# Nantucket Land Council

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February 7, 2022

Diane O'Neil, Director of Facilities
Nantucket Public Schools
10 Surfside Road
Nantucket, MA 02554

Re: Nantucket Public Schools: Campus Wide Master Plan

Dear Ms. O'Neil,

Thank you for your time in meeting with Nantucket Land Council staff over the past several months and providing us with some information regarding the proposed athletic field improvements, specifically regarding the installation of the track with two synthetic turf fields. The Nantucket Land Council is a non-profit organization with a mission to help protect and preserve Nantucket's waters and natural resources.

We have provided the information and plans to our consultants, the Horsley Witten Group (HW), for their review. Based upon this evaluation and input (see HW letter dated February 3, 2022 below) we would like to provide you with the following comments and concerns. There are additional items addressed in the comment letter, but we would like to highlight some of them here.

- The results from testing synthetic turf field materials proposed for Martha's Vineyard Regional High School (MVRHS), including turf, shockpad, brockfill, and pellet glue, which are represented as being the same materials proposed for Nantucket Public Schools, identify PFAS in the form of leachable PFAS compounds and PFAS precursors in the form of Total Oxidizable Precursor (TOP), detected in all components other than the pellet glue. Total Organic Fluorine (TOF), which provides a quantitative assessment for potential PFAS compounds beyond what current PFAS analyses can provide, was also detected in all materials. (HW *Soil and Material Testing* #5)

- While the materials may be the same as those proposed for MVRHS, these materials can have different chemical compositions depending on when, where, and how they are manufactured. Specific lot (batch) testing would need to be performed on the turf, pads, infill and glues to demonstrate that PFAS concentrations do not exceed the values detected in the MVRHS materials, as they have been referenced as comparable. (HW *Soil and Material Testing* #7)

- Soil sampling was conducted at the proposed site(s) in order to determine background levels of PFAS, metals and other contaminants. The results may not be relevant in determining a baseline as the samples were collected from within the top 6 inches where atmospheric deposition can influence results. This top layer of soil is proposed to be removed during construction, so any future monitoring will not be from the same location. (HW *Soil and Material Testing*)

- The stormwater infrastructure, as proposed, does not comply with MA Stormwater Standard #2 because it creates a peak discharge rate during 2-year and 10-year storms which is greater than existing conditions. The results of these calculations would change if more up to date rainfall depths were used in the analysis. More information should be provided relative to offsite discharges at several locations, including the Cow Point Road neighborhood, to ensure that flooding will not be an issue. (HW *Stormwater* #2 and #3)

- The project proposes over 2 acres of new impervious parking and plaza surfaces within the nitrogen-impaired Nantucket Harbor Watershed. There are opportunities to improve pre- treatment with landscaping and/or educational rain gardens for enhanced nutrient attenuation. If included, some of these stormwater best management practices (BMPs) can provide excellent educational opportunities. (HW *Stormwater* #1a, #1b and #1c)

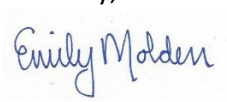
- A system of filters should be provided in the trench drains along the track to help prevent microplastics (degraded turf material) from entering the stormwater system and groundwater. (HW *Stormwater* #1c)

- No proposed monitoring plan has been provided. If the project proceeds, stormwater effluent, soils and groundwater should be monitored for long-term impacts. (HW *Other* #7)

- Based on a review of Nantucket's Zoning Bylaw (Section 139-12C), a Special Permit should be required for the storage of hazardous or toxic materials in the Public Wellhead Recharge District. It is unclear whether any analysis of the proposed track materials has been conducted, but this product may also be a PFAS concern. (HW *Special Permit)*

The proposed installation of the synthetic turf fields as part of the campus wide master plan involves the utilization of materials that pose a risk to Nantucket's water resources. In addition to the presence of known and regulated PFAS compounds, there is still so much we do not know about additional PFAS chemicals that are also present and the extent of impact their presence may carry. The current stormwater management design does not adequately address potential flooding concerns, does not go far enough to pre-treat increased runoff, and should be utilized for education where possible. This project currently lacks a well designed long-term monitoring program, and ultimately requires a Special Permit from the Zoning Bylaw. For these reasons the NLC is not in support of the proposed synthetic fields. We hope the NPS team and School Committee will take these concerns into consideration moving forward.

Thank you for your time.
Sincerely,



Emily Molden
Executive Director

Enclosure
CC: Elizabeth Hallett, Superintendent
Dr. Timothy Lepore, School Committee Chair

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February 3, 2022

Ms. Emily Molden, Executive Director
Nantucket Land Council, Inc.
6 Ash Lane
Nantucket, MA 02554

RE: Review of NPS Athletic Improvements Design and Testing Information

Dear Ms. Molden:

The Horsley Witten Group, Inc. (HW) has reviewed the materials provided by the Nantucket Land Council (NLC) related to soil and material testing data, proposed stormwater management, and special permit considerations for the NPS Campus Athletic Improvement Plan. The proposed project is not part of an active permit application; thus, our review should be considered preliminary in nature. Our comments are intended to support NLC in evaluating potential concerns and opportunities associated with the project.

