Barton & Loguidice

October 7, 2022

Randall Hughes, Vice President
Whitney Bailey Cox & Magnani
300 East Joppa Road, Suite 200
Baltimore, MD, 21286

Re: Revised Anne Arundel County Millersville Park Hydrogeologic Feasibility Evaluation
File: 2526.001.001

Dear Mr. Hughes:

Barton and Loguidice ("B&L") was retained by Whitney Bailey Cox & Magnani, LLC ("WBCM") to perform a preliminary evaluation of the feasibility of developing on-premises groundwater supply and discharge systems at the proposed Anne Arundel County Millersville Park property to support its development plans. The proposed park is located southeast of the intersection of MD-3 and MD-32, southeast of Fort George G. Meade and west of the Severn River, near Millersville in western Anne Arundel County, Maryland. This letter report was prepared and completed in accordance with B&L Proposal No. P708.5800, authorized by WBCM on January 14, 2022.

This report documents our essential findings, which include:

1. Water demands and wastewater discharges should be less than 5,000 gallons per day (gpd);

2. The project should be exempt from Maryland Department of the Environment (MDE) groundwater appropriation permitting requirements; and

3. The WBCM-proposed on-site sewage disposal system (OSDS) should be feasible to achieve based on the on-premises soils, and nitrogen should not be limiting from an MDE perspective.

Project Background

According to the initial teleconference and email correspondence provided, the proposed playing fields will be approximately 2.3 acres each, for five and one half fields, totaling approximately 12.5 acres of playing fields. There also is a planned bathroom, with a proposed fixture plan of 4 toilets, 2 urinals, and 4 faucets.

The gross parcel boundary encompasses 33.19 acres. As per planned site development, as indicated on drawings shared with B&L on February 10, 2022, the proposed impervious area of the property will be approximately 4 acres and the pervious acreage will be approximately 29 acres.

Based on the foregoing, B&L estimated water demands using various standard methods prescribed by applicable regulatory agency guidance and/or governed by our past comparable experience.

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Hydrogeologic and Environmental Setting

We first considered surface and subsurface conditions of the property and its surrounding vicinity. This was completed with information obtained from published sources about the local soils and hydrogeologic setting:

1. **Physiographic Setting** - The Park is located within the Atlantic Coastal Plain physiographic province, which is comprised of horizontal to sub-horizontal sand, silt and clay layers which descend and thicken in a southeasterly direction (Mack and Achmad, 1986 and Andreasen, 2007). The unconsolidated sediments of the Atlantic Coastal Plain were deposited millions of years ago and the sand layers constitute aquifers, and the intervening clay confining units function to restrict vertical groundwater movement.

2. **Underlying Geology** - The shallowest underlying geologic formations are mapped as the Matawan Formation and the Magothy Formation. These formations are predominantly sand with clay and silt (State of Maryland Department of Planning, 2017).

3. **Saprolite and Soil Mantle** - According to NRCS Web Soil Survey compiled by the U.S. Department of Agriculture, soils on the property are mapped as Adelphia-Holmdel complex, Sassafras sandy loam and Mattapex silt loams, which are documented to be generally well to moderately well-drained (USDA, 2021).

The Magothy Formation is the recommended target aquifer for the water supply well to support the park. The Magothy has an outcrop area situated west of MD Route 3 near and along Towsers Branch. Other more distant outcrop areas are located to the north and west. The formation generally is 60 foot thick at its outcrop and thickens to approximately 150 feet near Annapolis. The formation is comprised of light gray to white, fine to coarse sand with interbeds of organic black to dark gray clay and silt clay layers. Near Towsers Branch it is unconfined, but the Magothy is believed to be confined both at the Park and in areas southeast closer to Annapolis. Its transition from unconfined-to-confined may occur near Maryland Route 3. Below the Magothy are aquifers of the Potomac Group; these are not the subject of this evaluation.

Water Demand and Wastewater Discharge Estimate

This section presents water demand and wastewater discharge estimates for the proposed uses associated with the site. To develop our independent estimates, we relied on the following WBCM and Anne Arundel County representations relayed through correspondence dated May 25, 2022:

A. There will be 5.5 playing fields, each full-size field will be approximately 2.3 acres and the half field will be approximately 1.2 acres;
B. The playing fields will be irrigated from May through late October, on a schedule of 20 minutes per field three times per week
    - According to the Anne Arundel County Department of Parks and Recreation, each field will use about 80,000 gallons of water per irrigation season. This approximates slightly

more than 2,400 gpd on an annualized basis.
    - Assuming for simplicity, equivalent irrigation demands every-other-day during the irrigation season, the system as a whole will need to be designed to deliver approximately 60 gpm during irrigation cycles. Pump sizes and other irrigation system components require careful design in light of desired operational practices.

