fall)	12		
Less one rainout per week on average, school seasons	-24		
Total uses:	132	1320	
SYNTHETIC uses per year		Dunaway	Baseball
Feb 26 - March 17 (3 weeks), 1 use per day, 6 days per week	18		
March 18-June 9 (12 weeks), 2 uses per day, 6 days per week	144		
June 10 - Aug 17 (10 weeks), 2 uses per day, 6 days per week	120		120
August 19 - Nov 10 (12 weeks), 2 uses per day, 6 days per week	144		144
Additional night uses (2 per week, school year)	48		48
Nov 11 - Nov 30, 1 use per day, 6 days per week	18		18
Less .5 rainouts per week on average, school seasons	-12		-12
Less heat index days (1 per week for 8 weeks (3 spring, 5 fall))	-16		-16
Total uses:	464	4640	302

Members of the JBC visited scores of grass fields in New Hampshire and nearby states. **We were unable to find a single example of a high-quality natural grass field at a public high school that is used more than a handful of times a year.** One example of a quality grass field is at Plymouth High School. The field is literally roped off and used for 4-6 home football games a year and nothing else. Plymouth football uses a separate field for practices.

Tellingly, **we could not find a single example of a community that installed synthetic turf at a public high school, then went back to natural grass.** Towns that have converted are happy with the results. Portsmouth and Durham are local communities that liked their first synthetic fields so much, they built a second one.



Oyster River liked the synthetic field they built at the high school in 2016 so much, they built a second one at the new middle school that opened in 2022.

COST CONSIDERATIONS

INITIAL INSTALLATION

Most of the cost of building a new field is underground; the field surface is a relatively small part of the overall cost.

Synthetic turf is somewhat more expensive to install than sod. As reflected in Alt A3 and Alt B2, the marginal costs of synthetic for Dunaway is \$400,000. For the baseball / multi-sport field, it's \$585,000.

	Dunaway			Baseball	
	Turf	Sod		Turf	Sod
Subgrade earth & site work	same	same		same	same
Installation cost	\$828,000	\$428,000		\$1,244,000	\$659,000



ANNUAL MAINTENANCE

The JBC concluded **the installation cost savings of sod disappear over the 10-15 year lifespan of a turf field thanks to lower annual maintenance and operating costs.** Turf fields require no mowing, fertilization, aeration, weed control, irrigation, or line striping.

The JBC believes converting to synthetic will keep district annual field maintenance costs about what they are now. Field maintenance costs are rolled into the district's contract with C&W Services; there is not a separate line item tracking this cost precisely. A good faith estimate supplied by C&W Services is that field maintenance costs are about \$27,000 a year. The JBC estimates field maintenance costs for synthetic will be about \$24,700. These calculations are shown below in **GREEN**.

However, if sod is selected, the district will need to spend significantly more than it does now to have even a chance of maintaining the grass. Tripling the current maintenance cost for grass brings the annual expense to \$81,000.

We estimate the true marginal cost of synthetic over 10 years with maintenance costs drops to about \$355,000 for both fields. For Dunaway alone, it drops to about \$85,000. See below in **YELLOW.**

The cost-per-use of synthetic is less than one-third of the cost-per-use of grass (\$668 vs \$208). This calculation is shown below in **BLUE**.

10-Year Cost Comparison - Synthetic vs Sod

	Synthetic			Sod	
	Dunaway	Baseball	SUBTOTALS	Dunaway	Baseball
Sub-grade earth / site work	same	same		same	same
Installation cost	\$828,000	\$1,244,000		\$428,000	\$659,000
Current annual maintenance ¹				\$13,500	\$13,500
Recommended additional maintenance ²				\$27,000	\$27,000
Continued maintenance costs ³	\$6,750	\$6,750			
New contracted maintenance ⁴	\$5,600	\$5,600			
Annual maintenance subtotal:	\$12,350	\$12,350	\$24,700	\$40,500	\$40,500
10-Year Maintenance w/2.5% increase	\$138,362	\$138,362		\$453,737	\$453,737
10-year install & maintenance:	\$966,362	\$1,382,362		\$881,737	\$1,112,737
Marginal cost:	\$84,625	\$269,625	\$354,250		
Cost per use (464 vs 132 annual)	\$208	\$298		\$668	\$843
¹ : Split current costs evenly across both fields ² : Current maintenance inadequate. Recommend tripling investment, from \$27,000 to \$81,000, if grass is used. ³ : Acknowledges school maintenance costs don't go to zero. This reduces current costs in half ⁴ : Bases on initial price quote from one vendor					

ENVIRONMENTAL / SUSTAINABILITY CONSIDERATIONS

Opponents of synthetic turf have raised environmental concerns about PFAS, discharges from runoff, and end-of-life disposal, among other objections.

The JBC observes that the concerns raised by some members of the community are not unique to Dover. The same questions have been raised in many communities that have considered converting fields to synthetic turf. These include progressive, environmentally-responsible communities Durham, Portsmouth, and Hanover that all ended up building multiple synthetic fields.

Every college in New Hampshire has at least one synthetic turf field. UNH has five of them. There are more than 40 synthetic fields in New Hampshire. Eleven of Dover's fellow NH Division I high schools play on synthetic fields. Dover athletes play on these fields when they play away games.

All of these communities have considered the same issues and reached the same conclusion as the JBC: The advantages of synthetic turf outweigh any known drawbacks.

Below, we briefly address some of the questions raised in the School Board's resolution. The appendices of this report go into further detail to provide deeper answers.

PFAS: Dover's project can require the manufacturer of a synthetic carpet to certify it is made without any PFAS inputs. That said, PFAS is migratory and everywhere; we are all exposed to it every day. Any field installed in Dover – whether natural grass or synthetic – is likely to test positive for PFAS at some level. After reviewing many studies, the JBC found no conclusive evidence that synthetic turf comes with a heightened risk of PFAS exposure.

Discharges and Watershed: Dover's project will be subject to City of Dover and State of New Hampshire Department of Environmental Services permitting. This process includes comprehensive review of our engineered stormwater management plan. If officials have concerns about discharges or polluted run-off from the field, the project will not get permitted.

Sustainability: The JBC acknowledges that when it is time to resurface a synthetic playing field today, some carpets end up landfilled. This may still be true in the late 2030s, or recycling facilities and markets that are developing now may have matured and be available. The JBC is confident Dover will choose the most sustainable, cost-effective option available at that time.

SUMMARY OF ALTERNATIVES BY COST*

This chart is intended to help the community evaluate the project in terms of *marginal costs*. For example, the difference between Base Option A and Base Option B (without the maintenance building) is about \$6 million. Put another way, for 50 percent more, we get a new baseball field and a second multi-sport field.

The Bare Minimum	● Base Option A ● Does not shift Dunaway ● Does not upgrade to synthetic	\$10,365,000
Base Option A	● Dunaway ● Track ● Grandstands & press box ● Lights ● Concessions/Bathrooms	\$11,614,000
Base Option A + Renovate Baseball - Dunaway shift	● Base Option A ● Renovation of baseball field ● Does not shift Dunaway ● Forever precludes new baseball field with second multi-sport field	\$12,689,000
Base Option A + Renovate Baseball + Dunaway shift	● Base Option A ● Renovation of baseball field ● Shifts Dunaway ● Allows new baseball / multi-sport field in a future phase	\$13,538,000
Base Option B - Maintenance Building	● Athletics portion only ● Maintenance building excluded	\$17,630,000
Base Option B	● Base Option A ● New baseball / multi-sport field ● New maintenance building ● 25-car parking lot	\$20,037,000

**For clarity and to reduce clutter, the cost impact of baseball lights (up to \$480,000) and turf alternatives (\$400,000 and \$585,000) are not shown.*

HOW ARE WE GOING TO PAY FOR THIS?

Dover has already committed \$3.05 million of Capital Improvements Project funding toward the Dover High athletics project:

FY21 – Bleacher project (School District capital reserves)	\$350,000
FY23 – design and engineering, adopted CIP budget	\$200,000
FY25 – adopted CIP budget	\$2,500,000
Total:	\$3,050,000

The JBC seeks School Board support for, and City Council approval of, two things:

1. Debt authorization for the balance of the project cost.
2. Amending the School District budget for FY26 to fund debt service.

Three pieces contribute to the total costs of the project:

1. Capital improvements and annual debt service
2. On-going operations and maintenance costs
3. Capital reserves for the field's eventual resurfacing



Debt Service

Base Option 1

Base Option 1						Average	Annual
	11,614,000				Tax Rate	SF Home	Change
Fiscal Yr		Princ Bal	Interest	Total DS	Impact	Impact	Tax Impact
2026		11,614,000	270,026	270,026	0.04	23.23	23.23
2027	580,700	11,033,300	540,051	1,120,751	0.17	98.74	75.51
2028	580,700	10,452,600	513,048	1,093,748	0.17	98.74	0.00
2029	580,700	9,871,900	486,046	1,066,746	0.16	92.93	{5.81}
2030	580,700	9,291,200	459,043	1,039,743	0.16	92.93	0.00
2031	580,700	8,710,500	432,041	1,012,741	0.15	87.12	{5.81}
2032	580,700	8,129,800	405,038	985,738	0.15	87.12	0.00
2033	580,700	7,549,100	378,036	958,736	0.15	87.12	0.00
2034	580,700	6,968,400	351,033	931,733	0.14	81.31	{5.81}
2035	580,700	6,387,700	324,031	904,731	0.14	81.31	0.00
2036	580,700	5,807,000	297,028	877,728	0.13	75.51	{5.81}
2037	580,700	5,226,300	270,026	850,726	0.13	75.51	0.00
2038	580,700	4,645,600	243,023	823,723	0.13	75.51	0.00
2039	580,700	4,064,900	216,020	796,720	0.12	69.70	{5.81}
2040	580,700	3,484,200	189,018	769,718	0.12	69.70	0.00
2041	580,700	2,903,500	162,015	742,715	0.11	63.89	{5.81}
2042	580,700	2,322,800	135,013	715,713	0.11	63.89	0.00
2043	580,700	1,742,100	108,010	688,710	0.10	58.08	{5.81}
2044	580,700	1,161,400	81,008	661,708	0.10	58.08	0.00
2045	580,700	580,700	54,005	634,705	0.10	58.08	0.00
2046	580,700	0	27,003	607,703	0.09	52.27	{5.81}
Totals	11,614,000		5,940,562	17,554,562			

Prepared by City Finance Director Dan Lynch in May, 2025.

Base Option 2

Base Option 2						Average	Annual
	20,037,000				Tax Rate	SF Home	Change
Fiscal Yr	Yr 1	Princ Bal	Interest	Total DS	Impact	Impact	Tax Impact
2026		20,037,000	465,861	465,861	0.07	40.66	40.66
2027	1,001,850	19,035,150	931,721	1,933,571	0.29	168.43	127.78
2028	1,001,850	18,033,300	885,134	1,886,984	0.29	168.43	0.00
2029	1,001,850	17,031,450	838,548	1,840,398	0.28	162.63	(5.81)
2030	1,001,850	16,029,600	791,962	1,793,812	0.27	156.82	(5.81)
2031	1,001,850	15,027,750	745,376	1,747,226	0.27	156.82	0.00
2032	1,001,850	14,025,900	698,790	1,700,640	0.26	151.01	(5.81)
2033	1,001,850	13,024,050	652,204	1,654,054	0.25	145.20	(5.81)
2034	1,001,850	12,022,200	605,618	1,607,468	0.24	139.39	(5.81)
2035	1,001,850	11,020,350	559,032	1,560,882	0.24	139.39	0.00
2036	1,001,850	10,018,500	512,446	1,514,296	0.23	133.59	(5.81)
2037	1,001,850	9,016,650	465,860	1,467,710	0.22	127.78	(5.81)
2038	1,001,850	8,014,800	419,274	1,421,124	0.22	127.78	0.00
2039	1,001,850	7,012,950	372,688	1,374,538	0.21	121.97	(5.81)
2040	1,001,850	6,011,100	326,102	1,327,952	0.20	116.16	(5.81)
2041	1,001,850	5,009,250	279,516	1,281,366	0.19	110.35	(5.81)
2042	1,001,850	4,007,400	232,930	1,234,780	0.19	110.35	0.00
2043	1,001,850	3,005,550	186,344	1,188,194	0.18	104.55	(5.81)
2044	1,001,850	2,003,700	139,758	1,141,608	0.17	98.74	(5.81)
2045	1,001,850	1,001,850	93,172	1,095,022	0.17	98.74	0.00
2046	1,001,850	0	46,586	1,048,436	0.16	92.93	(5.81)
Totals	20,037,000		10,248,922	30,285,922			

Prepared by city Finance Director Dan Lynch in May, 2025.

Annual Operations & Maintenance:

Base Options 1 & 2

As discussed above, field maintenance costs are not traceable to a single line-item in the School District budget.

We should be cautious about over-estimating maintenance savings. Synthetic is not maintenance-free. Investing in maintaining the fields is likely to extend the playable lifespan of them. If we can get 2-4 extra years of use, that is a huge return.

Going with synthetic will reduce – but not eliminate – field maintenance costs. There will be lower costs for mowing, painting, aeration, seeding, fertilizing, weed control, and irrigation maintenance. The JBC recommends adding a new, outside field maintenance contract. New equipment costs are expected to roughly off-set.

We believe annual operations and maintenance costs for synthetic will be about \$12,350 per field, versus about \$40,500 per field for natural grass. With two fields, those costs are expected be about \$24,700 and \$81,000 respectively. See calculations below in **YELLOW**.

10-Year Cost Comparison - Synthetic vs Sod

	Synthetic			Sod		
	Dunaway	Baseball	SUBTOTALS	Dunaway	Baseball	
Sub-grade earth / site work	same	same		same	same	
Installation cost	\$828,000	\$1,244,000		\$428,000	\$659,000	
Current annual maintenance ¹				\$13,500	\$13,500	\$27,000
Recommended additional maintenance ²				\$27,000	\$27,000	
Continued maintenance costs ³	\$6,750	\$6,750				
New contracted maintenance ⁴	\$5,600	\$5,600				
Annual maintenance subtotal:	\$12,350	\$12,350	\$24,700	\$40,500	\$40,500	\$81,000
10-Year Maintenance w/2.5% increase	\$138,362	\$138,362		\$453,737	\$453,737	
10-year install & maintenance:	\$966,362	\$1,382,362		\$881,737	\$1,112,737	
Marginal cost:	\$84,625	\$269,625	\$354,250			
Cost per use (464 vs 132 annual)	\$208	\$298		\$668	\$843	
1: Split current costs evenly across both fields						
2: Current maintenance inadequate. Recommend tripling investment, from \$27,000 to \$81,000, if grass is used.						
3: Acknowledges school maintenance costs don't go to zero. This reduces current costs in half						
4: Bases on initial price quote from one vendor						

Capital Reserves: Base Options 1 & 2

Fields installed in 2025 are better than fields installed just 10 years ago and are expected to last longer. The expected lifespan of synthetic turf is about 10-15 years, dependent on how well the field is maintained. Eventually, replacing the carpet and infill will need to happen. The shock pad is expected to last for two surface replacement cycles.

Current field replacement costs for good quality carpet are about \$7.50/sf (no pad). This includes the cost of recycling and/or disposal. That is approximately

- \$675,000 for Dunaway Field
- \$825,000 for the baseball / multi-sport field

With 2.5 percent annual inflation compounded over 10 years, those costs rise to approximately

- \$834,000 for Dunaway
- \$1,030,000 for baseball / multi-sport
- Combined as in Base Option 2, that totals \$1,864,000.

The JBC recommends the School District place 10 percent of that expense into capital reserves annually for ten years starting the year after the field opens (FY 27). For Base Option 1 and Base Option 2, that would be between approximately \$80,000 - \$190,000 per year. After Year 10, this number may be adjusted based on actual performance.

The JBC is unable to predict capital expenses beyond about 20 years, or two surface replacement cycles. We are not confident that can be done with enough accuracy to inform policy decisions today.

New Revenue

Rental Income

The JBC reached out to area schools that have synthetic fields; gathered information about rental rates from area private facilities such as those in Epping, Hampton, and the new dome in Somersworth; and communicated with each of Dover's youth programs about field rental budgets.

It is clear that synthetic fields are in demand. The School District will likely generate rental income that can defray maintenance costs or go to capital reserves.

Area School Rates

- St. Thomas Aquinas HS: Charges \$125 - \$150 per event, more if lights are needed
- Exeter HS: Charges \$75 per hour, and a custodial fee of \$50 per hour for nonprofit organizations and \$100 per hour for for-profit organizations.
- Oyster River HS: Non-profit \$120 / hr with a 2-hour minimum and \$600 daily rate max; For-profit \$225 / hr with a 2-hour minimum and a \$1,200 daily rate max; \$75 / hr extra for lights; custodial fees of \$120-180 minimum.
- Portsmouth HS: Non-profit \$50 / hr without lights and \$75 with lights; private groups are twice those rates; all uses are subject to a 4-hour minimum (i.e., \$200 - \$600 per use minimums)
- UNH: A local program pays between \$170 - \$250 per hour for UNH fields

Dover Youth Programs

- Football: Has a long-term lease for a token amount for the field at the Strafford County complex. The football program has invested in improvements there and is responsible for maintenance. They are unlikely to be more than a special event user of Dunaway.
- Cocheco Lacrosse: Same agreement with Strafford County, but also spends about \$4,000 on synthetic field rentals in the early Spring. Some of that use may shift to Dover High.
- Garrison City Football Club (youth soccer): Currently pays \$5 per player in registration fees for the use of city fields such as those at Shaw's Lane. This totals \$2,000-\$3,000 per year. GCFC pays for indoor facilities in Winter and is interested in using new fields at Dover High. However, they currently have effectively no budget for outdoor field rentals.

- Baseball / softball: Building a synthetic baseball field, to include two, 60-foot youth fields, would have a major impact on every level of Dover's baseball programs. Of the youth programs, Dover Baseball is the most interested in leasing significant time at a new baseball field.

City Recreational Programs

To the extent city recreational programs use new School District synthetic fields, it is reasonable for the district to charge the city a fee.

Conclusion

The JBC conservatively estimates the School District may receive between \$5,000-\$10,000 in annual rental income for the fields, net of custodial fees. The JBC recommends the School District consider transferring all net rental income to capital reserves on an annual basis.

Private Fundraising

The School Board asked the JBC to explore private fundraising opportunities to support the project.

JBC / School Board members Michelle Clancy and Craig Flynn are organizing a group of volunteers who will form a non-profit named "Dover Athletic Fund" (or Foundation) and elect Board Members. DAF is expected to work autonomously to raise short- and long-term funds and donate them to the district earmarked for certain athletic improvements. The School Board may have a liaison to the fundraising group but will not have authority over it.

Though we are fortunate to have many community members committed to this fundraising effort, we should not expect significant funds to come from the DAF during the initial buildout. The timeframe for large scale fundraisers conflicts with the construction timeframe. It is more likely that fundraising could defray the debt service and maintenance costs, and hopefully assist with future upgrades and improvements around Dover, not just at the high school.

Dover Athletic Fund (or Foundation) Mission Statement

"Championing the future of sports in Dover, NH through sustainable funding, responsible stewardship, and community engagement."

APPENDIX

I. TURF FIELDS IN NEW HAMPSHIRE (40+)

Division 1 High Schools:

1. Bedford – has two, one at high school, plus a town field across the street the school uses
2. Pinkerton (Derry) – has two
3. Exeter
4. Goffstown
5. Manchester West
6. Manchester Central (Gill Stadium)
7. Manchester Memorial
8. Nashua – Stellios Stadium (used by Nashua North, Nashua South, and Bishop Guertin)
9. Salem

Division 2 High Schools:

1. Oyster River (Durham) – has two, one at the high school, one at middle school
2. Portsmouth (2010; renovated 2023). Portsmouth has a muni field at Community Campus (2021) and has approved a third turf field
3. Kingswood (Wolfeboro)
4. Hanover
5. Hollis-Brookline
6. Souhegan (Amherst)

Division 3 High Schools:

1. Inter-Lakes (Meredith)
2. Laconia



Salem High School became the most recent Division I high school in New Hampshire to convert to synthetic with its new field that opened in the fall of 2024.

Private Schools:

1. St Thomas Aquinas (Dover)
2. Phillips Exeter – has two, Phelps (stadium) and Hatch Fields
3. St. Pauls (Concord)
4. Derryfield (Manchester)
5. Trinity (Manchester – built & owned by city of Manchester at Derryfield Park

York County, Maine:

1. Berwick Academy
2. York High School (under construction, spring 2025)
3. Town of Kittery (approved, 2024)

COLLEGES (Every college in NH has at least one turf field):

1. UNH has five:
 - a. Wildcat Stadium
 - b. Tucker Field (soccer)
 - c. Memorial Field (in front on Whittemore Center) – AstroTurf, being replaced with turf 2024
 - d. Bremmer Field (football practice field)
 - e. Student Rec Field
2. Dartmouth has six:
 - a. Memorial Field (stadium). Converted to turf 2006, renovated 2015
 - b. Scully-Fahey Field: Astroturf 2000, replaced by turf in 2009;
 - c. Chase Field (field hockey): Astroturf 2000, resurfaced 2008
 - d. Red Rolfe Baseball Field (converted to synthetic, 2009)
 - e. Dartmouth Softball Park (converted to synthetic, 2012)
 - f. Graham indoor field
3. SNHU has two: Penman Stadium (2017) and Larkin Field
4. St. Anselm: Grappone Stadium (2022)
5. Keene State: Owl Field
6. Plymouth State: Panther Field (2021)
7. Franklin Pierce U: Sodexo Field
8. Colby Sawyer College: Veitch Field (2013)
9. New England College: Melander Field (2013)
10. Rivier College: Merrill Field (2010)

II. PARTICIPATION COUNTS

Few public projects touch as many families as this project will.

About 1,500 unique kids play a sport in Dover each year. That's about 1 in 10 households.

HIGH SCHOOL		MIDDLE SCHOOL		YOUTH PROGRAMS	
Football	71				
Girls Soccer	41	Girls Soccer	15	Garrison City FC	500
Boys Soccer	42	Boys Soccer	21	Baseball	400
Field Hockey	24	Field Hockey	24	Cochecho Lax	180
Unified Soccer	23			Softball	150
Cross Country	32	Cross Country	62	Football	125
Cheerleading	20				
Girls Lacrosse	37	Girls Lacrosse	25		
Boys Lacrosse	40	Boys Lacrosse	35		
Baseball	49	Baseball	24		
Track & Field	81	Track & Field	105		
Subtotals	460		311		1355
					2,136

III. TIGHE & BOND'S DECK OF FIELD DESIGNS

IV. CASE STUDY: FIELD CONSTRUCTION PROCESS AT ST. THOMAS AQUINAS

V. TIGHE & BOND'S BRIEFING ON SYNTHETIC TURF AND NATURAL GRASS

VI. SPORTS-RELATED INJURIES ON SYNTHETIC TURF AND NATURAL GRASS

- A. American Journal of Sports Medicine summary
- B. Article from The Lancet

VII. ENVIRONMENTAL IMPACTS

- A. Letter from AstroTurf
- B. Letter from Shaw Industries
- C. FieldTurf brochure
- D. Evaluation of PFAS in Artificial Turf by TCR (2024)
- E. Technical Memorandum for City of Portsmouth (2022)

Five Ways to Successfully Manage Natural Grass Year-After-Year

By: J. Michael Goatley, Ph.D.

Ideally, a successful natural grass playing surface requires someone in the role of “sports field manager” to make and implement decisions that deliver safe, quality playing surfaces on a consistent basis.

However, there are many situations where the resources simply don’t allow for funding such a position. [Sports Turf Managers Association](#) (STMA) – the professional association for 2,600 men and women who manage sports fields worldwide – provides science-based management tips to trained and untrained sports field managers across the U.S.

The 2,600 member organization utilizes best practices from its allied partners, [The Foundation for Safer Athletic Fields](#), association partners and a national network of university and college-based turfgrass specialists.

STMA offers expertise in delivering exceptional playing surfaces while using environmentally-responsible management strategies.

Below are five ways to successfully manage natural grass year-after-year:

1. Determine what is required of the field based on the sport.

Each sport has important playing characteristics and requires specific turfgrass and/or soil conditions as they would affect the sporting event. For example, consider the grass cutting height. If the field is used primarily for field hockey or soccer, it may require a lower cutting height to promote faster ball roll versus a football field, which may be maintained at a higher cutting height. Also, keep in mind that when one selects a lower growing, faster playing surface, there likely is going to be a need for more specialized mowing equipment and a significant increase in mowing frequency.

Assess the field’s crown (i.e. slope) and surface uniformity. The crown assists with surface drainage of water to prevent standing water and wet, muddy, unsafe playing conditions. Ensuring a smooth, uniform playing surface can eliminate low areas and divots in the field which could potentially collect water or present a tripping hazard to users.

2. Consider adjusting your natural grass management strategy according to players, use, and weather.

All athletes deserve a safe field, but evaluate who is using the field and how it is being used. Is it a practice field, for youth recreation, or for sanctioned league play? Game fields typically top the priority list when it comes to maintenance and resource allocation, but all fields should be safe for use.

Excessive use is another factor in a field’s playing condition. Managing practices and the rotation of goal locations (soccer, lacrosse, field hockey) is an essential part of the field management strategy. These issues should be discussed with the coach and staff prior to the use of the field. In times of stress, worn areas are often the most likely to present issues. For example, during rainy conditions, worn areas can collect and hold water. During drought stress, these spaces can become, hard, compacted and uneven.

Keep an eye on the weather. Continuous play on a field experiencing stress from extended drought can cause irreversible damage to turfgrass plants and negatively affect soil conditions. Similarly, continuous play that is consistently wet creates ruts and muddy, slippery playing conditions. A single event on a field under moisture stress (either too little or too much water) can destroy an entire season’s worth of effort in maintenance.

3. Climate affects grass selection, required field maintenance activities, the need for supplemental irrigation, and field use scheduling.

The varying seasons of sports will almost always lead to variability in field playing conditions depending on growing conditions for the grass. Turfgrasses are categorized as warm-season or cool-season depending on how well adapted they are to various climates. Each location's climate plays a large role in determining the type of grass, when and what field maintenance activities take place, irrigation needs and field use.

For example, a field located in New York will typically be planted with a cool-season grass. Field maintenance generally takes place April through November depending on snowfall. Irrigation is usually only needed during the hot summer months and surfaces are used in the spring, summer, and fall. By comparison, a field located in Florida will be planted with a warm-season grass. Field maintenance and irrigation may take place at anytime of year and typically fields are available for use almost year round.

4. Assess soil conditions.

The majority of sports are played on native soil (or subsoil) and they require regular chemical testing by a certified lab to determine pH and nutrient levels. Soil test results will provide the information needed to apply the correct amount of nutrients to achieve a healthy field. Implementing the correct maintenance practices – such as irrigation, fertilization, aerification, topdressing, verti-cutting, etc. – can deliver optimal growing conditions for the turfgrass of choice. There are private labs and local extension offices that can assist you in conducting a meaningful soil test and interpret the results. “Don’t guess – soil test!”

5. Identify the equipment you need to deliver a safe, quality playing surface.

Obviously, a mower is usually the first piece of equipment identified in natural grass field management. Evaluate your budget and the accessibility of other equipment – such as soil aeration equipment, spreaders and/or sprayers -- and the variety of hand tools required for the detail work. If an equipment purchase is not feasible, consider contracting out services, such as aeration. Other options include renting equipment or sharing with nearby facilities.

There are many benefits to the players, sporting activities and environment in playing sports on properly maintained natural grass fields. However, one point is very clear about managing natural grass fields: someone or some group has to take ownership of the management of the surface.

STMA is poised to be the resource that provides all levels of sports field managers the information required to deliver a safe, quality and great looking playing surface. For more information, visit STMA.org.

About J. Michael Goatley, Ph.D.

James Michael Goatley, Jr., Ph.D. is a Professor in the Department of Crop & Soil Environmental Sciences at Virginia Tech (Blacksburg, Va.). He is a two-year Past President of the [Sports Turf Managers Association](http://SportsTurfManagersAssociation.org).

About STMA

STMA is the not-for-profit, professional association for men and women who manage sports fields worldwide. Since 1981, the association and its 34 local chapters have been providing education, information and sharing practical knowledge in the art and science of sports field management. Its more than 2,600 members oversee sports fields and facilities at schools, colleges and universities, parks and recreational facilities, and professional sports stadiums.

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Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH

Manchester, NH

Brendan Lynch

Recreation and Enterprise Manager

Parks, Recreation & Cemetery Manchester NH

1. Costs, Scope of Maintenance, and Products Used

Natural Grass Fields:

- Maintenance includes mowing (1–2 times per week in growing season), fertilization, irrigation, aeration, overseeding, and topdressing.
- We use granular fertilizers and herbicides for weed control.
- Equipment includes mowers, aerators, seeders, and irrigation systems.
- Cost for products used is minimal per field, only between \$200-\$500 per field.

Turf Fields:

- Initial installation is significantly higher — typically around \$1 million per field depending on site work and drainage.
- Annual maintenance is lower and includes brushing, grooming, infill replenishment, seam inspections, and occasional sanitization — budgeted at around \$5,000/year.
- Products include magnet sweepers, grooming machines, and deodorizers/sanitizers.

2. Maintenance Responsibility

- Natural grass fields are maintained by Manchester Parks and Rec maintenance staff.
- Turf fields are maintained day-to-day by Manchester Parks and Rec maintenance staff. We have a maintenance contract in place with the field manufacturer to do yearly maintenance that includes the following: Clean and redistribute infill, field brushing, field inspection, infill depth testing, written report, and GMAX testing.

3. Annual Maintenance Budget and How It's Determined

- The budget is reviewed annually and is based on historic maintenance needs, usage patterns, and equipment/labor costs.

4. Are the Grass Fields “High Performance”?

- Some of our premier grass fields are maintained to high-performance standards — laser-leveled, irrigated, and heavily overseeded.
- However, not all of our fields meet that definition due to varying usage levels and resource availability.

- The turf fields are absolutely considered “High Performance” and are widely considered to be some of the best playing surfaces in the area.

5. Restrictions and Rest Periods

- We do not schedule formal rest periods, but we do delay spring use until our maintenance staff deems the fields playable — usually after snowmelt and initial spring treatments.
- Fields may also be closed during or after heavy rain events to avoid damage.
- Turf fields have no seasonal closures and are usable as soon as the snow clears.

6. Playability Issues

- Turf fields have excellent year-round playability and recover immediately after snow or rain.
- Grass fields can struggle in early spring and late fall and are more vulnerable to overuse, drainage issues, and compaction, especially in high-traffic zones.

7. Resurfacing Turf Fields

- Yes, we have completed resurfacing on all of our turf fields.
- The manufacturer removed the existing turf and I am unaware if it was recycled or repurposed.

8. Environmental Concerns

- We have not heard any concerns from community members and advocacy groups regarding PFAS in turf systems.
- There is no question that covering an area of the earth in plastic is worse for the environment than covering it in grass.
- However, natural grass fields use more water and require emission emitting equipment for routine maintenance.

9. Data on Surface Safety for Youth Sports

- We do not currently have a formal study or comparison on the safety of turf vs grass.
- Generally speaking, studies show that a turf field is more slippery than a grass field, leading to an increase in ACL tears and similar injuries.
- However, grass fields are prone to damage such as craters and divots, which will result in an increase in injuries such as rolled ankles.

Morning Michael,

It was a pleasure to speak with you and Kevin on the call yesterday.

Playability Considerations for Synthetic Turf vs. Natural Grass Fields based on my experience.

Impact of Weather on Playability

While synthetic turf fields offer significant advantages in terms of quicker recovery and usability after heavy rain events, this is only one climatic factor affecting playability. Heat, particularly radiant heat, has a significant impact on both the performance and safety of artificial turf surfaces.

Surface Temperature and Infill Options

Recent developments in infill materials provide some mitigation of excessive surface temperatures. For example, BrockFILL, a natural pine infill, has demonstrated significantly lower surface temperatures when compared to traditional Crumb Rubber. In a side-by-side test with identical turf products:

- BrockFILL: 121°F - *BrockFILL is not without drawbacks. When wet, it is prone to freezing, which renders the field unplayable in colder conditions.*
- Crumb Rubber (with cooling agent): 154°F

Non-Shoulder Season Play Challenges

Athletic performance can be significantly hindered by elevated surface temperatures, even during what are otherwise considered temperate days. For instance, during a collegiate field hockey match on a 70°F fall day in New England, surface temperatures reached 135°F—just below the NCAA's 140°F threshold for playability. Such temperatures raise legitimate concerns about athlete safety and the risk of heat-related illness, especially at the high school level where athletes may not be conditioned to the same standard.

Spring sports, such as track and field, often utilize the infield areas of turf fields. Yet, high radiant heat can make these spaces unsafe or unusable during peak sunlight hours.

To think you are going to play on a synthetic field all summer is unrealistic.

Shoulder Season Play

In regions like New England, early spring use of fields under snow-covered conditions is appealing. Synthetic turf can be cleared of snow, but this comes with risks:

- Potential damage to turf seams
- Need for specialized snow removal equipment
- Increased labor and maintenance costs
- Possible voiding of manufacturer warranties

In contrast, growth covers have enabled natural grass fields to be playable as early as March, offering a viable alternative for early-season sports, as well as, late season repairs.

Maintenance and Replacement Costs

Usage and Wear

The more a field is used, the more intensive its maintenance needs become. As Mr. Shay notes in his article *Making Smart Plays*, determining weekly player-use hours and the sports played are crucial factors in surface selection. For high schools in New England, natural turf options are generally limited to native soil fields due to climate and resource constraints.

Synthetic turf fields are often marketed as supporting 3–4 times more play hours than natural grass. However, this increased usage also accelerates wear and reduces the effective lifespan of the field.

Case Study:

At the 2023 NE-Sports Field Management Association Forum, Chase Ferguson (Assistant Director of Athletics/Operations, Holy Cross) reported the need to replace turf in their Indoor Practice Facility after only 7 years of use—despite being protected from weather and UV exposure. This underscores how wear and tear can rapidly degrade turf even under ideal conditions.

Cost of Replacement

The cost to resurface an artificial field is typically around 60% of the original installation cost. For a \$1 million field:

- Resurfacing Cost: ~\$600,000
- Average Resurfacing Cycle: Every 8 years
- Annualized Cost: ~\$75,000

Most fields can be resurfaced twice before the underlying shock pad requires replacement, which often costs as much as a new field installation.

Example – Stellos Stadium, Nashua, NH:

- Original Installation: 2001
- 2011 Replacement Cost: \$609,525

"School officials have said the turf field is worn out, with soft spots that may not pass safety tests."

Source: [Nashua Telegraph, 2011](#)

- 2024 Replacement Estimate: \$850,000
- 2024 Actual Cost: \$1.5 million

Artificial Turf: Natural Grass Benefits

Safe Healthy Playing Fields Coalition Fact Sheet

The Safe Healthy Playing Fields Coalition (SHPFC) website (www.safehealthyplayingfields.org) presents viable natural turf alternatives to synthetic turf, which places toxins and carcinogens in the bodies of our children and streams of our watershed. Know the risks to your health and the environment BEFORE these carpets are installed because backtracking is costly. Information to be aware of (and sourced on the SHPFC website, unless otherwise noted) includes the following:

Environmental facts:

- Grass is a natural filtration system; it filters rain as it runs into streams and waterways.
- Grass absorbs carbon dioxide, produces a cooling effect, and filters rain and storm water.

Must read: Growing Green Grass: Innovative discussions and solutions for managing high quality turfgrass (aka natural grass) blog by Jerrod Minnick who directs grounds and environment at the Maryland SoccerPlex & maintains both natural and synthetic turf fields. <http://growinggreengrass.net/>

Jerrod Minnick explains that a correctly built sand-based field does well in the rain. “Following Hurricane Irene and a Tropical Depression that brought over 13 inches to DC in 4 days, the University of Maryland moved a rainy day match to SoccerPlex. The grass field at Maryland was unplayable but the grass field at SoccerPlex Stadium was ready for play.” (“Field of the Year,” SportsTurf, October 2012, p.39 <http://read.dmtmag.com/i/86038/8>)

Techniques and technology for high-quality, frequent use, low environmental impact grass fields is evolving and improving:

The high quality warm-season fields are used about 900 to 950 hours per year, and the cool-season fields support 700 to 750 hours of play. (The County’s AT report said max 400-600 hours). “We prove everyday that the grass field will take more traffic than we ever thought. The more we evolve our ways, the more a grass field will be able to take,” Minnick says. (“Field Care: New Ideas on Fall Renovations,” Sports Field Management, October 2012 <http://www.sportsfieldmanagementmagazine.com/article-8665.aspx>)

Minnick also authored an article explaining that “going ‘green’ is not a complex issue. It is a basic issue of conservation,” eliminating unnecessary pesticide and fertilizer use and timing watering properly to conserve. He also reports that lawnmower technology is improving – hybrid mowers use up to 40% less diesel fuel and are comparable in cost to conventional mowers. (Source: “Environmental Stewardship & your maintenance plan: Set an Example” by Jerad Minnick, Sports Turf, August 2012, p. 8-13 <http://read.dmtmag.com/i/77829/8>)

OTHER EXPERTS:

A good link not just for Kevin Trotta’s work but links to other natural field information as well www.EnvironmentalTurfCraft.com. Kevin Trotta BS, MA is an Eco-Friendly Turfgrass / Sports Field Specialist, Consultant, Advocate, Speaker proponent of natural green grass, naturally (pesticide free).

Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH

SNHU

James A. Gassman

Associate Athletic Director- Facilities, Events, and Equipment, Athletics

Southern New Hampshire University

Address: 2500 North River Road, Manchester, NH 03106

- Do you happen to have any details you would be willing to share including costs, scope of maintenance, and products that you use in your field maintenance?

- From our synthetic field, we manage a lot of areas internally- we have a tractor with a turf plow (different than a truck plow) that plows our 2 artificial turf fields, but we also have a gator HPX and a greens groomer that maintains the field throughout the year for keeping the field level and not compacted-
- We spend around \$7000 a year with an external company to do a deep maintenance to the field- cleaning up all fibers, glueing rips, and softening the field so we do not have hard spots that cause injuries. They give us a pre and post maintenance summary that gives us infill depths and different information that allows us to know when we are getting close to end of life for the turf.
- For our grass fields- we outsource mowing, fertilizing, and irrigation replacement currently- we are looking to move it internally, but SNHU wants to keep the external contract- this costs us around \$25-30k a year, and does not include the seed or topdressing sand, we buy, as well as the infield dirt, topdressing product, drying agent, spray paint, etc- which is close to another \$15-20k for our baseball and softball field- we also spend a lot of hours grooming these fields, and have a lot of equipment to maintain the grass from aerovator, slice seeder, thatchers etc- this equipment we have compiled over the years, but some is very expensive.

- Does the university perform the maintenance on any of the fields or is there a contractor that performs regular maintenance?

- answered above

- Do you have information on the annual budget that you have for field maintenance? How is that budget determined?

- answered above

- Would you consider the natural grass fields you have on campus to be high performance grass?

- Our baseball and softball grass fields are very competitive and are some of the best in the region. Our problem is that our teams finish up their seasons so early, that it is hard to get them looking good when weather (this year specifically) is so cold and rainy for so long. We also have a very competitive fall season where our teams can have practices, individuals, and scrimmages

throughout the months of September through early December- so our fields get a lot of use, when the weather is not ideal.

- Do you put any restrictions on use of your fields or put in any scheduled rest periods when fields lie dormant from athletic activity?

- We have no restrictions on the grass fields, as they are for only varsity sports- if they were synthetic fields, we would be open to hosting more events, club teams, etc- we just cannot afford for the fields to get worn down and be a risk to the health of our athletes or other groups. This is why we have the 2 synthetic fields, so that our teams can use our synthetic fields year round- our baseball and softball teams practice indoors for the use of the cages, but will practice on Larkin Field for a majority of the spring due to the baseball and softball field not being cleared for use- we have to wait for our fields to thaw from the frost in the ground, and then firm up to allow our fields to be safe to use- if they are still frozen and the teams use them, they will kill the grass and we would not be able to fix the problems in a timely manner.

- Have you had any playability issues with any of the fields?

- Our baseball and softball fields are old, but maintained in a good condition- however, they were built on a slight slope, so they are never really as flat as we can get them- this is a major capital project that we need to get done- due to those issues, we have a water issue that we are getting fixed this summer for softball- due to the water that comes across the field, the tarp we have does nothing as the water just floods under the tarp from the outfield-
- This year we have had a lot of rain delays, but also issues with having to pull tarp and dry a field that was played until we had a rain delay- so the moisture was caught under the tarp- this takes an hour or so to dry a baseball field, and get ready for a game to get restarted- and after a rain delay- that is not the best case for getting games in a tight season. We also have to deal with delays due to frost, whether early in the spring, or late fall. If a synthetic field is installed properly, they just need general maintenance and grooming, which is a lot less time consuming than that of a grass field.

- Have you gone through a resurfacing of any of the turf fields yet? If so, was the surface recycled or repurposed in any particular way?

- We had Larkin Field resurfaced back in 2012- we used some of the turf to use in other areas- from bullpens at baseball, to washout areas throughout operations space that we have- however, due to how old our old turf was, the fibers were very worn down and hard to use in areas that would be played at other facilities.
- We also took all of the infill that we could extract and used back in the new turf, this was a huge cost saving and saved a lot of infill from going back to a landfill

- Were there any concerns raised from students, athletes or the community about PFAS when deciding to install the artificial grass?

- There was no concerns from our athletes about artificial turf- knowing we cannot manage all of our sports teams playing at the same facility for so many practices and games, grass would not be an option- at the NCAA Division II level, our spring and fall teams are all competing- some in the NCAA Championship season, some in the off season- but with the amount of hours per week

our teams practice, the length of their seasons- we could not sustain a natural grass field in NH for all the teams, and all their practices/games.

Do you have any data supporting the safety of one surface over another in regards to youth sports and injuries?

- We have not seen any increases on our field from other fields in risks of injuries – there are many studies provided leaning towards grass fields being a safer option, but with how our seasons run in New Hampshire, and not having football, we do not see any differences in the surfaces.



**Town of Arlington
730 Massachusetts Avenue
Arlington, MA 02476**

Artificial Turf Study Committee

Final Committee Report

April 12, 2024

Respectfully submitted by:

James DiTullio, Select Board appointee, Committee Chair
Natasha Waden, HHS designee, Committee Clerk
Mike Gildesgame, Conservation Committee appointee
Joseph Barr, Capital Planning Committee appointee
Jill Krajewski, Envision Arlington Committee appointee
Marvin Lewiton, Town Moderator appointee
Leslie Mayer, Park & Rec Commission appointee
Joe Connelly, Recreation Director (non-voting)
David Morgan, Conservation Agent (non-voting)

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Introduction

Arlington has long been a draw for young families seeking to raise their children in a vibrant community convenient to Boston. The most recent United States Census data pegs Arlington's 18-and-under population at more than 1 in 5. Communities with large numbers of young people require the open spaces and playing fields that those young people want and need. In recent years, Arlington's supply of playing fields has struggled to keep up with the rising demand. Even when Arlington's fields have met that demand, it has not been without criticism. In particular, it is widely accepted that many of Arlington's playing fields are worn and tired, suffering from both overuse and weather limitations. The demand for Arlington's fields has moved in parallel with the deterioration of those fields.

Amidst this predicament, town residents have searched for solutions whereby the supply of quality playing fields could match the intense demand. It is within this context that the topic of artificial turf playing fields (also known as synthetic turf playing fields) has emerged. For those town residents seeking a way to maximize each playing field to meet the demand for those fields (particularly from youth sports leagues), artificial turf fields would appear to offer an attractive alternative. Artificial turf proponents argue that these fields are able to withstand New England weather while being versatile enough to maximize field playing time without sacrificing the quality of playing conditions.

Despite the benefits cited by proponents, others have raised concerns about the hazards of materials used to make artificial turf, the costs associated with installing and periodically replacing artificial turf fields, and the adverse health effects experienced by those who play on and use artificial turf fields. Opponents argue that the vaunted benefits of this playing surface cannot overcome its notable and distinct limitations.

Into this debate the Arlington Artificial Turf Study Committee (ATSC) entered in December 2023. Created by passage of Amended Article 12 at the 2023 Annual Town Meeting, the ATSC was charged with reviewing and reporting on "artificial turf: its health, safety, and environmental impacts, and potential mitigation measures, and a comparison of artificial turf to natural turf fields." Consisting of seven voting members and two non-voting members -- all of whom represent parts of town government with concerns about and interests in Arlington's playing fields -- the ATSC sought to provide information to town leaders and residents who see great potential in the use of artificial turf but have legitimate concerns about its health, safety, and environmental impacts. With an overarching commitment to take the proverbial "deep dive" into the subject matter, the ATSC has meticulously and diligently studied artificial turf without fear or favor, letting science and data dictate its questions and its studies.

This report is the product of those efforts.

Scope of Work

The ATSC was charged with examining health, safety, and environmental impacts related to the use of both artificial and natural grass turf fields, as well as potential mitigation measures. Consistent with that charge, the Committee focused its research and discussions on several

specific areas related to turf fields: access to youth sports and its impact on mental and physical health; heat impacts on human health and heat related injuries; heat impacts on the environment; skin/bacteria issues; injury rates; chemical impacts on human health and the environment; alternative infills; chemical and particulate runoff impacts; stormwater management impacts; climate change resilience impacts and ecological effects; and a cost comparison of artificial turf fields to natural grass fields.

Access to Youth Sports and its Impact on Mental and Physical Health

Research shows that exercise and team sports, in particular, improve the overall health of young people. According to the Science Board that works in the President's Council on Youth Fitness and Nutrition, participation in sports impacts many aspects of health. Equitable access to youth programs both promotes exercise and allows children to develop the social interactions that occur as part of a team. Exercise is linked to a reduced risk of many diseases including Type 2 diabetes, obesity, cancer, depression, and anxiety. When the national youth sports survey looked at who is not participating in sports, they found that Black, Indigenous, and People of Color (BIPOC) and low-income households were particularly impacted by access to sports. Lack of access to playing spaces is a key contributor to the problem. It is important to mention that Arlington's outdoor recreation spaces and youth sports programs are accessible to families that cannot afford private sports clubs. However, a lack of field space can impact both enrollment and access to practice and playing times.^{1 2}

New England weather complicates the lack of field space created by the high number of children enrolled in sports programs. The wet weather conditions limit access to grass fields during the busy season, March 15 - June 15 and August 15 - November 15. According to Arlington's Department of Recreation, there are many field closures for rain and resting periods after rain that require rescheduling of games and practice. Often, games can get played (or, on occasion, Arlington can move to an away site to make up a game), but there is little chance to make up practice. Artificial turf fields do not have to be closed for rain and they allow for continuous play and field use. Artificial turf can be used earlier and later in the season and potentially in winter months. According to Ian Lacy from Tom Irwin Advisors, an expert on both natural grass and artificial turf fields³, artificial turf fields can be used 1.3x-1.5x more than natural grass fields. However, this assumes a natural turf field is appropriately rested. In our current situation, Arlington does not appropriately rest its fields. So while conversion from natural grass to artificial turf may increase the days where practices and games can be held, it will not significantly increase the number of playing fields in the community.

It is important that Arlington youth can participate in youth sports and have access to playing surfaces that promote continuous play when adverse weather restricts play on natural grass fields. As such, Arlington should consider increasing playing spaces to ensure equitable access

¹ <https://health.gov/our-work/nutrition-physical-activity/national-youth-sports-strategy/questions-answers#q4>

² https://health.gov/sites/default/files/2020-09/YSS_ScienceBoardReport_2020.09.01_opt.pdf

³ <https://www.tomirwinadvisors.com/about-us/mission/>

to team sports for all its young residents.⁴ In addition, Arlington should consider some strategies for increasing the usability for existing fields. Some strategies may include:

- **Linear sand injection system⁵.** According to turf expert Ian Lacy of Tom Irwin Advisors, the installation of a linear sand injection system on a natural grass turf field is a mitigation strategy that may help to address flooding/moisture conditions and may be relatively inexpensive to install on existing fields.
- **Understanding the impact weather has on access to Arlington's existing playing fields.** To better understand how inclement weather affects Arlington's playing fields it would be beneficial to collect actual data as to when grass and artificial turf fields are closed due to weather conditions (rain, heat, etc.). Ideally, this data would be collected annually and could be used to compare one year to another.

An additional strategy is site specific installation of artificial turf, which holds the possibility of increasing access to youth sports programs in Arlington and usability of playing spaces for those programs. Although such a strategy may be beneficial to the overall health of Arlington's youth, there are notable downsides to artificial turf, which will be discussed in this report.

Heat Impacts on Human Health and Heat Related Injuries

The impact of heat on human sporting activities may become an increasingly important issue as we continue to see the warming effects of climate change. While some research casts doubt on an automatic relationship between air temperature and surface temperature, there is clearly cause for concern related to the heat effects of artificial turf fields on their users. Exposure to high heat levels, on all types of playing surfaces (including natural grass); can have a cumulative effect on the human body. Children in particular are more vulnerable to high temperatures than adults, and they are not as adaptable to changes in temperature as adults are. Additionally, children are less likely to accurately assess the degree of heat strain to which they are exposed, and therefore their desire to participate and compete may lead them to stay on the field despite a level of discomfort that might lead an adult to rest instead.⁶ For these reasons, it is important to look at how heat may affect a field user on both artificial turf and natural grass fields and determine what mitigation measures may be necessary during periods of high heat temperatures.

⁴ Accessibility is a concern for the community, and a main concern of the Massachusetts Architectural Access Board is "the ability of children with disabilities and parent and friends, to do the same things as abled bodied people do." See <https://www.mass.gov/doc/aab-minutes-41218>. Within Arlington's public recreation programs and facilities, there is support for diversity, equity, and inclusion, and the Town has undergone a self-evaluation process to help guide its improvement efforts toward those objectives.

See <https://www.arlingtonma.gov/home/showpublisheddocument/40400/636479962772100000>.

To be considered an accessible surface, ground surfaces need to be "stable, firm, slip resistant, and maintained with materials that ensure continued slip resistance." See <https://www.mass.gov/doc/521-cmr-2900-floor-surfaces-2006-pdf/download>.

Grass, like some other ground surfaces, may be problematic in that regard.

⁵ Sand injection is fundamentally similar to regular aeration, with the key difference being that sand injection uses a pressurized water system to inject the aeration holes with compact sand in real time, as the holes are being punched.

⁶ <https://www.scientificamerican.com/article/heat-waves-affect-children-more-severely/>

Numerous studies have documented extremely high surface temperatures on artificial turf, and while there has been limited research on the temperature of the air above the field, data indicates that players on artificial turf fields have higher skin temperatures, indicating greater heat load, and perceive a greater degree of heat stress than when on natural grass fields. Most reputable studies or analyses show that artificial turf fields with crumb rubber infill can get considerably hotter than natural grass on hot, sunny days. While natural grass fields rarely get above 100° F due to the release and evaporation of water vapor that leads to cooling, artificial turf fields, in comparison, regularly rise above 100° F.⁷ Penn State University's Center for Sports Surface Research conducted studies comparing surface temperatures of synthetic turfs composed of various fiber and infill colors/materials and found that the maximum surface temperatures during hot, sunny conditions averaged from 140° F to 170° F.⁸ Another study conducted at Brigham Young University found that the surface temperature of the synthetic turf was 37° F higher than asphalt and 86.5° F hotter than natural turf.⁹ This is a concern for many reasons, including, as neuroscientist Kathleen Michels points out: "Any temperature over 120° F can cause skin burns with skin contact in two seconds."¹⁰ In addition, research on heat stress in college athletes has shown that a significant heat exposure on one day can result in additional physiological stress days later.^{11 12} However, it should be noted that the most extreme heat issues related to artificial turf fields have usually been documented in regions of the country where air temperatures are regularly above 80°, not New England.¹³

When examining heat issues related to turf, measuring surface temperatures of natural and artificial turf fields may not be the best assessment of how the playing surface feels to the user. A more common quantification is Wet Bulb Globe Temperature (WBGT), which measures the "expected heat stress on the human body when in direct sunlight."¹⁴ WBGT is utilized by the military, the Occupational Safety and Health Administration, and the American College of Sports Medicine, and it is often viewed as the "gold standard" for measuring heat stress during hot weather and for creating heat-related safety standards.^{15 16} Arlington High School Athletics Department staff use WBGT when taking temperature readings on both artificial turf and natural grass fields. When doing so, they have found the playing environment to be between seven and ten degrees hotter on synthetic fields than on natural grass fields.¹⁷

Heat-related concerns over artificial turf fields in New England would be most acute in the hottest months of the year, namely June, July, and August (also known as meteorological

⁷ <https://www.nrpa.org/parks-recreation-magazine/2019/may/synthetic-sports-fields-and-the-heat-island-effect/>

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

¹¹ <https://plantscience.psu.edu/research/centers/ssrc/documents/temperature.pdf>

¹² <https://www.scientificamerican.com/article/heat-waves-affect-children-more-severely/>

¹³ <https://ftw.usatoday.com/2015/08/its-so-hot-in-texas-turf-is-melting-cleats>

¹⁴ National Weather Service. "Wet Bulb Globe Temperature: How and when to use it."

<https://www.weather.gov/news/211009-WBGT>

¹⁵ National Weather Service. "Wet Bulb Globe Temperature Informational Guide."

<https://www.weather.gov/media/safety/heat/2020-WBGT-Handout.pdf>

¹⁶ Cates J, Rheeling, J. "Wet Bulb Globe Temperature (WBGT) – Why Should Your School Be Using It?" National Federation of State High School Associations. Apr 2023. <https://www.nfhs.org/articles/wet-bulb-globe-temperature-wbgt-why-should-your-school-be-using-it/>

¹⁷ Presentation by Arlington High School Athletic Trainer Samantha Jones 2/13/24

summer). Fortunately for the Town of Arlington, there are few organized athletic uses of Arlington fields during that time period, meaning far less concern with heat stress or heat exhaustion on athletes. Arlington's town and school athletic fields receive their greatest use in the "shoulder seasons" of spring (April-May) and fall (September-November), where temperatures in Arlington do not regularly cross the 80° F mark. Climate change is raising temperatures, there will be more hot days even in the shoulder seasons, and surface temperatures on artificial turf fields in Arlington could reach very high levels even on more temperate days. There is a greater possibility that heat will be a concern in the future and therefore it must be addressed. But, unlike some other issues related to artificial turf fields, the heat-related concerns are very capable of being mitigated, especially in a community like Arlington that is in the New England climate.

One mitigation strategy used by some artificial turf field owners is to water the fields to keep them cool on hot days. Such a strategy is not recommended. Watering artificial turf fields is effective only for a short period of time, and temperatures usually rebound after only about 20 minutes. Moreover, adding irrigation to this type of sports field is costly and, depending on the type of infill used, could be ineffective, as water could simply roll off the surface and not really soak in to provide that small window of temperature relief.

There are, however, several mitigation strategies that could improve heat safety for field users and can be deployed either singularly or in combination with other strategies.

- **Using alternative infill materials on synthetic turf fields.** Alternative infill materials (sand, coated sand, cork, Brockfill, etc.) have been suggested as replacements to crumb rubber that are not only less toxic but may also result in cooler field surface temperatures.¹⁸ However, none of these alternative infills can provide a surface that is comparable in temperature to natural grass, and they may have other limitations, such as increased migration from the field or the need for more frequent maintenance and/or replacement. Information from the Penn State Sports Surface Research Center suggests that significant temperature reductions may not be possible with infill changes alone.¹⁹
- **Installation of signage on playing fields.** Often signage around fields includes warnings about damage to the turf field, but additional signage or an alteration to existing signage should alert users to the health risks associated with field use on very hot, sunny days.
- **Formalized education and training about heat safety for youth sports coaches.** Annual training on recognizing heat strain is provided to coaching staff as part of Arlington High School's Athletics Department's Emergency Action Plan. Additionally, a five-day acclimatization program has been implemented for football players whose exposure tends to be greater due to their use of pads and uniforms, in accordance with Massachusetts Interscholastic Athletic Association (MIAA) guidelines.²⁰ However, for non-high school sports organizations, it is unclear what type of training, if any, is

¹⁸ Presentation by Ian Lacy, Lead Project Advisor, Tom Irwin Advisors on 2/20/24.

<https://www.arlingtonma.gov/home/showpublisheddocument/68878/638442810992730000>

¹⁹ <https://read.dmtmag.com/i/32290-june-2011/19?>

²⁰ Presentation by Arlington High School Athletic Trainer Samantha Jones 2/13/24.

provided or required for volunteer coaches/parents in regard to recognizing and responding to heat strain events. Aside from high school events, it is unclear that there is consistent monitoring of field temperatures in the Town of Arlington.

- **Installation of shade cover at all playing fields.** During the design of field renovations, consideration should be given to the installation of shade structures that can protect the user from direct sunlight during resting periods. Such structures may include dugout covers and shaded sideline seating. This should be considered regardless of field type, as hot temperatures outside the summer season are becoming increasingly common.
- **Monitoring air and surface temperatures.** The Arlington High School Athletics Department currently monitors field temperatures (WBGT) during the hottest part of the year and has guidelines for when field use is safe. Practices and tryouts are scheduled for cooler parts of the day whenever possible. However, it is unclear whether there is consistent monitoring of field temperatures outside of high school athletics. As such, it would seem appropriate to establish an air and surface temperature monitoring program for synthetic turf fields during the hottest part of the year. Such a policy is not unheard of and, in some circumstances, is quite common. For example, local beach administrators (like the Massachusetts Department of Conservation and Recreation and the Arlington Board of Health) regularly monitor local beaches for elevated bacteria levels in the water; if the bacteria levels go above a certain level on a certain day, the authorities close the beach for that day. The MIAA has established guidelines for the use of athletic fields of any kind during hot temperatures, with the guidelines stating that there should be no use of fields when the wet-bulb temperature goes above 86.1° F. In the same way, it seems both logical and prudent for local officials (like the Department of Park and Recreation or School Department) to monitor air and surface temperatures at artificial turf fields (as well as other fields) in Arlington, especially during June-August; if surface temperatures go above a certain established level, then those fields would be closed to use for that day – much like natural grass fields are closed when rain or snow conditions prevent their use.

As an example, the Montgomery County Public Schools in Maryland has developed the following guidelines for use of its artificial turf fields:

- Anytime the outdoor temperature exceeds 80 degrees, coaches exercise caution in conducting activities on artificial turf fields.
- When outdoor temperatures exceed 90 degrees, coaches may hold one regular morning or evening practice (before noon or after 5 p.m.).
- When the heat index is between 91–104 degrees between the hours of noon and 5 p.m., school athletic activities are restricted on artificial turf fields to one hour, with water breaks every 20 minutes.²¹

²¹ <https://www.nrpa.org/parks-recreation-magazine/2019/may/synthetic-sports-fields-and-the-heat-island-effect/>

Heat Impacts on the Environment

It has been established that artificial turf fields are hotter than natural turf fields.²² But the excess heat generated by artificial turf fields has impacts on the environment beyond those on the human body.

The surfaces of artificial turf fields have been shown to be significantly hotter than natural turf fields, contributing to the urban heat island effect.²³ It is expected that climate change will add 13 to 23 days where temperatures exceed 90° F, an increase from the current 8 days per year in Arlington.²⁴ Artificial turf fields could exacerbate already increasing temperatures in Arlington, particularly in areas identified as heat islands.

The Metropolitan Area Planning Council performed a heat analysis to ascertain the areas of Arlington that are most at risk of extreme heat.²⁵ The hottest 5% of areas, or “hot spots,” generally follow the Massachusetts Avenue corridor, which is the most densely developed part of Arlington with the greatest amount of impervious surfaces. There are also “hot spots” in parts of East Arlington, in a relatively dense residential area north and west of Massachusetts Avenue. It seems advisable, to the extent practicable, to avoid installing artificial turf fields in or near the existing hottest 5% areas in Arlington.

In addition to creating heat islands, extreme heat can inhibit wildlife movement and disrupt ecosystems. Higher surface heat temperatures on artificial turf could inhibit any wildlife movement across those fields during the hottest days of the year. Furthermore, extreme surface heat may affect the temperature of any stormwater runoff, which can also affect the ecology of the aquatic environments that are the receiving waters of the runoff.

Skin/Bacteria

Beyond the obvious impact from extreme surface temperatures on artificial turf fields, such as heat stroke, are other effects relating to an individual’s skin.

Safe Healthy Playing Fields Inc. estimates that skin injury can result from contact with a surface lasting just several seconds when the heat index runs from 120° – 140° F.²⁶ Although that is a serious concern for users of artificial turf fields, there are obvious mitigation measures to address them. For example, it seems unlikely that someone using an artificial turf field is directly exposing their bare feet or skin to the surface for extended periods of time; moreover, signage can make clear that all users of the field must wear shoes at all times. And, as discussed earlier, there is no reason why the Town of Arlington, were it to have new artificial turf fields, could not limit or close the fields to use on the hottest days of the year.

²² https://www.turi.org/content/download/13271/203906/file/Factsheet.Artificial_Turf.September2020.pdf.pdf

²³ Ibid.

²⁴ <https://www.arlingtonma.gov/home/showpublisheddocument/51627/637268071185670000>

²⁵ Ibid.

²⁶ <https://www.safehealthyplayingfields.org/heat-levels-synthetic-turf>

Artificial turf fields also raise questions of bacterial infections. The Massachusetts Department of Public Health (DPH) addressed this issue directly:

Some studies have measured the levels of bacteria on surfaces of different types of athletic fields. Very limited research has found fewer bacteria in [artificial turf fields] ATF than soil and the federal study reported indoor ATF having fewer bacteria than outdoor ATF. However, many factors (e.g., presence of bacteria, moisture, and temperature) influence the risk of bacterial infections following the use of any athletic surface. The frequency and severity of skin abrasions can also influence the risk of infection. California's Environmental Protection Agency reported that athletes experience more frequent turf burns (i.e., skin abrasions) on ATF relative to natural fields. Overall, practicing good hygiene is the best way to prevent getting and spreading infections. Washing skin abrasions with soap and water can decrease the risk of bacterial infections.

²⁷

As noted by DPH, the threat of bacterial infections from artificial turf is real but limited, and it can be mitigated through good hygiene practices. For this reason, the Mount Sinai Children's Environmental Health Center similarly recommends that those who play on artificial turf surfaces wash their hands before eating, drinking, or adjusting mouth guards, as well as cleaning cuts and abrasions immediately.²⁸

Injury Rates

A long-running critique of artificial turf playing fields holds that they have a higher incidence of player injuries than natural grass fields. That was certainly true with the first generation of artificial playing surface known as AstroTurf. Physicians and trainers noted that players were injured with a greater frequency on that turf, including ACL tears, concussions²⁹, and ankle sprains.³⁰ In 1992, John Powell from the University of Iowa published a paper that showed that professional football teams had more major knee injuries on artificial turf when compared to professionally maintained natural grass.³¹ In that era, players complained of greater muscle soreness on artificial turf as compared to playing on a professionally maintained natural grass surface.³²

But artificial turf has advanced considerably from its early AstroTurf days, and that includes improvements in lowering player injuries. Artificial turf manufacturers have made advancements in simulating more natural surfaces, particularly with the use of crumb rubber infill mixed with sand, often giving the turf a more grass-like feel. Nevertheless, criticism of artificial turf as it relates to player injuries remains, and it is not uncommon to hear players

²⁷ <https://www.mass.gov/info-details/artificial-turf-fields>

²⁸ <https://static1.squarespace.com/static/57fe8750d482e926d718f65a/t/593b15421e5b6c414467a03b/1497044293003/CEHC+Position+Statement+on+Recycled+Rubber+Turf+Surfaces+2017-5-10.pdf>

²⁹ https://www.hss.edu/condition-list_concussion.asp

³⁰ https://www.hss.edu/conditions_high-ankle-sprain-whats-different.asp

³¹ https://www.hss.edu/conditions_artificial-turf-sports-injury-prevention.asp

³² https://www.hss.edu/conditions_artificial-turf-sports-injury-prevention.asp

vocalize their opinions about the difference between the playability of artificial turf versus natural grass.³³

Recent studies on player injuries provide a mixed picture. While some studies still see a greater likelihood of sports injuries with artificial turf over grass, other studies see the two playing surfaces as equivalent with respect to injuries, and one recent study even saw an advantage to artificial turf fields.³⁴

A 2023 review of research related to player injuries found that there is a higher rate of foot and ankle injuries on artificial turf, both old-generation and new-generation, compared with natural grass.³⁵ That review also noted that high-quality studies suggest that the rates of knee injuries and hip injuries are similar between playing surfaces, although elite-level football athletes may be more predisposed to knee injuries on artificial turf compared with natural grass.³⁶

In contrast, a 2022 study found that in a comparison of artificial turf to natural grass, injury rates were equivalent in most cases.³⁷ A notable exception to that finding was higher rates of foot and ankle injuries in general, as well as higher knee injury rates among elite-level American football athletes, on artificial turf playing surfaces.³⁸ But the study found that concussion rates on artificial turf are decreased compared to natural grass that is maintained by professional groundskeeping operations.³⁹

And, as previously noted, a 2023 study of football (soccer) players actually found the overall incidence of football injuries to be lower on artificial turf than on grass.⁴⁰

In light of recent studies and research, it seems hard to definitively say whether modern artificial turf playing fields inherently present more risk of player injury than natural grass fields that are maintained to a professional standard. There could be a slightly higher risk of foot and ankle injuries on artificial turf fields versus natural grass fields, but the difference is not dramatic. And there is some indication that, with respect to sports injuries, artificial turf playing surfaces might even be better than natural grass, including in the area of concussions. In the end, although there may be many important differences between artificial turf fields and natural grass fields, player injuries does not appear to be an area that stands out in that regard.

With the benefit of first-hand local experience on both natural grass and artificial turf with crumb rubber infill, Arlington High School's head athletic trainer, Samantha Jones, concurred with that assessment. She stated that she has not seen any measurable difference in the type or number of injuries associated with playing surface, noting that more frequent injury types are attributable to factors like differing physiology or player preparedness.

³³ https://www.hss.edu/conditions_artificial-turf-sports-injury-prevention.asp

³⁴ It should be noted that these studies were focused on professional and collegiate athletics, and very little study information is available about the casual or municipal user.

³⁵ <https://pubmed.ncbi.nlm.nih.gov/35593739/>

³⁶ Ibid.

³⁷ <https://www.intechopen.com/chapters/83186>

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10139885/>

It is also worth noting that studies of sports injuries sometimes compare artificial turf fields to pristine, professional athletic natural grass fields. In that comparison, it is not surprising that the artificial turf fields often have a modestly worse record on certain sports injuries. But it is rare outside of collegiate or professional sports to find pristine, impeccably maintained natural grass fields. In reality, most municipal grass playing fields across the United States (like those in Arlington) are maintained to the level that is affordable for municipal budgets. Those fields are often stressed from heat and rain, and they can be much more likely to cause sports injuries.

Mark Cote, a Mass General Brigham Sports Medicine researcher who serves as director of Outcomes Research for Sports Medicine and Orthopedic Surgery at Massachusetts General Hospital, summed up succinctly the state of research on these issues in 2024: “I don’t think we’re at a point yet where we can say an injury would have been avoided because a field is turf or natural grass, nor are we at a point where we should immediately switch every field in America to natural grass.”⁴¹ Recognizing that artificial turf may increase the risk of non-contact injuries and that professional athletes often prefer natural grass playing fields, Cote stated: “While I’d prefer my own children to play on natural grass, I know an injury can happen on any surface without proper conditioning. At the end of the day, it’s a part of the sport.”⁴²

Chemical Impacts on Human Health

Artificial turf and its infills contain a wide variety of hazardous chemicals. What is not known at this point is how much exposure results from playing on these surfaces. In general, reducing exposure to hazardous materials has a positive health effect.

Exposure to hazardous materials comes in one of three ways: inhalation, ingestion, and dermal contact. While there is almost no data on the level of exposure to these materials in the context of artificial turf use, in general, when a product contains demonstrably toxic materials, minimizing possible exposure to them is always going to be better than not doing so. All things being equal, a reduction in potential exposure should lead to reduced harm to people and the environment.

Artificial turf fields in Arlington would be used primarily by children, who eat, drink, and breathe more per pound of body weight than do adults. As their brains and bodies are continually developing during childhood, the effects of any hazardous exposures are more significant than would be the case for comparable exposures in adults. For example, recent research suggests that there is no safe level of lead exposure for children. Their behavior also differs from that of adults, with more hand-to-mouth activity, which can act to increase potential exposures.

In terms of duration of exposure, almost all the exposure studies to date have been done on adults, who are less susceptible to comparable adverse exposure levels to chemicals. Many more children participate in youth sports programs than was the case 20 years ago, and as a result will likely have longer periods of exposure to any hazardous components in artificial turf than would

⁴¹ <https://www.massgeneralbrigham.org/en/about/newsroom/articles/turf-vs-grass-fields-sports-injury-prevention>

⁴² Ibid.

an adult. Exposure duration can be an important factor as diseases may have long latency periods (the time between exposure and disease).

Chemical exposure can lead to negative health outcomes. Chemical exposures can have cumulative impacts, defined as toxicity risk, carcinogenic risks, endocrine disruption risks, and reproductive risks. While there is an abundance of research that clearly illustrates the toxicity of components within artificial turf, there are few if any research studies that examine the potential for exposure to field users, nor do data currently exist that establish the exact level at which exposure to a particular hazardous material found in artificial turf results in disease. While one cancer related study suggested there was no association between artificial turf field use and cancer in athletes, there were questions raised about the methodology used in the study and whether or not the study results were valid.^{43 44 45}

There are also serious concerns related to crumb rubber infill and artificial turf fields. Crumb rubber infill, used to soften the playing surface on artificial turf fields, is made from very finely shredded automobile and truck tires, and has been one of the ways in which old tires are recycled. Used tires contain a wide assortment of toxic materials which have been linked to adverse human health effects and environmental damage. The small size of these particles makes it easier for dusts to be generated during field use, which can then be aerosolized and inhaled, or deposited on clothing or body parts. Dermal contact with these dusts or solids can result in an ingestion exposure if food is eaten without handwashing. In addition to potential direct exposures, these materials are a source of “take home” exposures if they are transferred via clothing, shoes, on skin, or in the hair to field users’ automobiles or homes. As such, the potential hazards associated with crumb rubber should be taken into consideration by Town officials when making decisions about future projects that may involve this material.

In addition to crumb rubber infill, artificial turf fields contain other chemicals of concern and hazardous materials, including the following:

Polycyclic aromatic hydrocarbons (PAHs). PAHs are chemicals that exist naturally in coal, oil, and gasoline. They can be formed by the burning of these materials, along with wood, tobacco, and even food that is cooked at high heat, such as meat on a grill. Exposures can result from breathing tiny PAH particles or particles to which PAHs are bound, eating grilled or charred food, or food onto which PAH particles have deposited from the air. Some PAHs can be absorbed through the skin. Exposures to PAHs have been associated with skin, lung, bladder, liver, and gastrointestinal cancers. High rates of cancer among firefighters are thought to be due to PAH exposures. Animal studies have shown an association between PAH exposure and reproductive, neurologic, and developmental effects.^{46 47}

⁴³ <https://kuow-prod.imgix.net/store/ee4a593cdd79b5f99ee947785173a309.pdf>

⁴⁴ <https://doh.wa.gov/community-and-environment/schools/environmental-health/synthetic-turf>

⁴⁵ <https://www.kuow.org/stories/does-playing-soccer-on-artificial-turf-increase-cancer-risk-especially-in-kids>

⁴⁶ <https://doi.org/10.1016/j.envpol.2022.119841>

⁴⁷ <https://doi.org/10.1016/j.envpol.2022.119841>

Heavy metals. Metals such as lead, zinc, and chromium as well as others, are commonly found in crumb rubber. These metals can have a range of adverse health effects, including impairment of the nervous system, gastrointestinal and kidney issues, immune system dysfunction, reproductive system toxicity, and cancer. Indications are that the primary route of field users' exposure to metals would be through ingestion rather than inhalation.⁴⁸

Per- and polyfluoroalkyl compounds (PFAS). PFAS is the umbrella term for the thousands of fluorinated compounds, which are commonly referred to as "forever chemicals" due to their extreme resistance to breaking down in the environment. They have been used in any number of products, including nonstick cookware, firefighting foam, stain-resistant upholstery, and rainwear. It has been estimated that nearly all Americans have been exposed to PFAS through drinking water contamination, using products made with PFAS, or breathing PFAS in the air. A number of these compounds have been banned for use in children's toys and other consumer products, and many manufacturers are trying to come up with safer alternatives. However, for other consumer products, including artificial turf, compliance with the ban is totally voluntary. New fluorinated compounds are continually being developed and used. Because there are many opportunities for exposure, and PFAS are resistant to breaking down, they can accumulate in our bodies. Data suggests that the amount of PFAS in our blood can be one thousand times greater than the EPA's proposed level for drinking water. Adverse health effects include alterations in metabolism, altered thyroid function, higher risk of being overweight, lower fetal growth rates, and reduced effectiveness of our immune system.^{49 50 51 52 53}

Phthalates are often referred to as plasticizers. They can make plastic products flexible and longer lasting. They are used in a wide variety of products including food packaging, medical products, personal care items, and sporting goods. The CDC states: "People are exposed to phthalates by eating and drinking foods that have contacted products containing phthalates. Some exposure can occur from breathing phthalate particles in the air. Children crawl around and touch many things, and then put their hands in their mouths. Because of that hand-to-mouth behavior, phthalate particles in dust might be a greater risk for children than for adults. Inside a person's body, phthalates are converted into breakdown products (metabolites) that quickly leave the body in urine. Research has documented a wide variety of adverse health effects resulting from chronic exposure to phthalates, including disruption of the endocrine system and abnormal functioning of some organ systems. This can affect pregnancy outcomes, child growth and development, and reproductive systems in both young children and adolescents."^{54 55 56 57 58}

⁴⁸ <https://www.nature.com/articles/s41598-023-38574-z>

⁴⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10718084/>

⁵⁰ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6348874/>

⁵¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10423336/>

⁵² <https://factor.niehs.nih.gov/2022/10/science-highlights/pfas-liver-injury>

⁵³ <https://www.healthandenvironment.org/che-webinars/96609>

⁵⁴ <https://www.mdpi.com/2227-9032/9/5/603>

⁵⁵ <https://www.hsph.harvard.edu/news/features/the-big-3-why-phthalates-should-be-restricted-or-banned-from-consumer-products/>

Microplastics: Comparable to investigations into the human health effects of PFAS and phthalates, research on the health effects of microplastics in both aquatic species and humans is extremely limited and in its early stages. Exposure to microplastics occurs through inhalation, ingestion, and food consumption, and is an increasing worldwide concern. Research indicates that ingestion of microplastics is harmful to aquatic and animal species, resulting in inflammation, oxidative stress, and cytotoxicity among other adverse effects. Translocation of these tiny plastic particles has been found to occur in mice after ingestion, including passage through the blood-brain barrier. It is believed that these may be seen in humans as well. One study showed behavioral changes in mice following short-term microplastic exposures.⁵⁹ In addition to the plastic particles themselves, there are concerns about the toxicity of compounds that have been either added to or are adsorbed to the surface of the base plastic, such as colorants, phthalates, and other chemicals which are used to provide specific properties, or heavy metals, which could result in other harmful effects.^{60 61 62}

While the chemicals above are in the highest quantities in the crumb rubber, they also can exist in the grass blades. While nearly all Americans currently have some level of exposure to both PFAS and phthalates, virtually all of the papers addressing health issues around PFAS and phthalates in artificial turf acknowledge that there is inadequate research in terms of exposure, and that much more research is needed. For example, while there are standards for PFAS in drinking water, there are currently no definitive levels for PFAS or phthalates at which adverse health effects will occur, making it difficult to associate specific levels of exposure with disease.

An additional chemical that has recently been discovered in used tires is 6-PPD Quinone.

6-PPD is an antioxidant compound which is added to the rubber in automobile and truck tires to prevent cracking and early aging and to increase their lifespan. When exposed to ozone and oxygen it transforms into 6PPD-quinone, further discussed in the section “Chemical and Particulate Runoff Impacts” below.^{63 64}

The limitations of existing personal sampling equipment make collecting inhalation exposure information during actual play or other representative field activities extremely challenging. New methods for both sampling and analysis are continually being developed and will hopefully be able to shed additional light on this important topic in the future. There is a long history of chemicals being found to cause harm at levels well below that originally thought to be

⁵⁶ <https://doi.org/10.1016/j.cbpc.2023.109645>

⁵⁷ https://journals.lww.com/co-pediatrics/abstract/2013/04000/phthalate_exposure_and_children_s_health.16.aspx

⁵⁸ https://www.epa.gov/sites/default/files/2017-08/documents/phthalates_updates_live_file_508_0.pdf

⁵⁹ <https://www.mdpi.com/1422-0067/24/15/12308>

⁶⁰ <https://doi.org/10.1021/envhealth.3c00052>

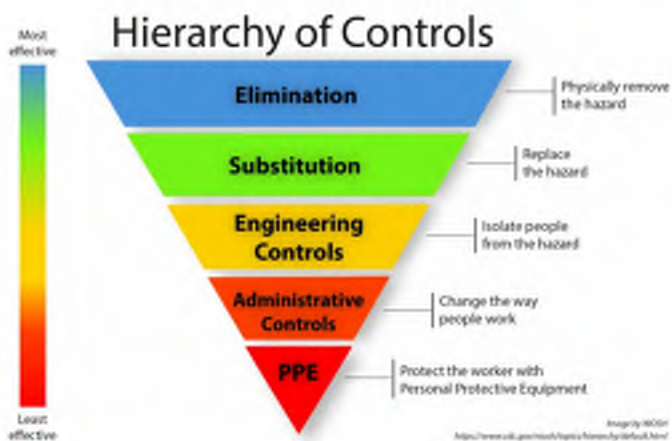
⁶¹ <https://particleandfibretotoxicology.biomedcentral.com/articles/10.1186/s12989-020-00387-7>

⁶² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8800959/>

⁶³ <https://www.epa.gov/chemical-research/6ppd-quinone>

⁶⁴ <https://doi.org/10.1016/j.scitotenv.2023.165240>

problematic, and it is not unreasonable to ask whether people should voluntarily add to their existing exposure levels when it may not be absolutely necessary.



