CHECKLIST FOR SWM DEVELOPMENT PLAN SUBMISSION

--Plan title shall be “Stormwater Management Development Plan”

--All of the information provided in SWM concept plan

--Comments received by review agencies during the concept plan

--Determination of final site layout and acreage of total impervious area onsite.

--Proposed topography

--Proposed drainage areas at all points of discharge from the site.

--Proposed SWM volume requirements for ESD targets and quantity control.

--The location and size of ESD practices used to the MEP and all nonstructural, alternative surfaces, and micro-scale practices used.

--Proposed hydrology analysis for runoff rates, storage volumes, and discharge velocities.

--SWM design details and specifications.

--Discharge calculations demonstrating stable conveyance of runoff off site.

--Preliminary erosion and sediment control plans showing LOD, sensitive areas, buffers, and forest preservation, proposed phasing, construction sequencing, proposed practices, and stabilization techniques.

--An overlay plan showing the location of SWM ESD practices and proposed erosion and sediment controls.

--A narrative to support the site development design and demonstrate that ESD will be achieved to MEP.

Created: February 9, 2023

REVIEWED IN ACCORDANCE WITH LOCAL COUNTY REQUIREMENTS. FREDERICK COUNTY ASSUMES NO LIABILITY FOR DESIGN AND/OR CONSTRUCTION. APPROVAL IS VALID FOR TWO (2) YEARS AFTER THE LAST DATE SHOWN ABOVE. THE PROJECT MUST BE UNDER CONSTRUCTION BEFORE THE APPROVAL EXPIRATION TO BE CONSIDERED ACTIVE. OTHERWISE, RESUBMITTAL OF PLANS, INCLUDING APPLICABLE FEES, MUST BE MADE TO DEVELOPMENT REVIEW FOR REAPPROVAL. FEES FOR RESUBMITTAL CANNOT BE WAIVED.

EXISTING CONDITIONS

GENERAL NOTES

A. PURPOSE STATEMENT:
1. THE PURPOSE OF THIS STORMWATER MANAGEMENT (SWM) CONCEPT PLAN IS FOR THE DEVELOPMENT OF A 21,838 S.F. MEDICAL OFFICE FACILITY ON THE SUBJECT SITE. THE SUBJECT SITE WAS PRELIMINARILY APPROVED AS LOTS C-7 & C-8 OF THE LINGANORE TOWN CENTER-SOUTH COMMERCIAL DEVELOPMENT (S-828T/AP#19092). THOSE LOTS ARE PENDING RECORDATION AND WILL BE RECORDED BY THE LINGANORE TOWN CENTER DEVELOPER AS ONE LOT CONTAINING APPROXIMATELY 2.02 ACRES ±. THE SITE IS LOCATED IN THE SW CORNER OF THE INTERSECTION OF OLD NATIONAL PIKE AND PROPOSED BULLHEAD STREET BETWEEN OLD NATIONAL PIKE AND SILVERSIDE STREET.

B. SITE NOTES:
1. PROPERTY IS CURRENTLY OWNED BY DRYDEN INVESTMENTS, LLC, AS RECORDED IN LIBER 09827 AT FOLIO 00008 AND IS DESIGNATED ON TAX MAP 79 AS PARCEL 34. TAX ID# IS 09-260250.
2. THE SITE IS ZONED P.U.D. WITH A COMMERCIAL DESIGNATION AND IS A PORTION OF THE COMMERCIAL COMPONENT OF THE LINGANORE P.U.D. PER SECTION 1-19-10.500.6.(A)(2) OF THE FREDERICK COUNTY ZONING ORDINANCE, ONLY THOSE LAND USES PERMITTED IN THE VILLAGE CENTER ZONE ARE PERMITTED WITHIN COMMERCIALLY DESIGNATED PARCELS WITHIN A P.U.D.
3. TOTAL SITE AREA = LOTS C-7 & C-8 TO BE COMBINED = 2.02 AC.±

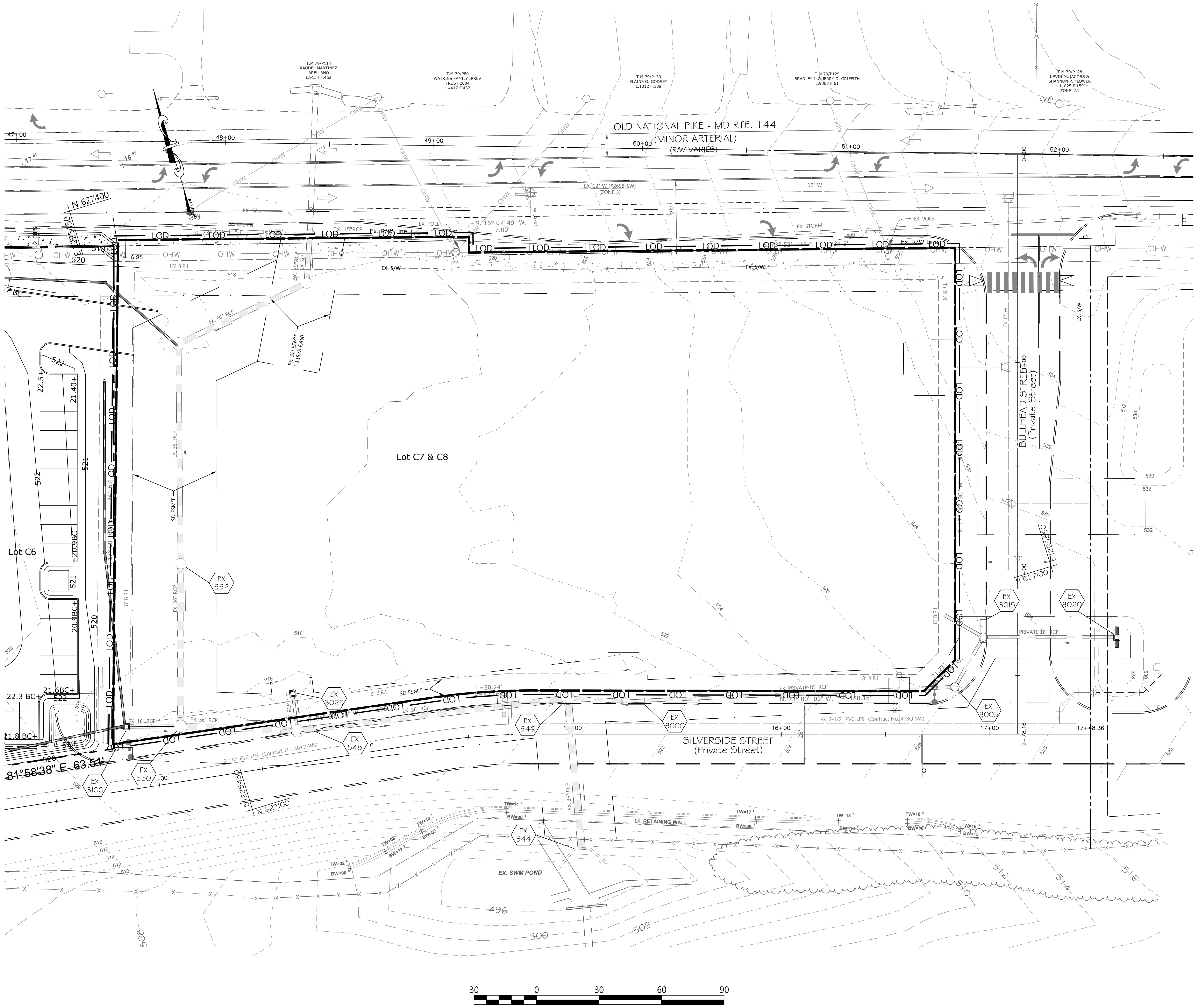
C. SEC. 1-15.2 STORM WATER MANAGEMENT (SWM) REQUIREMENTS
1. QUANTITY (PEAK) SWM IS BEING ADDRESSED BY AN EXISTING REGIONAL SWM POND LOCATED ON THE SOUTH SIDE OF SILVERSIDE STREET. ON-SITE SWM (ESD) SHALL BE PROVIDED IN THE AREAS AS SHOWN ON PLAN.
2. PROPOSED LAND DISTURBANCE = APPROX. 2.02 AC. ±

D. SEC. 1-19-9.100 FLOODPLAIN REGULATIONS
1. THERE ARE NO WETLANDS PER NATIONAL WETLAND INVENTORY MAPPING.
2. THE SITE IS NOT LOCATED WITHIN A 100-YEAR REGULATORY FLOODPLAIN PER FEMA FIRM PANEL #24021-C0320D, EFFECTIVE DATE 09/19/2007.

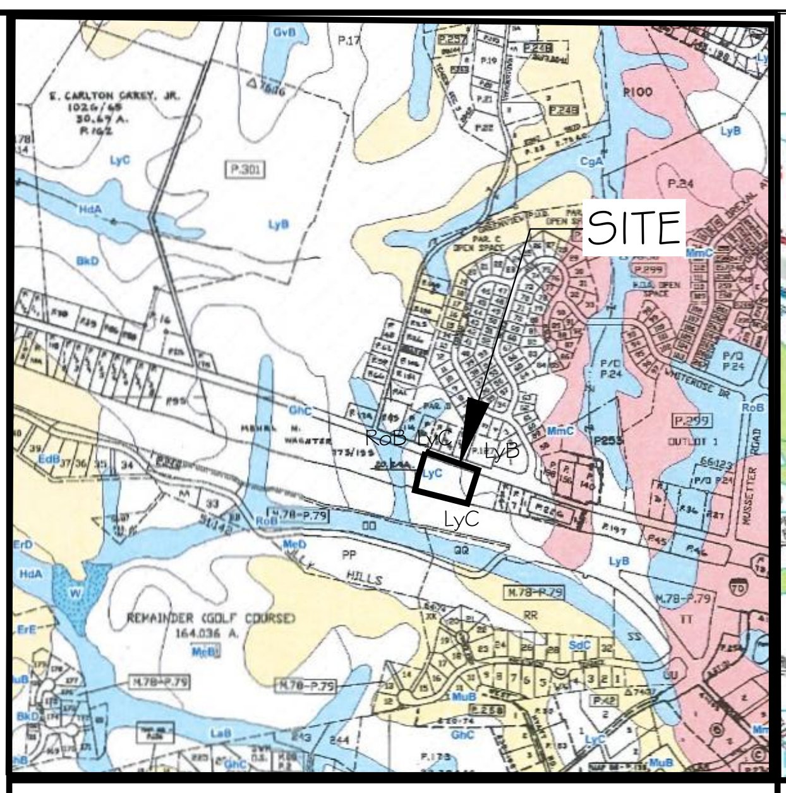
E. SEC. 1-19-9.300 WETSOILS REGULATIONS
1. SOILS DATA SHOWN IN THE SOILS MAP ON THIS SHEET IS BASED ON "SOIL CLASSIFICATION MAP OF FREDERICK COUNTY", PANEL 79.
2. PER A REPORT FILED TO FREDERICK COUNTY BY ACORN ENVIRONMENTAL, INC. DATED FEBRUARY 14, 2019, THE SOILS LOCATED ON THE SUBJECT SITE CLASSIFIED AS ROHRERSVILLE-LANTZ SILT LOAMS (RoB) DID NOT REPRESENT CHARACTERISTICS OF RoB SOILS AND ARE MORE REPRESENTATIVE OF MT. ZION SILT LOAM. MT. ZION SILT LOAM SOILS ARE NOT SUBJECT TO FLOODING. ALSO,, THE SUBJECT SITE HAS BEEN MASS-GRADED BY THE LINGANORE DEVELOPER PER THEIR MASS-GRADING PLANS (AP#18205) APPROVED ON MAY 9, 2018.

F. SEC. 1-21-1 FOREST RESOURCE ORDINANCE REQUIREMENTS
1. NO FOREST OR SPECIMEN TREES EXIST ON SITE. FRO MITIGATION WAS PREVIOUSLY PROVIDED BY THE PURCHASE OF FOREST BANKING CREDITS ON 4/19/2018 UNDER AP #17856.

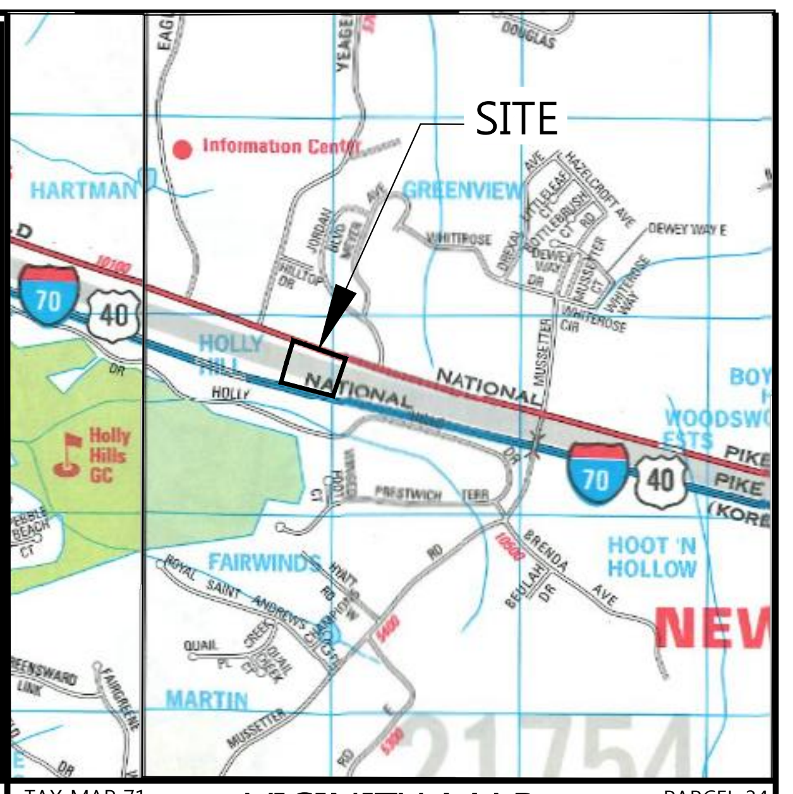
G. PREVIOUS SITE HISTORY:
1. LINGANORE TOWN CENTER PRELIMINARY PLAN (S-828T/AP#19092) - APPROVED 06/2019.
2. LINGANORE TOWN CENTER APFO APPROVAL (AP#19093) - APPROVED 04/2019.
3. LINGANORE TOWN CENTER FRO APPROVAL (AP#17856) - APPROVED 04/2018.
4. LINGANORE TOWN CENTER FRO EXEMPTION (AP#19094) - APPROVED 12/2018.
5. LINGANORE TOWN CENTER MASS-GRADING PLANS (AP#18205) - APPROVED 05/2018



SCALE: 1"=30'



SOIL MAP
SCALE 1" = 2000'



TAX MAP 71
VICINITY MAP
SCALE 1" = 2000'
PARCEL 34
TAX ID No. 09-260250

SOILS:
LyB - LINGANORE-HYATTSTOWN CHANNERY SILT LOAM, LOWER $\frac{1}{3}$ RESTRICTED, 3% - 8%, NOT HIGHLY ERODIBLE, HSG - C
LyC - LINGANORE-HYATTSTOWN CHANNERY SILT LOAM, LOWER $\frac{1}{3}$ RESTRICTED, 8% - 15%, NOT HIGHLY ERODIBLE, HSG - C

LEGEND

- - - - - - -	EX. DRAINAGE DIVIDE
—— LOD ——	LIMITS OF DISTURBANCE

LINGG
PROPERTY CONSULTING
256 West Patrick Street, Suite 2A
Frederick, Maryland 21701
www.LinggPropertyConsulting.com
LinggPC@xecu.net - e
(301) 644-2121 - o
(301) 698-3221 - f
Land Use Consulting • Land Planning & Design • Project Management • Site Planning
Subdivision Planning • Zoning Entitlement Consulting • Development Rights & Approval Strategies
Civil Engineering & Land Surveying Management

DMW
DAFT McCUNE WALKER INC
920 NORTH EAST STREET
FREDERICK, MD 21701
P: 301 696 9040
WWW.DMW.COM

EXISTING CONDITIONS MAP

SWM DEVELOPMENT PLAN for
FREDERICK PRIMARY CARE
MEDICAL OFFICE FACILITY

SITUATED ALONG SILVERSIDE STREET AT BULLHEAD STREET & OLD NATIONAL PIKE
ELECTION DISTRICT NO. 2
FREDERICK COUNTY, MARYLAND