C. Anne Arundel County plans Bermuda grass for the playing fields;
D. There will be no irrigation outside of the above stated timeframe;
E. The planned bathroom will have 4 toilets, 2 urinals, 4 faucets with an exterior mounted drinking fountain;
F. There will be no kitchen;
G. There will be no showers or accessory uses in the bathroom building.

Within the foregoing understandings and assumptions, B&L estimated water demands and wastewater discharges using standard methods prescribed by applicable regulatory guidance and/or governed by our past comparable experience.

The proposed bathroom has a flow projection of 235 gallons per day (gpd) using flow estimates from the MDE 2016 Design Guidelines for Wastewater Facilities: 35 gpd for flush toilets, 10 gpd for urinals, and 15 gpd for faucets. Using the estimates provided from Anne Arundel County, 440 gpd per field was used for a total of 2,420 gpd. Together, the bathroom and the playing fields, have a combined estimated water demand of 2,655 gpd on the average day during the playing season at the Park as shown in Table 1.

MDE Groundwater Appropriation Exemption

MDE manages potential aquifer and user impacts statewide through the Groundwater Appropriation Permit application and issuance process. MDE issues and conditions permits for statewide groundwater use to mitigate potential impacts on groundwater resources and on other neighboring users. When MDE judges it necessary, the agency may require pumping tests, hydrogeologic predictions and various measures to guard against large or unacceptable impacts.

Historically, all groundwater users of Maryland had to obtain a permit, which enabled the creation of a statewide database of uses, withdrawal rates and conditions potentially capable of causing impacts. MDE sought legislative approval to exempt small groundwater users, under 5,000 gpd, from needing an appropriation permit. Associated regulatory scrutiny was unneeded to guard against impacts so negligible and similar to natural groundwater supply variations. These minimal water demands do not impact neighboring wells or aquifers and therefore do not require as much regulation.

The Millersville Park site meets requirements for an exemption listed by MDE and is eligible to file a "Notice of Exemption." We do not anticipate agency opposition due to the site's estimated annual demand approximating only half of the 5,000 gpd threshold for requiring an appropriation permit.

Future On-Site Sewage Disposal System (OSDS)

WBCM and Anne Arundel County have delineated a 0.3 acre area within the site as the potential future OSDS area, which includes both initial and replacement trench layouts. Based on our review of published soils information, this 0.3 acre area likely will suffice and provide adequate space for a properly designed and permitted OSDS to support the planned bathroom building.

Soils present in the outlined septic area are delineated as Adelphia-Holmdel, AdB, based on USDA Web Soil Survey (USDA, 2022). This soil type is favorably classified within the 'moderately well drained' drainage class. Percolation tests were completed by the Anne Arundel County Health Department in April of 2017. These percolation testing proved passing and satisfactory results in the delineated septic area shown on Figure 1.

Baseline Nitrogen Allocation and Nitrogen Balance Calculation

The approach that we employed to evaluate the OSDS feasibility of the property stems from the MDE wastewater permits program method of establishing baseline nitrogen loading caps for groundwater discharge permits[1]. MDE assigns caps using historic effluent flow and nitrogen concentration. At the Millersville Park site, the primary source of nitrogen in the past was agriculture, and the primary source of future nitrogen would be the application of fertilizer to the playing fields.

For this reason, we found it appropriate to adapt the MDE wastewater permits program methods and ascribe a baseline nitrogen loading cap from past contributions from onsite agricultural to the future playing field proposed use. B&L used land use data from Maryland Department of Planning (2010) and Chesapeake Bay Program (2020) Chesapeake Assessment and Scenario Tool (CAST) for nitrogen loading rates and Best Management Practices (BMP) reductions. For conservatism, we applied a BMP 45% reduction in nitrogen loading from grain with manure value of 24.729 pounds of nitrogen per acre-year and applied this to the past agricultural land use footprint. Following this method resulted in an estimated nitrogen loading baseline condition of 296 lbs/yr.