**Soil and Material Testing**

It is our understanding that NPS sampled existing soils (within the top 6 inches) on site at two locations. The purpose of this sampling, presumably, was to determine if PFAS and metals are currently present. We do not have information on methods of collection, but were provided laboratory reports from Bureau Veritas, Alpha Analytical, and Cornell. We were also provided laboratory reports related to AstroTurf from AIRL, INC. and on the synthetic turf materials proposed for the Martha's Vineyard Regional High School (MVRHS) from Alpha Analytical. HW was involved in developing the PFAS sampling plan and in reviewing the Tetra Tech analysis from the MVRHS project as consultants to the Martha's Vineyard Commission.

For the NPS project, we reviewed the following lab reports, sample location map, and data spreadsheets:

*Soil Testing, Metals - Cornell*

- "Copy of NPS-Existing Soil-Metals Test Results.pdf" and .xlsx (Cornell Nutrient Analysis Laboratory data spreadsheet, dated 10/11/2021)
- "29078R.xlsx" (same document as previous)

*Soil Testing, PFAS- Alpha Analytical*

- "L215426_Oct 26 2021.pdf" and .xlsx (Alpha Analytical report dated 10/26/21)
- "Copy of NPS-Existing Soil-PFAS24 Test Results.pdf" and .xlsx (same as previous)
- "NPS Soil Sample Plan-211006.pdf" (SMRT plans dated Oct. 6, 2021)
- "PFAS in soil and in Brock infill.pdf" (summary table, no date)

*Soil Testing, PFAS - Bureau Veritas*

- "320060-061 BV Labs 1. pdf" and .xlsx (Bureau Veritas Laboratory analysis report, dated 1/20/20)

*Material testing - MVRHS*

- "2021-02-26 (TurfAnalysisReport_FINAL).pdf" (Tetra Tech MVRHS Synthetic Turf Testing and Analysis Summary Report dated 2/26/21)
- "Copy of Greenfields Turf_Brock Pad_Brock Fill-Test Results.pdf" (Alpha Analytical Report for MVRHS project, dated 2/11/21, not final)

*Material Testing - AstroTurf*

- "B48#2 PFAs analysis.pdf"—AIRL, INC. Lab Report (dated Jan 27, 2020)
- "PFAS Letter.pdf" (from AstroTurf, dated May 25, 2021)

We tabulated and compared the soil and material testing results against the Massachusetts Department of Environmental Protection (MassDEP) Method 1 Standards for soil in reporting category S-1/GW-1 (protective of groundwater) and S1/GW-3 (protective of surface water) for the six currently regulated per and polyfluoroalkyl substances (PFAS) compounds and select total metals. There are thousands of PFAS compounds but current laboratory methods only report between 21 to 34 different PFAS compounds. MassDEP only regulates six PFAS compounds where reference dose (RfD) information is available for conducting a human health risk assessment. It is expected that more compounds will be regulated as more information becomes available.

Findings from our review of the laboratory data are as follows:

1. Data from the Cornell Nutrient Analysis Laboratory for select metals indicated that metals are in soil, but there was no exceedance of the applicable MassDEP standards (**Table 1**). It should be noted that not all metal analytes have a standard.
2. Data from Alpha Labs indicate that PFAS was detected in the soil samples, but there was no exceedance of the applicable MassDEP standards for the six regulated compounds and no reporting obligations were triggered (**Table 2**). However, the Alpha Lab results for PFDA concentrations in Sample 1 are close to the S1/GW-1 standard. Given the lack of information on sample collection, we cannot rule out that the PFAS detected in these samples was introduced during sample collection.
3. We don't have enough information on the Bureau Veritas data to evaluate the results. We cannot confirm proper collection methods, there is no chain of custody information, and we do not know the location of the samples.
4. The AstroTurf results from AIRL are not relevant since AstroTurf is not the material that the applicant is proposing.
5. The results from MVRHS turf, shockpad, brockfill, and glue testing indicated that PFAS substances, precursors (as indicated by PFAS Total Oxidizable Precursor (TOP) analysis), and leachable PFAS compounds were present in all materials, except for the pellet glue. Total Organic Florine (TOF) was also detected in all materials except for the Brockfill, which indicates potential for additional PFAS compounds to be present in the material beyond what the laboratory can report. To illustrate which synthetic materials had a PFAS detection from the MVRHS testing, **Tables 3-4** are taken from HW's

review of Tetra Tech's MVRHS testing summary report (see HW memorandum to the MVC entitled "Synthetic Turf Laboratory Testing and Analysis Summary Report Martha's Vineyard Regional High School (MVRHS)" dated March 1, 2021). The TOP analysis was chosen to determine the potential for precursor PFAS compounds to form into detectable PFAS compounds under oxidizing conditions, such as long-term exposure to sunlight and acid rain. TOF analysis was chosen to determine the potential for PFAS compounds beyond those currently reported by the laboratory to be present in the materials.

6. The file "PFAS in soil and in Brock infill.pdf" (no date) is a summary table of Alpha Analytical's PFAS testing of the two soil samples and a third sample named "Brock Infill." An infill sample was not included in the actual laboratory report ("L215426_Oct 26 2021.pdf"), so the source of this data is unclear. In addition, the Brockfill data in the summary table indicates non-detects (N/D) for all compounds, which is inconsistent with the PFAS and TOP analyses from the MVRHS study that not only detected PFAS in Brockfill but showed an exceedance of at least one comparable standard (see **Table 3**).