The use of less toxic materials will always be better than more toxic ones, even without exposure data, as that reduces the possibility of exposure to a toxin. This is the basis for the Occupational Safety and Health Administration's (OSHA) hierarchy of controls, which call for (in order of effectiveness) eliminating the hazardous material entirely, substituting safer chemicals for more hazardous ones, implementing engineering controls to capture emissions or guard against mechanical

hazards, administrative controls such as work practice changes, and finally using personal protective equipment as the final and least preferred alternative.⁶⁵

Based on the available research, it seems advisable to move away from crumb rubber infill. As to what alternative infill material is preferable, continued research will be necessary. A portion of the Toxics Use Reduction Institute (TURI) comparison of infill materials is shown below.

Category	Tire crumb	EPDM	Shoe materials ^a	TPE	Acrylic-coated sand	Mineral- or plant-based
Lead ^b	Present	Present	Present	Present	Below detection limit ^c	Absent in some cases
Zinc ^b	Present	Present	Present	Present	Present ^d	Present in some cases
Other metals ^b	Present	Present	Present	Present	One additional metal present ^c	Present
Vulcanization compounds ^d	Present	Present	Present	Generally absent	Expected to be absent	Zeolite, when present, poses serious respiratory hazard. Plant-based materials can pose concerns related to dust, fungi, or allergens. Vulcanization compounds and phthalates are expected to be absent; VOCs and PAHs are expected to be low or absent. ^h
Phthalates	Present ^e	Present (lower) ^f	May be present, but subject to RSL	Present ^e	Expected to be absent	
VOCs	Present ^e	Present (lower in some cases, higher in others) ^f	Expected to be present, but subject to RSL	Present (lower) ^g	Expected to be absent	
PAHs	Present ^e	Present (lower) ^f	May be present, but subject to RSL	Present (lower) ^g	Below detection limit ^c	
PAHs (TURI sample) ^j	Present (highest) (548 mg/kg)	Present (20 mg/kg)	Present (55 mg/kg)	Present (below 10 mg/kg)		

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⁶⁵ https://www.osha.gov/sites/default/files/Hierarchy_of_Controls_02.01.23_form_508_2.pdf

Aside from discontinuing use of crumb rubber infill, another recommended mitigation strategy could include pre-installation testing by an independent laboratory to ensure that the materials are PFAS-free -- since once they are installed, it can be difficult to determine if any PFAS present is from the field materials or from PFAS that is already in the environment.

Alternative Infills

The environmental impact of artificial turf infill, in particular tire crumb rubber, has been identified as an issue of concern.^{67 68 69} There are, however, alternative infills. According to TURI's comparative assessment of chemical contents associated with alternative infills:⁷⁰

No infill material was clearly free of concerns, but several are likely to be somewhat safer than tire crumb. Some alternative materials contain some of the same chemicals of concern as those found in tire crumb; however, they may contain a smaller number of these chemicals, and the chemicals may be present in lower quantities.

Recently, several Massachusetts towns such as Lexington, Milton, and Malden have specified alternative infills to help mitigate chemical pollution and increased surface temperatures from the artificial turf fields permitted. Although certain alternative infills such as Brockfill and Greensand may hold promise for being more environmentally friendly and generating less heat than crumb rubber infill, there is not sufficient peer-reviewed research data at this time to definitively endorse them. Nevertheless, given the early promise of these alternative infills, as well as the widely accepted negative data on crumb rubber infill, it seems that future artificial turf projects should be looking exclusively at working with these alternatives. As time goes by and more reliable data on alternative infills is available, the case for these alternatives should be bolstered considerably.

Chemical & Particulate Runoff Impacts on the Environment

One of the most significant concerns surrounding artificial turf fields is their impact on wetland resources and waterways. Artificial turf fields can act as sources of harmful chemicals, including PFAS, metals, polycyclic aromatic hydrocarbons (PAHs), and others identified under the "Chemical Impacts on Human Health" section of this report.^{71 72 73 74 75 76} The State Wetlands Protection Act and its regulations, along with Arlington's Town Bylaw and its regulations,

⁶⁶ https://www.turi.org/var/plain_site/storage/original/application/b9727dedf5860ae7e83e3226d058b7ee.pdf

⁶⁷ <https://www.epa.gov/chemical-research/july-2019-report-tire-crumb-rubber-characterization-0>

⁶⁸ <https://pubs.acs.org/doi/10.1021/acs.estlett.2c00050>

⁶⁹ https://www.turi.org/content/download/13271/203906/file/Factsheet.Artificial_Turf.September2020.pdf.pdf

⁷⁰ <https://journals.sagepub.com/doi/full/10.1177/1048291120906206>

⁷¹ <https://portal.ct.gov/-/media/DEEP/artificialturf/DEPArtificialTurfReportpdf.pdf>

⁷² <https://www.epa.gov/chemical-research/july-2019-report-tire-crumb-rubber-characterization-0>

⁷³ <https://journals.sagepub.com/doi/full/10.1177/1048291120906206>

⁷⁴ <https://www.turi.org/content/download/11980/188623/file/TURI+Report+2018-002+June+2019.+Athletic+Playing+Fields.pdf>

⁷⁵ https://www.turi.org/content/download/13271/203906/file/Factsheet.Artificial_Turf.September2020.pdf.pdf

⁷⁶ <https://doi.org/10.1016/j.cscee.2022.100280>

require the protection of a variety of wetlands. Wetlands serve many functions and values in the community. These include groundwater supply, flood control and storm damage prevention, prevention of pollution, wildlife protection, plant and wildlife habitat protection, and protection of the natural character or recreational values of the wetland resources. A table outlining the potential negative impacts of artificial turf fields on each protected wetland interest can be found below and a map showing the proximity of recreational facilities (existing athletic fields) to wetland resource areas is included in Appendix 1.

Wetlands Values Table		
Wetland Value / Interest	Artificial Turf Field Meets Wetland Value / Interest?	Possible Mitigation for Artificial Turf Field
Public or Private Water Supply	Not applicable	
Ground Water Supply	No	Engineered Green Infrastructure (e.g., Bioretention Cells) may reduce some chemicals and microplastics but more research required to support this mitigation strategy
Flood Control	No - impervious	engineer field design and controls
Erosion Control and Sedimentation Control	Maybe	engineer field design and controls
Storm Damage Prevention	Maybe	engineer field design and stormwater management
Prevention of Pollution	No	Engineered Green Infrastructure (e.g., Bioretention Cells) may reduce some chemicals and microplastics but more research required to support this mitigation strategy
Wildlife Protection	No	No mitigation available
Plant or Wildlife Habitat	No	No mitigation available
Aquatic Species and their habitats	No	Engineered Green Infrastructure (e.g., Bioretention Cells) may reduce some chemicals and some microplastics but more research required to support this mitigation strategy
Natural Character or recreational values of the wetland resources	No	No mitigation available
Climate Change Resilience [Section 32, Arlington Wetlands Regulations, March 2023]	No	Alternate infills may reduce some heat impacts; but no mitigation is available for loss of Carbon sequestration; Sustainability issues / fossil fuel use

Artificial turf fields can contaminate the natural environment through leaching, airborne dust, volatilization, and physical migration of artificial turf components. Elevated concentrations of PFAS have been shown to have adverse effects on aquatic organisms, and PFAS environmental impacts from artificial turf are under-studied, though part-per-trillion (ppt) levels have been shown to be harmful. Elevated concentrations of the PFAS compounds PFOA and PFOS in aquatic ecosystems can result in death of aquatic organisms and affect their growth and reproduction. PFAS has been shown to leach from artificial turf fields and components. Additionally, tire crumb rubber, which is an infill material for most artificial turf fields, contains a newly discovered compound called 6ppd-quinone, which is acutely toxic to some freshwater fish. These chemicals, individually and in combination, pose a potential hazard to wildlife, water quality, and aquatic organisms, with an overall negative impact on the environment. Furthermore, microplastic particles from infill and weathered grass blades can also enter waterways, causing additional harm.^{77 78} As observed in Arlington at the Arlington Catholic High School artificial turf field and referenced in Arlington's Conservation Commission submissions to the May 2, 2023, Artificial Turf Forum and the ATSC, the tire crumb rubber infill from the school's field has migrated toward the nearby brook and within the protected wetland resource area of Mill Brook.

Though there is recent scientific evidence of the potential to use bioretention cells to reduce 6ppd-quinone concentrations in stormwater runoff impacted from oxidized tires / tire crumb rubber⁷⁹, it is unclear if these systems could be scaled-up to provide stormwater mitigation for an 80,000 square foot athletic field. The European Union recently acknowledged the negative impact of tire crumb rubber infills as microplastic pollution and in September 2023 enacted a ban on the sale of products containing intentionally added microplastics – specifically including in this ban “granular artificial turf infill”.⁸⁰

Natural turf fields can act as a natural filter for chemical and particulate pollution. Artificial turf fields typically do not contain systems to mitigate the chemical and particulate contamination in stormwater infiltration or runoff.⁸¹ Artificial turf fields that border wetlands, waterways, and other sensitive areas and resources are of most concern. Other areas are also impacted by artificial turf fields, as some chemicals can be volatilized and others may cling to clothing, shoes, and equipment, migrating off the fields to surrounding areas. Any stormwater drainage from an artificial turf field will eventually reach a wetland within Arlington. This extends environmental concerns beyond immediate proximity to sensitive areas. A field that drains to the public stormwater system may leak contaminants into a wetland or waterway downstream.

It should be noted that concerns about chemical runoff may arise with respect to natural turf fields, as well. Neither the Town of Arlington nor the ATSC has tested the natural grass playing fields in Arlington for concentrations of various chemicals of concern, including PFAS and

⁷⁷ <https://journals.sagepub.com/doi/full/10.1177/1048291120906206>

⁷⁸ <https://www.turi.org/content/download/11980/188623/file/TURI+Report+2018-002+June+2019,+Athletic+Playing+Fields.pdf>

⁷⁹ <https://pubs.acs.org/doi/epdf/10.1021/acs.estlett.3c00203>

⁸⁰ <https://pubs.acs.org/doi/10.1021/acs.est.4c00047>

⁸¹ <https://www.sportsfieldmanagement.org/natural-grass-athletic-fields/>

phthalates. Existing natural turf fields may also contain some amounts of those chemicals. Further study in this area is suggested.

Stormwater Management Impacts

How stormwater is retained, infiltrated, or discharged is important to the consideration of the environmental impact of artificial turf fields. Perhaps the most critical issue in this regard is the permeability of the playing surface, since permeable surfaces provide better stormwater management by allowing precipitation to infiltrate into the soil, rather than running off into storm drains or detention basins. The ability to manage stormwater will become ever more important as precipitation events become more severe and more unpredictable with expected climate change impacts.

The Massachusetts Department of Environmental Protection (MassDEP) is considering officially classifying artificial turf fields as impermeable surfaces under the Wetlands Protection Act. This change, if finalized, would potentially affect the siting and maintenance of artificial turf fields. MassDEP's latest proposed revision from December 2023 would define impervious surface for the "purposes of stormwater management (310 CMR 10.05(6)(k)-(q))" as follows:

any surface that prevents or significantly impedes the infiltration of water into the underlying soil, including, but not limited to artificial turf, Compacted Gravel or Soil, roads, building rooftops, solar arrays, parking lots, Public Shared Use Paths, bicycle paths, and sidewalks paved with concrete, asphalt, or other similar materials.⁸²

The permeability of artificial turf fields is a subject of debate, with some sources stating that they can be made permeable with the proper design and maintenance, and others stating that as an artificially constructed field, they are difficult or impossible to make permeable. While artificial turf fields can certainly be designed to quickly drain stormwater off the field (in many cases, more effectively than natural grass fields), the stormwater generally drains to perimeter drains and then to a detention basin or some stormwater management system. Since artificial turf fields are typically constructed on top of another engineered surface (rather than directly on top of the underlying soil), the real question then becomes whether the stormwater drains to a permeable surface, which depends on the specific design of the field.

There are techniques and systems that can allow for the capture and storage of stormwater, which can then be allowed to infiltrate into the soil and/or be released more slowly into the stormwater system to avoid overwhelming the system and causing flooding. Currently, artificial turf fields impede infiltration of water into the underlying soil, although this may change in the future as better systems are developed for managing the stormwater and allowing for improved stormwater infiltration to occur.

At a baseline, natural grass fields are considered permeable because they consist of natural grass over soil (unless the subgrade of the field is more heavily engineered). However, it is important to recognize that maintaining true and effective permeability requires ongoing maintenance of the fields, including proper aeration and grooming. Without that maintenance, the dirt

⁸² <https://www.mass.gov/doc/310-cmr-1000-wetlands-proposed-revisions-redlinestrikeout/download>

underneath the playing surface can become highly compacted and will not function as effectively as a permeable surface. Even under these conditions, a natural turf field may remain more permeable than an artificial turf field, but the exact comparison will depend on the design and maintenance of the field. It is difficult to make general statements about the permeability and stormwater management performance of artificial turf and natural grass fields, because the statements are highly dependent on the design, construction, and maintenance of the individual field, along with other factors such as topography and adjacent land use.

Climate Change Resilience Impacts and Ecological Effects

Issues surrounding climate change resilience and adaptation are increasingly critical as it becomes clear that our climate is changing in real time and we need to adapt our natural and built environment to address the threats associated with climate change, including extreme heat and precipitation. MassDEP defines Climate Change Resilience in guidance documents as follows.

The capacity to prevent, withstand, respond to, adapt to, and/or recover from climate change impacts and to build the capability and ability of an area/site/system to minimize the adverse impacts of climate change.⁸³

Artificial turf fields are inconsistent with climate change resilience in that they do not minimize anticipated adverse effects and, in fact, can exacerbate climate impacts.

Arlington has long been a leader in climate change resilience and mitigation, meaning that the Town adopts strong policies to minimize greenhouse gas emissions. Leaving aside the carbon footprint associated with artificial turf field construction, installation, and disposal, there are also climate impacts from the change from grass to artificial turf fields. While natural turf fields offer some mitigation of greenhouse gas emissions, especially carbon dioxide, artificial turf fields offer none.⁸⁴ Carbon sequestration is the process of creating long term storage of carbon dioxide, either geologically or in terrestrial ecosystems such as forests, fields, and other natural carbon sinks.⁸⁵ Natural turf fields create an opportunity for carbon sequestration in the field grass and soil, particularly if the field is well maintained and not regularly disturbed or fully replaced (since the removal and replacement of the turf will likely result in the release of some of the sequestered carbon).⁸⁶ While the amount of carbon sequestration that is possible through a natural turf field is more limited than would be possible in an unbuilt naturally vegetated environment, there is still a meaningful amount of carbon sequestration.⁸⁷ In contrast, an artificial turf field is a fully artificial environment that does not provide any standalone opportunity for carbon sequestration.

In the context of climate change, one must also consider the sustainability of artificial turf field components. There is mixed data related to whether meaningful recycling of artificial turf fields

⁸³https://www.lspa.org/index.php?option=com_dailyplanetblog&view=entry&year=2022&month=10&day=06&id=376:lspa-climate-change-mcp-toolkit-available

⁸⁴<https://doi.org/10.1016/j.scitotenv.2022.159974>

⁸⁵<https://read.dmtmag.com/i/27931-april-2011/7?>

⁸⁶<https://acsess.onlinelibrary.wiley.com/doi/10.2134/agronj2002.9300>

⁸⁷<https://www.mass.gov/doc/healthy-soils-action-plan-2023/download>

is currently happening (or happening consistently) in the Northeastern United States. The recycling question is an important one, because artificial turf fields must be replaced every 8-10 years. The recurring need for replacement over the lifetime of an athletic field must be reconciled with principles of sustainability and the risks that disposed components will migrate off site and become contaminants. If not recycled, components will be landfilled, incinerated, or subject to chemical decomposition; all of these options have negative climate change impacts and do not represent recycling into new plastic products. The Synthetic Turf Council states that “the carbon footprint of a particular recycle/end-of-life option (such as trucking long distances) may be integrated into the decision-making process and lead responsible parties to invalidate such an option”.⁸⁸

Installation of artificial turf can also have ecological effects. Habitat loss in urban settings is a significant threat to biodiversity and ecosystem health, including the systems that humans rely on for our quality of living.⁸⁹ Artificial turf replaces habitats, leading to a loss of plant and animal species diversity in the area. The removal or diminishment of a hub in the natural network has consequences for the whole system.

Cost Comparison of Artificial Turf Fields to Natural Grass Fields

In addition to health, safety, and environmental concerns, another area that is relevant to this topic is the life cycle cost comparison between artificial and natural grass turf fields, which includes installation, maintenance, replacement, and disposal costs.

While there are many variables to such a cost comparison, a true estimate is not possible without assessing and considering the site-specific field conditions. Additional factors related to cost include the potential funding sources for construction/rebuilding recreational fields, the overall municipal budget for field maintenance, and the availability of Town staff to regularly perform field maintenance, as opposed to outsourcing all or parts of field maintenance to contracted landscaping companies.

As stated by Ian Lacy of Tom Irwin Advisors, “you can’t compare a natural turf field to an artificial turf field because they are completely different systems.”⁹⁰ Artificial turf fields are designed and highly engineered systems, whereas the majority of natural grass fields are indigenous fields that have been adapted over time into playing fields. While there are many benefits and limitations to both types of fields, there is no way to get the same level of usage from a natural grass field as from an artificial turf field, especially with New England’s weather. Additionally, it is very challenging to assess a dollar amount to the number of hours and days in which a playing field, either synthetic turf or natural grass, can be utilized. As such, it would seem that a variety of factors, in addition to cost, would need to be considered when choosing the surface and maintenance program of an athletic playing field. Some of these factors include, but should not be limited to, the location, usage, and existing conditions of the field. Prior to major renovations or construction of its fields, the Town of Arlington should consider the best and most

⁸⁸ <https://www.syntheticurfCouncil.org/page/guidelines>

⁸⁹ <https://www.ipbes.net/global-assessment>

⁹⁰ Presentation on 2/20/24 by Ian Lacy, Lead Project Advisor, Tom Irwin Advisors.

<https://www.arlingtonma.gov/home/showpublisheddocument/68878/638442810992730000>

cost effective playing surface given site-specific conditions through a comprehensive assessment by a professional/consultant with experience in construction and maintenance of athletic fields.

The two major sources of funding for park and playground projects in Arlington are the Capital Plan and funding from the Community Preservation Act (CPA). In recent years, the Town has also benefited from parks and playground funding through the American Rescue Plan Act, which was a one-time infusion of funding from the federal government and is largely expended. It should be noted that CPA funds are prohibited from use for the acquisition of artificial turf for athletic fields. Although communities may still use CPA funds for other aspects of a field project, non-CPA funds must be appropriated to acquire the artificial turf surface.⁹¹

The Committee reviewed a variety of resources to try and better understand the costs associated with construction and maintenance of natural grass and artificial turf fields. Because no two resources were completely consistent in detailing what specifically is included in the cost, as such, it is hard to know how accurate these comparisons are at this time. Those resources include but are not limited to the following: presented material from Ian Lacy of Tom Irwin Advisors; the Toxics Use Reduction Institute (TURI) document “Building an Organic Maintenance Program for Athletic Fields: Guidance from Experts and Experienced Communities”; the Turfgrass Resource Center document “Natural Grass and Artificial Turf: Separating Myths and Facts”; as well as the maintenance costs reported by the Town of Arlington and Arlington Public Schools. These comparisons include the costs for the field itself and do not include costs for other typical elements of a playing field, like bleachers, lighting, fencing, etc., or the soft costs for design and construction management.

Installation Costs (per field)		
Organization	Artificial Turf	Natural Grass Field
Tom Irwin Advisors ⁹²	\$1,000,000	\$400,000
Turf grass Resource Center ⁹³	\$850,000-\$1,000,000	\$50,000-\$600,000

- *Tom Irwin Advisors- costs are based on a soccer sized field used for high school/college play. A high school/college sized soccer field is 81,000 square feet or 1.86 acres.⁹⁴ Detailed information about what is included in the installation was not available.*
- *The Turfgrass Resource Center- costs are based on 85,000 square feet or 1.95 acres and compare several types of natural grass fields to that of artificial turf fields. The artificial turf field costs vary from basic to premium construction and account for a ground rubber infill. The cost of natural grass fields varies depending on the soil base conditions and the preparation needs.*

⁹¹ <https://www.communitypreservation.org/allowable-uses>

⁹² Presentation on 2/20/24 by Ian Lacy, Lead Project Advisor, Tom Irwin Advisors.

<https://www.arlingtonma.gov/home/showpublisheddocument/68878/638442810992730000>

⁹³ <https://www.saratogasod.com/wp-content/uploads/2018/02/NaturalGrassArtificialTurf.pdf>

⁹⁴ <https://jobsinfootball.com/blog/soccer-field-dimensions/>

Annual Field Maintenance Costs (per field)		
Organization	Artificial Turf Field	Natural Grass Field
Tom Irwin Advisors ⁹⁵	\$15,000	\$30,000
Turf grass Resource Center ⁹⁶	\$13,000-\$39,000	\$8,000-\$49,000
Town of Arlington	\$13,000	\$11,000-\$40,000

- *Tom Irwin Advisors: detailed information about what is included in the maintenance costs was not available.*
- *Turfgrass Resource Center*
 - *Artificial turf includes the following: painting/removal, top dressing/infill, brushing/sweeping, disinfecting/fabric softener, carper repairs (rips; joints), water cooling, and weeding.*
 - *Natural grass field includes the following: painting, top dressing (sand), dragging, fertilizers, pesticides, aeration, sod replacement, and irrigation.*
- *Town of Arlington*
 - *Natural grass field maintenance contract includes the following: Aeration 3x/year; slice/seeding 2x/year; over-seeding on wear areas 2x/year; fertilizing 4x/year; and soil testing 2x/year. This does not include mowing/trimming, painting, or irrigation costs.*
 - *Artificial turf field is the responsibility of the Public Schools. According to Arlington's Athletic Director, the current maintenance contract includes the following: 6 visits (2 decompaction visits and 4 grooming visits), minor seam repairs, GMAX testing, and line painting for lacrosse and field hockey.*

End of Life Costs (per field)		
Organization	Artificial Turf Field	Natural Grass Field
Tom Irwin Advisors ⁹⁷	\$665,000 (carpet replacement and disposal costs @ 10yrs)	\$150,000 (Resodding @ 10 years)
Turf grass Resource Center ⁹⁸	\$149,000-\$191,000*	

- *Tom Irwin Advisors: includes removal and replacement of carpet at 10 years. Information about transportation charges was not available.*
- *Turfgrass Resource Center: includes disposal of carpet.*
 - *Does not include carpet replacement, transportation, or landfill surcharges that disposal may incur.*

⁹⁵ Presentation on 2/20/24 by Ian Lacy, Lead Project Advisor, Tom Irwin Advisors.

<https://www.arlingtonma.gov/home/showpublisheddocument/68878/638442810992730000>

⁹⁶ <https://www.saratogasod.com/wp-content/uploads/2018/02/NaturalGrassArtificialTurf.pdf>

⁹⁷ Presentation on 2/20/24 by Ian Lacy, Lead Project Advisor, Tom Irwin Advisors.

<https://www.arlingtonma.gov/home/showpublisheddocument/68878/638442810992730000>

⁹⁸ <https://www.saratogasod.com/wp-content/uploads/2018/02/NaturalGrassArtificialTurf.pdf>

Importance of Field Maintenance

One major factor which contributes to the life expectancy and usability of both artificial and natural grass fields is the maintenance of these surfaces. Ian Lacy of Tom Irwin Advisors has referenced a study he conducted at the FIFA headquarters in Zurich, Switzerland, in which he and his colleagues analyzed the maintenance needs of artificial turf used by a soccer association for 10 hours/day over a one-year period. As a result, he and his colleagues created maintenance frequency charts for both synthetic and natural turf surfaces, which can be found in Appendix 2. While these charts are based on usage of 10 hours/day for 7 days/week, they are not suggesting Arlington's fields need a similar level of maintenance. However, to extend the life expectancy and usability of its fields, a maintenance schedule for Arlington's specific needs (based on field usage related to type of activity played and number of hours per day the field is used) should be considered, budgeted for, and adhered to. Lacy stressed that despite municipal budget limitations, ongoing maintenance frequencies and costs must be considered in the cost of the initial project.

Given the limited number of playing fields in Arlington, better maintenance alone will not increase the field usage among user groups. One major challenge is Arlington's densely populated community and lack of additional open space to construct new playing fields. Similarly, converting one or two existing grass fields to artificial turf will not increase the usage or allow for the expansion of new or current recreational programs, although it would allow for user groups to access the fields earlier and later in the shoulder seasons and for some practices and games to continue when rain occurs during the season, thereby reducing a backlog of makeup games/practices.

While the Committee did not evaluate the full scope of field maintenance or management options, the Town of Arlington has developed a Public Land Management Plan which outlines those options and advises on the treatment of lands, such as playing fields, and includes recommendations of best practices.⁹⁹ As such, the Public Land Management Plan could suggest pathways for considering what type(s) of chemicals and maintenance make the most sense once regular maintenance is achieved.

Findings and Recommendations

After extensive research and discussion, the members of the Artificial Turf Study Committee reached a consensus with respect to the use of artificial turf in Arlington. Although no one on the Committee supported a moratorium or ban on the construction of artificial turf fields in Arlington, Committee members expressed concern with some of the environmental and health shortcomings of the product. In particular, the materials used in the production of artificial turf raise concerns about the impact on its users and the natural environment, including possible chemical pollution in aquatic ecosystems, particulate and plastic pollution, and increased heat. Committee members noted other environmental shortcomings of artificial turf, including its lack of carbon sequestration, the use of fossil fuels in its production, subsequent environmental impacts due to its required replacement every 8-10 years, and inconsistent recycling at end-of-life.

⁹⁹ <https://www.arlingtonma.gov/Home/Components/News/News/11931/2651?community=development>

On the other side of the ledger, Committee members recognized the merits of artificial turf, none more important than its accessibility and durability even in harsh New England weather. Although there is great appeal to the concept of natural grass playing fields, the simple reality is that those fields do not allow for the same degree of use as artificial turf fields. This Committee recognizes that young people greatly benefit from usable playing fields. A natural grass field does not serve its purpose if it sits unusable in early spring and late fall due to weather damage or overuse. Particularly in the shoulder seasons of March-April and October-November, artificial turf fields offer far more extensive opportunities for use than their natural turf counterparts. Moreover, Committee members acknowledged that many of the health and environmental shortcomings of artificial turf can be mitigated by using non-plastic and non-crumb rubber infills – with natural, alternative infills offering great potential.

On the whole, the Committee saw the benefits and drawbacks of artificial turf fields and carefully evaluated them. While Committee members opposed a ban on future artificial turf construction in Arlington, they could not fully embrace the option either. The Committee believes that artificial turf should be an option for future field planners in Arlington, after careful evaluation of the practicality and feasibility of natural turf options.

To the extent that future field planners choose to seriously evaluate artificial turf as an option, the Committee feels strongly that the following points should be considered by those planners for all future projects¹⁰⁰:

- Crumb rubber infills should not be used in artificial turf fields in Arlington.
- Any artificial turf installed at an Arlington field should be certified by an independent lab (not just the manufacturer) as being free of PFAS and other toxic chemicals before shipment.
- Any artificial turf field (and, for that matter, any natural grass field in Arlington) should be held to strict heat standards on the hottest days of the year, meaning those fields should be closely monitored by a designated Town of Arlington official to ensure that the fields are closed when surface temperatures exceed a certain recognized threshold.
- Any decision about where to place an artificial turf field should consider if placement of the field is in or near a designated heat island in Arlington (i.e., the hottest 5% of areas in Arlington, as determined by the Metropolitan Area Planning Council's published analysis).

¹⁰⁰ The Committee emphasizes that its discussions did not concentrate on any particular field or project. Any field in Arlington that is already artificial turf (like the Arlington Catholic High School field) or is far along in the planning and development stage (such as the new Arlington High School fields) was not a focus of this Committee's work or discussion. This Committee's findings and recommendations should inform future development at those fields when the time comes for the artificial turf fields at those locations to be replaced.

- When the Town of Arlington considers renovations of its fields, whether as natural grass or artificial turf, it should examine equitable access to high quality playing surfaces and balance the needs of different neighborhoods in that planning process.
- There should be no purchase of an artificial turf field until the Town of Arlington contractually mandates that the manufacturer will take full responsibility for ensuring that the materials will be recycled in the most environmentally sensitive manner possible at the end of the product's life.

The Committee wishes to emphasize that every future field development project in Arlington should be evaluated on a case-by-case basis, keeping the recommendations of this report in mind when doing so.

Regardless of whether Arlington builds any artificial turf fields in the future, the Committee feels strongly that all of Arlington's fields (artificial and natural turf alike) require high-quality maintenance programs. No future field should be developed (or re-developed) in Arlington without the costs of those high-quality maintenance programs being fully factored into the financial analysis for those projects. Even if Arlington never constructs another artificial turf field, it is absolutely essential that the Town maintain its existing natural turf fields to a higher standard than it has been doing in the past, which includes proper resting of the fields.

The Committee wants what is best for Arlington's field users, especially its youngest: healthy, well maintained playing fields that allow maximal use, enjoyment, and safety. Like any manufactured product of the modern age, artificial turf has its strengths and weaknesses. The Committee is now quite familiar with both. In the final analysis, the Committee believes that artificial turf fields can be an option for Arlington's future field projects (a) after careful evaluation of the practicality and feasibility of natural turf options, and (b) with proper health and environmental safeguards in place.

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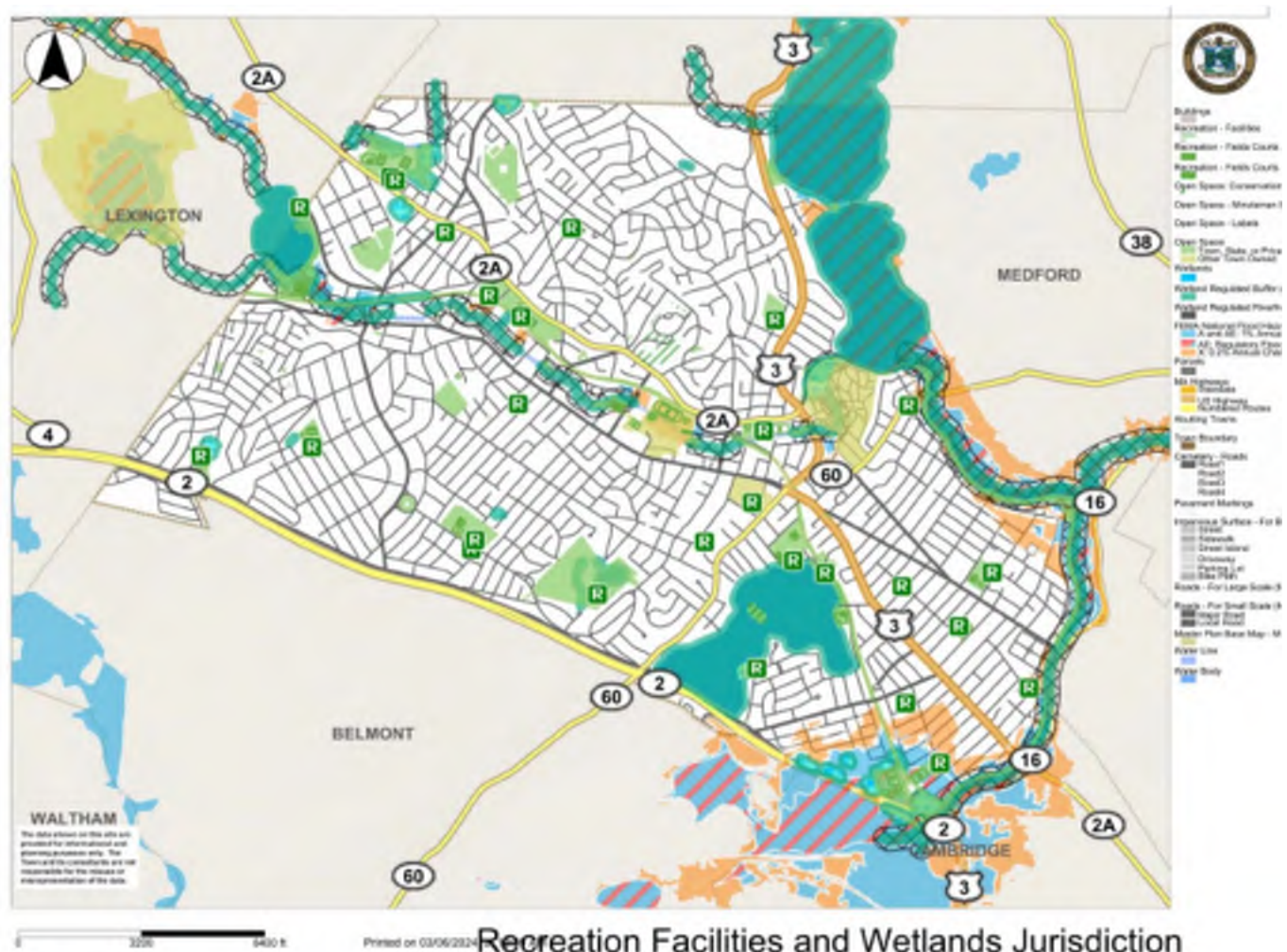
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Appendices

RECREATION FACILITIES AND WETLANDS JURISDICTION



APPENDIX 2

MAINTENANCE FREQUENCY - SYNTHETIC SURFACE & NATURAL TURF

MAINTENANCE FREQUENCY – SYNTHETIC SURFACE

Operation	Task	JAN	FEB	Mar	APR	May	June	July	Aug	Sept	Oct	Nov	Dec
Operations	Brushing			4	4	4	4	4	4	4	4	4	
	Aeration			1			1		1			1	
	Infill re-distribution			12	12	12	12	12	12	12	12	12	
	Top Dressing (Localized)		1	1			1		1			1	
	Grooming		1	1	1	1	1	1	1	1	1	1	
	Magnet Sweep			1			1		1				1
	Surface sanitization			1			1		1				
	Marking out (if required)	2	2	2	2	2	2	2	2	2	2	2	2
	Seam inspection/Repairs	1	1	1	1	1	1	1	1	1	1	1	1
	Snow Plough/ Removal	1	1	1									1
	Revitalisation			1			1					1	
	Top Dress			1					1				
	Leaf/Debris Removal							1	1		1	1	1

MAINTENANCE FREQUENCY– NATURAL TURF

Operation	Task	Mar	APR	May	June	July	Aug	Sept	Oct	Nov
Cultural Operations	Mowing	2	8	8	8	8	8	8	8	4
	De-Thatching			1				1		
	Marking out		4	8	8	8	8	8	8	4
	Top Dressing		1	1				1		
	Over - Seeding			1			1	1		1
	Core Aeration			1					1	
	Deep Tine Aeration									1
	Wetting Agents		1	1	1	1	1	1	1	
	Irrigation		20	20	20	30	30	30	20	10
Spray /Granular Applications	Insect Control (Organic)			1	1					
	Nutrition (Various)			1	1		1	1		1
End of Season Renovation	Over - Seeding							1		1
	Core Aeration							1		
	Top Dress							1		



Technical Memorandum

To: Peter H. Rice, Director of Public Works (City of Portsmouth, NH)
Suzanne Woodland (Deputy City Attorney)

From: Elizabeth Denly, TRC Vice President, PFAS Initiative Leader & Chemistry Director
Dr. Karen Vetrano, TRC Risk Assessment and Toxicology Manager

Date: June 7, 2022

Subject: Evaluation of PFAS in Synthetic Turf

1.0 SUMMARY OF INVESTIGATION

The City of Portsmouth recently installed a synthetic turf ballfield. Due to concerns raised by community members, the material used for the synthetic turf was evaluated for the potential presence of per- and polyfluoroalkyl substances (PFAS).

TRC prepared a sampling and analysis plan (SAP) in February 2022 which provided details and requirements on the following:

- Sampling procedures for the materials under investigation: carpet/grass, in-fill material, and the shock pad;
- Requirements for packaging of these materials by the manufacturer and shipping of these materials to the analytical laboratory;
- Procedures to be used by the analytical laboratory for the homogenization/compositing, extraction, and analysis of each material;
- Reporting limit goals for the individual PFAS analyses in each material; and
- Required field and analytical quality control samples and measurement criteria.

TRC worked directly with the synthetic turf manufacturers to establish an appropriate procedure for the collection of representative samples for analysis. TRC also worked directly with the analytical laboratory, Eurofins TestAmerica (Eurofins) in Lancaster, Pennsylvania, to ensure appropriate procedures would be used by the laboratory for the handling of these materials and that the resulting data would be representative of the materials under evaluation.

The evaluation was performed using the same synthetic turf material product purchased and installed by the City of Portsmouth, but the samples of this material that underwent evaluation were obtained directly from the manufacturers. Figures 1 through 3 provide photographs of the samples submitted for analysis.

- US Greentech (Safeshell Infill): Sample ID: Safeshell #1-3
- FieldTurf (Synthetic Turf Carpet): Sample ID: Carpet-001
- Schmitz Foam Products (ProPlay Pad): Sample ID: PP Pad-001

Prior to the laboratory extraction process, each material was disaggregated using a cryo-mill which reduced each material down to a homogenous powdery material. This process helped to ensure a representative sample of each material was being used in the extraction. Eurofins performed three analyses of each sample.

- 1) 70 individual PFAS using a modified version of USEPA Method 537.1, with isotope dilution liquid chromatography/dual mass spectrometry (i.e., pre-oxidation analysis)
- 2) Total oxidizable precursor (TOP) assay
- 3) Non-targeted analysis using quadrupole time of flight mass spectrometry (QTOF-MS).

Three equipment blanks were generated by the laboratory during the cryo-milling process to ensure the equipment was not contributing PFAS to the samples and that the equipment was properly decontaminated between samples. The equipment blanks were analyzed for only the 70 individual PFAS. Equipment blanks were associated with the samples as follows:

- EB-001: associated with Carpet-001
- EB-002: associated with PP Pad-001
- EB-003: associated with Safeshell #1-3

2.0 ANALYTICAL RESULTS

The results of the analyses for the 70 PFAS and TOP Assay are presented in Table 1. The results of the q-TOF analyses are discussed below and provided in Attachment 1. Copies of the laboratory data packages are provided in Attachment 1.

TOP Assay

TOP Assay analyses were performed on each sample. The purpose of the TOP Assay analyses was to determine if PFAS precursors are present in the samples. There are thousands of potential PFAS precursors, with only several that are commonly analyzed for by commercial laboratories. The current analytical method can quantify a list of 70 PFAS; the list of compounds includes perfluoroalkyl acids (PFAAs) and select PFAS precursors. This method is not designed to identify and report on the full suite of PFAS that may be present in each sample. However, through a strong oxidation procedure, the TOP Assay analysis causes the breakdown of PFAS precursor compounds into the measurable and regulated PFAAs. As a result, this investigation was designed to quantify the potential risk of accelerating precursor transformation into PFAAs that could result from the oxidation of these samples, a worst-case scenario. The analysis was completed by utilizing a pre- and post-TOP Assay procedure.

The post-oxidation analyses of the three samples did not result in a significant increase of PFAAs, indicating that these materials do not contain a significant mass of precursor PFAS. Potential transformation or oxidation of these materials in the future will therefore not likely cause an increase in the PFAA concentrations and will not result in additional risk.

Non-targeted QTOF-MS Results

Non-targeted QTOF-MS analyses were performed on each sample to determine if “other” PFAS were present that were not included in the analysis of the 70 individual PFAS. Consistent with the TOP Assay analyses, the QTOF-MS analyses did not reveal the presence of a significant mass of “other” PFAS. The QTOF-MS data are qualitative in nature; results represent qualitative estimations of presumptive positives. The process used to identify these peaks is described in the data package in Attachment 1.

There were several additional peaks identified in these samples but only one peak was tentatively

identified in sample Carpet-001 as bis(2,2,3,3,4,4,4- heptafluorobutyl) carbonate; this peak had a lower intensity than some of the unknown peaks also noted in this sample. Most of the compounds screened after the non-target analysis appeared as [M-H]⁻, which indicates a loss of hydrogen after dissociation in water. This indicates the presence of either a carboxylic or sulfonic acid functional group in the backbone of the compounds. However, in almost all cases, the identifications of these peaks were not available and reported as “unknown”.

Data Usability Evaluation

An evaluation of analytical data usability was performed and included the following parameters:

- Holding times and sample preservation
- Blanks (method and equipment)
- Isotopically labeled surrogate results
- Laboratory control sample (LCS) results
- Internal standards
- Sample results and reporting limits

The focus of the review was to ensure that the laboratory generated valid data for the PFAS results, and that results were usable for project objectives. Due to significantly low recoveries of PS Acid and EVE Acid in the LCS analyses, the nondetect results for these compounds are not usable for project objectives in the pre-oxidation analyses of all samples.

The following data quality nonconformances were noted, all of which have a minor impact on the usability of the data.

- Holding Times
 - The equipment blank samples were analyzed one to three days outside of the holding time. There is no significant effect on these results due to the minor holding time nonconformance.
- Method Blank Contamination
 - The positive results for PFOSA in equipment blank EB-001 and PFOS in equipment blanks EB-001, EB-002, and EB-003 are likely false positives due to method blank contamination.
 - The positive results for 6:2 FTS in the post-oxidation analyses of samples Carpet-001 and PP Pad-001 are likely false positives due to method blank contamination.
- Equipment Blank Contamination
 - The positive result for HFPO-DA in the post-oxidation analysis of sample PP Pad-001 is likely a false positive due to equipment blank contamination.
- Isotopically Labeled Surrogate Results
 - Potential uncertainty exists for 6:2 FTCA and 7:3 FTCA in the post-oxidation analyses of samples Carpet-001 and PP Pad-001 and 8:2 FTCA in the post-oxidation analysis of sample Safeshell #1-3 due to slightly low recoveries of the associated isotopically labeled surrogates.
 - Potential uncertainty exists for PFPeA in the pre-oxidation analysis of sample Safeshell #1-3 due to high recovery of the associated isotopically labeled surrogate.
- Ion Ratios
 - Potential uncertainty exists for the positive results for 6:2 FTS and PFOS in the post-oxidation analysis of sample Carpet-001 and 6:2 FTS, PFHxA, and PFHpA in the post-oxidation analysis of sample PP Pad-001 due to ion ratios outside of the

acceptance criteria.

In general, data are usable for project decisions based on a review of the accuracy, precision, and sensitivity of the data. With the exception of PS Acid and EVE Acid, the PFAS data are valid as reported and may be used for decision-making purposes.

3.0 PRELIMINARY RISK EVALUATION

A preliminary evaluation of the potential risk of exposure to PFAS detected in the synthetic turf components was performed. Consideration was made as to which turf components contain PFAS and the types of exposure applicable to those components.

As previously discussed, Table 1 presents the results of the analyses for the 70 PFAS and TOP Assay which are denoted under each sample as “Pre-Treatment” and “Post-Treatment”, respectively. As discussed above, the TOP Assay subjects the samples to strong oxidizers, under specific laboratory conditions in order to accelerate potential precursor oxidation into the measurable and regulated PFAAs, thus representing a worst-case scenario.

The USEPA (USEPA 2022a) and individual states (ITRC 2022) have derived health-based soil screening criteria under residential exposures for some of the PFAS. Table 2 presents a comparison of the detected concentrations to USEPA and New Hampshire (NH) human health-based residential soil screening values. When neither of these values were available, the lowest available screening value was obtained from another state. Finally, if there were no promulgated screening values available for a detected compound, the lowest NH residential soil screening level (PFOS) was used as a surrogate. Comparing detected concentrations in the synthetic turf components (i.e., grass/carpet, shock pad, and infill material) to available soil screening criteria is highly conservative (i.e., health protective). For example, USEPA residential soil screening criteria assume a combination of ingestion, dermal contact and inhalation (if volatile) exposures over a period of 24 hours/day, 350 days/year for 6 years for non-cancer effects and over a period of 350 days/year for a combined 26 years (20-year-old adult and 6-year-old child combined exposures) (USEPA 2014, 2022b). Exposures to the synthetic turf components will be much less than the assumed residential soil exposures. Additionally, the primary route of exposure for residential soils is ingestion, whereas exposure to the synthetic turf carpet and infill would be through limited dermal exposure. It is not expected that there would be physical contact with the shock pad since it is beneath the carpet and infill material.

Carpet Sample

As shown in Table 1, there were no detectable concentrations of PFAS in the FieldTurf, synthetic turf carpet pre-treatment sample. The following eight individual PFAS were detected at very low concentrations in the TOP Assay after extreme oxidizing conditions:

- 6:2 Fluorotelomer sulfonic acid*
- HFPODA (Gen-X)
- Perfluorobutanoic Acid (PFBA)
- Perfluorohexanoic Acid (PFHxA)
- Perfluorooctanesulfonic Acid (PFOS)
- Perfluoropentanoic Acid (PFPeA)
- PPF Acid (Pentafluoropentanoic Acid)
- R-EVE

*It should be noted that 6:2 Fluorotelomer sulfonic acid was also detected in a blank sample and therefore is not considered an actual detection in this sample.

With the exception of PPF Acid, all the detected compounds were below 1 nanogram/gram (ng/g), which is equivalent to 0.001 milligrams per kilogram (mg/kg). PPF acid was detected at 1.08 ng/g (0.00108 mg/kg).

As shown in Table 2, for those detected concentrations in the post-treatment carpet sample with residential soil screening values, all were well below their respective values, ranging from 446 (HFPODA) to 24,120 (Perfluorobutanoic acid) times lower. Two detected compounds do not have screening criteria. Conservatively assuming that these compounds are as toxic as PFOS, the detected concentrations were well below the surrogate PFOS screening value, ranging from 92 (PPF Acid) to 1,472 (R-EVE) times lower.

ProPlay Pad

As shown in Table 1, there were three PFAS with very low detected concentrations in the ProPlay (PP) Pad pre-treatment sample:

- Perfluorononanoic acid (PFNA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUnA)

The following six PFAS were detected at very low concentrations in the TOP Assay after extreme oxidizing conditions:

- 6:2 Fluorotelomer sulfonic acid*
- HFPODA (Gen-X)
- Perfluoroheptanoic Acid (PFHpA)
- Perfluorohexanoic Acid (PFHxA)
- PPF Acid (Perfluoropropionic Acid)
- R-EVE

*It should be noted that 6:2 Fluorotelomer sulfonic acid was also detected in a blank sample and therefore is not considered an actual detection in this sample.

All the detected compounds were below 1 ng/g, which is equivalent to 0.001 mg/kg.

As shown in Table 2, for those detected concentrations in the PP Pad sample with residential soil screening values, all were well below the documented screening value. For the pre-treatment samples, concentrations ranged from 117 (Perfluoroundecanoic acid) to 2,252 (Perfluorononanoic acid) times lower, while for the post-treatment samples, concentrations ranged from 119 (Perfluoroheptanoic acid) to 1,875 (Perfluorohexanoic acid) times lower than their respective health-based values. Two detected compounds do not have screening criteria. Conservatively assuming that these compounds are as toxic as PFOS, the detected concentrations were well below the surrogate PFOS screening value, ranging from 408 (PPF Acid) to 735 (R-EVE) times lower.

Safeshell #1-3 Infill

As shown in Table 1, there were six PFAS with very low detected concentrations in the SafeShell Infill pre-treatment sample:

- PEPA (Perfluoro-2-ethoxypropanoic acid)
- Perfluoropentanoic Acid (PFPeA)
- PFMOAA (Perfluoro-2-methoxyacetic acid)
- PFO2HxA (Perfluoro (3,5-dioxahexanoic)acid)
- PMPA (Perfluoro-2-methoxypropanoic acid)
- PPF Acid (Perfluoropropionic Acid)

The following four PFAS were detected at very low concentrations in the TOP Assay after extreme oxidizing conditions:

- 6:2 FTCA (6:2 Fluorotelomer carboxylic acid)
- 6:2 FTUCA (6:2 Fluorotelomer unsaturated carboxylic acid)
- PFO2HxA (Perfluoro (3,5-dioxahexanoic)acid)
- TAF (Perfluoro (3,5,7,9,11-pentaoxadodecanoic) acid)

With the exception of PFMOAA and PPF acid in the pre-treatment sample, all the detected compounds were below 1 ng/g, which is equivalent to 0.001 mg/kg. PFMOAA was detected at a concentration of 5.16 ng/g (0.00516 mg/kg) and PPF acid was detected at a concentration of 41 ng/g (0.041 mg/kg).

As shown in Table 2, only Perfluoropentanoic acid, detected in the pre-treatment SafeShell sample has an associated soil screening value and was 1500 times lower than that value. Five of the compounds detected in the pre-treatment sample did not have associated screening values. Conservatively assuming that these compounds are as toxic as PFOS, the detected concentrations were below the surrogate PFOS screening value, ranging from 2.5 (PPF Acid) to 2,169 (PMPA) times lower.

None of the post-treatment detected compounds had associated soil screening values. Conservatively assuming that these compounds are as toxic as PFOS, the detected concentrations were well below the surrogate PFOS screening value, ranging from 325 (PFO2HxA) to 2,353 (6:2 FTCA) times lower.

Conclusions

A preliminary evaluation of the potential risk of exposure to PFAS detected in the components of the synthetic turf system (grass/carpet, infill, and shock pad) was conducted by comparing the detected concentrations to available promulgated federal and state residential soil screening levels (USEPA, 2022a, ITRC, 2022). These screening values are meant to establish unlimited use of contaminated soil sites and therefore are extremely conservative (i.e., health protective) when used for comparing concentrations in synthetic turf.

Two primary PFAS analyses were conducted on the synthetic turf components, a modified version of EPA Method 537.1 which can detect 70 individual PFAS and the TOP Assay. The TOP Assay is meant as a worst-case condition and is used to quantify the potential risk of accelerating precursor transformation into PFAAs that could result from the oxidation of these samples in nature, thereby increasing the types and concentrations of PFAAs. The post-oxidation analyses of the three samples did not result in a significant increase of PFAAs, indicating that these materials do not contain a significant mass of precursor PFAS. Potential transformation or oxidation of these materials in the future will not cause an increase in PFAA concentrations and will not result in additional risk.

Of the synthetic turf components, the grass/carpet and infill material would be expected to be the two components in which there will be physical contact. The carpet sample had no detectable PFAS in the pre-treatment sample. Post-treatment samples showed very low level, trace concentrations (as evidenced in Table 1 as “J”, estimated values) of a limited number of PFAS. When compared to the health-based soil screening levels, all concentrations were orders of magnitude below the target benchmark levels, thus indicating no significant risk from exposure to these compounds.

The Shellsafe Infill material had very low-level concentrations of a limited number of PFAS in the pre-treatment and post-treatment samples. With the exception of PPF Acid detected in the pre-treatment sample, all were orders of magnitude below the target benchmark levels, thus indicating no significant risk from exposure to these compounds. PPF Acid does not have a promulgated health-based soil screening level and was compared to the NH residential soil screening level for PFOS and was 2.5 times lower, which still indicates no potential significant risk from this exposure. PPF Acid is a small molecule consisting of only two fully fluorinated carbons and is considered an ultra-short chain PFAA (Björnsdotter, M.K et al. 2020). Unlike PFOS which bioaccumulates and has an estimated half-life in humans of over 5 years (i.e., the body concentration decreases by half every 5 years with no additional exposure), PPF Acid is not expected to bioaccumulate, thus decreasing potential chronic toxicity. Therefore the comparison with the PFOS screening level as a surrogate is very conservative.

The comparison of detected PFAS concentrations in the shock pad to soil concentrations is an extremely conservative evaluation since it is covered by the grass/carpet and infill material and thus not available for contact. Nevertheless, the same evaluation was conducted. The shock pad had very low-level concentrations of a limited number of PFAS in the pre-treatment and post-treatment samples. All concentrations were orders of magnitude below the target benchmark levels, thus indicating no significant risk from exposure to these compounds.

Based on this evaluation, the detection of very low levels of a limited number of PFAS in the synthetic turf components does not represent a human health risk to those using the synthetic turf ballfields.

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FIGURES



Figure 1: US Greentech (Safeshell Infill)



Figure 2: FieldTurf (Synthetic Turf Carpet) **Figure 3: Schmitz Foam Products (ProPlay Pad)**

TABLES

Table 1
Summary of Analytical Results for Synthetic Turf Samples -- March 2022
Portsmouth, NH

			Sample Name:				Carpet-001				PP Pad-001			
			Lab Sample ID:				410-75808-1				410-76735-1			
			Sample Date:				3/8/2022				3/16/2022			
			Sample Type:				Pre-Treatment		Post-Treatment		Pre-Treatment		Post-Treatment	
			Units:				ng/g		ng/g		ng/g		ng/g	
Analysis	Analyte													
PFAS														
	10:2 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	10:2 FTS		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	10:2 FTUCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	11Cl-PF3OUdS		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	3:3 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	4:2 Fluorotelomer sulfonic acid		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	5:3 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	6:2 Fluorotelomer sulfonic acid		0.400	U	0.187	JBI	0.399	U	0.162	JBI	0.399	U	0.162	JBI
	6:2 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	6:2 FTUCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	7:3 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	8:2 Fluorotelomer sulfonic acid		0.600	U	0.600	U	0.599	U	0.600	U	0.599	U	0.600	U
	8:2 FTCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	8:2 FTUCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	9Cl-PF3ONS		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	DONA		0.600	U	0.120	U	0.599	U	0.120	U	0.599	U	0.120	U
	EVE Acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	HFPODA		0.400	U	0.515	J	0.399	U	0.526	J	0.399	U	0.526	J
	Hydro-EVE Acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Hydrolyzed PSDA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Hydro-PS Acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	MTP		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	NEtFOSA		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NEtFOSAA		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NEtFOSE		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NMeFOSA		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NMeFOSAA		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NMeFOSE		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	NVHOS		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PEPA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoro (2-ethoxyethane) sulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoro-4-ethylcyclohexanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorobutanesulfonic acid		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	Perfluorobutanoic acid		0.400	U	0.199	J	0.399	U	0.400	U	0.399	U	0.400	U
	Perfluorodecanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorodecanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorododecanesulfonic acid		0.400	U	0.400	U	0.399	U	0.400	U	0.399	U	0.400	U
	Perfluorododecanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoroheptanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoroheptanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.210	I	0.120	U
	Perfluorohexadecanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorohexanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorohexanoic acid		0.120	U	0.0570	J	0.120	U	0.160	I	0.120	U	0.160	I
	Perfluorononanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorononanoic acid		0.120	U	0.120	U	0.0444	J	0.120	U	0.120	U	0.120	U
	Perfluorooctadecanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorooctanesulfonamide		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorooctanesulfonic acid		0.120	U	0.135	I	0.120	U	0.120	U	0.120	U	0.120	U

Table 1
Summary of Analytical Results for Synthetic Turf Samples -- March 2022
Portsmouth, NH

			Sample Name:				Carpet-001				PP Pad-001			
			Lab Sample ID:				410-75808-1				410-76735-1			
			Sample Date:				3/8/2022				3/16/2022			
			Sample Type:				Pre-Treatment				Post-Treatment			
			Units:				ng/g		ng/g		ng/g		ng/g	
Analysis	Analyte													
	Perfluorooctanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoropentanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoropentanoic acid		0.120	U	0.0499	J	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluoropropanesulfonic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorotetradecanoic acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Perfluorotridecanoic acid		0.120	U	0.120	U	0.0406	J	0.120	U	0.120	U	0.120	U
	Perfluoroundecanoic acid		0.120	U	0.120	U	0.0538	J	0.120	U	0.120	U	0.120	U
	PFECA A		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFECA B		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFECA F		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFECA G		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFMOAA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFO2HxA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFO3OA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PFO4DA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PMPA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	PPF Acid		0.120	U	1.08	J	0.120	U	0.245					
	PS Acid		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	R-EVE		0.120	U	0.0679	J	0.120	U	0.136					
	R-PSDA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	R-PSDCA		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	TAF		0.120	U	0.120	U	0.120	U	0.120	U	0.120	U	0.120	U
	Total PFCA		0.300	U	0.306		0.300	U	0.370					

Notes:

ng/g - nanograms per gram.

ng/L - nanograms per liter.

B - Compound was found in the laboraotry method blank and sample.

I - Value is EMPC (estimated maximum possible concentration).

J - Estimated value.

NA - Not applicable.

U - Analyte was not detected at specified quantitation limit.

Values in **bold** indicate the analyte was detected.

PFAS - Per- and Poly-fluoroalkyl Substances.

Table 1
Summary of Analytical Results for Synthetic Turf Samples -- March 2022
Portsmouth, NH

		Sample Name:	Safeshell #1-3				EB-001		EB-002		EB 003	
		Lab Sample ID:	410-76903-1				410-75808-2		410-76735-2		410-76903-4	
		Sample Date:	3/9/2022				3/21/2022		3/21/2022		3/22/2022	
		Sample Type:	Pre-Treatment ng/g		Post-Treatment ng/g		Equipment Blank ng/L		Equipment Blank ng/L		Equipment Blank ng/L	
		Units:										
Analysis	Analyte											
PFAS												
	10:2 FTCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	10:2 FTS		0.394	U	0.399	U	4.24	U	5.00	U	4.76	U
	10:2 FTUCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	11Cl-PF3OUdS		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	3:3 FTCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	4:2 Fluorotelomer sulfonic acid		0.394	U	0.399	U	1.70	U	2.00	U	1.90	U
	5:3 FTCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	6:2 Fluorotelomer sulfonic acid		0.394	U	0.399	U	4.24	U	5.00	U	4.76	U
	6:2 FTCA		0.118	U	0.0425	J	1.70	U	2.00	U	1.90	U
	6:2 FTUCA		0.118	U	0.149		1.70	U	2.00	U	1.90	U
	7:3 FTCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	8:2 Fluorotelomer sulfonic acid		0.591	U	0.599	U	2.54	U	3.00	U	2.85	U
	8:2 FTCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	8:2 FTUCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	9Cl-PF3ONS		0.394	U	0.399	U	1.70	U	2.00	U	1.90	U
	DONA		0.591	U	0.120	U	1.70	U	2.00	U	1.90	U
	EVE Acid		0.118	U	0.120	U	8.48	U	9.99	U	9.52	U
	HFPODA		0.394	U	0.599	U	2.54	U	0.609	J	2.85	U
	Hydro-EVE Acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Hydrolyzed PSDA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Hydro-PS Acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	MTP		0.118	U	0.120	U	4.24	U	5.00	U	4.76	U
	NEtFOSA		0.394	U	0.399	U	4.24	U	5.00	U	4.76	U
	NEtFOSAA		0.394	U	0.399	U	2.54	U	3.00	U	2.85	U
	NEtFOSE		0.394	U	0.399	U	2.54	U	3.00	U	2.85	U
	NMeFOSA		0.394	U	0.399	U	2.54	U	3.00	U	2.85	U
	NMeFOSAA		0.394	U	0.399	U	1.70	U	2.00	U	1.90	U
	NMeFOSE		0.394	U	0.399	U	2.54	U	3.00	U	2.85	U
	NVHOS		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PEPA		0.0687	J	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoro (2-ethoxyethane) sulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoro-4-ethylcyclohexanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorobutanesulfonic acid		0.394	U	0.399	U	1.70	U	2.00	U	1.90	U
	Perfluorobutanoic acid		0.394	U	0.399	U	4.24	U	5.00	U	4.76	U
	Perfluorodecanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorodecanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorododecanesulfonic acid		0.394	U	0.399	U	2.54	U	3.00	U	2.85	U
	Perfluorododecanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoroheptanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoroheptanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorohexadecanoic acid		0.118	U	0.120	U	2.54	U	3.00	U	2.85	U
	Perfluorohexanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorohexanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoronanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoronanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorooctadecanoic acid		0.118	U	0.120	U	2.54	U	3.00	U	2.85	U
	Perfluorooctanesulfonamide		0.118	U	0.120	U	0.447	J	2.00	U	1.90	U
	Perfluorooctanesulfonic acid		0.118	U	0.120	U	0.501	J	0.804	J	0.731	J

Table 1
Summary of Analytical Results for Synthetic Turf Samples -- March 2022
Portsmouth, NH

Sample Name: Lab Sample ID: Sample Date: Sample Type: Units:			Safeshell #1-3				EB-001		EB-002		EB 003	
			410-76903-1				410-75808-2		410-76735-2		410-76903-4	
			3/9/2022				3/21/2022		3/21/2022		3/22/2022	
			Pre-Treatment ng/g		Post-Treatment ng/g		Equipment Blank ng/L		Equipment Blank ng/L		Equipment Blank ng/L	
Analysis	Analyte											
	Perfluorooctanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoropentanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoropentanoic acid		0.200		0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoropropanesulfonic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorotetradecanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluorotridecanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	Perfluoroundecanoic acid		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFECA A		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFECA B		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFECA F		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFECA G		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFMOAA		5.16		0.120	U	1.70	U	2.00	U	1.90	U
	PFO2HxA		0.0644	J	0.308		1.70	U	2.00	U	1.90	U
	PFO3OA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PFO4DA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	PMPA		0.0461	J	0.120	U	1.70	U	2.00	U	1.90	U
	PPF Acid		41.0		0.120	U	4.24	U	5.00	U	4.76	U
	PS Acid		0.118	U	0.120	U	8.48	U	9.99	U	9.52	U
	R-EVE		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	R-PSDA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	R-PSDCA		0.118	U	0.120	U	1.70	U	2.00	U	1.90	U
	TAF		0.118	U	0.0859	J	4.24	U	5.00	U	4.76	U
	Total PFCA		0.200	J	0.300	U	NA		NA		NA	

Notes:

ng/g - nanograms per gram.

ng/L - nanograms per liter.

B - Compound was found in the laboraotry method blank and sample.

I - Value is EMPC (estimated maximum possible concentration).

J - Estimated value.

NA - Not applicable.

U - Analyte was not detected at specified quantitation limit.

Values in **bold** indicate the analyte was detected.

PFAS - Per- and Poly-fluoroalkyl Substances.

Table 2
Comparison of Risk-Based Soil Screening Levels with Detected PFAS Concentrations
Portsmouth, NH

Analyte	CAS #	Residential Soil Screening Levels			Sample Name: Sample Date: Sample Type: Units:										
		EPA RSL mg/kg	NH DCRB mg/kg	Lowest Alternate State Level mg/kg		Carpet-001		PP Pad-001				Safeshell #1-3			
						3/8/2022		3/16/2022				3/9/2022			
						Post-Treatment ng/g mg/kg		Pre-Treatment ng/g mg/kg		Post-Treatment ng/g mg/kg		Pre-Treatment ng/g mg/kg		Post-Treatment ng/g mg/kg	
6:2 FTCA (a)	53826-12-3	NA	0.1	NA		--	--	--	--	--	--	--	0.0425	0.00004	
6:2 FTUCA (a)	70887-88-6	NA	0.1	NA		--	--	--	--	--	--	--	--	0.149	0.00015
HFPODA	13252-13-6	0.23	NA	NA		0.515	0.00052	--	--	0.526	0.00053	--	--	--	--
PEPA (a)	267239-61-2	NA	0.1	NA		--	--	--	--	--	--	0.0687	0.00007	--	--
Perfluorobutanoic acid	375-22-4	NA	NA	4.8 (HI EAL)		0.199	0.00020	--	--	--	--	--	--	--	--
Perfluoroheptanoic acid	375-85-9	NA	NA	0.025 (HI EAL)		--	--	--	--	0.21	0.00021	--	--	--	--
Perfluorohexanoic acid	307-24-4	NA	NA	0.3 (TX PCL)		0.057	0.00006	--	--	0.16	0.00016	--	--	--	--
Perfluorononanoic acid	375-95-1	0.19	0.1	NA		--	--	0.0444	0.00004	--	--	--	--	--	--
Perfluorooctanesulfonic acid	1763-23-1	0.13	0.1	NA		0.135	0.00014	--	--	--	--	--	--	--	--
Perfluoropentanoic acid	2706-90-3	NA	NA	0.3 (TX PCL)		0.0499	0.00005	--	--	--	--	0.2	0.00020	--	--
Perfluorotridecanoic acid	72629-94-8	NA	NA	0.0084 (HI EAL)		--	--	0.0406	0.00004	--	--	--	--	--	--
Perfluoroundecanoic acid	2058-94-8	NA	NA	0.0063 (HI EAL)		--	--	0.0538	0.00005	--	--	--	--	--	--
PFMOAA (a)	674-13-5	NA	0.1	NA		--	--	--	--	--	--	5.16	0.00516	--	--
PFO2HxA (a)	39492-88-1	NA	0.1	NA		--	--	--	--	--	--	0.0644	0.00006	0.308	0.00031
PMPA (a)	13140-29-9	NA	0.1	NA		--	--	--	--	--	--	0.0461	0.00005	--	--
PPF Acid (a)	422-64-0	NA	0.1	NA		1.08	0.00108	--	--	0.245	0.00025	41	0.04100	--	--
R-EVE (a)	2416366-22-6	NA	0.1	NA		0.0679	0.00007	--	--	0.136	0.00014	--	--	--	--
TAF (a)	39492-91-6	NA	0.1	NA		--	--	--	--	--	--	--	--	0.0859	0.000086
Total PFCA	TOTAL PFCA	NA	NA	NA		0.306	0.00031	--	--	0.37	0.00037	0.2	0.00020	--	--

(a) NH residential PFOS value used as a surrogate.

EPA RSL = USEPA Regional Screening Level (USEPA 2022)

NH DCRB = New Hampshire Direct Contact Risk-Based Soil Concentration (ITRC 2022)

TX PCL = Texas Protective Concentration Level (ITRC 2022)

HI EAL = Hawaii Environmental Action Level, unrestricted land use scenario (ITRC 2022)

ATTACHMENT 1

ANALYTICAL DATA PACKAGES

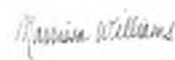
ANALYTICAL REPORT

Eurofins Lancaster Laboratories Environment Testing, LLC
2425 New Holland Pike
Lancaster, PA 17601
Tel: (717)656-2300

Laboratory Job ID: 410-75808-1
Client Project/Site: Synthetic Turf

For:
TRC Companies, Inc
650 Suffolk Street
Lowell, Massachusetts 01854

Attn: Elizabeth Denly



Authorized for release by:
5/13/2022 12:05:09 PM

Marissa Williams, Project Manager
(717)556-7246
Marissa.Williams@et.eurofinsus.com

LINKS

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The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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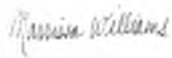
Analytical test results meet all requirements of the associated regulatory program (e.g., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis. Data qualifiers are applied to note exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

- QC results that exceed the upper limits and are associated with non-detect samples are qualified but further narration is not required since the bias is high and does not change a non-detect result. Further narration is also not required with QC blank detection when the associated sample concentration is non-detect or more than ten times the level in the blank.
 - Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD is performed, unless otherwise specified in the method.
 - Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.
- Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Measurement uncertainty values, as applicable, are available upon request.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as "analyze immediately" and tested in the laboratory are not performed within 15 minutes of collection.

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Marissa Williams
Project Manager
5/13/2022 12:05:09 PM

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Definitions/Glossary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Qualifiers

LCMS

Qualifier	Qualifier Description
*-	LCS and/or LCSD is outside acceptance limits, low biased.
*+	LCS and/or LCSD is outside acceptance limits, high biased.
*5-	Isotope dilution analyte is outside acceptance limits, low biased.
*5+	Isotope dilution analyte is outside acceptance limits, high biased.
B	Compound was found in the blank and sample.
cn	Refer to Case Narrative for further detail
E	Result exceeded calibration range.
H	Sample was prepped or analyzed beyond the specified holding time
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
1C	Result is from the primary column on a dual-column method.
2C	Result is from the confirmation column on a dual-column method.
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Case Narrative

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Narrative

Job Narrative 410-75808-1

Receipt

The samples were received on 3/11/2022 10:17 AM, 3/18/2022 8:41 AM, 3/21/2022 12:09 PM and 3/21/2022 2:00 PM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperatures of the 3 coolers at receipt time were 15.5°C, 16.4°C and 17.2°C

Receipt Exceptions

The following samples were received at the laboratory outside the required temperature criteria: Safeshell #1-3 (410-76903-1), Safeshell #2 (410-76903-2), Safeshell #3 (410-76903-3) and EB 003 (410-76903-4). This does not meet regulatory requirements. The client was contacted regarding this issue, and the laboratory was instructed to proceed with analysis.

LCMS

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

PFAS

Method 537_IDA_TOPS: The sample injection standard peak areas in the following sample: Carpet-001 (410-75808-1) are outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample. The recovery for a target analyte(s) in the laboratory control spike sample associated with the following sample: Carpet-001 (410-75808-1) is outside the QC acceptance limits. The QC limits applied to this data are advisory and the associated results are estimated. Target analytes were detected in the method blank associated with post oxidation samples: Carpet-001 (410-75808-1). No further action was taken.

Method 537_IDA_TOPS: The recovery for a target analyte(s) in the laboratory control spike sample associated with the following sample: PP Pad-001 (410-76735-1) is outside the QC acceptance limits. The QC limits applied to this data are advisory and the associated results are estimated. Target analytes were detected in the method blank associated with post oxidation samples: PP Pad-001 (410-76735-1). No further action was taken.

Method 537_IDA_TOPS: The sample injection standard peak areas in the following sample: Safeshell #1-3 (410-76903-1) are outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample. The recovery for a target analyte(s) in the laboratory control spike sample associated with the following sample: Safeshell #1-3 (410-76903-1) is outside the QC acceptance limits. The QC limits applied to this data are advisory and the associated results are estimated.

Method PFC_IDA: The following samples were analyzed one day past the extract hold time: EB-001 (410-75808-2) and EB-002 (410-76735-2). The data is reported.

Method PFC_IDA: The recovery for a target analyte(s) in the laboratory control spike(s) associated with the following samples: EB-001 (410-75808-2) and EB-002 (410-76735-2) is outside the QC acceptance limits. Sufficient sample volume was not available to re-extract this sample. Target analyte(s) were detected in the method blank associated with the following samples: EB-001 (410-75808-2) and EB-002 (410-76735-2). Sufficient sample volume was not available to re-extract this sample.

Method PFC_IDA: The labeled isotope recovery is outside of the QC acceptance limits in the following sample: EB 003 (410-76903-4). Since the recovery is biased high and the associated target analyte is not detected, the data is reported. The following sample was analyzed past the extract hold time: EB 003 (410-76903-4). The data is reported. The recovery for a target analyte(s) in the laboratory control spike(s) associated with the following sample: EB 003 (410-76903-4) is outside the QC acceptance limits. Sufficient sample volume was not available to re-extract this sample. Target analyte(s) were detected in the method blank associated with the following sample: EB 003 (410-76903-4). Sufficient sample volume was not available to re-extract this sample.

Method PFC_IDA: The recovery for target analyte Perfluorooctadecanoic acid is outside the QC acceptance limits in the closing continuing calibration verification standard. Since the result is high and target Perfluorooctadecanoic acid is not detected in the following samples: Carpet-001 (410-75808-1) and PP Pad-001 (410-76735-1), the data is reported.

Method PFC_IDA: The recovery for the labeled isotope(s) in the following samples: Carpet-001 (410-75808-1) and PP Pad-001

Case Narrative

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Job ID: 410-75808-1 (Continued)

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

(410-76735-1) is outside the QC acceptance limits. Since the recovery is high and the native analyte is not detected in the sample, the data is reported.

Method PFC_IDA: The recovery for the labeled isotope(s) in the following sample: Safeshell #1-3 (410-76903-1) is outside the QC acceptance limits due to the matrix of the sample.

Method PFC_IDA: The recovery for the labeled isotope(s) and target analyte(s) in the laboratory control spike samples associated with samples Carpet-001 (410-75808-1), PP Pad-001 (410-76735-1) and Safeshell #1-3 (410-76903-1) is outside of QC acceptance limits. The QC limits should be considered advisory until sufficient data points can be obtained to generate statistical limits. Poor recoveries for PS Acid and Eve Acid were observed in the laboratory control spike samples associated with samples: Carpet-001 (410-75808-1), PP Pad-001 (410-76735-1) and Safeshell #1-3 (410-76903-1). The results reported for PS acid and Eve Acid should be considered estimated.