We found that the nitrogen balance was favorable (Table 2). CAST source data on nutrient loading and BMPs were utilized to estimate the potential nitrogen loading of the turf grass fields. This approach produced a favorable result, at about 288.78 lbs/yr, roughly 7 lbs/yr less than the baseline condition of 296 lbs/yr based on current land use. We also utilized an alternate nitrogen loading calculation, guided by the information and data that WBCM provided to us. Five 2.28-acre playing fields with irrigation, and 2 to 3 applications of Urea per month. This approach provided a lower, even more favorable, nitrogen load for the planned development than the CAST, at about 275.52 lbs/yr, approximately 20 lbs/yr less than the baseline conditions).

[1] MDE uses groundwater discharge permits to regulate land-applied sanitary or industrial wastewater that is dispersed in large (5,000 gallons per day or greater) septic, spray or drip irrigation, rapid infiltration basin or other types of discharge systems.

Summary

In preparing the discussion points listed below, B&L has utilized its best level of effort consistent with its professional standards for conservatism, present scientific judgment and knowledge. We have upheld accepted industry practice to the best of our knowledge and belief. Accordingly, our professional opinions are summarized as follows:

1. **Water Demand is Less Than 5,000 gpd –** B&L calculated water demand via WBCM-provided data and MDE approved criteria. We estimate that the playing fields and bathroom facility will generate a maximum of 2,420 gpd, during the irrigation season of May through October. When there is no irrigation, the site will only use water from the bathroom, which has a water demand of 235 gpd.

2. **Project Qualifies for an MDE Groundwater Appropriation Permit Exemption –** Due to modest water demands of less than 5,000 gpd, the Millersville Park site will likely qualify for an MDE permit exemption and is eligible to file a "Notice of Exemption" with MDE. By applying MDE's typical policy thresholds for evaluating aquifer and offsite use impacts, we also do not anticipate impacts to neighboring property wells or the underlying aquifer. This opinion is supported by the modest water demand estimated for the planned use at the site.

3. **OSDS Feasibility –** Our review of published soil characteristics suggests that designing and permitting an approvable OSDS should not be problematic. Adequate acreage is available for on-site disposal, including initial and replacement trench designs. USDA Web Soil Survey shows moderately well drained soils on-site in the location of the proposed initial and replacement systems. Percolation testing is recommended to confirm OSDS feasibility.

4. **Nitrogen Balance is Favorable –** Using the current land use of the property (forested and agriculture), the estimated baseline nitrogen loading cap is 296 lbs/yr. Using a more conservation loading calculation as well as an alternative loading calculation, both prove that nitrogen will not be limiting on the site and loading will be under previous land use loading.

Overall project feasibility appears to be favorable, and site conditions analyzed using standard practices likely are supportive of development plans for the Millersville Park site. Should development plans change, it may be necessary to re-evaluate project feasibility.

Respectfully submitted,
BARTON & LOGUIDICE, D.P.C.

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Environmental Scientist I

David L. Pielmeier
Senior Project Manager

DLP/KG/tmj

Attachment(s)
Attachment A: Site Map
Table 1: Water Demand
Table 2: Nitrogen Balance

Selected References

Andreasen, D.C. 2007. Optimization of Ground-Water Withdrawls in Anne Arundel County, Maryland, from the Upper Patapsco, Lower Patapsco, and Patuxent Aquifers Projected through 2044: Maryland Geological Survey Report of Investigations 77.

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Maryland Department of Planning GIS. 2010. Maryland Land Use Land Cover. Maryland Government. Retrieved from https://data.imap.maryland.gov/datasets/97717f333baf4e79abb7ab8098a99ee50?geometry=-81.440%2C38.071%2C-73.096%2C39.568

Maryland Department of Planning GIS. 2017. Maryland Geology – Maryland Geologic Formations. Maryland Government. Retrieved from https://data.imap.maryland.gov/datasets/maryland-geology-geologic-formations/explore?location=38.791742%2C-77.240600%2C8.95