7. The turf carpet, pad, and infill materials proposed for NPS, while the same as the MVRHS materials, may have different chemical compositions depending on when, where, and how they are manufactured. We would recommend testing the specific lot (batch) for the carpet, pads, infill, and glues to be installed at the NPS campus to prove that PFAS concentrations do not exceed values detected in the MVRHS materials.

8. In addition, we recommend that the PFAS TOP analysis and Synthetic Precipitation Leaching Procedure (SPLP) methods are used for any future PFAS testing to predict additional combinations of PFAS that may emerge and what may leach from field components, respectively. Consideration should also be given for analysis of TOF. TOF can provide a quantitative assessment for potential PFAS compounds beyond what current PFAS analyte specific analyses provide.

9. Laboratory reporting limits should be considered before interpreting data results for PFAS. Because the PFAS standards are so low and concentrations in the parts per trillion, laboratory reports can be misleading when data is reported in a way that suggests non-detects or absence of PFAS compounds. In most situations, the Reportable Detection Limit (RDL) is higher than the regulatory standard for PFAS. In **Table 2**, for example, the AIRL, Inc. data presents a RDL of 1 ug/kg, which is greater than all but one of the six regulated compounds. The measured sample value could be 0.99 ug/kg but would not be reported even though it may exceed the regulatory standard. PFAS data should be reported to the Method Detection Limit (MDL), which is defined by EPA as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte." The RDL is higher than the MDL and is based on the lowest point in a calibration curve that is analyzed by the laboratory equipment. Labs reporting to the MDL may have values flagged with a "J" to indicate that a particular PFAS compound has been detected and the concentration is estimated since it is between the MDL and the RDL. Analytical reports should therefore report to the MDL and include J-flagged values until analytical methods are able to achieve lower RDLs.

**Table 1. Summary of Total Metals in Soil**

| Sample ID | | | | 29078-1 | 29078-2 |
|---|---|---|---|---|---|
| Sample Date | | | | Unknown | Unknown |
| **Total Metals** | **MassDEP S1/GW-1** | **MassDEP S1/GW-3** | **Units** | Sample Results | |
| Arsenic | 20 | 20 | mg/kg | 3.1 | 1.6 |
| Barium | 1,000 | 1,000 | mg/kg | 11.1 | 7.5 |
| Cadmium | 70 | 70 | mg/kg | 0.0 | 0.0 |
| Chromium | 100 | 100 | mg/kg | 1.3 | 0.0 |
| Copper | 1,000* | NS | mg/kg | 12.3 | 4.2 |
| Nickel | 600 | 600 | mg/kg | 2.3 | 1.6 |
| Lead | 200 | 200 | mg/kg | 39.2 | 25.7 |
| Zinc | 1,000 | 1,000 | mg/kg | 21.8 | 11.8 |
| Aluminum | NS | NS | mg/kg | 3,732.2 | 3,057.3 |
| Boron | NS | NS | mg/kg | 55.5 | 44.8 |
| Calcium | NS | NS | mg/kg | 1,663.6 | 949.4 |
| Cobalt | 500* | NS | mg/kg | 2.7 | 1.6 |
| Iron | NS | NS | mg/kg | 5,803.4 | 4,695.6 |
| Potassium | NS | NS | mg/kg | 245.6 | 202.2 |
| Magnesium | NS | NS | mg/kg | 578.6 | 371.6 |
| Manganese | NS | NS | mg/kg | 57.1 | 42.7 |
| Molydbendum | NS | NS | mg/kg | 0.0 | 0.0 |
| Sodium | NS | NS | mg/kg | 11.9 | 7.5 |
| Phosphorus | NS | NS | mg/kg | 662.1 | 385.7 |
| Sulfur | NS | NS | mg/kg | 267.1 | 249.2 |
| Strontium | NS | NS | mg/kg | 4.3 | 2.6 |
| Titanium | NS | NS | mg/kg | 113.9 | 41.1 |

* = No S1/GW-1 or S1/GW-3 standard is available. Reportable concentration for RCS-1 shown.
NS = No Standard