OWNER:
FREDERICK PRIMARY CARE ASSOCIATES
610 SOLAREX COURT
FREDERICK, MD 21703
(301) 663-6162

DATE	BY	REVISIONS

SEAL

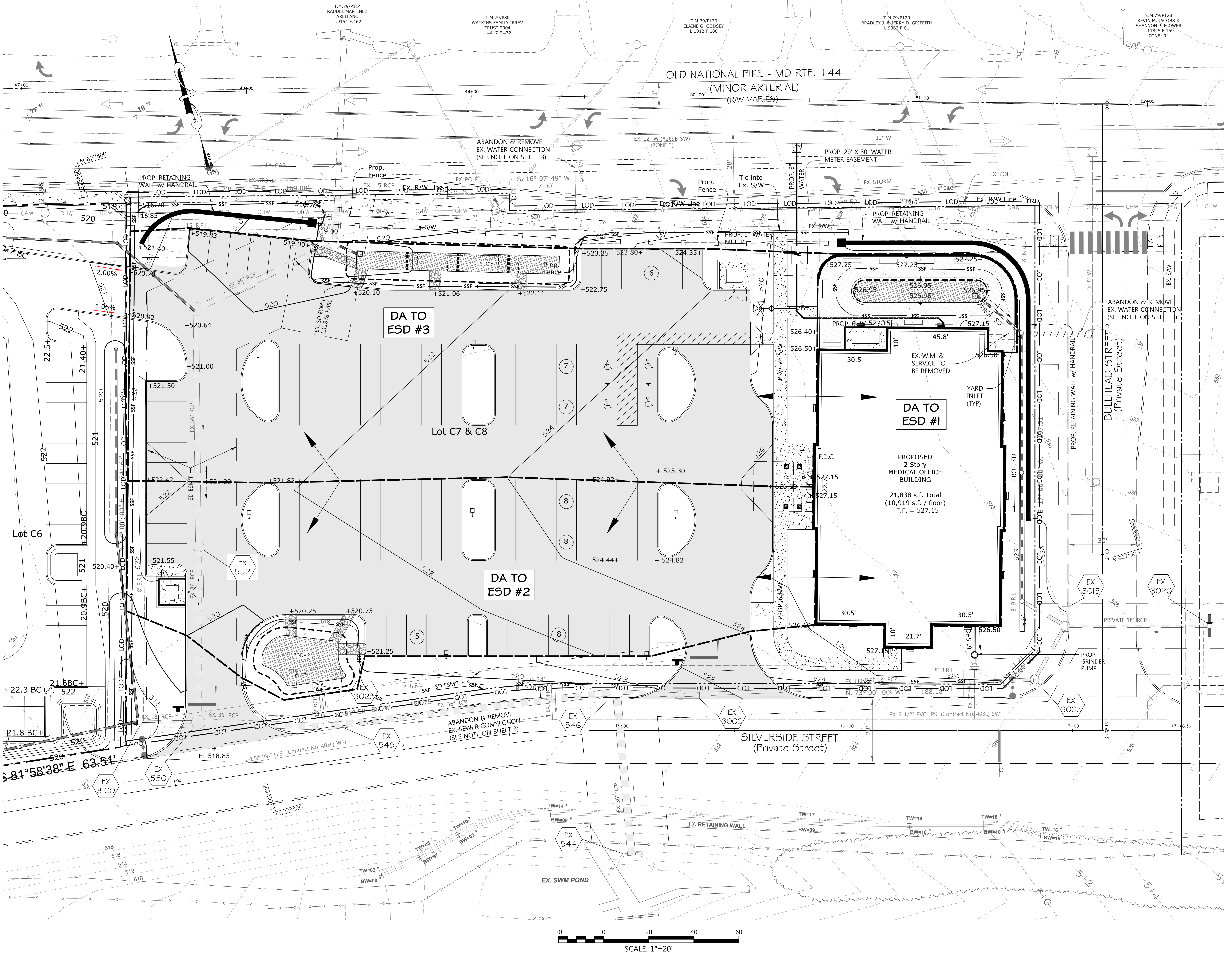
INITIAL SUB.: 05/11/2021
SCALE: 1"=30'
DRAWN: JNS
DESIGNED: DSM
CHECKED BY: MSC
PROJECT NO.: 20701
DRAWING: 1 of 2

FREDERICK CO. #PW265166

REVIEWED IN ACCORDANCE WITH LOCAL COUNTY REQUIREMENTS. FREDERICK COUNTY ASSUMES NO LIABILITY FOR DESIGN AND/OR CONSTRUCTION. APPROVAL IS VALID FOR TWO (2) YEARS AFTER THE LAST DATE SHOWN ABOVE. THE PROJECT MUST BE UNDER CONSTRUCTION BEFORE THE APPROVAL EXPIRATION TO BE CONSIDERED ACTIVE. OTHERWISE, RESUBMITTAL OF PLANS, INCLUDING APPLICABLE FEES, MUST BE MADE TO DEVELOPMENT REVIEW FOR REAPPROVAL. FEES FOR RESUBMITTAL CANNOT BE WAIVED.

PROPOSED CONDITIONS

Facility Type	Facility #	Drainage Area Treated (Ft2)	Impervious Area Treated (Ft2)
M-6 - Micro-Bioretention	1	14,105	13,535
M-6 - Micro-Bioretention	2	23,560	18,940
M-8 - Swales (Bio-swale)	3	32,315	25,755
	Totals:	**69,980**	**58,230**



LEGEND

PROP. DRAINAGE DIVIDE & FLOW ARROWS

LOD	LIMITS OF DISTURBANCE
SSF	SUPER SILT FENCE

LINGG
PROPERTY CONSULTING
256 West Patrick Street, Suite 2A
Frederick, Maryland 21701
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FREDERICK, MD 21701
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ESD DRAINAGE AREA MAP

SWM DEVELOPMENT PLAN for
FREDERICK PRIMARY CARE
MEDICAL OFFICE FACILITY

SITUATED ALONG SILVERSIDE STREET AT BULLHEAD
STREET & OLD NATIONAL PIKE
ELECTION DISTRICT NO. 2
FREDERICK COUNTY, MARYLAND

OWNER:
FREDERICK PRIMARY CARE ASSOCIATES
610 SOLAREX COURT
FREDERICK, MD 21703
(301) 663-6162

DATE	BY	REVISIONS

SEAL

INITIAL SUB.: 05/11/2021
SCALE: 1"=20'
DRAWN: JNS
DESIGNED: DSM
CHECKED BY: MSC
PROJECT NO.: 20701
DRAWING: 2 of 2

Example report is not a Design of attached plans

Brunswick Elementary School

400 Central, Brunswick, Maryland 21701

Stormwater Management ESD Report

REPORT TITLE:

SWM COMPS SWM DEV PLAN

OWNER/DEVELOPER:
Frederick County Public Schools
191 South East Street Frederick, MD 21701
(301)644-5000

ENGINEER:
MK Consulting Engineers, LLC
3300 Clipper Mill Rd.
Suite 201
Baltimore, Maryland 21211
(410)371-8977
Contact: Craig Blymiller

Professional Certification:
I certify that these documents were prepared or approved by me, and that I am duly licensed engineer under the laws of the state of Maryland
License Number: 25058
Expiration Date: 11-17-2022

No. 25058

12.8.21

Design Engineer's Certification

Submitted: December 16, 2021

SHEET INDEX

Index

1.) Design Narrative

Tax Map: 92G, Grid: 14, Parcel: 776
Election District: 25   Zoning: RS

EXISTING SITE

Site Description

The subject site is for Brunswick Elementary School is located at 400 Central Avenue, Brunswick, MD 21716. The subject site has two (2) connected parcels which combined equal a total acreage of school site is approximately 34.099 acres in size. The existing elementary school is located on parcel 776 and is approximately 24.63 acres. There are also 8 relocatable classrooms on-site. Parcel "JJJ" of plat no. 82 was conveyed to the Board of Education Frederick County by Brunswick Crossing, LLC. is approximately 9.469 acres. Parcel "JJJ" has been cleared during mass grading by Brunswick Crossing, LLC. and no structures are currently located on this parcel.

The site has a significant slope primarily from the highpoint in the middle of the site that falls to the Northwest and Southeast. The highest elevation on the site is in the middle of the site where there is a knoll that is located at an elevation of 452.0'+/-, from there the grade slopes down steeply to an elevation of 388.0'+/- along the southeast corner of Dayton Avenue. The elevation on the northwest corner of the site at Central Avenue is 397.0'+/-.

Stormwater Management

The site currently contains zero (0) stormwater management facilities. Soils on the site are hydrologic soils group "B" soils. Existing onsite soils were taken from "USDA Web Soil Survey" (See soils group table provided).

The site is not located within the 100-year floodplain as delineated on FEMA flood insurance rate maps 24021C0385D. The site is located in Zone X which means an area determined to be outside the 0.2% annual chance floodplain. A review of the Maryland Department of Natural Resources (DNR) mapping indicates that no wetlands or streams exist on the site.

PROPOSED CONDITIONS

Site Description

The proposed construction includes the 97,591 g.s.f. new building, bus loop, parent drop off, paved parking, service area, three (3) hard surface play areas, three (3) soft surface play areas, 2 multipurpose fields and various new utilities. The proposed impervious area for the project is 5.89 acres.

The proposed school site has two entrance points along Central Avenue. The first entrance point is located to the northwest of the site and is a bus entrance off of Central Avenue The second entrance is also located on the northwest of the site and provides access for the parent drop off area, parking areas and service area. These entrances are 175' apart.

Stormwater Management

MK Consulting is proposing eighteen (18) micro-bioretention facilities and one (1) underground storage facility to account for the proposed building and paving for the site. Storm drainage from the proposed school, sidewalk areas will be conveyed to proposed stormwater management the micro-bioretention facilities and one underground facility throughout the site. The facilities will be in the form of Environmental Site Design (ESD) techniques. This will be required to meet the 2007 Maryland Stormwater Design Manual regulations for the project. The ESD facilities primarily include micro-bioretention techniques. Quantity management is not required on parcel “JJJ” based on MOU between the county and the developer for the school site. ESD to the MEP has been achieved for the project on-site and no additional requirements are necessary.

2.) SWM Design Approach

Planning Techniques

The Environmental Site Design incorporates planning techniques to utilize the natural features of the site to reduce impacts from development and incorporate these features into the stormwater management design. The following are planning techniques and the methods of site design utilized for each:

1. Preserving and protecting natural features:

Proposed clearing will be minimized in conjunction with site construction. Any impacts to existing non-tidal wetlands, associated buffers, and streams will be minimized to the maximum extent possible. Any impacts to steep slopes and highly erodible soils will be minimized to the maximum extent possible. Steep slopes impacted by design will be protected utilizing accelerated vegetative stabilization, structural stabilization, diverting runoff around or over the slopes, benching, and incremental stabilizations as necessary.

2. Conserving the natural drainage patterns:

The site has been graded to keep the drainage patterns as close to natural as possible and to keep the natural runoff points intact.

3. Minimizing impervious area:

The proposed development design attempts to reduce impervious cover to the maximum extent possible.

4. Reducing runoff volume:

Implementation of ESD practices at areas of impervious runoff to delay the delivery of stormwater from the site to the existing stream. Implementation of ESD practices at areas of impervious runoff to delay the delivery of stormwater from site to existing stream.

5. Achieving groundwater recharge using ESD practices:

Implementation of ESD practices at areas of impervious runoff to allow stormwater to maintain the average annual predevelopment ground water recharge volume.

6. Limiting soil disturbance, mass grading and compaction:

Implementation of sediment and erosion control devices to protect areas during construction from unnecessary soil disturbance and compaction. The extent and duration of soil exposure will be minimized by phasing and sequencing soil disturbance activities.

Treatment Practices

To achieve environmental site design requirements to the maximum extent practical (MEP) the following practices have been implemented:

1. Micro-bioretention

Stormwater runoff is directed towards a proposed micro-bioretention facility to provide pollutant removal through vegetative filtering, sedimentation, biological uptake, and infiltration into underlying soil media.

2. Underground Storage Facility

Stormwater runoff is directed to the “Bio-Clean” underground storage facility through underground storm drain to provide pollutant removal through filtering media.

Implementation of Erosion and Sediment Control:

Integration of erosion & sediment controls into the stormwater management strategy will be accomplished by the following:

A.) Strategies to preserve sensitive resources, ensure soil stability, and preventing erosion.
B.) Erosion and sediment control plans will identify areas to be protected by marking the limit of disturbance, sensitive areas, buffers, and forested areas that are to be preserved or protected.
C.) Clearing, grading, and earth disturbance should be limited to that required to develop the lot.
D.) Phasing earth disturbing activities so that the smallest area is exposed for the shortest possible time.
E.) Complete grading as quickly as possible.
F.) Establish permanent vegetative as soon as possible on disturbed areas.
G.) Divert runoff from disturbed areas.
H.) Filter runoff at it flows from disturbed areas.
I.) Impound sediment-laden runoff temporarily so that soil particles are deposited onsite.

Erosion and sediment control practices being utilized during construction to address the control of erosion and sedimentation on site are as follows:

1. Stabilized construction entrance w/ mountable berm

   Located at site access point to avoid tracking sediment into roadways.

2. Perimeter silt fence

   Located along downstream of disturbance to intercept and trap sediment laden sheet flow so that deposition of sediment transported from upstream can occur.

3. Perimeter super silt fence

   Located along downstream of disturbance to intercept and trap sediment laden sheet flow so that deposition of sediment transported from upstream can occur.

4. Temporary stabilization

   To be placed as soon as possible following grading activities (min. 3 calendar days) to stabilize a disturbed area with vegetation for a temporary period of up to 6 months to prevent it from the forces of erosion.

5. Permanent stabilization

   To be placed upon completion of all grading activities (min. 3 calendar days) to permanently stabilize disturbed areas with vegetation to prevent it from the forces of erosion.

6. Clean water earth dike

   To intercept and direct clean water from an undisturbed area to a stabilized outfall at a non-erosive velocity.

7. Earth Dike

   To intercept and direct sediment laden runoff from a disturbed area to a sediment trapping practice. To segment drainage areas to reduce acreage to sediment control devices.

8. Rock outlet protection

   To be placed at the outfall of clean water dikes to reduce runoff velocity and protect existing ground from erosion.

9. Temporary gabion outlet structure
To be placed at the outfall of earth dikes. Protects existing ground from erosion and allows sediments to deposit in stone before discharge of runoff waters.

10. Blaze orange fencing
To be placed at the perimeter of all areas to be protected during construction. High visibility allows these areas to easily be seen and avoided.

11. Sediment Basin
To intercept sediment laden runoff and trap the sediment in order to protect drainage ways, properties, and right-of-ways downstream from sedimentation.

Conclusion

In conclusion, Environmental Site Design (ESD) to the Maximum Extent Practicable (MEP) has been established on this project. This report and accompanying plans demonstrate that the requirements of the "Stormwater Management Act of 2007" has been met.

3.) Environmental Site Design (ESD)

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

Environmental Site Design Storage Volume Required (ESDv) - POI 1

Site Data: L.O.D. / Study Area = 8.02 ac.
Existing Impervious Area = 1.99 ac.
Proposed Impervious Area = 2.20 ac.

Determine Redevelopment / New Development:
1.99 ac. Exist Imperv. Area / 8.02 ac. Site Area = 25%
25% < 40%, therefore, project is considered new development

New Development:
Area to Treat (At) = Impervious Area
At = 2.20 ac. Prop. Imperv. Area
At = 2.20 ac.

Imperviousness (I) = (At / A) x 100%
(I) = (2.20 ac. / 8.02) ac. x 100%
(I) = 27%

Rv = 0.05 + [(0.009) x (I)]
Rv = 0.05 + [(0.009) x (27)]
Rv = 0.29

Determine Target "PE" Using Table 5.3:
Use 27% in tables 5.3 to determine composite "PE" for the site.
(See Page-15 of "ESD Process & Computations)
B Soils @ 27% = 1.6"

ESDv = [(Pe) x (Rv) x (A)] / 12
ESDv = [(1.6) x (0.29) x (8.02)] / 12
ESDv = 0.31 ac. ft. or 13,504 c.f.

Total ESDv Required:
Total ESDv Required = 13,504 c.f.