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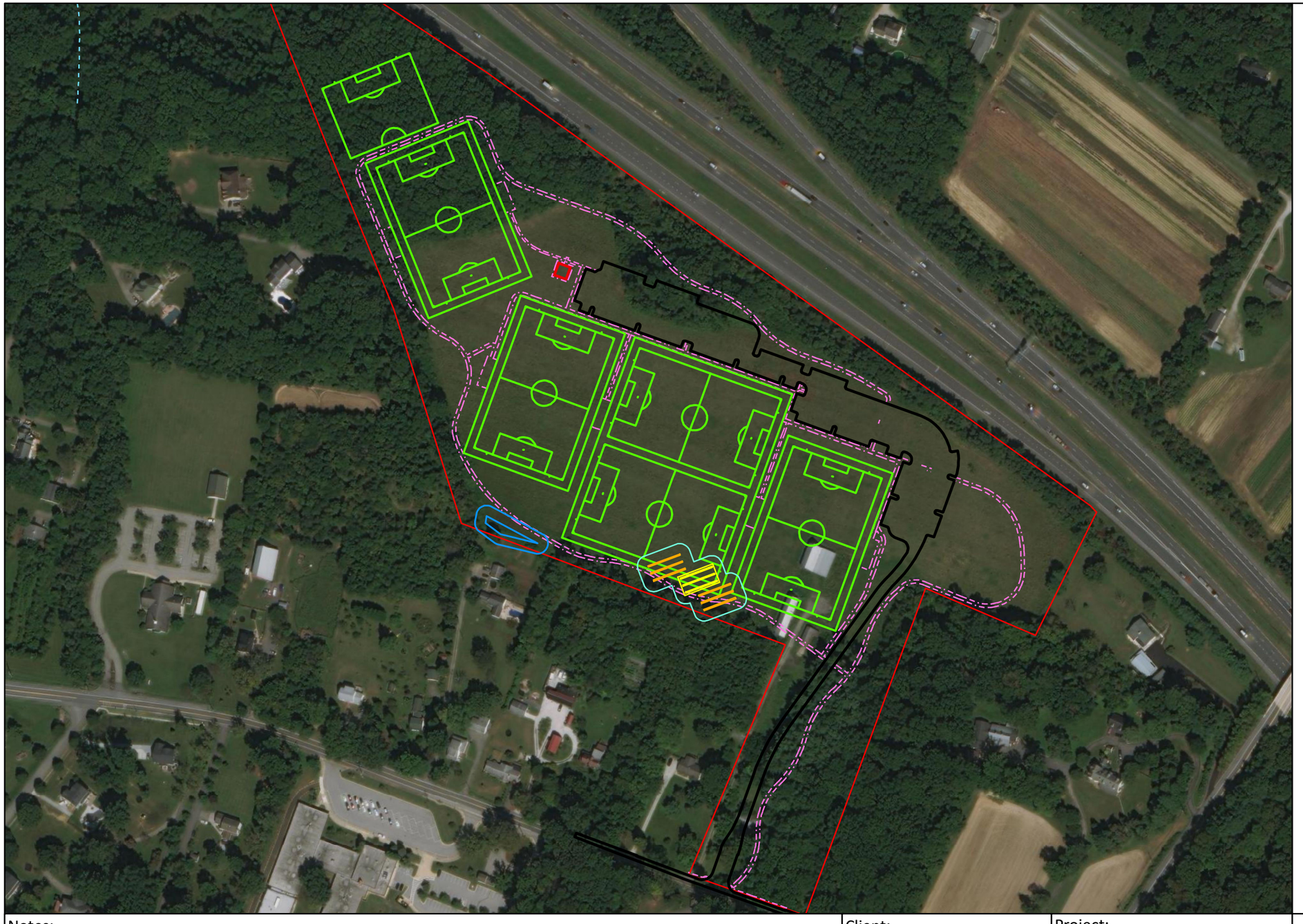
Preliminary Draft Subject to Revision



EXPLANATION:

N

- Site Boundary
- Wetland
- Paved Asphalt
- Stream
- Athletic Field Outline
- Impervious Walkway
- Proposed Bathroom
- Septic Trench - Initial
- Septic Trench - Replacements 1 & 2
- Septic Trench Buffer (Initial & Replacement Area)

Note: all mapped site features are proposed; they are not existing site features.

250 125 0 250 500 Feet

Notes:

1. Basemap from ESRI.
2. Proposed site features provided by WBCM.
3. Stream and Watershed data from Anne Arundel County Office of Planning and Zoning.