## Table 2. Summary of PFAS data

| Labs ID | | | | LRK965 | LRK966 | LRK966 | L2154526-01 | L2154526-02 | 320061 |
|---|---|---|---|---|---|---|---|---|---|
| Analytical Lab | | | | Bureau Veritas | Bureau Veritas | Bureau Veritas | Alpha Lab | Alpha Lab | AIRL, Inc. |
| Sampling Date | | | | Unknown | Unknown | Unknown | 10/6/2021 | 10/6/2021 | Unknown |
| Sample Matrix | | | | Unkown | Unknown | unknown | Soil | Soil | Astro Turf |
| sample ID | | | | 320060 | 320061 | 320061 Lab-Dup | 1 | 2 | #2 B 48 |
| **Perfluorinated Compounds** | **MassDEP S1/GW-1** | **MassDEP S1/GW-1** | **Units** | **Sample Results** | | | | | |
| Perfluorobutanoic acid (PFBA) | NS | NS | ug/kg | 0.12 U | 0.12 U | 0.12 U | 0.037 J | 0.309 J | 1* |
| Perfluoropentanoic acid (PFPeA) | NS | NS | ug/kg | 0.10 U | 0.10 U | 0.10 U | 0.05 U | 0.143 J | 1* |
| Perfluorobutanesulfonic acid (PFBS) | NS | NS | ug/kg | 0.14 U | 0.14 U | 0.14 U | 0.043 U | 0.053 J | 1* |
| 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | NS | NS | ug/kg | 0.22 U | 0.22 U | 0.22 U | 0.071 U | 0.075 U | 1* |
| Perfluorohexanoic acid (PFHxA) | NS | NS | ug/kg | 0.14 U | 0.14 U | 0.14 U | 0.057 U | 0.172 J | 1* |
| Perfluoropentanesulfonic acid (PFPeS) | NS | NS | ug/kg | 0.20 U | 0.20 U | 0.20 U | 0.091 U | 0.097 U | 1* |
| Perfluoroheptanoic acid (PFHpA) | 0.5 | 300 | ug/kg | 0.18 U | 0.18 U | 0.18 U | 0.049 U | 0.137 J | 1* |
| Perfluorohexanesulfonic acid (PFHxS) | 0.3 | 300 | ug/kg | 0.14 U | 0.14 U | 0.14 U | 0.066 U | 0.070 U | 1* |
| Perfluorooctanoic acid (PFOA) | 0.72 | 300 | ug/kg | 0.16 U | 0.16 U | 0.16 U | 0.091 J | 0.272 J | 1* |
| 6:2 Fluorotelomer sulfonic acid (6:2 FTS) | NS | NS | ug/kg | 0.13 U | 0.13 U | 0.13 U | 0.196 U | 0.209 U | 1* |
| Perfluoroheptanesulfonic acid (PFHpS) | NS | NS | ug/kg | 0.087 U | 0.087 U | 0.087 U | 0.149 U | 0.159 U | 1* |
| Perfluorononanoic acid (PFNA) | 0.32 | 300 | ug/kg | 0.15 U | 0.15 U | 0.15 U | 0.115 J | 0.191 J | 1* |
| Perfluorooctanesulfonic acid (PFOS) | 2 | 300 | ug/kg | 0.21 U | 0.21 U | 0.21 U | 0.696 | 0.399 | 1* |
| Perfluorodecanoic acid (PFDA) | 0.3 | 300 | ug/kg | 0.31 U | 0.31 U | 0.31 U | 0.208 J | 0.102 J | 1* |
| 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | NS | NS | ug/kg | 0.33 U | 0.33 U | 0.33 U | 0.314 U | 0.334 U | 1* |
| Perfluorononanesulfonic acid (PFNS) | NS | NS | ug/kg | 0.23 U | 0.23 U | 0.23 U | 0.327 U | 0.348 U | 1* |
| MeFOSAA | NS | NS | ug/kg | 0.30 U | 0.30 U | 0.30 U | 0.220 U | 0.234 U | 1* |
| Perfluoroundecanoic acid (PFUnA) | NS | NS | ug/kg | 0.15 U | 0.15 U | 0.15 U | 0.051 U | 0.074 J | 1* |
| Perfluorodecanesulfonic acid (PFDS) | NS | NS | ug/kg | 0.27 U | 0.27 U | 0.27 U | 0.167 U | 0.178 U | 1* |
| EtFOSAA | NS | NS | ug/kg | 0.32 U | 0.32 U | 0.32 U | 0.092 U | 0.098 U | 1* |
| Perfluorododecanoic acid (PFDoA) | NS | NS | ug/kg | 0.19 U | 0.19 U | 0.19 U | 0.108 J | 0.081 U | 1* |
| Perfluorotridecanoic acid (PFTRDA) | NS | NS | ug/kg | 0.17 U | 0.17 U | 0.17 U | 0.224 U | 0.238 U | 1* |
| Perfluorotetradecanoic acid(PFTEDA) | NS | NS | ug/kg | 0.15 U | 0.15 U | 0.15 U | 0.13 J | 0.063 U | 1* |
| Perfluorooctane Sulfonamide (PFOSA) | NS | NS | ug/kg | 0.19 U | 0.19 U | 0.19 U | NA | NA | 1* |
| EtFOSA | NS | NS | ug/kg | 0.31 U | 0.31 U | 0.31 U | NA | NA | 1* |
| MeFOSA | NS | NS | ug/kg | 0.28 U | 0.28 U | 0.28 U | NA | NA | 1* |
| EtFOSE | NS | NS | ug/kg | 0.27 U | 0.27 U | 0.27 U | NA | NA | 1* |
| MeFOSE | NS | NS | ug/kg | 0.17 U | 0.17 U | 0.17 U | NA | NA | 1* |
| Hexafluoropropyleneoxide dimer acid | NS | NS | ug/kg | 0.33 U | 0.33 U | 0.33 U | NA | NA | 1* |
| 4,8-Dioxa-3H-perfluorononanoic acid | NS | NS | ug/kg | 0.20 U | 0.20 U | 0.20 U | NA | NA | 1* |
| 9Cl-PF3ONS (F-53B Major) | NS | NS | ug/kg | 0.19 U | 0.19 U | 0.19 U | NA | NA | 1* |
| 11Cl-PF3OUdS (F-53B Minor) | NS | NS | ug/kg | 0.20 U | 0.20 U | 0.20 U | NA | NA | 1* |