Total ESDv Provided:
Total ESDv Provided = 20,974 c.f.
FACILITIES 1 THRU 10 AND 18 & 19

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

Environmental Site Design Storage Volume Required (ESDv) - POI 2

Site Data: L.O.D. / Study Area = 6.02 ac.
Existing Impervious Area = 0.74 ac.
Proposed Impervious Area = 3.43 ac.

Determine Redevelopment / New Development:
0.74 ac. Exist Imperv. Area / 6.02 ac. Site Area = 12%
12% < 40%, therefore, project is considered new development

New Development:
Area to Treat (At) = Impervious Area
At = 3.43 ac. Prop. Imperv. Area
At = 3.43 ac.

Imperviousness (I) = (At / A) x 100%
(I) = (3.43 ac. / 6.02) ac. x 100%
(I) = 57%

Rv = 0.05 + [(0.009) x (I)]
Rv = 0.05 + [(0.009) x (57)]
Rv = 0.56

Determine Target "PE" Using Table 5.3:
Use 57% in tables 5.3 to determine composite "PE" for the site.
(See Page-15 of "ESD Process & Computations)
B Soils @ 57% = 2.0"

ESDv = [(Pe) x (Rv) x (A)] / 12
ESDv = [(2.0) x (0.56) x (6.02)] / 12
ESDv = 0.56 ac. ft. or 24,394 c.f.

Total ESDv Required:
Total ESDv Required = 24,394 c.f.

Total ESDv Provided:
Total ESDv Provided = 31,555 c.f.
FACILITIES 11 THRU 17

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

E.S.D. Practice Analysis

Environmental Site Design Storage Volume Required (ESDv)

The following chart is intended to demonstrate that Environmental Site Design practices have been applied to the maximum extent practical.

Planning Techniques	
Practice	Comments
Preserve & Protect Nat. Resources	No significant natural resources exist on the site. Impacts to site are required to achieve the project purpose.
Conserve Nat. Drainage Patterns	Minor adjustments to drainage areas have been made. The site will continue to discharge to 1 design point in the developed condition.
Minimize Impervious Area	Proposed impervious surfaces have been minimized.
Reduce Runoff Volume	The minimum amount of impervious area that is required to achieve the project purpose is being proposed. Quantity management is not required for the 10 & 100 year storm events.
Limit Soil Disturbance	The proposed disturbed area is the minimum required to construct the project.
Cluster Development	This is a new development project that proposes to construct an addition.
Alternative Surfaces (Section 5.3)	
Practice	Comments
A-1 Green Roofs	ESD is being achieved without the application of this practice..
A-2 Permeable Pavements	ESD is being achieved without the application of this practice..
A-3 Reinforced Turf	There are no light traffic or infrequently used impervious areas being proposed at this site.
Nonstructural Practices (Section 5.4.2)	
Practice	Comments
N-1 Disconnection of Rooftop Runoff	Proposed site layout does not allow for rooftop disconnect opportunities.
N-2 Disconnection of Non-rooftop Runoff	Proposed site layout does not allow for rooftop disconnect opportunities.
N-3 Sheetflow to Conservation Areas	There are no conservation areas that qualify on the site.

Micro-Scale Practices (Section 5.4.3)	
Practice	Comments
M-1 Rainwater Harvesting	An irrigation system is not being proposed for this project.
M-2 Submerged Gravel Wetlands	Submerged Gravel Wetland is not being proposed for this project.
M-3 Landscape Infiltration	Due to drainage area restrictions, opportunities do not exist for the application of this practice.
M-4 Infiltration Berms	No opportunities exist for the application of this practice.
M-5 Dry Wells	No opportunities exist for the application of this practice.
M-6 Micro-Bioretention	Micro-bioretention facilities are being proposed.
M-7 Rain Gardens	ESD is being achieved with other practices. No Rain Gardens are being proposed.
M-8 Swales	ESD is being achieved with other practices. No Swales are being proposed.
M-9 Enhanced Filters	ESD is being achieved with other practices. No Enhanced Filters are being proposed.
Structural Practices (BMP's)	
Stormwater Ponds (Section 3.1)	
Practice	Comments
P-1 Micropool Extended Detention Pond	In consideration of this site being developed for an Elementary school, standing wet pools of water would be a safety concern for this project.
P-2 Wet Pond	In consideration of this site being developed for an Elementary school, standing wet pools of water would be a safety concern for this project.
P-3 Wet Extended Detention Pond	In consideration of this site being developed for an Elementary school, standing wet pools of water would be a safety concern for this project.
P-4 Multiple Pond System	In consideration of this site being developed for an Elementary school, standing wet pools of water would be a safety concern for this project.
P-5 Pocket Pond	In consideration of this site being developed for an Elementary school, standing wet pools of water would be a safety concern for this project.

Stormwater Wetlands (Section 3.2)

Practice	Comments
W-1 Shallow Wetland	Due to the site being located in an Elementary School area, standing water associated with this practice is not desirable. Additionally, soil conditions would not support a wetland facility.
W-2 Extended Detention Shallow Wetland	Due to the site being located in an Elementary School area, standing water associated with this practice is not desirable. Additionally, soil conditions would not support a wetland facility.
W-3 Pond/Wetland System	Due to the site being located in an Elementary School area, standing water associated with this practice is not desirable. Additionally, soil conditions would not support a wetland facility.
W-4 Pocket wetland	Due to the site being located in an Elementary School area, standing water associated with this practice is not desirable. Additionally, soil conditions would not support a wetland facility.

Stormwater Infiltration (Section 3.3)

Practice	Comments
I-1 Infiltration Trench	ESD is being achieved with other practices.
I-2 Infiltration Basin	ESD is being achieved with other practices.

Stormwater Filtering Systems (Section 3.4)

Practice	Comments
F-1 Surface Sand Filter	ESD is being achieved with other practices.
F-2 Underground Sand Filter	ESD is being achieved with other practices.
F-3 Perimeter Sand Filter	ESD is being achieved with other practices.
F-4 Organic Filter	ESD is being achieved with other practices.
F-5 Pocket Sand Filter	ESD is being achieved with other practices.
F-6 Bioretention	ESD is being achieved with other practices.

Open Channel Systems (Section 3.5)

Practice	Comments
O-1 Dry Swale	ESD is being achieved with other practices.
O-2 Wet Swale	ESD is being achieved with other practices.

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/16/2021

ESD Techniques /Facility Summary

Micro-Bioretention Facilities

Facility No.	Total ESDv Treated
SWM-1 Micro-bioretention Facility	2,049 Cubic Feet
SWM-2 Micro-bioretention Facility	1,976 Cubic Feet
SWM-3 Micro-bioretention Facility	1,060 Cubic Feet
SWM-4 Micro-bioretention Facility	2,068 Cubic Feet
SWM-5 Micro-bioretention Facility	1,764 Cubic Feet
SWM-6 Micro-bioretention Facility	1,446 Cubic Feet
SWM-7 Micro-bioretention Facility	3,062 Cubic Feet
SWM-8 Micro-bioretention Facility	632 Cubic Feet
SWM-9 Micro-bioretention Facility	1,019 Cubic Feet
SWM-10 Micro-bioretention Facility	2,943 Cubic Feet
SWM-11 Micro-bioretention Facility	2,117 Cubic Feet
SWM-12 Micro-bioretention Facility	2,421 Cubic Feet
SWM-13 Micro-bioretention Facility	2,479 Cubic Feet
SWM-14 Micro-bioretention Facility	2,928 Cubic Feet
SWM-15 Micro-bioretention Facility	2,317 Cubic Feet
SWM-16 Micro-bioretention Facility	2,789 Cubic Feet
SWM-17 Bio-Clean Underground Facility	16,504 Cubic Feet
SWM-18 Micro-bioretention Facility	1,958 Cubic Feet
SWM-19 Micro-bioretention Facility	997 Cubic Feet
Total	52,529 Cubic Feet

Total ESDv Provided	**52,529 Cubic Feet**

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-1 Micro-Bioretention Facility

Drainage Area: A

Area to Facility:	21,274 s.f. or	0.49	ac.
Impervious Area:	8,968 s.f. or	0.21	ac.
Surface Area of Filter:	1,610 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,610 s.f. / 21,274 s.f. = 7.6%

Percentage of Imperviousness: 8,968 s.f. / 21,274 s.f. = 42 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 42)
Rv = 0.428

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B'=Soils, 45%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.428 x 21,317 s.f. / 12
ESDv = 1,369 c.f.

Storage Volume Provided:
4,041 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,041 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.428 x 0.49 ac./12
1 YR Vol. = 2,049 c.f.

ESDv Treated = 2,049 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,049 c.f. / 0.428 x 21,274 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #1
Drainage Area #A
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	1,610	0.037	0.00	0.018	0.000	0.000	0
424.00	2,286	0.052	1.00	0.045	0.045	0.045	1,948

Interpolated Values

elevation [ft]	volume [acre·ft]	[ft³]
424.00	0.045	1,948

volume [acre·ft]	[ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,610 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,093 c.f.

Total volume provided:
1,948 c.f. surface storage + 2,093 c.f. planting media storage = 4,041 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-2 Micro-Bioretention Facility

Drainage Area: B

Area to Facility:	19,303 s.f. or	0.44 ac.
Impervious Area:	8,738 s.f. or	0.20 ac.
Surface Area of Filter:	1,235 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
1,235 s.f. / 19,303 s.f. = 6.4%

Percentage of Imperviousness: 8,738 s.f. / 19,303 s.f. = 45 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 45)
Rv = 0.455

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils 45%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.455 x 19,303 s.f. / 12
ESDv = 1,317 c.f.

Storage Volume Provided:
3,072 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 3,072 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.455 x 0.44 ac./12
1 YR Vol. = 1,976 c.f.

ESDv Treated = 1,976 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,976 c.f. / 0.455 x 19,303 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #2
Drainage Area #B
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	1,235	0.028	0.00	0.014	0.000	0.000	0
424.00	1,696	0.039	1.00	0.034	0.034	0.034	1,466

Interpolated Values

elevation [ft]	volume [acre·ft]	[ft³]
424.00	0.034	1,466

volume [acre·ft]	[ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,235 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,606 c.f.

Total volume provided:
1,466 c.f. surface storage + 1,606 c.f. planting media storage = 3,072 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-3 Micro-Bioretention Facility

Drainage Area: C
Area to Facility: 12,016 s.f. or 0.28 ac.
Impervious Area: 4,605 s.f. or 0.11 ac.
Surface Area of Filter: 1,832 s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
1,832 s.f. / 12,016 s.f. = 15.2%

Percentage of Imperviousness: 4,605 s.f. / 12,016 s.f. = 38 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 38)
Rv = 0.392

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B'=Soils 40%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.392 x 12,016 s.f. / 12
ESDv = 706 c.f.

Storage Volume Provided:
4,480 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,480 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.392 x 0.28 ac./12
1 YR Vol. = 1,060 c.f.

ESDv Treated = 1,060 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,060 c.f. / 0.392 x 12,016 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #3
Drainage Area #C
Storage Volume

Elevation [ft.]	**Area [ft^2]**	**Area [acre]**	**Change in Elevation [ft]**	**Average Area [acre]**	**Incremental Volume [acre·ft]**	**Cumulative Volume [acre·ft]**	**Cumulative Volume [ft^3]**
423.00	0	0.000				0.000	0
423.00	1,832	0.042	0.00	0.021	0.000	0.000	0
424.00	2,364	0.054	1.00	0.048	0.048	0.048	2,098

Interpolated Values

elevation	**volume**	
[ft]	**[acre·ft]**	**[ft^3]**
424.00	0.048	2,098

volume		**elevation**
[acre·ft]	**[ft^3]**	**[ft]**

Storage Volume Provided within Planting Media:
1,832 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,382 c.f.

Total volume provided:
2,098 c.f. surface storage + 2382 c.f. planting media storage = 4,480 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-4 Micro-Bioretention Facility

Drainage Area: D
Area to Facility: 21,478 s.f. or 0.49 ac.
Impervious Area: 9,078 s.f. or 0.21 ac.
Surface Area of Filter: 1,450 s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
1,450 s.f. / 21,478 s.f. = 6.8%

Percentage of Imperviousness: 9,078 s.f. / 21,478 s.f. = 42 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 42)
Rv = 0.428

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 45%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.428 x 21,478 s.f. / 12
ESDv = 1,379 c.f.

Storage Volume Provided:
3,574 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 3,574 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.428 x 0.49 ac./12
1 YR Vol. = 2,068 c.f.

ESDv Treated = 2,068 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,068 c.f. / 0.428 x 21,478 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #4
Drainage Area #D
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	1,450	0.033	0.00	0.017	0.000	0.000	0
424.00	1,928	0.044	1.00	0.039	0.039	0.039	1,689

Interpolated Values

elevation [ft]	volume [acre·ft]	[ft³]
424.00	0.039	1,689

volume [acre·ft]	[ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,450 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,885 c.f.

Total volume provided:
1,689 c.f. surface storage + 1,885 c.f. planting media storage = 3,574 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-5 Micro-Bioretention Facility

Drainage Area: E

Area to Facility:	15,682 s.f. or	0.36 ac.	
Impervious Area:	7,914 s.f. or	0.18 ac.	
Surface Area of Filter:	1,909 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,909 s.f. / 15,682 s.f. = 12.2%

Percentage of Imperviousness: 7,914 s.f. / 15,682 s.f. = 50 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 50)
Rv = 0.500

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 50%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.50 x 15,682 s.f. / 12
ESDv = 1,176 c.f.

Storage Volume Provided:
4,745 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,745 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.500 x 0.36 ac./12
1 YR Vol. = 1,764 c.f.

ESDv Treated = 1,764 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,764 c.f. / 0.500 x 15,682 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
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Micro-Bioretention Facility #5
Drainage Area #E
Storage Volume

Elevation [ft.]	Area [ft^2]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft^3]
423.00	0	0.000				0.000	0
423.00	1,909	0.044	0.00	0.022	0.000	0.000	0
424.00	2,617	0.060	1.00	0.052	0.052	0.052	2,263

Interpolated Values

elevation	volume	
[ft]	[acre·ft]	[ft^3]
424.00	0.052	2,263

volume		elevation
[acre·ft]	[ft^3]	[ft]

Storage Volume Provided within Planting Media:
1,909 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,482 c.f.

Total volume provided:
2,263 c.f. surface storage + 2,482 c.f. planting media storage = 4,745 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-6 Micro-Bioretention Facility

Drainage Area: F

Area to Facility:	12,623 s.f. or	0.29 ac.
Impervious Area:	6,478 s.f. or	0.15 ac.
Surface Area of Filter:	1,324 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
1,324 s.f. / 12,623 s.f. = 10.5%

Percentage of Imperviousness: 6,478 s.f. / 12,623 s.f. = 51 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 51)
Rv = 0.509

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 55%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.509 x 12,623 s.f. / 12
ESDv = 964 c.f.

Storage Volume Provided:
3,312 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 3,312 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.509 x 0.29 ac./12
1 YR Vol. = 1,446 c.f.

ESDv Treated = 1,446 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,446 c.f. / 0.509 x 12,623 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
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Micro-Bioretention Facility #6
Drainage Area #F
Storage Volume

Elevation [ft.]	**Area [ft²]**	**Area [acre]**	**Change in Elevation [ft]**	**Average Area [acre]**	**Incremental Volume [acre·ft]**	**Cumulative Volume [acre·ft]**	**Cumulative Volume [ft³]**
423.00	0	0.000				0.000	0
423.00	1,324	0.030	0.00	0.015	0.000	0.000	0
424.00	1,857	0.043	1.00	0.037	0.037	0.037	1,591

Interpolated Values

elevation	**volume**	
[ft]	**[acre·ft]**	**[ft³]**
424.00	0.037	1,591

volume		**elevation**
[acre·ft]	**[ft³]**	**[ft]**

Storage Volume Provided within Planting Media:
1,324 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,721 c.f.

Total volume provided:
1,591 c.f. surface storage + 1,721 c.f. planting media storage = 3,312 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-7 Micro-Bioretention Facility

Drainage Area: G

Area to Facility:	18,768 s.f. or	0.43	ac.
Impervious Area:	14,103 s.f. or	0.32	ac.
Surface Area of Filter:	1,728 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,728 s.f. / 18,768 s.f. = 9.2%

Percentage of Imperviousness: 14,103 s.f. / 18,768 s.f. = 75 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 75)
Rv = 0.725

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 75%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.725 x 18,768 s.f. / 12
ESDv = 2,495 c.f.