Method PFC_IDA: The recovery for the labeled isotope(s) in the method blank associated with samples: Safeshell #1-3 (410-76903-1) is outside the QC acceptance limits. Since the recovery is high and the associated native analyte is not detected in the method blank, the data is reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
6:2 Fluorotelomer sulfonic acid	0.187	J H I B cn	0.400	0.120	ng/g	1		537 TOP	Post-Treatment
HFPODA	0.515	J H cn	0.600	0.200	ng/g	1		537 TOP	Post-Treatment
Perfluorobutanoic acid	0.199	J H cn	0.400	0.160	ng/g	1		537 TOP	Post-Treatment
Perfluorohexanoic acid	0.0570	J H cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
Perfluorooctanesulfonic acid	0.135	H I cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
Perfluoropentanoic acid	0.0499	J H cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
PPF Acid	1.08	H *+ cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
R-EVE	0.0679	J H cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
PFBA	0.199				ng/g	1		Total PFCA-Dif	Total/NA
PFPA	0.0499				ng/g	1		Total PFCA-Dif	Total/NA
PFHxA	0.0570				ng/g	1		Total PFCA-Dif	Total/NA
PFHpA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFOA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFNA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.306				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.306		0.300	0.100	ng/g	1		Total PFCA-Sum	Post-Treatment

Client Sample ID: EB-001

Lab Sample ID: 410-75808-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorooctanesulfonamide	0.447	J H B cn	1.70	0.424	ng/L	1		537 IDA	Total/NA
Perfluorooctanesulfonic acid	0.501	J H B cn	1.70	0.424	ng/L	1		537 IDA	Total/NA

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorononanoic acid	0.0444	J cn	0.120	0.0399	ng/g	1		537 IDA	Pre-Treatment
Perfluorotridecanoic acid	0.0406	J cn	0.120	0.0399	ng/g	1		537 IDA	Pre-Treatment
Perfluoroundecanoic acid	0.0538	J cn	0.120	0.0399	ng/g	1		537 IDA	Pre-Treatment
6:2 Fluorotelomer sulfonic acid	0.162	J H I B cn	0.400	0.120	ng/g	1		537 TOP	Post-Treatment
HFPODA	0.526	J H cn	0.600	0.200	ng/g	1		537 TOP	Post-Treatment
Perfluoroheptanoic acid	0.210	H I cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
Perfluorohexanoic acid	0.160	H I cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
PPF Acid	0.245	H *+ cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
R-EVE	0.136	H cn	0.120	0.0400	ng/g	1		537 TOP	Post-Treatment
PFBA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFPA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFHxA	0.160				ng/g	1		Total PFCA-Dif	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Lancaster Laboratories Environment Testing, LLC

Detection Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001 (Continued)

Lab Sample ID: 410-76735-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
PFHpA	0.210				ng/g	1		Total PFCA-Dif	Total/NA
PFOA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFNA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.370				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.370		0.300	0.100	ng/g	1		Total PFCA-Sum	Post-Treatment

Client Sample ID: EB-002

Lab Sample ID: 410-76735-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
HFPODA	0.609	J H cn	3.00	0.500	ng/L	1		537 IDA	Total/NA
Perfluorooctanesulfonic acid	0.804	J H B cn	2.00	0.500	ng/L	1		537 IDA	Total/NA

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
PEPA	0.0687	J cn	0.118	0.0394	ng/g	1		537 IDA	Pre-Treatment
Perfluoropentanoic acid	0.200	cn	0.118	0.0394	ng/g	1		537 IDA	Pre-Treatment
PFMOAA	5.16	*- cn	0.118	0.0394	ng/g	1		537 IDA	Pre-Treatment
PFO2HxA	0.0644	J cn	0.118	0.0394	ng/g	1		537 IDA	Pre-Treatment
PMPA	0.0461	J cn	0.118	0.0394	ng/g	1		537 IDA	Pre-Treatment
PPF Acid - DL	41.0	*-	1.18	0.394	ng/g	10		537 IDA	Pre-Treatment
6:2 FTCA	0.0425	J H *+ cn	0.120	0.0399	ng/g	1		537 TOP	Post-Treatment
6:2 FTUCA	0.149	H *- cn	0.120	0.0399	ng/g	1		537 TOP	Post-Treatment
PFO2HxA	0.308	H *+ cn	0.120	0.0399	ng/g	1		537 TOP	Post-Treatment
TAF	0.0859	J H *+ cn	0.120	0.0399	ng/g	1		537 TOP	Post-Treatment
PFBA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFPA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFHxA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFHpA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFOA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
PFNA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.000				ng/g	1		Total PFCA-Dif	Total/NA
Total PFCA	0.200	J	0.300	0.100	ng/g	1		Total PFCA-Sum	Pre-Treatment

Client Sample ID: EB 003

Lab Sample ID: 410-76903-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorooctanesulfonic acid	0.731	J H B cn	1.90	0.476	ng/L	1		537 IDA	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
10:2 FTS	<0.120	cn	0.400	0.120	ng/g		04/04/22 11:19	04/06/22 12:18	1
10:2 FTUCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
11Cl-PF3OUdS	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
3:3 FTCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
4:2 Fluorotelomer sulfonic acid	<0.120	cn	0.400	0.120	ng/g		04/04/22 11:19	04/06/22 12:18	1
5:3 FTCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
6:2 Fluorotelomer sulfonic acid	<0.120	cn	0.400	0.120	ng/g		04/04/22 11:19	04/06/22 12:18	1
6:2 FTCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
6:2 FTUCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
7:3 FTCA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
8:2 Fluorotelomer sulfonic acid	<0.120	cn	0.600	0.120	ng/g		04/04/22 11:19	04/06/22 12:18	1
8:2 FTCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
8:2 FTUCA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
9Cl-PF3ONS	<0.0400	cn	0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
DONA	<0.0400	cn	0.600	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
EVE Acid	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
HFPODA	<0.0800	cn	0.400	0.0800	ng/g		04/04/22 11:19	04/06/22 12:18	1
Hydro-EVE Acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Hydrolyzed PSDA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Hydro-PS Acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
MTP	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
NEtFOSA	<0.100	cn	0.400	0.100	ng/g		04/04/22 11:19	04/06/22 12:18	1
NEtFOSAA	<0.0400	cn	0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
NEtFOSE	<0.100	cn	0.400	0.100	ng/g		04/04/22 11:19	04/06/22 12:18	1
NMeFOSA	<0.100	cn	0.400	0.100	ng/g		04/04/22 11:19	04/06/22 12:18	1
NMeFOSAA	<0.0400	cn	0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
NMeFOSE	<0.100	cn	0.400	0.100	ng/g		04/04/22 11:19	04/06/22 12:18	1
NVHOS	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PEPA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorobutanesulfonic acid	<0.0800	cn	0.400	0.0800	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorobutanoic acid	<0.160	cn	0.400	0.160	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorodecanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorodecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorododecanesulfonic acid	<0.0400	cn	0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorododecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoroheptanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoroheptanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorohexadecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorohexanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorohexanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorononanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorononanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorooctadecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorooctanesulfonamide	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorooctanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoropentanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoropentanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoropropanesulfonic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorotetradecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluorotridecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Perfluoroundecanoic acid	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFECA A	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFECA B	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFECA F	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFECA G	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFMOAA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFO2HxA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFO3OA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PFO4DA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PMPA	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PPF Acid	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
PS Acid	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
R-EVE	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
R-PSDA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
R-PSDCA	<0.0400	*- cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
TAF	<0.0400	cn	0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 12:18	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	169	cn	10 - 193				04/04/22 11:19	04/06/22 12:18	1
d3-NMeFOSAA	131	cn	10 - 178				04/04/22 11:19	04/06/22 12:18	1
13C3 HFPO-DA	138	cn	10 - 169				04/04/22 11:19	04/06/22 12:18	1
d7-N-MeFOSE-M	94	cn	10 - 179				04/04/22 11:19	04/06/22 12:18	1
d9-N-EtFOSE-M	99	cn	10 - 185				04/04/22 11:19	04/06/22 12:18	1
M2-6:2 FTS	197	cn	10 - 200				04/04/22 11:19	04/06/22 12:18	1
M2-8:2 FTS	269	*5+ cn	15 - 200				04/04/22 11:19	04/06/22 12:18	1
13C3 PFBS	151	cn	27 - 179				04/04/22 11:19	04/06/22 12:18	1
M2-4:2 FTS	330	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:18	1
13C5 PFHxA	149	cn	10 - 174				04/04/22 11:19	04/06/22 12:18	1
13C9 PFNA	164	cn	26 - 165				04/04/22 11:19	04/06/22 12:18	1
13C6 PFDA	148	cn	26 - 161				04/04/22 11:19	04/06/22 12:18	1
13C7 PFUnA	137	cn	12 - 173				04/04/22 11:19	04/06/22 12:18	1
13C3 PFHxS	157	cn	24 - 171				04/04/22 11:19	04/06/22 12:18	1
13C2-PFDoDA	117	cn	11 - 166				04/04/22 11:19	04/06/22 12:18	1
d5-NEtPFOSA	85	cn	10 - 180				04/04/22 11:19	04/06/22 12:18	1
d3-NMePFOSA	83	cn	10 - 175				04/04/22 11:19	04/06/22 12:18	1
13C2-2-Perfluorohexylethanoic acid	260	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:18	1
13C2-2-Perfluorooctylethanoic acid	364	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:18	1
13C2-2-Perfluorodecylethanoic acid	328	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:18	1
13C2-2H-Perfluoro-2-octenoic acid	114	cn	10 - 164				04/04/22 11:19	04/06/22 12:18	1
13C2-2H-Perfluoro-2-decenoic acid	154	cn	10 - 162				04/04/22 11:19	04/06/22 12:18	1
13C2-2H-Perfluoro-2-dodecenoic acid	157	cn	10 - 161				04/04/22 11:19	04/06/22 12:18	1
13C4 PFBA	144	cn	28 - 153				04/04/22 11:19	04/06/22 12:18	1
13C5 PFPeA	147	cn	24 - 161				04/04/22 11:19	04/06/22 12:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C4 PFHpA	146	cn	10 - 178	04/04/22 11:19	04/06/22 12:18	1
13C8 PFOA	152	cn	26 - 159	04/04/22 11:19	04/06/22 12:18	1
13C8 PFOS	155	*5+ cn	41 - 154	04/04/22 11:19	04/06/22 12:18	1
13C8 FOSA	133	cn	14 - 163	04/04/22 11:19	04/06/22 12:18	1
13C2 PFTeDA	129	cn	10 - 169	04/04/22 11:19	04/06/22 12:18	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
10:2 FTS	<0.120	H cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:51	1
10:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
11Cl-PF3OUdS	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
3:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
4:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:51	1
5:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
6:2 Fluorotelomer sulfonic acid	0.187	J H I B cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:51	1
6:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
6:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
7:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
8:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.600	0.120	ng/g		05/10/22 10:06	05/12/22 12:51	1
8:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
8:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
9Cl-PF3ONS	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
DONA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
EVE Acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
HFPODA	0.515	J H cn	0.600	0.200	ng/g		05/10/22 10:06	05/12/22 12:51	1
Hydro-EVE Acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Hydrolyzed PSDA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Hydro-PS Acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
MTP	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
NEtFOSA	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:51	1
NEtFOSAA	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
NEtFOSE	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:51	1
NMeFOSA	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:51	1
NMeFOSAA	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
NMeFOSE	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:51	1
NVHOS	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PEPA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorobutanesulfonic acid	<0.0800	H cn	0.400	0.0800	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorobutanoic acid	0.199	J H cn	0.400	0.160	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorodecanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorodecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorododecanesulfonic acid	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorododecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoroheptanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoroheptanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorohexadecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorohexanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorohexanoic acid	0.0570	J H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorononanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorononanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorooctadecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorooctanesulfonamide	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorooctanesulfonic acid	0.135	H I cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoropentanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoropentanoic acid	0.0499	J H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoropropanesulfonic acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorotetradecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluorotridecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
Perfluoroundecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFECA A	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFECA B	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFECA F	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFECA G	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFMOAA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFO2HxA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFO3OA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PFO4DA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PMPA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PPF Acid	1.08	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
PS Acid	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
R-EVE	0.0679	J H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
R-PSDA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
R-PSDCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1
TAF	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:51	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	522	*5+ cn	10 - 200	05/10/22 10:06	05/12/22 12:51	1
M2-8:2 FTS	488	*5+ cn	15 - 200	05/10/22 10:06	05/12/22 12:51	1
13C2 PFTeDA	247	*5+ cn	10 - 169	05/10/22 10:06	05/12/22 12:51	1
13C3 HFPO-DA	108	cn	10 - 169	05/10/22 10:06	05/12/22 12:51	1
13C3 PFBS	125	cn	27 - 179	05/10/22 10:06	05/12/22 12:51	1
13C4 PFBA	99	cn	28 - 153	05/10/22 10:06	05/12/22 12:51	1
13C4 PFHpA	144	cn	10 - 178	05/10/22 10:06	05/12/22 12:51	1
13C5 PFPeA	68	cn	24 - 161	05/10/22 10:06	05/12/22 12:51	1
13C8 PFOA	112	cn	26 - 159	05/10/22 10:06	05/12/22 12:51	1
13C8 PFOS	138	cn	41 - 154	05/10/22 10:06	05/12/22 12:51	1
d5-NEtFOSAA	384	*5+ cn	10 - 193	05/10/22 10:06	05/12/22 12:51	1
d7-N-MeFOSE-M	121	cn	10 - 179	05/10/22 10:06	05/12/22 12:51	1
d9-N-EtFOSE-M	188	*5+ cn	10 - 185	05/10/22 10:06	05/12/22 12:51	1
13C3 PFHxS	171	cn	24 - 171	05/10/22 10:06	05/12/22 12:51	1
13C5 PFHxA	92	cn	10 - 174	05/10/22 10:06	05/12/22 12:51	1
13C6 PFDA	168	*5+ cn	26 - 161	05/10/22 10:06	05/12/22 12:51	1
13C7 PFUnA	213	*5+ cn	12 - 173	05/10/22 10:06	05/12/22 12:51	1
d3-NMePFOSA	106	cn	10 - 175	05/10/22 10:06	05/12/22 12:51	1
d5-NEtPFOSA	119	cn	10 - 180	05/10/22 10:06	05/12/22 12:51	1
13C8 FOSA	167	*5+ cn	14 - 163	05/10/22 10:06	05/12/22 12:51	1
13C2-PFDoDA	158	cn	11 - 166	05/10/22 10:06	05/12/22 12:51	1
13C9 PFNA	110	cn	26 - 165	05/10/22 10:06	05/12/22 12:51	1
13C2-2-Perfluorohexylethanoic acid	48	*5- cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1
13C2-2-Perfluorooctylethanoic acid	111	cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1
13C2-2-Perfluorodecylethanoic acid	181	*5+ cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1
13C2-2H-Perfluoro-2-octenoic acid	66	cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-2H-Perfluoro-2-decenoic acid	199	*5+ cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1
13C2-2H-Perfluoro-2-dodecenoic acid	265	*5+ cn	50 - 150	05/10/22 10:06	05/12/22 12:51	1
Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFHxA	84	cn	10 - 137	05/10/22 10:06	05/12/22 12:51	1
13C4 PFOA	109	cn	10 - 146	05/10/22 10:06	05/12/22 12:51	1
13C2 PFUnA	109	cn	10 - 143	05/10/22 10:06	05/12/22 12:51	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: Total PFCA-Dif - Total PFCA (Treatment Difference)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PFBA	0.199				ng/g			05/13/22 13:16	1
PFPA	0.0499				ng/g			05/13/22 13:16	1
PFHxA	0.0570				ng/g			05/13/22 13:16	1
PFHpA	0.000				ng/g			05/13/22 13:16	1
PFOA	0.000				ng/g			05/13/22 13:16	1
PFNA	0.000				ng/g			05/13/22 13:16	1
Total PFCA	0.306				ng/g			05/13/22 13:16	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: Total PFCA-Sum - Total PFCA (Summary) - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	<0.100		0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Method: Total PFCA-Sum - Total PFCA (Summary) - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	0.306		0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-001

Lab Sample ID: 410-75808-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
10:2 FTS	<0.848	H cn	4.24	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
10:2 FTUCA	<0.594	H cn	1.70	0.594	ng/L		04/04/22 06:59	05/03/22 01:18	1
11Cl-PF3OUdS	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
3:3 FTCA	<0.254	H cn	1.70	0.254	ng/L		04/04/22 06:59	05/03/22 01:18	1
4:2 Fluorotelomer sulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
5:3 FTCA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
6:2 Fluorotelomer sulfonic acid	<1.70	H cn	4.24	1.70	ng/L		04/04/22 06:59	05/03/22 01:18	1
6:2 FTCA	<0.339	H cn	1.70	0.339	ng/L		04/04/22 06:59	05/03/22 01:18	1
6:2 FTUCA	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
7:3 FTCA	<0.254	H cn	1.70	0.254	ng/L		04/04/22 06:59	05/03/22 01:18	1
8:2 Fluorotelomer sulfonic acid	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
8:2 FTCA	<0.339	H cn	1.70	0.339	ng/L		04/04/22 06:59	05/03/22 01:18	1
8:2 FTUCA	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
9Cl-PF3ONS	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
DONA	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
EVE Acid	<2.54	H cn	8.48	2.54	ng/L		04/04/22 06:59	05/03/22 01:18	1
HFPODA	<0.424	H cn	2.54	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Hydro-EVE Acid	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
Hydrolyzed PSDA	<0.763	H cn	1.70	0.763	ng/L		04/04/22 06:59	05/03/22 01:18	1
Hydro-PS Acid	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
MTP	<1.70	H cn	4.24	1.70	ng/L		04/04/22 06:59	05/03/22 01:18	1
NEtFOSA	<0.848	H cn	4.24	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
NEtFOSAA	<0.424	H cn	2.54	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
NEtFOSE	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
NMeFOSA	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
NMeFOSAA	<0.509	H cn	1.70	0.509	ng/L		04/04/22 06:59	05/03/22 01:18	1
NMeFOSE	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
NVHOS	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PEPA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorobutanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorobutanoic acid	<1.70	H cn	4.24	1.70	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorodecanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorodecanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorododecanesulfonic acid	<0.424	H cn	2.54	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorododecanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoroheptanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoroheptanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorohexadecanoic acid	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorohexanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorohexanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorononanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorononanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorooctadecanoic acid	<0.848	H cn	2.54	0.848	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorooctanesulfonamide	0.447	J H B cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorooctanesulfonic acid	0.501	J H B cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-001

Lab Sample ID: 410-75808-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoropentanesulfonic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoropentanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoropropanesulfonic acid	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorotetradecanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluorotridecanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
Perfluoroundecanoic acid	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFECA A	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFECA B	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFECA F	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFECA G	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFMOAA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFO2HxA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFO3OA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PFO4DA	<0.594	H cn	1.70	0.594	ng/L		04/04/22 06:59	05/03/22 01:18	1
PMPA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
PPF Acid	<1.70	H cn	4.24	1.70	ng/L		04/04/22 06:59	05/03/22 01:18	1
PS Acid	<2.54	H cn	8.48	2.54	ng/L		04/04/22 06:59	05/03/22 01:18	1
R-EVE	<0.339	H cn	1.70	0.339	ng/L		04/04/22 06:59	05/03/22 01:18	1
R-PSDA	<0.424	H cn	1.70	0.424	ng/L		04/04/22 06:59	05/03/22 01:18	1
R-PSDCA	<0.170	H cn	1.70	0.170	ng/L		04/04/22 06:59	05/03/22 01:18	1
TAF	<1.70	H cn	4.24	1.70	ng/L		04/04/22 06:59	05/03/22 01:18	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	125	cn	29 - 195	04/04/22 06:59	05/03/22 01:18	1
d3-NMeFOSAA	129	cn	31 - 174	04/04/22 06:59	05/03/22 01:18	1
13C3 HFPO-DA	121	cn	17 - 185	04/04/22 06:59	05/03/22 01:18	1
d7-N-MeFOSE-M	96	cn	10 - 178	04/04/22 06:59	05/03/22 01:18	1
d9-N-EtFOSE-M	95	cn	10 - 177	04/04/22 06:59	05/03/22 01:18	1
M2-6:2 FTS	128	cn	17 - 200	04/04/22 06:59	05/03/22 01:18	1
M2-8:2 FTS	132	cn	33 - 200	04/04/22 06:59	05/03/22 01:18	1
13C3 PFBS	140	cn	16 - 200	04/04/22 06:59	05/03/22 01:18	1
M2-4:2 FTS	126	cn	10 - 200	04/04/22 06:59	05/03/22 01:18	1
13C5 PFHxA	101	cn	24 - 179	04/04/22 06:59	05/03/22 01:18	1
13C9 PFNA	125	cn	51 - 167	04/04/22 06:59	05/03/22 01:18	1
13C6 PFDA	128	cn	49 - 163	04/04/22 06:59	05/03/22 01:18	1
13C7 PFUnA	125	cn	34 - 174	04/04/22 06:59	05/03/22 01:18	1
13C3 PFHxS	128	cn	28 - 188	04/04/22 06:59	05/03/22 01:18	1
13C2-PFDoDA	115	cn	17 - 176	04/04/22 06:59	05/03/22 01:18	1
d5-NEtPFOSA	53	cn	10 - 159	04/04/22 06:59	05/03/22 01:18	1
d3-NMePFOSA	53	cn	10 - 155	04/04/22 06:59	05/03/22 01:18	1
13C2-2-Perfluorohexylethanoic acid	80	cn	10 - 200	04/04/22 06:59	05/03/22 01:18	1
13C2-2-Perfluorooctylethanoic acid	99	cn	10 - 200	04/04/22 06:59	05/03/22 01:18	1
13C2-2-Perfluorodecylethanoic acid	78	cn	10 - 200	04/04/22 06:59	05/03/22 01:18	1
13C2-2H-Perfluoro-2-octenoic acid	143	cn	20 - 173	04/04/22 06:59	05/03/22 01:18	1
13C2-2H-Perfluoro-2-decenoic acid	141	cn	21 - 166	04/04/22 06:59	05/03/22 01:18	1
13C2-2H-Perfluoro-2-dodecenoic acid	130	cn	14 - 166	04/04/22 06:59	05/03/22 01:18	1
13C4 PFBA	128	cn	42 - 165	04/04/22 06:59	05/03/22 01:18	1
13C5 PFPeA	134	cn	38 - 187	04/04/22 06:59	05/03/22 01:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-001

Lab Sample ID: 410-75808-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C4 PFHpA	123	cn	31 - 182	04/04/22 06:59	05/03/22 01:18	1
13C8 PFOA	124	cn	48 - 162	04/04/22 06:59	05/03/22 01:18	1
13C8 PFOS	123	cn	51 - 159	04/04/22 06:59	05/03/22 01:18	1
13C8 FOSA	102	cn	10 - 168	04/04/22 06:59	05/03/22 01:18	1
13C2 PFTeDA	110	cn	10 - 179	04/04/22 06:59	05/03/22 01:18	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
10:2 FTS	<0.120	cn	0.399	0.120	ng/g		04/04/22 11:19	04/06/22 12:29	1
10:2 FTUCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
11Cl-PF3OUdS	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
3:3 FTCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
4:2 Fluorotelomer sulfonic acid	<0.120	cn	0.399	0.120	ng/g		04/04/22 11:19	04/06/22 12:29	1
5:3 FTCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
6:2 Fluorotelomer sulfonic acid	<0.120	cn	0.399	0.120	ng/g		04/04/22 11:19	04/06/22 12:29	1
6:2 FTCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
6:2 FTUCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
7:3 FTCA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
8:2 Fluorotelomer sulfonic acid	<0.120	cn	0.599	0.120	ng/g		04/04/22 11:19	04/06/22 12:29	1
8:2 FTCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
8:2 FTUCA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
9Cl-PF3ONS	<0.0399	cn	0.399	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
DONA	<0.0399	cn	0.599	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
EVE Acid	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
HFPODA	<0.0798	cn	0.399	0.0798	ng/g		04/04/22 11:19	04/06/22 12:29	1
Hydro-EVE Acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Hydrolyzed PSDA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Hydro-PS Acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
MTP	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
NEtFOSA	<0.0998	cn	0.399	0.0998	ng/g		04/04/22 11:19	04/06/22 12:29	1
NEtFOSAA	<0.0399	cn	0.399	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
NEtFOSE	<0.0998	cn	0.399	0.0998	ng/g		04/04/22 11:19	04/06/22 12:29	1
NMeFOSA	<0.0998	cn	0.399	0.0998	ng/g		04/04/22 11:19	04/06/22 12:29	1
NMeFOSAA	<0.0399	cn	0.399	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
NMeFOSE	<0.0998	cn	0.399	0.0998	ng/g		04/04/22 11:19	04/06/22 12:29	1
NVHOS	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PEPA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorobutanesulfonic acid	<0.0798	cn	0.399	0.0798	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorobutanoic acid	<0.160	cn	0.399	0.160	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorodecanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorodecanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorododecanesulfonic acid	<0.0399	cn	0.399	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorododecanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoroheptanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoroheptanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorohexadecanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorohexanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorohexanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorononanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorononanoic acid	0.0444	J cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorooctadecanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorooctanesulfonamide	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorooctanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoropentanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoropentanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoropropanesulfonic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorotetradecanoic acid	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluorotridecanoic acid	0.0406	J cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Perfluoroundecanoic acid	0.0538	J cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFECA A	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFECA B	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFECA F	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFECA G	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFMOAA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFO2HxA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFO3OA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PFO4DA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PMPA	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PPF Acid	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
PS Acid	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
R-EVE	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
R-PSDA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
R-PSDCA	<0.0399	*- cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
TAF	<0.0399	cn	0.120	0.0399	ng/g		04/04/22 11:19	04/06/22 12:29	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	124	cn	10 - 193				04/04/22 11:19	04/06/22 12:29	1
d3-NMeFOSAA	138	cn	10 - 178				04/04/22 11:19	04/06/22 12:29	1
13C3 HFPO-DA	145	cn	10 - 169				04/04/22 11:19	04/06/22 12:29	1
d7-N-MeFOSE-M	147	cn	10 - 179				04/04/22 11:19	04/06/22 12:29	1
d9-N-EtFOSE-M	179	cn	10 - 185				04/04/22 11:19	04/06/22 12:29	1
M2-6:2 FTS	198	cn	10 - 200				04/04/22 11:19	04/06/22 12:29	1
M2-8:2 FTS	162	cn	15 - 200				04/04/22 11:19	04/06/22 12:29	1
13C3 PFBS	138	cn	27 - 179				04/04/22 11:19	04/06/22 12:29	1
M2-4:2 FTS	353	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:29	1
13C5 PFHxA	146	cn	10 - 174				04/04/22 11:19	04/06/22 12:29	1
13C9 PFNA	154	cn	26 - 165				04/04/22 11:19	04/06/22 12:29	1
13C6 PFDA	150	cn	26 - 161				04/04/22 11:19	04/06/22 12:29	1
13C7 PFUnA	120	cn	12 - 173				04/04/22 11:19	04/06/22 12:29	1
13C3 PFHxS	140	cn	24 - 171				04/04/22 11:19	04/06/22 12:29	1
13C2-PFDoDA	147	cn	11 - 166				04/04/22 11:19	04/06/22 12:29	1
d5-NEtPFOSA	122	cn	10 - 180				04/04/22 11:19	04/06/22 12:29	1
d3-NMePFOSA	138	cn	10 - 175				04/04/22 11:19	04/06/22 12:29	1
13C2-2-Perfluorohexylethanoic acid	304	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:29	1
13C2-2-Perfluorooctylethanoic acid	270	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:29	1
13C2-2-Perfluorodecylethanoic acid	307	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 12:29	1
13C2-2H-Perfluoro-2-octenoic acid	134	cn	10 - 164				04/04/22 11:19	04/06/22 12:29	1
13C2-2H-Perfluoro-2-decenoic acid	128	cn	10 - 162				04/04/22 11:19	04/06/22 12:29	1
13C2-2H-Perfluoro-2-dodecenoic acid	141	cn	10 - 161				04/04/22 11:19	04/06/22 12:29	1
13C4 PFBA	148	cn	28 - 153				04/04/22 11:19	04/06/22 12:29	1
13C5 PFPeA	164	*5+ cn	24 - 161				04/04/22 11:19	04/06/22 12:29	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C4 PFHpA	147	cn	10 - 178	04/04/22 11:19	04/06/22 12:29	1
13C8 PFOA	137	cn	26 - 159	04/04/22 11:19	04/06/22 12:29	1
13C8 PFOS	146	cn	41 - 154	04/04/22 11:19	04/06/22 12:29	1
13C8 FOSA	149	cn	14 - 163	04/04/22 11:19	04/06/22 12:29	1
13C2 PFTeDA	141	cn	10 - 169	04/04/22 11:19	04/06/22 12:29	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
10:2 FTS	<0.120	H cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 13:13	1
10:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
11Cl-PF3OUdS	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
3:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
4:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 13:13	1
5:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
6:2 Fluorotelomer sulfonic acid	0.162	J H I B cn	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 13:13	1
6:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
6:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
7:3 FTCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
8:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.600	0.120	ng/g		05/10/22 10:06	05/12/22 13:13	1
8:2 FTCA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
8:2 FTUCA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
9Cl-PF3ONS	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
DONA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
EVE Acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
HFPODA	0.526	J H cn	0.600	0.200	ng/g		05/10/22 10:06	05/12/22 13:13	1
Hydro-EVE Acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Hydrolyzed PSDA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Hydro-PS Acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
MTP	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
NEtFOSA	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 13:13	1
NEtFOSAA	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
NEtFOSE	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 13:13	1
NMeFOSA	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 13:13	1
NMeFOSAA	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
NMeFOSE	<0.100	H cn	0.400	0.100	ng/g		05/10/22 10:06	05/12/22 13:13	1
NVHOS	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PEPA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorobutanesulfonic acid	<0.0800	H cn	0.400	0.0800	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorobutanoic acid	<0.160	H cn	0.400	0.160	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorodecanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorodecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorododecanesulfonic acid	<0.0400	H cn	0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorododecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoroheptanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoroheptanoic acid	0.210	H I cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorohexadecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorohexanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorohexanoic acid	0.160	H I cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorononanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorononanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorooctadecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorooctanesulfonamide	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorooctanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoropentanesulfonic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoropentanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoropropanesulfonic acid	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorotetradecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluorotridecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Perfluoroundecanoic acid	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFECA A	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFECA B	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFECA F	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFECA G	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFMOAA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFO2HxA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFO3OA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PFO4DA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PMPA	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PPF Acid	0.245	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
PS Acid	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
R-EVE	0.136	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
R-PSDA	<0.0400	H *- cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
R-PSDCA	<0.0400	H cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
TAF	<0.0400	H *+ cn	0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 13:13	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
M2-6:2 FTS	321	*5+ cn	10 - 200				05/10/22 10:06	05/12/22 13:13	1
M2-8:2 FTS	223	*5+ cn	15 - 200				05/10/22 10:06	05/12/22 13:13	1
13C2 PFTeDA	90	cn	10 - 169				05/10/22 10:06	05/12/22 13:13	1
13C3 HFPO-DA	75	cn	10 - 169				05/10/22 10:06	05/12/22 13:13	1
13C3 PFBS	105	cn	27 - 179				05/10/22 10:06	05/12/22 13:13	1
13C4 PFBA	85	cn	28 - 153				05/10/22 10:06	05/12/22 13:13	1
13C4 PFHpA	96	cn	10 - 178				05/10/22 10:06	05/12/22 13:13	1
13C5 PFPeA	81	cn	24 - 161				05/10/22 10:06	05/12/22 13:13	1
13C8 PFOA	90	cn	26 - 159				05/10/22 10:06	05/12/22 13:13	1
13C8 PFOS	108	cn	41 - 154				05/10/22 10:06	05/12/22 13:13	1
d5-NEtFOSAA	115	cn	10 - 193				05/10/22 10:06	05/12/22 13:13	1
d7-N-MeFOSE-M	70	cn	10 - 179				05/10/22 10:06	05/12/22 13:13	1
d9-N-EtFOSE-M	65	cn	10 - 185				05/10/22 10:06	05/12/22 13:13	1
13C3 PFHxS	107	cn	24 - 171				05/10/22 10:06	05/12/22 13:13	1
13C5 PFHxA	77	cn	10 - 174				05/10/22 10:06	05/12/22 13:13	1
13C6 PFDA	98	cn	26 - 161				05/10/22 10:06	05/12/22 13:13	1
13C7 PFUnA	82	cn	12 - 173				05/10/22 10:06	05/12/22 13:13	1
d3-NMePFOSA	56	cn	10 - 175				05/10/22 10:06	05/12/22 13:13	1
d5-NEtPFOSA	50	cn	10 - 180				05/10/22 10:06	05/12/22 13:13	1
13C8 FOSA	55	cn	14 - 163				05/10/22 10:06	05/12/22 13:13	1
13C2-PFDoDA	91	cn	11 - 166				05/10/22 10:06	05/12/22 13:13	1
13C9 PFNA	101	cn	26 - 165				05/10/22 10:06	05/12/22 13:13	1
13C2-2-Perfluorohexylethanoic acid	40	*5- cn	50 - 150				05/10/22 10:06	05/12/22 13:13	1
13C2-2-Perfluorooctylethanoic acid	53	cn	50 - 150				05/10/22 10:06	05/12/22 13:13	1
13C2-2-Perfluorodecylethanoic acid	66	cn	50 - 150				05/10/22 10:06	05/12/22 13:13	1
13C2-2H-Perfluoro-2-octenoic acid	83	cn	50 - 150				05/10/22 10:06	05/12/22 13:13	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-2H-Perfluoro-2-decenoic acid	110	cn	50 - 150	05/10/22 10:06	05/12/22 13:13	1
13C2-2H-Perfluoro-2-dodecenoic acid	133	cn	50 - 150	05/10/22 10:06	05/12/22 13:13	1
Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFHxA	73	cn	10 - 137	05/10/22 10:06	05/12/22 13:13	1
13C4 PFOA	99	cn	10 - 146	05/10/22 10:06	05/12/22 13:13	1
13C2 PFUnA	90	cn	10 - 143	05/10/22 10:06	05/12/22 13:13	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: Total PFCA-Dif - Total PFCA (Treatment Difference)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PFBA	0.000				ng/g			05/13/22 13:16	1
PFPA	0.000				ng/g			05/13/22 13:16	1
PFHxA	0.160				ng/g			05/13/22 13:16	1
PFHpA	0.210				ng/g			05/13/22 13:16	1
PFOA	0.000				ng/g			05/13/22 13:16	1
PFNA	0.000				ng/g			05/13/22 13:16	1
Total PFCA	0.370				ng/g			05/13/22 13:16	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: Total PFCA-Sum - Total PFCA (Summary) - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	<0.100		0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Method: Total PFCA-Sum - Total PFCA (Summary) - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	0.370		0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-002

Lab Sample ID: 410-76735-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
10:2 FTS	<0.999	H cn	5.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
10:2 FTUCA	<0.699	H cn	2.00	0.699	ng/L		04/04/22 06:59	05/03/22 01:29	1
11Cl-PF3OUdS	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
3:3 FTCA	<0.300	H cn	2.00	0.300	ng/L		04/04/22 06:59	05/03/22 01:29	1
4:2 Fluorotelomer sulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
5:3 FTCA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
6:2 Fluorotelomer sulfonic acid	<2.00	H cn	5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
6:2 FTCA	<0.400	H cn	2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:29	1
6:2 FTUCA	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
7:3 FTCA	<0.300	H cn	2.00	0.300	ng/L		04/04/22 06:59	05/03/22 01:29	1
8:2 Fluorotelomer sulfonic acid	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
8:2 FTCA	<0.400	H cn	2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:29	1
8:2 FTUCA	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
9Cl-PF3ONS	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
DONA	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
EVE Acid	<3.00	H cn	9.99	3.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
HFPODA	0.609	J H cn	3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Hydro-EVE Acid	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
Hydrolyzed PSDA	<0.899	H cn	2.00	0.899	ng/L		04/04/22 06:59	05/03/22 01:29	1
Hydro-PS Acid	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
MTP	<2.00	H cn	5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
NEtFOSA	<0.999	H cn	5.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
NEtFOSAA	<0.500	H cn	3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
NEtFOSE	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
NMeFOSA	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
NMeFOSAA	<0.600	H cn	2.00	0.600	ng/L		04/04/22 06:59	05/03/22 01:29	1
NMeFOSE	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
NVHOS	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PEPA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorobutanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorobutanoic acid	<2.00	H cn	5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorodecanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorodecanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorododecanesulfonic acid	<0.500	H cn	3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorododecanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoroheptanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoroheptanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorohexadecanoic acid	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorohexanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorohexanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorononanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorononanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorooctadecanoic acid	<0.999	H cn	3.00	0.999	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorooctanesulfonamide	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorooctanesulfonic acid	0.804	J H B cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-002

Lab Sample ID: 410-76735-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoropentanesulfonic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoropentanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoropropanesulfonic acid	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorotetradecanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluorotridecanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
Perfluoroundecanoic acid	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFECA A	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFECA B	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFECA F	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFECA G	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFMOAA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFO2HxA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFO3OA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PFO4DA	<0.699	H cn	2.00	0.699	ng/L		04/04/22 06:59	05/03/22 01:29	1
PMPA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
PPF Acid	<2.00	H cn	5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
PS Acid	<3.00	H cn	9.99	3.00	ng/L		04/04/22 06:59	05/03/22 01:29	1
R-EVE	<0.400	H cn	2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:29	1
R-PSDA	<0.500	H cn	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:29	1
R-PSDCA	<0.200	H cn	2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:29	1
TAF	<2.00	H cn	5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:29	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	131	cn	29 - 195	04/04/22 06:59	05/03/22 01:29	1
d3-NMeFOSAA	135	cn	31 - 174	04/04/22 06:59	05/03/22 01:29	1
13C3 HFPO-DA	109	cn	17 - 185	04/04/22 06:59	05/03/22 01:29	1
d7-N-MeFOSE-M	111	cn	10 - 178	04/04/22 06:59	05/03/22 01:29	1
d9-N-EtFOSE-M	112	cn	10 - 177	04/04/22 06:59	05/03/22 01:29	1
M2-6:2 FTS	130	cn	17 - 200	04/04/22 06:59	05/03/22 01:29	1
M2-8:2 FTS	135	cn	33 - 200	04/04/22 06:59	05/03/22 01:29	1
13C3 PFBS	128	cn	16 - 200	04/04/22 06:59	05/03/22 01:29	1
M2-4:2 FTS	113	cn	10 - 200	04/04/22 06:59	05/03/22 01:29	1
13C5 PFHxA	116	cn	24 - 179	04/04/22 06:59	05/03/22 01:29	1
13C9 PFNA	118	cn	51 - 167	04/04/22 06:59	05/03/22 01:29	1
13C6 PFDA	134	cn	49 - 163	04/04/22 06:59	05/03/22 01:29	1
13C7 PFUnA	131	cn	34 - 174	04/04/22 06:59	05/03/22 01:29	1
13C3 PFHxS	126	cn	28 - 188	04/04/22 06:59	05/03/22 01:29	1
13C2-PFDoDA	125	cn	17 - 176	04/04/22 06:59	05/03/22 01:29	1
d5-NEtPFOSA	108	cn	10 - 159	04/04/22 06:59	05/03/22 01:29	1
d3-NMePFOSA	105	cn	10 - 155	04/04/22 06:59	05/03/22 01:29	1
13C2-2-Perfluorohexylethanoic acid	79	cn	10 - 200	04/04/22 06:59	05/03/22 01:29	1
13C2-2-Perfluorooctylethanoic acid	103	cn	10 - 200	04/04/22 06:59	05/03/22 01:29	1
13C2-2-Perfluorodecylethanoic acid	86	cn	10 - 200	04/04/22 06:59	05/03/22 01:29	1
13C2-2H-Perfluoro-2-octenoic acid	147	cn	20 - 173	04/04/22 06:59	05/03/22 01:29	1
13C2-2H-Perfluoro-2-decenoic acid	165	cn	21 - 166	04/04/22 06:59	05/03/22 01:29	1
13C2-2H-Perfluoro-2-dodecenoic acid	159	cn	14 - 166	04/04/22 06:59	05/03/22 01:29	1
13C4 PFBA	124	cn	42 - 165	04/04/22 06:59	05/03/22 01:29	1
13C5 PFPeA	118	cn	38 - 187	04/04/22 06:59	05/03/22 01:29	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB-002

Lab Sample ID: 410-76735-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

<i>Isotope Dilution</i>	<i>%Recovery</i>	<i>Qualifier</i>	<i>Limits</i>	<i>Prepared</i>	<i>Analyzed</i>	<i>Dil Fac</i>
13C4 PFHpA	117	cn	31 - 182	04/04/22 06:59	05/03/22 01:29	1
13C8 PFOA	120	cn	48 - 162	04/04/22 06:59	05/03/22 01:29	1
13C8 PFOS	118	cn	51 - 159	04/04/22 06:59	05/03/22 01:29	1
13C8 FOSA	113	cn	10 - 168	04/04/22 06:59	05/03/22 01:29	1
13C2 PFTeDA	118	cn	10 - 179	04/04/22 06:59	05/03/22 01:29	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
10:2 FTS	<0.118	cn	0.394	0.118	ng/g		04/04/22 11:19	04/06/22 20:59	1
10:2 FTUCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
11Cl-PF3OUdS	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
3:3 FTCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
4:2 Fluorotelomer sulfonic acid	<0.118	cn	0.394	0.118	ng/g		04/04/22 11:19	04/06/22 20:59	1
5:3 FTCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
6:2 Fluorotelomer sulfonic acid	<0.118	cn	0.394	0.118	ng/g		04/04/22 11:19	04/06/22 20:59	1
6:2 FTCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
6:2 FTUCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
7:3 FTCA	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
8:2 Fluorotelomer sulfonic acid	<0.118	cn	0.591	0.118	ng/g		04/04/22 11:19	04/06/22 20:59	1
8:2 FTCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
8:2 FTUCA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
9Cl-PF3ONS	<0.0394	cn	0.394	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
DONA	<0.0394	cn	0.591	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
EVE Acid	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
HFODA	<0.0787	cn	0.394	0.0787	ng/g		04/04/22 11:19	04/06/22 20:59	1
Hydro-EVE Acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Hydrolyzed PSDA	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Hydro-PS Acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
MTP	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
NEtFOSA	<0.0984	cn	0.394	0.0984	ng/g		04/04/22 11:19	04/06/22 20:59	1
NEtFOSAA	<0.0394	cn	0.394	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
NEtFOSE	<0.0984	cn	0.394	0.0984	ng/g		04/04/22 11:19	04/06/22 20:59	1
NMeFOSA	<0.0984	cn	0.394	0.0984	ng/g		04/04/22 11:19	04/06/22 20:59	1
NMeFOSAA	<0.0394	cn	0.394	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
NMeFOSE	<0.0984	cn	0.394	0.0984	ng/g		04/04/22 11:19	04/06/22 20:59	1
NVHOS	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PEPA	0.0687	J cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorobutanesulfonic acid	<0.0787	cn	0.394	0.0787	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorobutanoic acid	<0.157	cn	0.394	0.157	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorodecanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorodecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorododecanesulfonic acid	<0.0394	cn	0.394	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorododecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoroheptanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoroheptanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorohexadecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorohexanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorohexanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorononanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorononanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorooctadecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorooctanesulfonamide	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorooctanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoropentanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoropentanoic acid	0.200	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoropropanesulfonic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorotetradecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluorotridecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Perfluoroundecanoic acid	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFECA A	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFECA B	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFECA F	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFECA G	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFMOAA	5.16	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFO2HxA	0.0644	J cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFO3OA	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PFO4DA	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PMPA	0.0461	J cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
PS Acid	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
R-EVE	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
R-PSDA	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
R-PSDCA	<0.0394	*- cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
TAF	<0.0394	cn	0.118	0.0394	ng/g		04/04/22 11:19	04/06/22 20:59	1
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
d5-NEtFOSAA	171	cn	10 - 193				04/04/22 11:19	04/06/22 20:59	1
d3-NMeFOSAA	174	cn	10 - 178				04/04/22 11:19	04/06/22 20:59	1
13C3 HFPO-DA	116	cn	10 - 169				04/04/22 11:19	04/06/22 20:59	1
d7-N-MeFOSE-M	120	cn	10 - 179				04/04/22 11:19	04/06/22 20:59	1
d9-N-EtFOSE-M	108	cn	10 - 185				04/04/22 11:19	04/06/22 20:59	1
M2-6:2 FTS	188	cn	10 - 200				04/04/22 11:19	04/06/22 20:59	1
M2-8:2 FTS	241	*5+ cn	15 - 200				04/04/22 11:19	04/06/22 20:59	1
13C3 PFBS	221	*5+ cn	27 - 179				04/04/22 11:19	04/06/22 20:59	1
M2-4:2 FTS	230	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 20:59	1
13C5 PFHxA	97	cn	10 - 174				04/04/22 11:19	04/06/22 20:59	1
13C9 PFNA	131	cn	26 - 165				04/04/22 11:19	04/06/22 20:59	1
13C6 PFDA	131	cn	26 - 161				04/04/22 11:19	04/06/22 20:59	1
13C7 PFUnA	153	cn	12 - 173				04/04/22 11:19	04/06/22 20:59	1
13C3 PFHxS	142	cn	24 - 171				04/04/22 11:19	04/06/22 20:59	1
13C2-PFDoDA	151	cn	11 - 166				04/04/22 11:19	04/06/22 20:59	1
d5-NEtPFOSA	93	cn	10 - 180				04/04/22 11:19	04/06/22 20:59	1
d3-NMePFOSA	103	cn	10 - 175				04/04/22 11:19	04/06/22 20:59	1
13C2-2-Perfluorohexylethanoic acid	125	cn	10 - 200				04/04/22 11:19	04/06/22 20:59	1
13C2-2-Perfluorooctylethanoic acid	188	cn	10 - 200				04/04/22 11:19	04/06/22 20:59	1
13C2-2-Perfluorodecylethanoic acid	210	*5+ cn	10 - 200				04/04/22 11:19	04/06/22 20:59	1
13C2-2H-Perfluoro-2-octenoic acid	68	cn	10 - 164				04/04/22 11:19	04/06/22 20:59	1
13C2-2H-Perfluoro-2-decenoic acid	83	cn	10 - 162				04/04/22 11:19	04/06/22 20:59	1
13C2-2H-Perfluoro-2-dodecenoic acid	112	cn	10 - 161				04/04/22 11:19	04/06/22 20:59	1
13C4 PFBA	127	cn	28 - 153				04/04/22 11:19	04/06/22 20:59	1
13C5 PFPeA	174	*5+ cn	24 - 161				04/04/22 11:19	04/06/22 20:59	1
13C4 PFHpA	112	cn	10 - 178				04/04/22 11:19	04/06/22 20:59	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C8 PFOA	118	cn	26 - 159	04/04/22 11:19	04/06/22 20:59	1
13C8 PFOS	129	cn	41 - 154	04/04/22 11:19	04/06/22 20:59	1
13C8 FOSA	119	cn	14 - 163	04/04/22 11:19	04/06/22 20:59	1
13C2 PFTeDA	153	cn	10 - 169	04/04/22 11:19	04/06/22 20:59	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution - Pre-Treatment - DL

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PPF Acid	41.0	*-	1.18	0.394	ng/g	-	04/04/22 11:19	04/06/22 21:10	10
Isotope Dilution	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
13C4 PFBA	144		28 - 153				04/04/22 11:19	04/06/22 21:10	10

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
10:2 FTS	<0.120	H cn	0.399	0.120	ng/g		05/10/22 10:06	05/12/22 13:24	1
10:2 FTUCA	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
11Cl-PF3OUdS	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
3:3 FTCA	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
4:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.399	0.120	ng/g		05/10/22 10:06	05/12/22 13:24	1
5:3 FTCA	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
6:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.399	0.120	ng/g		05/10/22 10:06	05/12/22 13:24	1
6:2 FTCA	0.0425	J H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
6:2 FTUCA	0.149	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
7:3 FTCA	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
8:2 Fluorotelomer sulfonic acid	<0.120	H cn	0.599	0.120	ng/g		05/10/22 10:06	05/12/22 13:24	1
8:2 FTCA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
8:2 FTUCA	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
9Cl-PF3ONS	<0.0399	H cn	0.399	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
DONA	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
EVE Acid	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
HFPODA	<0.200	H cn	0.599	0.200	ng/g		05/10/22 10:06	05/12/22 13:24	1
Hydro-EVE Acid	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Hydrolyzed PSDA	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Hydro-PS Acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
MTP	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
NEtFOSA	<0.0998	H cn	0.399	0.0998	ng/g		05/10/22 10:06	05/12/22 13:24	1
NEtFOSAA	<0.0399	H cn	0.399	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
NEtFOSE	<0.0998	H cn	0.399	0.0998	ng/g		05/10/22 10:06	05/12/22 13:24	1
NMeFOSA	<0.0998	H cn	0.399	0.0998	ng/g		05/10/22 10:06	05/12/22 13:24	1
NMeFOSAA	<0.0399	H cn	0.399	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
NMeFOSE	<0.0998	H cn	0.399	0.0998	ng/g		05/10/22 10:06	05/12/22 13:24	1
NVHOS	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PEPA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorobutanesulfonic acid	<0.0798	H cn	0.399	0.0798	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorobutanoic acid	<0.160	H cn	0.399	0.160	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorodecanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorodecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorododecanesulfonic acid	<0.0399	H cn	0.399	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorododecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoroheptanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoroheptanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorohexadecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorohexanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorohexanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorononanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorononanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorooctadecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorooctanesulfonamide	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorooctanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoropentanesulfonic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoropentanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoropropanesulfonic acid	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorotetradecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluorotridecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
Perfluoroundecanoic acid	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFECa A	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFECa B	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFECa F	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFECa G	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFMOAA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFO2HxA	0.308	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFO3OA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PFO4DA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PMPA	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PPF Acid	<0.0399	H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
PS Acid	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
R-EVE	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
R-PSDA	<0.0399	H *- cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
R-PSDCA	<0.0399	H cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1
TAF	0.0859	J H *+ cn	0.120	0.0399	ng/g		05/10/22 10:06	05/12/22 13:24	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	587	*5+ cn	10 - 200	05/10/22 10:06	05/12/22 13:24	1
M2-8:2 FTS	385	*5+ cn	15 - 200	05/10/22 10:06	05/12/22 13:24	1
13C2 PFTeDA	80	cn	10 - 169	05/10/22 10:06	05/12/22 13:24	1
13C3 HFPO-DA	78	cn	10 - 169	05/10/22 10:06	05/12/22 13:24	1
13C3 PFBS	190	*5+ cn	27 - 179	05/10/22 10:06	05/12/22 13:24	1
13C4 PFBA	93	cn	28 - 153	05/10/22 10:06	05/12/22 13:24	1
13C4 PFHpA	113	cn	10 - 178	05/10/22 10:06	05/12/22 13:24	1
13C5 PFPeA	125	cn	24 - 161	05/10/22 10:06	05/12/22 13:24	1
13C8 PFOA	96	cn	26 - 159	05/10/22 10:06	05/12/22 13:24	1
13C8 PFOS	110	cn	41 - 154	05/10/22 10:06	05/12/22 13:24	1
d5-NEtFOSAA	119	cn	10 - 193	05/10/22 10:06	05/12/22 13:24	1
d7-N-MeFOSE-M	34	cn	10 - 179	05/10/22 10:06	05/12/22 13:24	1
d9-N-EtFOSE-M	53	cn	10 - 185	05/10/22 10:06	05/12/22 13:24	1
13C3 PFHxS	149	cn	24 - 171	05/10/22 10:06	05/12/22 13:24	1
13C5 PFHxA	75	cn	10 - 174	05/10/22 10:06	05/12/22 13:24	1
13C6 PFDA	85	cn	26 - 161	05/10/22 10:06	05/12/22 13:24	1
13C7 PFUnA	73	cn	12 - 173	05/10/22 10:06	05/12/22 13:24	1
d3-NMePFOSA	41	cn	10 - 175	05/10/22 10:06	05/12/22 13:24	1
d5-NEtPFOSA	45	cn	10 - 180	05/10/22 10:06	05/12/22 13:24	1
13C8 FOSA	55	cn	14 - 163	05/10/22 10:06	05/12/22 13:24	1
13C2-PFDoDA	59	cn	11 - 166	05/10/22 10:06	05/12/22 13:24	1
13C9 PFNA	101	cn	26 - 165	05/10/22 10:06	05/12/22 13:24	1
13C2-2-Perfluorohexylethanoic acid	54	cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1
13C2-2-Perfluorooctylethanoic acid	48	*5- cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1
13C2-2-Perfluorodecylethanoic acid	56	cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1
13C2-2H-Perfluoro-2-octenoic acid	100	cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: 537 TOP - Fluorinated Alkyl Substances - Post-Treatment (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2-2H-Perfluoro-2-decenoic acid	102	cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1
13C2-2H-Perfluoro-2-dodecenoic acid	123	cn	50 - 150	05/10/22 10:06	05/12/22 13:24	1
Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFHxA	79	cn	10 - 137	05/10/22 10:06	05/12/22 13:24	1
13C4 PFOA	120	cn	10 - 146	05/10/22 10:06	05/12/22 13:24	1
13C2 PFUnA	119	cn	10 - 143	05/10/22 10:06	05/12/22 13:24	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: Total PFCA-Dif - Total PFCA (Treatment Difference)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PFBA	0.000				ng/g			05/13/22 13:16	1
PFPA	0.000				ng/g			05/13/22 13:16	1
PFHxA	0.000				ng/g			05/13/22 13:16	1
PFHpA	0.000				ng/g			05/13/22 13:16	1
PFOA	0.000				ng/g			05/13/22 13:16	1
PFNA	0.000				ng/g			05/13/22 13:16	1
Total PFCA	0.000				ng/g			05/13/22 13:16	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: Total PFCA-Sum - Total PFCA (Summary) - Pre-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	0.200	J	0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Method: Total PFCA-Sum - Total PFCA (Summary) - Post-Treatment

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total PFCA	<0.100		0.300	0.100	ng/g			05/13/22 13:14	1

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB 003

Lab Sample ID: 410-76903-4

Date Collected: 03/22/22 00:00

Matrix: Water

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.476	H *- cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
10:2 FTS	<0.952	H cn	4.76	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
10:2 FTUCA	<0.666	H cn	1.90	0.666	ng/L		04/04/22 06:59	05/05/22 08:05	1
11Cl-PF3OUdS	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
3:3 FTCA	<0.285	H cn	1.90	0.285	ng/L		04/04/22 06:59	05/05/22 08:05	1
4:2 Fluorotelomer sulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
5:3 FTCA	<0.190	H *- cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
6:2 Fluorotelomer sulfonic acid	<1.90	H cn	4.76	1.90	ng/L		04/04/22 06:59	05/05/22 08:05	1
6:2 FTCA	<0.381	H *- cn	1.90	0.381	ng/L		04/04/22 06:59	05/05/22 08:05	1
6:2 FTUCA	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
7:3 FTCA	<0.285	H cn	1.90	0.285	ng/L		04/04/22 06:59	05/05/22 08:05	1
8:2 Fluorotelomer sulfonic acid	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
8:2 FTCA	<0.381	H *- cn	1.90	0.381	ng/L		04/04/22 06:59	05/05/22 08:05	1
8:2 FTUCA	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
9Cl-PF3ONS	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
DONA	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
EVE Acid	<2.85	H *- cn	9.52	2.85	ng/L		04/04/22 06:59	05/05/22 08:05	1
HFPODA	<0.476	H cn	2.85	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Hydro-EVE Acid	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
Hydrolyzed PSDA	<0.856	H cn	1.90	0.856	ng/L		04/04/22 06:59	05/05/22 08:05	1
Hydro-PS Acid	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
MTP	<1.90	H cn	4.76	1.90	ng/L		04/04/22 06:59	05/05/22 08:05	1
NEtFOSA	<0.952	H cn	4.76	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
NEtFOSAA	<0.476	H cn	2.85	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
NEtFOSE	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
NMeFOSA	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
NMeFOSAA	<0.571	H cn	1.90	0.571	ng/L		04/04/22 06:59	05/05/22 08:05	1
NMeFOSE	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
NVHOS	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PEPA	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorobutanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorobutanoic acid	<1.90	H cn	4.76	1.90	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorodecanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorodecanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorododecanesulfonic acid	<0.476	H cn	2.85	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorododecanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoroheptanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoroheptanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorohexadecanoic acid	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorohexanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorohexanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorononanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorononanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorooctadecanoic acid	<0.952	H cn	2.85	0.952	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorooctanesulfonamide	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorooctanesulfonic acid	0.731	J H B cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB 003

Lab Sample ID: 410-76903-4

Date Collected: 03/22/22 00:00

Matrix: Water

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoropentanesulfonic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoropentanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoropropanesulfonic acid	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorotetradecanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluorotridecanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
Perfluoroundecanoic acid	<0.476	H cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFECA A	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFECA B	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFECA F	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFECA G	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFMOAA	<0.190	H *- cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFO2HxA	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFO3OA	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PFO4DA	<0.666	H cn	1.90	0.666	ng/L		04/04/22 06:59	05/05/22 08:05	1
PMPA	<0.190	H cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
PPF Acid	<1.90	H cn	4.76	1.90	ng/L		04/04/22 06:59	05/05/22 08:05	1
PS Acid	<2.85	H *- cn	9.52	2.85	ng/L		04/04/22 06:59	05/05/22 08:05	1
R-EVE	<0.381	H cn	1.90	0.381	ng/L		04/04/22 06:59	05/05/22 08:05	1
R-PSDA	<0.476	H *- cn	1.90	0.476	ng/L		04/04/22 06:59	05/05/22 08:05	1
R-PSDCA	<0.190	H *- cn	1.90	0.190	ng/L		04/04/22 06:59	05/05/22 08:05	1
TAF	<1.90	H cn	4.76	1.90	ng/L		04/04/22 06:59	05/05/22 08:05	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	125	cn	10 - 179	04/04/22 06:59	05/05/22 08:05	1
13C2-2H-Perfluoro-2-decenoic acid	170	*5+ cn	21 - 166	04/04/22 06:59	05/05/22 08:05	1
13C2-2H-Perfluoro-2-dodecenoic acid	156	cn	14 - 166	04/04/22 06:59	05/05/22 08:05	1
13C2-2H-Perfluoro-2-octenoic acid	171	cn	20 - 173	04/04/22 06:59	05/05/22 08:05	1
13C2-2-Perfluorodecylethanoic acid	114	cn	10 - 200	04/04/22 06:59	05/05/22 08:05	1
13C2-2-Perfluorohexylethanoic acid	98	cn	10 - 200	04/04/22 06:59	05/05/22 08:05	1
13C2-2-Perfluorooctylethanoic acid	133	cn	10 - 200	04/04/22 06:59	05/05/22 08:05	1
13C2-PFDoDA	127	cn	17 - 176	04/04/22 06:59	05/05/22 08:05	1
13C3 HFPO-DA	138	cn	17 - 185	04/04/22 06:59	05/05/22 08:05	1
13C3 PFBS	141	cn	16 - 200	04/04/22 06:59	05/05/22 08:05	1
13C3 PFHxS	136	cn	28 - 188	04/04/22 06:59	05/05/22 08:05	1
13C4 PFBA	131	cn	42 - 165	04/04/22 06:59	05/05/22 08:05	1
13C4 PFHpA	131	cn	31 - 182	04/04/22 06:59	05/05/22 08:05	1
13C5 PFHxA	124	cn	24 - 179	04/04/22 06:59	05/05/22 08:05	1
13C5 PFPeA	133	cn	38 - 187	04/04/22 06:59	05/05/22 08:05	1
13C6 PFDA	133	cn	49 - 163	04/04/22 06:59	05/05/22 08:05	1
13C7 PFUnA	132	cn	34 - 174	04/04/22 06:59	05/05/22 08:05	1
13C8 FOSA	119	cn	10 - 168	04/04/22 06:59	05/05/22 08:05	1
13C8 PFOA	127	cn	48 - 162	04/04/22 06:59	05/05/22 08:05	1
13C8 PFOS	131	cn	51 - 159	04/04/22 06:59	05/05/22 08:05	1
13C9 PFNA	126	cn	51 - 167	04/04/22 06:59	05/05/22 08:05	1
d3-NMeFOSAA	150	cn	31 - 174	04/04/22 06:59	05/05/22 08:05	1
d3-NMePFOSA	120	cn	10 - 155	04/04/22 06:59	05/05/22 08:05	1
d5-NEtFOSAA	148	cn	29 - 195	04/04/22 06:59	05/05/22 08:05	1
d5-NEtPFOSA	120	cn	10 - 159	04/04/22 06:59	05/05/22 08:05	1

Eurofins Lancaster Laboratories Environment Testing, LLC

Client Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: EB 003

Lab Sample ID: 410-76903-4

Date Collected: 03/22/22 00:00

Matrix: Water

Date Received: 03/21/22 12:09

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
d7-N-MeFOSE-M	129	cn	10 - 178	04/04/22 06:59	05/05/22 08:05	1
d9-N-EtFOSE-M	120	cn	10 - 177	04/04/22 06:59	05/05/22 08:05	1
M2-4:2 FTS	141	cn	10 - 200	04/04/22 06:59	05/05/22 08:05	1
M2-6:2 FTS	129	cn	17 - 200	04/04/22 06:59	05/05/22 08:05	1
M2-8:2 FTS	144	cn	33 - 200	04/04/22 06:59	05/05/22 08:05	1

Surrogate Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances

Matrix: Solid

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Surrogate Recovery (Acceptance Limits)		
		PFHxA (10-137)	PFOA (10-146)	PFUnA (10-143)
LCS 410-253462/3-B	Lab Control Sample	86	120	95
LCSD 410-253462/4-B	Lab Control Sample Dup	115	137	123
MB 410-253462/2-B	Method Blank	101	128	111
Surrogate Legend				
PFHxA = 13C2 PFHxA				
PFOA = 13C4 PFOA				
PFUnA = 13C2 PFUnA				

Method: 537 TOP - Fluorinated Alkyl Substances

Matrix: Solid

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Surrogate Recovery (Acceptance Limits)		
		PFHxA	PFOA	PFUnA
MB 410-253462/1-B	Method Blank			
Surrogate Legend				
PFHxA = 13C2 PFHxA				
PFOA = 13C4 PFOA				
PFUnA = 13C2 PFUnA				

Method: 537 TOP - Fluorinated Alkyl Substances

Matrix: Solid

Prep Type: Post-Treatment

Lab Sample ID	Client Sample ID	Percent Surrogate Recovery (Acceptance Limits)		
		PFHxA (10-137)	PFOA (10-146)	PFUnA (10-143)
410-75808-1	Carpet-001	84 cn	109 cn	109 cn
410-76735-1	PP Pad-001	73 cn	99 cn	90 cn
410-76903-1	Safeshell #1-3	79 cn	120 cn	119 cn
Surrogate Legend				
PFHxA = 13C2 PFHxA				
PFOA = 13C4 PFOA				
PFUnA = 13C2 PFUnA				

Isotope Dilution Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution

Matrix: Solid

Prep Type: Total/NA

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	HFPODA (10-169)	C3PFBS (27-179)	C3PFHS (24-171)	13C5PHA (10-174)	PFDODA (11-166)	C6PFDA (26-161)	13C7PUA (12-173)	MFHEA (10-200)
LCS 410-240631/2-B	Lab Control Sample	137	160	154	148	139	155	150	232 *5+
LCSD 410-240631/3-B	Lab Control Sample Dup	139	153	151	146	133	155	153	258 *5+
MB 410-240631/1-B	Method Blank	129	152	154	139	134	152	147	244 *5+
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	MFOEA (10-200)	MFDEA (10-200)	C9PFNA (26-165)	MFHUEA (10-164)	d3NMFOS (10-178)	MFOUEA (10-162)	d3NMFSA (10-175)	MFDEUA (10-161)
LCS 410-240631/2-B	Lab Control Sample	237 *5+	218 *5+	154	121	150	126	137	111
LCSD 410-240631/3-B	Lab Control Sample Dup	234 *5+	226 *5+	147	124	139	118	139	113
MB 410-240631/1-B	Method Blank	218 *5+	208 *5+	148	119	132	116	131	102
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d5NEFOS (10-193)	PFBA (28-153)	d5NPFSA (10-180)	PFPeA (24-161)	C4PFHA (10-178)	NMFM (10-179)	C8PFOA (26-159)	NEFM (10-185)
LCS 410-240631/2-B	Lab Control Sample	155	147	146	152	153	144	159	137
LCSD 410-240631/3-B	Lab Control Sample Dup	153	143	148	151	150	143	147	133
MB 410-240631/1-B	Method Blank	154	147	141	146	152	133	150	129
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	C8PFOS (41-154)	M242FTS (10-200)	M262FTS (10-200)	PFOSA (14-163)	M282FTS (15-200)	PFTDA (10-169)		
LCS 410-240631/2-B	Lab Control Sample	146	176	165	155	135	137		
LCSD 410-240631/3-B	Lab Control Sample Dup	145	168	160	153	147	130		
MB 410-240631/1-B	Method Blank	148	160	161	150	155	125		
Surrogate Legend									
HFPODA = 13C3 HFPO-DA									
C3PFBS = 13C3 PFBS									
C3PFHS = 13C3 PFHxS									
13C5PHA = 13C5 PFHxA									
PFDODA = 13C2-PFDODA									
C6PFDA = 13C6 PFDA									
13C7PUA = 13C7 PFUnA									
MFHEA = 13C2-2-Perfluorohexylethanoic acid									
MFOEA = 13C2-2-Perfluorooctylethanoic acid									
MFDEA = 13C2-2-Perfluorodecylethanoic acid									
C9PFNA = 13C9 PFNA									
MFHUEA = 13C2-2H-Perfluoro-2-octenoic acid									
d3NMFOS = d3-NMeFOSAA									
MFOUEA = 13C2-2H-Perfluoro-2-decenoic acid									
d3NMFSA = d3-NMePFOSA									
MFDEUA = 13C2-2H-Perfluoro-2-dodecenoic acid									
d5NEFOS = d5-NEtFOSAA									
PFBA = 13C4 PFBA									
d5NPFSA = d5-NEtPFOSA									
PFPeA = 13C5 PFPeA									
C4PFHA = 13C4 PFHpA									
NMFM = d7-N-MeFOSE-M									
C8PFOA = 13C8 PFOA									
NEFM = d9-N-EtFOSE-M									
C8PFOS = 13C8 PFOS									
M242FTS = M2-4:2 FTS									

Isotope Dilution Summary

Client: TRC Companies, Inc

Job ID: 410-75808-1

Project/Site: Synthetic Turf

M262FTS = M2-6:2 FTS

PFOSA = 13C8 FOSA

M282FTS = M2-8:2 FTS

PFTDA = 13C2 PFTeDA

Method: 537 IDA - EPA 537 Isotope Dilution

Matrix: Solid

Prep Type: Pre-Treatment

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d5NEFOS (10-193)	d3NMFOS (10-178)	HFPODA (10-169)	NMFM (10-179)	NEFM (10-185)	M262FTS (10-200)	M282FTS (15-200)	C3PFBS (27-179)
410-75808-1	Carpet-001	169 cn	131 cn	138 cn	94 cn	99 cn	197 cn	269 *5+ cn	151 cn
410-76735-1	PP Pad-001	124 cn	138 cn	145 cn	147 cn	179 cn	198 cn	162 cn	138 cn
410-76903-1	Safeshell #1-3	171 cn	174 cn	116 cn	120 cn	108 cn	188 cn	241 *5+ cn	221 *5+ cn
410-76903-1 - DL	Safeshell #1-3								
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	M242FTS (10-200)	13C5PHA (10-174)	C9PFNA (26-165)	C6PFDA (26-161)	13C7PUA (12-173)	C3PFHS (24-171)	PFDODA (11-166)	d5NPFSA (10-180)
410-75808-1	Carpet-001	330 *5+ cn	149 cn	164 cn	148 cn	137 cn	157 cn	117 cn	85 cn
410-76735-1	PP Pad-001	353 *5+ cn	146 cn	154 cn	150 cn	120 cn	140 cn	147 cn	122 cn
410-76903-1	Safeshell #1-3	230 *5+ cn	97 cn	131 cn	131 cn	153 cn	142 cn	151 cn	93 cn
410-76903-1 - DL	Safeshell #1-3								
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d3NMFSA (10-175)	MFHEA (10-200)	MFOEA (10-200)	MFDEA (10-200)	MFHUEA (10-164)	MFOUEA (10-162)	MFDEUA (10-161)	PFBA (28-153)
410-75808-1	Carpet-001	83 cn	260 *5+ cn	364 *5+ cn	328 *5+ cn	114 cn	154 cn	157 cn	144 cn
410-76735-1	PP Pad-001	138 cn	304 *5+ cn	270 *5+ cn	307 *5+ cn	134 cn	128 cn	141 cn	148 cn
410-76903-1	Safeshell #1-3	103 cn	125 cn	188 cn	210 *5+ cn	68 cn	83 cn	112 cn	127 cn
410-76903-1 - DL	Safeshell #1-3								144
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFPeA (24-161)	C4PFHA (10-178)	C8PFOA (26-159)	C8PFOS (41-154)	PFOSA (14-163)	PFTDA (10-169)		
410-75808-1	Carpet-001	147 cn	146 cn	152 cn	155 *5+ cn	133 cn	129 cn		
410-76735-1	PP Pad-001	164 *5+ cn	147 cn	137 cn	146 cn	149 cn	141 cn		
410-76903-1	Safeshell #1-3	174 *5+ cn	112 cn	118 cn	129 cn	119 cn	153 cn		
410-76903-1 - DL	Safeshell #1-3								

Surrogate Legend

d5NEFOS = d5-NEtFOSAA
d3NMFOS = d3-NMeFOSAA
HFPODA = 13C3 HFPO-DA
NMFM = d7-N-MeFOSE-M
NEFM = d9-N-EtFOSE-M
M262FTS = M2-6:2 FTS
M282FTS = M2-8:2 FTS
C3PFBS = 13C3 PFBS
M242FTS = M2-4:2 FTS
13C5PHA = 13C5 PFHxA

Isotope Dilution Summary

Client: TRC Companies, Inc

Job ID: 410-75808-1

Project/Site: Synthetic Turf

C9PFNA = 13C9 PFNA

C6PFDA = 13C6 PFDA

13C7PUA = 13C7 PFUnA

C3PFHS = 13C3 PFHxS

PFDODA = 13C2-PFDODA

d5NPFSA = d5-NEtPFOSA

d3NMFSA = d3-NMePFOSA

MFHEA = 13C2-2-Perfluorohexylethanoic acid

MFOEA = 13C2-2-Perfluorooctylethanoic acid

MFDEA = 13C2-2-Perfluorodecylethanoic acid

MFHUEA = 13C2-2H-Perfluoro-2-octenoic acid

MFOUEA = 13C2-2H-Perfluoro-2-decenoic acid

MFDUEA = 13C2-2H-Perfluoro-2-dodecenoic acid

PFBA = 13C4 PFBA

PFPeA = 13C5 PFPeA

C4PFHA = 13C4 PFHpA

C8PFOA = 13C8 PFOA

C8PFOS = 13C8 PFOS

PFOSA = 13C8 FOSA

PFTDA = 13C2 PFTeDA

Method: 537 IDA - EPA 537 Isotope Dilution

Matrix: Water

Prep Type: Total/NA

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d5NEFOS (29-195)	d3NMFOS (31-174)	HFPODA (17-185)	NMFM (10-178)	NEFM (10-177)	M262FTS (17-200)	M282FTS (33-200)	C3PFBS (16-200)
410-75808-2	EB-001	125 cn	129 cn	121 cn	96 cn	95 cn	128 cn	132 cn	140 cn
410-76735-2	EB-002	131 cn	135 cn	109 cn	111 cn	112 cn	130 cn	135 cn	128 cn
410-76903-4	EB 003	148 cn	150 cn	138 cn	129 cn	120 cn	129 cn	144 cn	141 cn
LCS 410-240479/3-A	Lab Control Sample	128	128	112	102	104	119	109	124
LCSD 410-240479/4-A	Lab Control Sample Dup	131	135	112	103	108	115	128	125
MB 410-240479/1-A	Method Blank	134	134	117	112	111	134	136	128
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	M242FTS (10-200)	13C5PHA (24-179)	C9PFNA (51-167)	C6PFDA (49-163)	13C7PUA (34-174)	C3PFHS (28-188)	PFDODA (17-176)	d5NPFSA (10-159)
410-75808-2	EB-001	126 cn	101 cn	125 cn	128 cn	125 cn	128 cn	115 cn	53 cn
410-76735-2	EB-002	113 cn	116 cn	118 cn	134 cn	131 cn	126 cn	125 cn	108 cn
410-76903-4	EB 003	141 cn	124 cn	126 cn	133 cn	132 cn	136 cn	127 cn	120 cn
LCS 410-240479/3-A	Lab Control Sample	109	116	118	118	118	120	116	85
LCSD 410-240479/4-A	Lab Control Sample Dup	110	112	117	125	121	120	121	98
MB 410-240479/1-A	Method Blank	115	115	119	126	126	129	117	102
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	d3NMFSA (10-155)	MFHEA (10-200)	MFOEA (10-200)	MFDEA (10-200)	MFHUEA (20-173)	MFOUEA (21-166)	MFDUEA (14-166)	PFBA (42-165)
410-75808-2	EB-001	53 cn	80 cn	99 cn	78 cn	143 cn	141 cn	130 cn	128 cn
410-76735-2	EB-002	105 cn	79 cn	103 cn	86 cn	147 cn	165 cn	159 cn	124 cn
410-76903-4	EB 003	120 cn	98 cn	133 cn	114 cn	171 cn	170 *5+ cn	156 cn	131 cn
LCS 410-240479/3-A	Lab Control Sample	84	84	108	103	138	136	134	115
LCSD 410-240479/4-A	Lab Control Sample Dup	96	82	112	102	134	143	136	111
MB 410-240479/1-A	Method Blank	98	77	92	90	156	163	150	124
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFPeA (38-187)	C4PFHA (31-182)	C8PFOA (48-162)	C8PFOS (51-159)	PFOSA (10-168)	PFTDA (10-179)		
410-75808-2	EB-001	134 cn	123 cn	124 cn	123 cn	102 cn	110 cn		

Eurofins Lancaster Laboratories Environment Testing, LLC

Isotope Dilution Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Matrix: Water

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Isotope Dilution Recovery (Acceptance Limits)					
		PFPeA (38-187)	C4PFHA (31-182)	C8PFOA (48-162)	C8PFOS (51-159)	PFOSA (10-168)	PFTDA (10-179)
410-76735-2	EB-002	118 cn	117 cn	120 cn	118 cn	113 cn	118 cn
410-76903-4	EB 003	133 cn	131 cn	127 cn	131 cn	119 cn	125 cn
LCS 410-240479/3-A	Lab Control Sample	123	118	118	120	105	118
LCSD 410-240479/4-A	Lab Control Sample Dup	105	114	116	122	109	118
MB 410-240479/1-A	Method Blank	126	124	118	127	104	115
Surrogate Legend							
d5NEFOS = d5-NEtFOSAA							
d3NMFOS = d3-NMeFOSAA							
HFPODA = 13C3 HFPO-DA							
NMFm = d7-N-MeFOSE-M							
NEFM = d9-N-EtFOSE-M							
M262FTS = M2-6:2 FTS							
M282FTS = M2-8:2 FTS							
C3PFBS = 13C3 PFBS							
M242FTS = M2-4:2 FTS							
13C5PHA = 13C5 PFHxA							
C9PFNA = 13C9 PFNA							
C6PFDA = 13C6 PFDA							
13C7PUA = 13C7 PFUnA							
C3PFHS = 13C3 PFHxS							
PFDoDA = 13C2-PFDoDA							
d5NPFSA = d5-NEtPFOSA							
d3NMFSA = d3-NMePFOSA							
MFHEA = 13C2-2-Perfluorohexylethanoic acid							
MFOEA = 13C2-2-Perfluorooctylethanoic acid							
MFDEA = 13C2-2-Perfluorodecylethanoic acid							
MFHUEA = 13C2-2H-Perfluoro-2-octenoic acid							
MFOUEA = 13C2-2H-Perfluoro-2-decenoic acid							
MFDUEA = 13C2-2H-Perfluoro-2-dodecenoic acid							
PFBA = 13C4 PFBA							
PFPeA = 13C5 PFPeA							
C4PFHA = 13C4 PFHpA							
C8PFOA = 13C8 PFOA							
C8PFOS = 13C8 PFOS							
PFOSA = 13C8 FOSA							
PFTDA = 13C2 PFTeDA							

Method: 537 TOP - Fluorinated Alkyl Substances

Matrix: Solid

Prep Type: Total/NA

Lab Sample ID	Client Sample ID	Percent Isotope Dilution Recovery (Acceptance Limits)							
		M262FTS (10-200)	M282FTS (15-200)	PFTDA (10-169)	HFPODA (10-169)	C3PFBS (27-179)	PFBA (28-153)	C4PFHA (10-178)	PFPeA (24-161)
LCS 410-253462/3-B	Lab Control Sample	211 *5+	167	86	107	166	99	103	136
LCSD 410-253462/4-B	Lab Control Sample Dup	221 *5+	176	110	130	205 *5+	122	129	174 *5+
MB 410-253462/2-B	Method Blank	347 *5+	236 *5+	101	130	139	120	100	122
Lab Sample ID	Client Sample ID	Percent Isotope Dilution Recovery (Acceptance Limits)							
		C8PFOA (26-159)	C8PFOS (41-154)	d5NEFOS (10-193)	NMFm (10-179)	NEFM (10-185)	C3PFHS (24-171)	13C5PHA (10-174)	C6PFDA (26-161)
LCS 410-253462/3-B	Lab Control Sample	105	117	109	81	79	114	90	104

Eurofins Lancaster Laboratories Environment Testing, LLC

Isotope Dilution Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Matrix: Solid

Prep Type: Total/NA

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	C8PFOA (26-159)	C8PFOS (41-154)	d5NEFOS (10-193)	NMFM (10-179)	NEFM (10-185)	C3PFHS (24-171)	13C5PHA (10-174)	C6PFDA (26-161)
LCSD 410-253462/4-B	Lab Control Sample Dup	131	153	135	104	105	134	122	140
MB 410-253462/2-B	Method Blank	122	152	147	98	89	135	110	129
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	13C7PUA (12-173)	d3NMFSa (10-175)	d5NPFSA (10-180)	PFOSA (14-163)	PFDODA (11-166)	C9PFNA (26-165)	MFHEA (50-150)	MFOEA (50-150)
LCS 410-253462/3-B	Lab Control Sample	87	79	70	79	95	99	72	57
LCSD 410-253462/4-B	Lab Control Sample Dup	114	86	79	111	121	137	95	82
MB 410-253462/2-B	Method Blank	113	77	72	100	123	134	66	90
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	MFDEA (50-150)	MFHUEA (50-150)	MFOUEA (50-150)	MFDUEA (50-150)				
LCS 410-253462/3-B	Lab Control Sample	63	116	96	118				
LCSD 410-253462/4-B	Lab Control Sample Dup	78	148	118	151 *5+				
MB 410-253462/2-B	Method Blank	80	113	161 *5+	170 *5+				
Surrogate Legend									
M262FTS = M2-6:2 FTS									
M282FTS = M2-8:2 FTS									
PFTDA = 13C2 PFTeDA									
HFPODA = 13C3 HFPO-DA									
C3PFBS = 13C3 PFBS									
PFBA = 13C4 PFBA									
C4PFHA = 13C4 PFHpA									
PFPeA = 13C5 PFPeA									
C8PFOA = 13C8 PFOA									
C8PFOS = 13C8 PFOS									
d5NEFOS = d5-NEtFOSAA									
NMFM = d7-N-MeFOSE-M									
NEFM = d9-N-EtFOSE-M									
C3PFHS = 13C3 PFHxS									
13C5PHA = 13C5 PFHxA									
C6PFDA = 13C6 PFDA									
13C7PUA = 13C7 PFUnA									
d3NMFSa = d3-NMePFOSA									
d5NPFSA = d5-NEtPFOSA									
PFOSA = 13C8 FOSA									
PFDODA = 13C2-PFDODA									
C9PFNA = 13C9 PFNA									
MFHEA = 13C2-2-Perfluorohexylethanoic acid									
MFOEA = 13C2-2-Perfluorooctylethanoic acid									
MFDEA = 13C2-2-Perfluorodecylethanoic acid									
MFHUEA = 13C2-2H-Perfluoro-2-octenoic acid									
MFOUEA = 13C2-2H-Perfluoro-2-decenoic acid									
MFDUEA = 13C2-2H-Perfluoro-2-dodecenoic acid									

Isotope Dilution Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances

Matrix: Solid

Prep Type: Post-Treatment

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	M262FTS (10-200)	M282FTS (15-200)	PFTDA (10-169)	HFPODA (10-169)	C3PFBS (27-179)	PFBA (28-153)	C4PFHA (10-178)	PFPeA (24-161)
410-75808-1	Carpet-001	522 *5+ cn	488 *5+ cn	247 *5+ cn	108 cn	125 cn	99 cn	144 cn	68 cn
410-76735-1	PP Pad-001	321 *5+ cn	223 *5+ cn	90 cn	75 cn	105 cn	85 cn	96 cn	81 cn
410-76903-1	Safeshell #1-3	587 *5+ cn	385 *5+ cn	80 cn	78 cn	190 *5+ cn	93 cn	113 cn	125 cn
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	C8PFOA (26-159)	C8PFOS (41-154)	d5NEFOS (10-193)	NMFM (10-179)	NEFM (10-185)	C3PFHS (24-171)	13C5PHA (10-174)	C6PFDA (26-161)
410-75808-1	Carpet-001	112 cn	138 cn	384 *5+ cn	121 cn	188 *5+ cn	171 cn	92 cn	168 *5+ cn
410-76735-1	PP Pad-001	90 cn	108 cn	115 cn	70 cn	65 cn	107 cn	77 cn	98 cn
410-76903-1	Safeshell #1-3	96 cn	110 cn	119 cn	34 cn	53 cn	149 cn	75 cn	85 cn
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	13C7PUA (12-173)	d3NMFSA (10-175)	d5NPFSA (10-180)	PFOSA (14-163)	PFDODA (11-166)	C9PFNA (26-165)	MFHEA (50-150)	MFOEA (50-150)
410-75808-1	Carpet-001	213 *5+ cn	106 cn	119 cn	167 *5+ cn	158 cn	110 cn	48 *5- cn	111 cn
410-76735-1	PP Pad-001	82 cn	56 cn	50 cn	55 cn	91 cn	101 cn	40 *5- cn	53 cn
410-76903-1	Safeshell #1-3	73 cn	41 cn	45 cn	55 cn	59 cn	101 cn	54 cn	48 *5- cn
		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	MFDEA (50-150)	MFHUEA (50-150)	MFOUEA (50-150)	MFDUEA (50-150)				
410-75808-1	Carpet-001	181 *5+ cn	66 cn	199 *5+ cn	265 *5+ cn				
410-76735-1	PP Pad-001	66 cn	83 cn	110 cn	133 cn				
410-76903-1	Safeshell #1-3	56 cn	100 cn	102 cn	123 cn				