* = Lab report indixcates no PFAS detected above RDL of 1 ug/kg
Yellow = laboratory dection limit exceeds Method 1 Standard

**Table 3. Solids Analysis***

| Sample | Semi-volatile organic compounds (SVOCs) | MCP 14 Metals | Per and polyfluoroalkyl substances (PFAS) | Total Oxidizable Precursor Analysis (TOPA) | Total Fluorine/Total Organic Fluorine |
|---|---|---|---|---|---|
| *Turf Carpet* | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected but below applicable comparison values |
| *BrockFill* | Detected and exceeds at least one comparison value | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected and exceeds at least one comparison value | Not detected by the laboratory |
| *Shockpad* | Not detected by the laboratory | Detected but below applicable comparison values | Not detected by the laboratory | Detected but below applicable comparison values | Detected but below applicable comparison values |
| *Ultrabond* | Not detected by the laboratory, elevated reporting limits due to matrix | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected but below applicable comparison values | Detected but below applicable comparison values |
| *Pellet Glue* | Not detected by the laboratory, elevated reporting limits due to matrix | Detected but below applicable comparison values | Not detected by the laboratory | Detected but below applicable comparison values | Detected but below applicable comparison values |

**Table taken from HW memorandum to MVC entitled "Synthetic Turf Laboratory Testing and Analysis Summary Report Martha's Vineyard Regional High School (MVRHS)" dated 3/1/21.*

**Table 4. Synthetic Precipitation Leaching Procedure (SPLP) Analysis***

| Sample | SVOCs | MCP 14 Metals | PFAS |
|---|---|---|---|
| *Turf Carpet* | Detected but below applicable comparison values | Detected and exceeds at least one comparison value | Detected but below applicable comparison values |
| *BrockFill* | Detected but below applicable comparison values | Detected but below applicable comparison values. One or more elevated reporting limits | Detected but below applicable comparison values |
| *Shockpad* | Not detected by the laboratory | Detected and exceeds at least one comparison values | Detected but below applicable comparison values |
| *Ultrabond* | Not detected by the laboratory | Detected but below applicable comparison values. One or more elevated reporting limits | Detected but below applicable comparison values. |
| *Pellet Glue* | Not detected by the laboratory | Detected but below applicable comparison values. One or more elevated reporting limit | Not detected by the laboratory |

**Table taken from HW memorandum to MVC entitled "Synthetic Turf Laboratory Testing and Analysis Summary Report Martha's Vineyard Regional High School (MVRHS)" dated 3/1/21*

**Stormwater**

We reviewed the site plans (dated 11/16/21) and the stormwater management report (dated 11/16/21) by SMRT. The proposed stormwater system includes several subsurface infiltration systems for the synthetic field #1/track and two new parking lots, oil/grit separators for pretreatment in the parking lots, and a dry well for the Field #2 drainage area. There are several technical issues and discrepancies between the design plan, drainage maps, and the HydroCAD model that make it challenging to complete a more thorough evaluation of the proposed drainage design. Once addressed, some of the following comments may be resolved:

1. There are several opportunities to improve the overall approach to stormwater management system being proposed at the site.

    a. The site is in the nitrogen-impaired Nantucket Harbor Watershed. The stormwater management practices proposed to manage over 2 acres of new impervious parking and plaza surfaces provide little to no nitrogen removal benefits. Vegetative filters such as bioretention, tree trenches, and swales have more mechanisms for nitrogen treatment. They could be integrated with landscaping features and/or combined with infiltration practices for enhanced treatment.

    b. The proposed parking lots and plazas are highly visible. Green stormwater infrastructure could provide great teaching opportunities for students to engage in the evolving science and art of watershed restoration. Where possible, BMPs should be creatively designed to incorporate educational features, such as observation ports, structures to facilitate flow and water quality monitoring, posts for rain gauges, plants for pollinators, educational signage, etc.

    c. We recommend all infiltration chambers should include an isolator row for pretreatment and long-term maintenance. Chamber manufacturer's maintenance guidelines should be included in the stormwater O&M plan (see Appendix G of the drainage report).

    d. The trench drains at the edge of the track do not appear to be designed to prevent degraded turf material from entering the stormwater system. The addition of a filter in the track channel drain or at key collection junctions in the drainage system could be included to trap microplastics from entering the recharge chambers. These could be cleaned out on an annual basis.

2. As proposed, the stormwater system does not comply with MA Stormwater Standard #2 that prohibits a peak discharge rate increase for 2 and 10-yr storms over existing conditions. The applicant included a table on page 8 of the drainage report highlighting several locations where offsite runoff discharge rates are expected to be higher in the post-development scenario (see grey shading in **Table 5**). This is not allowable for 2 and 10-yr storms, even for what seems like a small amount of additional runoff (+0.24 cfs in DP-4, for example). In reality, this could be 50% more runoff than current conditions. Documenting % increases in flow or volumes is often more meaningful than cfs. Matching pre- and post-peak rates is not required for the 100-yr storm; however, an analysis confirming safe conveyance and avoidance of downstream flooding must be provided. Not enough information was provided on the design plans for us to evaluate how water is routed from the practices, overflow designs, offsite drainage infrastructure.