Storage Volume Provided:
4,301 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,301 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.725 x 0.43 ac./12
1 YR Vol. = 3,062 c.f.

ESDv Treated = 3,062 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 3,062 c.f. / 0.725 x 18,768 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
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Date: 12/19/2021

Micro-Bioretention Facility #7
Drainage Area #G
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	1,728	0.040	0.00	0.020	0.000	0.000	0
424.00	2,381	0.055	1.00	0.047	0.047	0.047	2,055

Interpolated Values

elevation [ft]	volume [acre·ft]	[ft³]
424.00	0.047	2,055

volume [acre·ft]	[ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,728 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,246 c.f.

Total volume provided:
2,055 c.f. surface storage + 2,246 c.f. planting media storage = 4,301 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-8 Micro-Bioretention Facility

Drainage Area: H

Area to Facility: 5,830 s.f. or 0.13 ac.
Impervious Area: 2,778 s.f. or 0.06 ac.
Surface Area of Filter: 807 s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
807 s.f. / 5,830 s.f. = 13.8%

Percentage of Imperviousness: 2,778 s.f. / 5,830 s.f. = 48 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 48)
Rv = 0.482

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 50%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.482 x 5,830 s.f. / 12
ESDv = 422 c.f.

Storage Volume Provided:
2,067 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,067 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.482 x 0.13 ac./12
1 YR Vol. = 632 c.f.

ESDv Treated = 632 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 632 c.f. / 0.482 x 5,830 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
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Date: 12/19/2021

Micro-Bioretention Facility #8
Drainage Area #H
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	807	0.019	0.00	0.009	0.000	0.000	0
424.00	1,229	0.028	1.00	0.023	0.023	0.023	1,018

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
424.00	0.023	1,018

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
807 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,049 c.f.

Total volume provided:
1,108 c.f. surface storage + 1,049 c.f. planting media storage = 2,067 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-9 Micro-Bioretention Facility

Drainage Area: I

Area to Facility:	14,989 s.f. or	0.34 ac.
Impervious Area:	4,122 s.f. or	0.09 ac.
Surface Area of Filter:	1,687 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
1,687 s.f. / 14,989 s.f. = 11.3%

Percentage of Imperviousness: 4,122 s.f. / 14,989 s.f. = 28 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 28)
Rv = 0.302

ESDv based on drainage to the facility:
Pe = 1.6" (See table 5.3, ('B' Soils, 30%))
ESDv = Pe x Rv x A / 12
ESDv = 1.6" x 0.302 x 14,989 s.f. / 12
ESDv = 604 c.f.

Storage Volume Provided:
4,137 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,137 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.302 x 0.34 ac./12
1 YR Vol. = 1,019 c.f.

ESDv Treated = 1,019 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,019 c.f. / 0.302 x 14,989 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #9
Drainage Area #I
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000				0.000	0
423.00	1,687	0.039	0.00	0.019	0.000	0.000	0
424.00	2,201	0.051	1.00	0.045	0.045	0.045	1,944

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
424.00	0.045	1,944

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,687 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,193 c.f.

Total volume provided:
1,944 c.f. surface storage + 2,193 c.f. planting media storage = 4,137 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-10 Micro-Bioretention Facility

Drainage Area: J
Area to Facility: 21,514 s.f. or 0.49 ac.
Impervious Area: 13,438 s.f. or 0.31 ac.
Surface Area of Filter: 1,272 s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
1,272 s.f. / 21,514 s.f. = 5.9%

Percentage of Imperviousness: 13,438 s.f. / 21,514 s.f. = 62 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 62)
Rv = 0.608

ESDv based on drainage to the facility:
Pe = 2.0" (See table 5.3, ('B' Soils, 65%))
ESDv = Pe x Rv x A / 12
ESDv = 2.0" x 0.608 x 21,517 s.f. / 12
ESDv = 2,180c.f.

Storage Volume Provided:
3,184 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 3,184 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.608 x 0.49 ac./12
1 YR Vol. = 2,943 c.f.

ESDv Treated = 2,943 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,943 c.f. / 0.608 x 21,514 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #10
Drainage Area #J
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
423.00	0	0.000	▨	▨	▨	0.000	0
423.00	1,272	0.029	0.00	0.015	0.000	0.000	0
424.00	1,788	0.041	1.00	0.035	0.035	0.035	1,530

Interpolated Values

elevation	volume	
[ft]	[acre·ft]	[ft³]
424.00	0.035	1,530

volume		elevation
[acre·ft]	[ft³]	[ft]

Storage Volume Provided within Planting Media:
1,272 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,654 c.f.

Total volume provided:
1,530 c.f. surface storage + 1,654 c.f. planting media storage = 3,184 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-11 Micro-Bioretention Facility

Drainage Area: K

Area to Facility:	18,818	s.f. or	0.43	ac.
Impervious Area:	9,497	s.f. or	0.22	ac.
Surface Area of Filter:	877	s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
877 s.f. / 18,818 s.f. = 4.7%

Percentage of Imperviousness: 9,497 s.f. / 18,818 s.f. = 50 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 50)
Rv = 0.500

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 50%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.50 x 18,818 s.f. / 12
ESDv = 1,411 c.f.

Storage Volume Provided:
2,204 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,204 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.500 x 0.43 ac./12
1 YR Vol. = 2,117 c.f.

ESDv Treated = 2,117 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,117 c.f. / 0.500 x 18,818 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #11
Drainage Area #K
Storage Volume

Elevation [ft.]	**Area [ft²]**	**Area [acre]**	**Change in Elevation [ft]**	**Average Area [acre]**	**Incremental Volume [acre·ft]**	**Cumulative Volume [acre·ft]**	**Cumulative Volume [ft³]**
429.00	0	0.000				0.000	0
429.00	877	0.020	0.00	0.010	0.000	0.000	0
430.00	1,250	0.029	1.00	0.024	0.024	0.024	1,064

Interpolated Values

elevation [ft]	**volume [acre·ft]**	**[ft³]**
430.00	0.024	1,064

volume [acre·ft]	**[ft³]**	**elevation [ft]**

Storage Volume Provided within Planting Media:
877 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,140 c.f.

Total volume provided:
1,064 c.f. surface storage + 1,140 c.f. planting media storage = 2,204 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-12 Micro-Bioretention Facility

Drainage Area: L

Area to Facility:	18,860 s.f. or	0.43 ac.
Impervious Area:	14,480 s.f. or	0.33 ac.
Surface Area of Filter:	960 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
960 s.f. / 18,860 s.f. = 5.1%

Percentage of Imperviousness: 14,480 s.f. / 18,860 s.f. = 77 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 77)
Rv = 0.743

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 80%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.743 x 18,860 s.f. / 12
ESDv = 2,569 c.f.

Storage Volume Provided:
2,421 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,421 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.743 x 0.43 ac./12
1 YR Vol. = 3,153 c.f.

ESDv Treated = 2,421 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,421 c.f. / 0.743 x 18,860 s.f.
Pe (Treated) = 2.07 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #11
Drainage Area #K
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
429.00	0	0.000				0.000	0
429.00	877	0.020	0.00	0.010	0.000	0.000	0
430.00	1,250	0.029	1.00	0.024	0.024	0.024	1,064

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
430.00	0.024	1,064

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
877 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,140 c.f.

Total volume provided:
1,064 c.f. surface storage + 1,140 c.f. planting media storage = 2,204 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-13 Micro-Bioretention Facility

Drainage Area: M

Area to Facility:	18,848 s.f. or	0.43 ac.	
Impervious Area:	12,815 s.f. or	0.29 ac.	
Surface Area of Filter:	1,078 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,078 s.f. / 18,848 s.f. = 5.7%

Percentage of Imperviousness: 12,815 s.f. / 18,848 s.f. = 68 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 68)
Rv = 0.662

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 70%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.662 x 18,848 s.f. / 12
ESDv = 2,288 c.f.

Storage Volume Provided:
2,479 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,479 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.662 x 0.43 ac./12
1 YR Vol. = 2,807 c.f.

ESDv Treated = 2,479 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,479 c.f. / 0.662 x 18,848 s.f.
Pe (Treated) = 2.38 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #13
Drainage Area #M
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
426.00	0	0.000				0.000	0
426.00	1,078	0.025	0.00	0.012	0.000	0.000	0
427.00	1,498	0.034	1.00	0.030	0.030	0.030	1,288

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
427.00	0.030	1,288

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,078 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,401 c.f.

Total volume provided:
1,288 c.f. surface storage + 1,401 c.f. planting media storage = 2,479 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-14 Micro-Bioretention Facility

Drainage Area: N

Area to Facility:	20,240 s.f. or	0.46 ac.	
Impervious Area:	14,953 s.f. or	0.34 ac.	
Surface Area of Filter:	1,176 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,176 s.f. / 20,240 s.f. = 5.8%

Percentage of Imperviousness: 14,953 s.f. / 20,240 s.f. = 74 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 74)
Rv = 0.716

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 75%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.716 x 20,240 s.f. / 12
ESDv = 2,657 c.f.

Storage Volume Provided:
2,928 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,928 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.716 x 0.46 ac./12
1 YR Vol. = 3,261 c.f.

ESDv Treated = 2,928 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,928 c.f. / 0.716 x 20,240 s.f.
Pe (Treated) = 2.42 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #14
Drainage Area #N
Storage Volume

Elevation [ft.]	Area [ft^2]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft^3]
426.00	0	0.000				0.000	0
426.00	1,176	0.027	0.00	0.013	0.000	0.000	0
427.00	1,622	0.037	1.00	0.032	0.032	0.032	1,399

Interpolated Values

elevation [ft]	volume [acre·ft]	[ft^3]
427.00	0.032	1,399

volume [acre·ft]	[ft^3]	elevation [ft]

Storage Volume Provided within Planting Media:
1,176 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,529 c.f.

Total volume provided:
1,399 c.f. surface storage + 1,529 c.f. planting media storage = 2,928 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-15 Micro-Bioretention Facility

Drainage Area: O

Area to Facility:	18,215 s.f. or	0.42 ac.
Impervious Area:	13,657 s.f. or	0.31 ac.
Surface Area of Filter:	901 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
901 s.f. / 18,215 s.f. = 4.9%

Percentage of Imperviousness: 13,657 s.f. / 18,215 s.f. = 75 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 75)
Rv = 0.725

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 80%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.725 x 18,215 s.f. / 12
ESDv = 2,421 c.f.

Storage Volume Provided:
2,317 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,317 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.725 x 0.42 ac./12
1 YR Vol. = 2,971 c.f.

ESDv Treated = 2,317 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,317 c.f. / 0.725 x 18,215 s.f.
Pe (Treated) = 2.11 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #15
Drainage Area #O
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
424.00	0	0.000				0.000	0
424.00	901	0.021	0.00	0.010	0.000	0.000	0
425.00	1,390	0.032	1.00	0.026	0.026	0.026	1,146

Interpolated Values

elevation	volume	
[ft]	[acre·ft]	[ft³]
425.00	0.026	1,146

volume		elevation
[acre·ft]	[ft³]	[ft]

Storage Volume Provided within Planting Media:
901 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,171 c.f.

Total volume provided:
1,146 c.f. surface storage + 1,171 c.f. planting media storage = 2,317 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-16 Micro-Bioretention Facility

Drainage Area: P

Area to Facility:	18,474 s.f. or	0.42 ac.	
Impervious Area:	12,740 s.f. or	0.29 ac.	
Surface Area of Filter:	1,738 s.f.		

Surface area of filter must be at least 2% of the contributing drainage area.
1,738 s.f. / 18,474 s.f. = 9.4%

Percentage of Imperviousness: 12,740 s.f. / 18,474 s.f. = 69 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 69)
Rv = 0.671

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B' Soils, 70%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.671 x 18,474 s.f. / 12
ESDv = 2,273 c.f.

Storage Volume Provided:
4,339 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 4,339 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.671 x 0.42 ac./12
1 YR Vol. = 2,789 c.f.

ESDv Treated = 2,789 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 2,789 c.f. / 0.671 x 18,474 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #16
Drainage Area #P
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
431.00	0	0.000				0.000	0
431.00	1,738	0.040	0.00	0.020	0.000	0.000	0
432.00	2,421	0.056	1.00	0.048	0.048	0.048	2,080

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
432.00	0.048	2,080

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,738 surface s.f. x 3.25' deep filter @ 40% void ratio = 2,259 c.f.

Total volume provided:
2,080 c.f. surface storage + 2,259 c.f. planting media storage = 4,339 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-17 Micro-Bioretention Facility

Drainage Area: Q
Area to Facility: 101,171 s.f. or 2.32 ac.
Impervious Area: 75,566 s.f. or 1.73 ac.
Surface Area of Filter: s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
0 s.f. / 101,171 s.f. = 0.0%

Percentage of Imperviousness: 75,566 s.f. / 101,171 s.f. = 75 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 75)
Rv = 0.725

ESDv based on drainage to the facility:
Pe = 2.2" (See table 5.3, ('B'=2.2" Soils, 75%))
ESDv = Pe x Rv x A / 12
ESDv = 2.2" x 0.725 x 101,171 s.f. / 12
ESDv = 13,447 c.f.

Storage Volume Provided:
16,588 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 16,588 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.725 x 2.32 ac./12
1 YR Vol. = 16,504 c.f.

ESDv Treated = 16,504 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 16,504 c.f. / 0.725 x 101,171 s.f.
Pe (Treated) = 2.70 "

SUBMITTAL DRAWINGS

Bio Clean
A Forterra Company

Proven Stormwater Treatment Technology

PROJECT #:

13627

PROJECT NAME:

Brunswick Elementary School

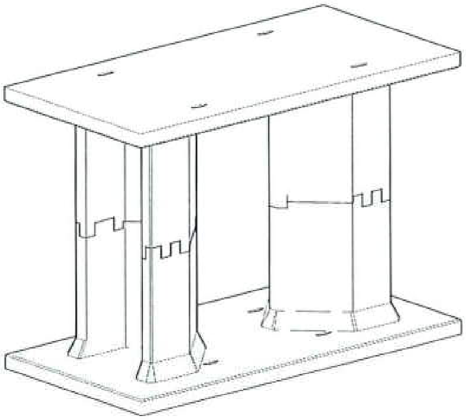
PREPARED FOR:

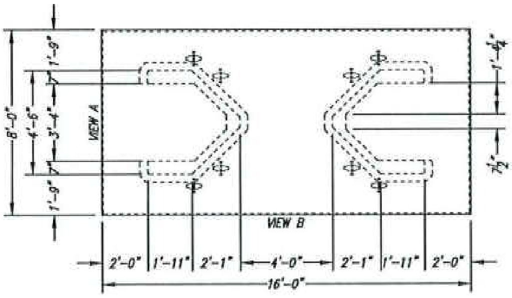
DATE SUBMITTED:

October 5th, 2021

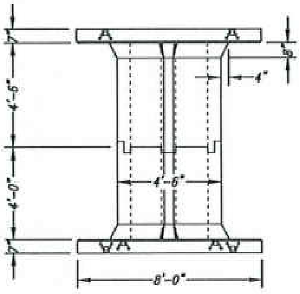
Bio Clean
5796 Armada Dr. #250
Carlsbad, CA 92008

www.BioCleanEnvironmental.com
P 855-566-3938

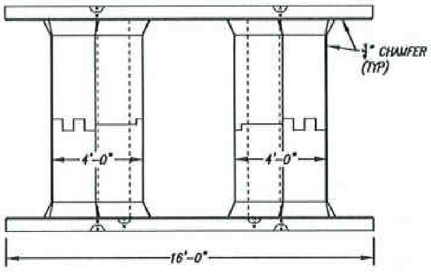




TOP VIEW



ELEVATION VIEW A



ELEVATION VIEW B

1:50 SCALE

Frank Sisk
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Bio Clean
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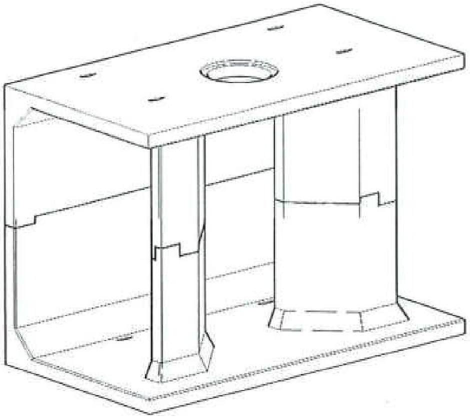
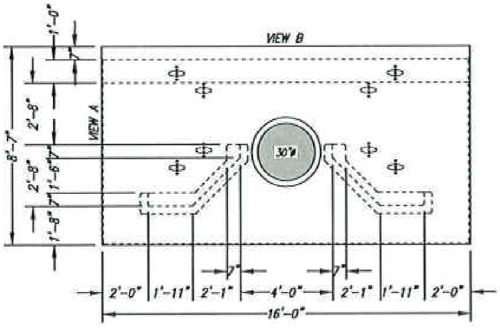
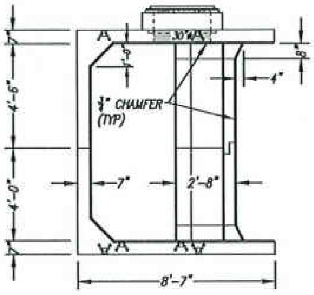
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - INTERIOR