Surrogate Legend

M262FTS = M2-6:2 FTS
 M282FTS = M2-8:2 FTS
 PFTDA = 13C2 PFTeDA
 HFPODA = 13C3 HFPO-DA
 C3PFBS = 13C3 PFBS
 PFBA = 13C4 PFBA
 C4PFHA = 13C4 PFHpA
 PFPeA = 13C5 PFPeA
 C8PFOA = 13C8 PFOA
 C8PFOS = 13C8 PFOS
 d5NEFOS = d5-NEtFOSAA
 NMFM = d7-N-MeFOSE-M
 NEFM = d9-N-EtFOSE-M
 C3PFHS = 13C3 PFHxS
 13C5PHA = 13C5 PFHxA
 C6PFDA = 13C6 PFDA
 13C7PUA = 13C7 PFUnA
 d3NMFSA = d3-NMePFOSA
 d5NPFSA = d5-NEtPFOSA
 PFOSA = 13C8 FOSA
 PFDODA = 13C2-PFDODA
 C9PFNA = 13C9 PFNA

Isotope Dilution Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

- MFHEA = 13C2-2-Perfluorohexylethanoic acid
- MFOEA = 13C2-2-Perfluorooctylethanoic acid
- MFDEA = 13C2-2-Perfluorodecylethanoic acid
- MFHUEA = 13C2-2H-Perfluoro-2-octenoic acid
- MFOUEA = 13C2-2H-Perfluoro-2-decenoic acid
- MFDEUA = 13C2-2H-Perfluoro-2-dodecenoic acid

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QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution

Lab Sample ID: MB 410-240479/1-A

Matrix: Water

Analysis Batch: 250678

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240479

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
10:2 FTS	<1.00		5.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
10:2 FTUCA	<0.700		2.00	0.700	ng/L		04/04/22 06:59	05/03/22 01:07	1
11CI-PF3OUdS	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
3:3 FTCA	<0.300		2.00	0.300	ng/L		04/04/22 06:59	05/03/22 01:07	1
4:2 Fluorotelomer sulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
5:3 FTCA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
6:2 Fluorotelomer sulfonic acid	<2.00		5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
6:2 FTCA	<0.400		2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:07	1
6:2 FTUCA	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
7:3 FTCA	<0.300		2.00	0.300	ng/L		04/04/22 06:59	05/03/22 01:07	1
8:2 Fluorotelomer sulfonic acid	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
8:2 FTCA	<0.400		2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:07	1
8:2 FTUCA	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
9CI-PF3ONS	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
DONA	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
EVE Acid	<3.00		10.0	3.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
HFPODA	<0.500		3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Hydro-EVE Acid	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
Hydrolyzed PSDA	<0.900		2.00	0.900	ng/L		04/04/22 06:59	05/03/22 01:07	1
Hydro-PS Acid	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
MTP	<2.00		5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
NEtFOSA	<1.00		5.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
NEtFOSAA	<0.500		3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
NEtFOSE	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
NMeFOSA	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
NMeFOSAA	<0.600		2.00	0.600	ng/L		04/04/22 06:59	05/03/22 01:07	1
NMeFOSE	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
NVHOS	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PEPA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorobutanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorobutanoic acid	<2.00		5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorodecanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorodecanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorododecanesulfonic acid	<0.500		3.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorododecanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoroheptanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoroheptanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorohexadecanoic acid	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorohexanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorohexanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorononanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorononanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorooctadecanoic acid	<1.00		3.00	1.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorooctanesulfonamide	0.5231	J	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: MB 410-240479/1-A

Matrix: Water

Analysis Batch: 250678

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240479

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorooctanesulfonic acid	0.7280	J	2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorooctanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoropentanesulfonic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoropentanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoropropanesulfonic acid	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorotetradecanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluorotridecanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
Perfluoroundecanoic acid	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFECa A	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFECa B	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFECa F	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFECa G	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFMOAA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFO2HxA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFO3OA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PFO4DA	<0.700		2.00	0.700	ng/L		04/04/22 06:59	05/03/22 01:07	1
PMPA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
PPF Acid	<2.00		5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
PS Acid	<3.00		10.0	3.00	ng/L		04/04/22 06:59	05/03/22 01:07	1
R-EVE	<0.400		2.00	0.400	ng/L		04/04/22 06:59	05/03/22 01:07	1
R-PSDA	<0.500		2.00	0.500	ng/L		04/04/22 06:59	05/03/22 01:07	1
R-PSDCA	<0.200		2.00	0.200	ng/L		04/04/22 06:59	05/03/22 01:07	1
TAF	<2.00		5.00	2.00	ng/L		04/04/22 06:59	05/03/22 01:07	1

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	117		17 - 185	04/04/22 06:59	05/03/22 01:07	1
13C3 PFBS	128		16 - 200	04/04/22 06:59	05/03/22 01:07	1
13C3 PFHxS	129		28 - 188	04/04/22 06:59	05/03/22 01:07	1
13C5 PFHxA	115		24 - 179	04/04/22 06:59	05/03/22 01:07	1
13C2-PFDoDA	117		17 - 176	04/04/22 06:59	05/03/22 01:07	1
13C6 PFDA	126		49 - 163	04/04/22 06:59	05/03/22 01:07	1
13C7 PFUnA	126		34 - 174	04/04/22 06:59	05/03/22 01:07	1
13C2-2-Perfluorohexylethanoic acid	77		10 - 200	04/04/22 06:59	05/03/22 01:07	1
13C2-2-Perfluorooctylethanoic acid	92		10 - 200	04/04/22 06:59	05/03/22 01:07	1
13C2-2-Perfluorodecylethanoic acid	90		10 - 200	04/04/22 06:59	05/03/22 01:07	1
13C2-2H-Perfluoro-2-octenoic acid	156		20 - 173	04/04/22 06:59	05/03/22 01:07	1
13C9 PFNA	119		51 - 167	04/04/22 06:59	05/03/22 01:07	1
13C2-2H-Perfluoro-2-decenoic acid	163		21 - 166	04/04/22 06:59	05/03/22 01:07	1
d3-NMeFOSAA	134		31 - 174	04/04/22 06:59	05/03/22 01:07	1
13C2-2H-Perfluoro-2-dodecenoic acid	150		14 - 166	04/04/22 06:59	05/03/22 01:07	1
d3-NMePFOSA	98		10 - 155	04/04/22 06:59	05/03/22 01:07	1
13C4 PFBA	124		42 - 165	04/04/22 06:59	05/03/22 01:07	1
d5-NEtFOSAA	134		29 - 195	04/04/22 06:59	05/03/22 01:07	1
13C5 PFPeA	126		38 - 187	04/04/22 06:59	05/03/22 01:07	1
d5-NEtPFOSA	102		10 - 159	04/04/22 06:59	05/03/22 01:07	1
13C4 PFHpA	124		31 - 182	04/04/22 06:59	05/03/22 01:07	1
d7-N-MeFOSE-M	112		10 - 178	04/04/22 06:59	05/03/22 01:07	1
13C8 PFOA	118		48 - 162	04/04/22 06:59	05/03/22 01:07	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: MB 410-240479/1-A

Matrix: Water

Analysis Batch: 250678

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240479

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
d9-N-EtFOSE-M	111		10 - 177	04/04/22 06:59	05/03/22 01:07	1
13C8 PFOS	127		51 - 159	04/04/22 06:59	05/03/22 01:07	1
M2-4:2 FTS	115		10 - 200	04/04/22 06:59	05/03/22 01:07	1
13C8 FOSA	104		10 - 168	04/04/22 06:59	05/03/22 01:07	1
M2-6:2 FTS	134		17 - 200	04/04/22 06:59	05/03/22 01:07	1
13C2 PFTeDA	115		10 - 179	04/04/22 06:59	05/03/22 01:07	1
M2-8:2 FTS	136		33 - 200	04/04/22 06:59	05/03/22 01:07	1

Lab Sample ID: LCS 410-240479/3-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240479

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
10:2 FTCA	25.6	15.84	*-	ng/L		62	70 - 130
10:2 FTS	24.7	22.12		ng/L		90	50 - 146
10:2 FTUCA	25.6	18.99		ng/L		74	70 - 130
11Cl-PF3OUdS	23.8	18.23		ng/L		77	53 - 139
3:3 FTCA	25.6	19.04		ng/L		74	70 - 130
4:2 Fluorotelomer sulfonic acid	23.9	17.48		ng/L		73	55 - 139
5:3 FTCA	25.6	17.63	*-	ng/L		69	70 - 130
6:2 Fluorotelomer sulfonic acid	24.3	16.33		ng/L		67	28 - 173
6:2 FTCA	25.6	16.75	*-	ng/L		65	70 - 130
6:2 FTUCA	25.6	17.84		ng/L		70	70 - 130
7:3 FTCA	25.6	31.51		ng/L		123	70 - 130
8:2 Fluorotelomer sulfonic acid	24.5	17.71		ng/L		72	55 - 138
8:2 FTCA	25.6	16.34	*-	ng/L		64	70 - 130
8:2 FTUCA	25.6	22.46		ng/L		88	70 - 130
9Cl-PF3ONS	23.8	18.09		ng/L		76	59 - 135
DONA	24.2	18.83		ng/L		78	55 - 143
EVE Acid	25.6	<3.00	*-	ng/L		6	70 - 130
HFPODA	25.6	21.30		ng/L		83	50 - 135
Hydro-EVE Acid	25.6	22.73		ng/L		89	70 - 130
Hydrolyzed PSDA	25.6	22.23		ng/L		87	70 - 130
Hydro-PS Acid	25.6	22.07		ng/L		86	70 - 130
MTP	25.6	21.70		ng/L		85	70 - 130
NEtFOSA	25.6	18.47		ng/L		72	61 - 134
NEtFOSAA	25.6	18.75		ng/L		73	55 - 134
NEtFOSE	25.6	19.77		ng/L		77	60 - 136
NMeFOSA	25.6	18.89		ng/L		74	64 - 143
NMeFOSAA	25.6	18.66		ng/L		73	59 - 140
NMeFOSE	25.6	18.66		ng/L		73	55 - 144
NVHOS	25.6	18.13		ng/L		71	70 - 130
PEPA	25.6	21.33		ng/L		83	70 - 130
Perfluoro (2-ethoxyethane) sulfonic acid	22.8	17.50		ng/L		77	70 - 130
Perfluoro-4-ethylcyclohexanesulfonic acid	23.6	17.58		ng/L		74	70 - 130
Perfluorobutanesulfonic acid	22.7	19.67		ng/L		87	53 - 138
Perfluorobutanoic acid	25.6	18.73		ng/L		73	59 - 136

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCS 410-240479/3-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240479

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Perfluorodecanesulfonic acid	24.7	17.78		ng/L		72	55 - 137
Perfluorodecanoic acid	25.6	20.94		ng/L		82	56 - 138
Perfluorododecanesulfonic acid	24.8	18.13		ng/L		73	48 - 138
Perfluorododecanoic acid	25.6	19.80		ng/L		77	59 - 143
Perfluoroheptanesulfonic acid	24.4	17.80		ng/L		73	56 - 140
Perfluoroheptanoic acid	25.6	19.64		ng/L		77	59 - 145
Perfluorohexadecanoic acid	25.6	21.02		ng/L		82	41 - 158
Perfluorohexanesulfonic acid	23.3	17.38		ng/L		74	58 - 134
Perfluorohexanoic acid	25.6	20.11		ng/L		79	58 - 139
Perfluorononanesulfonic acid	24.6	17.77		ng/L		72	59 - 136
Perfluorononanoic acid	25.6	19.54		ng/L		76	61 - 139
Perfluorooctadecanoic acid	25.6	21.22		ng/L		83	29 - 172
Perfluorooctanesulfonamide	25.6	19.74		ng/L		77	43 - 167
Perfluorooctanesulfonic acid	23.7	19.06		ng/L		80	45 - 150
Perfluorooctanoic acid	25.6	20.92		ng/L		82	51 - 145
Perfluoropentanesulfonic acid	24.0	18.32		ng/L		76	55 - 140
Perfluoropentanoic acid	25.6	19.75		ng/L		77	57 - 141
Perfluoropropanesulfonic acid	23.4	19.84		ng/L		85	70 - 130
Perfluorotetradecanoic acid	25.6	20.17		ng/L		79	62 - 139
Perfluorotridecanoic acid	25.6	19.67		ng/L		77	58 - 146
Perfluoroundecanoic acid	25.6	20.58		ng/L		80	60 - 141
PFECA A	25.6	20.62		ng/L		81	70 - 130
PFECA B	25.6	23.08		ng/L		90	70 - 130
PFECA F	25.6	23.64		ng/L		92	70 - 130
PFECA G	25.6	19.27		ng/L		75	70 - 130
PFM0AA	25.6	17.46	*-	ng/L		68	70 - 130
PFO2HxA	25.6	21.10		ng/L		82	70 - 130
PFO3OA	25.6	20.47		ng/L		80	70 - 130
PFO4DA	25.6	21.96		ng/L		86	70 - 130
PMPA	25.6	20.03		ng/L		78	70 - 130
PPF Acid	25.6	24.44		ng/L		95	70 - 130
PS Acid	25.6	<3.00	*-	ng/L		9	70 - 130
R-EVE	25.6	23.12		ng/L		90	70 - 130
R-PSDA	25.6	17.46	*-	ng/L		68	70 - 130
R-PSDCA	25.6	17.91		ng/L		70	70 - 130
TAF	25.6	20.99		ng/L		82	70 - 130

Isotope Dilution	LCS %Recovery	LCS Qualifier	Limits
13C3 HFPO-DA	112		17 - 185
13C3 PFBS	124		16 - 200
13C3 PFHxS	120		28 - 188
13C5 PFHxA	116		24 - 179
13C2-PFDoDA	116		17 - 176
13C6 PFDA	118		49 - 163
13C7 PFUnA	118		34 - 174
13C2-2-Perfluorohexylethanoic acid	84		10 - 200
13C2-2-Perfluorooctylethanoic acid	108		10 - 200

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCS 410-240479/3-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240479

Isotope Dilution	LCS LCS		Limits
	%Recovery	Qualifier	
13C2-2-Perfluorodecylethanoic acid	103		10 - 200
13C2-2H-Perfluoro-2-octenoic acid	138		20 - 173
13C9 PFNA	118		51 - 167
13C2-2H-Perfluoro-2-decenoic acid	136		21 - 166
d3-NMeFOSAA	128		31 - 174
13C2-2H-Perfluoro-2-dodecenoic acid	134		14 - 166
d3-NMePFOSA	84		10 - 155
13C4 PFBA	115		42 - 165
d5-NEtFOSAA	128		29 - 195
13C5 PFPeA	123		38 - 187
d5-NEtPFOSA	85		10 - 159
13C4 PFHpA	118		31 - 182
d7-N-MeFOSE-M	102		10 - 178
13C8 PFOA	118		48 - 162
d9-N-EtFOSE-M	104		10 - 177
13C8 PFOS	120		51 - 159
M2-4:2 FTS	109		10 - 200
13C8 FOSA	105		10 - 168
M2-6:2 FTS	119		17 - 200
13C2 PFTeDA	118		10 - 179
M2-8:2 FTS	109		33 - 200

Lab Sample ID: LCSD 410-240479/4-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240479

Analyte	Spike Added	LCSD LCSD		Unit	D	%Rec	%Rec		RPD	
		Result	Qualifier				Limits	RPD	Limit	
10:2 FTCA	25.6	16.60	*-	ng/L		65	70 - 130	5	30	
10:2 FTS	24.7	18.64		ng/L		76	50 - 146	17	30	
10:2 FTUCA	25.6	20.04		ng/L		78	70 - 130	5	30	
11Cl-PF3OUdS	23.8	18.15		ng/L		76	53 - 139	0	30	
3:3 FTCA	25.6	22.17		ng/L		87	70 - 130	15	30	
4:2 Fluorotelomer sulfonic acid	23.9	18.36		ng/L		77	55 - 139	5	30	
5:3 FTCA	25.6	18.20		ng/L		71	70 - 130	3	30	
6:2 Fluorotelomer sulfonic acid	24.3	17.07		ng/L		70	28 - 173	4	30	
6:2 FTCA	25.6	17.27	*-	ng/L		67	70 - 130	3	30	
6:2 FTUCA	25.6	17.91		ng/L		70	70 - 130	0	30	
7:3 FTCA	25.6	32.75		ng/L		128	70 - 130	4	30	
8:2 Fluorotelomer sulfonic acid	24.5	15.63		ng/L		64	55 - 138	13	30	
8:2 FTCA	25.6	17.13	*-	ng/L		67	70 - 130	5	30	
8:2 FTUCA	25.6	21.83		ng/L		85	70 - 130	3	30	
9Cl-PF3ONS	23.8	18.54		ng/L		78	59 - 135	2	30	
DONA	24.2	18.77		ng/L		78	55 - 143	0	30	
EVE Acid	25.6	<3.00	*-	ng/L		8	70 - 130	19	30	
HFPODA	25.6	20.26		ng/L		79	50 - 135	5	30	
Hydro-EVE Acid	25.6	23.01		ng/L		90	70 - 130	1	30	

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCSD 410-240479/4-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240479

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Hydrolyzed PSDA	25.6	20.83		ng/L		81	70 - 130	6	30
Hydro-PS Acid	25.6	21.05		ng/L		82	70 - 130	5	30
MTP	25.6	20.85		ng/L		81	70 - 130	4	30
NEtFOSA	25.6	18.54		ng/L		72	61 - 134	0	30
NEtFOSAA	25.6	19.65		ng/L		77	55 - 134	5	30
NEtFOSE	25.6	20.30		ng/L		79	60 - 136	3	30
NMeFOSA	25.6	19.89		ng/L		78	64 - 143	5	30
NMeFOSAA	25.6	19.08		ng/L		75	59 - 140	2	30
NMeFOSE	25.6	19.21		ng/L		75	55 - 144	3	30
NVHOS	25.6	18.03		ng/L		70	70 - 130	1	30
PEPA	25.6	21.56		ng/L		84	70 - 130	1	30
Perfluoro (2-ethoxyethane) sulfonic acid	22.8	17.27		ng/L		76	70 - 130	1	30
Perfluoro-4-ethylcyclohexanesulfonic acid	23.6	18.45		ng/L		78	70 - 130	5	30
Perfluorobutanesulfonic acid	22.7	17.99		ng/L		79	53 - 138	9	30
Perfluorobutanoic acid	25.6	19.08		ng/L		75	59 - 136	2	30
Perfluorodecanesulfonic acid	24.7	17.85		ng/L		72	55 - 137	0	30
Perfluorodecanoic acid	25.6	20.00		ng/L		78	56 - 138	5	30
Perfluorododecanesulfonic acid	24.8	18.98		ng/L		77	48 - 138	5	30
Perfluorododecanoic acid	25.6	19.48		ng/L		76	59 - 143	2	30
Perfluoroheptanesulfonic acid	24.4	18.00		ng/L		74	56 - 140	1	30
Perfluoroheptanoic acid	25.6	20.54		ng/L		80	59 - 145	4	30
Perfluorohexadecanoic acid	25.6	21.29		ng/L		83	41 - 158	1	30
Perfluorohexanesulfonic acid	23.3	17.96		ng/L		77	58 - 134	3	30
Perfluorohexanoic acid	25.6	20.84		ng/L		81	58 - 139	4	30
Perfluorononanesulfonic acid	24.6	18.32		ng/L		75	59 - 136	3	30
Perfluorononanoic acid	25.6	20.39		ng/L		80	61 - 139	4	30
Perfluorooctadecanoic acid	25.6	22.47		ng/L		88	29 - 172	6	30
Perfluorooctanesulfonamide	25.6	19.92		ng/L		78	43 - 167	1	30
Perfluorooctanesulfonic acid	23.7	19.51		ng/L		82	45 - 150	2	30
Perfluorooctanoic acid	25.6	21.75		ng/L		85	51 - 145	4	30
Perfluoropentanesulfonic acid	24.0	18.01		ng/L		75	55 - 140	2	30
Perfluoropentanoic acid	25.6	14.63		ng/L		57	57 - 141	30	30
Perfluoropropanesulfonic acid	23.4	20.37		ng/L		87	70 - 130	3	30
Perfluorotetradecanoic acid	25.6	20.24		ng/L		79	62 - 139	0	30
Perfluorotridecanoic acid	25.6	20.58		ng/L		80	58 - 146	5	30
Perfluoroundecanoic acid	25.6	21.71		ng/L		85	60 - 141	5	30
PFECA A	25.6	20.10		ng/L		79	70 - 130	3	30
PFECA B	25.6	21.80		ng/L		85	70 - 130	6	30
PFECA F	25.6	23.82		ng/L		93	70 - 130	1	30
PFECA G	25.6	19.31		ng/L		75	70 - 130	0	30
PFMOAA	25.6	17.62	*-	ng/L		69	70 - 130	1	30
PFO2HxA	25.6	22.24		ng/L		87	70 - 130	5	30
PFO3OA	25.6	21.60		ng/L		84	70 - 130	5	30
PFO4DA	25.6	21.85		ng/L		85	70 - 130	0	30
PMPA	25.6	19.12		ng/L		75	70 - 130	5	30
PPF Acid	25.6	24.15		ng/L		94	70 - 130	1	30
PS Acid	25.6	<3.00	*-	ng/L		9	70 - 130	7	30

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCSD 410-240479/4-A

Matrix: Water

Analysis Batch: 251038

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240479

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
R-EVE	25.6	21.31		ng/L		83	70 - 130	8	30
R-PSDA	25.6	15.61	*-	ng/L		61	70 - 130	11	30
R-PSDCA	25.6	17.21	*-	ng/L		67	70 - 130	4	30
TAF	25.6	21.26		ng/L		83	70 - 130	1	30

Isotope Dilution	LCSD %Recovery	LCSD Qualifier	Limits
13C3 HFPO-DA	112		17 - 185
13C3 PFBS	125		16 - 200
13C3 PFHxS	120		28 - 188
13C5 PFHxA	112		24 - 179
13C2-PFDoDA	121		17 - 176
13C6 PFDA	125		49 - 163
13C7 PFUnA	121		34 - 174
13C2-2-Perfluorohexylethanoic acid	82		10 - 200
13C2-2-Perfluorooctylethanoic acid	112		10 - 200
13C2-2-Perfluorodecylethanoic acid	102		10 - 200
13C2-2H-Perfluoro-2-octenoic acid	134		20 - 173
13C9 PFNA	117		51 - 167
13C2-2H-Perfluoro-2-decenoic acid	143		21 - 166
d3-NMeFOSAA	135		31 - 174
13C2-2H-Perfluoro-2-dodecenoic acid	136		14 - 166
d3-NMePFOSA	96		10 - 155
13C4 PFBA	111		42 - 165
d5-NEtFOSAA	131		29 - 195
13C5 PFPeA	105		38 - 187
d5-NEtPFOSA	98		10 - 159
13C4 PFHpA	114		31 - 182
d7-N-MeFOSE-M	103		10 - 178
13C8 PFOA	116		48 - 162
d9-N-EtFOSE-M	108		10 - 177
13C8 PFOS	122		51 - 159
M2-4:2 FTS	110		10 - 200
13C8 FOSA	109		10 - 168
M2-6:2 FTS	115		17 - 200
13C2 PFTeDA	118		10 - 179
M2-8:2 FTS	128		33 - 200

Lab Sample ID: MB 410-240631/1-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240631

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
10:2 FTS	<0.120		0.400	0.120	ng/g		04/04/22 11:19	04/06/22 11:45	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: MB 410-240631/1-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240631

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTUCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
11Cl-PF3OUdS	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
3:3 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
4:2 Fluorotelomer sulfonic acid	<0.120		0.400	0.120	ng/g		04/04/22 11:19	04/06/22 11:45	1
5:3 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
6:2 Fluorotelomer sulfonic acid	<0.120		0.400	0.120	ng/g		04/04/22 11:19	04/06/22 11:45	1
6:2 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
6:2 FTUCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
7:3 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
8:2 Fluorotelomer sulfonic acid	<0.120		0.600	0.120	ng/g		04/04/22 11:19	04/06/22 11:45	1
8:2 FTCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
8:2 FTUCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
9Cl-PF3ONS	<0.0400		0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
DONA	<0.0400		0.600	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
EVE Acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
HFPODA	<0.0800		0.400	0.0800	ng/g		04/04/22 11:19	04/06/22 11:45	1
Hydro-EVE Acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Hydrolyzed PSDA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Hydro-PS Acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
MTP	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
NEtFOSA	<0.100		0.400	0.100	ng/g		04/04/22 11:19	04/06/22 11:45	1
NEtFOSAA	<0.0400		0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
NEtFOSE	<0.100		0.400	0.100	ng/g		04/04/22 11:19	04/06/22 11:45	1
NMeFOSA	<0.100		0.400	0.100	ng/g		04/04/22 11:19	04/06/22 11:45	1
NMeFOSAA	<0.0400		0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
NMeFOSE	<0.100		0.400	0.100	ng/g		04/04/22 11:19	04/06/22 11:45	1
NVHOS	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PEPA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorobutanesulfonic acid	<0.0800		0.400	0.0800	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorobutanoic acid	<0.160		0.400	0.160	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorodecanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorodecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorododecanesulfonic acid	<0.0400		0.400	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorododecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoroheptanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoroheptanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorohexadecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorohexanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorohexanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorononanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorononanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorooctadecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorooctanesulfonamide	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorooctanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorooctanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: MB 410-240631/1-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240631

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluoropentanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoropentanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoropropanesulfonic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorotetradecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluorotridecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
Perfluoroundecanoic acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFECA A	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFECA B	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFECA F	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFECA G	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFMOAA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFO2HxA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFO3OA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PFO4DA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PMPA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PPF Acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
PS Acid	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
R-EVE	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
R-PSDA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
R-PSDCA	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1
TAF	<0.0400		0.120	0.0400	ng/g		04/04/22 11:19	04/06/22 11:45	1

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	129		10 - 169	04/04/22 11:19	04/06/22 11:45	1
13C3 PFBS	152		27 - 179	04/04/22 11:19	04/06/22 11:45	1
13C3 PFHxS	154		24 - 171	04/04/22 11:19	04/06/22 11:45	1
13C5 PFHxA	139		10 - 174	04/04/22 11:19	04/06/22 11:45	1
13C2-PFDoDA	134		11 - 166	04/04/22 11:19	04/06/22 11:45	1
13C6 PFDA	152		26 - 161	04/04/22 11:19	04/06/22 11:45	1
13C7 PFUnA	147		12 - 173	04/04/22 11:19	04/06/22 11:45	1
13C2-2-Perfluorohexylethanoic acid	244	*5+	10 - 200	04/04/22 11:19	04/06/22 11:45	1
13C2-2-Perfluorooctylethanoic acid	218	*5+	10 - 200	04/04/22 11:19	04/06/22 11:45	1
13C2-2-Perfluorodecylethanoic acid	208	*5+	10 - 200	04/04/22 11:19	04/06/22 11:45	1
13C2-2H-Perfluoro-2-octenoic acid	119		10 - 164	04/04/22 11:19	04/06/22 11:45	1
13C9 PFNA	148		26 - 165	04/04/22 11:19	04/06/22 11:45	1
13C2-2H-Perfluoro-2-decenoic acid	116		10 - 162	04/04/22 11:19	04/06/22 11:45	1
d3-NMeFOSAA	132		10 - 178	04/04/22 11:19	04/06/22 11:45	1
13C2-2H-Perfluoro-2-dodecenoic acid	102		10 - 161	04/04/22 11:19	04/06/22 11:45	1
d3-NMePFOSA	131		10 - 175	04/04/22 11:19	04/06/22 11:45	1
13C4 PFBA	147		28 - 153	04/04/22 11:19	04/06/22 11:45	1
d5-NEtFOSAA	154		10 - 193	04/04/22 11:19	04/06/22 11:45	1
13C5 PFPeA	146		24 - 161	04/04/22 11:19	04/06/22 11:45	1
d5-NEtPFOSA	141		10 - 180	04/04/22 11:19	04/06/22 11:45	1
13C4 PFHpA	152		10 - 178	04/04/22 11:19	04/06/22 11:45	1
d7-N-MeFOSE-M	133		10 - 179	04/04/22 11:19	04/06/22 11:45	1
13C8 PFOA	150		26 - 159	04/04/22 11:19	04/06/22 11:45	1
d9-N-EtFOSE-M	129		10 - 185	04/04/22 11:19	04/06/22 11:45	1
13C8 PFOS	148		41 - 154	04/04/22 11:19	04/06/22 11:45	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: MB 410-240631/1-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 240631

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-4:2 FTS	160		10 - 200	04/04/22 11:19	04/06/22 11:45	1
13C8 FOSA	150		14 - 163	04/04/22 11:19	04/06/22 11:45	1
M2-6:2 FTS	161		10 - 200	04/04/22 11:19	04/06/22 11:45	1
13C2 PFTeDA	125		10 - 169	04/04/22 11:19	04/06/22 11:45	1
M2-8:2 FTS	155		15 - 200	04/04/22 11:19	04/06/22 11:45	1

Lab Sample ID: LCS 410-240631/2-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240631

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
10:2 FTCA	5.00	4.032		ng/g		81	70 - 130
10:2 FTS	4.82	3.815		ng/g		79	46 - 143
10:2 FTUCA	5.00	4.082		ng/g		82	70 - 130
11Cl-PF3OUdS	4.65	3.767		ng/g		81	55 - 135
3:3 FTCA	5.00	3.749		ng/g		75	70 - 130
4:2 Fluorotelomer sulfonic acid	4.67	3.136		ng/g		67	58 - 131
5:3 FTCA	5.00	3.959		ng/g		79	70 - 130
6:2 Fluorotelomer sulfonic acid	4.74	3.262		ng/g		69	59 - 135
6:2 FTCA	5.00	4.368		ng/g		87	70 - 130
6:2 FTUCA	5.00	3.966		ng/g		79	70 - 130
7:3 FTCA	5.00	2.692	*-	ng/g		54	70 - 130
8:2 Fluorotelomer sulfonic acid	4.79	4.141		ng/g		86	55 - 133
8:2 FTCA	5.00	4.160		ng/g		83	70 - 130
8:2 FTUCA	5.00	3.641		ng/g		73	70 - 130
9Cl-PF3ONS	4.65	4.004		ng/g		86	62 - 130
DONA	4.73	3.756		ng/g		79	57 - 137
EVE Acid	5.00	0.2785	*-	ng/g		6	70 - 130
HFPODA	5.00	4.392		ng/g		88	49 - 135
Hydro-EVE Acid	5.00	3.972		ng/g		79	70 - 130
Hydrolyzed PSDA	5.00	3.430	*-	ng/g		69	70 - 130
Hydro-PS Acid	5.00	3.694		ng/g		74	70 - 130
MTP	5.00	2.987	*-	ng/g		60	70 - 130
NEtFOSA	5.00	3.782		ng/g		76	60 - 123
NEtFOSAA	5.00	3.389		ng/g		68	57 - 127
NEtFOSE	5.00	4.146		ng/g		83	60 - 126
NMeFOSA	5.00	4.005		ng/g		80	60 - 129
NMeFOSAA	5.00	3.471		ng/g		69	60 - 134
NMeFOSE	5.00	3.931		ng/g		79	60 - 130
NVHOS	5.00	3.590		ng/g		72	70 - 130
PEPA	5.00	4.333		ng/g		87	70 - 130
Perfluoro (2-ethoxyethane) sulfonic acid	4.45	3.163		ng/g		71	70 - 130
Perfluoro-4-ethylcyclohexanesul fonic acid	4.61	3.710		ng/g		80	70 - 130
Perfluorobutanesulfonic acid	4.43	3.388		ng/g		77	54 - 130
Perfluorobutanoic acid	5.00	3.974		ng/g		79	60 - 128
Perfluorodecanesulfonic acid	4.82	3.468		ng/g		72	57 - 132
Perfluorodecanoic acid	5.00	3.670		ng/g		73	56 - 133

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCS 410-240631/2-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240631

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Perfluorododecanesulfonic acid	4.84	3.836		ng/g		79	38 - 145
Perfluorododecanoic acid	5.00	3.838		ng/g		77	60 - 135
Perfluoroheptanesulfonic acid	4.76	3.666		ng/g		77	59 - 132
Perfluoroheptanoic acid	5.00	3.828		ng/g		77	59 - 137
Perfluorohexadecanoic acid	5.00	3.775		ng/g		76	38 - 147
Perfluorohexanesulfonic acid	4.56	3.601		ng/g		79	59 - 129
Perfluorohexanoic acid	5.00	3.985		ng/g		80	59 - 132
Perfluorononanesulfonic acid	4.80	3.601		ng/g		75	60 - 132
Perfluorononanoic acid	5.00	3.539		ng/g		71	61 - 134
Perfluorooctadecanoic acid	5.00	3.261		ng/g		65	16 - 160
Perfluorooctanesulfonamide	5.00	3.695		ng/g		74	47 - 149
Perfluorooctanesulfonic acid	4.63	3.586		ng/g		78	61 - 126
Perfluorooctanoic acid	5.00	3.532		ng/g		71	59 - 131
Perfluoropentanesulfonic acid	4.69	3.323		ng/g		71	57 - 133
Perfluoropentanoic acid	5.00	3.370		ng/g		67	58 - 134
Perfluoropropanesulfonic acid	4.58	3.903		ng/g		85	70 - 130
Perfluorotetradecanoic acid	5.00	3.888		ng/g		78	62 - 134
Perfluorotridecanoic acid	5.00	3.894		ng/g		78	53 - 143
Perfluoroundecanoic acid	5.00	3.923		ng/g		78	60 - 134
PFECA A	5.00	3.706		ng/g		74	70 - 130
PFECA B	5.00	3.796		ng/g		76	70 - 130
PFECA F	5.00	4.552		ng/g		91	70 - 130
PFECA G	5.00	3.336	*-	ng/g		67	70 - 130
PFMOAA	5.00	2.695	*-	ng/g		54	70 - 130
PFO2HxA	5.00	3.877		ng/g		78	70 - 130
PFO3OA	5.00	3.347	*-	ng/g		67	70 - 130
PFO4DA	5.00	3.611		ng/g		72	70 - 130
PMPA	5.00	3.552		ng/g		71	70 - 130
PPF Acid	5.00	3.466	*-	ng/g		69	70 - 130
PS Acid	5.00	0.2898	*-	ng/g		6	70 - 130
R-EVE	5.00	2.675	*-	ng/g		54	70 - 130
R-PSDA	5.00	2.523	*-	ng/g		50	70 - 130
R-PSDCA	5.00	2.871	*-	ng/g		57	70 - 130
TAF	5.00	3.531		ng/g		71	70 - 130

Isotope Dilution	LCS LCS		Limits
	%Recovery	Qualifier	
13C3 HFPO-DA	137		10 - 169
13C3 PFBS	160		27 - 179
13C3 PFHxS	154		24 - 171
13C5 PFHxA	148		10 - 174
13C2-PFDoDA	139		11 - 166
13C6 PFDA	155		26 - 161
13C7 PFUnA	150		12 - 173
13C2-2-Perfluorohexylethanoic acid	232	*5+	10 - 200
13C2-2-Perfluorooctylethanoic acid	237	*5+	10 - 200
13C2-2-Perfluorodecylethanoic acid	218	*5+	10 - 200

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCS 410-240631/2-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 240631

Isotope Dilution	LCS LCS		Limits
	%Recovery	Qualifier	
13C2-2H-Perfluoro-2-octenoic acid	121		10 - 164
13C9 PFNA	154		26 - 165
13C2-2H-Perfluoro-2-decenoic acid	126		10 - 162
d3-NMeFOSAA	150		10 - 178
13C2-2H-Perfluoro-2-dodecenoic acid	111		10 - 161
d3-NMePFOSA	137		10 - 175
13C4 PFBA	147		28 - 153
d5-NEtFOSAA	155		10 - 193
13C5 PFPeA	152		24 - 161
d5-NEtPFOSA	146		10 - 180
13C4 PFHpA	153		10 - 178
d7-N-MeFOSE-M	144		10 - 179
13C8 PFOA	159		26 - 159
d9-N-EtFOSE-M	137		10 - 185
13C8 PFOS	146		41 - 154
M2-4:2 FTS	176		10 - 200
13C8 FOSA	155		14 - 163
M2-6:2 FTS	165		10 - 200
13C2 PFTeDA	137		10 - 169
M2-8:2 FTS	135		15 - 200

Lab Sample ID: LCSD 410-240631/3-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240631

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec		RPD	Limit
							Limits	RPD		
10:2 FTCA	5.00	3.638		ng/g		73	70 - 130	10		30
10:2 FTS	4.82	3.463		ng/g		72	46 - 143	10		30
10:2 FTUCA	5.00	3.829		ng/g		77	70 - 130	6		30
11Cl-PF3OUdS	4.65	3.549		ng/g		76	55 - 135	6		30
3:3 FTCA	5.00	3.921		ng/g		78	70 - 130	4		30
4:2 Fluorotelomer sulfonic acid	4.67	3.213		ng/g		69	58 - 131	2		30
5:3 FTCA	5.00	4.056		ng/g		81	70 - 130	2		30
6:2 Fluorotelomer sulfonic acid	4.74	3.294		ng/g		69	59 - 135	1		30
6:2 FTCA	5.00	4.024		ng/g		80	70 - 130	8		30
6:2 FTUCA	5.00	3.842		ng/g		77	70 - 130	3		30
7:3 FTCA	5.00	2.372	*-	ng/g		47	70 - 130	13		30
8:2 Fluorotelomer sulfonic acid	4.79	3.950		ng/g		82	55 - 133	5		30
8:2 FTCA	5.00	4.236		ng/g		85	70 - 130	2		30
8:2 FTUCA	5.00	3.907		ng/g		78	70 - 130	7		30
9Cl-PF3ONS	4.65	3.672		ng/g		79	62 - 130	9		30
DONA	4.73	3.851		ng/g		82	57 - 137	2		30
EVE Acid	5.00	0.2270	*-	ng/g		5	70 - 130	20		30
HFPODA	5.00	4.383		ng/g		88	49 - 135	0		30
Hydro-EVE Acid	5.00	3.806		ng/g		76	70 - 130	4		30
Hydrolyzed PSDA	5.00	3.363	*-	ng/g		67	70 - 130	2		30
Hydro-PS Acid	5.00	3.681		ng/g		74	70 - 130	0		30

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCSD 410-240631/3-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240631

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
MTP	5.00	3.095	*-	ng/g		62	70 - 130	4	30
NEtFOSA	5.00	3.766		ng/g		75	60 - 123	0	30
NEtFOSAA	5.00	3.458		ng/g		69	57 - 127	2	30
NEtFOSE	5.00	4.177		ng/g		84	60 - 126	1	30
NMeFOSA	5.00	4.008		ng/g		80	60 - 129	0	30
NMeFOSAA	5.00	3.840		ng/g		77	60 - 134	10	30
NMeFOSE	5.00	4.013		ng/g		80	60 - 130	2	30
NVHOS	5.00	3.659		ng/g		73	70 - 130	2	30
PEPA	5.00	4.336		ng/g		87	70 - 130	0	30
Perfluoro (2-ethoxyethane) sulfonic acid	4.45	3.206		ng/g		72	70 - 130	1	30
Perfluoro-4-ethylcyclohexanesulfonic acid	4.61	3.616		ng/g		78	70 - 130	3	30
Perfluorobutanesulfonic acid	4.43	3.454		ng/g		78	54 - 130	2	30
Perfluorobutanoic acid	5.00	3.997		ng/g		80	60 - 128	1	30
Perfluorodecanesulfonic acid	4.82	3.405		ng/g		71	57 - 132	2	30
Perfluorodecanoic acid	5.00	3.709		ng/g		74	56 - 133	1	30
Perfluorododecanesulfonic acid	4.84	3.795		ng/g		78	38 - 145	1	30
Perfluorododecanoic acid	5.00	3.865		ng/g		77	60 - 135	1	30
Perfluoroheptanesulfonic acid	4.76	3.564		ng/g		75	59 - 132	3	30
Perfluoroheptanoic acid	5.00	4.131		ng/g		83	59 - 137	8	30
Perfluorohexadecanoic acid	5.00	3.471		ng/g		69	38 - 147	8	30
Perfluorohexanesulfonic acid	4.56	3.737		ng/g		82	59 - 129	4	30
Perfluorohexanoic acid	5.00	3.930		ng/g		79	59 - 132	1	30
Perfluorononanesulfonic acid	4.80	3.560		ng/g		74	60 - 132	1	30
Perfluorononanoic acid	5.00	3.606		ng/g		72	61 - 134	2	30
Perfluorooctadecanoic acid	5.00	3.333		ng/g		67	16 - 160	2	30
Perfluorooctanesulfonamide	5.00	3.579		ng/g		72	47 - 149	3	30
Perfluorooctanesulfonic acid	4.63	3.550		ng/g		77	61 - 126	1	30
Perfluorooctanoic acid	5.00	3.681		ng/g		74	59 - 131	4	30
Perfluoropentanesulfonic acid	4.69	3.532		ng/g		75	57 - 133	6	30
Perfluoropentanoic acid	5.00	3.429		ng/g		69	58 - 134	2	30
Perfluoropropanesulfonic acid	4.58	3.728		ng/g		81	70 - 130	5	30
Perfluorotetradecanoic acid	5.00	3.783		ng/g		76	62 - 134	3	30
Perfluorotridecanoic acid	5.00	3.798		ng/g		76	53 - 143	2	30
Perfluoroundecanoic acid	5.00	3.680		ng/g		74	60 - 134	6	30
PFECA A	5.00	3.715		ng/g		74	70 - 130	0	30
PFECA B	5.00	3.855		ng/g		77	70 - 130	2	30
PFECA F	5.00	4.665		ng/g		93	70 - 130	2	30
PFECA G	5.00	3.291	*-	ng/g		66	70 - 130	1	30
PFMOAA	5.00	2.768	*-	ng/g		55	70 - 130	3	30
PFO2HxA	5.00	3.931		ng/g		79	70 - 130	1	30
PFO3OA	5.00	3.435	*-	ng/g		69	70 - 130	3	30
PFO4DA	5.00	3.600		ng/g		72	70 - 130	0	30
PMPA	5.00	3.590		ng/g		72	70 - 130	1	30
PPF Acid	5.00	3.394	*-	ng/g		68	70 - 130	2	30
PS Acid	5.00	0.2500	*-	ng/g		5	70 - 130	15	30
R-EVE	5.00	2.620	*-	ng/g		52	70 - 130	2	30
R-PSDA	5.00	2.479	*-	ng/g		50	70 - 130	2	30

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 IDA - EPA 537 Isotope Dilution (Continued)

Lab Sample ID: LCSD 410-240631/3-B

Matrix: Solid

Analysis Batch: 241603

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 240631

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
R-PSDCA	5.00	2.820	*	ng/g		56	70 - 130	2	30
TAF	5.00	3.552		ng/g		71	70 - 130	1	30

Isotope Dilution	LCSD %Recovery	LCSD Qualifier	Limits
13C3 HFPO-DA	139		10 - 169
13C3 PFBS	153		27 - 179
13C3 PFHxS	151		24 - 171
13C5 PFHxA	146		10 - 174
13C2-PFDoDA	133		11 - 166
13C6 PFDA	155		26 - 161
13C7 PFUnA	153		12 - 173
13C2-2-Perfluorohexylethanoic acid	258	*5+	10 - 200
13C2-2-Perfluorooctylethanoic acid	234	*5+	10 - 200
13C2-2-Perfluorodecylethanoic acid	226	*5+	10 - 200
13C2-2H-Perfluoro-2-octenoic acid	124		10 - 164
13C9 PFNA	147		26 - 165
13C2-2H-Perfluoro-2-decenoic acid	118		10 - 162
d3-NMeFOSAA	139		10 - 178
13C2-2H-Perfluoro-2-dodecenoic acid	113		10 - 161
d3-NMePFOSA	139		10 - 175
13C4 PFBA	143		28 - 153
d5-NEtFOSAA	153		10 - 193
13C5 PFPeA	151		24 - 161
d5-NEtPFOSA	148		10 - 180
13C4 PFHpA	150		10 - 178
d7-N-MeFOSE-M	143		10 - 179
13C8 PFOA	147		26 - 159
d9-N-EtFOSE-M	133		10 - 185
13C8 PFOS	145		41 - 154
M2-4:2 FTS	168		10 - 200
13C8 FOSA	153		14 - 163
M2-6:2 FTS	160		10 - 200
13C2 PFTeDA	130		10 - 169
M2-8:2 FTS	147		15 - 200

Method: 537 TOP - Fluorinated Alkyl Substances

Lab Sample ID: MB 410-253462/1-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 253462

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFHxA				05/10/22 10:06	05/12/22 12:07	1
13C4 PFOA				05/10/22 10:06	05/12/22 12:07	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: MB 410-253462/1-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 253462

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFUnA				05/10/22 10:06	05/12/22 12:07	1

Lab Sample ID: MB 410-253462/2-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 253462

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
10:2 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
10:2 FTS	<0.120		0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:18	1
10:2 FTUCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
11Cl-PF3OUdS	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
3:3 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
4:2 Fluorotelomer sulfonic acid	<0.120		0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:18	1
5:3 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
6:2 Fluorotelomer sulfonic acid	0.1366	J	0.400	0.120	ng/g		05/10/22 10:06	05/12/22 12:18	1
6:2 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
6:2 FTUCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
7:3 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
8:2 Fluorotelomer sulfonic acid	<0.120		0.600	0.120	ng/g		05/10/22 10:06	05/12/22 12:18	1
8:2 FTCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
8:2 FTUCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
9Cl-PF3ONS	<0.0400		0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
DONA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
EVE Acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
HFPODA	<0.200		0.600	0.200	ng/g		05/10/22 10:06	05/12/22 12:18	1
Hydro-EVE Acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Hydrolyzed PSDA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Hydro-PS Acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
MTP	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
NEtFOSA	<0.100		0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:18	1
NEtFOSAA	<0.0400		0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
NEtFOSE	<0.100		0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:18	1
NMeFOSA	<0.100		0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:18	1
NMeFOSAA	<0.0400		0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
NMeFOSE	<0.100		0.400	0.100	ng/g		05/10/22 10:06	05/12/22 12:18	1
NVHOS	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PEPA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoro (2-ethoxyethane) sulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoro-4-ethylcyclohexanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorobutanesulfonic acid	<0.0800		0.400	0.0800	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorobutanoic acid	<0.160		0.400	0.160	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorodecanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorodecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorododecanesulfonic acid	<0.0400		0.400	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorododecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoroheptanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoroheptanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: MB 410-253462/2-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 253462

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorohexadecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorohexanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorohexanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorononanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorononanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorooctadecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorooctanesulfonamide	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorooctanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorooctanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoropentanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoropentanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoropropanesulfonic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorotetradecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluorotridecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
Perfluoroundecanoic acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFECA A	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFECA B	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFECA F	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFECA G	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFMOAA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFO2HxA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFO3OA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PFO4DA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PMPA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PPF Acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
PS Acid	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
R-EVE	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
R-PSDA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
R-PSDCA	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1
TAF	<0.0400		0.120	0.0400	ng/g		05/10/22 10:06	05/12/22 12:18	1

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
M2-6:2 FTS	347	*5+	10 - 200	05/10/22 10:06	05/12/22 12:18	1
M2-8:2 FTS	236	*5+	15 - 200	05/10/22 10:06	05/12/22 12:18	1
13C2 PFTeDA	101		10 - 169	05/10/22 10:06	05/12/22 12:18	1
13C3 HFPO-DA	130		10 - 169	05/10/22 10:06	05/12/22 12:18	1
13C3 PFBS	139		27 - 179	05/10/22 10:06	05/12/22 12:18	1
13C4 PFBA	120		28 - 153	05/10/22 10:06	05/12/22 12:18	1
13C4 PFHpA	100		10 - 178	05/10/22 10:06	05/12/22 12:18	1
13C5 PFPeA	122		24 - 161	05/10/22 10:06	05/12/22 12:18	1
13C8 PFOA	122		26 - 159	05/10/22 10:06	05/12/22 12:18	1
13C8 PFOS	152		41 - 154	05/10/22 10:06	05/12/22 12:18	1
d5-NEtFOSAA	147		10 - 193	05/10/22 10:06	05/12/22 12:18	1
d7-N-MeFOSE-M	98		10 - 179	05/10/22 10:06	05/12/22 12:18	1
d9-N-EtFOSE-M	89		10 - 185	05/10/22 10:06	05/12/22 12:18	1
13C3 PFHxS	135		24 - 171	05/10/22 10:06	05/12/22 12:18	1
13C5 PFHxA	110		10 - 174	05/10/22 10:06	05/12/22 12:18	1
13C6 PFDA	129		26 - 161	05/10/22 10:06	05/12/22 12:18	1
13C7 PFUnA	113		12 - 173	05/10/22 10:06	05/12/22 12:18	1

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: MB 410-253462/2-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 253462

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
d3-NMePFOSA	77		10 - 175	05/10/22 10:06	05/12/22 12:18	1
d5-NEtPFOSA	72		10 - 180	05/10/22 10:06	05/12/22 12:18	1
13C8 FOSA	100		14 - 163	05/10/22 10:06	05/12/22 12:18	1
13C2-PFDoDA	123		11 - 166	05/10/22 10:06	05/12/22 12:18	1
13C9 PFNA	134		26 - 165	05/10/22 10:06	05/12/22 12:18	1
13C2-2-Perfluorohexylethanoic acid	66		50 - 150	05/10/22 10:06	05/12/22 12:18	1
13C2-2-Perfluorooctylethanoic acid	90		50 - 150	05/10/22 10:06	05/12/22 12:18	1
13C2-2-Perfluorodecylethanoic acid	80		50 - 150	05/10/22 10:06	05/12/22 12:18	1
13C2-2H-Perfluoro-2-octenoic acid	113		50 - 150	05/10/22 10:06	05/12/22 12:18	1
13C2-2H-Perfluoro-2-decenoic acid	161	*5+	50 - 150	05/10/22 10:06	05/12/22 12:18	1
13C2-2H-Perfluoro-2-dodecenoic acid	170	*5+	50 - 150	05/10/22 10:06	05/12/22 12:18	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFHxA	101		10 - 137	05/10/22 10:06	05/12/22 12:18	1
13C4 PFOA	128		10 - 146	05/10/22 10:06	05/12/22 12:18	1
13C2 PFUnA	111		10 - 143	05/10/22 10:06	05/12/22 12:18	1

Lab Sample ID: LCS 410-253462/3-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 253462

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
10:2 FTCA	10.0	15.01	*+	ng/g		150	70 - 130
10:2 FTS	9.64	9.544		ng/g		99	46 - 143
10:2 FTUCA	10.0	5.156	*-	ng/g		52	70 - 130
11Cl-PF3OUdS	9.30	7.140		ng/g		77	55 - 135
3:3 FTCA	10.0	9.301		ng/g		93	70 - 130
4:2 Fluorotelomer sulfonic acid	9.34	5.937		ng/g		64	58 - 131
5:3 FTCA	10.0	7.645		ng/g		76	70 - 130
6:2 Fluorotelomer sulfonic acid	9.48	8.032	I	ng/g		85	59 - 135
6:2 FTCA	10.0	15.15	*+	ng/g		152	70 - 130
6:2 FTUCA	10.0	6.489	*-	ng/g		65	70 - 130
7:3 FTCA	10.0	10.91		ng/g		109	70 - 130
8:2 Fluorotelomer sulfonic acid	9.58	7.579		ng/g		79	55 - 133
8:2 FTCA	10.0	15.10	*+	ng/g		151	70 - 130
8:2 FTUCA	10.0	5.904	*-	ng/g		59	70 - 130
9Cl-PF3ONS	9.30	7.672		ng/g		82	62 - 130
DONA	9.45	5.776		ng/g		61	57 - 137
EVE Acid	10.0	10.86		ng/g		109	70 - 130
HFPODA	10.0	8.060		ng/g		81	49 - 135
Hydro-EVE Acid	10.0	13.06	*+	ng/g		131	70 - 130
Hydrolyzed PSDA	10.0	6.717	*-	ng/g		67	70 - 130
Hydro-PS Acid	10.0	8.772		ng/g		88	70 - 130
MTP	10.0	13.00		ng/g		130	70 - 130
NEtFOSA	10.0	8.087		ng/g		81	60 - 123
NEtFOSAA	10.0	7.654		ng/g		77	57 - 127
NEtFOSE	10.0	7.925		ng/g		79	60 - 126
NMeFOSA	10.0	9.111		ng/g		91	60 - 129

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCS 410-253462/3-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 253462

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
NMeFOSAA	10.0	7.897		ng/g		79	60 - 134
NMeFOSE	10.0	8.663		ng/g		87	60 - 130
NVHOS	10.0	9.059		ng/g		91	70 - 130
PEPA	10.0	13.58	*+	ng/g		136	70 - 130
Perfluoro (2-ethoxyethane) sulfonic acid	8.90	8.566		ng/g		96	70 - 130
Perfluoro-4-ethylcyclohexanesulfonic acid	9.22	7.650		ng/g		83	70 - 130
Perfluorobutanesulfonic acid	8.85	8.515		ng/g		96	54 - 130
Perfluorobutanoic acid	10.0	10.17		ng/g		102	60 - 128
Perfluorodecanesulfonic acid	9.64	7.421		ng/g		77	57 - 132
Perfluorodecanoic acid	10.0	10.11		ng/g		101	56 - 133
Perfluorododecanesulfonic acid	9.68	7.025		ng/g		73	38 - 145
Perfluorododecanoic acid	10.0	10.03		ng/g		100	60 - 135
Perfluoroheptanesulfonic acid	9.52	8.841		ng/g		93	59 - 132
Perfluoroheptanoic acid	10.0	8.063		ng/g		81	59 - 137
Perfluorohexadecanoic acid	10.0	11.37		ng/g		114	38 - 147
Perfluorohexanesulfonic acid	9.12	7.780		ng/g		85	59 - 129
Perfluorohexanoic acid	10.0	10.00		ng/g		100	59 - 132
Perfluorononanesulfonic acid	9.60	7.595		ng/g		79	60 - 132
Perfluorononanoic acid	10.0	9.804		ng/g		98	61 - 134
Perfluorooctadecanoic acid	10.0	8.622		ng/g		86	16 - 160
Perfluorooctanesulfonamide	10.0	8.481		ng/g		85	47 - 149
Perfluorooctanesulfonic acid	9.26	7.131		ng/g		77	61 - 126
Perfluorooctanoic acid	10.0	10.61		ng/g		106	59 - 131
Perfluoropentanesulfonic acid	9.38	9.043		ng/g		96	57 - 133
Perfluoropentanoic acid	10.0	9.226		ng/g		92	58 - 134
Perfluoropropanesulfonic acid	9.16	14.90	*+	ng/g		163	70 - 130
Perfluorotetradecanoic acid	10.0	9.796		ng/g		98	62 - 134
Perfluorotridecanoic acid	10.0	8.489		ng/g		85	53 - 143
Perfluoroundecanoic acid	10.0	11.62		ng/g		116	60 - 134
PFECA A	10.0	7.758		ng/g		78	70 - 130
PFECA B	10.0	6.389	*-	ng/g		64	70 - 130
PFECA F	10.0	13.42	*+	ng/g		134	70 - 130
PFECA G	10.0	11.06		ng/g		111	70 - 130
PFMOAA	10.0	14.27	*+	ng/g		143	70 - 130
PFO2HxA	10.0	15.15	*+	ng/g		152	70 - 130
PFO3OA	10.0	13.22	*+	ng/g		132	70 - 130
PFO4DA	10.0	16.24	*+	ng/g		162	70 - 130
PMPA	10.0	14.70	*+	ng/g		147	70 - 130
PPF Acid	10.0	13.46	*+	ng/g		135	70 - 130
PS Acid	10.0	5.698	*-	ng/g		57	70 - 130
R-EVE	10.0	7.937		ng/g		79	70 - 130
R-PSDA	10.0	5.532	*-	ng/g		55	70 - 130
R-PSDCA	10.0	8.890		ng/g		89	70 - 130
TAF	10.0	15.71	*+	ng/g		157	70 - 130

Isotope Dilution	LCS %Recovery	LCS Qualifier	Limits
M2-6:2 FTS	211	*5+	10 - 200

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCS 410-253462/3-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 253462

Isotope Dilution	LCS LCS		Limits
	%Recovery	Qualifier	
M2-8:2 FTS	167		15 - 200
13C2 PFTeDA	86		10 - 169
13C3 HFPO-DA	107		10 - 169
13C3 PFBS	166		27 - 179
13C4 PFBA	99		28 - 153
13C4 PFHpA	103		10 - 178
13C5 PFPeA	136		24 - 161
13C8 PFOA	105		26 - 159
13C8 PFOS	117		41 - 154
d5-NEtFOSAA	109		10 - 193
d7-N-MeFOSE-M	81		10 - 179
d9-N-EtFOSE-M	79		10 - 185
13C3 PFHxS	114		24 - 171
13C5 PFHxA	90		10 - 174
13C6 PFDA	104		26 - 161
13C7 PFUnA	87		12 - 173
d3-NMePFOSA	79		10 - 175
d5-NEtPFOSA	70		10 - 180
13C8 FOSA	79		14 - 163
13C2-PFDoDA	95		11 - 166
13C9 PFNA	99		26 - 165
13C2-2-Perfluorohexylethanoic acid	72		50 - 150
13C2-2-Perfluorooctylethanoic acid	57		50 - 150
13C2-2-Perfluorodecylethanoic acid	63		50 - 150
13C2-2H-Perfluoro-2-octenoic acid	116		50 - 150
13C2-2H-Perfluoro-2-decenoic acid	96		50 - 150
13C2-2H-Perfluoro-2-dodecenoic acid	118		50 - 150

Surrogate	LCS LCS		Limits
	%Recovery	Qualifier	
13C2 PFHxA	86		10 - 137
13C4 PFOA	120		10 - 146
13C2 PFUnA	95		10 - 143

Lab Sample ID: LCSD 410-253462/4-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 253462

Analyte	Spike Added	LCSD LCSD		Unit	D	%Rec	%Rec		RPD	Limit
		Result	Qualifier				Limits			
10:2 FTCA	10.0	16.87	*+	ng/g		169	70 - 130	12		30
10:2 FTS	9.64	10.17		ng/g		105	46 - 143	6		30
10:2 FTUCA	10.0	5.480	*-	ng/g		55	70 - 130	6		30
11Cl-PF3OUdS	9.30	7.470		ng/g		80	55 - 135	5		30
3:3 FTCA	10.0	9.508		ng/g		95	70 - 130	2		30
4:2 Fluorotelomer sulfonic acid	9.34	7.425		ng/g		79	58 - 131	22		30

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 410-253462/4-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 253462

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
5:3 FTCA	10.0	7.768		ng/g		78	70 - 130	2	30
6:2 Fluorotelomer sulfonic acid	9.48	8.488	I	ng/g		90	59 - 135	6	30
6:2 FTCA	10.0	13.97	*+	ng/g		140	70 - 130	8	30
6:2 FTUCA	10.0	6.303	*-	ng/g		63	70 - 130	3	30
7:3 FTCA	10.0	9.743		ng/g		97	70 - 130	11	30
8:2 Fluorotelomer sulfonic acid	9.58	8.239		ng/g		86	55 - 133	8	30
8:2 FTCA	10.0	14.69	*+	ng/g		147	70 - 130	3	30
8:2 FTUCA	10.0	6.229	*-	ng/g		62	70 - 130	5	30
9CI-PF3ONS	9.30	7.640		ng/g		82	62 - 130	0	30
DONA	9.45	5.386		ng/g		57	57 - 137	7	30
EVE Acid	10.0	14.12	*+	ng/g		141	70 - 130	26	30
HFPODA	10.0	8.845		ng/g		88	49 - 135	9	30
Hydro-EVE Acid	10.0	12.94		ng/g		129	70 - 130	1	30
Hydrolyzed PSDA	10.0	6.384	*-	ng/g		64	70 - 130	5	30
Hydro-PS Acid	10.0	8.841		ng/g		88	70 - 130	1	30
MTP	10.0	13.30	*+	ng/g		133	70 - 130	2	30
NEtFOSA	10.0	7.704		ng/g		77	60 - 123	5	30
NEtFOSAA	10.0	8.283	E	ng/g		83	57 - 127	8	30
NEtFOSE	10.0	7.731		ng/g		77	60 - 126	2	30
NMeFOSA	10.0	9.454		ng/g		95	60 - 129	4	30
NMeFOSAA	10.0	8.254	E	ng/g		83	60 - 134	4	30
NMeFOSE	10.0	9.294		ng/g		93	60 - 130	7	30
NVHOS	10.0	9.239		ng/g		92	70 - 130	2	30
PEPA	10.0	13.65	*+	ng/g		137	70 - 130	1	30
Perfluoro (2-ethoxyethane) sulfonic acid	8.90	8.762		ng/g		98	70 - 130	2	30
Perfluoro-4-ethylcyclohexanesulfonic acid	9.22	8.382		ng/g		91	70 - 130	9	30
Perfluorobutanesulfonic acid	8.85	8.411		ng/g		95	54 - 130	1	30
Perfluorobutanoic acid	10.0	10.43		ng/g		104	60 - 128	3	30
Perfluorodecanesulfonic acid	9.64	7.418		ng/g		77	57 - 132	0	30
Perfluorodecanoic acid	10.0	9.594		ng/g		96	56 - 133	5	30
Perfluorododecanesulfonic acid	9.68	7.530		ng/g		78	38 - 145	7	30
Perfluorododecanoic acid	10.0	9.921		ng/g		99	60 - 135	1	30
Perfluoroheptanesulfonic acid	9.52	9.169		ng/g		96	59 - 132	4	30
Perfluoroheptanoic acid	10.0	8.460		ng/g		85	59 - 137	5	30
Perfluorohexadecanoic acid	10.0	11.32		ng/g		113	38 - 147	0	30
Perfluorohexanesulfonic acid	9.12	7.925		ng/g		87	59 - 129	2	30
Perfluorohexanoic acid	10.0	9.946		ng/g		99	59 - 132	1	30
Perfluorononanesulfonic acid	9.60	8.222		ng/g		86	60 - 132	8	30
Perfluorononanoic acid	10.0	10.35		ng/g		104	61 - 134	5	30
Perfluorooctadecanoic acid	10.0	9.282		ng/g		93	16 - 160	7	30
Perfluorooctanesulfonamide	10.0	8.166		ng/g		82	47 - 149	4	30
Perfluorooctanesulfonic acid	9.26	7.469		ng/g		81	61 - 126	5	30
Perfluorooctanoic acid	10.0	10.79		ng/g		108	59 - 131	2	30
Perfluoropentanesulfonic acid	9.38	9.020		ng/g		96	57 - 133	0	30
Perfluoropentanoic acid	10.0	9.793		ng/g		98	58 - 134	6	30
Perfluoropropanesulfonic acid	9.16	15.38	*+	ng/g		168	70 - 130	3	30
Perfluorotetradecanoic acid	10.0	10.02		ng/g		100	62 - 134	2	30

Eurofins Lancaster Laboratories Environment Testing, LLC

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 410-253462/4-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 253462

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Perfluorotridecanoic acid	10.0	9.078		ng/g		91	53 - 143	7	30
Perfluoroundecanoic acid	10.0	11.08		ng/g		111	60 - 134	5	30
PFECA A	10.0	8.062		ng/g		81	70 - 130	4	30
PFECA B	10.0	6.949	*-	ng/g		69	70 - 130	8	30
PFECA F	10.0	13.90	*+	ng/g		139	70 - 130	3	30
PFECA G	10.0	10.32		ng/g		103	70 - 130	7	30
PFMOAA	10.0	15.01	*+	ng/g		150	70 - 130	5	30
PFO2HxA	10.0	15.62	*+	ng/g		156	70 - 130	3	30
PFO3OA	10.0	15.05	*+	ng/g		150	70 - 130	13	30
PFO4DA	10.0	17.34	*+	ng/g		173	70 - 130	7	30
PMPA	10.0	15.34	*+	ng/g		153	70 - 130	4	30
PPF Acid	10.0	14.36	*+	ng/g		144	70 - 130	6	30
PS Acid	10.0	6.849	*-	ng/g		68	70 - 130	18	30
R-EVE	10.0	8.480	E	ng/g		85	70 - 130	7	30
R-PSDA	10.0	5.838	*-	ng/g		58	70 - 130	5	30
R-PSDCA	10.0	8.997		ng/g		90	70 - 130	1	30
TAF	10.0	16.01	*+	ng/g		160	70 - 130	2	30

Isotope Dilution	LCSD %Recovery	LCSD Qualifier	LCSD Limits
M2-6:2 FTS	221	*5+	10 - 200
M2-8:2 FTS	176		15 - 200
13C2 PFTeDA	110		10 - 169
13C3 HFPO-DA	130		10 - 169
13C3 PFBS	205	*5+	27 - 179
13C4 PFBA	122		28 - 153
13C4 PFHpA	129		10 - 178
13C5 PFPeA	174	*5+	24 - 161
13C8 PFOA	131		26 - 159
13C8 PFOS	153		41 - 154
d5-NEtFOSAA	135		10 - 193
d7-N-MeFOSE-M	104		10 - 179
d9-N-EtFOSE-M	105		10 - 185
13C3 PFHxS	134		24 - 171
13C5 PFHxA	122		10 - 174
13C6 PFDA	140		26 - 161
13C7 PFUnA	114		12 - 173
d3-NMePFOSA	86		10 - 175
d5-NEtPFOSA	79		10 - 180
13C8 FOSA	111		14 - 163
13C2-PFDoDA	121		11 - 166
13C9 PFNA	137		26 - 165
13C2-2-Perfluorohexylethanoic acid	95		50 - 150
13C2-2-Perfluorooctylethanoic acid	82		50 - 150
13C2-2-Perfluorodecylethanoic acid	78		50 - 150
13C2-2H-Perfluoro-2-octenoic acid	148		50 - 150

QC Sample Results

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method: 537 TOP - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 410-253462/4-B

Matrix: Solid

Analysis Batch: 254465

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 253462

Isotope Dilution	LCSD	LCSD	Limits
	%Recovery	Qualifier	
<i>13C2-2H-Perfluoro-2-decenoic acid</i>	118		50 - 150
<i>13C2-2H-Perfluoro-2-dodecenoic acid</i>	151	*5+	50 - 150
Surrogate	LCSD	LCSD	Limits
	%Recovery	Qualifier	
<i>13C2 PFHxA</i>	115		10 - 137
<i>13C4 PFOA</i>	137		10 - 146
<i>13C2 PFUnA</i>	123		10 - 143

QC Association Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

LCMS

Prep Batch: 240479

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-2	EB-001	Total/NA	Water	537 IDA	
410-76735-2	EB-002	Total/NA	Water	537 IDA	
410-76903-4	EB 003	Total/NA	Water	537 IDA	
MB 410-240479/1-A	Method Blank	Total/NA	Water	537 IDA	
LCS 410-240479/3-A	Lab Control Sample	Total/NA	Water	537 IDA	
LCSD 410-240479/4-A	Lab Control Sample Dup	Total/NA	Water	537 IDA	

Prep Batch: 240631

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Pre-Treatment	Solid	TOP Pre-Prep	
410-76735-1	PP Pad-001	Pre-Treatment	Solid	TOP Pre-Prep	
410-76903-1 - DL	Safeshell #1-3	Pre-Treatment	Solid	TOP Pre-Prep	
410-76903-1	Safeshell #1-3	Pre-Treatment	Solid	TOP Pre-Prep	
MB 410-240631/1-B	Method Blank	Total/NA	Solid	TOP Pre-Prep	
LCS 410-240631/2-B	Lab Control Sample	Total/NA	Solid	TOP Pre-Prep	
LCSD 410-240631/3-B	Lab Control Sample Dup	Total/NA	Solid	TOP Pre-Prep	

Cleanup Batch: 241190

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Pre-Treatment	Solid	Extract Aliquot	240631
410-76735-1	PP Pad-001	Pre-Treatment	Solid	Extract Aliquot	240631
410-76903-1 - DL	Safeshell #1-3	Pre-Treatment	Solid	Extract Aliquot	240631
410-76903-1	Safeshell #1-3	Pre-Treatment	Solid	Extract Aliquot	240631
MB 410-240631/1-B	Method Blank	Total/NA	Solid	Extract Aliquot	240631
LCS 410-240631/2-B	Lab Control Sample	Total/NA	Solid	Extract Aliquot	240631
LCSD 410-240631/3-B	Lab Control Sample Dup	Total/NA	Solid	Extract Aliquot	240631

Analysis Batch: 241603

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Pre-Treatment	Solid	537 IDA	241190
410-76735-1	PP Pad-001	Pre-Treatment	Solid	537 IDA	241190
410-76903-1	Safeshell #1-3	Pre-Treatment	Solid	537 IDA	241190
410-76903-1 - DL	Safeshell #1-3	Pre-Treatment	Solid	537 IDA	241190
MB 410-240631/1-B	Method Blank	Total/NA	Solid	537 IDA	241190
LCS 410-240631/2-B	Lab Control Sample	Total/NA	Solid	537 IDA	241190
LCSD 410-240631/3-B	Lab Control Sample Dup	Total/NA	Solid	537 IDA	241190

Analysis Batch: 250678

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-2	EB-001	Total/NA	Water	537 IDA	240479
410-76735-2	EB-002	Total/NA	Water	537 IDA	240479
MB 410-240479/1-A	Method Blank	Total/NA	Water	537 IDA	240479

Analysis Batch: 251038

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 410-240479/3-A	Lab Control Sample	Total/NA	Water	537 IDA	240479
LCSD 410-240479/4-A	Lab Control Sample Dup	Total/NA	Water	537 IDA	240479

Analysis Batch: 251322

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-76903-4	EB 003	Total/NA	Water	537 IDA	240479

QC Association Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

LCMS

Prep Batch: 253462

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Post-Treatment	Solid	TOP Post-Prep	
410-75808-1 - RA	Carpet-001	Post-Treatment	Solid	TOP Post-Prep	
410-76735-1	PP Pad-001	Post-Treatment	Solid	TOP Post-Prep	
410-76903-1 - RA	Safeshell #1-3	Post-Treatment	Solid	TOP Post-Prep	
410-76903-1	Safeshell #1-3	Post-Treatment	Solid	TOP Post-Prep	
MB 410-253462/1-B	Method Blank	Total/NA	Solid	TOP Post-Prep	
MB 410-253462/2-B	Method Blank	Total/NA	Solid	TOP Post-Prep	
LCS 410-253462/3-B	Lab Control Sample	Total/NA	Solid	TOP Post-Prep	
LCSD 410-253462/4-B	Lab Control Sample Dup	Total/NA	Solid	TOP Post-Prep	

Cleanup Batch: 254035

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1 - RA	Carpet-001	Post-Treatment	Solid	Extract Aliquot	253462
410-75808-1	Carpet-001	Post-Treatment	Solid	Extract Aliquot	253462
410-76735-1	PP Pad-001	Post-Treatment	Solid	Extract Aliquot	253462
410-76903-1	Safeshell #1-3	Post-Treatment	Solid	Extract Aliquot	253462
410-76903-1 - RA	Safeshell #1-3	Post-Treatment	Solid	Extract Aliquot	253462
MB 410-253462/1-B	Method Blank	Total/NA	Solid	Extract Aliquot	253462
MB 410-253462/2-B	Method Blank	Total/NA	Solid	Extract Aliquot	253462
LCS 410-253462/3-B	Lab Control Sample	Total/NA	Solid	Extract Aliquot	253462
LCSD 410-253462/4-B	Lab Control Sample Dup	Total/NA	Solid	Extract Aliquot	253462

Analysis Batch: 254465

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Post-Treatment	Solid	537 TOP	254035
410-75808-1 - RA	Carpet-001	Post-Treatment	Solid	537 TOP	254035
410-76735-1	PP Pad-001	Post-Treatment	Solid	537 TOP	254035
410-76903-1	Safeshell #1-3	Post-Treatment	Solid	537 TOP	254035
410-76903-1 - RA	Safeshell #1-3	Post-Treatment	Solid	537 TOP	254035
MB 410-253462/1-B	Method Blank	Total/NA	Solid	537 TOP	254035
MB 410-253462/2-B	Method Blank	Total/NA	Solid	537 TOP	254035
LCS 410-253462/3-B	Lab Control Sample	Total/NA	Solid	537 TOP	254035
LCSD 410-253462/4-B	Lab Control Sample Dup	Total/NA	Solid	537 TOP	254035

Analysis Batch: 255026

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Post-Treatment	Solid	Total PFCA-Sum	
410-75808-1	Carpet-001	Pre-Treatment	Solid	Total PFCA-Sum	
410-76735-1	PP Pad-001	Post-Treatment	Solid	Total PFCA-Sum	
410-76735-1	PP Pad-001	Pre-Treatment	Solid	Total PFCA-Sum	
410-76903-1	Safeshell #1-3	Post-Treatment	Solid	Total PFCA-Sum	
410-76903-1	Safeshell #1-3	Pre-Treatment	Solid	Total PFCA-Sum	

Analysis Batch: 255030

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
410-75808-1	Carpet-001	Total/NA	Solid	Total PFCA-Dif	
410-76735-1	PP Pad-001	Total/NA	Solid	Total PFCA-Dif	
410-76903-1	Safeshell #1-3	Total/NA	Solid	Total PFCA-Dif	

Lab Chronicle

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Carpet-001

Lab Sample ID: 410-75808-1

Date Collected: 03/08/22 17:12

Matrix: Solid

Date Received: 03/11/22 10:17

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Pre-Treatment	Prep	TOP Pre-Prep			240631	04/04/22 11:19	S7AC	ELLE
Pre-Treatment	Cleanup	Extract Aliquot			241190	04/05/22 12:39	S7AC	ELLE
Pre-Treatment	Analysis	537 IDA		1	241603	04/06/22 12:18	UUV6	ELLE
Post-Treatment	Prep	TOP Post-Prep			253462	05/10/22 10:06	S7AC	ELLE
Post-Treatment	Cleanup	Extract Aliquot			254035	05/11/22 11:49	S7AC	ELLE
Post-Treatment	Analysis	537 TOP		1	254465	05/12/22 12:51	MT26	ELLE
Post-Treatment	Prep	TOP Post-Prep	RA		253462	05/10/22 10:06	S7AC	ELLE
Post-Treatment	Cleanup	Extract Aliquot	RA		254035	05/11/22 11:49	S7AC	ELLE
Post-Treatment	Analysis	537 TOP	RA	1	254465	05/12/22 13:02	MT26	ELLE
Total/NA	Analysis	Total PFCA-Dif		1	255030	05/13/22 13:16	MT26	ELLE
Post-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE
Pre-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE

Client Sample ID: EB-001

Lab Sample ID: 410-75808-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	537 IDA			240479	04/04/22 06:59	RC3V	ELLE
Total/NA	Analysis	537 IDA		1	250678	05/03/22 01:18	MT26	ELLE

Client Sample ID: PP Pad-001

Lab Sample ID: 410-76735-1

Date Collected: 03/16/22 13:30

Matrix: Solid

Date Received: 03/18/22 08:41

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Pre-Treatment	Prep	TOP Pre-Prep			240631	04/04/22 11:19	S7AC	ELLE
Pre-Treatment	Cleanup	Extract Aliquot			241190	04/05/22 12:39	S7AC	ELLE
Pre-Treatment	Analysis	537 IDA		1	241603	04/06/22 12:29	UUV6	ELLE
Post-Treatment	Prep	TOP Post-Prep			253462	05/10/22 10:06	S7AC	ELLE
Post-Treatment	Cleanup	Extract Aliquot			254035	05/11/22 11:49	S7AC	ELLE
Post-Treatment	Analysis	537 TOP		1	254465	05/12/22 13:13	MT26	ELLE
Total/NA	Analysis	Total PFCA-Dif		1	255030	05/13/22 13:16	MT26	ELLE
Post-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE
Pre-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE

Client Sample ID: EB-002

Lab Sample ID: 410-76735-2

Date Collected: 03/21/22 13:53

Matrix: Water

Date Received: 03/21/22 14:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	537 IDA			240479	04/04/22 06:59	RC3V	ELLE
Total/NA	Analysis	537 IDA		1	250678	05/03/22 01:29	MT26	ELLE

Lab Chronicle

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Client Sample ID: Safeshell #1-3

Lab Sample ID: 410-76903-1

Date Collected: 03/09/22 15:00

Matrix: Solid

Date Received: 03/21/22 12:09

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Pre-Treatment	Prep	TOP Pre-Prep			240631	04/04/22 11:19	S7AC	ELLE
Pre-Treatment	Cleanup	Extract Aliquot			241190	04/05/22 12:39	S7AC	ELLE
Pre-Treatment	Analysis	537 IDA		1	241603	04/06/22 20:59	UUV6	ELLE
Pre-Treatment	Prep	TOP Pre-Prep	DL		240631	04/04/22 11:19	S7AC	ELLE
Pre-Treatment	Cleanup	Extract Aliquot	DL		241190	04/05/22 12:39	S7AC	ELLE
Pre-Treatment	Analysis	537 IDA	DL	10	241603	04/06/22 21:10	UUV6	ELLE
Post-Treatment	Prep	TOP Post-Prep			253462	05/10/22 10:06	S7AC	ELLE
Post-Treatment	Cleanup	Extract Aliquot			254035	05/11/22 11:49	S7AC	ELLE
Post-Treatment	Analysis	537 TOP		1	254465	05/12/22 13:24	MT26	ELLE
Post-Treatment	Prep	TOP Post-Prep	RA		253462	05/10/22 10:06	S7AC	ELLE
Post-Treatment	Cleanup	Extract Aliquot	RA		254035	05/11/22 11:49	S7AC	ELLE
Post-Treatment	Analysis	537 TOP	RA	1	254465	05/12/22 13:35	MT26	ELLE
Total/NA	Analysis	Total PFCA-Dif		1	255030	05/13/22 13:16	MT26	ELLE
Post-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE
Pre-Treatment	Analysis	Total PFCA-Sum		1	255026	05/13/22 13:14	MT26	ELLE

Client Sample ID: EB 003

Lab Sample ID: 410-76903-4

Date Collected: 03/22/22 00:00

Matrix: Water

Date Received: 03/21/22 12:09

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	537 IDA			240479	04/04/22 06:59	RC3V	ELLE
Total/NA	Analysis	537 IDA		1	251322	05/05/22 08:05	UCD3	ELLE

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Non-targeted analysis (NTA) of turf samples by qToF

Analytical procedure for PFAS analysis

UPLC Methods

PFAS were analyzed in negative ionization mode using a UPLC-QToF-HRMS (AB Sciex X500R QTOF system) equipped with a Phenomenex Gemini C18 column (3 mm x 50 mm, 3 μ m) in TOF MSMS and information dependent acquisition (IDA) mode. A gradient solvent program was operated with 20 mM sodium acetate in MilliQ water (solution A) and 20mM sodium acetate in LC-MS grade methanol having 0.5% water (solution B). The details of the gradient method are provided in Table S2. Signals were acquired between the 0.1 and 11.5 minutes with total run time of 12 minutes.