**Table 5. Flow Summary (taken from Drainage Report)**

| Runoff Summary- Peak Flow (cfs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Analysis Point | Design Storm Event Return Period | | | | | | | | |
| | 2-Year | | | 10-Year | | | 100-Year | | |
| | Pre | Post | Δ | Pre | Post | Δ | Pre | Post | Δ |
| DP-1 | 0.16 | 0.14 | -0.02 | 0.99 | 0.48 | -0.51 | 3.96 | 2.70 | -1.26 |
| DP-2 | 0.95 | 0.13 | -0.82 | 2.65 | 0.51 | -2.14 | 6.61 | 13.22 | +6.61 |
| DP-3 | 0.23 | DP Eliminated | | 1.00 | DP Eliminated | | 2.87 | DP Eliminated | |
| DP-4 | 0.46 | .70 | +0.24 | 1.60 | 1.42 | -0.18 | 4.48 | 3.09 | -1.39 |
| DP-5 | N/A | 0 | 0 | N/A | .01 | +.01 | N/A | .21 | +.21 |

The applicant should be asked for more information regarding offsite discharge at the following four locations (**Figure 1**):

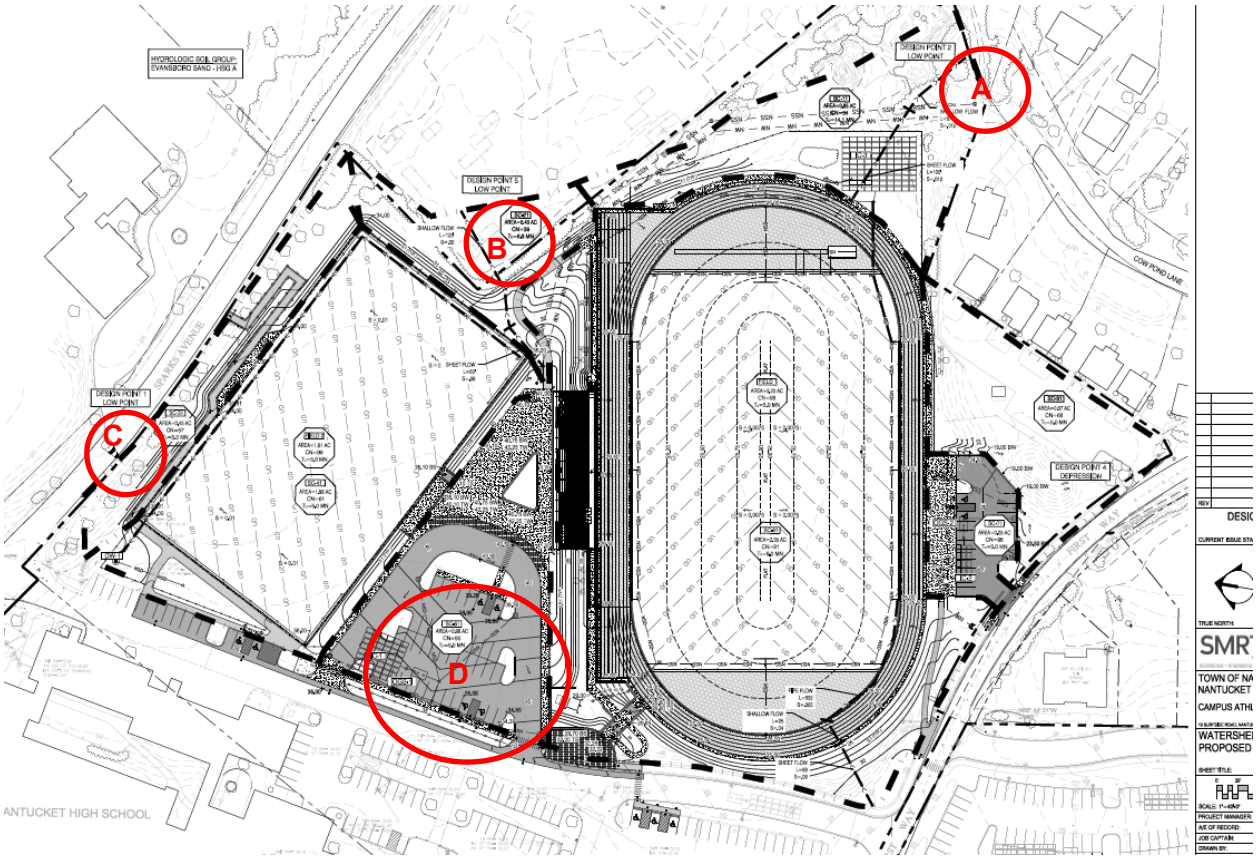
*a.* Cow Point Road/residential neighborhood: The applicant states in the drainage report that *"The 100-yr post development flow at DP-2 is exceeded by 6.61 cfs. This area will continue to drain to a low point at the end of Cow Point Road. This area is large enough to contain runoff from this storm so it can infiltrate, and offsite flooding is not anticipated."* What is the expected volume of overflow and how does applicant know Cow Point Rd. will not flood? How does excess flow leave the piped system/chambers?