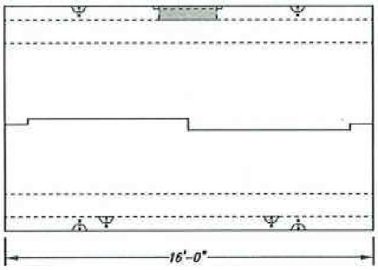




TOP VIEW
(FRAME & COVER / GRADE ADJUSTMENT NOT SHOWN)



ELEVATION VIEW A



ELEVATION VIEW B

1:50 SCALE

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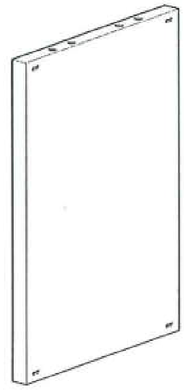
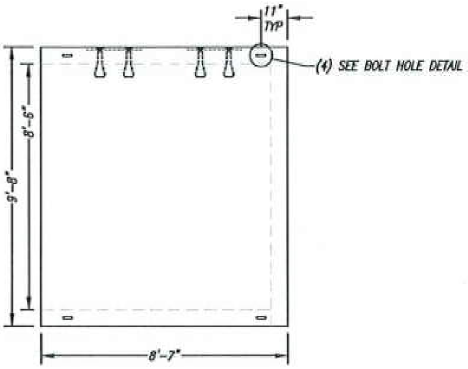
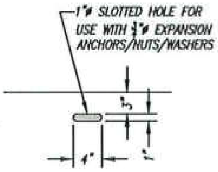
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - PERIMETER

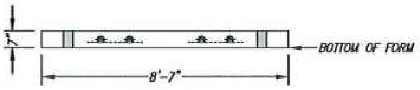




EXTERIOR VIEW



BOLT HOLE DETAIL



TOP VIEW

12/27/19JCPAMG

1:40 SCALE

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URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - EXTERIOR WALL PANEL

SUBMITTAL DRAWINGS

Bio Clean

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Proven Stormwater Treatment Technology

PROJECT #:

13627

PROJECT NAME:

Brunswick Elementary School

PREPARED FOR:

DATE SUBMITTED:

October 5th, 2021

DISCLOSURE: It is the sole responsibility of purchaser to verify these submittals are accurate based upon the final set of construction plans. Bio Clean is not responsible for any variations to design after these submittals are approved. If information in these submittals do not match the final set of construction plans it is the responsibility of the purchaser to request revision(s) from Bio Clean prior to approving the submittals. If the purchaser approves this submittal without final construction plans and/or without approval from the project engineer they do so at own risk. Bio Clean highly recommends that the purchaser get official stamped approval from Project Engineer(s) and/or all other Project Design Professions in accordance with project submittal specifications and manufactures recommendations.

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Carlsbad, CA 92008

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SITE SPECIFIC DATA*			
PROJECT NUMBER	13267		
PROJECT NAME	BRUNSWICK ELEMENTARY		
PROJECT LOCATION	BRUNSWICK, MD		
STRUCTURE ID	URBANPOND		
REQUIRED STORAGE VOLUME (CF)	16,244		
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	427.55	HDPE	15"
INLET PIPE 2	425.84	HDPE	15"
OUTLET PIPE 1	422.80	HDPE	18"
FINISHED GRADE ELEVATION	435 TO 436		
TOP OF LINKUP SLAB ELEV	432.46		
SURFACE LOADING REQUIREMENT	HS20		
FRAME AND COVER	ø30"		
CORROSIVE SOIL CONDITIONS	NA		
KNOWN GROUNDWATER ELEVATION	NA		

NOTES: CONCEPT ONLY, NOT FOR CONSTRUCTION. ALL MODULES HAVE 8.5' INSIDE HEIGHT.

*PER ENGINEER OF RECORD

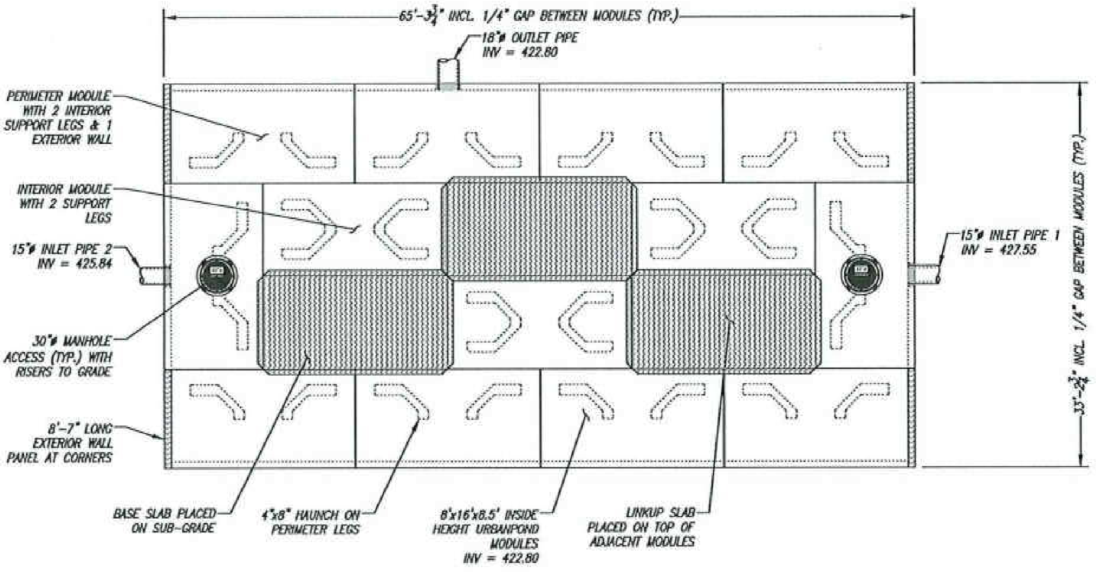
URBANPOND MODULES		
TYPE	HEIGHT	COUNT
8'X16' INT. TOP	4'-6"	3
8'X16' INT. BASE	4'-0"	3
8'X16' PERIM. TOP	4'-6"	10
8'X16' PERIM. BASE	4'-0"	10
9'X17' LINKUP SLAB	7"	3
8'X16' BASE SLAB	7"	3

SIDEWALLS		
LENGTH (FT)	HEIGHT (FT)	COUNT
8'-7"	9'-8"	4

TOTAL STORAGE CAPACITY

WATER STORAGE VOLUME PROVIDED = 16,588 CF

HEAVIEST PIECE: PERIMETER MODULE = 23,300 LBS.



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	GRADE ADJUSTMENT RISERS			
		3"	6"	12"
1:100 SCALE	30"ø	4	2	4

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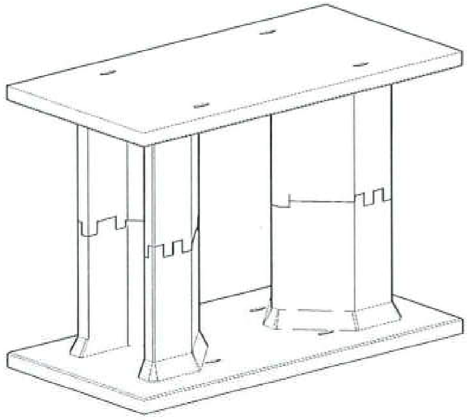
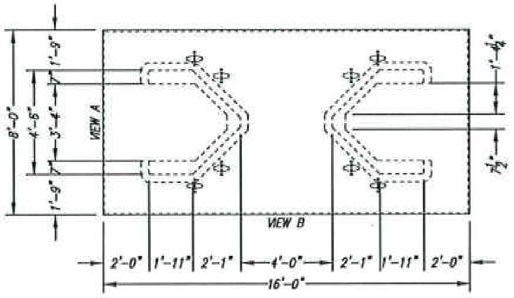
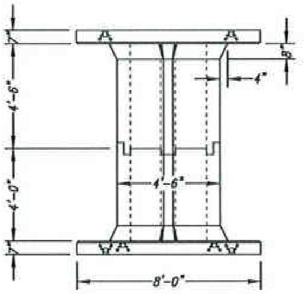
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
PLAN VIEW

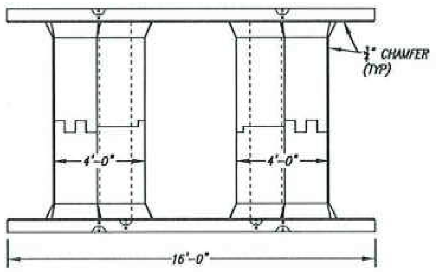




TOP VIEW



ELEVATION VIEW A



ELEVATION VIEW B

1:50 SCALE

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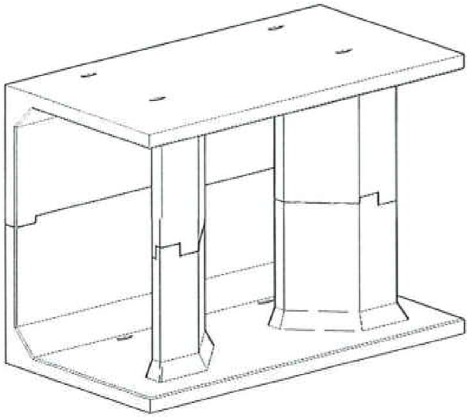
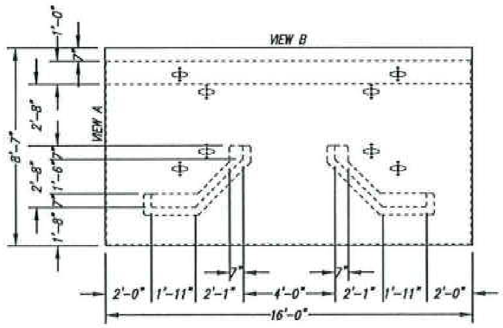
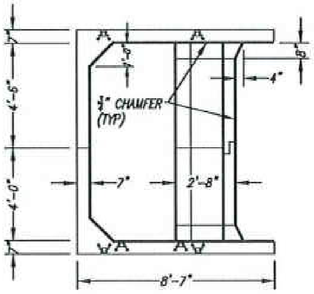
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - INTERIOR

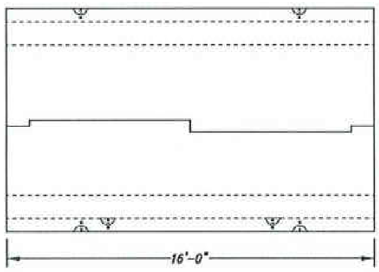




TOP VIEW



ELEVATION VIEW A



ELEVATION VIEW B

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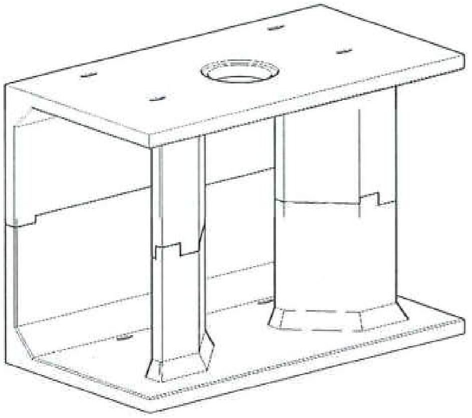
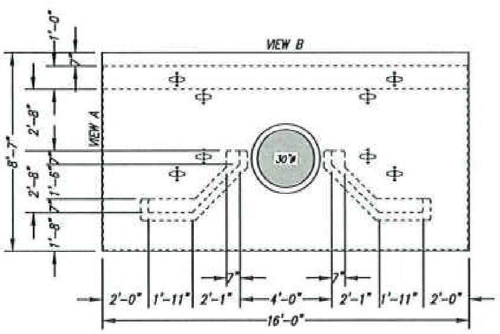
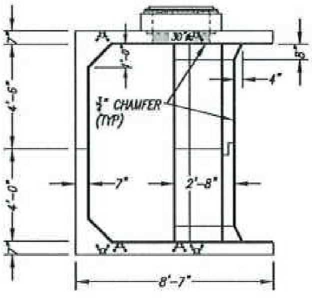
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - PERIMETER



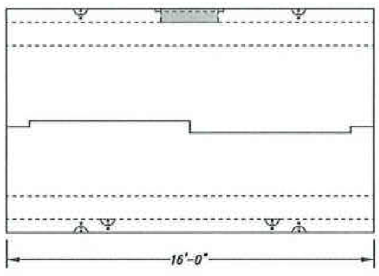


TOP VIEW

(FRAME & COVER / GRADE ADJUSTMENT NOT SHOWN)



ELEVATION VIEW A



ELEVATION VIEW B

1:50 SCALE

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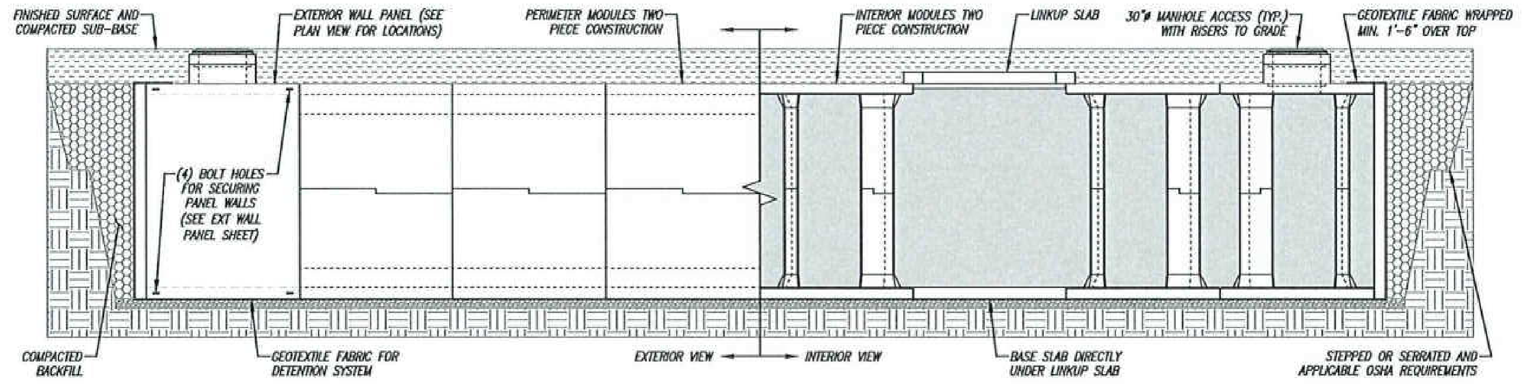
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - PERIMETER