Table 1. Gradient solvent program for the UPLC

Time (min)	Flowrate (mL/min)	%A	%B
0.0	0.5	95	5
0.5	0.5	95	5
1.5	0.5	40	60
3.0	0.5	5	95
9.0	0.5	5	95
9.2	0.5	95	5
12.0	0.5	95	5

Mass spectroscopy method

Three samples were run in negative and positive mode collision energy in IDA mode. Sample's analytes were fragmented at 25V (± 10 V) in both TOF MS and TOF MSMS. Source and gas parameters were kept constant, where ion source gas 1 and 2 kept at 30 psi, curtain gas 25 psi, CAD gas 7 psi, temperature 300°C, spray voltage and delustering potential (DP) were -4100 V and

-80V (DP spread 20 V). For other IDA criteria, maximum candidate ions 10, intensity threshold exceeds 200 cps and dynamic background subtraction were used. Mass range was set at 100 to 1000 Da with accumulation time 0.08s and 0.25s in MS and MSMS, respectively.

Non-targeted analysis (NTA)

Data were processed with SCIEX LibraryView deconvolution software. This software extracts the raw chromatograms across a defined mass range from 0-5000AMU and examines peaks of interest utilizing exact mass and MS/MS fragmentation. The peaks are compared to the 5070 unique PFAS compounds from Fluoros 2.5, in house ClPFPECA (Chlorofluoro ether carboxylic acids), Fluorochemical_HR_MS and Labeled PFAS library where the software algorithm assigns possible matches to each peak, or feature. The features were then evaluated to confirm ample signal-to-noise as well as confirming the compound fit to the library match. The precursor mass tolerance ± 0.2 Da and fragment mass tolerance ± 0.1 Da was used. The reported results include only peaks with a signal-to-noise greater than 10:1 and that have a library confidence of less than 5ppm error. These are the recommended settings provided by the manufacturer. One thing the software cannot account for are isomers. For the molecular formula determination C_{0-20} , H_{0-5} , F_{0-60} , N_{0-1} , O_{0-16} and S_{0-2} was used. Post data generation, a filtering algorithm was used to reduce the m/z signals of the blank (methanol) from each sample with a filter of mass error of 5 ppm and RT window of 1 min.

Results

Results are presented in separate file for each sample and labeled as 240_156265_A-1-A_Pos, 240_156265_A-1-A_Neg and 240_156265_A-1-A_Neg_lowCE for data acquired in positive, negative and negative ionization of low CE, respectively.

Compiled data for all the samples are reported in excel files “NTA_data” and “NTA_data_5ppm” for all the screened ions and unique ions with 5 ppm mass error, respectively.

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Accreditation/Certification Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Massachusetts	State	M-PA009	06-30-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
537 IDA	537 IDA	Water	10:2 FTCA
537 IDA	537 IDA	Water	10:2 FTS
537 IDA	537 IDA	Water	10:2 FTUCA
537 IDA	537 IDA	Water	11Cl-PF3OUdS
537 IDA	537 IDA	Water	3:3 FTCA
537 IDA	537 IDA	Water	4:2 Fluorotelomer sulfonic acid
537 IDA	537 IDA	Water	5:3 FTCA
537 IDA	537 IDA	Water	6:2 Fluorotelomer sulfonic acid
537 IDA	537 IDA	Water	6:2 FTCA
537 IDA	537 IDA	Water	6:2 FTUCA
537 IDA	537 IDA	Water	7:3 FTCA
537 IDA	537 IDA	Water	8:2 Fluorotelomer sulfonic acid
537 IDA	537 IDA	Water	8:2 FTCA
537 IDA	537 IDA	Water	8:2 FTUCA
537 IDA	537 IDA	Water	9Cl-PF3ONS
537 IDA	537 IDA	Water	DONA
537 IDA	537 IDA	Water	EVE Acid
537 IDA	537 IDA	Water	HFPODA
537 IDA	537 IDA	Water	Hydro-EVE Acid
537 IDA	537 IDA	Water	Hydrolyzed PSDA
537 IDA	537 IDA	Water	Hydro-PS Acid
537 IDA	537 IDA	Water	MTP
537 IDA	537 IDA	Water	NEtFOSA
537 IDA	537 IDA	Water	NEtFOSAA
537 IDA	537 IDA	Water	NEtFOSE
537 IDA	537 IDA	Water	NMeFOSA
537 IDA	537 IDA	Water	NMeFOSAA
537 IDA	537 IDA	Water	NMeFOSE
537 IDA	537 IDA	Water	NVHOS
537 IDA	537 IDA	Water	PEPA
537 IDA	537 IDA	Water	Perfluoro (2-ethoxyethane) sulfonic acid
537 IDA	537 IDA	Water	Perfluoro-4-ethylcyclohexanesulfonic acid
537 IDA	537 IDA	Water	Perfluorobutanesulfonic acid
537 IDA	537 IDA	Water	Perfluorobutanoic acid
537 IDA	537 IDA	Water	Perfluorodecanesulfonic acid
537 IDA	537 IDA	Water	Perfluorodecanoic acid
537 IDA	537 IDA	Water	Perfluorododecanesulfonic acid
537 IDA	537 IDA	Water	Perfluorododecanoic acid
537 IDA	537 IDA	Water	Perfluoroheptanesulfonic acid
537 IDA	537 IDA	Water	Perfluoroheptanoic acid
537 IDA	537 IDA	Water	Perfluorohexadecanoic acid
537 IDA	537 IDA	Water	Perfluorohexanesulfonic acid
537 IDA	537 IDA	Water	Perfluorohexanoic acid
537 IDA	537 IDA	Water	Perfluorononanesulfonic acid
537 IDA	537 IDA	Water	Perfluorononanoic acid

Eurofins Lancaster Laboratories Environment Testing, LLC

Accreditation/Certification Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.			
Analysis Method	Prep Method	Matrix	Analyte
537 IDA	537 IDA	Water	Perfluorooctadecanoic acid
537 IDA	537 IDA	Water	Perfluorooctanesulfonamide
537 IDA	537 IDA	Water	Perfluorooctanesulfonic acid
537 IDA	537 IDA	Water	Perfluorooctanoic acid
537 IDA	537 IDA	Water	Perfluoropentanesulfonic acid
537 IDA	537 IDA	Water	Perfluoropentanoic acid
537 IDA	537 IDA	Water	Perfluoropropanesulfonic acid
537 IDA	537 IDA	Water	Perfluorotetradecanoic acid
537 IDA	537 IDA	Water	Perfluorotridecanoic acid
537 IDA	537 IDA	Water	Perfluoroundecanoic acid
537 IDA	537 IDA	Water	PFECA A
537 IDA	537 IDA	Water	PFECA B
537 IDA	537 IDA	Water	PFECA F
537 IDA	537 IDA	Water	PFECA G
537 IDA	537 IDA	Water	PFMOAA
537 IDA	537 IDA	Water	PFO2HxA
537 IDA	537 IDA	Water	PFO3OA
537 IDA	537 IDA	Water	PFO4DA
537 IDA	537 IDA	Water	PMPA
537 IDA	537 IDA	Water	PPF Acid
537 IDA	537 IDA	Water	PS Acid
537 IDA	537 IDA	Water	R-EVE
537 IDA	537 IDA	Water	R-PSDA
537 IDA	537 IDA	Water	R-PSDCA
537 IDA	537 IDA	Water	TAF
537 IDA	TOP Pre-Prep	Solid	10:2 FTCA
537 IDA	TOP Pre-Prep	Solid	10:2 FTS
537 IDA	TOP Pre-Prep	Solid	10:2 FTUCA
537 IDA	TOP Pre-Prep	Solid	11Cl-PF3OUdS
537 IDA	TOP Pre-Prep	Solid	3:3 FTCA
537 IDA	TOP Pre-Prep	Solid	4:2 Fluorotelomer sulfonic acid
537 IDA	TOP Pre-Prep	Solid	5:3 FTCA
537 IDA	TOP Pre-Prep	Solid	6:2 Fluorotelomer sulfonic acid
537 IDA	TOP Pre-Prep	Solid	6:2 FTCA
537 IDA	TOP Pre-Prep	Solid	6:2 FTUCA
537 IDA	TOP Pre-Prep	Solid	7:3 FTCA
537 IDA	TOP Pre-Prep	Solid	8:2 Fluorotelomer sulfonic acid
537 IDA	TOP Pre-Prep	Solid	8:2 FTCA
537 IDA	TOP Pre-Prep	Solid	8:2 FTUCA
537 IDA	TOP Pre-Prep	Solid	9Cl-PF3ONS
537 IDA	TOP Pre-Prep	Solid	DONA
537 IDA	TOP Pre-Prep	Solid	EVE Acid
537 IDA	TOP Pre-Prep	Solid	HFPODA
537 IDA	TOP Pre-Prep	Solid	Hydro-EVE Acid
537 IDA	TOP Pre-Prep	Solid	Hydrolyzed PSDA
537 IDA	TOP Pre-Prep	Solid	Hydro-PS Acid
537 IDA	TOP Pre-Prep	Solid	MTP

Eurofins Lancaster Laboratories Environment Testing, LLC

Accreditation/Certification Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.			
Analysis Method	Prep Method	Matrix	Analyte
537 IDA	TOP Pre-Prep	Solid	NEtFOSA
537 IDA	TOP Pre-Prep	Solid	NEtFOSAA
537 IDA	TOP Pre-Prep	Solid	NEtFOSE
537 IDA	TOP Pre-Prep	Solid	NMeFOSA
537 IDA	TOP Pre-Prep	Solid	NMeFOSAA
537 IDA	TOP Pre-Prep	Solid	NMeFOSE
537 IDA	TOP Pre-Prep	Solid	NVHOS
537 IDA	TOP Pre-Prep	Solid	PEPA
537 IDA	TOP Pre-Prep	Solid	Perfluoro (2-ethoxyethane) sulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoro-4-ethylcyclohexanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorobutanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorobutanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorodecanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorodecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorododecanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorododecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoroheptanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoroheptanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorohexadecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorohexanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorohexanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorononanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorononanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorooctadecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorooctanesulfonamide
537 IDA	TOP Pre-Prep	Solid	Perfluorooctanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorooctanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoropentanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoropentanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoropropanesulfonic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorotetradecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluorotridecanoic acid
537 IDA	TOP Pre-Prep	Solid	Perfluoroundecanoic acid
537 IDA	TOP Pre-Prep	Solid	PFECA A
537 IDA	TOP Pre-Prep	Solid	PFECA B
537 IDA	TOP Pre-Prep	Solid	PFECA F
537 IDA	TOP Pre-Prep	Solid	PFECA G
537 IDA	TOP Pre-Prep	Solid	PFMOAA
537 IDA	TOP Pre-Prep	Solid	PFO2HxA
537 IDA	TOP Pre-Prep	Solid	PFO3OA
537 IDA	TOP Pre-Prep	Solid	PFO4DA
537 IDA	TOP Pre-Prep	Solid	PMPA
537 IDA	TOP Pre-Prep	Solid	PPF Acid
537 IDA	TOP Pre-Prep	Solid	PS Acid
537 IDA	TOP Pre-Prep	Solid	R-EVE
537 IDA	TOP Pre-Prep	Solid	R-PSDA
537 IDA	TOP Pre-Prep	Solid	R-PSDCA

Eurofins Lancaster Laboratories Environment Testing, LLC

Accreditation/Certification Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.			
Analysis Method	Prep Method	Matrix	Analyte
537 IDA	TOP Pre-Prep	Solid	TAF
537 TOP	TOP Post-Prep	Solid	10:2 FTCA
537 TOP	TOP Post-Prep	Solid	10:2 FTS
537 TOP	TOP Post-Prep	Solid	10:2 FTUCA
537 TOP	TOP Post-Prep	Solid	11Cl-PF3OUdS
537 TOP	TOP Post-Prep	Solid	3:3 FTCA
537 TOP	TOP Post-Prep	Solid	4:2 Fluorotelomer sulfonic acid
537 TOP	TOP Post-Prep	Solid	5:3 FTCA
537 TOP	TOP Post-Prep	Solid	6:2 Fluorotelomer sulfonic acid
537 TOP	TOP Post-Prep	Solid	6:2 FTCA
537 TOP	TOP Post-Prep	Solid	6:2 FTUCA
537 TOP	TOP Post-Prep	Solid	7:3 FTCA
537 TOP	TOP Post-Prep	Solid	8:2 Fluorotelomer sulfonic acid
537 TOP	TOP Post-Prep	Solid	8:2 FTCA
537 TOP	TOP Post-Prep	Solid	8:2 FTUCA
537 TOP	TOP Post-Prep	Solid	9Cl-PF3ONS
537 TOP	TOP Post-Prep	Solid	DONA
537 TOP	TOP Post-Prep	Solid	EVE Acid
537 TOP	TOP Post-Prep	Solid	HFPODA
537 TOP	TOP Post-Prep	Solid	Hydro-EVE Acid
537 TOP	TOP Post-Prep	Solid	Hydrolyzed PSDA
537 TOP	TOP Post-Prep	Solid	Hydro-PS Acid
537 TOP	TOP Post-Prep	Solid	MTP
537 TOP	TOP Post-Prep	Solid	NEtFOSA
537 TOP	TOP Post-Prep	Solid	NEtFOSAA
537 TOP	TOP Post-Prep	Solid	NEtFOSE
537 TOP	TOP Post-Prep	Solid	NMeFOSA
537 TOP	TOP Post-Prep	Solid	NMeFOSAA
537 TOP	TOP Post-Prep	Solid	NMeFOSE
537 TOP	TOP Post-Prep	Solid	NVHOS
537 TOP	TOP Post-Prep	Solid	PEPA
537 TOP	TOP Post-Prep	Solid	Perfluoro (2-ethoxyethane) sulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluoro-4-ethylcyclohexanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorobutanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorobutanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorodecanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorodecanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorododecanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorododecanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluoroheptanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluoroheptanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorohexadecanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorohexanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorohexanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorononanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorononanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorooctadecanoic acid

Eurofins Lancaster Laboratories Environment Testing, LLC

Accreditation/Certification Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.			
Analysis Method	Prep Method	Matrix	Analyte
537 TOP	TOP Post-Prep	Solid	Perfluorooctanesulfonamide
537 TOP	TOP Post-Prep	Solid	Perfluorooctanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorooctanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluoropentanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluoropentanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluoropropanesulfonic acid
537 TOP	TOP Post-Prep	Solid	Perfluorotetradecanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluorotridecanoic acid
537 TOP	TOP Post-Prep	Solid	Perfluoroundecanoic acid
537 TOP	TOP Post-Prep	Solid	PFECA A
537 TOP	TOP Post-Prep	Solid	PFECA B
537 TOP	TOP Post-Prep	Solid	PFECA F
537 TOP	TOP Post-Prep	Solid	PFECA G
537 TOP	TOP Post-Prep	Solid	PFMOAA
537 TOP	TOP Post-Prep	Solid	PFO2HxA
537 TOP	TOP Post-Prep	Solid	PFO3OA
537 TOP	TOP Post-Prep	Solid	PFO4DA
537 TOP	TOP Post-Prep	Solid	PMPA
537 TOP	TOP Post-Prep	Solid	PPF Acid
537 TOP	TOP Post-Prep	Solid	PS Acid
537 TOP	TOP Post-Prep	Solid	R-EVE
537 TOP	TOP Post-Prep	Solid	R-PSDA
537 TOP	TOP Post-Prep	Solid	R-PSDCA
537 TOP	TOP Post-Prep	Solid	TAF
Total PFCA-Dif		Solid	PFBA
Total PFCA-Dif		Solid	PFHpA
Total PFCA-Dif		Solid	PFHxA
Total PFCA-Dif		Solid	PFNA
Total PFCA-Dif		Solid	PFOA
Total PFCA-Dif		Solid	PFPA
Total PFCA-Dif		Solid	Total PFCA
Total PFCA-Sum		Solid	Total PFCA

Method Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Method	Method Description	Protocol	Laboratory
537 IDA	EPA 537 Isotope Dilution	EPA	ELLE
537 TOP	Fluorinated Alkyl Substances	EPA	ELLE
Total PFCA-Dif	Total PFCA (Treatment Difference)	TAL SOP	ELLE
Total PFCA-Sum	Total PFCA (Summary)	TAL SOP	ELLE
537 IDA	EPA 537 Isotope Dilution	EPA	ELLE
Extract Aliquot	Preparation, Extract Aliquot	None	ELLE
TOP Post-Prep	Shake Extraction with Ultrasonic Bath Extraction	SW846	ELLE
TOP Pre-Prep	Shake Extraction with Ultrasonic Bath Extraction	SW846	ELLE

Protocol References:

EPA = US Environmental Protection Agency

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL SOP = TestAmerica Laboratories, Standard Operating Procedure

Laboratory References:

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: TRC Companies, Inc
Project/Site: Synthetic Turf

Job ID: 410-75808-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
410-75808-1	Carpet-001	Solid	03/08/22 17:12	03/11/22 10:17
410-75808-2	EB-001	Water	03/21/22 13:53	03/21/22 14:00
410-76735-1	PP Pad-001	Solid	03/16/22 13:30	03/18/22 08:41
410-76735-2	EB-002	Water	03/21/22 13:53	03/21/22 14:00
410-76903-1	Safeshell #1-3	Solid	03/09/22 15:00	03/21/22 12:09
410-76903-4	EB 003	Water	03/22/22 00:00	03/21/22 12:09



410-76735 Chain of Custody

Chain of Custody Record

Environment Testing
America

Sampler: Phil Jauregui -- Schmitz Foam Products		Lab PM: Marissa Williams		Carrier Tracking No(s): 1ZR63A500344491382		COC No:																	
Client Contact: Elizabeth Denly		Phone: (517) 781-6620		E-Mail: p.jauregui@schmitzfoam.com		Page: 1																	
Company: TRC		PWSID: NA		Analysis Requested				Job #:															
Address: 650 Suffolk Street		Due Date Requested: see below		Field Filtered Sample (Yes or No) IMS (Yes or No) PFAS Target List of 70 PFAS: See quote 41009406 - 1 & SAP TOP Assay PFAS: See quote 41009406 - 1 & SAP Non-target PFAS: See quote 41009406 - 1 & SAP Total Number of containers				Preservation Codes:															
City: Lowell		TAT Requested (days): 70 PFAS & TOP Assay: 15 business days						A - HCL B - NaOH C - Zn Acetate D - Nitric Acid E - NaHSO4 F - MeOH G - Amchlor H - Ascorbic Acid I - Ice J - DI Water K - EDTA L - EDA				M - Hexane N - None O - AsNaO2 P - Na2O4S Q - Na2SO3 R - Na2S2O3 S - H2SO4 T - TSP Dodecahydrate U - Acetone V - MCAA W - pH 4-5 Z - other (specify)											
State, Zip: MA, 01854		Non-target analysis: 25 business days																					
Phone: 978-656-3577		Compliance Project: ☐ Yes ☐ No																					
Email: edenly@trccompanies.com		PO #: 178559																					
Project Name: Synthetic Turf		WO #: NA																					
Site: NA		Project #: 474501																					
SSOW#: NA																							
Sample Identification		Sample Date		Sample Time		Sample Type (C=comp, G=grab)		Matrix (W=water, S=solid, O=waste/soil, BT=Tissue, Air/Air)		Field Filtered Sample (Yes or No)		IMS (Yes or No)		PFAS Target List of 70 PFAS: See quote 41009406 - 1 & SAP		TOP Assay PFAS: See quote 41009406 - 1 & SAP		Non-target PFAS: See quote 41009406 - 1 & SAP		Total Number of containers		Special Instructions/Note:	
PP Pad-001		3/16/22		1:30 PM		G		S		☒		☒		☒		☒		☒		☒		See SAP for homogenization requirements	



Chain of Custody Record

Phc 410-76903 Chain of Custody

Client:		Sampler:		Lab PM:		Carrier Tracking No(s):		COC No:	
Client Contact: Elizabeth Denly		Adam Coleman		Marrissa Williams					
Phone:		E-Mail:		State of Origin:		Page:			
513.313.1584		acoleman@usgreentech.com		Arkansas		1			
Company: TRC				PWSID NA		Analysis Requested			
Address: 650 Suffolk Street		Due Date Requested: see below		Field Filtered Sample (Yes or No) Total Number of containers				Job #:	
City: Lowell		TAT Requested (days): 70 PFAS & TOP Assay: 15 business days Non-target analysis: 25 business days						Preservation Codes:	
State, Zip: MA, 01854		Compliance Project: Δ Yes Δ No						A - HCL M - Hexane B - NaOH N - None C - Zn Acetate O - AsNaO2 D - Nitric Acid P - Na2O4S E - NaHSO4 Q - Na2SO3 F - MeOH R - Na2S2O3 G - Amchlor S - H2SO4 H - Ascorbic Acid T - TSP Dodecahydrate I - Ice U - Acetone J - DI Water V - MCAA K - EDTA W - pH 4-5 L - EDTA Z - other (specify)	
Phone: 978-656-3577		PO #: 178559							
Email: edenly@trccompanies.com		WO #: NA							
Project Name: Synthetic Turf		Project #: 474501							
Site: NA		SSOW#: NA							
Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=grab) BT=Tissue, A=Air	Matrix (W=water, B=solid, O=waste/sludg) BT=Tissue, A=Air	Special Instructions/Note:			
Safeshell #1	3/9/22	15:00 EST	G	S	X	X	X		See SAP for homogenization requirements
Safeshell #2	3/9/22	15:00 EST	G	S	X	X	X		See SAP for homogenization requirements
Safeshell #3	3/9/22	15:00 EST	G	S	X	X	X		See SAP for homogenization requirements
Possible Hazard Identification									
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological									
Deliverable Requested: I, II, III, IV, Other (specify) Level IV and EquIS EDD					Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)				
					☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months				
Empty Kit Relinquished by: Adam Coleman					Date: NA				
Relinquished by: Adam Coleman					Time: NA				
Relinquished by:					Method of Shipment: FedEx				
Relinquished by:					Received by:				
Relinquished by:					Date/Time:				
Relinquished by:					Company:				
Relinquished by:					Received by:				
Relinquished by:					Date/Time:				
Relinquished by:					Company:				
Custody Seal Intact: Δ Yes (Δ No)					Coolant Temperature(s) °C and Other Remarks:				
Custody Seal No :					3/2/22 12:09 17.2				

Login Sample Receipt Checklist

Client: TRC Companies, Inc

Job Number: 410-75808-1

Login Number: 75808

List Number: 1

Creator: Bryan, Debra A

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No ice present, no attempt to chill
Cooler Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	False	Thermal preservation not required.
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	False	Refer to Job Narrative for details.
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

Login Sample Receipt Checklist

Client: TRC Companies, Inc

Job Number: 410-75808-1

Login Number: 76735

List Number: 1

Creator: McCaskey, Jonathan

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No ice present, no attempt to chill
Cooler Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	False	Thermal preservation not required.
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

Login Sample Receipt Checklist

Client: TRC Companies, Inc

Job Number: 410-75808-1

Login Number: 76903

List Number: 1

Creator: Bryan, Debra A

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No ice present, no attempt to chill
Cooler Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	False	Refer to Job Narrative for details.
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable ($\leq 6^{\circ}\text{C}$, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	True	
Sample custody seals are intact.	N/A	

NON-TARGETED ANALYSIS (NTA) SUMMARY REPORT

Eurofins Environmental Testing America
Eurofins Lancaster Laboratories Environmental LLC
2425 New Holland Pike
Lancaster, PA, 17601, USA
Tel: (717) 556 7231

Laboratory Job ID: 410-75808-1, 410-76735-1, 76903-1

Client: TRC

Project: Synthetic Turf

For: Elizabeth Denly

Authorized for release by: Charles Neslund,
Scientific Officer and PFAS Practice Leader

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Sample 410-76735-1 Summary.....	22
Sample 410-76903-1 Summary.....	26
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This report summarizes the results of the NTA (Non-Target Analysis) performed on the three samples submitted to Eurofins Lancaster Laboratories Environment Testing. The three samples are detailed below;

<u>ELLET Job #</u>	<u>Client Description</u>
Job# 410-75808-1	Carpet-001
Job# 410-76735-1	PP Pad-001
Job# 410-76903-1	Safeshell #1-3

The analysis was performed using UPLC-QToF-MS (ultra performance liquid chromatography quadrupole time-of-flight-mass spectroscopy). The results summarized in the attached tables represent qualitative estimations of presumptive positives. As such, Eurofins Lancaster Laboratories Environment Testing did not have available purified analytical standards to confirm results for each presumptive positive.

Sample Preparation

The samples did not present any issues during preparation. The extract generated from the extraction and analysis of each sample for a targeted list of PFAS, by LC/MS/MS, was used for NTA analysis and analyzed without dilution.

Analytical methods

UPLC Methods

PFAS were analyzed in negative ionization mode using a UPLC-QToF-HRMS (AB Sciex X500R QTOF system) equipped with a Phenomenex Gemini C18 column (3 mm x 50 mm, 3 µm) in TOF MSMS and information dependent acquisition (IDA) mode. A gradient solvent program was operated with 20 mM sodium acetate in MilliQ water (solution A) and 20mM sodium acetate in LC-MS grade methanol having 0.5% water (solution B). The details of the gradient method are provided in Table 1. Signals were acquired between the 0.1 and 11.5 minutes with total run time of 12 minutes.

Table 1. Gradient solvent program for the UPLC

Time (min)	Flowrate (mL/min)	%A	%B
0.0	0.5	95	5
0.5	0.5	95	5
1.5	0.5	40	60
3.0	0.5	5	95
9.0	0.5	5	95
9.2	0.5	95	5
12.0	0.5	95	5

Mass spectroscopy method

Three samples were acquired with negative and positive mode collision energy in IDA mode. Each sample's analytes were fragmented at 25V (± 10 V) in both TOF MS and TOF MSMS. Source and gas parameters were kept constant, where ion source gas 1 and 2 kept at 30 psi, curtain gas 25 psi, CAD gas 7 psi, temperature 300°C, spray voltage and delustering potential (DP) were -4100 V and -80V (DP spread 20 V). For other IDA criteria, maximum candidate ions 10, intensity threshold exceeds 200 cps and dynamic background subtraction were used. Mass range was set at 100 to 1000 Da with accumulation time 0.08s and 0.25s in MS and MSMS, respectively.

Non-targeted analysis (NTA)

Data were processed with SCIEX LibraryView deconvolution software. This software extracts the raw chromatograms across a defined mass range from 0-1500AMU and examines peaks of interest utilizing exact mass and MS/MS fragmentation. The peaks are compared to the 5,070 unique PFAS compounds from different fluorinated compounds library where the software algorithm assigns possible matches to each peak, or feature. The features were then evaluated to confirm ample signal-to-noise as well as confirming the compound fit to the library match. The precursor mass tolerance ± 0.2 Da and fragment mass tolerance ± 0.1 Da was used. The reported results include only peaks with a signal-to-noise greater than 10:1, absolute intensity more than 1000 and that have a library confidence of less than 5ppm error. These are the recommended settings provided by the manufacturer. One thing the software cannot account for are isomers. For the molecular formula determination, settings of C₀₋₂₀, H₀₋₅, F₀₋₆₀, N₀₋₁, O₀₋₁₆ and S₀₋₂ were used, where the subscript values represent the allowable number of that specific element that could be present in any proposed empirical formula. Post data generation, a filtering algorithm was used to subtract the m/z signals of the blank (methanol) from each sample.

Results

These data are qualitative in nature. While qualitative compounds do have different areas/intensities, this does not always correlate to more or less abundance in the sample. Vastly different ionization efficiencies of NTA compounds can occur which impacts estimation and speculation about relative concentrations.

Results are presented in separate tables for each sample and labeled as 75808_Neg, 75808_Pos, 76735_Neg, 76735_Pos, 76903_Neg and 76903_Pos. "Neg" and "Pos" represent for data acquired in positive and negative ionization, respectively.

410-75808-1

Table 2. NTA results for sample “75808_Neg” acquired in negative polarity

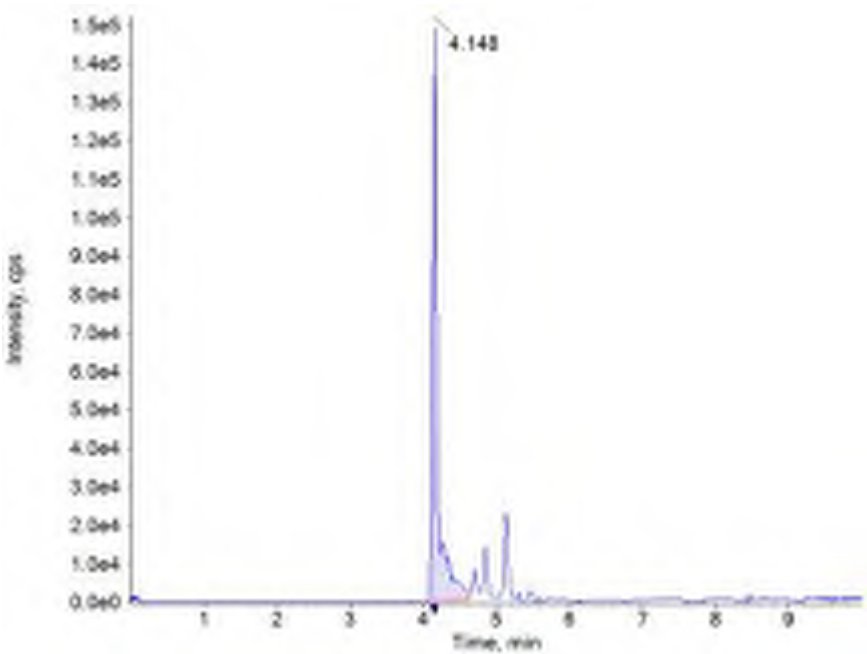
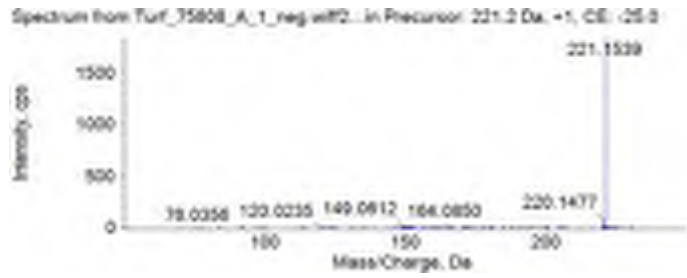
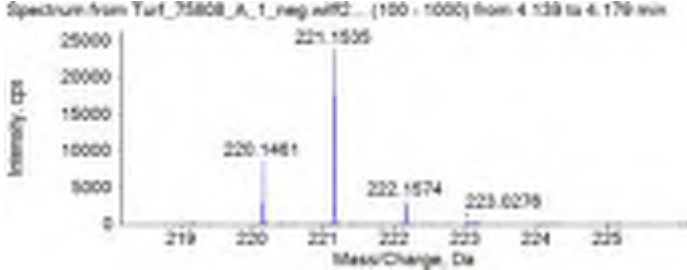
S.N.	Compound Formula	Compound Name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{222.16131}	unknown	7.57E+05	4.15	[M-H]-	221.1546	221.1535	-4.97
2	{224.14073}	unknown	5.23E+04	4.15	[M-H ₂ O-H]-	205.1234	205.1232	-0.97
3	{220.18219}	unknown	5.57E+04	4.25	[M-H]-	219.1755	219.175	-2.28
4	{375.25069}	unknown	6.19E+05	4.26	[M-H]-	374.244	374.2432	-2.14
5	{184.14566}	unknown	3.43E+04	4.26	[M-H]-	183.1389	183.1387	-1.09
6	C ₉ H ₄ F ₁₄ O ₃	Bis(2,2,3,3,4,4,4-heptafluorobutyl) carbonate	8.41E+04	4.66	[M+H] ⁺	427.001	426.9992	-4.2
7	{250.15980}	unknown	2.14E+05	4.67	[M-H]-	249.1531	249.1523	-3.21
8	{276.20765}	unknown	1.14E+04	5.14	[M-H]-	275.2009	275.2009	0
9	{454.30651}	unknown	1.34E+06	6.21	[M+Cl]-	489.2765	489.276	-1.02
10	{282.25479}	unknown	1.28E+07	8.34	[M-H]-	281.2481	281.2472	-3.20
11	{656.42655}	unknown	9.67E+05	8.49	[M-H]-	655.4198	655.4191	-1.06
12	{490.26753}	unknown	2.12E+05	8.86	[M-H]-	489.2608	489.261	0.40
13	{270.25560}	unknown	5.17E+05	8.98	[M-H]-	269.2489	269.2481	-2.97

Table 3. NTA results for sample “75808_Pos” acquired in positive polarity

S.N.	Compound Formula	Compound Name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{692.24754}	unknown	1.38E+04	5.4	[M-H]-	691.2408	691.2405	-0.43
2	{656.41163}	unknown	1.03E+06	6.06	[M-H]-	655.4049	655.4041	-1.22
3	{178.10490}	unknown	2.87E+05	9.4	[M-H]-	177.0982	177.0974	-4.52

Compounds chromatographs and mass spectra for sample “75808_neg” acquired in negative polarity

1. 221.1535 / 4.14 (Library/Formula)

Retention Time: 4.15 minutes Precursor m/z : 221.1546 Fit (%) N/A RFit (%) N/A		Analyte Name: 221.1535 / 4.14	
		Acquired / Library MSMS	
		Acquired / Theoretical MS	

2. 205.1223 / 4.10 [M-H₂O-H]- (Library/Formula)

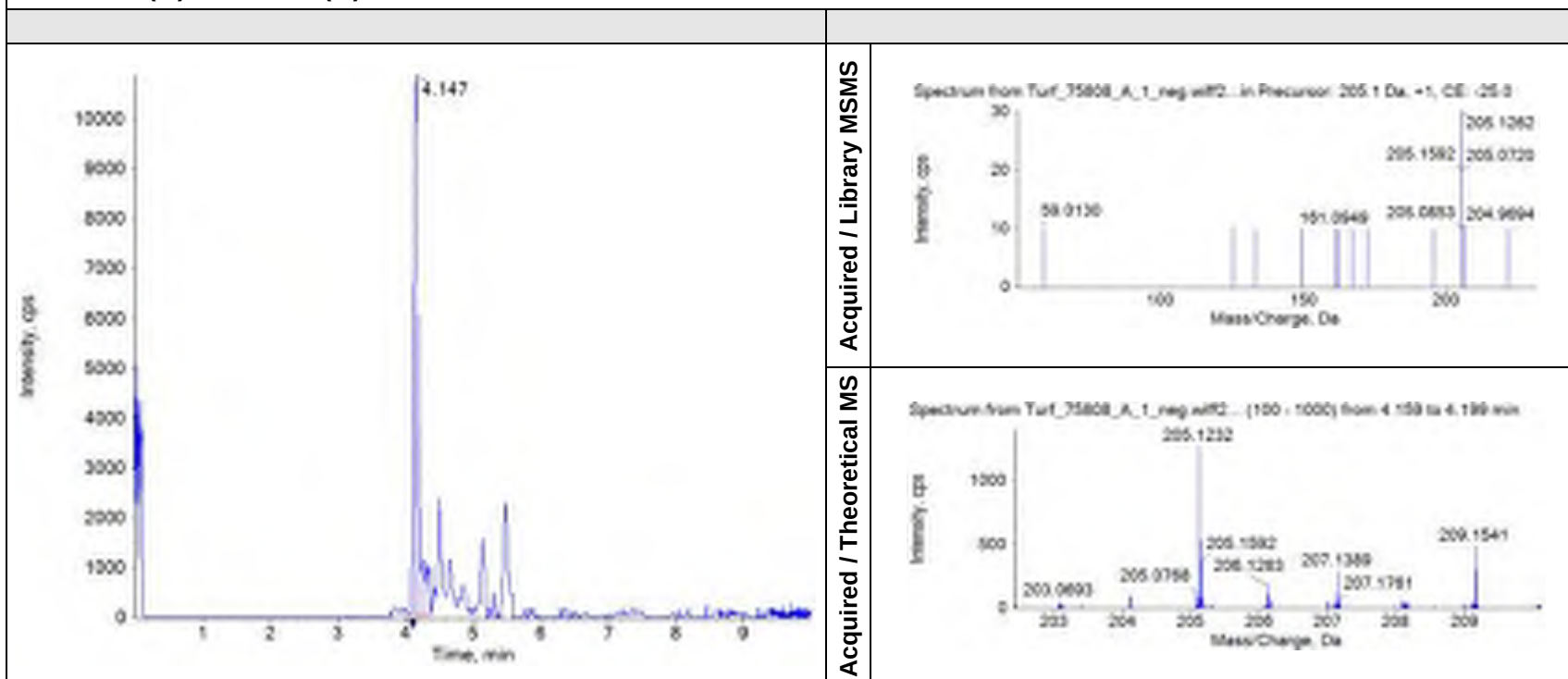
Retention Time: 4.15 minutes

Precursor m/z : 205.1234

Fit (%) N/A RFit (%) N/A

Analyte Name:

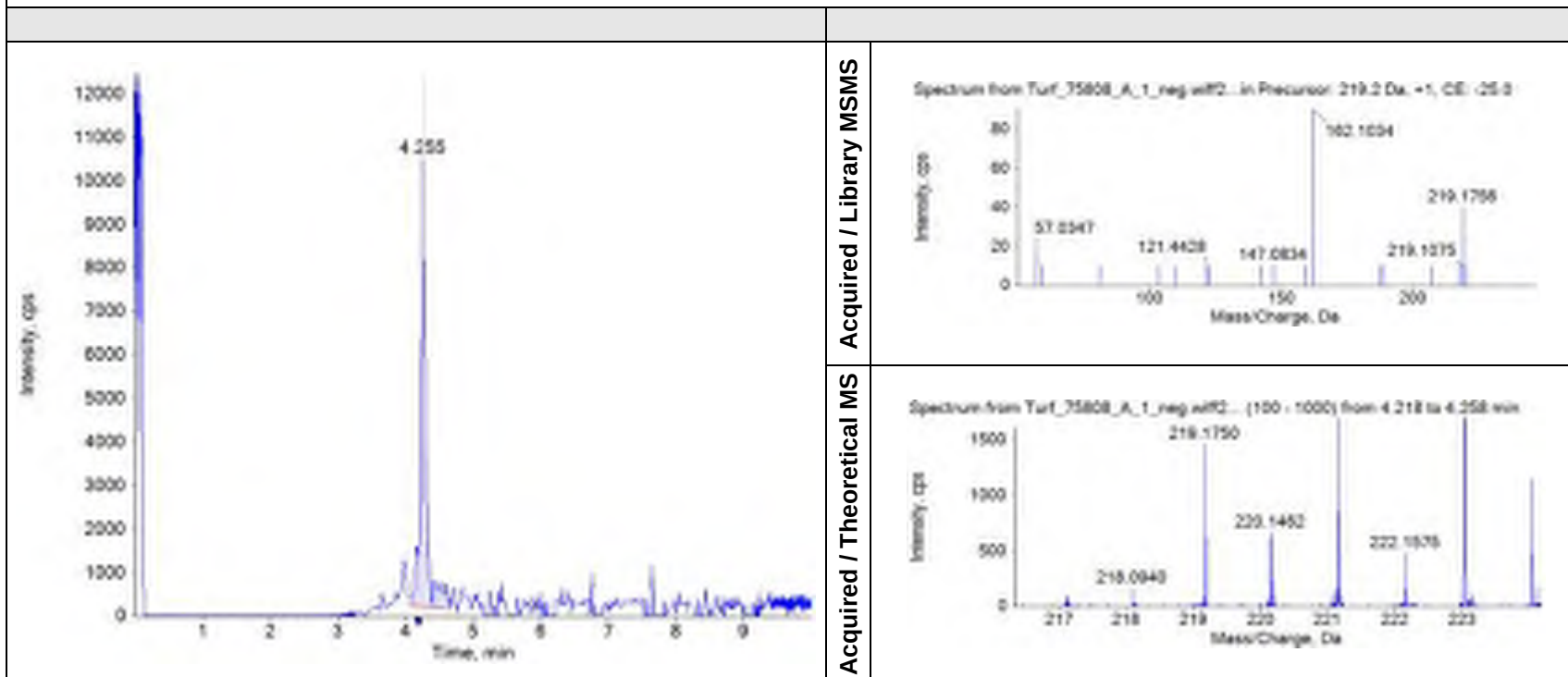
205.1223 / 4.10 [M-H₂O-H]-



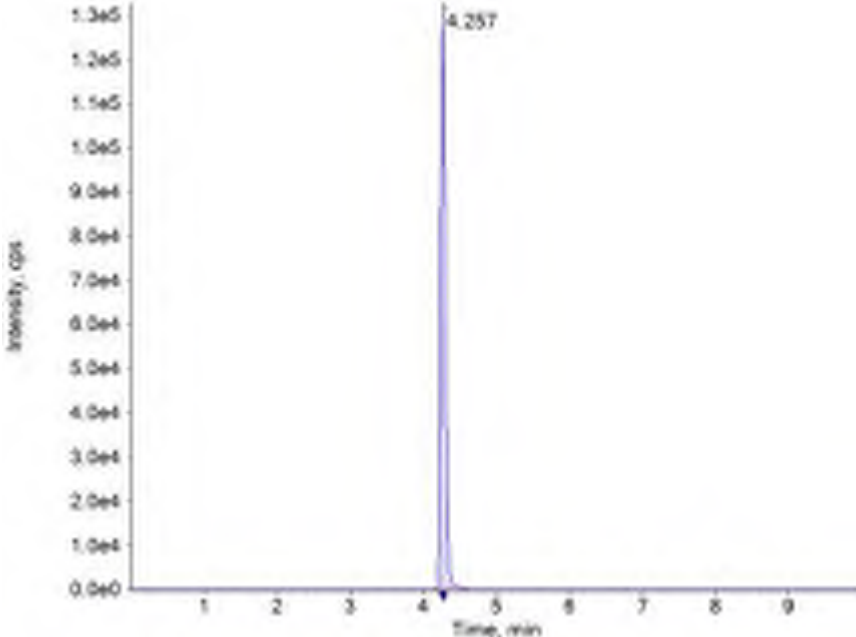
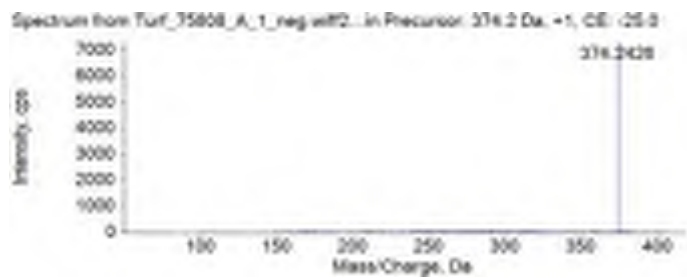
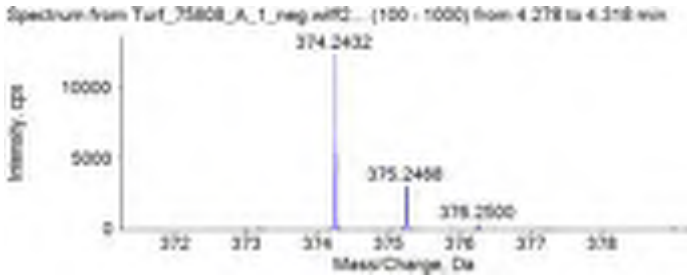
3. 219.1744 / 4.18 (Library/Formu

Retention Time: 4.25 minutes
Precursor m/z : 219.1755
Fit (%) N/A RFit (%) N/A

Analyte Name:
219.1744 / 4.18



4. 374.2429 / 4.26 (Library/Formu

Retention Time: 4.26 minutes Precursor m/z : 374.2440 Fit (%) N/A RFit (%) N/A		Analyte Name: 374.2429 / 4.26	
		Acquired / Library MSMS	
		Acquired / Theoretical MS	
			

5. 183.1378 / 4.33 (Library/Formula)

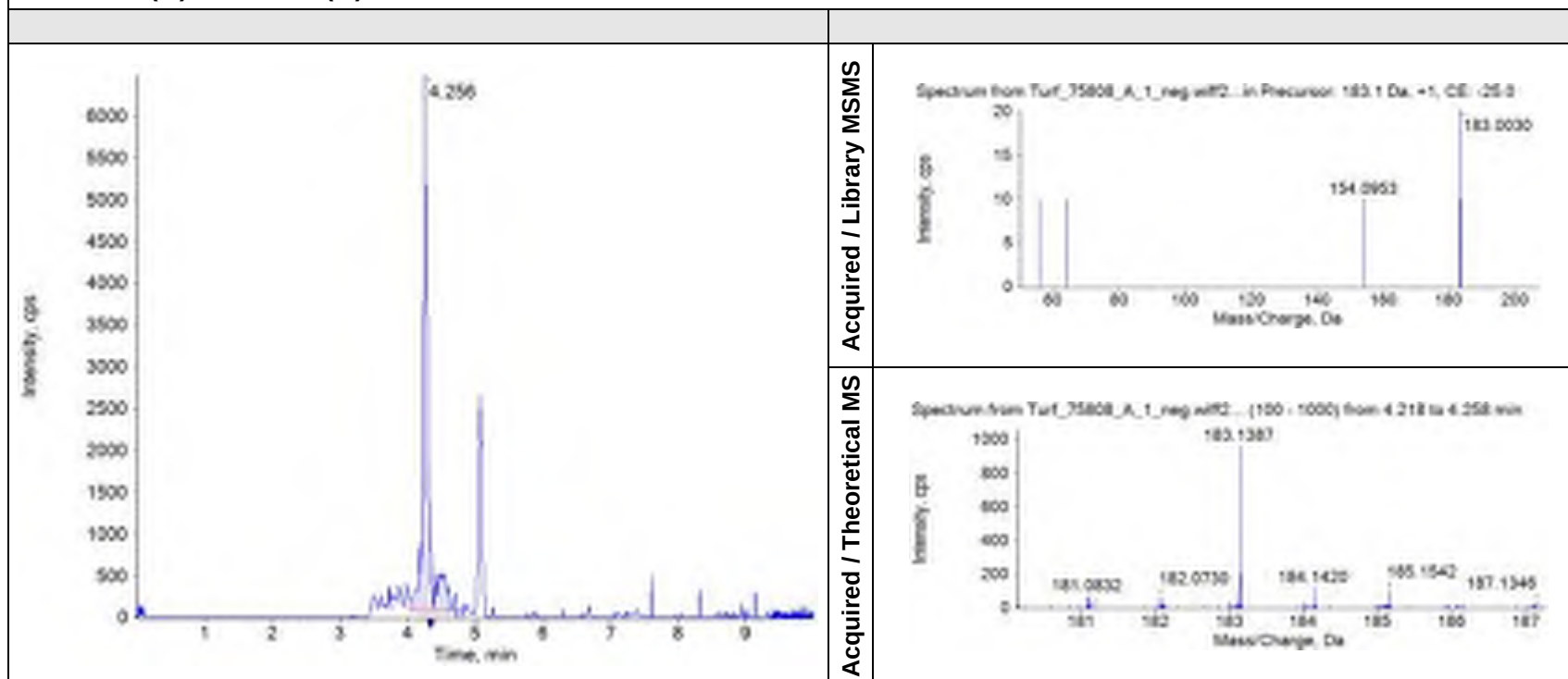
Retention Time: 4.26 minutes

Precursor m/z : 183.1389

Fit (%) N/A RFit (%) N/A

Analyte Name:

183.1378 / 4.33



6. Bis(2,2,3,3,4,4,4-heptafluorobutyl) carbonate (Library/Formula)

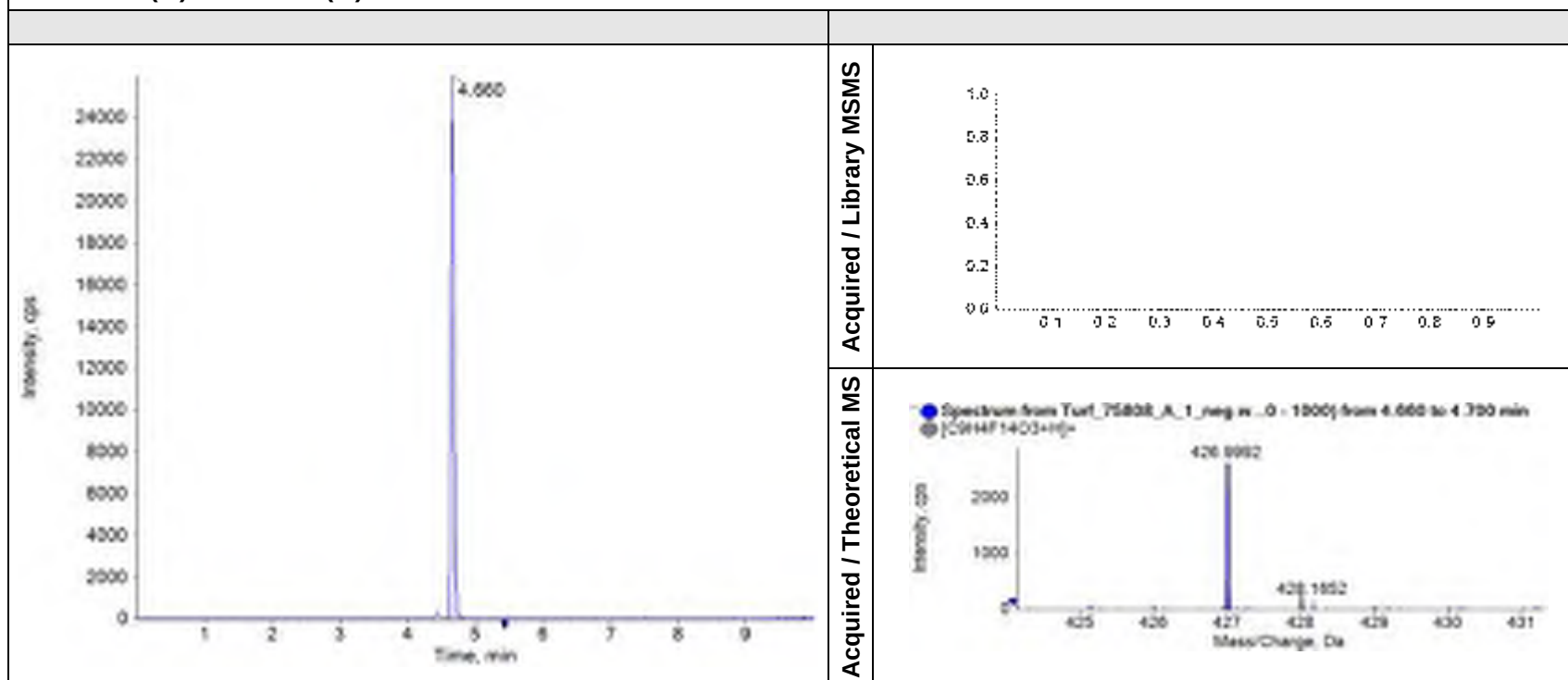
Retention Time: 4.66 minutes

Precursor m/z : 427.0010

Fit (%) N/A RFit (%) N/A

Analyte Name:

Bis(2,2,3,3,4,4,4-heptafluorobutyl)
carbonate



7. 249.1520 / 4.75 (Library/Formula)

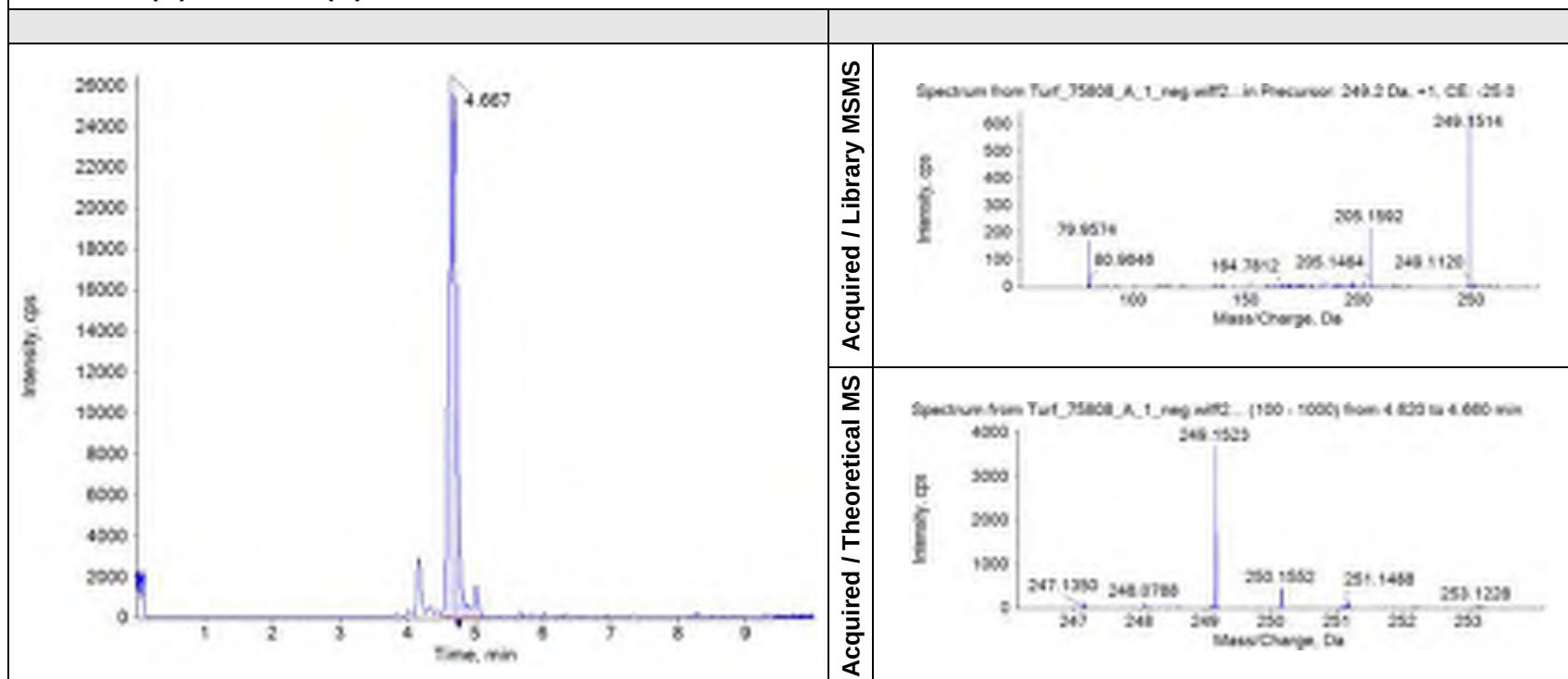
Retention Time: 4.67 minutes

Precursor m/z : 249.1531

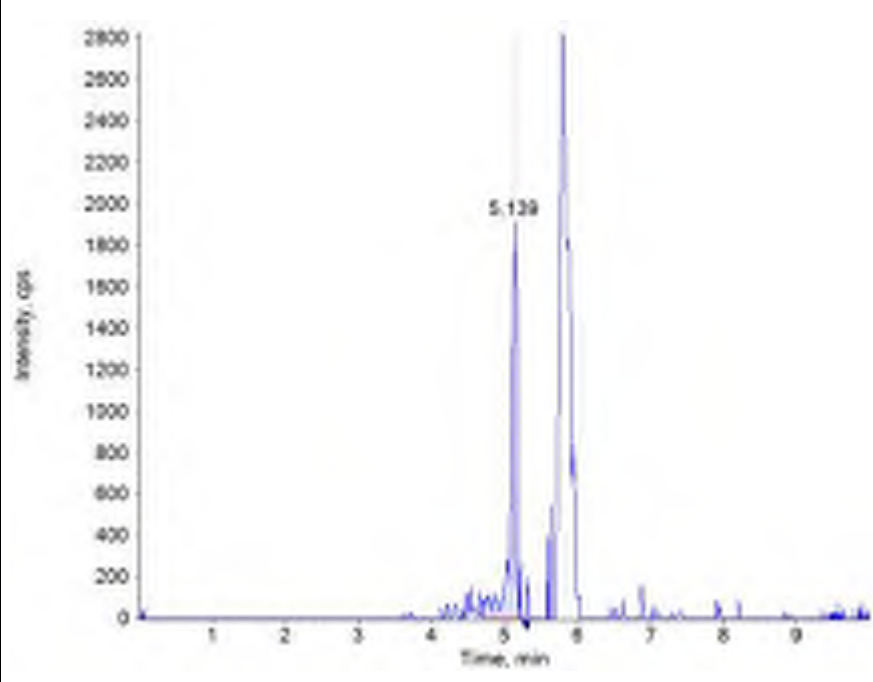
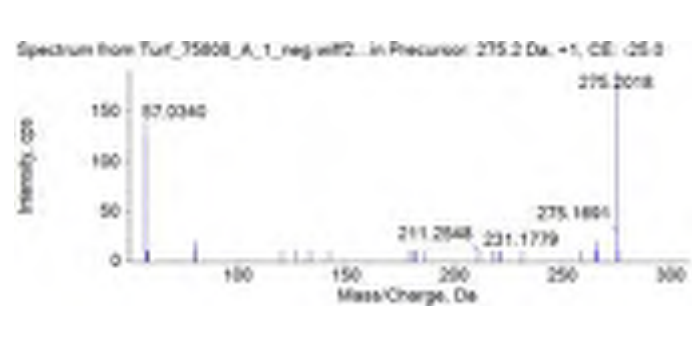
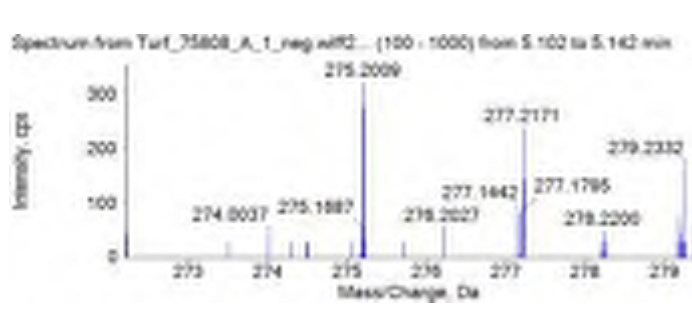
Fit (%) N/A RFit (%) N/A

Analyte Name:

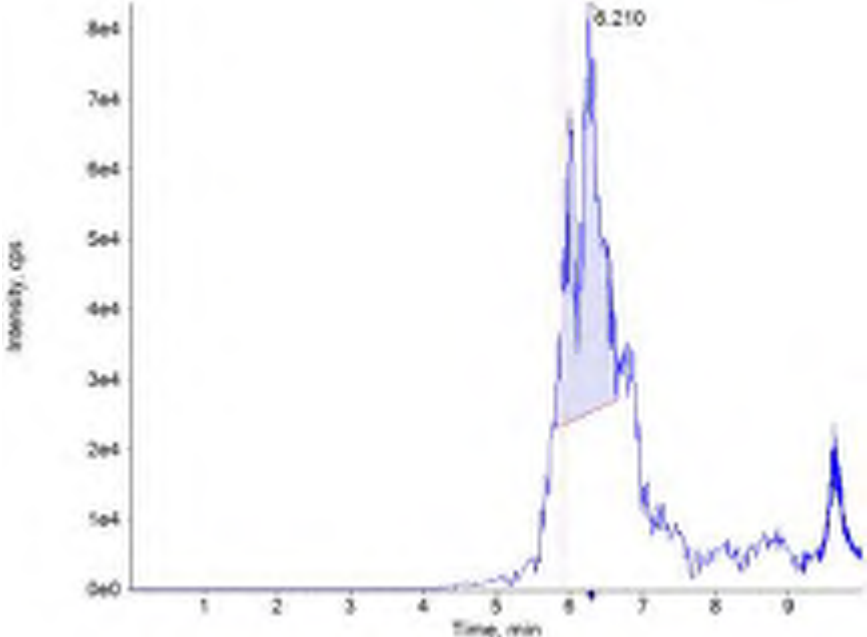
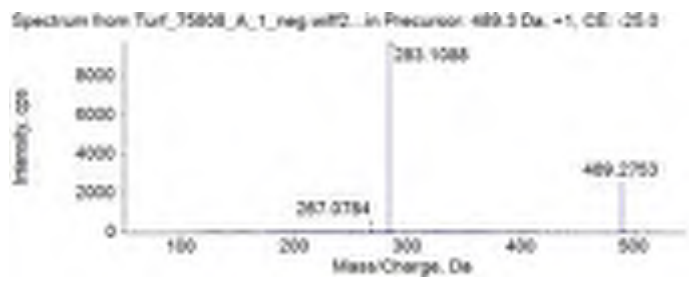
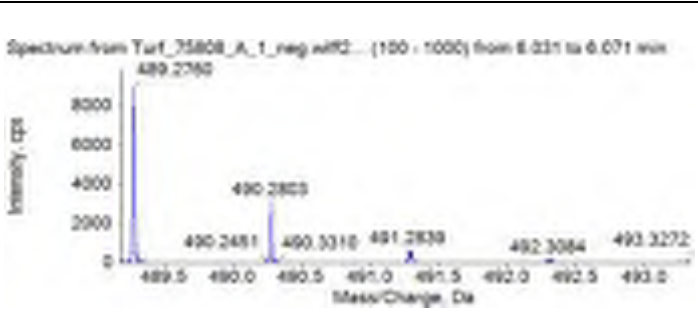
249.1520 / 4.75



8. 275.1998 / 5.29 (Library/Formula)

Retention Time: 5.14 minutes Precursor m/z : 275.2009 Fit (%) N/A RFit (%) N/A Analyte Name: 275.1998 / 5.29			
	Acquired / Library MSMS		
			

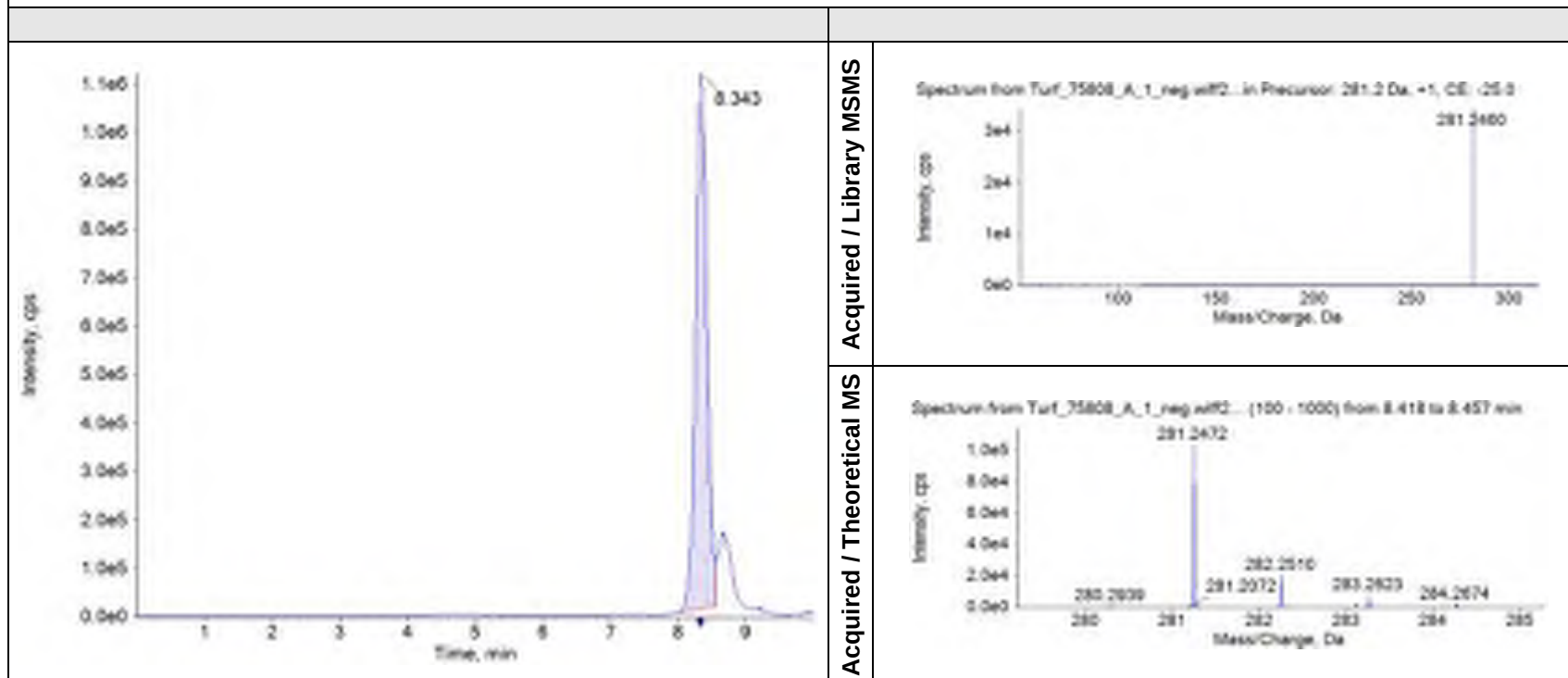
9. 489.2754 / 6.29 [M+Cl]⁻ (Library/Formula) ● ●

Retention Time: 6.21 minutes Precursor m/z : 489.2765 Fit (%) N/A RFit (%) N/A		Analyte Name: 489.2754 / 6.29 [M+Cl]⁻	
	Acquired / Library MSMS	Spectrum from Turf_75808_A_1_neg.wiff2... in Precursor: 489.3 Da, +1, CE: 25.0 	
		Spectrum from Turf_75808_A_1_neg.wiff2... (100 : 1000) from 6.031 to 6.071 min 	

10. 281.2470 / 8.32 (Library/Formula)

Retention Time: 8.34 minutes
Precursor m/z : 281.2481
Fit (%) N/A RFit (%) N/A

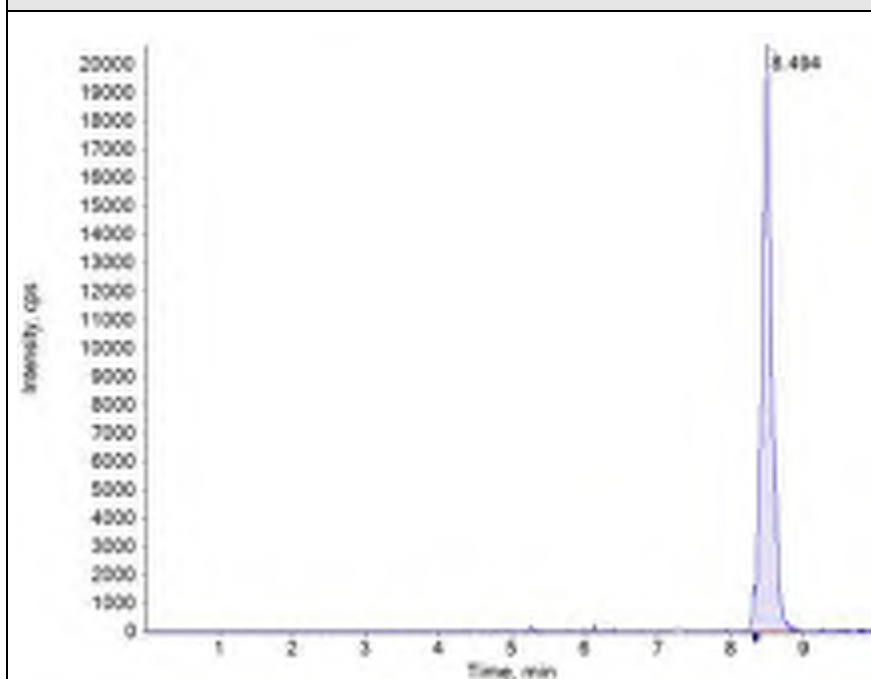
Analyte Name:
281.2470 / 8.32



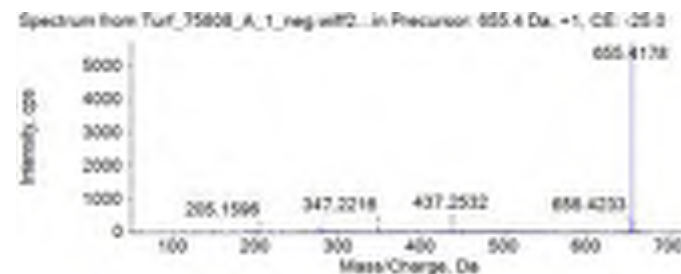
11. 655.4394 / 8.34 (Library/Formula)

Retention Time: 8.49 minutes
Precursor m/z : 655.4405
Fit (%) N/A RFit (%) N/A

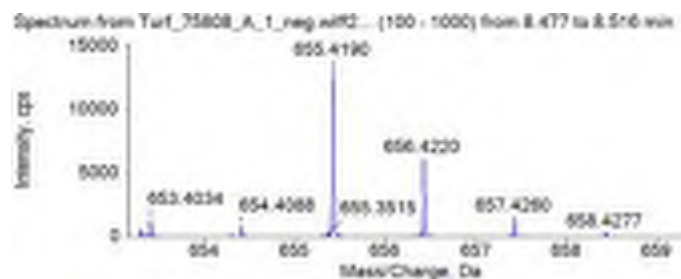
Analyte Name:
655.4394 / 8.34



Acquired / Library MSMS



Acquired / Theoretical MS



12. 489.2597 / 8.85 (Library/Formula)

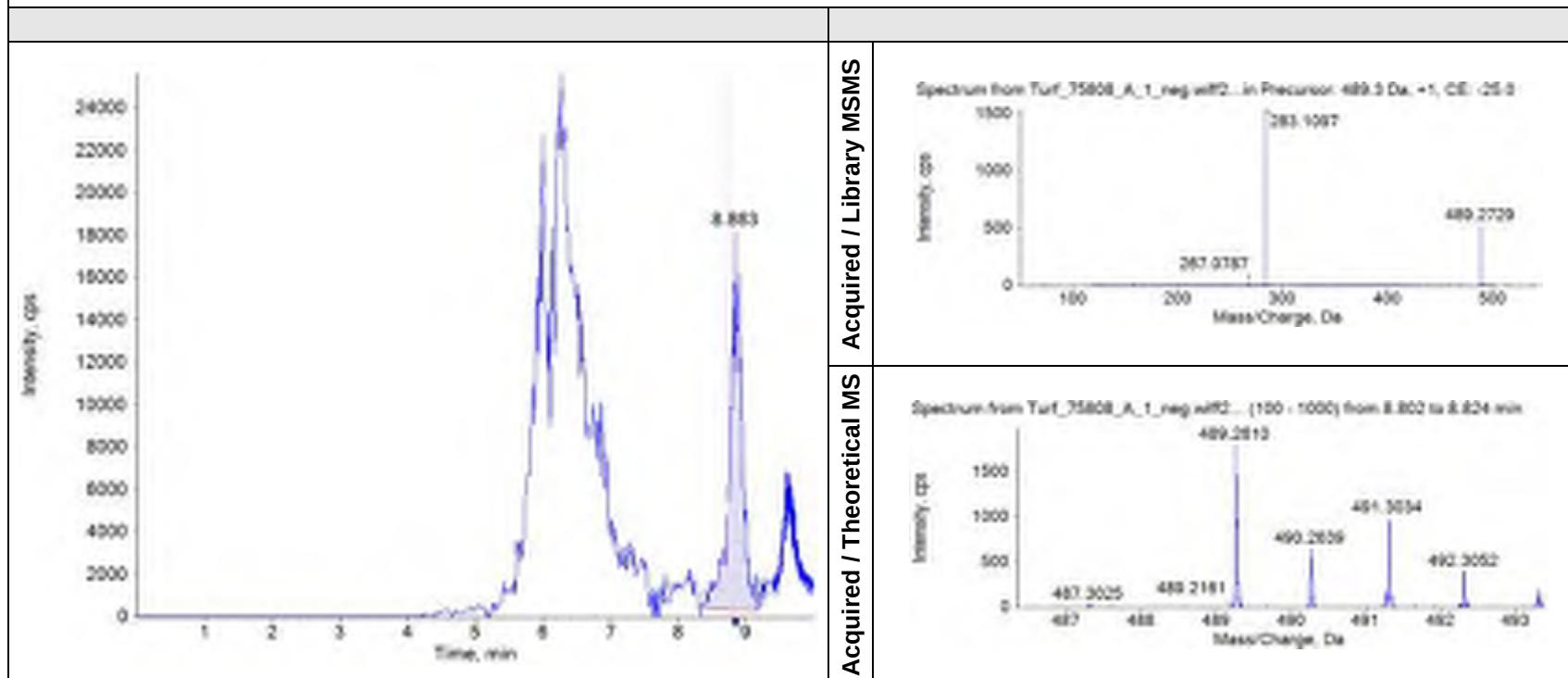
Retention Time: 8.86 minutes

Precursor m/z : 489.2608

Fit (%) N/A RFit (%) N/A

Analyte Name:

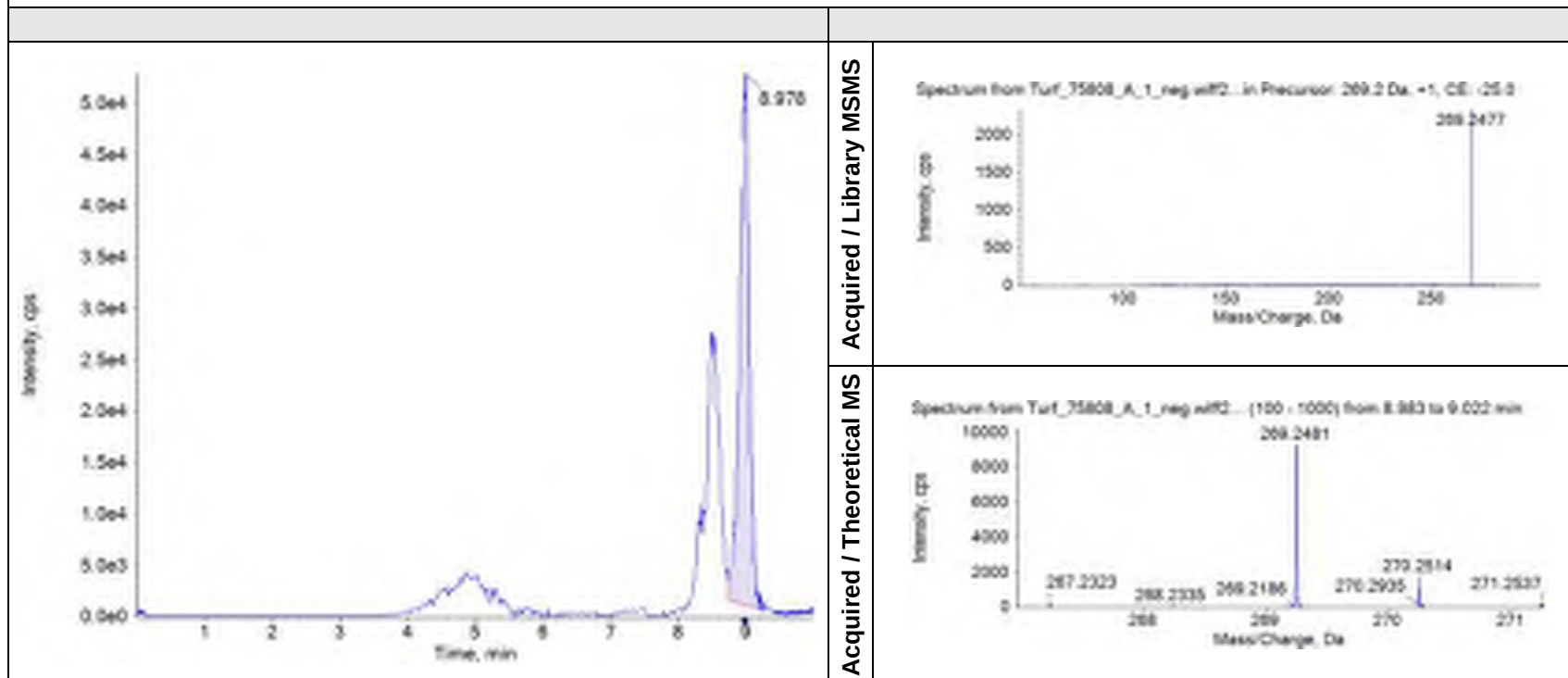
489.2597 / 8.85



13. 269.2478 / 8.98 (Library/Formula)