Client:

Whitney Bailey Cox & Magnani, LLC

PROJECT NO. 2526.001.001

Project:

Millersville Park Site Development

Anne Arundel County, MD

Barton & Loguidice

Figure 1:

Site Map

July 8, 2022

Table 1: Water Demand Estimate

Site Feature	Acreage[1]	Flow Projection (gpd)	Demand; per use category (gpd)
Proposed bathroom [2]	***0.040313***	***235***	***235.00***
Proposed playing fields with half field[3]	12.54	440	2,420
Total with half field	**12.580313**		**2,655**

[1] MDE Flow Projection outlined in 2016 Water Demand document.

[2] MDE flow projection for public parks: flush toliets - 35 GPD, urinals - 10 GPD, faucets - 15 GPD.

[3] AA County estimates "The irrigation systems operate for 20 minutes in each field zone on a schedule of three (3) times per week. During irrigation season (roughly May - late October) each field will use about 80,000 gallons of water under this schedule. At 182 days (1/2 year), that translates to about 440 gpd per field. Using the five and one-half fields discussed for Millersville, would calculate to 440,000 gallons per season or just over 2,400 gpd."

Table 2: Nitrogen Baseline and Future Loading Assessment

Row	Millersville Park, Anne Arundel County, MD 21108	Acres (+/-)	Nitrogen loading rate (lb/acre/yr)	Nitrogen Load (lb/yr)	Rationale / Source
A	**Total Area of Property without Residence**	33.19	-	-	Site Drawings from WBCM.
B	**Baseline Forested Area** (Nitrogen loading rate category "True Forested"applied to 1.686 lbs/yr load)	13.10	1.69	22.09	Land use acres from: MD imap and MD Department of Planning 2010 from https://data.imap.maryland.gov/datasets/97717f333baf4e79abb7ab8098a99ee5_0 [last accessed January 2021]. Nitrogen loading rates from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019.
C	**Baseline Agriculture Area** (Nitrogen loading rate category "Grain w/ Manure" w/ 45% BMP N removal efficiency applied to 24.729 lbs/yr load)	20.09	13.60	273.24	Land use acres from: MD imap and MD Department of Planning 2010 from https://data.imap.maryland.gov/datasets/97717f333baf4e79abb7ab8098a99ee5_0 [last accessed January 2021]. Nitrogen loading rates from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019. Furnished by USGS via email, January 2021. Assume BMP efficiency of 45% reduction of N for grain w/ manure.
E	**Baseline Nitrogen Load Cap**			295.33	
F	**Future Bermudagrass Playing Fields** (Proposed: (5) 2.43 acre playing fields with irrigation; Nitrogen loading rate category "Turfgrass" w/ 9.00% BMP N removal efficency applied to 0.75 lbs/ac twice a month for 9 months)	12.54	12.29	154.05	Proposed land use provided by WBCM. Nitrogen BMP efficency from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019, assume BMP efficiency of 9% reduction of N for turfgrass. Nitrogen application rate from Univeristy of Missouri, Division of Plant Sciences: https://turf.missouri.edu/stat/reports/mainburm.htm.
F ALT	***Future Bermudagrass Playing Fields*** *(Proposed: (5) 2.43 acre playing fields with irrigation; Nitrogen loading rate category "Turfgrass" w/ 9.00% BMP N removal efficency applied to 12.338 lbs/yr load)*	*12.54*	*11.23*	*140.79*	*Proposed land use provided by WBCM. Nitrogen loading rates from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019. Furnished by USGS via email, January 2021. Assume BMP efficiency of 9% reduction of N for turfgrass*
G	**Future Restroom** (Proposed: (1) 0.040313 acre restroom)	0.04	n/a	2.68	Convert septic tank effluent nitrogen to pounds per year ([(220/2 avg gpd) x 8 mg/L*8.34]/1,000,000]*365).
H	**Future Pavement/Impervious** (Proposed: 3.52263)	4.08	22.32	90.97	Proposed land use acres provided by WBCM. Nitrogen loading rates from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019.
I	**Future Mixed Open/Perivous** (Proposed: 3.52263)	16.92	2.43	41.08	Proposed land use acres provided by WBCM. Nitrogen loading rates from: Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019.
Application to Developed					**Rationale / Source**
J	**Site Area Nitrogen Load Using Calculated N Loading**			6.55	Nitrogen load from Row E minus nitrogen load from Row F, G, H, & I.
J ALT	***Site Area Nitrogen Load Using CAST N Loading***			*19.81*	Nitrogen load from Row E minus nitrogen load from Row F-ALT, G, H, & I.