ELEVATION VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE. SOIL COMPACTION REQUIREMENTS PER GEOTECHNICAL ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. PIPES CANNOT INTRUDE BEYOND FLUSH. INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR UNLESS OTHERWISE NOTED. ALL GAPS AROUND PIPES SHALL BE SEALED WATERTIGHT WITH A NON-SHRINK GROUT PER MANUFACTURER'S STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLE FRAMES AND COVERS. CONTRACTOR TO GROUT ALL FRAMES AND COVERS TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. THE URBANPOND MODULE SYSTEM IS TO BE INSTALLED IN ACCORDANCE WITH ASTM C891-90, INSTALLATION OF UNDERGROUND PRECAST UTILITY STRUCTURES. PROJECT PLAN AND SPECIFICATIONS MUST BE FOLLOWED ALONG WITH ANY APPLICABLE REGULATIONS.
7. CONTRACTOR TO PLACE A LAYER OF GEOTEXTILE FABRIC IN THE EXCAVATED PIT PRIOR TO PLACEMENT OF URBANPOND MODULES. THE FABRIC SHALL EXTEND BEYOND THE FOOTPRINT OF THE URBANPOND MODULES IN ORDER TO WRAP UP ALONG THE OUTER WALLS AND BE SECURED INTO PLACE WITH THE BACKFILL. THE GEOTEXTILE FABRIC PREVENTS FINE SOIL PARTICLES FROM MIGRATING INTO THE SYSTEM.
8. WHEN A MEMBRANE LINER IS REQUIRED, THE LINER SHALL BE SANDWICHED IN BETWEEN AN INNER AND OUTER LAYER OF GEOTEXTILE FABRIC TO PREVENT PUNCTURES.
9. WHEN A MEMBRANE LINER IS REQUIRED, PIPES SHALL BE ATTACHED TO THE LINER USING PIPE BOOTS SUPPLIED BY THE LINER MANUFACTURER.
10. DESIGNATED EMBEDDED LIFTERS MUST BE USED. USE PROPER RIGGING TO ASSURE ALL LIFTERS ARE EQUALLY ENGAGED WITH A MINIMUM 60 DEGREE ANGLE ON SLINGS AS NOTED AND IN ACCORDANCE WITH MANUFACTURER'S LIFTING PROCEDURES. USE RIGGING THAT EQUALIZES THE LOAD BETWEEN ALL LIFTERS.
11. BIO CLEAN RECOMMENDS BEGINNING INSTALLATION WITH THE OUTLET MODULE.
12. MODULES MUST BE PLACED AS CLOSE TOGETHER AS POSSIBLE, AND GAPS SHALL NOT BE GREATER THAN 1/4".
13. PLACE BASE SLABS DIRECTLY UNDER LOCATIONS FEATURING LINKUP SLABS. INSTALL LINKUP SLABS ONLY AFTER ALL 4 SUPPORTING MODULES ARE IN PLACE. INSTALL LINKUPSLABS AS PROJECT PROGRESSES TO ENSURE BEST FIT.
14. ALL EXTERIOR SYSTEM JOINTS SHALL BE COVERED WITH A MINIMUM 6" JOINT WRAP (ON SIDES AND TOP).
15. INSTALL PANEL WALLS AT DESIGNATED LOCATIONS ON THE PLAN VIEW DRAWING. SECURE PANEL WALLS WITH 2 BOLTS ON TOP AND 2 BOLTS ON THE BOTTOM.
16. THE FILL PLACED AROUND THE URBANPOND MODULES MUST BE DEPOSITED EVENLY, AT APPROXIMATELY THE SAME ELEVATION, AROUND ALL SIDES. AT NO TIME SHALL THE FILL BEHIND ONE SIDE BE MORE THAN 1'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL BE COMPACTED AND/OR VIBRATED TO ENSURE THAT BACKFILL MATERIAL IS WELL SEATED AND PROPERLY INTERLOCKED. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGING ACTION. CARE SHALL ALSO BE TAKEN SO AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MATERIAL MUST BE CLEAN, CRUSHED, ANGULAR NO. 57 (AASHTO M43) AGGREGATE OR NATIVE MATERIAL IF APPROVED BY THE SITE GEOTECHNICAL ENGINEER. IF NATIVE MATERIAL IS SUSCEPTIBLE TO MIGRATION, CONFIRM WITH GEOTECHNICAL ENGINEER AND PROVIDE PROTECTION AS REQUIRED.
17. AT NO TIME SHALL MACHINERY OR VEHICLES GREATER THAN THE DESIGN HS-20 LOADING CRITERIA TRAVEL ON TOP OF THE SYSTEM WITHOUT THE MINIMUM DESIGN COVERAGE. IF TRAVEL IS NECESSARY OVER THE SYSTEM PRIOR TO ACHIEVING THE MINIMUM DESIGN COVER, IT MAY BE NECESSARY TO REDUCE THE ULTIMATE LOAD/BURDEN OF THE OPERATING MACHINERY SO AS NOT TO EXCEED THE CAPACITY OF THE SYSTEM. IN SOME CASES, IN ORDER TO ACHIEVE REQUIRED COMPACTION, HAND COMPACTION MAY BE NECESSARY IN ORDER TO NOT EXCEED THE ALLOTTED DESIGN LOADING.
18. A PRE-CONSTRUCTION MEETING IS REQUIRED PRIOR TO PLACEMENT OF URBANPOND.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.
3. ANY VARIATION FOUND DURING CONSTRUCTION FROM THE SITE AND SYSTEM ANALYSIS MUST BE REPORTED TO THE PROJECT DESIGN ENGINEER.

1:60 SCALE

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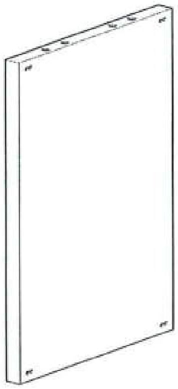
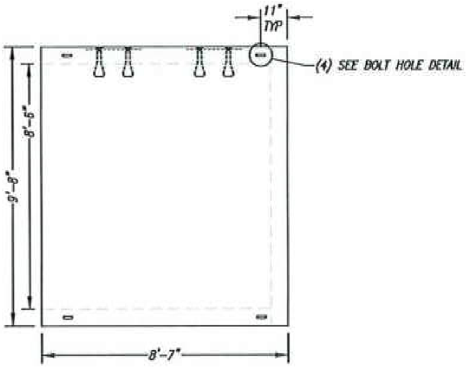
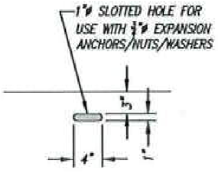
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
GENERAL ELEVATION DETAILS

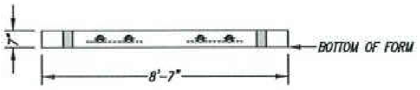




EXTERIOR VIEW



BOLT HOLE DETAIL



TOP VIEW

1:40 SCALE

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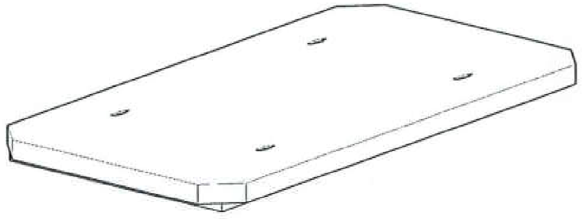
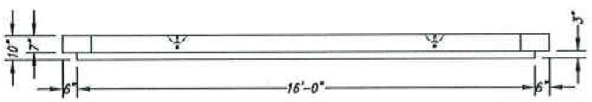
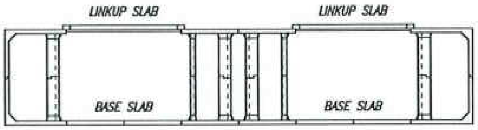
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
DOUBLE MODULE - EXTERIOR WALL PANEL

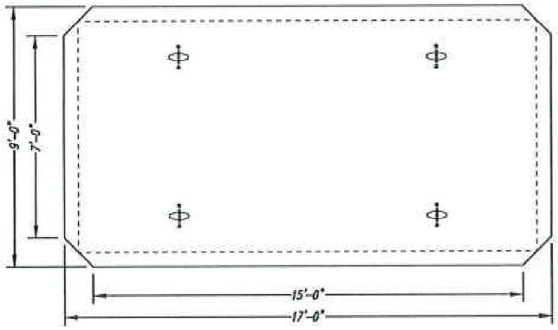




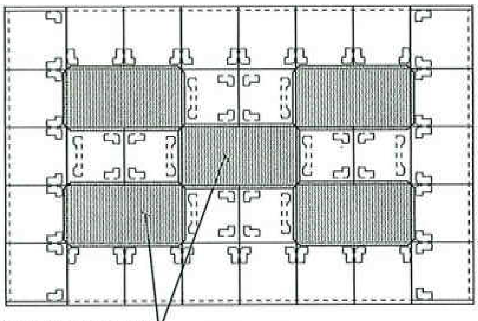
LINKUP SLAB ELEVATION VIEW



ELEVATION VIEW
(QUARTER SCALE)



LINKUP SLAB TOP VIEW



LINKUP SLABS BEAR ON TOP EDGES OF 4 ADJACENT MODULES

TOP VIEW
(QUARTER SCALE)

1:40 SCALE

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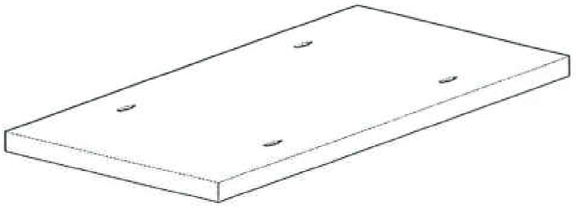
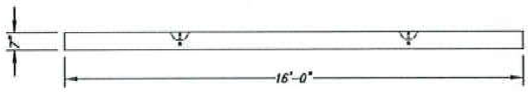
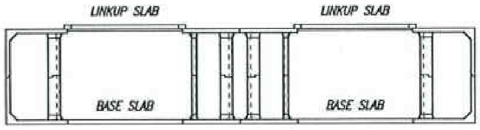
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
LINKUP SLAB

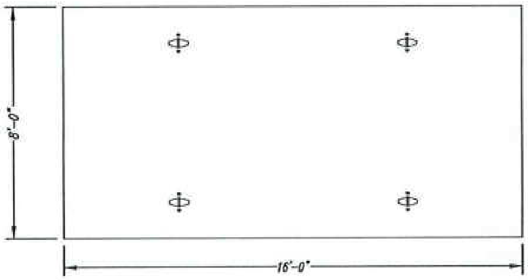




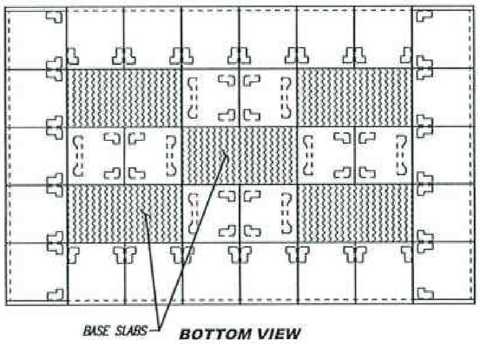
BASE SLAB
ELEVATION VIEW



ELEVATION VIEW
(QUARTER SCALE)



BASE SLAB
TOP VIEW



BOTTOM VIEW
(QUARTER SCALE)

1:40 SCALE

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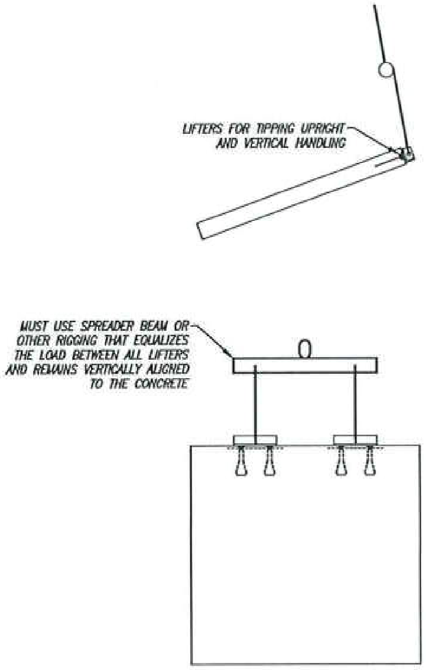
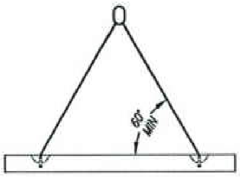
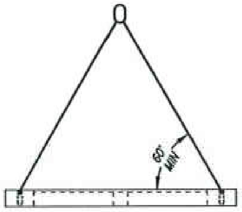
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
BASE SLAB



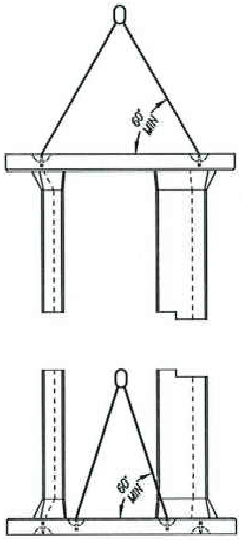
EXTERIOR WALL PANEL



LINKUP & BASE SLAB



STRUTTED FRAME



*** SINGLE MODULE**
INTERIOR & PERIMETER

* SOME MODULES MUST USE RIGGING THAT EQUALIZES THE LOAD BETWEEN ALL LIFTERS

1:40 SCALE

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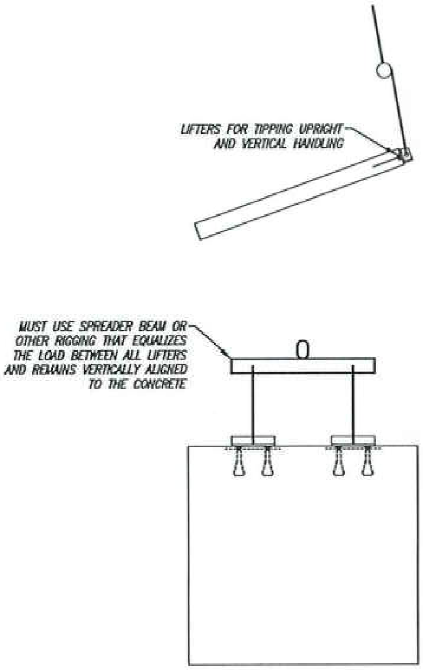
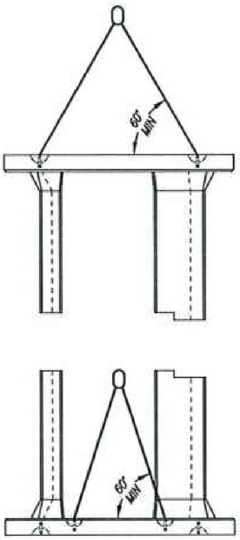
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
LIFT RIGGING



EXTERIOR WALL PANEL



*** SINGLE MODULE INTERIOR & PERIMETER**

* SOME MODULES MUST USE RIGGING THAT EQUALIZES THE LOAD BETWEEN ALL LIFTERS

1:40 SCALE

Frank Sisk
Regional Sales Manager
frank.sisk@forterrabp.com
804-393-6099

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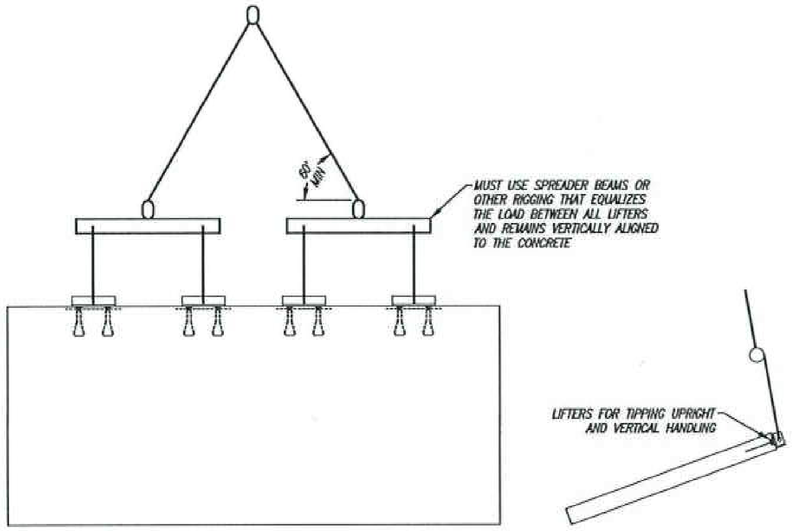
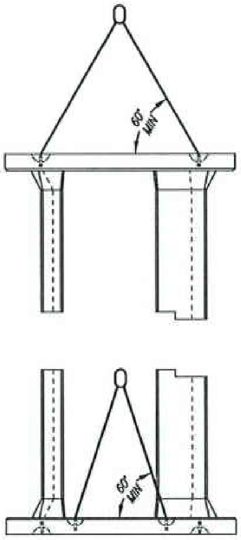
URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
LIFT RIGGING



EXTERIOR WALL PANEL



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Bio Clean
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URBANPOND
PRECAST CONCRETE STORMWATER DETENTION
LIFT RIGGING

OVERVIEW

The Bio Clean UrbanPond™ is a technological breakthrough in underground stormwater management.

Its unique square tessellation assembly provides superior strength and material efficiency over traditional rectangular modules. Each module utilizes an offset 3-legged design with two narrow legs running parallel and one wider leg running perpendicular. This unique geometry allows for maximum strength and minimum material usage. The standard design is rated for H-20 loading.