Retention Time: 8.98 minutes
Precursor m/z : 269.2489
Fit (%) N/A RFit (%) N/A

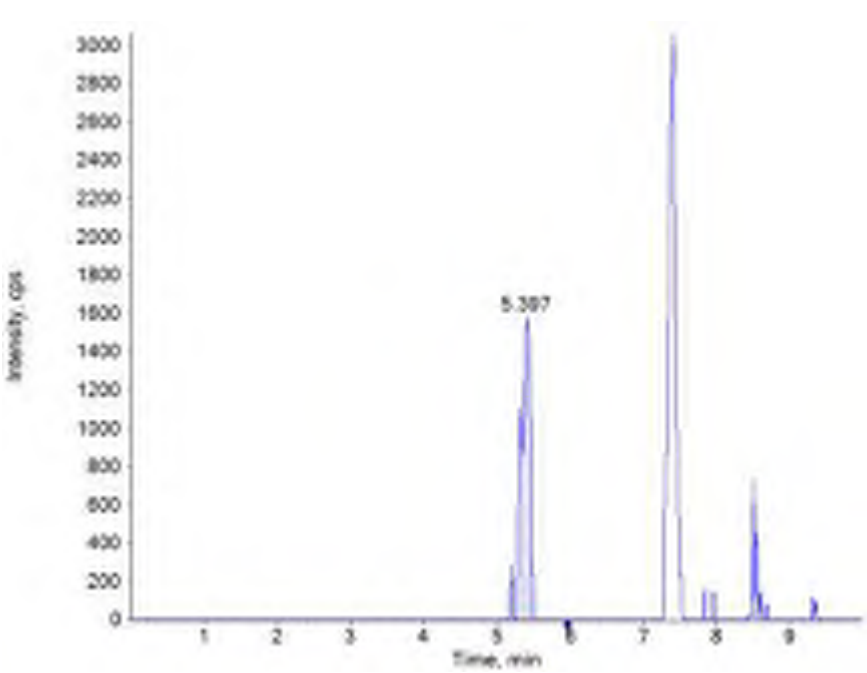
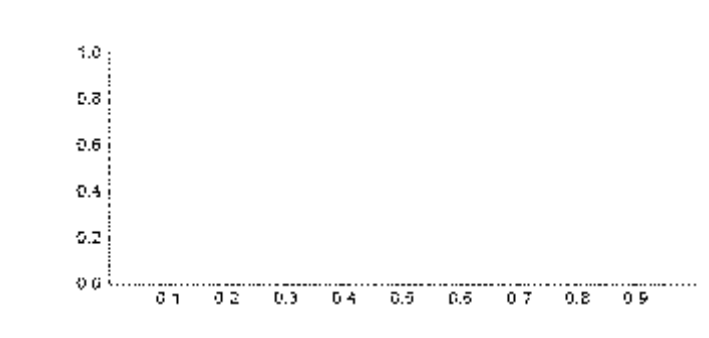
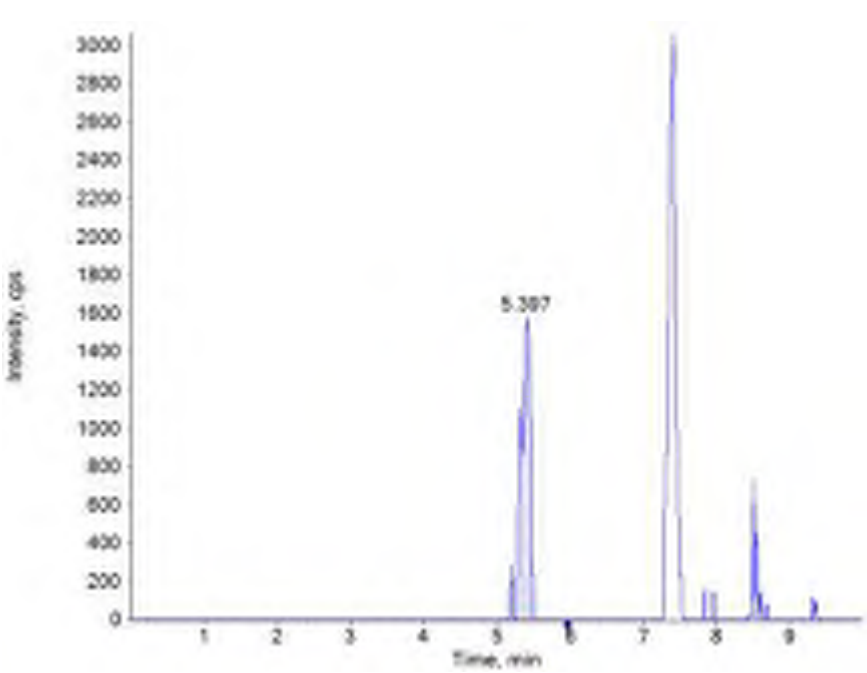
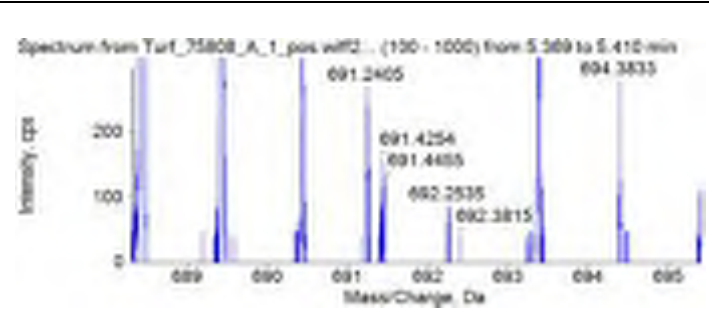
Analyte Name:
269.2478 / 8.98



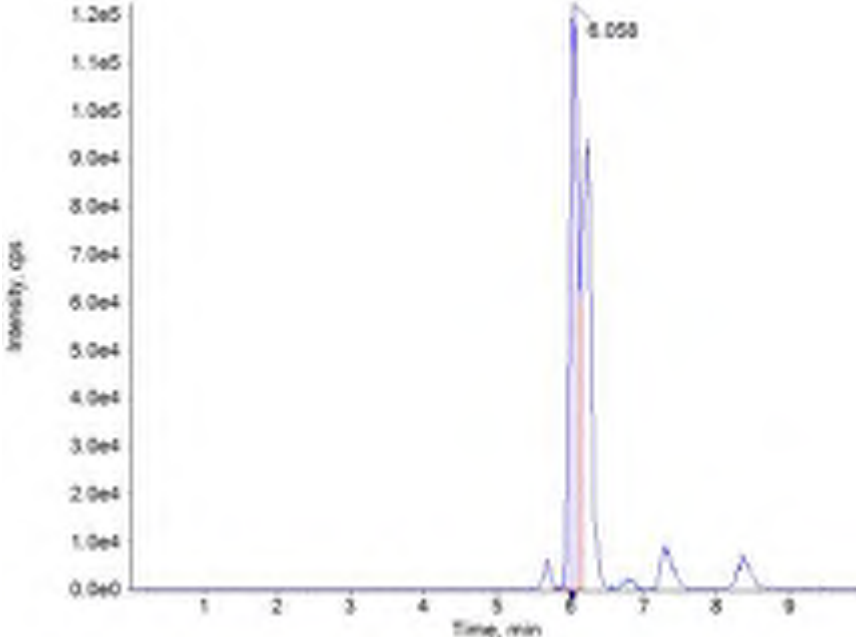
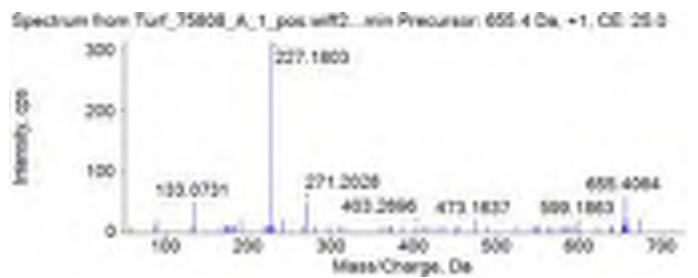
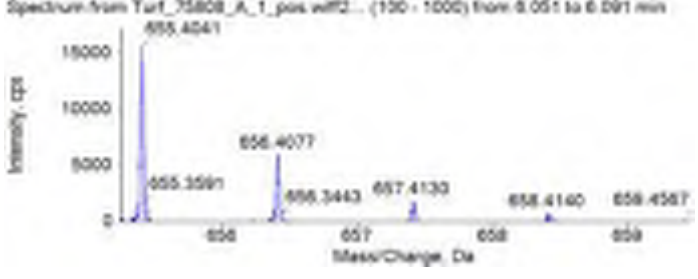
Compounds chromatographs and mass spectra for sample “75808_pos” acquired in positive polarity

1. 691.2397 / 5.96 (Library/Formu



Retention Time: 5.40 minutes Precursor m/z : 691.2408 Fit (%) N/A RFit (%) N/A		Analyte Name: 691.2397 / 5.96	
		Acquired / Library MSMS	
		Acquired / Theoretical MS	Spectrum from Turt_75808_A_1_pos.wiff2... (150 - 1000) from 5.369 to 5.410 min 

2. 655.4038 / 6.03 (Library/Formula) ● ●

Retention Time: 6.06 minutes Precursor m/z : 655.4049 Fit (%) N/A RFit (%) N/A		Analyte Name: 655.4038 / 6.03	
		Acquired / Library MSMS	
		Acquired / Theoretical MS	

3. 177.0971 / 9.41 (Library/Formula)



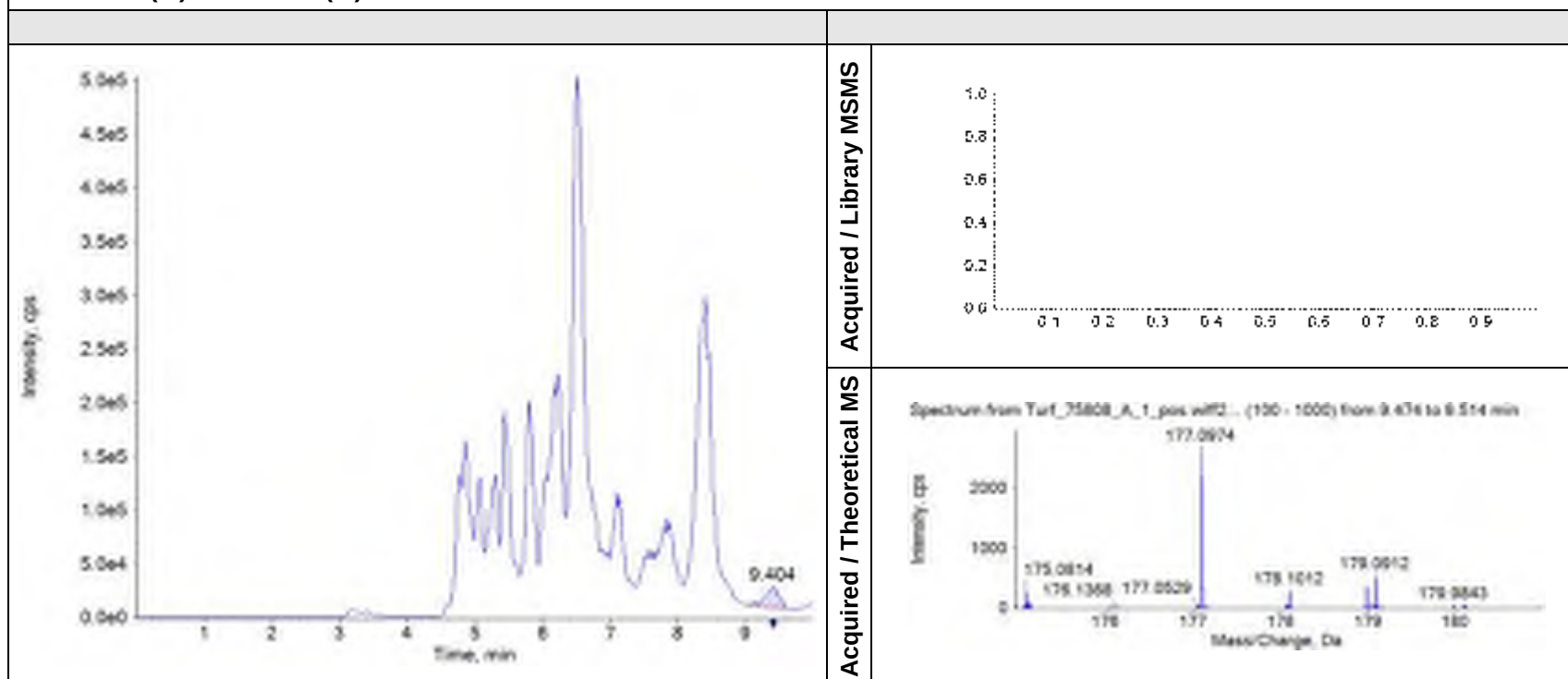
Retention Time: 9.40 minutes

Precursor m/z : 177.0982

Fit (%) N/A RFit (%) N/A

Analyte Name:

177.0971 / 9.41



410-76735-1

Table 4. NTA results for sample “76935_Neg” acquired in negative polarity

S.N.	Compound Formula	Compound name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{452.33572}	unknown	1.94E+04	3.33	[M-H]-	451.329	451.3278	-2.66
2	{213.06473}	unknown	1.03E+05	3.42	[M-H]-	212.058	212.0572	-3.77

Table 5. NTA results for sample “76935_Pos” acquired in positive polarity

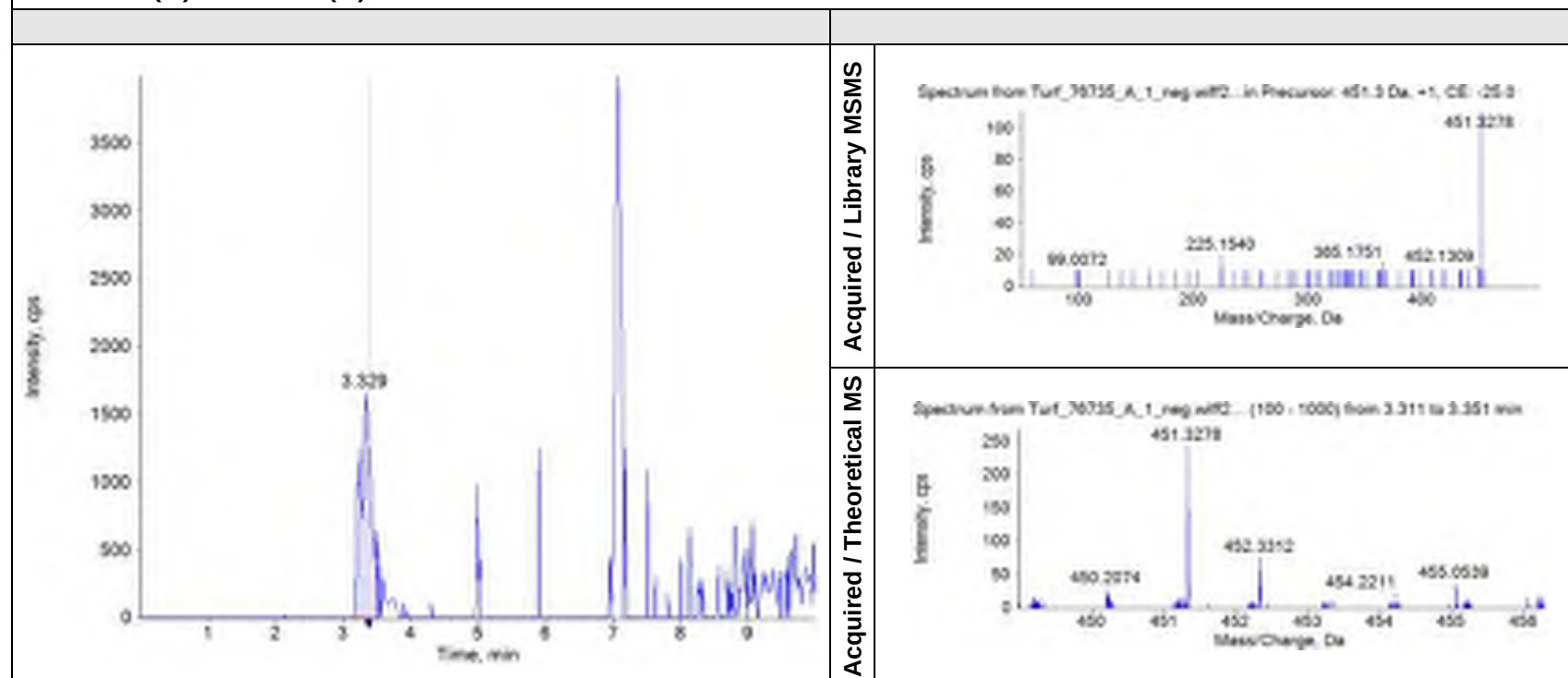
S.N.	Compound Formula	Compound name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{705.45637}	unknown	4.70E+04	5.62	[M-H]-	704.4496	704.4505	1.28

Compounds chromatographs and mass spectra for sample “76735_neg” acquired in negative polarity

1. 451.3279 / 3.37 [M-H]⁻ (Library/Formula) ● ●

Retention Time: 3.33 minutes
Precursor m/z : 451.3290
Fit (%) N/A RFit (%) N/A

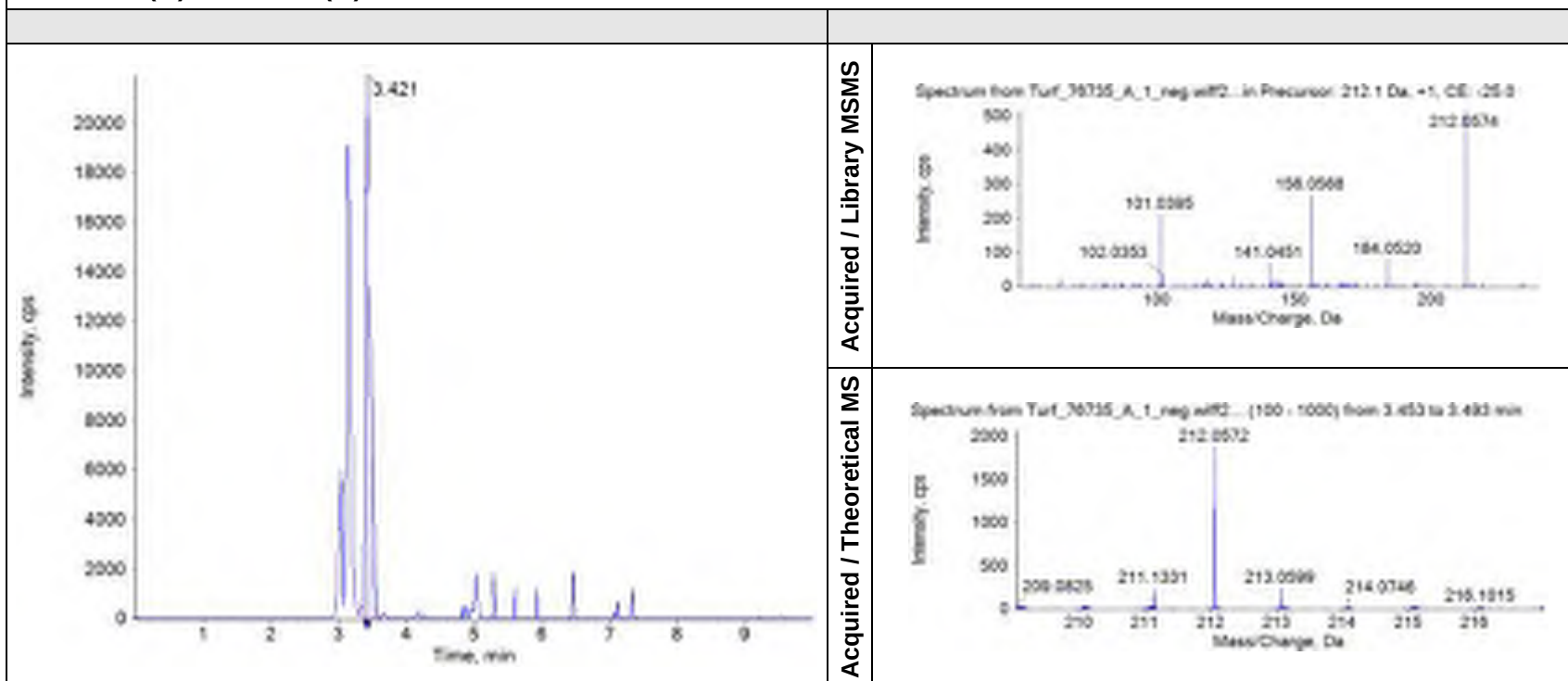
Analyte Name:
451.3279 / 3.37 [M-H]⁻



2. 212.0569 / 3.41 (Library/Formu

Retention Time: 3.42 minutes
Precursor m/z : 212.0580
Fit (%) N/A RFit (%) N/A

Analyte Name:
212.0569 / 3.41



Compounds chromatographs and mass spectra for sample "76735_pos" acquired in positive polarity

1. 704.4485 / 5.47 (Library/Formula)



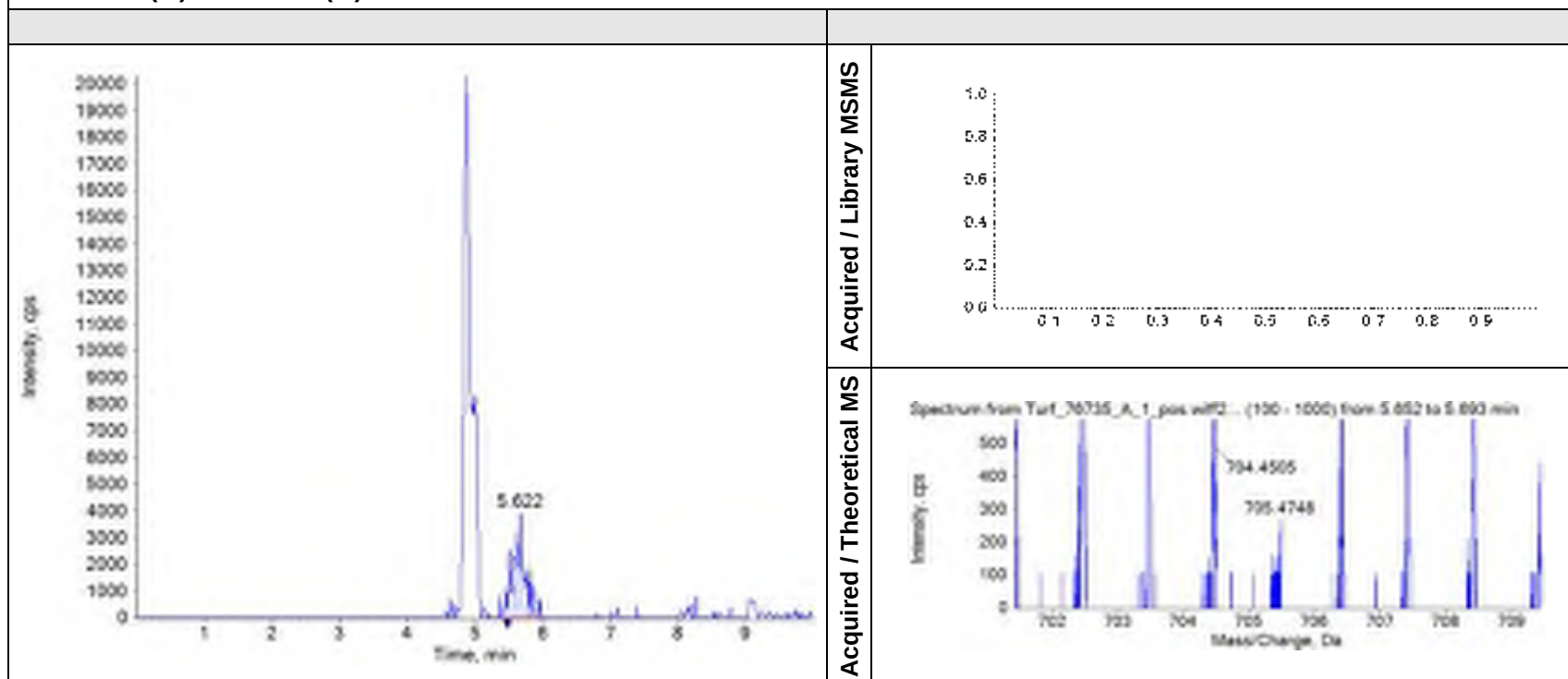
Retention Time: 5.62 minutes

Precursor m/z : 704.4496

Fit (%) N/A RFit (%) N/A

Analyte Name:

704.4485 / 5.47



410-76903-1

Table 6. NTA results for sample “76903_Neg”

S.N.	Compound Formula	Compound name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{224.14073}	unknown	1.03E+05	4.12	[M-H ₂ O-H]-	205.1234	205.1223	-5.36
2	{300.20708}	unknown	8.39E+04	5.38	[M-H]-	299.2004	299.2	-1.34

Table 7. NTA results for sample “76903_Pos”

S.N.	Compound Formula	Compound name	Area	Retention Time	Adduct / Charge	Precursor Mass	Found At Mass	Mass Error (ppm)
1	{312.27000}	unknown	7.44E+04	9.15	[M-H]-	311.2633	311.2631	-0.642543238
2	{240.13271}	unknown	1.87E+04	5.91	[M-H]-	239.126	239.1265	2.090943496
3	{243.23080}	unknown	1.13E+04	5.64	[M-H]-	242.2241	242.2248	2.889877502

Compounds chromatographs and mass spectra for sample “76903_neg” acquired in negative polarity

1. 205.1223 / 4.10 [M-H₂O-H]- (Library/Formula)

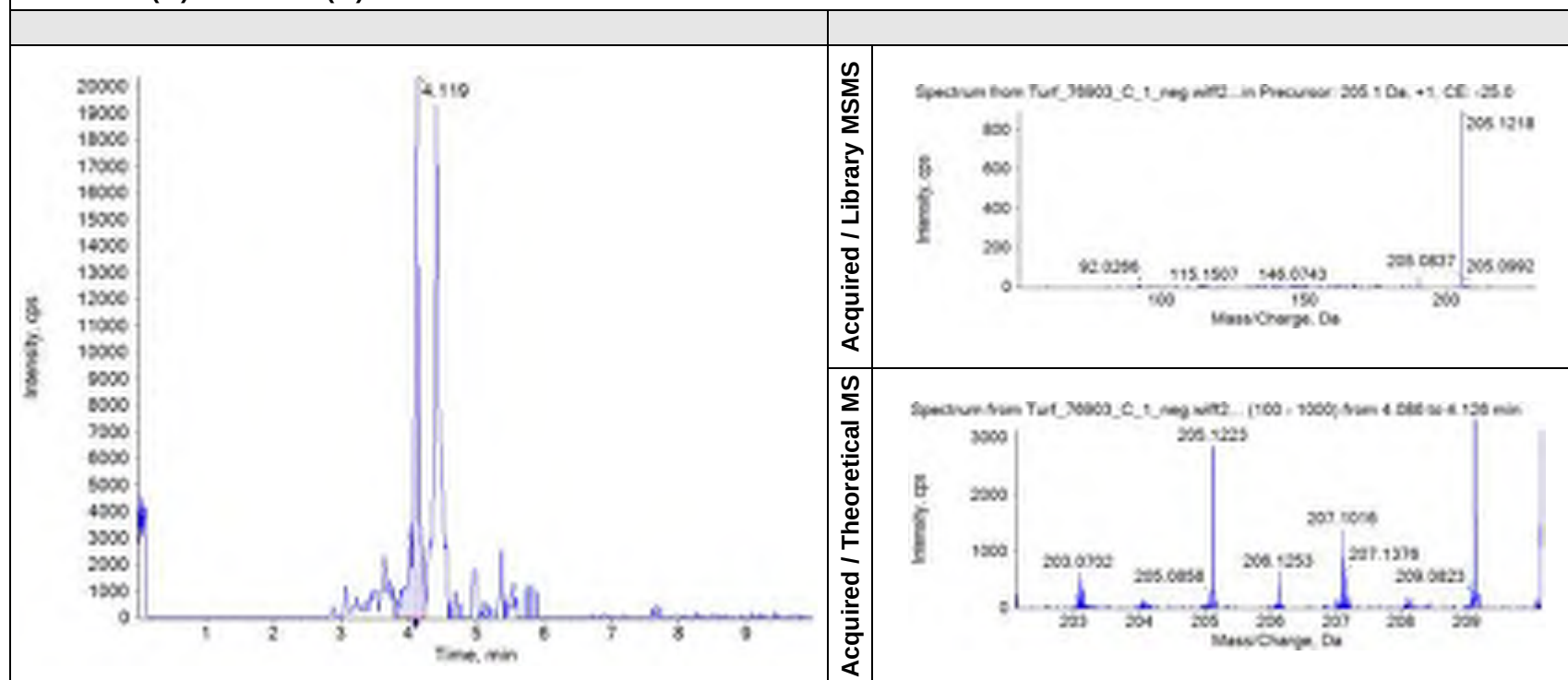
Retention Time: 4.12 minutes

Precursor m/z : 205.1234

Fit (%) N/A RFit (%) N/A

Analyte Name:

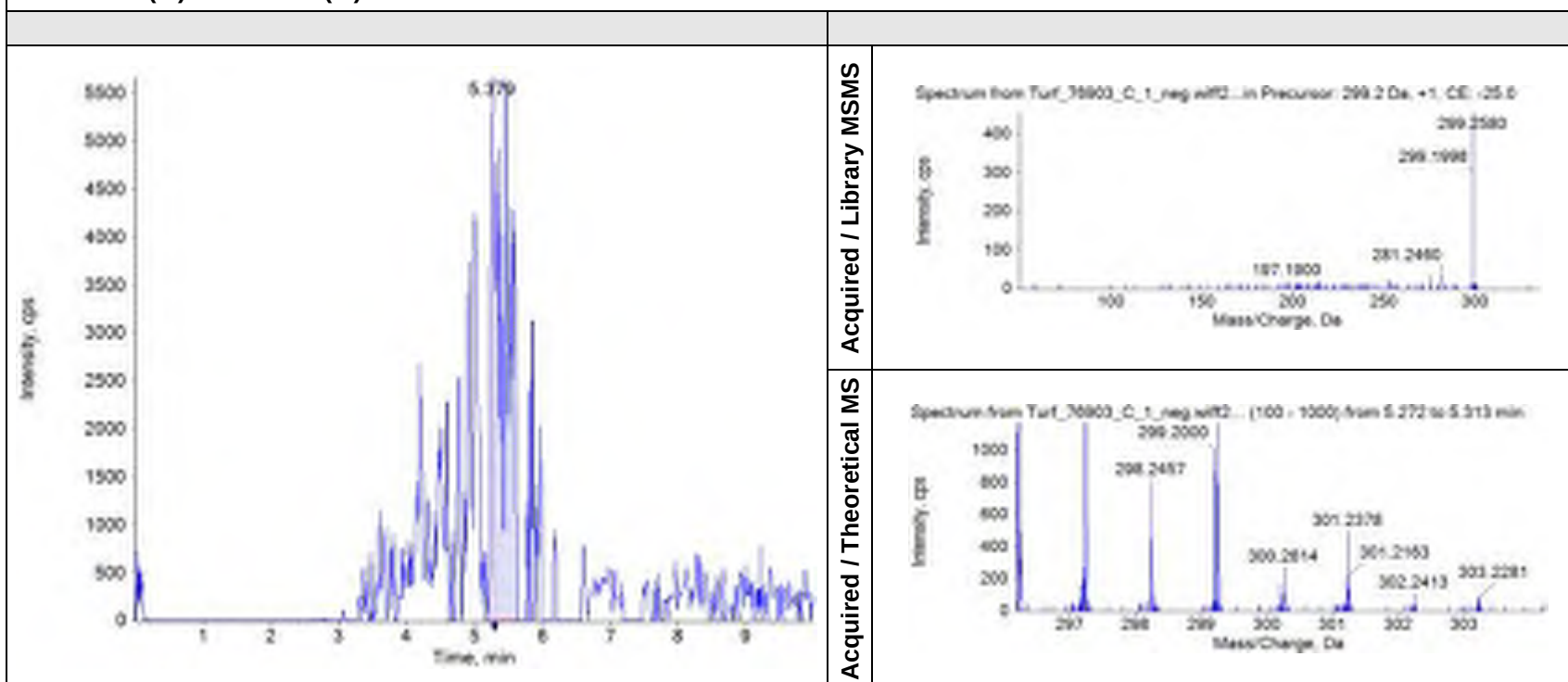
205.1223 / 4.10 [M-H₂O-H]-



2. 299.1993 / 5.29 [M-H]- (Library/Formula)

Retention Time: 5.38 minutes
Precursor m/z : 299.2004
Fit (%) N/A RFit (%) N/A

Analyte Name:
299.1993 / 5.29 [M-H]-



Compounds chromatographs and mass spectra for sample "76735_pos" acquired in positive polarity

1. 311.2622 / 9.14 (Library/Formula)

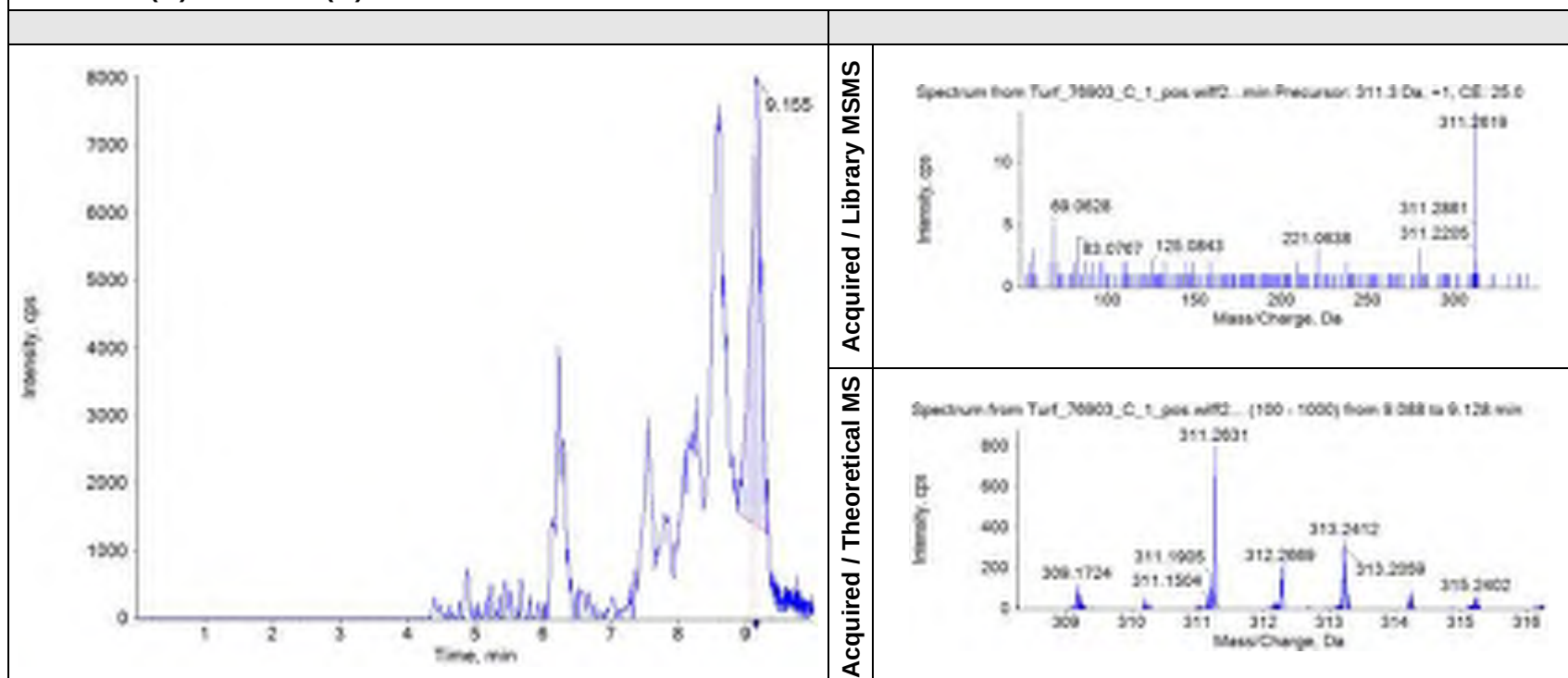
Retention Time: 9.15 minutes

Precursor m/z : 311.2633

Fit (%) N/A RFit (%) N/A

Analyte Name:

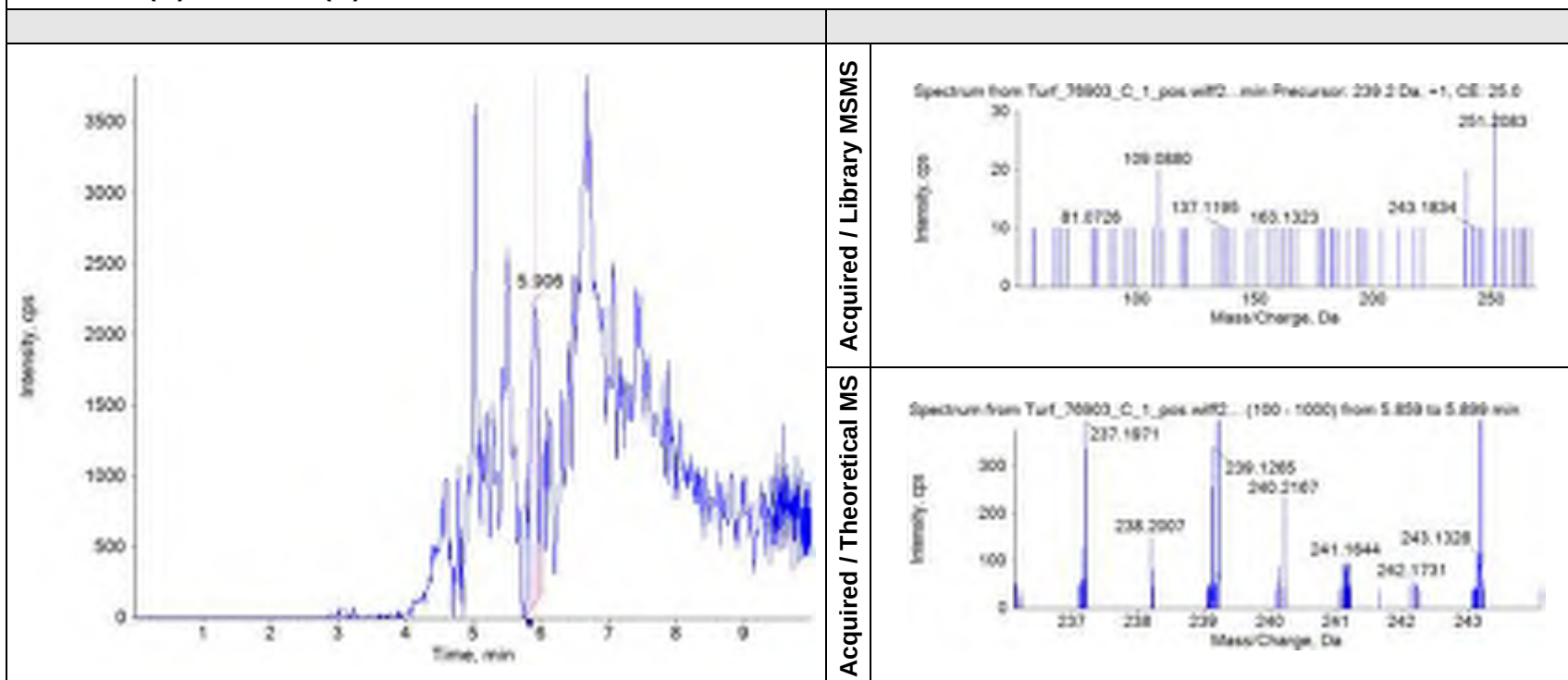
311.2622 / 9.14



2. 239.1249 / 5.82 (Library/Formula)

Retention Time: 5.91 minutes
Precursor m/z : 239.1260
Fit (%) N/A RFit (%) N/A

Analyte Name:
239.1249 / 5.82

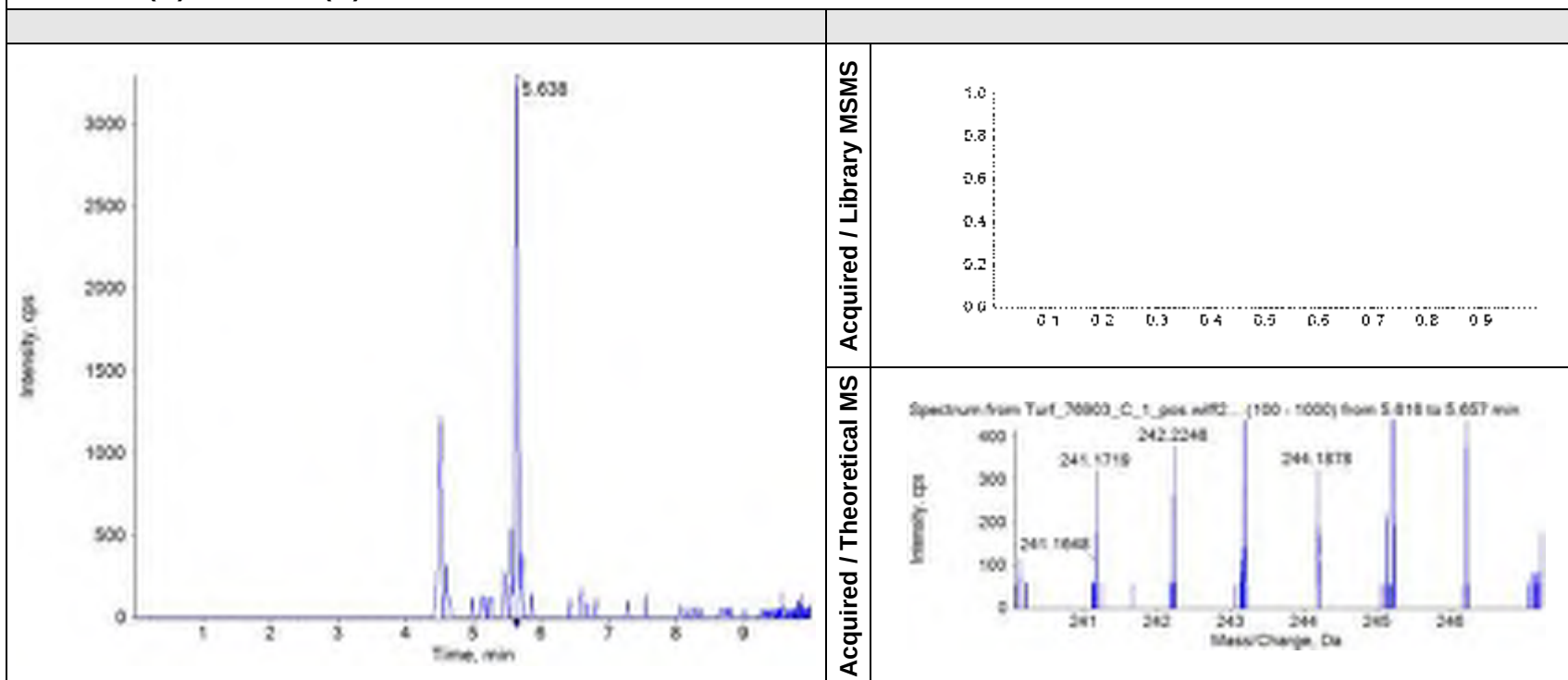


3. 242.2230 / 5.63 (Library/Formula)



Retention Time: 5.64 minutes
Precursor m/z : 242.2241
Fit (%) N/A RFit (%) N/A

Analyte Name:
242.2230 / 5.63



General Conclusion

Most of the compounds screened after NTA appeared as $[M-H]^-$, which indicate a loss of hydrogen after dissociation in water. This indicate the presence of either a carboxylic or sulfonic acid functional group in the backbone of the compounds.

Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH

Blaine Cox

University of New Hampshire

Executive Director

Facilities Operations & Maintenance

- Do you happen to have any details you would be willing to share including costs, scope of maintenance, and products that you use in your field maintenance?
 - o Two totally different surfaces and scopes of maintenance.
 - o Equipment is totally different for Turf.
 - o UNH has all the lines stitched in rather than repainting (materials and labor).
 - o Multi-use
 - Football
 - Lacrosse
 - Soccer
 - Field Hockey (specific turf at the Whit)... very short
- Does the university perform the maintenance on any of the fields or is there a contractor that performs regular maintenance?
 - o UNH is all artificial.
 - Hard to keep grass during playing seasons.
 - GMax testing required for turf.
 - Loss of infill due to winter clearing and regular use requires it to be brushed more frequently than a high school may be.
 - Use of the Turf field earlier in the year versus grass. Example is a Lacrosse home game on February 19th.
 - No disinfection of the fields at UNH.
 - UNH does up to three practices a day plus games.
 - Brush field once every two weeks.
 - One hour daily on turf... grass seed cost have increased.
- Do you consider the migration to Artificial Turf a net positive for concussions?
 - o Yes.
 - o UNH operates under the direction of sustainable projects and given turf uses less pesticides it meets that criteria.
 - o UNH has replaced their turf with RAD Sports (same contractor that UMass used on the Rec field).
 - o UNH believes the turf is recyclable. (would need to confirm with Mark Guether).
- How does the maintenance of natural grass compare to the maintenance of artificial turf (\$ to \$)?
 - o No grass fields remain for competitive sports. One field for club rugby.
- Do you put any restrictions on use of your fields or put in any scheduled rest periods when fields lie dormant from athletic activity?
 - o No.
- Have you had any playability issues with any of the fields?
 - o Only issue that arose is on the field hockey field that needs to be watered. Watered before at half and after.

- Have you gone through a resurfacing of any of the turf fields yet? If so, was the surface recycled or repurposed in any particular way?
 - o They believe it was.
- Were there any concerns raised from students, athletes or the community about PFAS when deciding to install the artificial grass?
 - o No.
- Do you have any data supporting the safety of one surface over another in regards to youth sports and injuries?
 - o Would have to check with DH&S.



Picture of UNH Tucker Field turf April 4, 2024. They played a home game at UNH On April 6th (two days later).

See 2025 schedule below with the earliest game being played on February 8, 2025 (H: 33 deg, L: 17 deg).

DATE	CONFERENCE	OPPONENT	LOCATION
2/8/2025		Marist	Durham, N.H.
2/15/2025		at Brown	Providence, R.I.
2/18/2025		at Dartmouth	Hanover, N.H.
2/22/2025		at Quinnipiac	Hamden, Conn.
3/1/2025		at Merrimack	North Andover, Mass.
3/5/2025		at Sacred Heart	Fairfield, Conn.
3/12/2025		Boston U.	Durham, N.H.
3/16/2025	*	at UMass Lowell	Lowell, Mass.
3/21/2025	*	UMBC	Durham, NH
3/29/2025	*	Bryant	Durham, N.H.
3/31/2025		Cornell	Durham, N.H.
4/5-4/2025	*	at UAlbany	Albany, N.Y.
4/12/2025	*	at Vermont	Burlington, VT
4/19/2025	*	Binghamton	Durham, N.H.
4/22/2025		at Harvard	Cambridge, Mass.

- Field hockey pad and carpet recently replaced: \$1 million.

Artificial Turf versus Natural Grass Workshop - City Council City of Dover, NH

Mark Geuther

University of New Hampshire

Director , Facilities Project Management

Facilities Operations & Maintenance

Comment: You probably know that Tighe & Bond was the engineering firm on all three of our most recent synthetic turf replacements.

- During the design process for a replacement field surface, did you or your engineers specify that the old turf surface being removed was to be recycled? If so, did you receive confirmation that it was recycled? *We did recycle the turf from Mooradian Field, but I have no documentation. We would be more aggressive in documenting in the future.*
- Did UNH repurposed old turf in any particular way rather than recycling it? *We did “donate” a small quantity of the turf to the City of Rochester Rec Dept. (could have been Rochester baseball, which might be outside the Rec Dept) for batting cage surface.*
- Do you recall any concerns raised from students, athletes, parents, or the community about PFAS when deciding to install the artificial grass? *None that I am aware of.*
- Do you have any data supporting the safety of one surface over another in regards to injuries? *None that I am aware of. Athletics may have done research. As you likely are aware, the City of Dover doesn't have the staff (nor does UNH) to maintain a natural grass fields. We have a hard enough time keeping up with the synthetic turf maintenance. However, the impression should not be given that synthetic fields are maintenance free and never have to be replaced. I hope the City/SAU is planning on the maintenance and replacement in future budgets.*

The contractor we have used on the football and soccer/lacrosse fields was RAD Sports. They install both synthetic and natural grass fields, they would be an excellent resource in my opinion. I have attached contact information for the principals if you are interested in reaching out.



AstroTurf Products Are Not Manufactured with PFAS

PFAS have become an increasingly debated topic with contamination now commonly found in groundwater, rainwater, and soil. Artificial turf has also come under scrutiny as a possible source of PFAS. All synthetic turf products currently produced at AstroTurf are manufactured without PFAS. AstroTurf specifies that all turf ingredients be free of PFAS when purchasing raw materials. Our raw materials and finished goods have been submitted to third-party analytical chemistry labs and tested for 32 PFAS using state-of-the-art procedures finding that PFAS concentrations were below detectable limits. In 2020, AstroTurf removed a fluorinated polymer (non-migrating and not one of the 32 PFAS of concern) from the turf construction. This was a proactive decision over and above the regulation to eliminate doubt of PFAS during testing. AstroTurf continues to be the leader in artificial turf - safe for consumers - safe for the environment. As we understand the concern on the presence of these chemicals, AstroTurf will continue to monitor and safeguard the quality and safety of their products.

AstroTurf prides itself on its responsibility to the health and safety of our customers and employees, to the environment and to manufacturing in a responsible manner.

*Anthony Daniell
Director of Research and Development
Synthetic Turf Resources*



Shaw Industries Group, Inc.
Corporate Sustainability
PO Drawer 2128 Mail Drop: 071-01
Dalton, GA 30722-2128

March 6, 2023

SHAW SPORTS TURF PFAS STATEMENT

Dear Valued Customer:

Shaw has a longstanding commitment to sustainability and the responsible manufacture of our products. This includes a strong focus on the material chemistry of our products. This commitment applies to our brands and is inclusive of Shaw Sports Turf.

PFAS chemicals are one of many substances that we require our supply partners to disclose the presence of in raw materials, components, and finished goods purchased by Shaw. Based on information provided to date by suppliers, Shaw Sports Turf does not use PFAS chemicals currently listed on California's Proposition 65 regulations or identified as target analytes in USEPA Methods for analysis of PFAS (specifically Methods 533, 537, 3827 and Draft Method 1633) to manufacture the components of its sports turf field products.

We are committed to continuously improving the performance and material health profile of our Shaw Sports Turf products. If you have any questions, please email us at sustainability@shawinc.com

Corporate Sustainability & Product Stewardship
Shaw Industries Group, Inc.
(CRH)

Final Design Report

May 17, 2023



University of New Hampshire



Known for excellence.
Built on trust.

Dover, NH – Citywide Background PFAS Sampling Program

Team 12

Nathan Salas (Project Manager)
Briar Brogna
Max Fortin
Michael Bidonde

Project Sponsors

Ken Mavrogeorge, PE
City Engineer
City of Dover, NH
K.Mavrogeorge@dover.nh.gov

James M. Wieck, P.G.
Hydrogeologist/Associate Principal
GZA GeoEnvironmental, Inc.
james.wieck@gza.com

Project Faculty Advisor

Dr. Paula Mouser

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Appendices

Appendix A – *Sample Procedure and Protocol*

Appendix B – *Health and Safety Plan*

Appendix C – *Potential PFAS Sources in and Near Dover, NH*

Appendix D – *Field Notes and Sample Photos*

Appendix E – *Reordered Results*

Disclaimer

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Executive Summary

New Hampshire currently has maximum containment levels for four types of per- and polyfluoroalkyl substances (PFAS) in drinking water. As PFAS are emerging contaminants of concern, many states and municipalities have been preparing to comply with potential future regulations. The City of Dover wants to characterize environmental concentrations of PFAS throughout the city. We have prepared and executed a sampling plan to characterize these concentrations and compounds. Along with sampling across the city we have also analyzed our results using various spatial mapping and statistical methods. After analyzing the results, we made a few observations about PFAS in Dover and used these to make long-term sampling recommendations.

Our team has selected three objectives to start to characterize PFAS concentrations in Dover. These three sub-objectives are drinking water sources, rainwater, and stormwater. The first objective focuses on drinking water sources for the City as this water is most directly affecting the residents of the City. We have used groundwater protection zones around the City to target this sub-objective. The second objective focuses on rainwater as it is important to quantify PFAS concentrations that are being introduced to the City from atmospheric deposition. The third objective focuses on quantifying the PFAS concentrations that can accumulate in rainwater as it runs off of impervious surfaces in residential and commercial areas,

The following report includes our reasoning behind the selected PFAS analytes, laboratory, and sampling locations. We have also included the sampling procedures and protocols and a Health and Safety plan for our team.

The analytical results of this sampling effort were returned in early January 2023. We then began to analyze the results based on number of detections, composition, and concentration relating to NH state promulgated and federally proposed Maximum Containment Levels (MCL). A principal component analysis of the data was performed which was useful for visualizing the similarities in concentrations and compounds detected across sample types. The main observations from this analysis process are: (1) the precipitation falling on Dover contains low levels of PFAS, (2) the composition of the wastewater samples differs from the composition of the surface water samples, and (3) all six of the PFAS that the EPA is proposing MCLs for were detected in the surface water samples.

Based on these preliminary observations, our team solicited feedback from City of Dover personnel and used it to make recommendations for Dover to continue long-term monitoring of PFAS in the city. This project has been presented to the City of Dover, the University of New Hampshire (UNH) Undergraduate Research Conference, and the Civil and Environmental Engineering (CEE) senior capstone class.

1 Introduction

On June 15, 2022, the U.S. EPA reduced the health advisory for four PFAS. The City of Dover wants to evaluate concentrations of PFAS upstream of regulatory compliance points and around potential sources of PFAS. The EPA's health advisories are non-enforceable, but health advisories can often lead to enforceable maximum containment levels (MCLs). The City aims to be proactive and start to understand the environmental concentrations within the City before state or federal regulations are decreased. Over the past several years the City of Dover has had consultants conduct sampling and testing of surface waters and groundwaters throughout the City. These samples tend to be in locations with known PFAS pollution sources. The City is now looking to quantify concentrations in locations that have not been previously sampled but could still be influenced by potential sources or environmental transportation of PFAS.

The project team members, through Project Manager Nathan Salas, have received input from Dr. Paula Mouser (Professor at the University of New Hampshire), Ken Mavrogeorge, P.E. (City Engineer for the City of Dover), and James Wieck, P.G. (Hydrogeologist with GZA GeoEnvironmental, Inc.) to develop a PFAS Background Sampling and Testing Plan. This Report serves as the Final Sampling and Testing Report for the City of Dover, NH and includes recommendations for a long-term PFAS background sampling program for the City.

2 Scope of Work

The Project Team has prepared the following Scope of Work to be used to determine background concentrations of PFAS in Dover. The tasks described below outline the work to be completed in the Fall of 2022 and Spring 2023. This scope was initially constructed in September 2022 and updated in February 2023. The work in this list is completed and it has been denoted as such below.

1. Project Management:

- COMPLETED: Plan and facilitate a kick-off meeting with the project sponsor to discuss project goals, schedule, expectations, and responsibilities of the Project Team, Project Sponsor, and Project Consultant.
- COMPLETED: Meet at least bi-weekly with Project Advisor, Project Sponsor, and Project Consultant to discuss project progress and solicit feedback on project tasks. We have assumed at least 15 meetings throughout the duration of this project. Seven meetings have occurred this semester.
- COMPLETED: Provide weekly progress reports to the Project Advisor, Project Sponsor, and Project Consultant.
- COMPLETED: Develop a schedule for project deliverables.
- COMPLETED: Develop and maintain a record of all project progress updates, photo logs of sampling sites, and material used for meetings and reports.

2. Review existing information and Site Visit(s):

- COMPLETED: Literature review to expand the team's knowledge in the structure and variety of PFAS, uses of PFAS, transport throughout the environment, PFAS sampling approaches, and common PFAS sources in municipalities.
- COMPLETED: Review available information provided by GZA and the City of Dover, NH.
- COMPLETED: Conduct site visits as necessary to better understand water and wastewater assets in the City of Dover, develop a list of potential sampling locations, and prioritize those locations.

3. Preliminary Sampling and Testing Report:

- COMPLETED: Develop a Health and Safety plan for PFAS sampling.
 - COMPLETED: Compose the Preliminary Sampling and Testing Report.
4. COMPLETED: Present the Preliminary Sampling and Testing Report to the City of Dover, Community Services Department personnel.
 5. COMPLETED: Implement the sampling program by collecting samples and submitting samples to a commercial lab for analysis.
 6. Data Analysis:
 - COMPLETED: Compile and evaluate results of sampling efforts.
 - COMPLETED: Combine these results with previous PFAS sampling in Dover.
 7. Draft Final Sampling and Testing Report:
 - COMPLETED: Compile results of sampling program and data analysis into a coherent report. Include conclusions of sampling, recommendations, and a proposed long-term monitoring plan.
 8. Present Report findings:
 - COMPLETED: Present to the City of Dover Community Services Department personnel.
 - COMPLETED: Present to the UNH Undergraduate Research Conference (URC).
 - COMPLETED: Present to the UNH Civil and Environmental Engineering (CEE) Senior Project Class.

3 Background & Purpose

PFAS are a group of 10,000+ synthetic compounds including Perfluorooctanesulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA), Perfluorohexane Sulfonic Acid (PFHxS), and Perfluorononanoic Acid (PFNA). These are used to make fluoropolymer coating for products.

PFAS have been used in consumer products since the 1940s due to their useful properties of oil and water resistance (EPA, 2022). PFAS are manufactured in firefighter foam, pesticides, non-stick pans, waterproof clothes, sweat-wicking clothes and in personal products like makeup (Interstate Technology Regulatory Council, 2022). Common PFAS sources in the environment include fire training/response sites, industrial sites, manufacturing plants, wastewater discharges, and landfills. PFAS have also been found in human blood by the U.S. Center for Disease Control (CDC) (Center for Disease Control and Prevention, 2022), indicating widespread contamination among communities.

Due to their useful hydrophilic, hydrophobic, and oleophobic properties, PFAS chemicals became widely popular, but those same properties present issues for environmental degradation and transportation (EPA, 2022). PFAS tends not to degrade in the environment, and because of this can remain present for many years (Interstate Technology Regulatory Council, 2022). PFAS can take many routes to spread through the environment and elevated levels have been found thousands of kilometers from populated areas. Parts per billion (ppb) levels in soils can sustain parts per trillion (ppt) levels in groundwater for years. The release of PFAS through facility emissions can enable the atmosphere to transfer PFAS miles from the source (Zemba, 2020). Runoff can carry these chemicals to surface waters and groundwaters from PFAS source sites (Interstate Technology Regulatory Council, 2022). In cases where these groundwaters and surface waters are used as a drinking water source it can be transmitted into the bloodstream of humans, where they can bioaccumulate for years before being slowly excreted out (Interstate Technology Regulatory Council, 2022). These qualities can make the time and location of the original release of PFAS difficult to determine.

On March 14th, 2023, the EPA announced the Proposed PFAS National Primary Drinking Water Regulations (EPA, 2023). These regulations include both maximum containment level goals (MCLG) and maximum containment levels (MCLs) for six PFAS. Table 1 displays these proposed regulations. These proposed rules would also require public water systems to monitor for these PFAS, notify the public of the levels of these PFAS, and to reduce the levels of these PFAS in drinking water if they exceed the proposed standards (EPA, 2023). If this proposal is approved this would be the first national enforceable standard for PFAS.

Table 1 Proposed PFAS National Primary Drinking Water Regulations.

Compound	Proposed MCLG	Proposed MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFNA	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index
PFHxS		
PFBS		
HFPO-DA (commonly referred to as GenX Chemicals)		

The state of New Hampshire has established health based MCLs for four PFAS in drinking water, shown in Table 2 below. These compounds were selected because they had the greatest number of

scientifically peer-reviewed studies and are found in New Hampshire (New Hampshire Department of Environmental Services, 2022). Since these are MCLs, they are enforceable.

Table 2 New Hampshire Drinking Water PFAS MCLs.

PFAS	Maximum Contaminant Level (MCL) (ppt)
PFOA	12
PFOS	15
PFNA	11
PFHxS	18

The City of Dover, founded in 1623, currently serves 9,008 residents with around 1.8-2.4 MGD of treated drinking water (Dover, 2022). Dover collects this water by using 10 wells that draw from four aquifers. One of these aquifers, Pudding Hill, was taken offline when PFAS contamination from a nearby metal recycling facility was discovered (Fernandes, 2021). Barbadoes Pond, Willand Pond, and the Hoppers Aquifer are the three aquifers currently providing water to the residents, with recharges occurring from Bellamy River and Isinglass River as necessary (Dover, 2022). Lowell Ave water treatment plant (WTP) and French Cross Road WTP are the two water treatment plants currently in place to filter the City’s water, and a Pudding Hill WTP is currently being built. This new WTP will have the capacity to remove PFAS.

Some PFAS sampling around Dover has already occurred thanks to the New Hampshire Department of Environmental Services (NHDES) and private consultants, and some results are available via the NHDES PFAS sampling map. The majority of this sampling was done on surface and groundwater. Sampling has also been done in the four Wellhead Protection Areas associated with the water supply wells that provide Dover’s water. The combination of PFAS’ persistence in the environment and the growing concern regarding these chemicals has warranted a more thorough and complete understanding of PFAS levels and potential sources throughout the City of

Dover to comply with anticipated future regulations. The purpose of this report is to provide the reasons why sites were sampled, analyze the results, and provide recommendations for a long-term monitoring plan for the City of Dover. Sampling and Testing Plan

3.1 Target PFAS Analytes

Due to the inability of labs being able to analyze samples for every PFAS that exist, it is required to select a few compounds to target. The EPA has multiple lists available of common PFAS to analyze for in water samples. PFAS EPA Method 8327 – 24 Compound List will be the most reasonable PFAS to target. These compounds are some of the most common PFAS found in the environment (Interstate Technology Regulatory Council, 2022). Table 3 displays the list of PFAS that Absolute Resource Associates' (ARA) have analyzed our samples for. This list is ARA's own list of 29 PFAS. All 24 PFAS from the aforementioned EPA list are included in ARA's list but there is an additional 5 PFAS.

Table 3 PFAS analyzed for in this project's samples.

Analyte	Acronym	CAS
PFAS Sulfonic Acids		
Perfluoro-1-butanesulfonic acid	PFBS	375-73-5
Perfluoro-1-pentanesulfonic acid	PFPeS	2706-91-4
Perfluoro-1-hexanesulfonic acid	PFHxS	355-46-4
Perfluoro-1-heptanesulfonic acid	PFHpS	375-92-8
Perfluoro-1-octanesulfonic acid	PFOS	1763-23-1
Perfluoro-1-nonanesulfonic acid	PFNS	68259-12-1
Perfluoro-1-decanesulfonic acid	PFDS	335-77-3
1H, 1H, 2H, 2H-perfluorohexane sulfonic acid	4:2 FTS	757124-72-4
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid	6:2 FTS	27619-97-2
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid	8:2 FTS	39108-34-4
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11CL-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9CL-PF3ONS	756426-58-1
PFAS Carboxylic Acids		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnDA	2058-94-8
Perfluorododecanoic acid	PFDoDA	307-55-1
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
2,3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoic acid (GenX Acid)	HFPO-DA	13252-13-6
PFAS Sulfonamides and Sulfonamidoacetic Acids		
N-ethylperfluoro-1-octanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6
N-methylperfluoro-1-octanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
Perfluoro-1-octanesulfonamide	PFOSA	754-91-6
n-methyl perfluorooctane sulfonamide	NMeFOSA	31506-32-8
Propanoic Acids		
4,8-dioxa-3h-perfluorononanoic acid	ADONA	919005-14-4

3.2 Analytical Laboratory

ARA is an analytical laboratory located in Portsmouth, NH that has years of experience testing for PFAS. The City of Dover has a preexisting relationship with ARA and for this reason was used to analyze the samples. As discussed in Section 3.1, each sample will be analyzed for ARA's 29

PFAS list. All sample bottles were provided by ARA under standard chain-of-custody protocol. PFAS free water was also provided by ARA for field and equipment blanks and for use of rinsing equipment.

ARA uses a modified EPA Method 533 to analyze environmental samples. This process involves using isotope dilution and liquid chromatography with tandem mass spectrometry (LC-MS/MS). Using a solid phase extraction (SPE) cartridge containing polystyrene divinylbenzene (SDVB) the method analytes and surrogates are extracted. Methanol is used to elute the compounds from the solid phase sorbent. After being adjusted to 96.4% (vol/vol) methanol: water, the extract is injected in an LC equipped with a C18 column connected to an MS/MS. The produced mass spectra and retention times are compared with those of a calibration curve to determine the concentration of each analyte.

3.3 Potential Sources of PFAS in the City of Dover

Common historic and current uses of PFAS are listed below in Table 4, provided by the Interstate Technology Regulatory Council's (ITRC) website. (Interstate Technology Regulatory Council, 2022).

Table 4 Historic and Current uses of PFAS from the ITRC website.

Industry/Application	PFAS Type	Documented Use and Examples of Some PFAS
Aviation and Aerospace	Polymer	Mechanical components made of fluoropolymers (such as PTFE and PFA tubing, piping, seals, gaskets, cables, and insulators)
	Nonpolymers	Hydraulic fluid additives made from PFSA salts (such as PFOS at about 0.1%) to prevent evaporation, fires, and corrosion
Automotive	Polymer	Mechanical components made of fluoropolymers, including wiring and cable, fuel delivery tubing, seals, bearings, gaskets and lubricants, and some polymer coatings on carpets
	Nonpolymers	Surface treatment for textiles, upholsteries, carpets, leather, and exterior surfaces
Biocides (Herbicides and Pesticides)	Polymer	None reported
	Nonpolymers	Active ingredients such as short-chain sulfonamides in plant growth regulators and herbicides, and EtFOSA (sulfluramid) in ant and termite baits; inert enhancing ingredients in pesticides; PFPAs and PFPIAs as anti-foaming agents in solutions
Building and Construction	Polymer	Fluoropolymer membranes and coatings (such as PTFE, PVDF, and/or side-chain fluorinated polymers) in architectural materials (like fabrics, roofing membranes, metals, stone, tiles, concrete, radomes); adhesives, seals, caulks; additives in paints (for example, low- and no-VOC latex paints), varnishes, dyes, stains, sealants; surface treatment agent and laminates for conserving landmarks
	Nonpolymers	Additives in paints, coatings, and surface treatments (PASf- and fluorotelomer-based compounds, ammonium salt of PFHxA)
Cable and Wiring	Polymer	Coatings and jacketings made of fluoropolymers (such as PTFE and PVDF) for weathering, flame, and soil resistance, with cables used in many applications, including communication facilities, antennae, and computer networks
	Nonpolymers	None reported
Cosmetics/Personal Care Products	Polymer	Dental floss and micro powders used in creams and lotions.
	Nonpolymers	Cosmetics, shampoos, nail polish, eye makeup, denture cleaners
Industry/Application	PFAS Type	Documented Use and Examples of Some PFAS

Electronics	Polymer	Fluoropolymers (such as PVDF and PTFE) used in insulators, solder sleeves, printed circuit boards, cell phones, computers, speakers, and transducers
	Nonpolymers	Flame retardants for polycarbonate resin (such as the potassium salt of PFBS)
Energy	Polymer	Fluoropolymer films (such as FEP, PVDF) to cover solar panel collectors, electrolyte fuel cells, PTFE expansion joint materials for power plants
	Nonpolymers	Fuel cell and battery electrolyte (such as the lithium salt of PFAAs)
Firefighting/Safety	Polymer	Fluoropolymers used in firefighting equipment and protective clothing (such as those woven with PTFE). Other polymer coatings using side-chain fluorinated polymers)
	Nonpolymers	Coatings and materials used as water repellents and some Class B foam (may contain PFCAs, PFSAAs, and fluorotelomer-based derivatives), vapor suppression for flammable liquids (for example, gasoline storage)
Food Processing	Polymer	Fluoropolymer fabrication materials (such as PTFE) (liners for trays, ovens, grills)
	Nonpolymers	May be used as coatings on food packaging
Household Products	Polymer	Nonstick coatings (fluoropolymers such as PTFE); aftermarket treatment for textiles, upholsteries, carpets, and leather (such as FT-based side-chain fluorinated polymers)
	Nonpolymers	Aftermarket treatment for textiles, upholsteries, carpets, and leather (such as PASFs; floor polishes (such as the ammonium salt of PFDA), coatings, and floor finishes (PFPAAs and PFPiAs) and cleaning agents and alkaline cleaners; automobile waxes; may include PFAAs, PASF- and fluorotelomer-based derivatives
Medical Products	Polymer	Fluoropolymers used in surgical patches, cardiovascular grafts, raw materials for human body implants (such as catheters, stents, needles, and other) given biocompatibility and extremely low coefficient of friction
	Nonpolymers	X-ray film, stain- and water-repellent protective medical fabrics (like surgical drapes and gowns) created from PASF- or fluorotelomer-based (meth)acrylate polymers and polyurethanes
Metal Plating	Polymer	None reported
	Nonpolymers	Wetting agent, mist suppression for harmful vapors, and surfactants (may include potassium, lithium, diethanolamine and ammonium salts of PFOS or 6:2 FTS)
Industry/Application	PFAS Type	Documented Use and Examples of Some PFAS

Oil Production	Polymer	Lining of gas pipes
	Nonpolymers	Marketed for and potential instances of use in oil well production
Mining	Polymer	None reported
	Nonpolymers	Instances of surfactants used in ore mining flotation
Paper and Packaging	Polymer	Oil and grease and water repellent to paper, paperboard, molded pulp products (including food contact materials), and LDPE bags; examples include side-chain fluorinated polymers in which the PASF- or fluorotelomer-based alcohols or their acrylate or methacrylate esters are attached on side chains
	Nonpolymers	Phosphate ester salts (esterification of PASF or FT-based alcohols with phosphoric acid; PFPEs
PFAS Production	Polymer	Not applicable
	Nonpolymers	Emulsion polymerization processing aids for fluoropolymers (such as PTFE, FEP, PFA, PVDF), (co)monomer of side-chain fluorinated polymers; (co)monomer of fluoropolymers and to make fluoroelastomers; may use salts of long-chain PFCAs (such as PFOA and PFNA), salts of short-chain PFCAs (such as PFHxA), or PFECAs
Photolithography & Semiconductor	Polymer	Equipment raw materials (such as PFA) for molded wafer baskets to handle corrosive liquids and gases, use as fluids in mechanical vacuum pumps
	Nonpolymers	Photolithography (such as using PFOS) in manufacture of semiconductor chips
Textiles (Upholstery, Carpets), Leather, and Apparel	Polymer	Fluoropolymers (such as PTFE) are used in the construction of outdoor gear, clothing, and housewares; side-chain fluorinated polymers (such as PASF- or fluorotelomer-based (meth)acrylate polymers and -polyurethanes) may be used in oil- and water-repellent and stain release finishing and treatment coatings
	Nonpolymers	PFOA-based chromium treatment for paper and leather. Nonpolymer coatings used to treat textiles to provide oil- and water- repellent and stain release finishes

From the facilities that these products are produced or the areas that these activities occur, PFAS can be released through air emissions and dispersion, spills, and disposal of manufacturing wastes and wastewater (Interstate Technology Regulatory Council, 2022). Some common sites that have been found to be sources of PFAS in the environment include fire training/fire response sites,

industrial sites, landfills, and wastewater treatment plants and the resulting biosolids (Utah Department of Environmental Quality, 2022). As car wax and industrial cleaning products are known to use PFAS, auto-salvage yards and carwashes are another potential source (Connecticut Department of Energy and Environmental Protection, 2022).

Our team has used the NHDES OneStop Data Mapper to create Figure 1 and Table 17 (in Appendix C) which displays the potential contamination sources of PFAS within and surrounding the City of Dover. We reviewed the ITRC PFAS webpage to determine which businesses and industries are identified as the most likely potential PFAS sources and worked through Table 17 to remove businesses that are not likely potential PFAS sources. We then imported all of these locations into GIS (Geographic Information Systems) and mapped them across the City and surrounding areas to create Figure 1. Figure 1 is displayed below, and Table 17 is included in Appendix C.

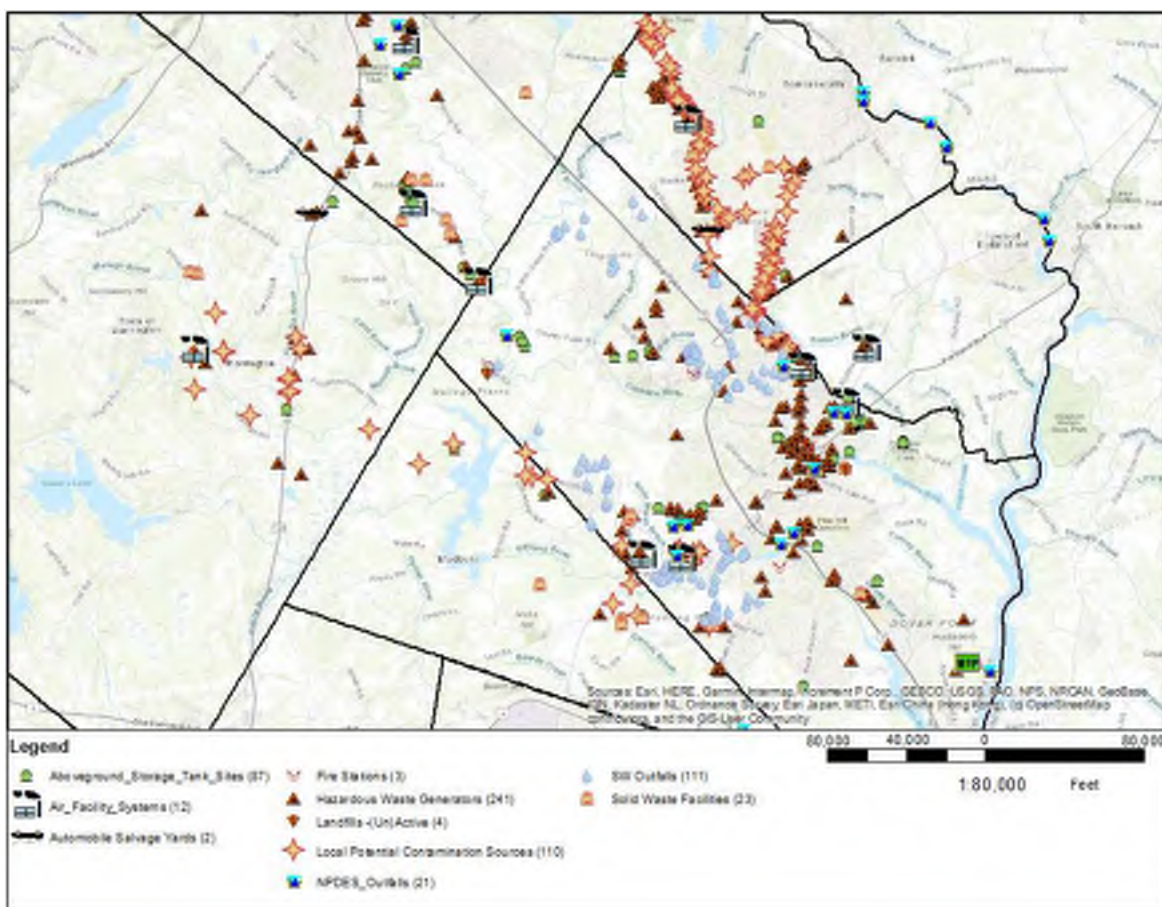


Figure 1 Potential PFAS sources throughout Dover and the surrounding areas.

3.4 Sampling Objectives and Locations Sampled

Once our team gathered the available information from the City of Dover and GZA GeoEnvironmental, we discussed how to best separate the information and use it to select potential sampling locations. We created three defined objectives. Each objective has individual goals to characterize various water around Dover. These three objectives and the locations we sampled to achieve their goals are described below. Table 5 displays the naming convention used for the samples.

Table 5 Naming convention for the samples.

Acronym	Definition
SW	Surface Water Sample
STW	Stormwater Sample
RW	Rainwater Sample
WW	Wastewater Sample
FB	Field Blank
EB	Equipment Blank

Our team sampled the following locations in mid-December 2022.

3.4.1 Drinking Water Sources

The first sub-objective was to quantify the background concentrations of PFAS in the water that the city is using as a drinking source. This has the highest priority since this water is being directly ingested by the residents of Dover. Figure 2 below shows the locations of ground water protection zones and their proximity to potential PFAS sources. There is also a potential future drinking water source area denoted on the map as a Protected Area of Interest. These potential sources are the same ones discussed in Section 4.3 and listed in Appendix C, Table 17.

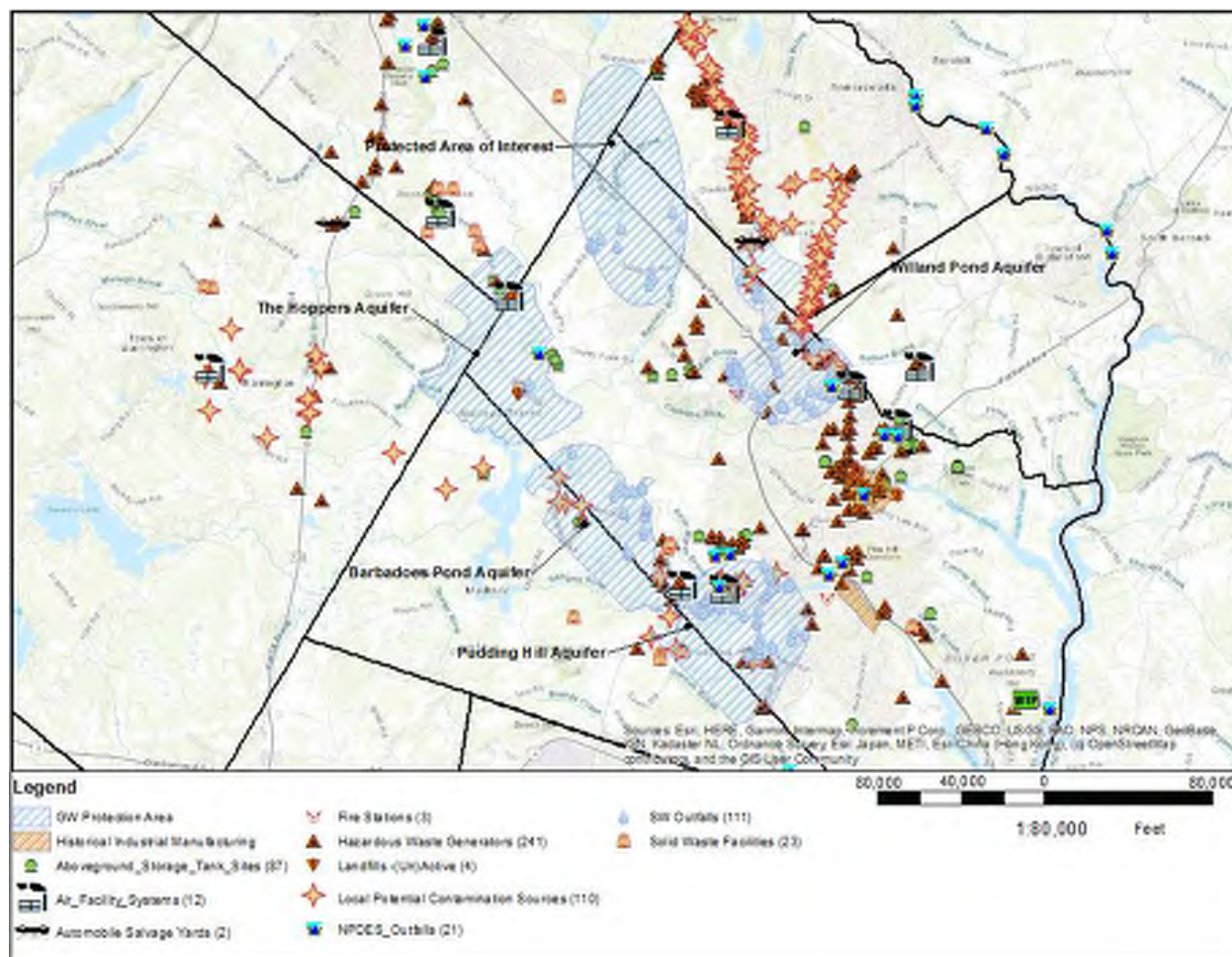


Figure 2 Groundwater protection areas in the City of Dover.