*b.* DP 5: The applicant states in the drainage report that *"The addition of Design Point 5 also indicates minimal flow off site. The peak runoff for the 2, 10, and 100-year flows do not exceed 1 cfs, indicating minimal runoff. The geotechnical infiltration indicated sandy soils which infiltrate stormwater very quickly across the site. Due to the low runoff flows and existing soil conditions offsite flooding is not anticipated."* There is no threshold where 1 cfs is considered de minimis. More information is needed.

c. Sparks Ave: The applicant states in the drainage report that *"Due to the proposed layout, the area between Field 2 and Sparks Ave cannot feasibly be directed toward a treatment BMP. The only proposed improvement is the accessible ramp connecting Field 2 to the existing sidewalk. However, water will collect in a depression along the vegetated shoulder which will provide some treatment before entering the groundwater table."* Maybe this is a good place for a rain garden?

*d.* Loop parking and plaza: The HydroCAD model also shows overflow from SC-51 (the new 1-acre loop parking area) during the 100-yr event, but this area is not included as an analysis point in the Table on page 8 of the drainage report.

**Figure 1. Drainage map and discharge locations in question**




3. The applicant is using outdated rainfall depths from the Hydrology Handbook for Conservation Commissioners. HW recommends using more recent rainfall depths from Cornell's Northeast Climate Center (**Table 6**). This change may help with meeting pre and post peak rate standards for 2 and 10-yr storms since the newer rainfall depths are lower for smaller storms. However, the more updated rainfall depths for the 100-yr storm are greater. It is worth noting that NOAA Atlas 14+ data may be required in the future based on pending updates to the MA Stormwater Standards.

**Table 6. Comparison between rainfall depths being used**

| Annual Rainfall (inches) | | | |
|---|---|---|---|
| Event Frequency | 2 -yr | 10-yr | 100-yr |
| Hydrology Handbook | 3.60 | 4.90 | 7.2 |
| Updated NRCC | 3.15 | 4.63 | 8.05 |

4. The measured infiltration rates at three locations on the site were used for modeling infiltration chambers IC-1 and IC-2. An average infiltration rate of 14.7 in/hr was applied based on the two highest field test measurements. The MA Stormwater Standards require infiltration tests be conducted at the actual location of the proposed infiltration practice and that a factor of safety (50%) be applied to field measured rates (Vol 3 Ch 1 page 12 of the Stormwater Standards) if the

standard Rawls rate is not going to be used. We don't think the infiltration rate used here was calculated correctly and may be an overestimate. NPS may want to use the appropriate Rawls rate (8.27 in/hr for sand, for example) for modeling exfiltration to avoid further issues.

5. The modeling Design Points are inconsistent between pre-development drainage maps, post-development drainage maps, and the HydroCAD model. Issues include but are not limited to:
    a. Pre-development Design Point 3 should be routed to the location where it leaves the site, not the middle of the depression (i.e., where would stormwater flow once the depression is full?)
    b. SC-21 and Design Point 5 are not modeled.
    c. SC-51 (loop parking) does not flow to a design point—the chambers backup during the 100-year storm and will flood the adjacent parking lot, which may be OK, but this is not included in the HydroCAD model.

6. The post-development HydroCAD model shows return errors that compromise modeling results, including but not limited to oscillations, overflow devices above the top of the storage, and storage range exceedances. With these errors present, it's difficult to properly review the results.

**Special Permit**

We reviewed the Town's wellhead protection bylaw, the comparable Oak Bluff's bylaw, and letters requesting the special permit for MVRHS from the Oak Bluff's Building Commissioner (dated Nov 2, 2021) and the Oak Bluff's Planning Board (dated Sept 24, 2021). We offer the following comments as non-legal opinions:

1. Per Section 139-12.G of the Nantucket Bylaws, the storage of hazardous or toxic materials is prohibited in the Public Wellhead Recharge District. PFAS was detected in the same field materials proposed at MVRHS and PFAS compounds are considered hazardous materials under MGL Chapter 21E and potential Contaminants of Concern. Since NPS is proposing to use the same materials that have previously been shown to contain PFAS, then there seems to be reasonable justification for the project to require a special permit.

2. The letter from the OB Building Commissioner specifies the track, and presumably the synthetic field material, as being toxic at a level greater than normal household use triggering the special permit requirement. To our knowledge, PFAS testing of the track material at MVRHS has not been conducted. We have not reviewed any reports describing "normal household" PFAS levels.

3. The MVRHS special permit application process is underway despite the lengthy and thorough permitting process that the MVRHS application has already been through to date. This is not the case on Nantucket, where without the special permit, there would be limited review of this project.

**Other**

The following are additional topics from HW's review of the MVRHS project that we think may be applicable to the NPS project and of interest to the NLC. We recommend contacting the MVC to find the most updated and succinct staff summary reports documenting field usage discussions, maintenance costs comparisons between synthetic and grass fields, carbon footprint calculations, and end-of-life cost estimates.