UrbanPond has high void percentages to maximize stormwater volume, and its robust precast form allows systems to be buried deeper without the need for specialized backfill, increased wall thicknesses, or extra rebar reinforcement.

A BREAKTHROUGH SYSTEM FOR MANAGING STORMWATER RUNOFF

ADVANTAGES

- THE SQUARE TESSELLATION PROVIDES SUPERIOR STRENGTH AND LOAD CAPACITY
- DESIGNED TO MEET H-20 LOADING REQUIREMENTS
- CAN BE INSTALLED DEEPER WITHOUT THE NEED TO INCREASE WALL THICKNESS OR ADD ADDITIONAL REBAR
- EVERY MODULE DRAINS DOWN FULLY
- HIGHER VOID PERCENTAGES AND INCREASED MATERIAL EFFICIENCY FOR BEST IN CLASS COST PER CUBIC FOOT STORAGE
- LIGHTER WEIGHT, EASIER TO INSTALL
- A LINKUP SLAB ALLOWS ELIMINATION OF SOME MODULES, FURTHER DECREASING COST AND INSTALLATION TIME

APPLICATIONS

UrbanPond is engineered specifically for:

Detention with controlled discharge utilizing built-in outlet orifice structures.

Retention for long-term retention of runoff onsite to meet strict stormwater requirements.

Harvesting self-contained treatment and reuse of stormwater for irrigation and grey water needs.

Capture & Infiltration of runoff back into underlying native soils for recharge needs.

Treatment utilized as an underground extended detention basin or pond for advanced treatment of stormwater - integrates well with treatment train components (biofiltration, separation, etc.).

Flood Control of peak storm events to minimize downstream flooding and erosion.

Low Impact Development to maximize land use with underground storage - construct an urban infill without a pond at grade.

SPECIFICATIONS

UrbanPond is available with inside heights ranging from 3 feet to 14 feet, in 6 inch increments. Single UrbanPond Modules are available with inside heights ranging from 3 feet to 7 feet, in 6 inch increments, and the Double UrbanPond Modules are available up to 14 feet.

The system's internal offset leg configuration provides channel-less water distribution for stormwater entering and exiting the system.

SINGLE URBANPOND MODULE

I.D. Module Height (ft.)	Module Storage Capacity (cu. ft.)
3	179
4	238
5	298
6	357
7	417

Available in 6 inch increments.

DOUBLE URBANPOND MODULE

I.D. Module Height (ft.)	Module Storage Capacity (cu. ft.)
6	357
7	417
8	477
9	536
10	596
11	655
12	715
13	775
14	834

Available in 6 inch increments.

CONFIGURATIONS

UrbanPond is a modular precast concrete structure that can be assembled from one to several hundred modules in various shapes and configurations to meet site specific constraints and volume requirements.

Each UrbanPond module is 8 feet wide x 8 feet long (outside dimension) - specifically designed to fit on a standard flatbed truck. UrbanPond can be configured in a combination of modules from as low as 3 feet to as high as 14 feet (inside height).

View looking down with top slabs removed.

URBANPOND ASSEMBLY

The UrbanPond is based on a square tessellation. A tessellation is created when a shape is repeated over and over again covering a plane without any gaps or overlaps. Because of the self-supporting characteristic of tessellated-shaped structures, Bio Clean has been able to further reduce material usage and costs up to 20% without sacrificing structural strength.

As shown in the image to the left, the offset leg configuration of the modules creates a very open and channel-less internal space.

In any configuration, each module provides access walkways greater than 3 feet wide for easy access to every module.

SINGLE URBANPOND MODULE

Available in heights from 3 ft. to 7 ft.

RISER TO GRADE

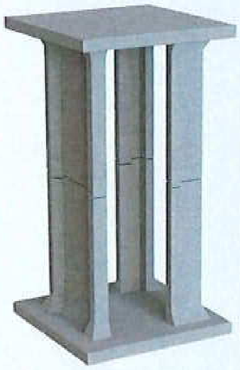
For easy maintenance and inspection access.

LINKUP SLAB

LinkUP Slabs span the open cavities like a checkerboard.

DOUBLE URBANPOND MODULE

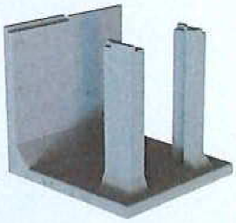
Available in heights from 6 ft. to 14 ft.

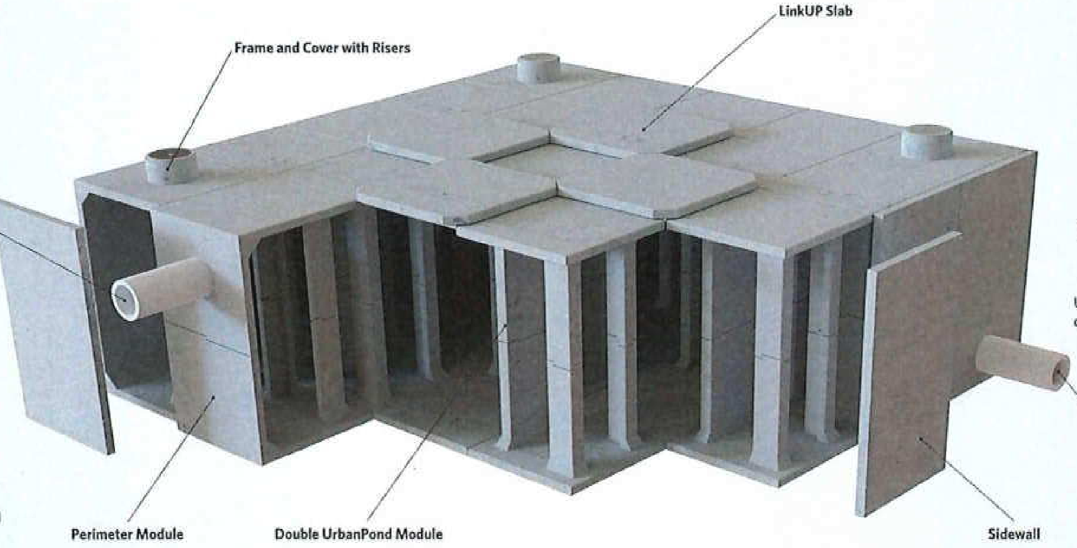


UrbanPond can be engineered with optional infiltration openings.

PERIMETER MODULE

Built-in perimeter wall





INSTALLATION

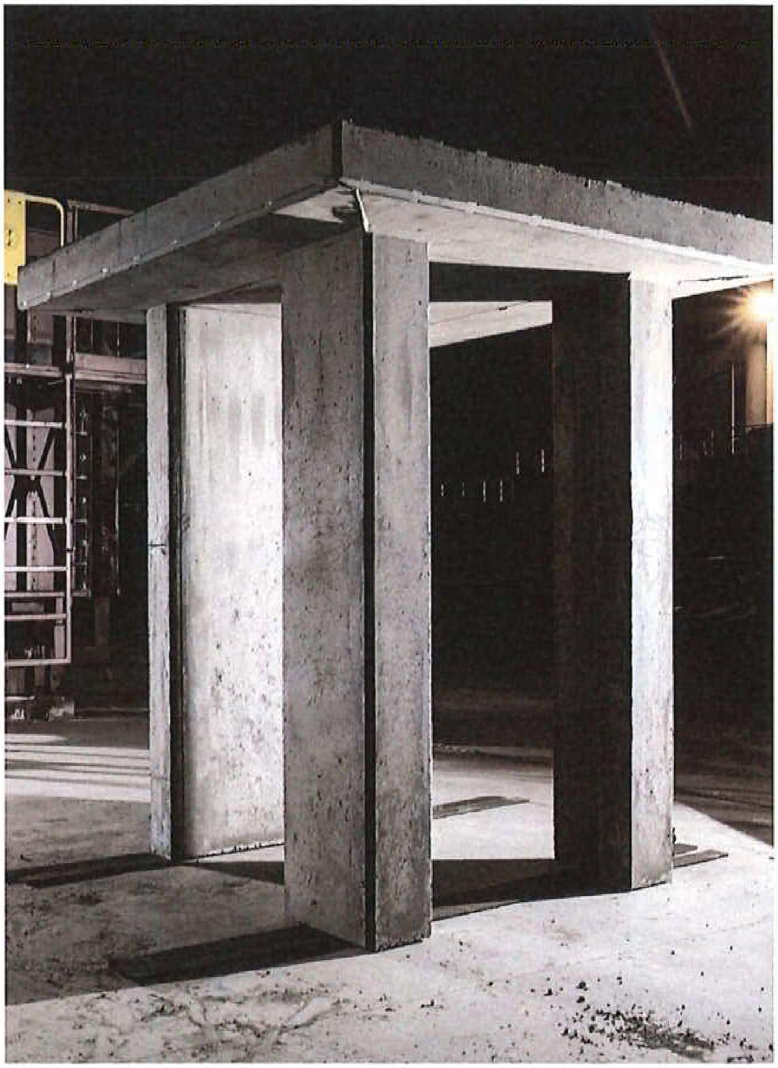
Each Single UrbanPond module is 8 ft. wide by 8 ft. long (O.D.) and easily fits onto a flatbed truck. This size maximizes the space on each truck load. A 12 foot Double UrbanPond module (two pieces) weighs only 20,000 lbs. total, or only 10,000 lbs.

As many as 4 individual pieces can be delivered on a single truckload to reduce shipping costs and minimize crane requirements during install. Most units can be installed using a simple backhoe due to low weights.

MAINTENANCE

UrbanPond is designed to be easily accessed and maintained from finished surface via multiple access ports. Using a standard vacuum truck, each access point is conveniently located, as ports are strategically placed throughout the assembly.

Modules can be modified to act as clear wells or pretreatment chambers for capturing trash, debris, and sediment. This consolidates maintenance requirements to a select few modules. Standard manholes, hinged manholes, and other access hatches are available.



Section [________]
Stormwater Storage System

PART 1 – GENERAL

01.01.00 Purpose

The purpose of this specification is to establish generally acceptable criteria for underground stormwater storage systems for detention, retention, or infiltration of stormwater runoff. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to identify devices complying with this specification.

01.02.00 Description

Stormwater storage systems (SWSS) are used for detention, retention, or infiltration of storm water. The SWSS is a modular precast concrete storage system composed of multiple modules comprised of a top slab, multiple support legs and walls, maintenance access ports, and optional inlet and/or outlet pipes.

Underground detention systems are used for temporarily collecting stormwater runoff and releasing it at a specified rate. Underground retention systems are used for storing a permanent volume of stormwater runoff. This water can be re-used for a variety of purposes. Underground infiltration allows collected stormwater runoff to recharge into the underlying soils. The SWSS is a precast concrete engineered system composed of interconnected modules.

01.03.00 Manufacturer

The manufacturer of the SWSS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which has a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SWSS shall be manufactured by Bio Clean A Forterra Company, or assigned distributors or licensees. Bio Clean A Forterra Company, can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: 760-433-7640
Fax: 760-433-3176
www.biocleanenvironmental.com

01.04.00 Submittals

01.04.01 Submittal drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Submittal drawings are to detail the SWSS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on submittal drawings
- Design loading
- Maximum and minimum depth of cover
- Seasonal high ground water level (if applicable)

01.04.03 Inspection and maintenance documentation submitted upon request.

01.04.04 Professional Engineer stamped and signed drawings available upon request and may require additional time for review.

01.04.05 Data sheets and installation instructions for lifting inserts, anchors, and other devices are available upon request.

01.04.06 Data sheets and installation instructions for accessory items, such as sealants, gaskets, pipe entry connectors, steps, racks, and other items installed after delivery shall be included with the submittal package.

01.04.07 Design data for loading and material specifications shall be shown on the submittal drawings. This shall include:

- Live load used in design
- Vertical and lateral earth loads used in design
- Depth of soil fill on the structure
- Water table depth used in calculations

01.05.00 Work Included

01.05.01 Specification requirements for installation of UrbanPond.

01.05.02 Manufacturer to supply components of the UrbanPond modules.

01.06.00 Reference Standards

Where applicable, the latest editions of the following standards shall form a part of this specification to the extent referenced. The publications referenced to in the text of this guide specification are by the basic designation only.

AASHTO – American Association of State Highway and Transportation Officials
ACI – American Concrete Institute
ASTM – American Society for Testing Materials
AWS – American Welding Society
CRSI – Concrete Reinforcing Steel Institute
NPCA – National Precast Concrete Association

AASHTO	Standard Specifications for Highway Bridges
AASHTO	Standard Specification for Transportation Materials and Methods for Sampling and Testing
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 517.2R	Accelerated Curing of Concrete at Atmospheric Pressure
ASTM A 36	Specification for Carbon Structural Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM A 184	Specification for Fabricated Deformed Steel Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 496	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706	Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775	Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM A 884	Specification for Epoxy-Coated Steel and Welded Wire Fabric for Reinforcement
ASTM A 1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C 76	Specification for reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C 125	Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Specifications for Portland Cement
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 403	Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 566	Test Method for Total Evaporable Moisture content of Aggregate by Drying
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 617	Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM C 857	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C 858	Specification for Underground Precast Concrete Utility Structures
ASTM C 877	Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
ASTM C 890	Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C 891	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 1018	Test method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading)
ASTM C 1037	Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1227	Standard Specification for Precast Concrete Septic Tanks
ASTM C 1231	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders
ASTM C 1240	Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete due to Alkali-Silica Reaction

ASTM C 1399	Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
ASTM C 1550	Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel)
ASMT C 1582	Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM C 1613	Standard Specification for Precast Concrete Grease Interceptors
ASTM G 109	Standard Test Method for Determining the Effects of Chemical Admixtures of the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
AWS D 1.1	Structural Welding Code - Steel
CRSI	Manual of Standard Practice
CRSI	Placing Reinforcing Bars
NPCA	Quality Control Manual for Precast Concrete Plants

01.07.00 General Requirements

01.07.01 The precast concrete modules shall be designed and produced by an experienced and acceptable concrete manufacturer.
01.07.02 The detention, retention, or infiltration modules shall have length and width dimensions of 8' x 8', with an adjustable inside height, and three supporting legs.
01.07.03 The modules shall be able to withstand H20 loading with full impact at 12" minimum cover over the top of the modules.
01.07.04 Groundwater at or below the invert of system.
01.07.05 Lateral soil pressures to be based on active earth pressure. Lateral soil pressure = 35 pcf for 120 pcf backfill unit weight.
01.07.06 Vertical soil pressures: Live load = HS20-44. Dead load = 120 pcf cover fill unit weight.
01.07.07 Engineer to verify geotechnical requirements.

01.08.00 Design

01.08.01 Precast concrete modules shall be designed to withstand design conditions in accordance with the applicable industry design standards. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete modules shall be indicated on the submittal drawings, and designed by a licensed professional engineer.
01.08.02 Joints and sealants between adjacent modules shall be of the type and configuration on the submittal drawings, meeting specified design and performance requirements.
01.08.03 Concrete mix shall be self-consolidating to minimize bugholes and not segregate.

01.08.04 Selections of proportions for concrete mix shall be based on current self-consolidating concrete mix design techniques. At a minimum, ACI 211.1 shall be used.

01.08.05 Mix designs for each strength and type of concrete that will be used are available upon request. Submitted mix designs shall include the quantity, type, brand and applicable data sheets for all design constituents as well as documentation indicating conformance with applicable reference specifications.

01.08.06 Concrete modules shall have a 28-day compressive strength of 6,000 psi for self-consolidating concrete.

01.08.07 Concrete that will be exposed to freezing and thawing shall contain air and shall have a water-cement ratio of 0.45 or less. Concrete which will not be exposed to freezing, but which is required to be leak resistant, shall have a water-cement ratio of 0.48 or less. For corrosion protection, reinforced concrete exposed to deicer salts, brackish water or seawater shall have a water-cement ratio of 0.40 or less.

01.08.08 The air content of concrete that will be exposed to freezing conditions shall be within the limits given below:

Nominal Maximum Aggregate Size (in)	Air Content %	
	Severe Exposure	Moderate Exposure
3/8	6.0 to 9.0	4.5 to 7.5
1/2	5.5 to 8.5	4.0 to 7.0
3/4	4.5 to 7.5	3.5 to 6.5
1	4.5 to 7.5	3.0 to 6.0
1-1/2	4.5 to 7.0	3.0 to 6.0
For specified compressive strengths greater than 5,000 psi, air content may be reduced 1%.		