Our team used Figure 2, data provided by GZA GeoEnvironmental, and the NHDES PFAS Sampling Map to narrow down the potential sampling locations. We noticed that both the Pudding Hill Aquifer and the Barbadoes Pond Aquifer have already been sampled more thoroughly than the other groundwater protection zones and the Protected Area of Interest. With this in mind, we decided to focus sampling efforts on the two other groundwater protections areas (The Hoppers Aquifer, Willand Pond Aquifer) and the Protected Area of Interest. Outside of these zones we also sampled seven additional sites that have aided in characterizing the PFAS concentrations in drinking water sources in Dover.

Since The Hopper Aquifer has also been previously sampled for PFAS, we sampled two sites in this groundwater protection zone. We noticed a lack of PFAS sampling on the south side of this groundwater protection zone. There were no groundwater wells in this area that we had access to, so we sampled two surface water sampling locations. These surface waters likely infiltrate into the soil and recharge to The Hoppers Aquifer or The Hoppers Aquifer flows into these bodies of water. Either way, these surface waters are likely hydraulically connected to the groundwater and should serve as a good surrogate for a groundwater sample. Figure 3, below, displays these locations: SW-1 and SW-2.

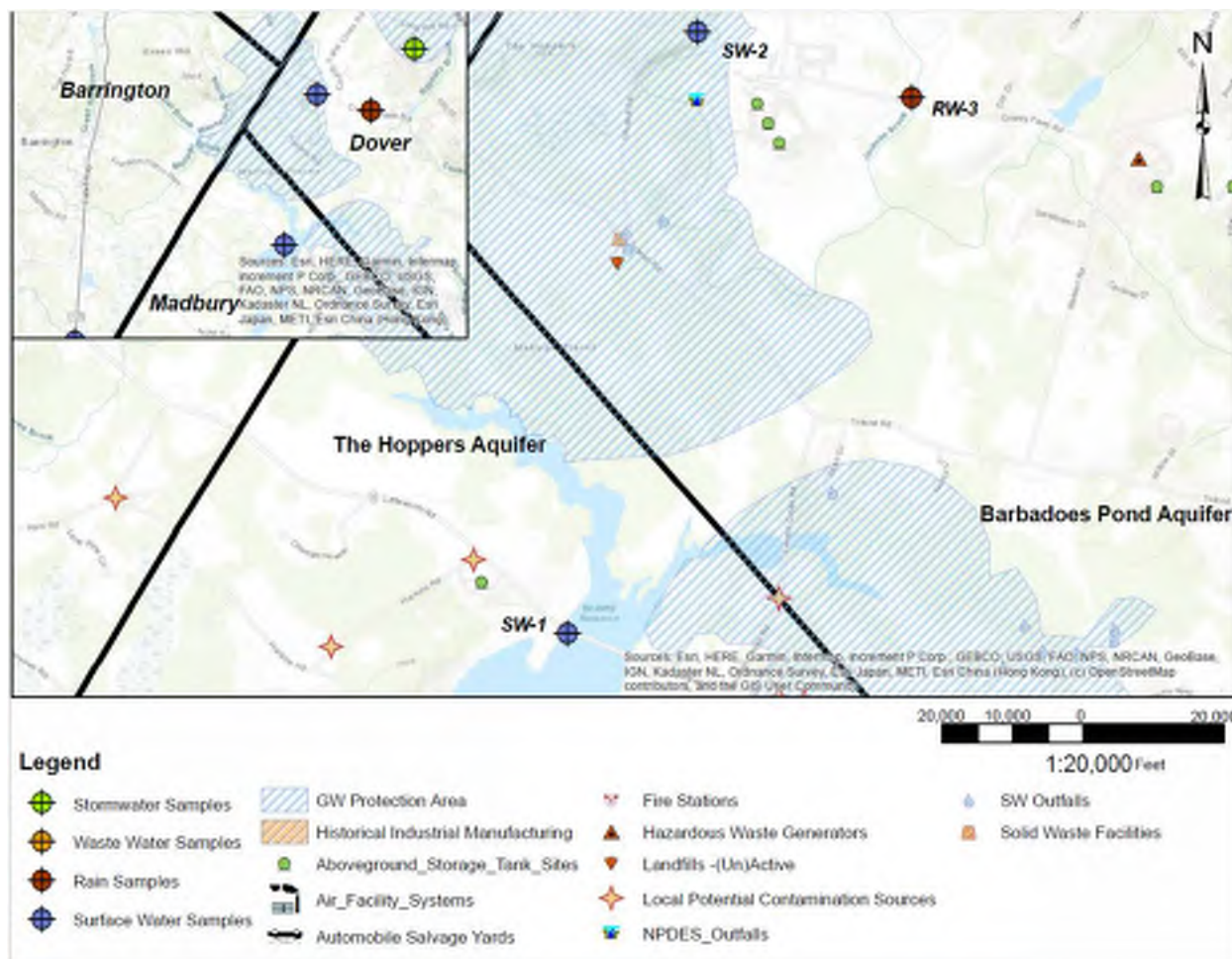


Figure 3 Location of SW-1 and SW-2.

Our team sampled two locations in the Willand Pond Aquifer protection zone. The first of these sample locations is SW-10, displayed in Figure 4 below. SW-10 is a surface water sample from Willand Pond. We have identified over 75 potential PFAS sources surrounding this well on the north and east sides of Somersworth. On Figure 4 several of these potential sources can be seen

on the eastern side. In Figure 2, many more of these potential sources can be seen to the north. This sampling site could have influenced PFAS concentration from these potential sources.

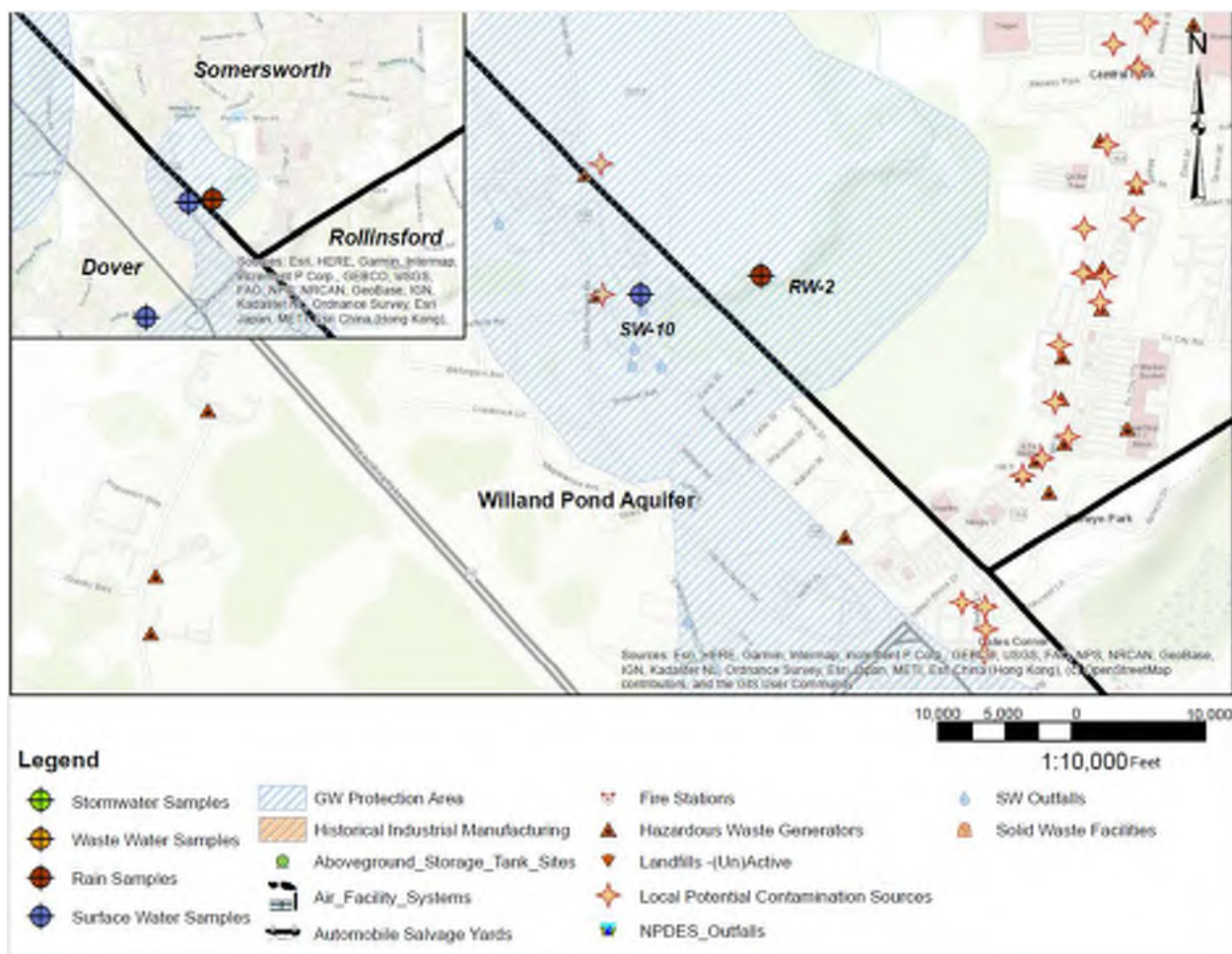


Figure 4 Location of SW-10.

The second sample in the Willand Pond Aquifer protection zone is a surface water sample on the southwestern portion of this zone. Figure 5, below, displays this SW-5 location. This sample is located in Indian Brook on a portion of the aquifer protection zone that we have found to be underrepresented by previous PFAS sampling data. This brook appears to be fed by a groundwater discharge location so by sampling this water we hope to capture PFAS concentrations that would be representative of the groundwater in this zone.

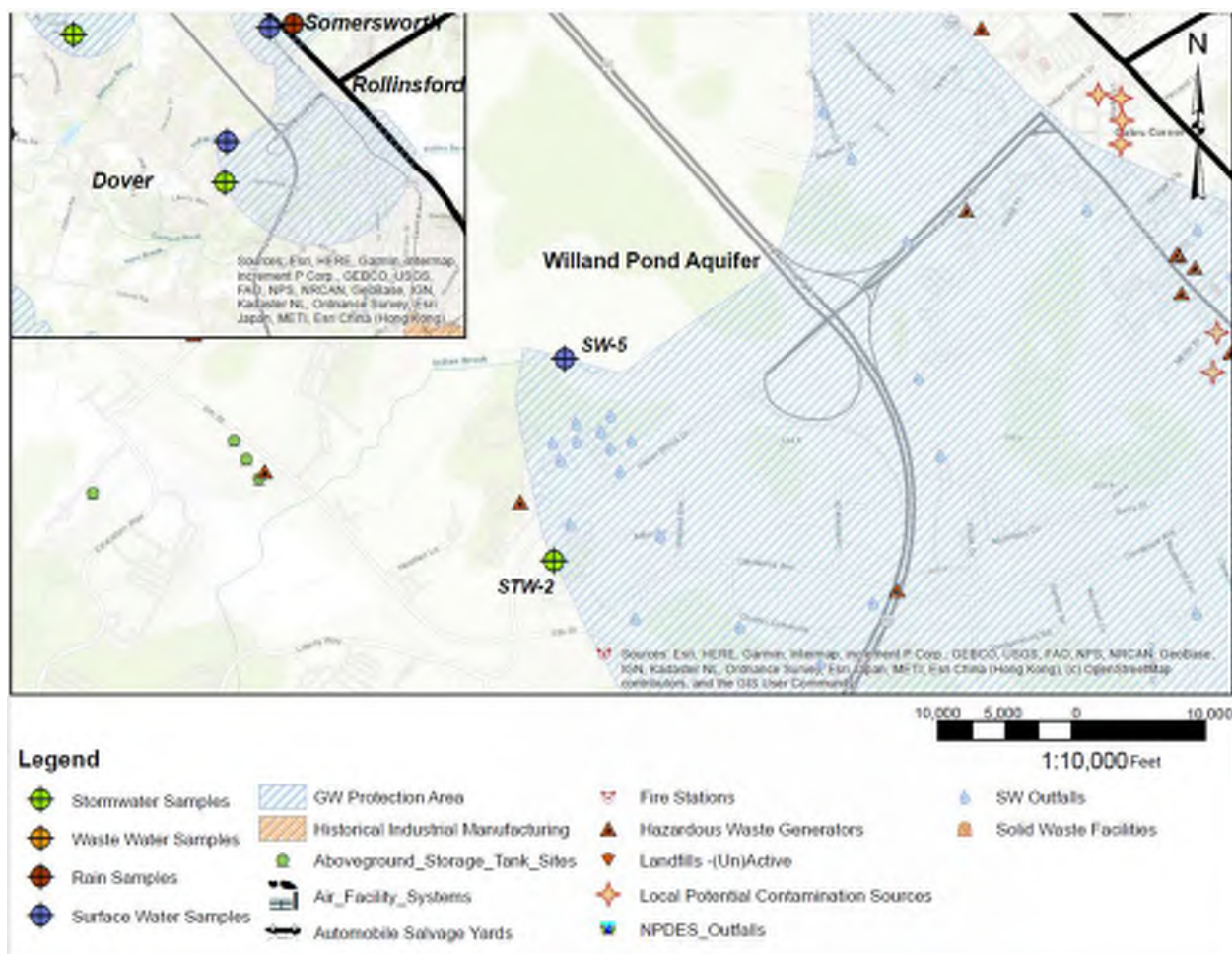


Figure 5 Location of SW-5.

The final zone that we have decided to focus on is the Protected Area of Interest on the northern side of the City. This zone has been determined by the City as an area of interest due to the possibility of it becoming a drinking water source for Dover. Figure 6, below, displays the two sampling locations that we sampled in this zone. The location of SW-4 in Clark Brook was chosen due to its proximity to Route 16. This sample would help identify if there is any PFAS contamination running off of this highway. The second sample in this zone is SW-3 in Blackwater Brook. This location is downstream of Clark Brook and Blackwater Brook which both pass underneath Route 16 and flow from neighboring cities, Somersworth, and Rochester. This location

would help characterize potential PFAS contamination from Route 16 and from the neighboring cities.

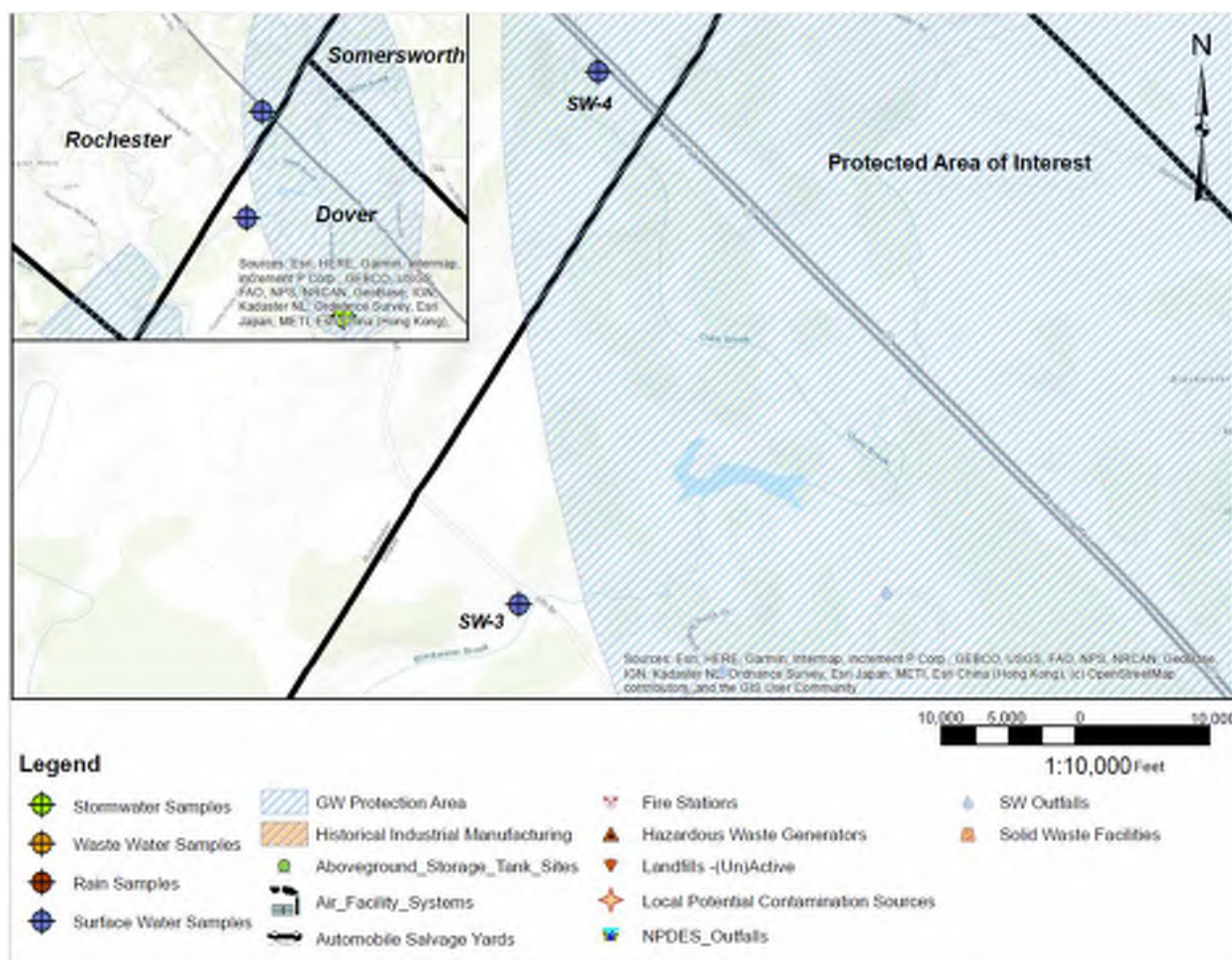


Figure 6 Location of SW-3 & SW-4.

In addition to sampling the above locations, our team sampled seven other locations to aid in characterizing potential PFAS concentrations in drinking water sources for Dover. The first of these locations is a surface water sample, SW-6, from the Isinglass River next to Calef Highway. The Isinglass River flows into The Hoppers Aquifer and serves as a recharge. By sampling upstream of the groundwater protection zone, PFAS concentrations can be monitored before they enter Dover's drinking water systems. Figure 7 displays this location below.

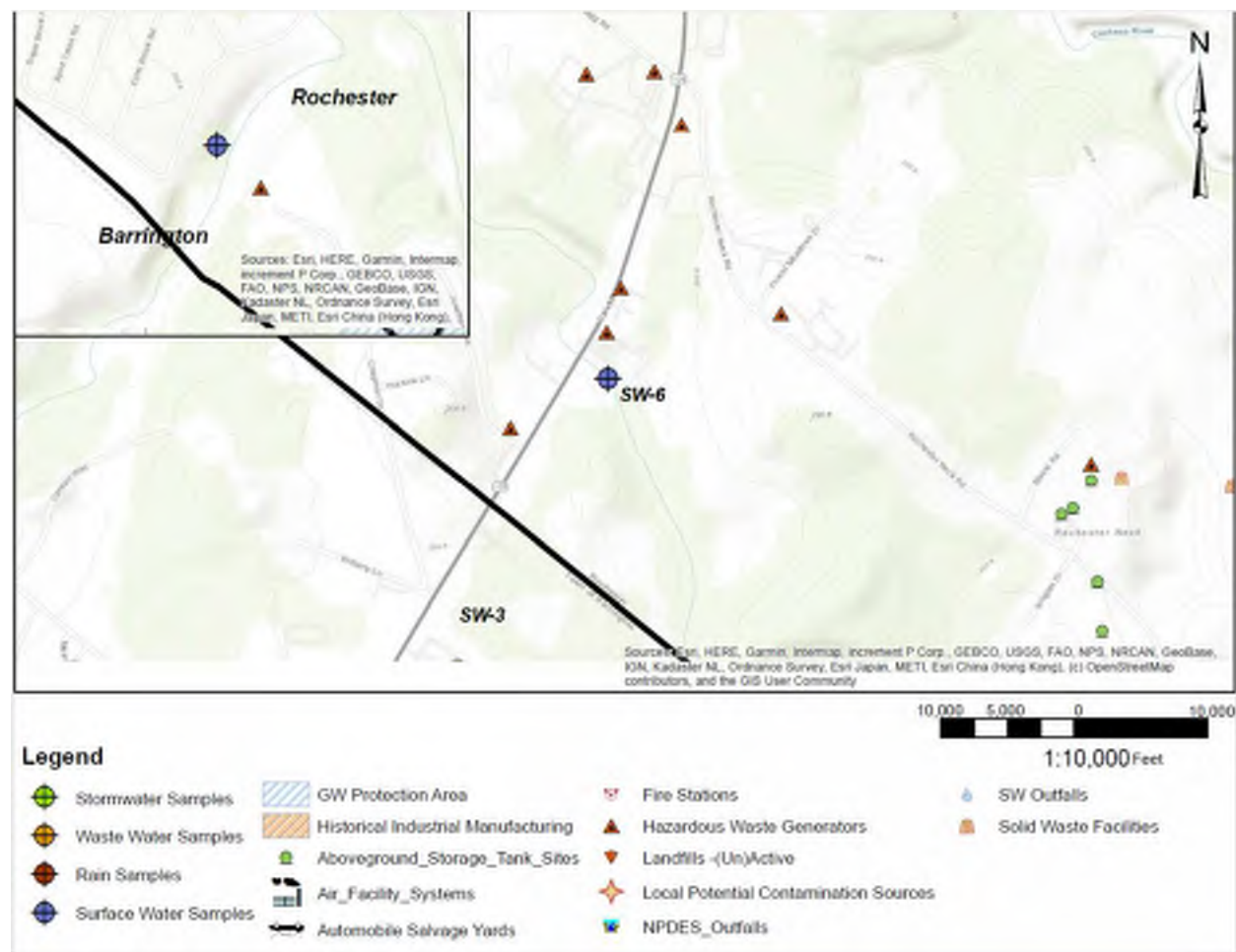


Figure 7 Location of SW-6.

We sampled the Bellamy River next to Calef Highway for similar reasons except the Bellamy River interacts with the Hoppers Aquifer, the Barbadoes Pond Aquifer, and the Pudding Hill Aquifer. Figure 8 displays the location of SW-7.

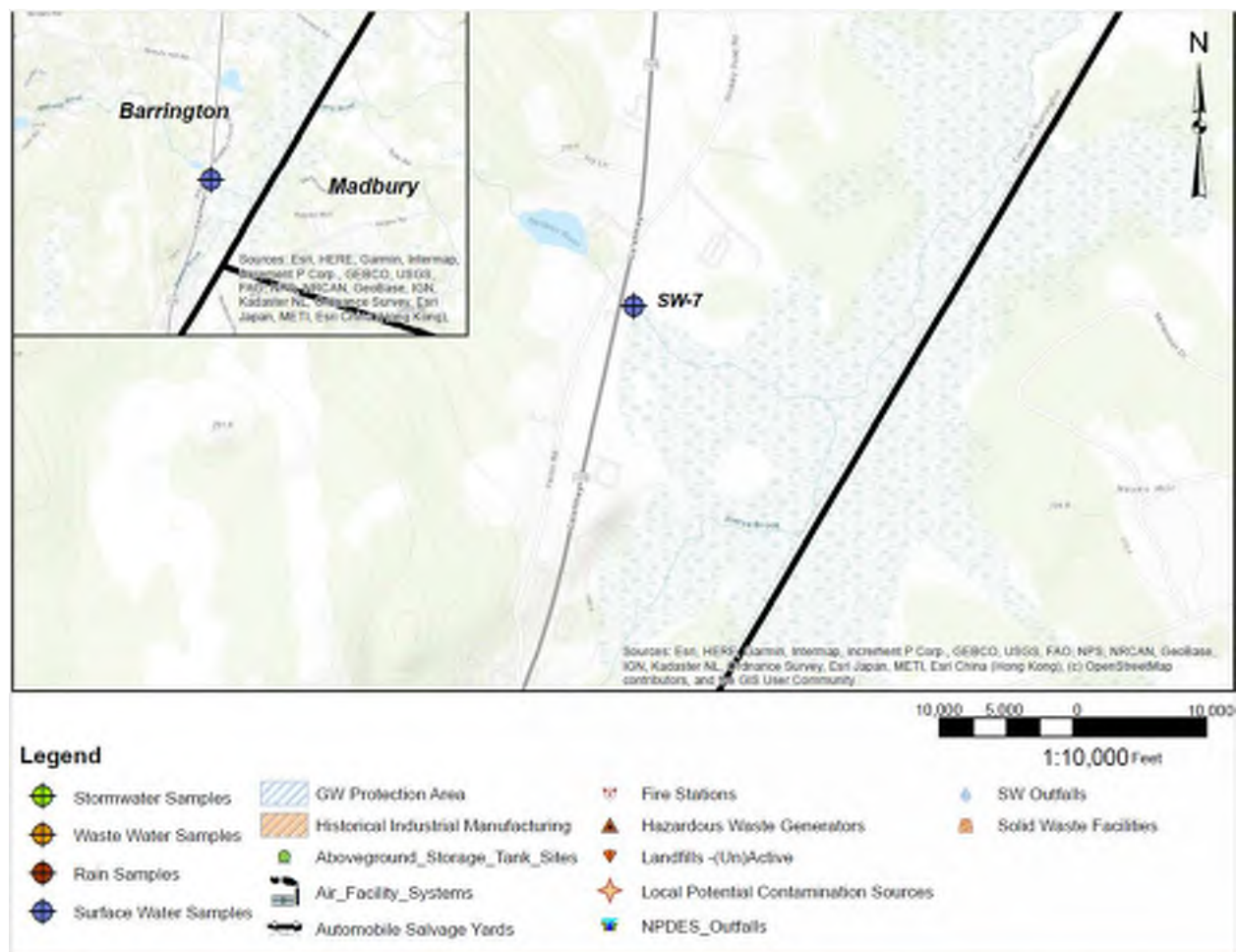


Figure 8 Location of SW-7.

The Cocheco River was sampled next to Pickering Road in Rochester to monitor PFAS concentrations in the Cocheco River before it reaches the City of Dover. Figure 9 displays the location of SW-9.

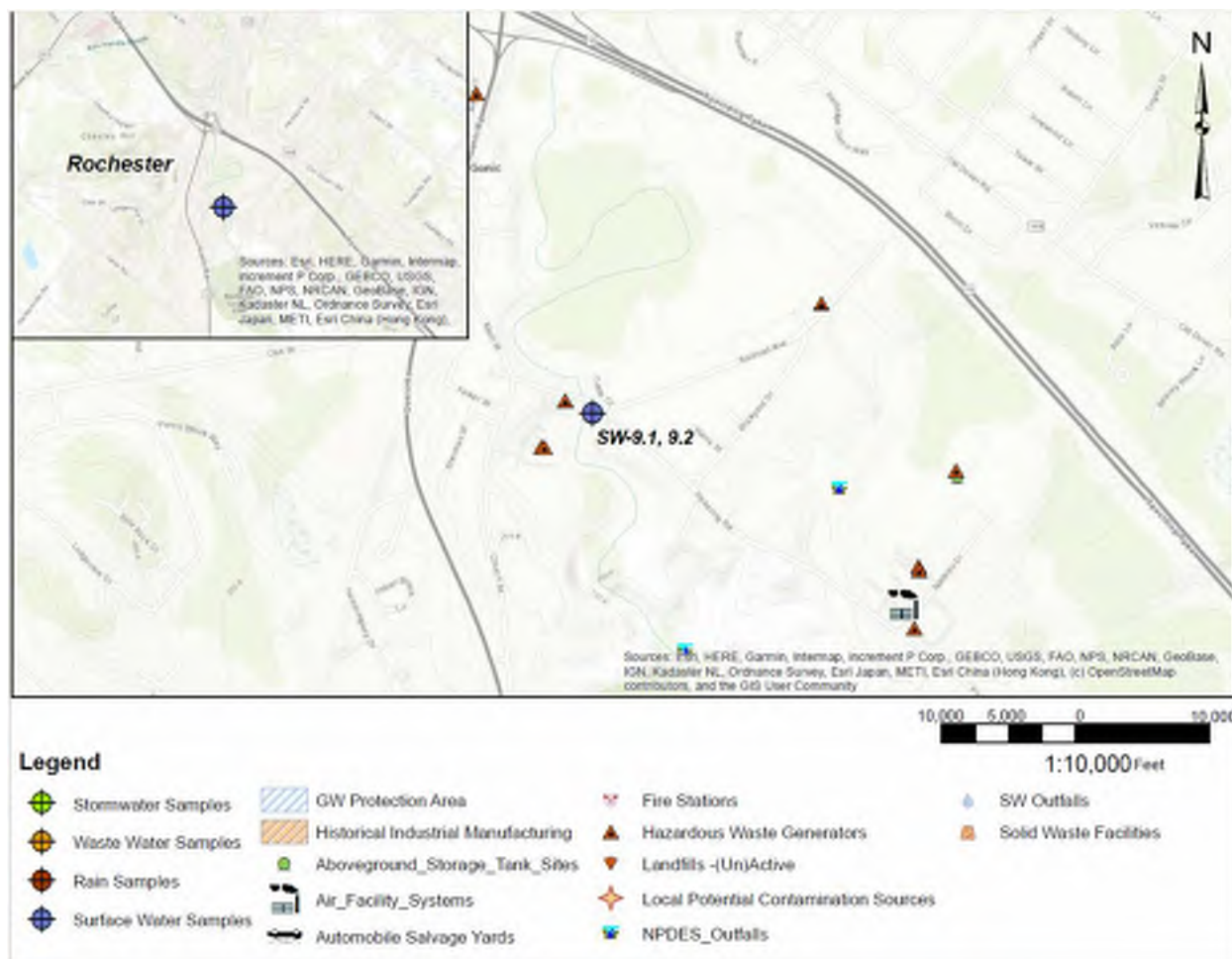


Figure 9 Location of SW-9.1 & SW-9.2.

A sample from Fresh Creek next to Old Mill Ln was taken, SW-16. Fresh Creek is fed by numerous other brooks coming from neighboring communities and could help characterize PFAS concentrations that are flowing into Dover. Figure 10 displays the location of SW-16.

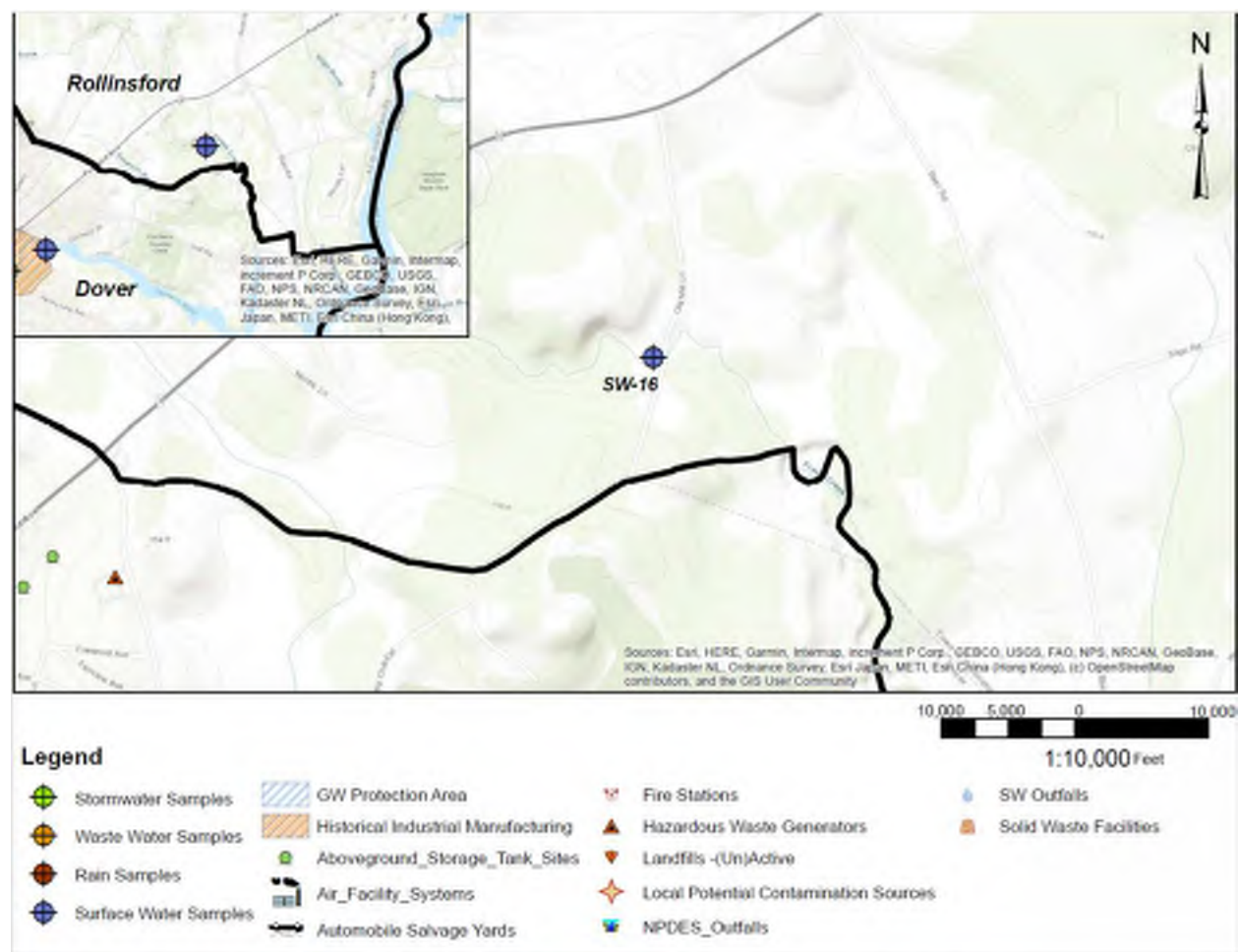


Figure 10 Location of SW-16.

Downtown Dover is a place of historic industrial and manufacturing use. There have also been many large fires that have occurred in this area (Dover Public Library, n.d.). For these reasons, we sampled the Cocheco River just downstream of downtown. Figure 11 displays the location of SW-8.

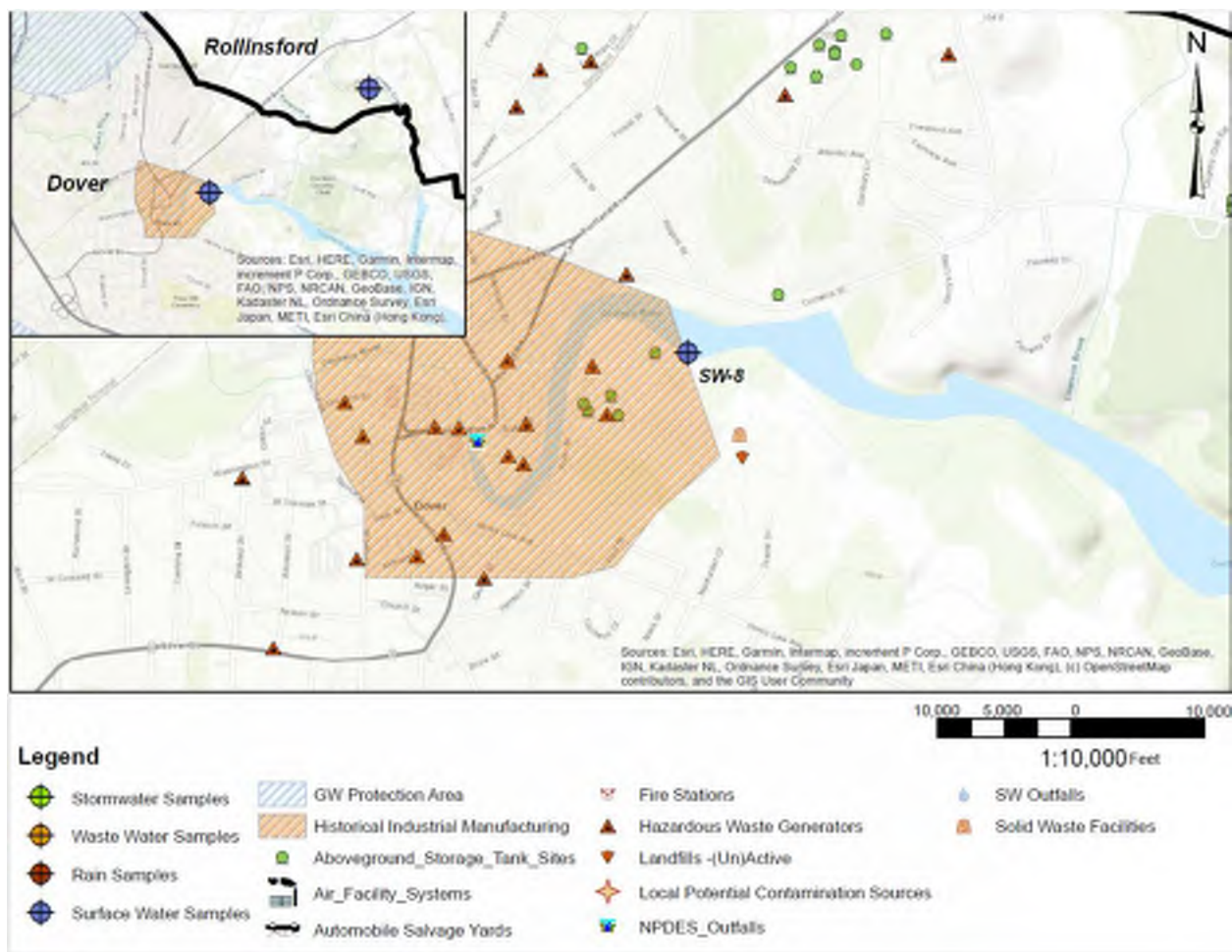


Figure 11 Location of SW-8.

While the fate and transport of PFAS within wastewater treatment facilities is not entirely understood, it is evident that these facilities are at least transporting the PFAS received from influent wastewater to biosolids or the effluent water (Lenka, 2021). Our team sampled both the influent, WW-1, and effluent, WW-2, water from Dover’s wastewater treatment plant. By doing this, the role that this treatment plant plays in the fate and transport of PFAS can start to be evaluated. Figure 12 shows the location of both WW-1 and WW-2.

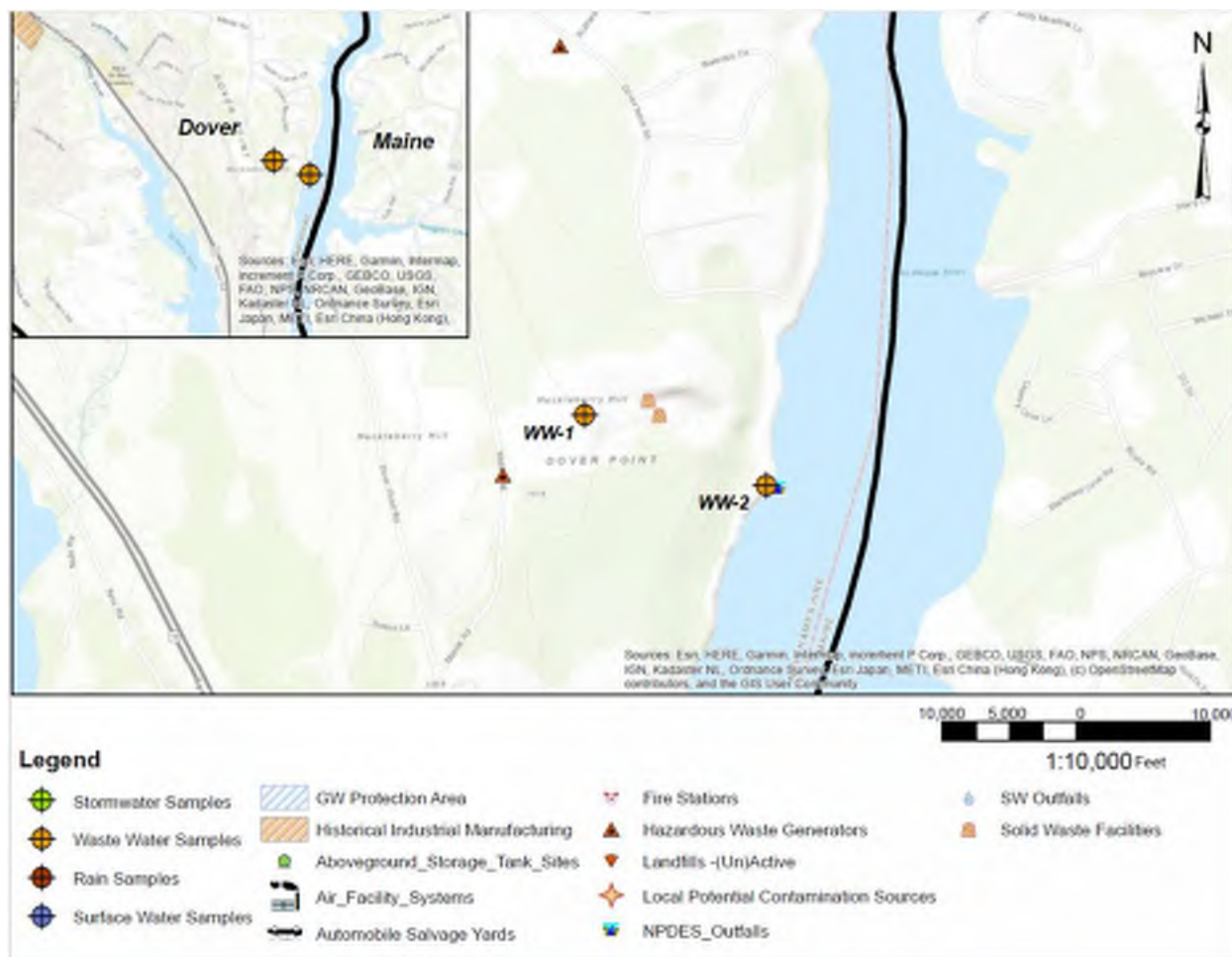


Figure 12 Location of WW-1 & WW-2.

3.4.2 Rainwater

Our second sub-objective was characterizing PFAS concentrations in the rainwater in Dover. PFAS have been known to enter the atmosphere through industrial stack emissions and through fugitive emissions from manufacturers, storage, and transport in supply and waste streams (Shimizu, 2021). This atmospheric PFAS can then be deposited back to municipalities through dry and wet deposition. Dry deposition mostly refers to the settling of particles due to gravity and direct uptake of gases by plants, soil, and surface water (Shimizu, 2021). In this project we will be focusing on characterizing wet deposition which occurs with precipitation.

It is important to quantify the PFAS concentrations of this wet deposition as this water flows into surface water and infiltrates the ground. This has an impact on groundwater and recreational waters, which directly impacts public health.

We deployed rainwater sample stations at three locations in the City. These stations consisted of a funnel that is connected to a storage container to collect any precipitation that may occur. We constructed these stations with PFAS free materials so as to not contaminate any of the rainwater samples collected. Figure 13 is a picture of one of these rainwater stations.



Figure 13 Rainwater PFAS sampling station.

Figure 14 displays the location of the first rainwater collection station, RW-1. This station was located next to Willand Pond at a City of Dover building. This site was used due to the ease of access by our team and the City of Dover engineers as we needed help monitoring these stations while they operated.

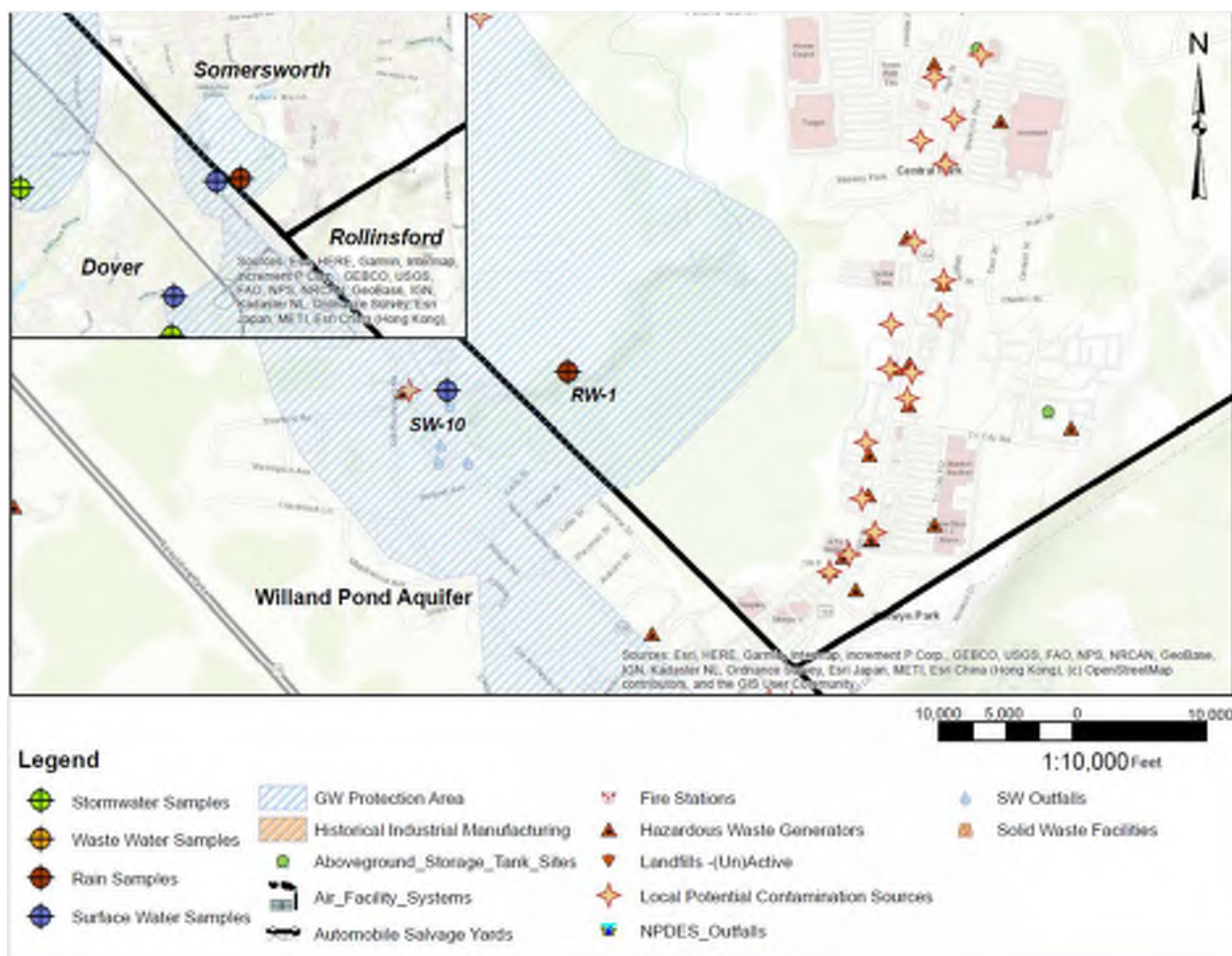


Figure 14 Location of sample station RW-1.

Figure 15 displays the second location for rainwater sampling station RW-2. This location was used because this is the City of Dover Community Services building. This granted easy access to this station for both our team and the City of Dover engineers.

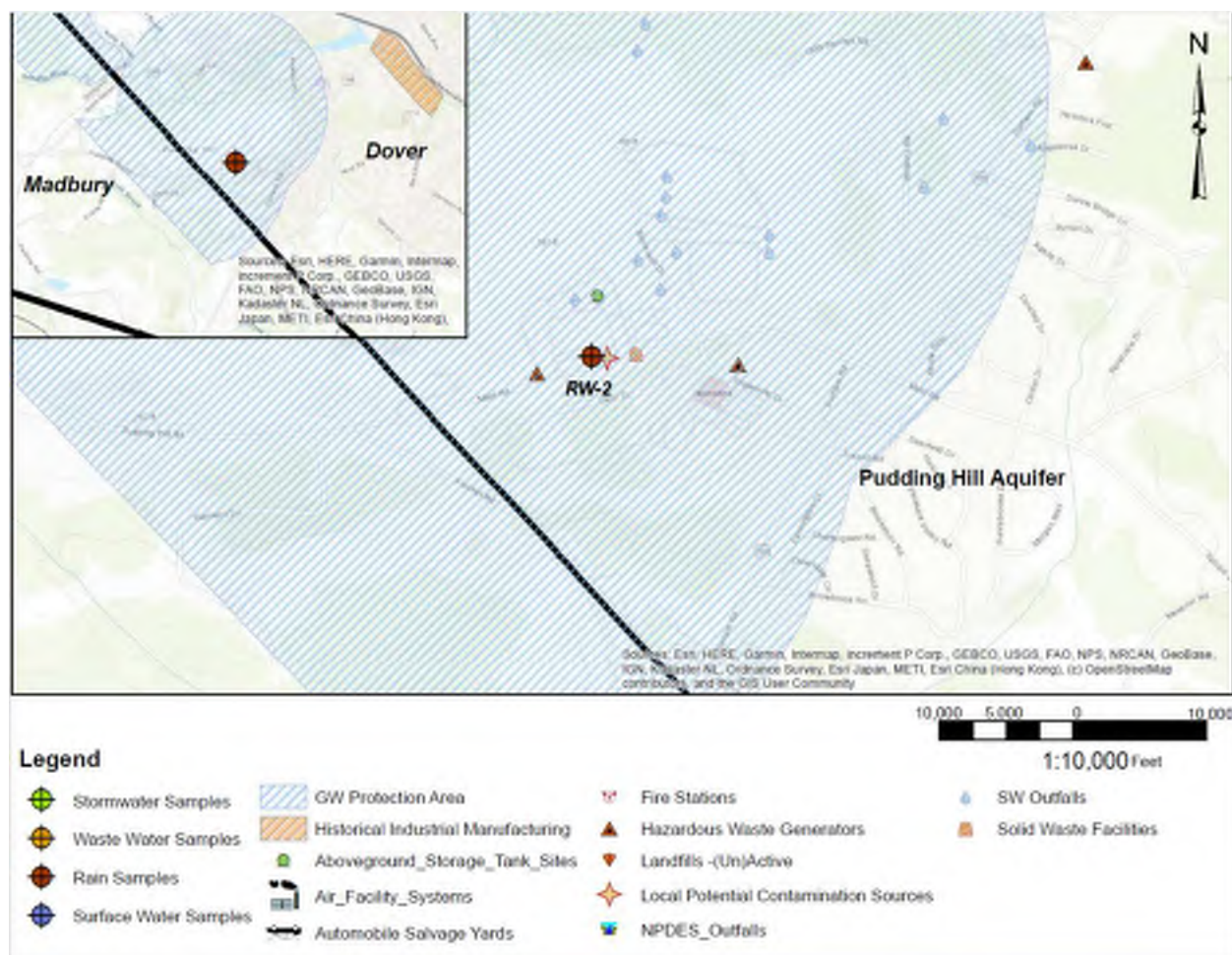


Figure 15 Location for sample station RW-2.

The third and final location for rainwater sampling station RW-3 is at a pump station off of County Farm Rd. This is again another location that is convenient for both our team and the City of Dover employees. Figure 16 displays the location of RW-3.

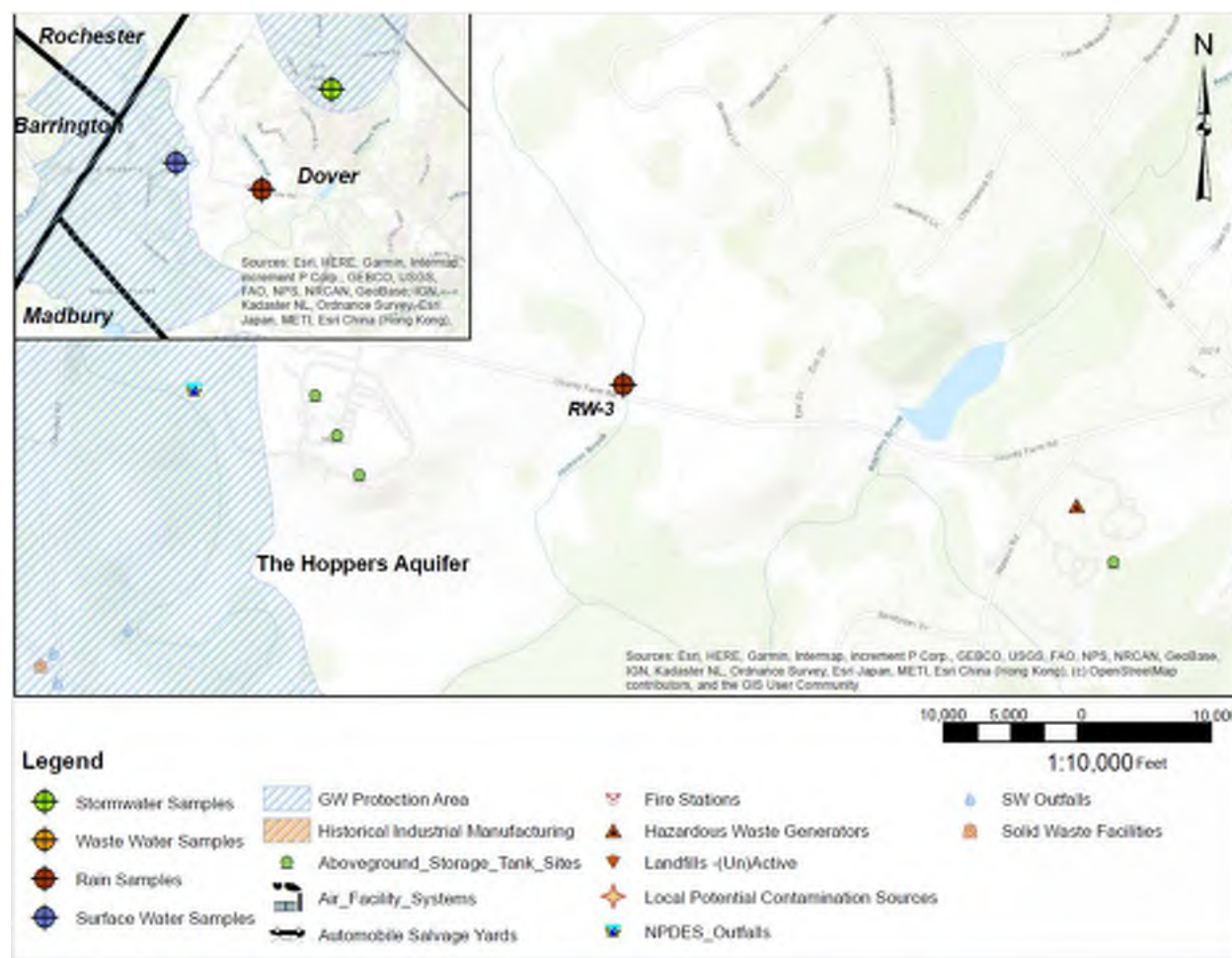


Figure 16 Location of sample station RW-3.

These locations are spread across the city and have provided our team with information used to evaluate spatial variability of PFAS concentrations in the rainwater that falls on Dover.

3.4.3 Stormwater

As rainwater flows over urbanized areas it accumulates pollutants that have been sitting on impervious areas. The PFAS on these surfaces is anticipated to be due to atmospheric deposition, both wet and dry. It is important to quantify this concentration as well because this water also flows into surface and groundwater. In order to capture this “runoff” concentration we sampled stormwater outfall locations.

Our team collected two of these stormwater samples throughout the city. The first, STW-1, is located within the Protected Area of Interest zone on the north side of the city. This stormwater outfall captures water that flows over a residential area. Figure 17, below, displays the location of STW-1.

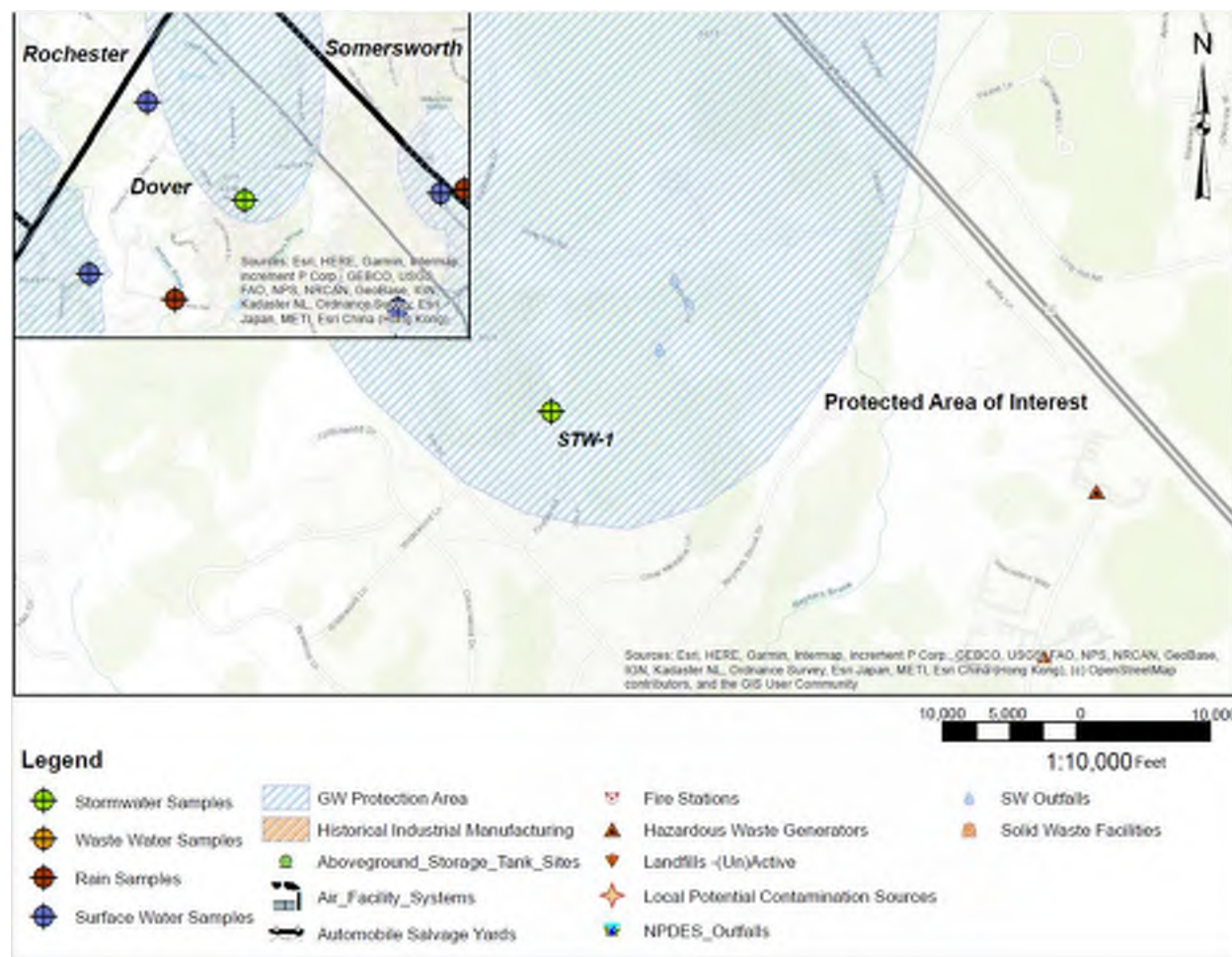


Figure 17 Location of STW-1.

The second stormwater outfall location that we sampled is located in the Willand Pond Aquifer protection zone. STW-2 services an area that has a mix between residential and commercial. Most importantly it services a local fire station which have been known to be potential sources of PFAS (Interstate Technology Regulatory Council, 2022). Figure 18, below, displays the location of STW-2.

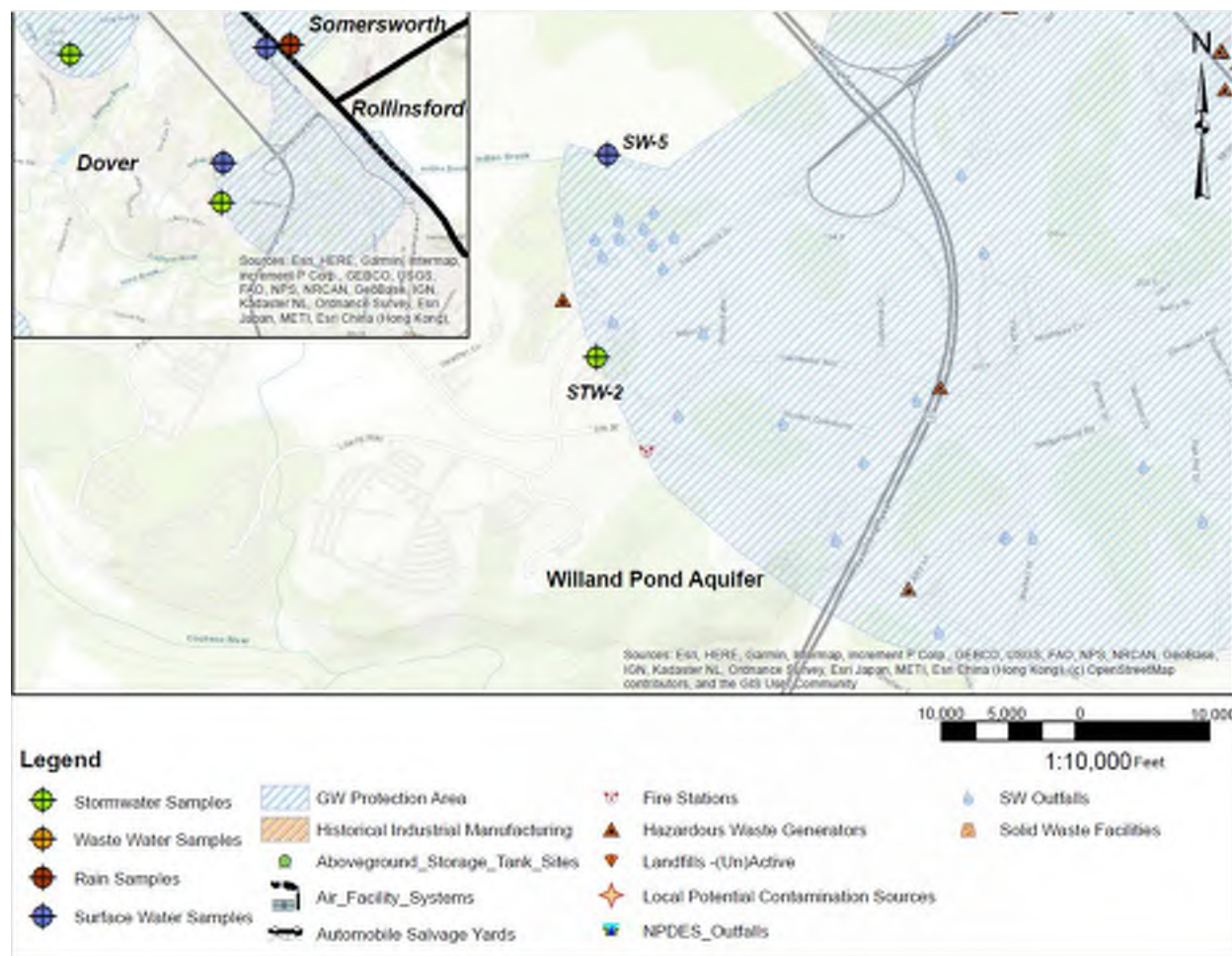


Figure 18 Location of STW-2.

3.4.4 Sampling Due Diligence

In order to check the accuracy of the sampling results, we took a duplicate sample, an equipment blank, and a field blank. These three samples provided a check to see if our team's sampling methods, techniques, and materials cross contaminated the samples with external PFAS. The duplicate was taken at SW-9, EB-1 was the equipment blank for the bailers which was performed at the location for SW-9, and FB-1 was the field blank taken before the first sample on the first day of sampling at the location for SW-8.

3.4.5 Collective Sampling Locations

Figure 19 displays the four groundwater protection zones, the protected area of interest, the identified potential sources, and the sampled locations.

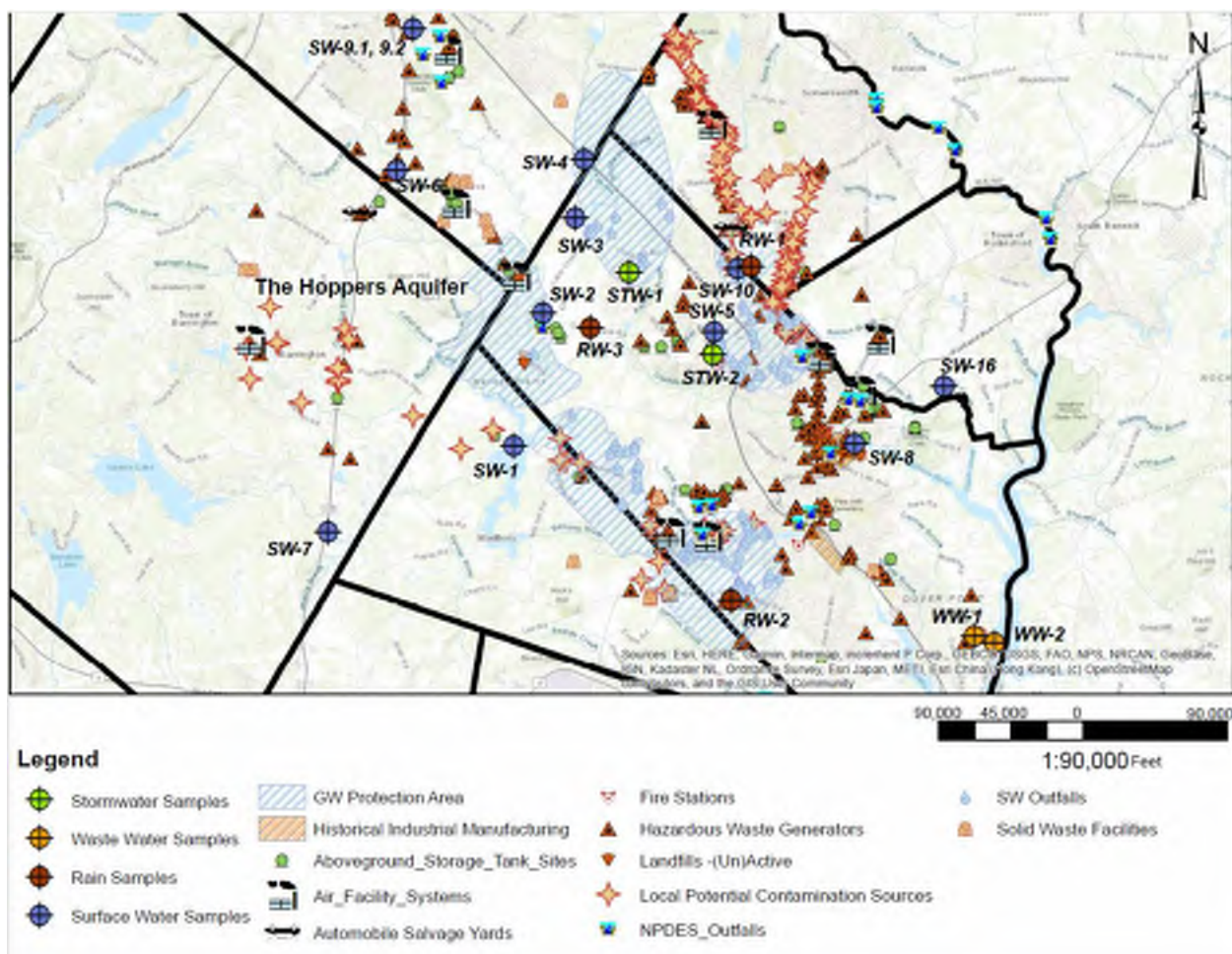


Figure 19 All of the sampled sites.

Table 6 lists all of the sampling discussed in Section 4.4. This table also includes each sample's coordinates and the sampling objective that each sample meets.

Table 6 Locations for all sites sampled in this study.

Sample ID	Northing	Easting	Sampling Objective	Notes
SW-1	43.196641	-70.951018	Drinking Water Sources	
SW-2	43.221598	-70.9445304		
SW-3	43.2389305	-70.9357706		
SW-4	43.2500106	-70.934923		
SW-5	43.21751308	-70.90162835		
SW-6	43.247028	-70.98085		
SW-7	43.181053	-70.999185		
SW-8	43.1967926	-70.8665321		
SW-9.1	43.2742507	-70.9770045		
SW-9.2	43.2742507	-70.9770045	Due Diligence	
SW-10	43.2289555	-70.8947566	Drinking Water Sources	
SW-16	43.207037	-70.84364		
WW-1	43.1598272	-70.83167557		
WW-2	43.1598272	-70.83167557		
STW-1	43.22990898	-70.9199263	Stormwater	
STW-2	43.21217765	-70.89971825		
RW-1	43.2295918	-70.8935433	Rainwater	
RW-2	43.16805402	-70.89802905		
RW-3	43.218675	-70.933508		
FB-1	43.1967926	-70.8665321	Due Diligence	Taken at SW-8 location
EB-1	43.2742507	-70.9770045		Taken at SW-9 location

The field notes and pictures of the sampling sites are included in Appendix D.

3.4.6 Sampling Alternatives Used

Our team's original plan incorporated sampling two groundwater wells and another stormwater outfall location. While in the field we were unable to obtain the keys to access either of the groundwater wells and the stormwater outfall location was inaccessible. We resorted to the alternative locations we had planned for these sites which included SW-9, SW-10, and SW-16. Several of the surface water sampling locations were also slightly moved up or downstream so our team could access them.

3.5 Sampling Procedures and Protocols

The sampling procedures and protocols that our team utilized are included in Appendix A.

3.5.1 Health and Safety Plan

The Health and Safety Plan for this project is attached in Appendix B.

4 Results

The results of the 2022 December sampling trip were returned to our team in early January 2023. Appendix E includes the reordered results of this trip. Both our Field Blank and Equipment Blank were returned without any PFAS detections. These blank results mean that our sampling practices and materials did not introduce any external PFAS into the samples.

4.1 Supplemental Data

In addition to using the results from our team’s sampling efforts, we have also used data from the NHDES PFAS Data Mapper. This extends the data set our team is working with in order to give us a better idea of the PFAS concentration throughout Dover. Since the majority of our samples were surface water samples, we only extracted the available surface water samples from inside of Dover. There were four sites, and each had been sampled a different number of times for different PFAS. If a site was sampled more than once for a certain PFAS the average value was used. If a certain PFAS was not detected an N/D is shown and if the PFAS wasn’t analyzed for an N/A is shown. Table 7, below, displays the final data used.

Table 7 Supplemental surface water PFAS samples from NHDES PFAS Data Mapper.

PFAS	Temporally Averaged Values (ng/L)			
	198401044INTAKE	198401044SW1	198401044SW4	198907059RIVER
PFBA	N/D	N/D	N/D	4.12
PFPeA	N/D	N/D	N/D	9.61
PFHxA	2.65	N/D	N/D	9.86
PFHpA	N/D	N/D	N/D	2.70
PFOA	7.60	2.17	2.99	6.28
PFNA	N/D	N/D	N/D	1.77
PFDA	N/D	N/D	N/D	1.N/D3
PFUnA	N/D	N/D	N/D	N/D
PFDoA	N/D	N/D	N/D	N/D
PFTTrA	N/D	N/D	N/D	N/D
PFTeA	N/D	N/D	N/D	N/D
PFBS	N/D	N/D	N/D	1.95
PFPeS	N/A	N/A	N/A	N/D
PFHxS	4.10	N/D	N/D	0.96
PFHpS	N/A	N/A	N/A	N/D
PFOS	7.63	1.85	2.60	4.79
PFNS	N/A	N/A	N/A	N/D
PFDS	N/A	N/A	N/A	N/D
4:2 FTSA	N/A	N/A	N/A	N/D
6:2 FTSA	N/A	N/A	N/A	N/D
8:2 FTSA	N/A	N/A	N/A	N/D
NETFOSAA	N/D	N/D	N/D	N/D
NMEFOSAA	N/D	N/D	N/D	N/D
NMEFOSA	N/A	N/A	N/A	N/D
GenXAcid	N/A	N/A	N/A	N/D
N/A = Not Analyzed for N/D = Not Detected				

4.2 Analysis

Our first step in the analysis process was to reorder the data into 4 groups and list them from smallest PFAS to largest PFAS chain length. Table 8 below displays the analyzed PFAS in this new format. Appendix E includes the full reordered results.

Table 8 Reordered list of PFAS analytes for this study.

Grouping	Analyte	Analyte Acronym
Sulfonic Acids	perfluorobutane sulfonic acid	PFBS
	perfluoropentane sulfonic acid	PFPeS
	perfluorohexane sulfonic acid	PFHxS
	perfluoroheptane sulfonic acid	PFHpS
	perfluorooctane sulfonic acid	PFOS
	perfluorononanesulfonic acid	PFNS
	perfluorodecane sulfonic acid	PFDS
	4:2 fluorotelomer sulfonic acid	4:2FTS
	6:2 fluorotelomer sulfonic acid	6:2FTS
	8:2 fluorotelomer sulfonic acid	8:2FTS
	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11CLPF3OUDS
	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9CLPF3ONS
Carboxylic Acids	perfluorobutanoic acid	PFBA
	perfluoropentanoic acid	PFPeA
	perfluorohexanoic acid	PFHxA
	perfluoroheptanoic acid	PFHpA
	perfluorooctanoic acid	PFOA
	perfluorononanoic acid	PFNA
	perfluorodecanoic acid	PFDA
	perfluoroundecanoic acid	PFUnDA
	perfluorododecanoic acid	PFDoDA
	perfluorotridecanoic acid	PFTTrDA
	perfluorotetradecanoic acid	PFTeDA
	2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propanoic acid	GenX Acid
Sulfonamide Acids	n-ethyl perfluorooctanesulfonamido acetic acid	N-EtFOSAA
	n-methylperfluorooctane sulfonamido acetic acid	N-MeFOSAA
	perfluorooctane sulfonamide	PFOSA
	n-methyl perfluorooctane sulfonamide	NMeFOSA
Propanoic Acids	4,8-dioxa-3h-perfluorononanoic acid (ADONA acid)	ADONA

Table 9 below displays the number of samples with detections for each PFAS analyte for each different type of sample. For ease of use these have been color coded with red being the maximum number of detections for each type and green being no detections.

Table 9 Number of detections of each PFAS for each sample type.

Grouping	Analyte Acronym	Number of Detections			
		SW	STW	RW	WW
Sulfonic Acids	PFBS	4	1	1	2
	PFPeS	1	0	0	0
	PFHxS	3	1	0	2
	PFHpS	0	0	0	0
	PFOS	12	1	2	2
	PFNS	0	0	0	0
	PFDS	0	0	0	0
	4:2FTS	0	0	0	0
	6:2FTS	1	0	0	0
	8:2FTS	0	0	1	0
	11CLPF3OUDS	0	0	0	0
	9CLPF3ONS	0	0	0	0
Carboxylic Acids	PFBA	9	2	3	2
	PFPeA	1	0	0	2
	PFHxA	6	0	0	2
	PFHpA	13	2	3	2
	PFOA	15	2	3	2
	PFNA	1	0	0	0
	PFDA	1	0	0	0
	PFUnDA	1	0	0	0
	PFDoDA	0	0	0	0
	PFTTrDA	0	0	0	0
	PFTeDA	0	0	0	0
	GenX Acid	1	0	0	0
Sulfonamide Acids	N-EtFOSAA	0	0	0	0
	N-MeFOSAA	0	0	0	0
	PFOSA	0	0	0	0
	NMeFOSA	0	0	0	0
Propanoic Acids	ADONA	2	0	0	0
Total Number of Samples		16	2	3	2

PFOS, PFBA, PFHpA, and PFOA were detected in almost every sample. In NH, standards exist for PFOA and PFOS in drinking water but PFHpA and PFBA do not have any standards in NH or nationally.

4.2.1 NH MCLs and EPAs Proposed MCLs

As described in Section 3 and Table 2, New Hampshire has set state MCLs for four PFAS. We have compared our results for these four PFAS against the state MCLs. Table 10, below, displays the number of detections that exceed NH PFAS MCLs for each sample type. 1.1% of the samples exceeded the NH MCLs.

Table 10 Number of detections exceeding NH's drinking water MCLs.

PFAS	NH MCLs (ng/L)	Number of Detections Exceeding MCLs			
		SW	STW	RW	WW
PFHxS	18	0	0	0	0
PFOS	15	0	0	0	0
PFOA	12	1	0	0	0
PFNA	11	0	0	0	0
Total number of Samples		16	2	3	2

Also described in Section 3, the EPA announced proposed MCLs for six FPAS. Table 11 displays the number of times detections that exceed the MCLs for PFOS and PFOA. 17.4% of the samples exceeded the EPA proposed MCLs.