1. Field usage estimates: An industry average of approximately 700-800 hours is regularly cited as approaching the upper use limit for maintaining a high-quality, natural grass field in the northeast, but it depends on the activity and season of play (i.e., lacrosse in the spring is the hardest on natural grass). Intensity factors could be applied to hourly usage estimates to better account for differences in field stress by sport/season. Has the town evaluated field usage island wide to verify that two synthetic fields are necessary to accommodate athletic needs? Synthetic fields have been used in other communities specifically to take stress off remaining natural grass fields. Based on the field usage calculations provided by NPS, the total number of hours per year on the remaining grass fields does not appear to decrease under the proposed project. If the school is concerned about field stress, there should be a rotation plan to take fields out of use/provide a resting period for better grass establishment.

2. End-of-life: The MVRHS projects plans for a 10–12-year lifespan for the synthetic field and commits to putting replacement costs in the school's long-term capital budget. They put the onus of recycling, however, on the future contractor hired to replace the field knowing that there is currently no viable recycling option. We recommend accounting for replacement costs with a more transparent life-cycle analysis and realistic material disposal option. Can anything be learned from the disposal plans (if any) from the existing turf field on the island that is close to 10-yrs old?

3. Maintenance plan: NPS should provide a more detailed annual budget and maintenance plan that includes new equipment, staff training, G-max testing, and contractual needs. For the synthetic fields, there should be a clear transition plan for maintenance handover at the end of the warranty period, a disinfection and spot cleaning plan, and clear guidelines for anticipated herbicide applications, if any. Because this is wellhead protection area and the stormwater is being infiltrated, there will be restrictions on chemicals that can be used. Similarly, for the natural fields, information on fertilizer usage, weed/pest control, and irrigation should be specified. There are several organic field management programs that have been successful in the region that the school may want to investigate. As an example, the maintenance plans for the synthetic and natural grass fields from the proposed MVRHS project can be reviewed.

4. Life-cycle cost (20 yrs): NPS prepared a cost estimate that indicates the synthetic fields would cost less than natural grass fields over a 25-yr period, which is not consistent with other cost comparisons that we have seen. For example, MVC found that over a 20-yr life cycle analysis the proposed synthetic field at MVRHS would cost more: "*Based on the estimates by Huntress, installing and maintaining a synthetic field would cost about $749,452 more than a natural grass field over 20 years, although 91% of the cost would be in the installation and replacement, compared to 46% for natural grass, and annual maintenance costs would be lower*" (from "DRI #352-M4 – MVRHS Athletic

Fields MVC Staff Report – 2021-2-4"). To evaluate the NPS cost comparison, more information on the following would be helpful:

   a. A better understanding of the design for the upgraded grass field to evaluate a $1.3M installation cost estimate.

   b. Additional detail on the maintenance and unit cost assumptions used to generate the $113,800/yr maintenance estimate for the grass field ($36,000/yr current + $77,000/yr additional). This cost (and hourly) estimate is significantly higher than values we've seen reported by others that range from $8,000-$48,000/yr.

   c. More detail on how the recycling costs were generated (they are currently lumped together with replacement costs at $9/SF).

   d. Clarification on how many replacements of the synthetic turf are included in the estimate.

5. Carbon calculations: We recommend contacting MVC to learn more about the carbon footprint calculations done for the MVHRS project.

6. Lighting and noise: Are there new lighting/speaker systems being proposed and how those would affect abutters? If so, an illumination and noise analysis should be completed to show extent of off-site impacts. Are lighting plans going to meet Dark Sky standards for athletic facilities?

7. Monitoring Plan: Because this is in a wellhead protection area, NPS should develop a monitoring plan and commit to collecting effluent and groundwater samples at fixed stations beneath and downgradient of the synthetic field(s). The MVRHS project includes a monitoring plan that can be used as a model.

8. Health and Safety: In addition to required surface compaction safety testing, we'd recommend the school commit to tracking injuries sustained on the synthetic and grass fields to help inform future decisions about alternative playing surfaces on Nantucket.

9. Vegetation: How many trees are being removed for the athletic improvements and what is the proposed landscape planting plan? Are there opportunities to increase canopy cover and replant native species, enhance vegetative buffers between adjacent properties, or help mitigate the expanded carbon footprint of the proposed project?

10. False choice: The MVRHS project suffered from an "all or nothing" project presentation (i.e., without the synthetic field, there will be no new track). Perhaps the merits of grass vs turf were evaluated in the years prior to the final project design. Regardless, it would be informative to be able to compare objectives, life-cycle costs, annual maintenance, field use, carbon footprint, etc. for the project against a viable all-natural alternative.

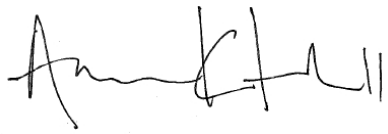
We look forward to discussing our comments on the proposed project with NLC and answering any additional questions you may have.

Sincerely,

**Horsley Witten Group, Inc.**

Bryan Massa, LSP
Senior Scientist

Eliza Hoffman
Design Engineer



Anne Kitchell, LEED AP
Associate Principal