Table 11 Number of detections that exceed the EPA proposed drinking water MCLs.

PFAS	EPA Proposed MCLs (ng/L)	Number of Detections Exceeding MCLs			
		SW	STW	RW	WW
PFOA	4	3	0	0	2
PFOS	4	1	0	0	2
Total number of Samples		16	2	3	2

While the exceedances are concerning, the surface water and wastewater sampled aren't being directly used as drinking water sources. Since the proposed MCL for PFNA, PFHxS, PFBS, and GenX Acid is based on having a combined Hazard Index less than 1.0 our team only analyzed the presence of these chemicals in our sample set rather than try to determine exceedances. Table 12 displays the number of times that the six PFAS were detected.

Table 12 Number of detections for the six PFAS the EPA is proposing MCLs for.

PFAS	Number of Detections			
	SW	STW	RW	WW
PFOA	15	2	3	2
PFOS	12	1	2	2
PFNA	1	0	0	0
PFHxS	3	1	0	2
PFBS	4	1	1	2
GenX Acid	1	0	0	0
<i>Total number of Samples</i>	16	2	3	2

Collectively these six PFAS were detected in 39.8% of the samples. This shows that even while the concentrations were above the MCLs only a few times, most of these chemicals are commonly detected in water samples across the City of Dover.

Because PFOA and PFOS are the two most common PFAS of the six PFAS from above, the results for each have been mapped in order to view spatially where the highest concentrations exist. Figure 20, below, displays the PFOS.

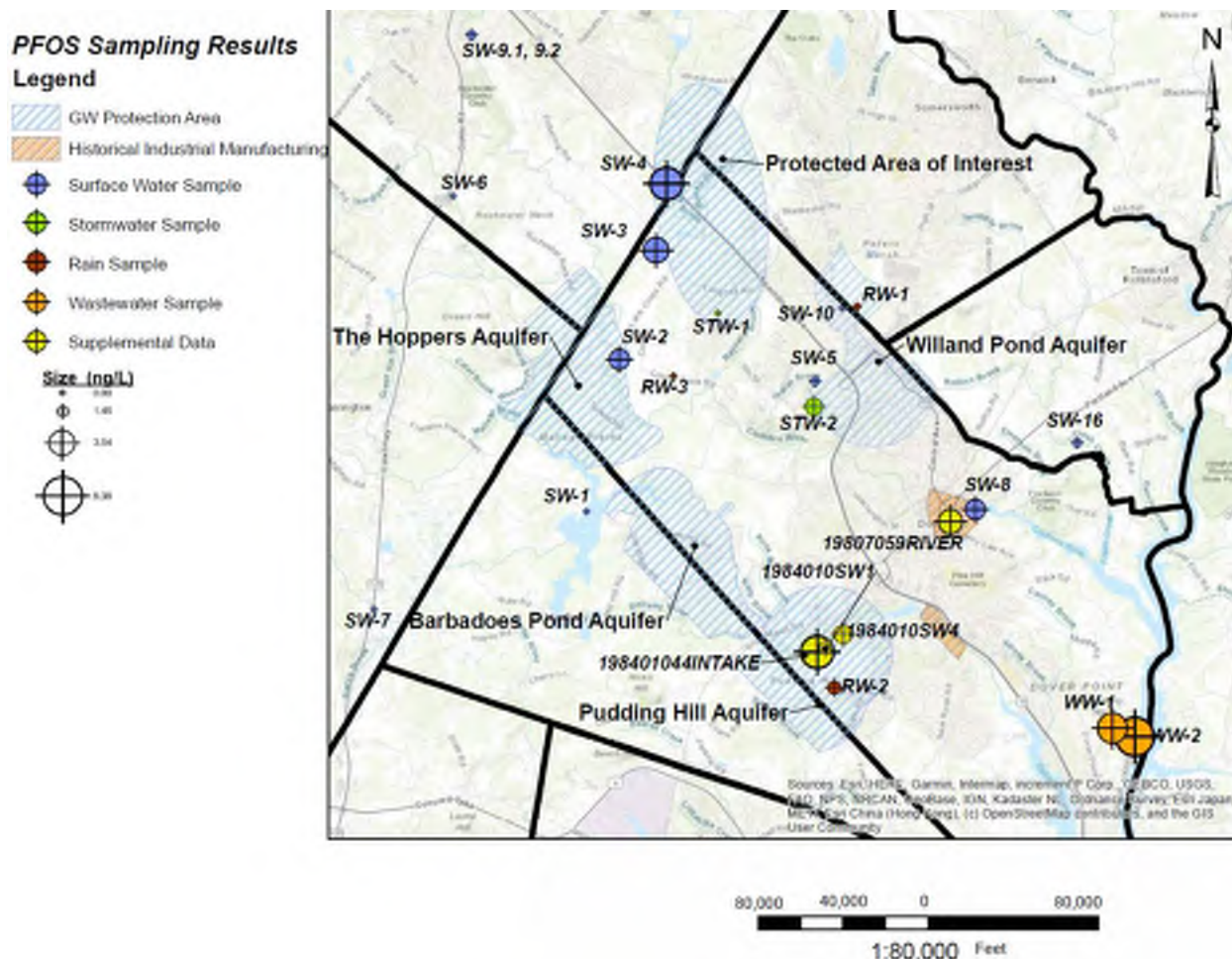


Figure 20 Magnitude of PFOS concentrations from samples in this study.

Using Figure 20, the highest concentrations of PFOS exist in the Protected Area of Interest, the wastewater treatment plant, and one uncharacteristically high concentration in the Bellamy River at 198401044INTAKE. This sample was from the supplemental data and is likely linked to the sampling from the known contamination from the New England Metal Recycling Center.

Figure 21, below, displays the results of PFOA in Dover. GZA GeoEnvironmental also provided supplemental sample results within the Bellamy Watershed. These samples are only included in this map due to the results of that sampling only yielding detections for PFOA.

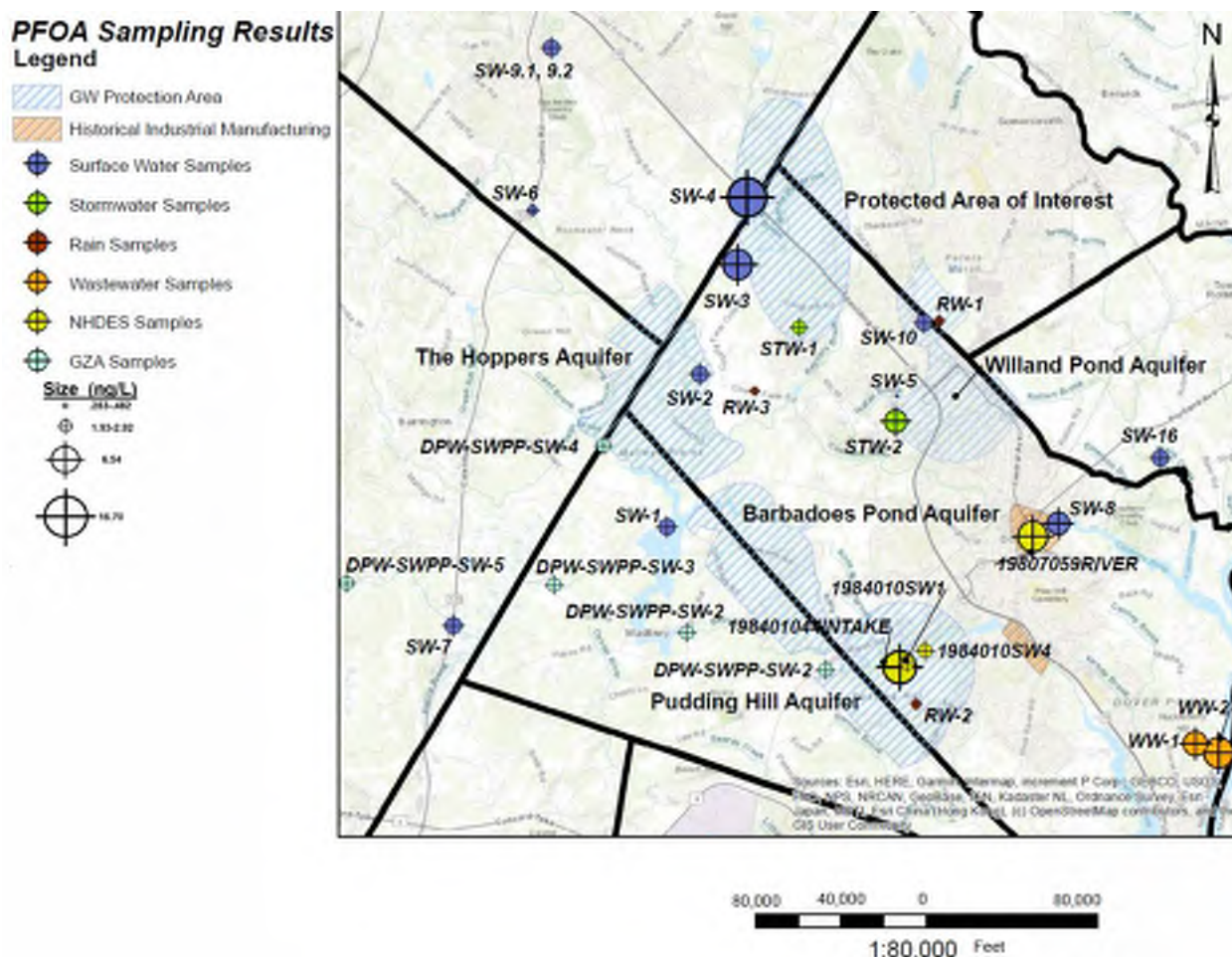


Figure 21 Magnitude of PFOA concentrations from samples in this study.

The highest concentration of PFOA exists at the same three locations as the highest concentrations of PFOS. It is expected that the wastewater treatment plant would have higher concentrations as this plant receives water that is exposed to PFAS in homes and at industries throughout Dover. The high concentrations within the Protected Area of Interest are interesting because there don't seem to be that many potential sources of PFAS nearby. Further tests could help locate the direction of the source and determine if the rest of this area has high concentrations. 198401044INTAKE has high concentrations of PFOA as well and is again likely linked to the New England Metal Recycling Center sampling.

4.2.2 Complexity of Samples

Our team defines the complexity of a sample as the quantity of types of PFAS that exist in each sample. For example, eight PFAS were detected in SW-4 making it a complex sample while only two PFAS were detected in SW-7 which makes it a more simplistic sample. Figure 22 displays the sample complexities overlayed on a map that includes the potential sources discussed in Section 3.3.

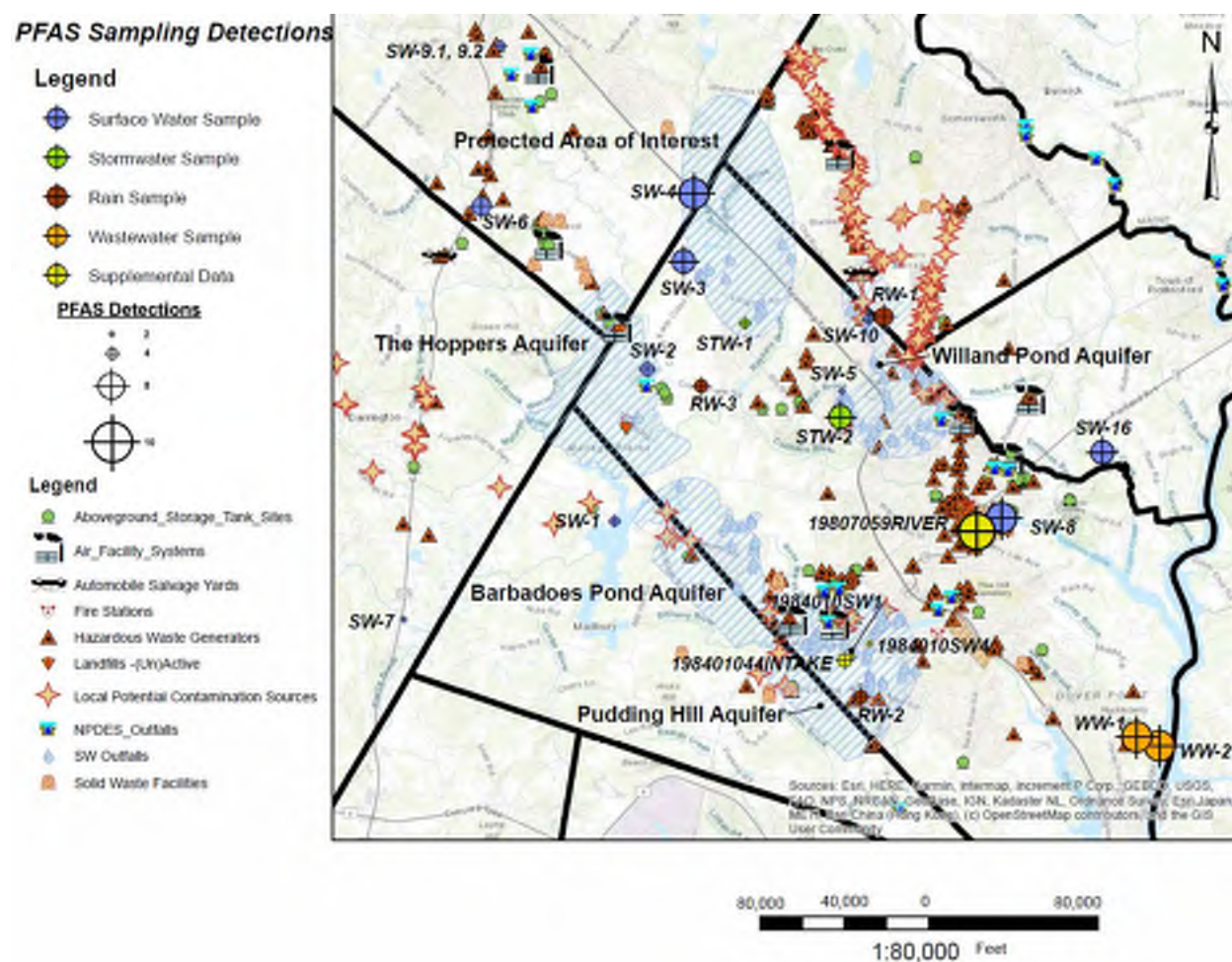


Figure 22 Number of detections at each sample site from this study.

It is not surprising that the samples taken downtown (SW-8 & 19807059RIVER) are complex since this is an area with historical industrial use and many potential sources nearby. The wastewater samples (WW-1 & WW-2) are also complex which is expected because the water that the plant

receives is residential and industrial wastewater which can come into contact with many different types of PFAS. SW-3, SW-4, and SW-16 being somewhat complex is unexpected. There seem to be no nearby potential sources of PFAS near these sites. The brooks that feed these locations could be transporting PFAS to these locations but further investigation is needed. Most of the other sites are simplistic which could mean a few things: the nearby potential sources could be polluting one specific PFAS or some of the locations we identified as potential sources are not polluting PFAS into the nearby environment.

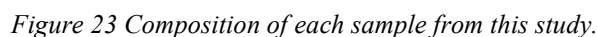
4.2.3 Sample Composition

In order to compare the composition of each sample location quickly, pie charts for each were made. Since the molar mass of PFAS can vary drastically, comparing their mass concentrations in pie charts results in inaccurate distributions. The results, both from our team and the supplemental data, were converted into their molar concentrations and then pie charts for each location were created with the molar concentrations. In order to make the best use of the pie charts a color scheme was created. Table 13 displays this scheme. Only PFAS that were detected in at least one sample were included. Each group has a different base color and within each group the larger the PFAS the darker the color becomes.

Table 13 Color scheme used for the pie charts on the following maps.

Grouping	PFAS
Sulfonic Acids	PFBS
	PFPeS
	PFHxS
	PFHpS
	PFOS
Carboxylic Acids	PFBA
	PFPeA
	PFHxA
	PFHpA
	PFOA
	PFNA
	PFDA
	PFOA
Precursors	6:2FTS
	8:2FTS
Other	GenX Acid
	ADONA

Figure 23, below, was then created which displays both the piecharts and the potential sources discussed in Section 3.3.



Also using Figure 23, the composition of the PFAS found in both the influent and effluent (WW-1 and WW-2 respectively) doesn't match the general composition of the surface waters. In order

to confirm both of these visual analyses, a statistical analysis was performed. This is discussed in Section 4.3.

4.2.1 Hydraulic Connectivity of Sample Locations

Using the United States Geological Survey (USGS) StreamStats website, the watershed for each surface water sample was identified. All of these watersheds and the identified potential sources are shown below in Figure 24.

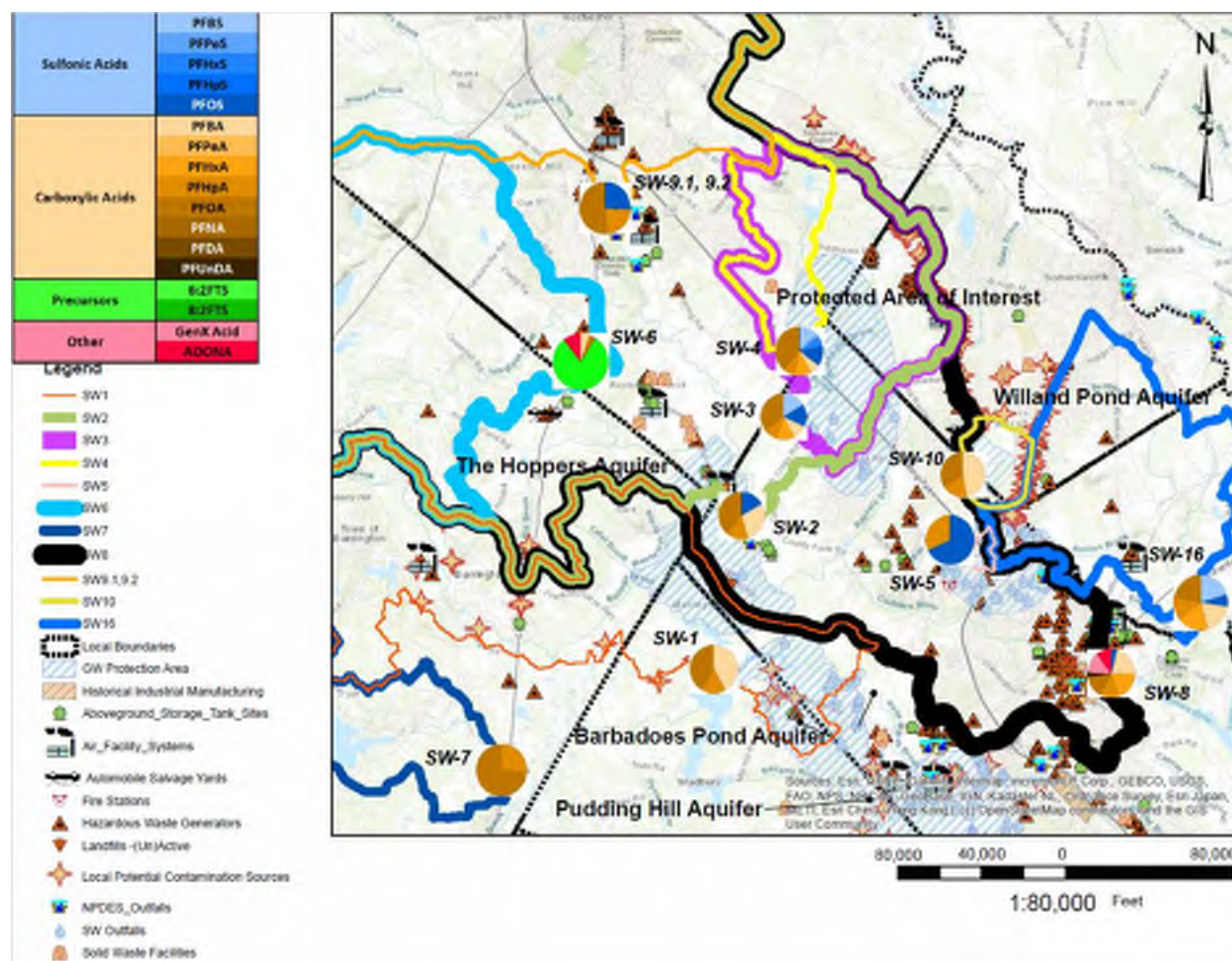


Figure 24 Watershed of each surface water sample from this study.

This map was made so that the concentrations and types of PFAS detected at each surface water sample can be linked to potential sources. The map was also used to see how these surface water

samples are hydraulically connected. For example, both SW-4 and SW-3 are located with the same watershed, therefore PFAS composition should be related if surface water is picking up sources within this drainage area. Possible explanations for these differences include groundwater discharge from a unique PFAS source, PFAS transformations, and surface water/groundwater discharge or recharge influencing concentrations.

This map was used to determine potential hot spots across Dover and was used to guide the recommended long-term sampling plan. SW-4 had some of the largest concentrations detected in the surface water samples. Since these high concentrations exist in SW-4 but are not as high in SW-3, the source of PFAS is likely within SW-4 watershed. SW-8 also had large concentrations as well as detections of PFAS that were not found in many other places in our data set, if at all. This means that the source for these unusual detections likely exists in the location between SW-2's watershed and SW-8's watershed.

4.3 Statistical Analysis

Our team used JMP (a statistical analysis software) to perform a principal component analysis (PCA) for our samples. This analysis reduces the dimensionality of a dataset by creating new variables that are linear combinations of the original variables. This enables us to visualize the results on a two-dimensional plot to easily identify clusters of results that are closely related. Results that were below the detection limit were left out of this analysis. Through a series of statistical calculations, JMP creates different components for the data set. The percentage of variation for each component is calculated. Figure 25, below, displays the Eigenvalue, percent of variation, and the cumulative percent accounted for each component. The first and second component account for 68% of the variation in this dataset.

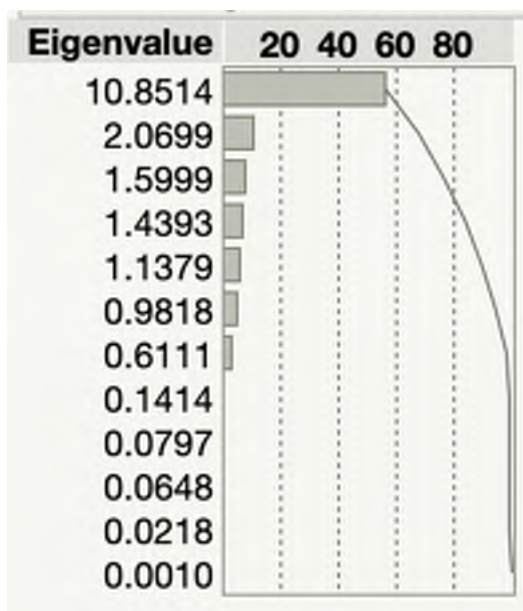


Figure 25 Eigenvalue plot from the PCA.

Below is Figure 26 which is the PCA Loading Plot. This displays the magnitude and direction of component 1 and component 2 for each sample. With Figure 26, the two wastewater samples (WW-1 & WW-2) have a different composition than the rest of the samples and so does SW-6. Most of the other samples have similar compositions. This confirms the same conclusion determined in Section 5.2.4.

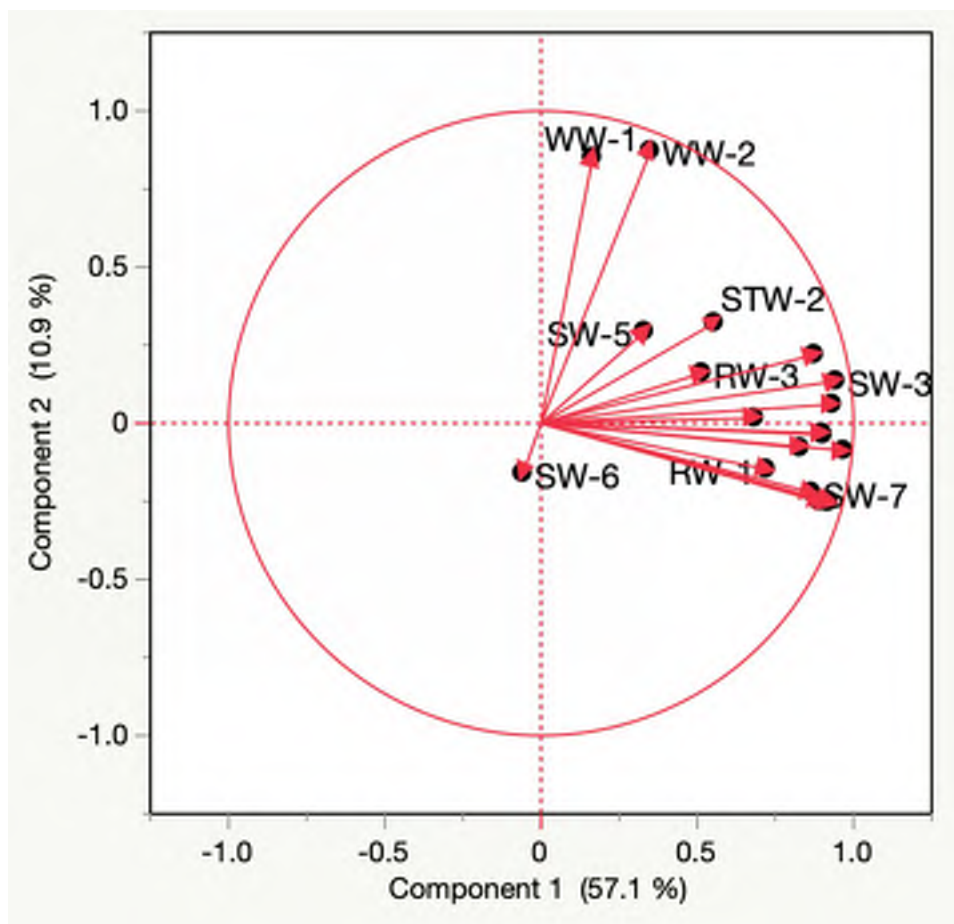


Figure 26 Loading plot from the PCA.

Figure 27, below, is the Score Plot. Instead of relating the sample locations to each other this plot relates the cumulative concentrations of each PFAS to each other. The cumulative concentrations of PFAS that are similar to other PFAS are clumped together in the middle of the plot while the cumulative concentrations that are unlike the others are further away from the clump.

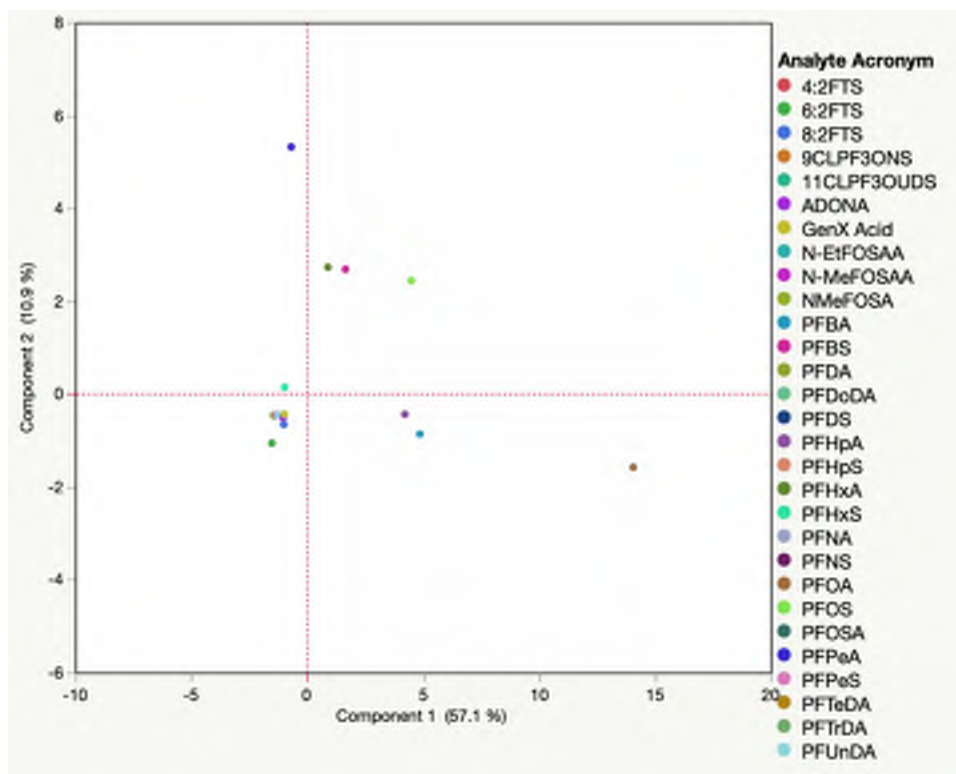


Figure 27 Score plot from the PCA.

Using Figure 27, the two PFAS with the highest cumulative concentrations throughout all samples are PFPeA and PFOA. After reviewing the data, PFPeA was only detected in the wastewater samples at very high concentrations (45.8 ppt and 23.4 ppt). PFOA was detected in most samples but at smaller concentrations (ranging from 0.283 to 16.7). The other PFAS with cumulative concentrations unlike the norm are PFBS, PFOS, PFBA, PFHxA, and PFHpA.

Combining this analysis with the frequency of detections, PFOA and PFOS are two of the most common PFAS and with some of the highest concentrations throughout this sampling of Dover.

4.4 Conclusion

After analyzing the results, the team has identified a few key observations as well as some remaining knowledge gaps. Sections 4.4.1 and 4.4.2 discuss these in detail.

4.4.1 Key Observations

The precipitation that falls in Dover contains a limited number of detectable PFAS. While these concentrations are low, it is still being deposited all across the city during precipitation events.

The stormwater samples also contain PFAS. Unfortunately, since there are only two samples, and they were not collected immediately after precipitation events, it is not possible to relate these detections to possible surface/runoff sources.

The wastewater sample composition does not match the composition of the typical surface water samples in Dover, which suggests that wastewater discharge signatures are not necessarily dominating surface water signatures in Dover. Although the wastewater samples did have some of the highest concentrations of PFAS, there may be other sources that contribute to the types and concentrations of PFAS in surface water samples (e.g., septic systems) which were not sampled in this study. Similarly, the surface water signatures do not appear to be dominated by wastewater signatures.

Of the PFAS detected in the wastewater samples, PFBA, PFPeA, and PFHxA have lower concentrations in the effluent of the treatment plant. PFBA, PFHxS, PFOS, PFHpA, and PFOA (although slight) have higher concentrations in the effluent. This suggests that transformation processes are occurring within the treatment plant that are transforming undetected PFAS precursors into detectable PFAS, and observations documented in peer reviewed studies (Tavasoli, 2020).

The PFAS in surface waters in and around Dover are mainly composed of PFOS, PFBA, PFHpA, and PFOA. These surface waters also contain all of the six PFAS listed in EPA's Proposed MCLs. The Protected Area of Interest was more complex and had higher concentrations than expected.

SW-6 and SW-8 had detections for 6:2 FTS, GenX Acid, and ADONA that were not seen in any of the other samples.

In order to continually advance the understanding of PFAS concentrations across the City of Dover we recommend further testing be conducted. Section 6 describes our recommendations for a long-term sampling plan for Dover.

4.4.2 Remaining Knowledge Gaps

The largest knowledge gap for this project is not knowing the concentrations of PFAS in the groundwater that the City of Dover uses for drinking water. The team is aware the City has been monitoring the groundwater but for this project, no groundwater samples were taken.

The team was unable to identify a background concentration of PFAS within runoff/stormwater due to our limited stormwater sample set. The variation of PFAS concentrations through precipitation events is also unknown since the team was only able to sample the rain from one event.

The team identified as many potential sources in and around Dover as was reasonable for this project, but there could be numerous sources of PFAS that were unidentified. Since PFAS can resist degradation in the environment for decades, the PFAS detected in this sampling round could be from historical sources that no longer exist but are still releasing PFAS.

The last major knowledge gap is that the health effects of exposure to PFAS in the environment at the concentrations found is largely unknown. The general understanding is that exposure to PFAS does have various negative health effects but specific effects from dermal contact through swimming in surface waters that contain PFAS and getting rained on by precipitation that contain PFAS are unknown.

5 Long-Term Sampling Plan Recommendations

After analyzing the results of our sampling, the team has identified some trends and discovered areas that would benefit from further analysis. Continual sampling of Dover will aid in detecting more spatial trends, tracking temporal trends, and identifying sources. The following sections detail the specific recommendations for long-term monitoring in further detail.

5.1 Sampling Recommendations

Below in Table 14 are the team's specific recommendations for each sample type. These have been ordered from highest priority to lowest in terms of public safety and preparation for regulatory compliance.

Table 14 Long-term sampling recommendations for the City of Dover.

Sample Type	Recommendations
Groundwater	Since the City of Dover relies on groundwater as a drinking water source, identifying the conditions of PFAS near production wells is important for preparing to comply with potential future drinking water regulations. For this reason, sampling the groundwater in close proximity to production wells and available monitoring wells near the team's identified potential sources is recommended.
Wastewater	Wastewater treatment plants have been blamed for the release of PFAS into the environment. Based on the results of this initial sampling round and the speculation on wastewater treatment plants, the team recommends sampling sewer lines that feed the wastewater treatment plant. Sampling sewer lines that service entirely residential areas, sewer lines that service industrial, and sewer lines that service both can aid in determining where the source of the PFAS entering the treatment plant originates from.
Surface Water	The team recommends resampling SW-1, SW-2, and SW-5 because they were easily accessible and yielded results that were representative of the entire surface water data that was collected in this sampling round. SW-4, SW-6, and SW-8 should also be resampled because each had unusual detections or large concentrations. Additional surface water samples should

	be taken upstream of the Protected Area of Interest, SW-6, and SW-8 in order to identify sources.
Rainwater	The rainwater stations designed and created by the team were easy to build and functioned well. However, the team wasn't able to take an equipment blank of these stations so if the City of Dover constructs and deploys them, an equipment blank should be taken. Taking rainwater samples throughout the year as well as tracking weather during sampling can aid in identifying sources.
Stormwater	Since only two stormwater samples were taken, no major trends were able to be identified. The team recommends taking more stormwater samples in general and focusing these in areas where there are a lot of identified potential sources. Stormwater sampling should also be done during or immediately after precipitation events to ensure there is water flowing out of stormwater outfalls.

Along with sampling these various different waters, at least one equipment and field blank should be taken during each sampling trip to ensure the quality and validity of the sampler and sampling techniques.

5.2 Sampling Equipment

Since any future sampling will not have a set list of locations or sample types, the sampling equipment needed for one sample of each type is listed below.

Groundwater Equipment:

- Peristaltic Pump or Inertia Pump
- Appropriate size and length HDPE tubing
- Nitrile Gloves

Wastewater Equipment:

- High-density polyethylene (HDPE) disposable bailer and HDPE 1000mL sample bottle
- If using bailer, about 10 ft of ¼ inch nylon rope
- Nitrile gloves

Surface Water Equipment:

- High-density polyethylene (HDPE) disposable bailer or HDPE 1000mL sample bottle
- If using bailer, about 10 ft of ¼ inch nylon rope
- Nitrile gloves

Rainwater Equipment:

- One rainwater sampling station (wooden garden stake, zip ties, metal hose clamp x2, HDPE 1000mL sample bottle, eight-inch polypropylene funnel, aluminum hook to hold funnel in place)
- Nitrile Gloves

Stormwater Equipment:

- High-density polyethylene (HDPE) disposable bailer or HDPE 1000mL sample bottle
- If using bailer, 10 ft of ¼ inch nylon rope
- Nitrile gloves

5.3 Estimated Costs

The team put together a rudimentary cost estimate including the engineering fees (given that the engineers would select, sample, and analyze the next round), the laboratory costs, and the cost of the sampling equipment. This estimate assumes a generic cost for the engineers' time as well as assumes the next round of sampling will have the same number of samples and be analyzed by Absolute Resource Associates again.

Table 15 Cost estimate for an additional round of sampling.

Fees	Unit Costs	Quantity	Total
Engineering			
Entry level Engineer	\$ 90.00 <i>per hour</i>	125 <i>hr</i>	\$ 11,250.00
Project Manager	\$ 135.00 <i>per hour</i>	50 <i>hr</i>	\$ 6,750.00
Senior Project Manager	\$ 150.00 <i>per hour</i>	25 <i>hr</i>	\$ 3,750.00
Principle Engineer	\$ 200.00 <i>per hour</i>	10 <i>hr</i>	\$ 2,000.00
Total			\$ 23,750.00
Laboratory			
Field samples	\$ 275.00 <i>per sample</i>	19 <i>samples</i>	\$ 5,225.00
Blanks	\$ 275.00 <i>per sample</i>	2 <i>blanks</i>	\$ 550.00
Total			\$ 5,775.00
Equipment			
Bailers	\$ 11.00 <i>per bailer</i>	15 <i>bailers</i>	\$ 165.00
Sample Bottles	\$ 3.00 <i>per bottle</i>	15 <i>bottles</i>	\$ 45.00

Rainwater Stations	\$ 50.00	<i>per station</i>	3	<i>stations</i>	\$ 150.00
Rope	\$ 0.15	<i>per foot</i>	200	<i>feet</i>	\$ 30.00
Total					\$ 390.00
Total Project Cost:				\$	29,915.00

6 Summary

We started last semester by doing general research on PFAS and then refined research on PFAS in municipalities in order to better understand the fate and transport of PFAS. We then regularly met with Ken Mavrogeorge, PE (City Engineer for Dover, NH), James Wieck, PG (Associate Principal at GZA GeoEnvironmental, Inc.), and Dr. Paula Mouser (Professor at the University of New Hampshire) to develop the Preliminary Sampling and Testing Report. A site visit was conducted in order for our team to gather a better understanding of the project and the City of Dover. A Health and Safety plan, included in Appendix B, was developed for our safety while sampling. Eastern Analytical, Inc. and ARA were contacted in order to get quotes for PFAS analysis. Information about Dover's ground water protection zones, previous PFAS sampling in the City of Dover, and locations of existing wells were provided to us by the City of Dover and GZA. With all of this information and aid from the City, GZA, and Dr. Mouser, we selected recommended sampling locations best suited to start to understand the background concentrations of PFAS within Dover.

Before winter break these samples were collected by our team and delivered to ARA. Once we returned from our break, we began to analyze the results. Since both the field blank and equipment blank had no detections, we had no reason to believe that the results were influenced by the introduction of external PFAS. The results were compared to NH PFAS MCLs and EPA's proposed MCLs for PFAS. The number of detections for each sample and the composition of each sample (through pie charts) were calculated and displayed on maps of Dover. A principal component analysis was performed to determine any outliers within the dataset.

After these results were analyzed, the team presented to the City of Dover discussing the results and analysis procedure as well as the key takeaways from this initial round of sampling. Using this analysis, we developed long-term monitoring recommendations for Dover.

Due to our lack of experience in composing sampling plans, we struggled to come up with ways to select the actual sampling locations. We worked through this problem by meeting with the project sponsor, project consultant, and project advisor and regularly discussing our options and methods. It was also challenging to work around sensitive information with the City and GZA, but our team transferred sensitive information carefully and learned to work around this. Field sampling for PFAS was also something that our team didn't have much experience in but after GZA guidance we were able to successfully have no detections in both our equipment and field blanks. Working with a dataset with so many variables was also challenging but through discussions at our meetings and directly meeting with Dr. Mouser we developed some ways to effectively view and interpret this data.

This project was presented at the UNH Undergraduate Research Conference, to the City of Dover, and to the UNH CEE Senior Project Class.

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Appendix A – *Sample Procedure and Protocol*

Sample Collection Procedures

Collecting samples that are to be analyzed for PFAS requires a specific sampling procedure in order to eliminate contaminating the sample with external PFAS. Below is the sampling procedure that our team will follow in order to properly collect PFAS samples. These procedures are from EPA Method 1633 Draft 2 (EPA, 2022).

- 1) Collect samples in HDPE containers following conventional sampling practices. All sample containers must have liner-less HDPE or polypropylene caps.
- 2) Using new nitrile gloves collect the sample for PFAS first, prior to collecting samples for any other parameters into any other containers; this avoids contact with any other type of sample container, bottles, or package materials.
- 3) Samples that flow freely are collected as grab samples or in refrigerated bottles using sampling equipment. Collect 500 mL of sample in an HDPE bottle. Do not fill the bottle past the shoulder, to allow room for expansion during frozen storage.
- 4) As with all other samples, do not place the sample bottle cap on any surface when collecting the sample, and avoid all contact with the inside of the sample bottle or its cap.
- 5) When the sample is collected and capped, place the sample bottle(s) in an individual sealed plastic bag (e.g., Ziploc®) separated from all other sample parameter bottles and placed in a shipping container packed only with ice.
- 6) Maintain all aqueous samples protected from light at 0 - 6 °C from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 °C during transport and be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample

temperature is 0 - 6 °C upon receipt. Once received by the laboratory, the samples may be stored at ≤ -20 °C, or at 0 - 6 °C, until sample preparation. However, the allowable holding time for samples depends on the storage temperature, as described in step 4.

- 7) Aqueous samples should be analyzed as soon as possible; however, samples may be held in the laboratory for up to 90 days from collection, when stored at ≤ -20 °C and protected from the light. When stored at 0 - 6 °C and protected from the light, aqueous samples may be held for up to 28 days, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after 7 days. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.

Field Sampling Practices

When feasible, use single-use, disposable polyethylene or silicone materials (tubing, bailers, etc.) for monitoring well purging and sampling equipment. When reuse of materials or sampling equipment across multiple sampling locations is necessary, follow project decontamination protocols with allowed materials and incorporate collection of equipment rinsate blanks into sampling program, as appropriate. Use only allowable items as described in Table 16 below, unless necessary. This table is from the NHDES PFAS sampling website (New Hampshire Department of Environmental Services, 2022).

Table 16 Items that could introduce PFAS into samples from NHDES.

Categories of Items that Could Introduce PFAS Contamination Into the Sample		
Category	Prohibited Items/Actions that could introduce PFAS Sample Contamination	Allowable Items
Pumps and Tubing	Teflon® and other fluoropolymer containing materials.	High-density polyethylene (HDPE), low density polyethylene (LDPE) or silicone tubing.
Sample Container	Containers should not come into contact with carpeting or upholstery inside buildings.	Containers should be stored in a Ziploc bag and transported in coolers.
Stacked Glassware	Foil should not be used as a layer between stacked sample bottles.	Plain paper.
Field Documentation	Waterproof/treated paper or field books, plastic clipboards, markers, Post-It® and other adhesive paper products.	Plain Paper, metal clipboard, ball-point pens, and Fine or Ultra-Fine Point Sharpie® markers.
Clothing	Clothing or boots made of or with Gore-Tex™, Carhartt, or other synthetic water resistant and/or stain resistant materials, Tyvek® material.	Synthetic or cotton material, previously laundered clothing (preferably previously washed greater than six times) without the use of fabric softeners.
Personal Care Products	The handling or application of cosmetics, moisturizers, hand cream, sunscreens, and insect repellents in the sampling area. Note: The presence of PFAS in some of these types products has been documented. However, cross contamination of water samples due to the use of these products has not been documented. The sample collection procedure described in this document should prevent these materials from coming into contact with the water sample. However, limiting the use of these products the day of sampling is still recommended.	Sunscreens - Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30 - Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Stick SPF 50 - Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 - Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30 - Coppertone Sunscreen Stick Kids SPF 55 - L'Oréal Silky Sheer Face Lotion 50+ - Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 - Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30 - Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ Insect Repellents - OFF Deep Woods & Sawyer Permethrin
Food/ Beverage	Pre-packaged food, fast food packaging.	

Common products that may contain PFAS: 1) Paints; 2) Sealants, including products used on grout, countertops and floor treatments; 3) House cleaners and stain removers; 4) Floor wax removers; 5) Stain-resistant textiles (or chemicals used to treat textiles in homes and businesses) including, but not limited to, carpets, shoes and clothing; 6) Furniture with stain-resistant fabric; 7) Water proof textiles; 8) Food cooking ware and utensils; 9) Ski and boat waxes; 10) Dental floss, cosmetics, sunscreen and other personal care products; 11) Construction materials, including caulk sealants and plumbing sealants; 12) Pesticides; 13) Treated paper; 14) Chemical coatings for metal roofing; 15) Solar panels; 16) Purchased garden soils; 17) Automotive supplies, including waxes, cleaners, windshield wipers and additives to fluids used in automobiles; 18) Camping and other outdoor gear; 19) Spray- and grease-based lubricants; and 20) Inks.

Note: Other commercially available products may be PFAS-free. This document identifies products that have been tested by other government entities.

Appendix B – *Health and Safety Plan*

Health and Safety Plan

Emergency Contact Information

Capstone Project Manager: Nathan Salas

Email: Nathan.Salas@unh.edu

Phone: (636) 219-4490

Capstone Faculty Adviser: Dr. Paula Mouser

Email: Paula.Mouser@unh.edu

Phone: (802) 922-4509

Capstone Safety Officer: Max Fortin

Email: Max.Fortin@unh.edu

Phone: (603) 554-2748

City Engineer: Kenneth Mavrogeorge, PE

Email: k.mavrogeorge@Dover.nh.gov

Phone: (603) 516-6454

Dover Police

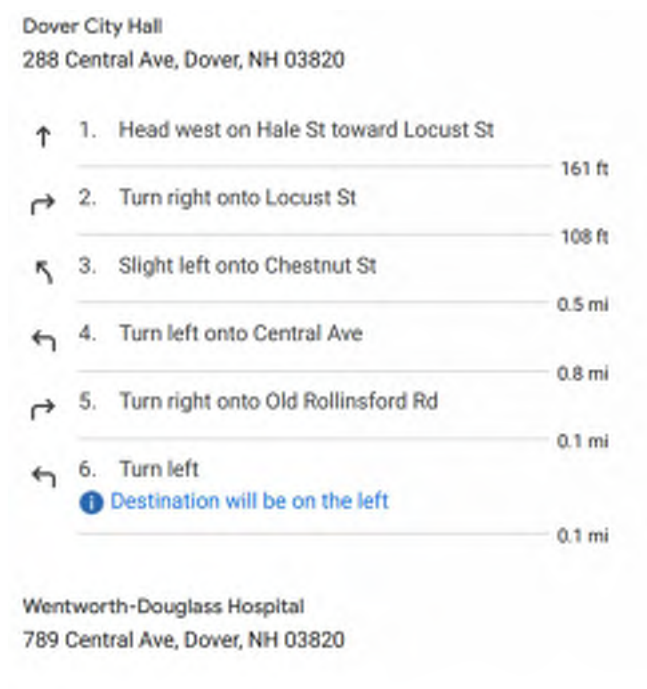
Phone: (603) 742-4646

Emergency Phone: 911

This Health and Safety Plan was developed by The University of New Hampshire Dover, NH – Citywide Background Per and Polyfluoroalkyl Substances (PFAS) Sampling Program Senior Project Team. The intended use of this document is to serve as a plan for the health and safety of the team while taking various water samples that could be contaminated with low levels of PFAS.

In cases of emergency, the nearest hospital is the Wentworth-Douglass Hospital in Dover, NH. Since samples will be taken at various places in Dover, the Google Maps directions from city hall to the Wentworth-Douglass Hospital have been provided on the next page. Alternative directions will need to be used when the team is at the actual sample locations.





Sampling Procedures:

Personal protective equipment (PPE), such as gloves and safety glasses, will be worn while taking all samples to reduce possible exposure. Below is a list of prohibited and allowable items that can be used while sampling for PFAS. This table is from the Interstate Technology and Regulatory Council's (ITRC) PFAS information page. Samplers will be sure to follow this table to the best of their ability.

Table 1 Items that could introduce PFAS into samples from NHDES

Categories of Items that Could Introduce PFAS Contamination Into the Sample		
Category	Prohibited Items/Actions that could introduce PFAS Sample Contamination	Allowable Items
Pumps and Tubing	Teflon® and other fluoropolymer containing materials.	High-density polyethylene (HDPE), low density polyethylene (LDPE) or silicone tubing.
Sample Container	Containers should not come into contact with carpeting or upholstery inside buildings.	Containers should be stored in a Ziploc bag and transported in coolers.
Stacked Glassware	Foil should not be used as a layer between stacked sample bottles.	Plain paper.
Field Documentation	Waterproof/treated paper or field books, plastic clipboards, markers, Post-It® and other adhesive paper products.	Plain Paper, metal clipboard, ball-point pens, and Fine or Ultra-Fine Point Sharpie® markers.
Clothing	Clothing or boots made of or with Gore- Tex™ Carhartt, or other synthetic water resistant and/or stain resistant materials, Tyvek® material.	Synthetic or cotton material, previously laundered clothing (preferably previously washed greater than six times) without the use of fabric softeners.
Personal Care Products	The handling or application of cosmetics, moisturizers, hand cream, sunscreens, and insect repellents in the sampling area. Note: The presence of PFAS in some of these types products has been documented. However, cross contamination of water samples due to the use of these products has not been documented. The sample collection procedure described in this document should prevent these materials from coming into contact with the water sample. However, limiting the use of these products the day of sampling is still recommended.	Sunscreens - Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30 - Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Stick SPF 50 - Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 - Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30 - Coppertone Sunscreen Stick Kids SPF 55 - L'Oréal Silky Sheer Face Lotion 50+ - Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 - Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30 - Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ Insect Repellents - OFF Deep Woods & Sawyer Permethrin
Food/Beverage	Pre-packaged food, fast food packaging.	

Common products that may contain PFAS: 1) Paints; 2) Sealants, including products used on grout, countertops and floor treatments; 3) House cleaners and stain removers; 4) Floor wax removers; 5) Stain-resistant textiles (or chemicals used to treat textiles in homes and businesses) including, but not limited to, carpets, shoes and clothing; 6) Furniture with stain-resistant fabric; 7) Water proof textiles; 8) Food cooking ware and utensils; 9) Ski and boat waxes; 10) Dental floss, cosmetics, sunscreen and other personal care products; 11) Construction materials, including caulk sealants and plumbing sealants; 12) Pesticides; 13) Treated paper; 14) Chemical coatings for metal roofing; 15) Solar panels; 16) Purchased garden soils; 17) Automotive supplies, including waxes, cleaners, windshield wipers and additives to fluids used in automobiles; 18) Camping and other outdoor gear; 19) Spray- and grease-based lubricants; and 20) Inks.

Note: Other commercially available products may be PFAS-free. This document identifies products that have been tested by other government entities.

Sample collection method/sequence:

Use new nitrile gloves to collect the sample for PFAS first, prior to collecting samples for any other parameters into any other containers; this avoids contact with any other type of sample container, bottles, or package materials. Do not place the sample bottle cap on any surface when collecting the sample, and avoid all contact with the inside of the sample bottle or its cap. When sample is collected and capped, place the sample bottle in an individual sealed plastic bag, separate from all other sample parameter bottles, and place in shipping container packed only with ice.

Samples collected from groundwater monitoring wells:

Use single-use, disposable polyethylene, or silicone materials (tubing, bailers, etc.) for monitoring well purging and sampling equipment. When using positive displacement/submersible pump sampling equipment, familiarize yourself with the sampling pump/accessory equipment specifications to confirm that device components are not made of nor contain Teflon® or PTFE.

Exposure Risk:

While sampling surface waters and groundwaters there is a chance of being exposed to both PFAS and heavy metals. Any possible exposure to these chemicals would occur in low concentrations and do not pose a significant risk to the samplers if all PPE protocol is followed.

There is also the risk of being exposed to numerous contaminants when sampling from stormwater outfall locations. Those contaminants include heavy metals, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, halogenated aliphatic, halogenated ethers, monocyclic aromatics, phenols and cresols, phthalate esters, nitrosamines, pesticides, and other organics, especially in urban and/or industrialized areas (Ahmed, 2019). Pathogenic bacteria, viruses and protozoa can also be found in stormwater runoff and transported to environmental water bodies through sewer overflows, defective septic systems, agricultural runoff, defecation from wild animals and discharge of treated sewage (Ahmed, 2019). Samplers should wear safety glasses and nitrile gloves when sampling stormwater outfalls to minimize potential exposure routes.

The sampling locations include areas that are heavily vegetated. This introduces biological hazards including poisonous plants, biting/stinging insects, biting animals, and physically damaging plants (i.e., thorns). Since the team plans to sample in the winter, there will be a minimal concern for biting/stinging insects and poisonous plants. Biting animals and physically

damaging plants are constant risks when in the field. To combat this, the sampler should stay aware of their surroundings and be flexible in altering sampling plans for their own safety. Table 2 displays the possible health effects associated with potential contaminants that the sampler could be exposed to.

Table 2 below displays the on-site hazards and the mitigation techniques.

Table 2 Hazard Assessment

On-Site Hazards	Hazard Mitigation
Exposure to low levels of PFAS	Toxicity and/or carcinogenicity of each substance has not been precisely determined. Samples should be treated as potential health hazardous and handled with adequate protection to skin and eyes.
Exposure to low levels of Heavy Metals (<i>Arsenic, Antimony, Cadmium, Chromium, Copper, Lead, Selenium</i>)	Some of these metals are known carcinogens. These can also cause acute and chronic toxicity in the liver, kidney, and intestine. Samples should be handled with skin and eye protection.
Physically Damaging Plants	Scrapes, cuts, and bruises can occur. Wear proper protective clothing to protect skin.
Pathogenic Bacteria	Diarrhea, gastrointestinal illness, nausea, vomiting, fever, abdominal pain, salmonellosis, cholera, etc... can be caused if sampler is exposed. Use and disposal of gloves and be cautious of not touching your face while wearing the gloves can reduce the exposure to these bacteria.
Chemical Hazards	All chemicals used in field activities such as solvents, reagents, decontamination solutions, or any other hazardous chemical must be accompanied by the appropriate labels, safety data sheets, and employee training. Proper PPE must be worn.

Weather Hazard	Weather will be assessed prior to field work, if conditions are deemed workable then workers will dress appropriate for field work with current weather conditions.
Equipment Hazard	All equipment will be handled with caution.
Water / Wetlands Hazard	When working on or near water all workers shall use the “buddy system” and will not work alone.
Slip, Trips, and Falls Hazard	Be aware of changing on site conditions and mark potential slip, trip, or fall hazards with markers or paint.
Heavy Traffic or Working Alongside Roadway	Use of cones, when necessary, remain out of traffic thruways, and workers will wear bright reflective clothing

Appendix C – *Potential PFAS Sources in and Near Dover, NH*

Table 17 Potential PFAS Sources in and Near Dover, NH.

Potential PFAS Source	Type of Facility	Town	Address
FAMILY CARE OF SOMERSWORTH	DR OFFICE	SOMERSWORTH	353 HIGH ST
G&G AUTOMOTIVE	2 BAY GARAGE, 12+VEHICLES SITTING, 2 MAN SHOP	BARRINGTON	95 PASTURE HILL RD
SEACOAST VASCULAR	MEDICAL FACILITY	SOMERSWORTH	267 RTE 108
ADAGIO SPA & SALON	SALON	BARRINGTON	567 RTE 125
MARSH BROOK PROFESSIONAL CENTER	HOSTS A NUMBER OF MEDICAL SERVICES	SOMERSWORTH	237 RTE 108
RANGE AUTOMOTIVE	VEHICLE SERVICE STATION	SOMERSWORTH	445 HIGH ST
EASY STREET SHOES	SHOE STORE	SOMERSWORTH	364 RTE 108
MONSTER GAS	GAS STATION WITH CAR WASH	SOMERSWORTH	489 HIGH ST
WILLAND POND AUTO	AUTO REPAIR, GAS STATION	DOVER	60 NEW ROCHESTER RD
PROMPTO OIL CHANGE	OIL CHANGE ONLY	DOVER	10 WEEKS LN
ERIC'S SMALL ENGINE REPAIR, EASTERN POWER EQUIP	EASTERN POWER EQUIPMENT INC	BARRINGTON	862 FRANKLIN PIERCE HWY
BZ ASSOCIATES	MACHINERY HEARD DURING SURVEY, UNKNOWN USE	SOMERSWORTH	26 WILLAND DR
GASTROENTEROLOG Y, PA		SOMERSWORTH	21 CLARK WAY
SEACOAST REDICARE	MEDICAL OFFICE	SOMERSWORTH	396 HIGH ST
STEVES ACCURATE AUTOMOTIVE	AUTO REPAIR, GAS	MADBURY	194 LITTLEWORTH RD
TRIUMPH AUTO GLASS	CAR DEALERSHIP AND PARTS SUPPLIER	SOMERSWORTH	371 RTE 108
DOVER MOTOR MART	LARGE TRUCK	SOMERSWORTH	8 WILLAND DR

	SPECIALIZATION		
RAM GENERAL CONTRACTOR	DUMP TRUCKS, BACKHOE, STORAGE SHEDS,PT TAKEN ALONG ROAD	MADBURY	HUCKINS RD
DR. DAVID NESS FAMILY DENTISTRY	DENTIST OFFICE	SOMERSWORTH	8 CLARK WAY
WALMART GAS MIDWAY AUTO SALVAGE	GAS STATION FORMER AUTO SALVAGE YARD	SOMERSWORTH SOMERSWORTH	23 WALTONS WAY 157 RTE 108
HILLTOP CHEVROLET	SALES AND SERVICE	SOMERSWORTH	385 RTE 108
DUPONTS SERVICE CENTER	CAR SERVICE	DOVER	28 SUMNER ST
FRISBEE HEALTH SERVICES		BARRINGTON	426 CALEF HWY
PHASE 2 SPECTEX		ROCHESTER	AIRPORT DR
NEW MEADOWS LAUNDROMAT	LAUNDROMAT	DOVER	1 LILAC LANE
ADVANCE AUTO PARTS	PARTS STORE, PARKING LOT SERVICE BY CUSTOMERS?	SOMERSWORTH	10 ANDREWS RD
BARRINGTON HARDWARE	BLUE SEAL FEEDS, SMALL ENGINE REPAIR, PROPANE TANK CLOSED?	BARRINGTON	RTE 9 SMOKE ST
TODD'S TOUCH AUTO-DETAILING	AUTO DETAILING, PAINTING	SOMERSWORTH	217 RTE 108
BLACK DOG CAR WASH	CAR WASH	SOMERSWORTH	413 HIGH ST
DOVER DENTAL ASSOCIATES	DENTIST OFFICE	DOVER	AMES PLAZA-CENTRAL AVE
SOMERSWORTH NISSAN/IZUZU	INCORRECT COORDINATES -	SOMERSWORTH	RTE 108
FMC - FALL MACHINE COMPANY	DUPE POINT MACHINE WORK, MANUFACTURING	SOMERSWORTH	10 WILLAND DR
GOODWIN COMMUNITY HEALTH	HEALTHCARE FACILITY	SOMERSWORTH	311 RTE 108
COMMERCIAL CONDOS	DENTIST IN COMPLEX	SOMERSWORTH	350 BARCLAY SQ
MURPHY AND SONS (WARD SHEET METAL)	NAME CHANGE TO MURPHY AND SONS	DOVER	1 SUMNER ST
CENTRAL PARK GARAGE	VEHICLE SERVICE STATION	SOMERSWORTH	470 HIGH ST

KIA SOMERSWORTH	SALES AND SERVICE	SOMERSWORTH	375 RTE 108
SONO BELLA SPA AND SALON	BEAUTY SALON	DOVER	15 WEEKS LN
ALBANY ENGINEERED COMPOSITES BLDG 2	LARGE MANUFACTURING	ROCHESTER	AIRPORT DR
DOVER PUBLIC WORKS		DOVER	275 MAST RD
RAM MACHINERY KNIGHTS GARAGE	SHEET METAL CAR GARAGE	DOVER	106 CROSBY ROAD
HEAD AND NECK DOCTOR	DR OFFICES	BARRINGTON	528 CALEF HWY
TRI-CITY SUBARU	DEALERSHIP W/ SERVICE BAYS	SOMERSWORTH	361 HIGH ST
TIRE WAREHOUSE		SOMERSWORTH	195 RTE 108
BARRINGTON COUNTRY LLC	CANNOT CONFIRM PCS LOCATION	SOMERSWORTH	426 RTE 108
EMPIRE BEAUTY SCHOOL	BEAUTY SALON SCHOOL	BARRINGTON	RTE 9
GREAT BAY ORAL SURGERY	DR OFFICES	SOMERSWORTH	362 RTE 108
STAR LUMBER	LUMBER YARD, WOOD PRESERVATION	SOMERSWORTH	259 RTE 108
FEDCO TRUCK AND EQUIPMENT	OIL TRUCKS IN PARKING LOT FROM SEVERAL LOCAL COMPANIES	SOMERSWORTH	450 HIGH ST
MOBIL GAS	GAS STATION	SOMERSWORTH	358 RTE 108
PORTLAND GLASS		SOMERSWORTH	196 TRI CITY RD
	ON SITE	SOMERSWORTH	3 RTE 108
THE OAKS GOLF COURSE	MAINTENANCE BUILDING FOR EQUIPMENT	SOMERSWORTH	100 HIDEAWAY PLACE
SHEAR POWER PROFESSIONAL HAIRCUTTERS	HAIR SALON	SOMERSWORTH	424 RTE 108
MAPLE COMMONS	RENTAL EQUIPMENT, CHAINSAW REPAIR	SOMERSWORTH	439 RT 108
CYN ENVIRONMENTAL SERVICES	OIL AND WASTE MANAGEMENT	SOMERSWORTH	
LAFERRIERE'S CABINET SHOP	MAY BE OUT OF BUSINESS	DOVER	8 PROGRESS DR
GARLAND AUTO		DOVER	16 FRENCH CROSS RD
KEY AUTO CENTER	SERVICE FACILITY	MADBURY	14 PUDDING HILL RD
		SOMERSWORTH	RTE 108 &

	SEPARATE		BLACKWATER RD
LUCKYLADY TOY KENNELS	GROOMING AND KENNEL SERVICE	BARRINGTON	559 CALEF HWY
US ARMY RESERVE CENTER	ARMY EQUIPMENT MAINTENANCE	SOMERSWORTH	179 RTE 108
AUTOZONE		SOMERSWORTH	503 HIGH ST
NEW ENGLAND METAL RECYCLING LL	KNOWN SOURCE	MADBURY	290 KNOX MARSH RD
IRVING GAS	GAS STATION	SOMERSWORTH	425 HIGH ST
BLACK DOG CAR WASH	CAR WASH	SOMERSWORTH	4 ENTERPRISE DR
BP GAS	GAS STATION	SOMERSWORTH	463 HIGH ST
COAST PUBLIC TRANSIT	BUS SERVICE	DOVER	42 SUMNER ST
HOLMWOODS FURNITURE	FURNITURE REPAIR AND SALES	SOMERSWORTH	411 RTE 108
VARNEY'S CLEANERS	DRY CLEANERS	DOVER	23 WEEKS LN
PRESTIGE		DOVER	AMES PLAZA-CENTRAL AVE
GULF FUEL STATION	GAS STATION	SOMERSWORTH	420 RTE 108
WEBBER ENERGY FUELS	GAS STATION	SOMERSWORTH	420 RTE 108
ARMY RESERVE FACILITY	STORAGE AND MAINTENANCE OF MILITARY VEHICLES	SOMERSWORTH	15 BLACKWATER RD
AIREX CORP	MANUFACTURER	SOMERSWORTH	15 LILAC LN
DR. JOHN HOELL		SOMERSWORTH	1 GREENFIELD DR
ROBERT CHRISTIAN, DDS	DENTIST	SOMERSWORTH	263 RTE 108
UNNAMED GARAGE	VEHICLE SERVICE STATION	SOMERSWORTH	446 HIGH ST
CONTINENTAL CONTITECH	MANUFACTURER	SOMERSWORTH	10 INTERSTATE DR
SKYHAVEN AIRPORT HANGERS	REPAIR OF AVIATION EQUIPMENT, FUEL STORAGE	ROCHESTER	238 ROCHESTER HILL RD
BOB SHERWOOD LANDSCAPE CO	LANDSCAPING	DOVER	55 KNOX MARSH RD
RIVERSIDE GARAGE AND LEASE	VEHICLE REPAIR AND SALES	SOMERSWORTH	481 HIGH ST
HAIR EXCITEMENT	SALON	DOVER	CORNER OF CENTRAL AVE & MAIN ST
UNIQUE REFLECTIONS	BEAUTY SALON	SOMERSWORTH	379 HIGH ST

SEACOAST CARDIOLOGY	DR. OFFICE	SOMERSWORTH	203 RTE 108
MORRISON CYCLE/SKIDOO	ALSO SMALL ENGINE REPAIR/PAINT SHOP ACROSS STREET. GENERAL REPAIR, SALES, IN	MADBURY	181 LITTLEWORTH RD
GREAT FALLS VET HOSPITAL	MEDICAL FACILITY	SOMERSWORTH	428 RTE 108
DANA'S AUTO BODY	AUTO SERVICE AND REPAIR	MADBURY	212 LITTLEWORTH RD
PINEWOOD MEDICAL CENTER	PAIN CARE, SALMON FALLS FAMILY HEALTH, PINEWOOD MEDICAL	SOMERSWORTH	PINEWOOD DRIVE
VIDEO TRANSFER SERVICE	PT TAKEN @ 300' DOWN RD, SMALL SHOP-PHOTOS AND FILM TO VIDEO	BARRINGTON	HAM RD
STRATHAM TIRE		SOMERSWORTH	4 GATOR ROCK
PINEWOOD MEDICAL LAB	MEDICAL LAB	SOMERSWORTH	5 CLARK WAY
CENTRAL PARK VETERINARY HOSPITAL	MEDICAL FACILITY	SOMERSWORTH	252 RTE 108
VIP DISCOUNT AUTO	VEHICLE SERVICE STATION	SOMERSWORTH	6 WALTONS WAY
BARRINGTON HEALTH CENTER	DR. OFFICE	BARRINGTON	8 CENTURY PINES DR
ALBANY ENGINEERED COMPOSITES SHIPPING & RECEIVING	MANUFACTURER	ROCHESTER	AIRPORT DR
MIDWAY USED CARS	AUTO DEALER W/ SERVICE	SOMERSWORTH	155 RTE 108
SUMNER PRINTING HAIR EVERYWHERE	PRINTING SERVICES	SOMERSWORTH DOVER	433 RT 108 SHAWS
KEY AUTO SERVICE CENTER	AUTO SERVICE	SOMERSWORTH	221 RTE 108
SOMERSWORTH NISSAN	VEHICLE SERVICE AND REPAIR, DEALERSHIP	SOMERSWORTH	285 RTE 108
COLONY AUTOBODY		DOVER	880 CENTRAL AV
RTD TECHNOLOGIES	MOLD MAKING	SOMERSWORTH	360 RTE 108
KIM'S KUT N KURL	SALON	BARRINGTON	528 RTE 125
SOMERSWORTH PUBLIC WORKS	CITY MAINTENANCE	SOMERSWORTH	18 LILAC LN

MONROE MUFFLER BRAKE	VEHICLE SERVICE STATION	SOMERSWORTH	31 WALTONS WAY
PAPA BEAR CAR CARE	VEHICLE SERVICE STATION	SOMERSWORTH	464 HIGH ST
MIDAS	CAR REPAIR	SOMERSWORTH	497 HIGH ST
SUPERCUTS	BEAUTY SALON	DOVER	20 WEEKS LN

Appendix D – *Field Notes and Sampling Photos*

Below are the pictures taken in the field at each sampling site and the field notes during the December 2022 sampling trip.

SW-1:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

This sample site was moved to the north side of the bridge due to access issues with the original site.

New Coordinates: 43.196641, -70.951018





SW-2:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Moved upstream. **New Coordinates: 43.2215980, -70.9445304**





SW-3:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Sampled upstream of bridge. Moved slightly for better access. **New Coordinates: 43.2389305, -70.9357706**





SW-4:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Sampled downstream of the culvert. Moved slightly for better access.

New Coordinates: 43.2500106, -70.934923





SW-5:

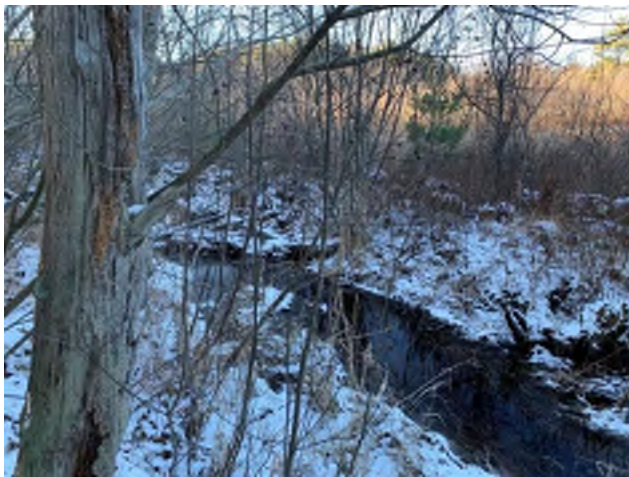
12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Used bottle instead of bailer.







SW-6:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

Sampled as planned.



SW-7:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

Sampled as planned.



SW-8:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Moved upstream, water was frozen at the selected site. **New Coordinates: 43.1967926, -70.8665321**



SW-9.1 & SW-9.2:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

SW-9 was the alternative for GW-1. We were unable to obtain the keys to the monitoring wells so the alternative was used. SW-9 was also moved significantly upstream due to the number of samples that would've been in close proximity in the Cocheco River. A duplicate was taken here.

New Coordinates: 43.2742507, -70.9770045



SW-10:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

SW-10 was the alternative for GW-2. We were unable to obtain the keys to the monitoring wells so the alternative was used. Moved slightly for better access. **New Coordinates: 43.2289555, -70.8947566**



SW-16:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

SW-16 was the alternative for STW-3. There was no flow at the STW-3 location. Taken upstream of bridge.

New Coordinates: 43.207037, -70.84364





WW-1:

12/13/2022

Clear & Sunny, 25°F

Nathan

Met with Jimmy Casey and sampled the influent water at the wastewater treatment plant.

WW-2:

12/13/2022

Clear & Sunny, 25°F

Nathan

Met with Jimmy Casey and sampled the effluent water at the wastewater treatment plant.

STW-1:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Bottle used instead of bailer.



STW-2:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

Bottle was used instead of bailer.



RW-1:

Deployed December 7th, 2022 by Nathan & Michael.

Collected December 19th, 2022 by Nathan.

Moved slightly in order for the rainwater catchment device to be within the site fence.

New Coordinates: 43.2295918, -70.8935433

RW-2:

Deployed December 7th, 2022 by Nathan & Michael.

Collected December 19th, 2022 by Nathan.



RW-3:

Deployed December 7th, 2022 by Nathan & Michael.

Collected December 19th, 2022 by Nathan.



FB-1:

12/12/2022

Clear & Sunny, 32°F

Nathan & Michael

The field blank was taken at the first sample location, SW-8.

EB-1:

12/13/2022

Clear & Sunny, 25°F

Nathan & Briar

The equipment blank was taken near the bridge at SW-9.

Appendix E – *Reordered Results*

On the next page.

1

All results displayed in ng/L
Result has no qualifiers
“J” Result was below instrument calibration range but above method detection limit (MDL)
Result is below associated detection limit

Mavrogeorge, Kenneth

From: Mavrogeorge, Kenneth
Sent: Monday, February 24, 2025 12:22 PM
To:
Cc:

Subject: RE: athletics iterations

Importance: High

Councilor Cullen,

Thank you for providing the design iterations the JBC had reviewed as part of the ballfield project for DHS. I reviewed the documents more closely than I did before the informal TRC last week and came up with the following questions and comments:

Dover Athletic Complex Questions/Comments:

1. Soccer Field

a. How was the width of the soccer field chosen?

- i. It appears to exceed the minimum for HS soccer by 45 feet (ASBA 2023 manual). That could reduce the width of the complex and track and reduce costs.

1. At 310' x 210' it appears to meet the minimum for collegiate sports.

- ii. How do the NHIAA regulations come into play. If I'm not mistaken the NHIAA field dimensions are as follows, please confirm:

1. Length: Minimum 75 yards, maximum 80 yards

2. Width: Minimum 45 yards, maximum 50 yards

- iii. The National Federation of State High School Associations (NFHS) recommends that high school soccer fields be between 100 and 120 yards long, and between 55 and 80 yards wide. This proposed field exceeds the minimum standards as well.

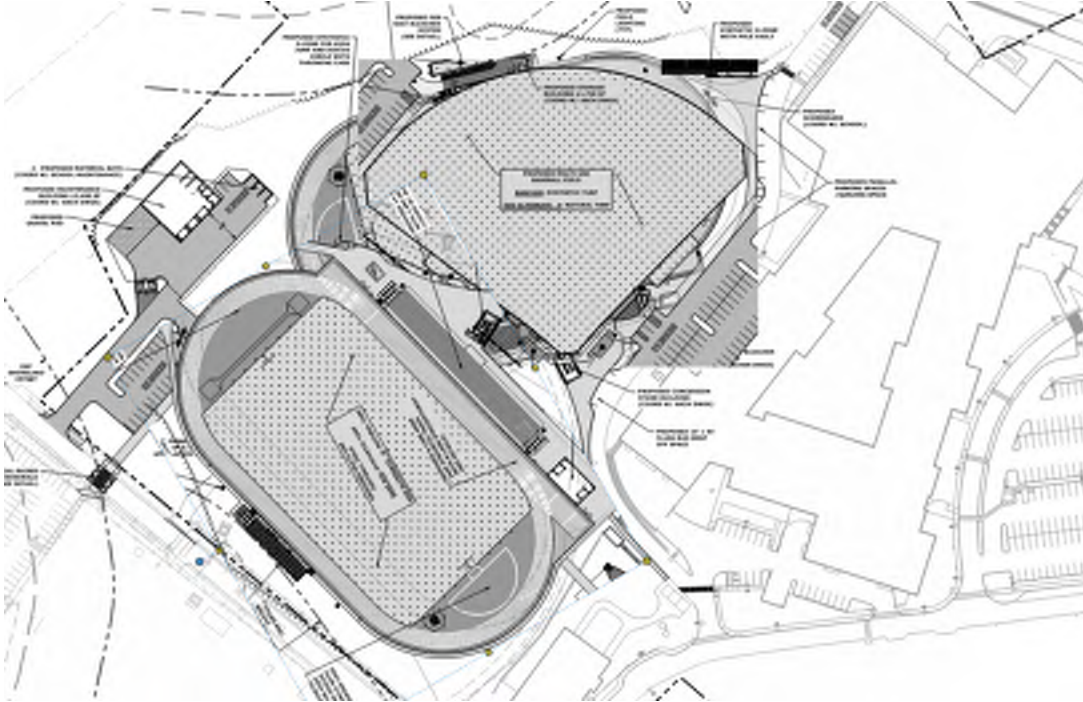
2. Concession Stand, Maintenance Building, Storage Area:

- a. Can the concession stand and rest rooms move closer to the parking lot and Bellamy Rd?
- b. Seems odd to have concessions over 500 feet from the parking lot.
- c. Its currently proposed location is not practical for visitors of baseball or football to utilize during games.
- d. As a parent with young kids I can safely say that the location of the concession stand as proposed is a safety concern.
- e. Why is the concession stand within a fenced in area? Would this be accessible during baseball/multisport events?
- f. A lot of utility work and conduit runs are required to construct the buildings as this proposes. Keeping them close to Bellamy and together avoids unnecessary utility costs.
- g. Can the maintenance, storage and concessions be consolidated into one space with room for future expansion rather than having three unique structures? Having them along Bellamy could create a unique welcoming entrance to the sports complex rather than having them scattered about.
- h. Moving the maintenance area closer to Bellamy could reduce the amount of impervious area.

3. Field configurations:

- a. Looks like the two fields could be swapped and solve a number of issues:
- i. Foul balls into the road.
- ii. Multipurpose field constraints on Bellamy

- iii. *Reduction in natural buffer impacts*
- iv. *Better access to rest rooms and concessions for all sports with the baseball viewing area adjacent to the home team bleachers.*
- v. *Better possibility for shared lighting for the complexes with the fields closer together.*
- b. *This configuration does not seem to have been considered in all the iterations provided to date.*



- c. *Outfield dimensions for baseball are flexible unlike the football, soccer, and other field sports which can help reduce state shoreland buffer impacts and shorten permitting timelines.*
- 4. **Bleachers:**
 - a. *If the layout is flipped as proposed above, can the home bleachers be made double-sided to allow for viewing of baseball and football from the same structure?*
- 5. **Utilities:**
 - a. *There is a lot of sewer rework that is unnecessary with this concept.*
 - i. *Appears that the sewer is being rerouted to utilize the same tie in at Bellamy versus just providing a separate sewer lateral for each new building.*
 - ii. *There would be no need for state permitting if no structures were added. Keep sewer laterals less than 300 feet.*
- 6. **Track and Field:**
 - a. *Can the triple jump and long jump pits be swapped with the pole vault to reduce the width of the field and reduce area needs and ultimately earthwork?*
 - b. *What is the purpose for increasing the width of the track? Is the existing track not up to current NHIAA standards?*
- 7. **Pedestrian Areas:**
 - a. *Why is there so much impervious area behind the bleachers?*
 - b. *Can more green space be added to avoid creating more impervious surfaces?*
- 8. **Baseball Field:**
 - a. *Where is the scorer for baseball supposed to sit?*
 - b. *Can the elevated seating be consolidated or simplified to be down the lines on simplified bleachers?*
 - c. *If the field remains along Bellamy then a large net would be required to protect vehicles on the road which is proposed. That is more maintenance for the school or City if the City takes it over.*
- 9. **Landscaping elements:**

- a. *There are concepts online with very decorative and seemingly expensive landscape elements. Are these all ADA compliant and can they be value engineered a bit to be more affordable?*

I am in agreement that something needs to be done at these fields and I am hoping that my comments are helpful in achieving a cost effective means to that end. I am happy to meet with you and the designers at Tighe & Bond if you wish to discuss these comments in greater detail.

Regards,

Ken

Ken Mavrogeorge, PE

City Engineer

City of Dover, NH

271 Mast Rd.

Dover, NH 03820-4169

e: k.mavrogeorge@doover.nh.gov

p: 603.516.6454 | f: 603.516.6463

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****[Click here to read the latest City of Dover Engineering Monthly Report!](#)****