PART 2 - PRODUCTS

02.01.00 Stormwater Storage

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

02.01.01 Size – As indicated on plans.

02.01.02 Concrete – Manufacturer's approved mix design providing a minimum compressive strength of 6,000 psi at 28 days.

02.01.03 Reinforcing bars – per ASTM A 615 or ASTM A 706, Grade 60.

02.01.04 Reinforcing mesh – per ASTM A 1064, Grade 80.

02.01.05 Cover for reinforcing bars – per ACI 318.

02.02.00 Accessory Items

02.02.01 Joint Wrap – Minimum 6" wide, self-adhesive, flexible joint sealant. Recommend ConSeal CS-212 or equivalent.

02.02.02 Geotextile – Non-woven, 180 lb tensile strength, minimum 7.0 ounce per square yard typical weight.

02.03.00 Concrete Foundation Slab (Provided by Contractor)

When indicated on the plans, contractor shall provide a poured-in-place, reinforced concrete foundation slab.

02.03.01 The foundation slab shall extend a minimum of 1 foot in each direction beyond the footprint of the UrbanPond modules.
02.03.02 Minimum compressive strength of 4,000 psi at 28 days, or as required by site-specific geotechnical engineer recommendations.
02.03.03 Reinforcing bar design as indicated on the plans.

02.04.00 Membrane Liner

When indicated on the plans, a membrane liner for watertight applications is required. The liner shall be placed in between an inner and outer layer of geotextile fabric per Section 02.02.02.

02.04.01 Double-scrim reinforced containment liner with high puncture resistance, UV resistance, and burst strength of 1,250 psi.
Recommended BTL 40 or approved equal.
02.04.02 Geotextile fabric of equal area shall be placed on both the interior and exterior faces of the membrane liner to prevent punctures.
02.04.03 Pipe boots supplied by liner manufacturer required for all pipe penetrations.
02.04.04 Liner size or shape may require a liner manufacturer's representative be present for field installations.
02.04.05 Liner to be approved by Enginer of Record.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The SWSS is a pre-engineered storage device capable of capturing and retaining stormwater for an extended period of time and is designed to be installed sub-surface and handle various surface load conditions.
03.01.02 Loading - The SWSS must be tested in the field using a full scale stacked internal modules at its maximum height of 14' (ID) and applying loads consistent with AASHTO HL93 requirements and pass all tests as followed without any signs of cracking or failure:

- Single wheel center of slab at 2' fill distributed – 28,000 lbs test load
- Single wheel center of slab at 2' fill – 35,000 lbs test load
- Single wheel center of slab at 8' fill distributed – 98,800 lbs test load
- Single wheel "edge" of slab at 2' fill distributed – 28,000 lbs test load
- Edge loading – 70,000 lbs load test

03.01.03 Storage Capacity of SWSS as indicated on the plans.

PART 4 - EXECUTION

04.01.00 General

The installation of the SWSS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the UrbanPond modules and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation – Site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Joint Wrap – Seal exterior vertical and horizontal seams with joint wrap in accordance with ASTM C 891. Prepare surfaces and install joint wrap in accordance with manufacturer's instructions.

04.02.03 Field modifications to the modules will invalidate the product warranty and are strictly prohibited without prior written consent from Bio Clean.

04.02.04 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.
Deposit backfill equally around all sides of modules at the same time and same elevation.
Prevent wedging action against modules by stepping or serrating slopes.

04.02.05 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of SWSS.
Compact in even lifts.
Do not disrupt or damage joint wrap during backfilling and compaction.

04.02.06 Concrete Structures – After backfill has been inspected by the governing agency and approved, the concrete structures shall be lifted and placed in proper position per plans.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – SWSS shall be shipped to the job site, and are the responsibility of the contractor to offload the units and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SWSS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor. SWSS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Inspection and Maintenance

04.04.01 Inspection – After installation, the contractor shall demonstrate that the SWSS has been properly installed at the correct location(s), elevations, and with appropriate components. The contractor shall demonstrate that the SWSS has been installed per the manufacturer's specifications and recommendations. All components shall be inspected by a qualified person once at least once per year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of at least once a year or as site conditions require. The maintenance shall be performed by someone qualified.

04.04.03 Material Disposal - All debris, trash, organics, and sediments removed from the UrbanPond system shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The Manufacturer shall guarantee the UrbanPond modules against all manufacturing defects in materials and workmanship for a period of (1) year from the date of delivery to the job site. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SWSS is limited to the recommended application for which it was designed.

[End of This Section]

1 YEAR WARRANTY

Product Warranty

URBANPOND

Bio Clean Environmental Services, Inc. products are engineered and manufactured with the intent to be considered as permanent infrastructure. Bio Clean Environmental Services, Inc. warranties its products to be free of manufacturer's defects for a period of 1 year from the date of purchase. If a warranty claim is made and determined to be valid, Bio Clean Environmental Services, Inc. will either repair or replace the product, at the discretion of Bio Clean Environmental Services, Inc. Warranty claims must be submitted, evaluated, and approved by Bio Clean Environmental Services, Inc. for the claim to be determined to be valid. All warranty work and/or corrective action must be authorized by Bio Clean Environmental Services, Inc. prior to beginning the work not covered by this warranty. There are no other warranties either expressed or implied other than what is specifically specified herein. Abusive treatment, neglect, or improper use of Bio Clean Environmental Services, Inc. products will not be covered by this warranty.

Effective January 1st, 2021

Bio Clean
A Forterra Company

855.566.3938
stormwater@forterrabp.com

TENCATE
Mirafi®

Drainage Separation

Mirafi® 180N

Mirafi® 180N is a needlepunched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 180N geotextile is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	N (lbs)	912 (205)	912 (205)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	N (lbs)	356 (80)	356 (80)
CBR Puncture Strength	ASTM D6241	N (lbs)	2224 (500)	
Apparent Opening Size (AOS) [1]	ASTM D4751	mm (U.S. Sieve)	0.18 (80)	
Permittivity	ASTM D4491	sec^{-1}	1.4	
Flow Rate	ASTM D4491	$l/min/m^2$ ($gal/min/ft^2$)	3870 (95)	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

[1] ASTM D 4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D5261	g/m^2 (oz/yd^2)	271 (8.0)	
Thickness	ASTM D5199	mm (mils)	1.8 (72)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	4.5 x 91 (15 x 300)
Roll Area	--	m^2 (yd^2)	418 (500)	
Estimated Roll Weight	--	kg (lb)	120 (265)	

Made in USA

TENCATE™
materials that make a difference

ConSeal™ CS-212

Polyolefin Backed Exterior Joint Wrap

ConSeal™
Concrete Sealants Inc.

Membrane Waterproofing and Exterior Joint Wrap for Precast Concrete Joints

Applications

For joints in: Box Culverts, Underground Concrete Vaults, Segmented Bridge Structures, Wastewater Structures and Arched Bridge Structures, Manholes. **Not intended for use in expansion joints or joints that move.**

Sealing Properties

- Excellent resistance to puncture, tear and abrasions.
- Aggressively bonds to concrete and metal structures.
- Provides a permanent flexible water and soil barrier.
- Will not shrink, harden or oxide upon aging.
- Available in numerous standard sizes.
  - Standard thicknesses: 0.065" and 0.100"
  - Standard widths: 4", 6", 8", 9", 12", 24", 36" and 48"
- Custom widths and lengths available upon request.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

Specifications

ConSeal CS-212 meets ASTM E-1745, C-877, C-990 Specifications, and AASHTO M198 Type B.

Technical Data

ASTM E-1745: Standard specification for plastic water vapor retarders used in contact with soil or granular fill under concrete slabs.

Class C. Specification	Test Method	E-1745 Requirement	CS-212
Water Vapor Permeance	ASTM F-1249	0.30 perms, max.	0.045 perms, max.
Tensile Strength	ASTM E-154	13.6 lbs./ inch, min.	21.0 lbs./ inch, min.
Puncture Resistance	ASTM D-1709	475 grams, min.	864 grams, min.

ASTM C-877: Standard specification for external sealing bands for non-circular concrete sewer, storm drain and culvert pipe.

Type III, Specification	E-1745 Requirement	CS-212
Backing Bond Element	4 Mil, min. thickness	4 Mil
Butyl Rubber Adhesive	0.03 inch, min. thickness	0.065, min.

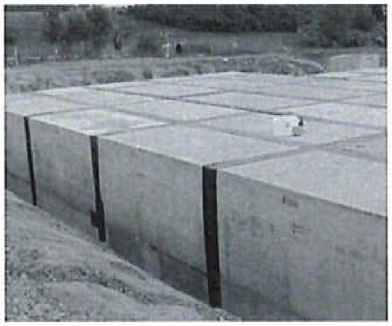
Don't Just Seal It, ConSeal It!

ISO 9001 Registered

ConSeal™ CS-212

Polyolefin Backed Exterior Joint Wrap

CONSEAL™
CONCRETE SEALANTS INC.



Membrane Waterproofing and Exterior Joint Wrap for Precast Concrete Joints

Technical Data Continued

ASTM C-990: Standard specification for joints for concrete pipe, manholes and precast box sections using preformed flexible joint sealants.

Section 6, Specification	Test Method	C-990 Requirements	CS-212
Hydrocarbon blend content % by weight	ASTM D-4	50-70%	52, min.
Inert mineral filler % by weight	ASTM C-990	30% min.	45, min.
Volatile Matter % by weight	ASTM C-990	2.0 max.	1.20
Specific Gravity	ASTM C-990	1.15-1.50	1.20-1.25
Ductility, 7°F	ASTM D-113	5.0, min.	12, min.
Penetration, cone 77°F, 150 gm. 5 sec.	ASTM D-217	50-120 mm	70-80 mm
Softening point, °F	ASTM D-36	320°F, min.	335°F, min.

Limited Warranty

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufactures in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the users' responsibility to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

Don't Just Seal It, ConSeal It!

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Installation Instructions

CS-212/213 ConWrap

CONSEAL™
CONCRETE SEALANTS INC.

ConWrap Placement Procedures

The following procedures should be followed for optimum ConWrap performance.

- Clean the surface with a brush and remove any dirt, debris, flashing, or concrete high points, which could keep ConWrap CS-212 from adhering to the concrete.
    - If necessary, a joint primer (i.e. CS-50 or CS-75) can be applied to improve adhesion. CS-50 is a solvent-based primer that can be applied days or weeks in advance. CS-75 is a water-based primer that dries tacky and must be applied at the time of the installation.
    - When using a primer, allow the primer to dry before placing sealant. The primer will normally be dry to the touch (CS-50) or tacky (CS-75) within 15-20 minutes. (Note: Primer can be applied at the job site or at the plant several days in advance of the set.)
- To apply ConWrap to a horizontal joint, begin by removing the release paper from the adhesive side and apply the ConWrap to the concrete. Continue around the joint by removing the release paper as the roll of ConWrap is unrolled. Press the wrap firmly by hand against the entire surface as it is applied to assure full contact.
- Where joining two sections, or where two ends meet together, provide an overlap of approximately 2" and firmly press the overlapping strip onto the end of the underlying strip to seal the joint.

Disclaimer: This publication is to assist users to understand the proper use of ConSeal's products. *Contact ConSeal's technical staff for installation instructions that meet your specific requirement.* Concrete Sealants, Inc. does not warranty any improper use of its products.

Don't Just Seal It, ConSeal It!

ISO 9001
Registered

Bio Clean

A Forterra Company

UrbanPond™

A Stormwater Storage Solution

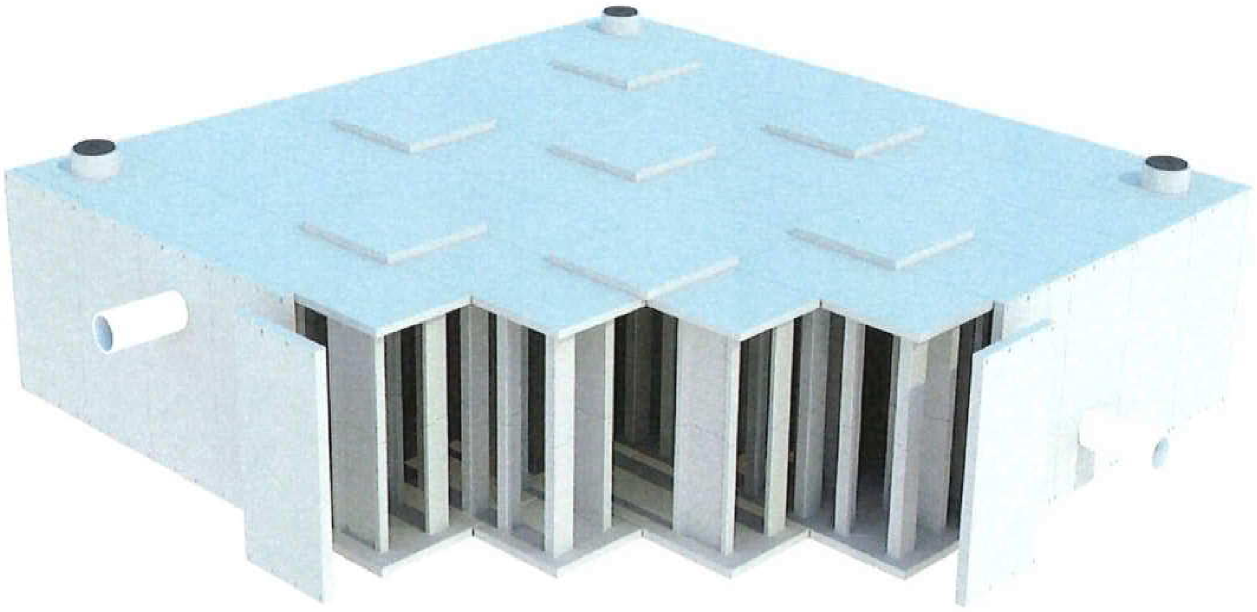
INSTALLATION MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938
stormwater@forterrabp.com | biocleanenvironmental.com

INSTALLATION PROCEDURES

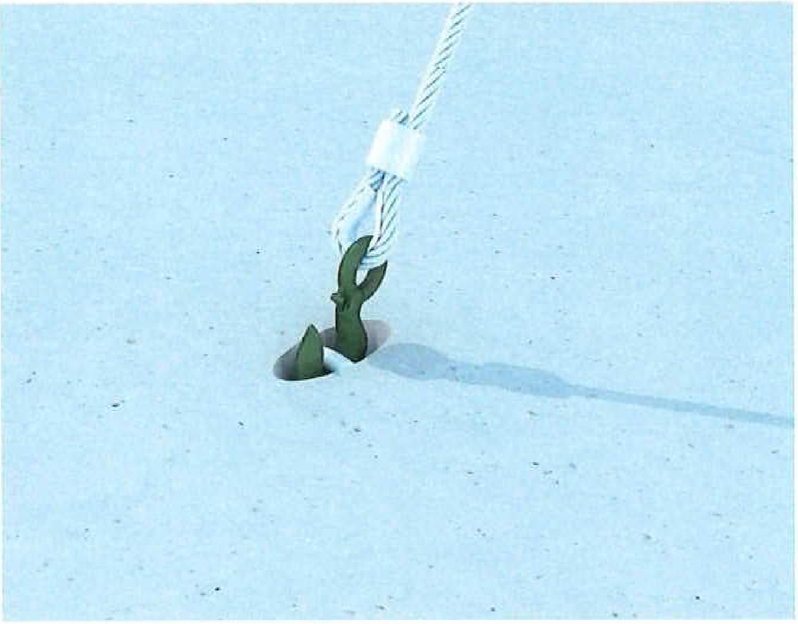
The UrbanPond™ is an underground modular storage system designed for stormwater retention, detention, harvesting, or infiltration. UrbanPond™ utilizes the strength and durability of precast concrete to create an efficient and resilient stormwater management solution. A modular design gives UrbanPond the flexibility to meet nearly any site requirements with configurations ranging from 2' to 14' inside height. Modules are delivered ready to be installed, minimizing staging requirements and decreasing installation times.

UrbanPond™ can be installed in a variety of configurations and heights. Taller systems are installed stacked with top and inverted bottom modules. Shorter systems consist of the top modules only placed upon a concrete slab. Either configuration can be combined with a membrane liner for leak resistant applications. Installation procedures for each configuration are described herein.



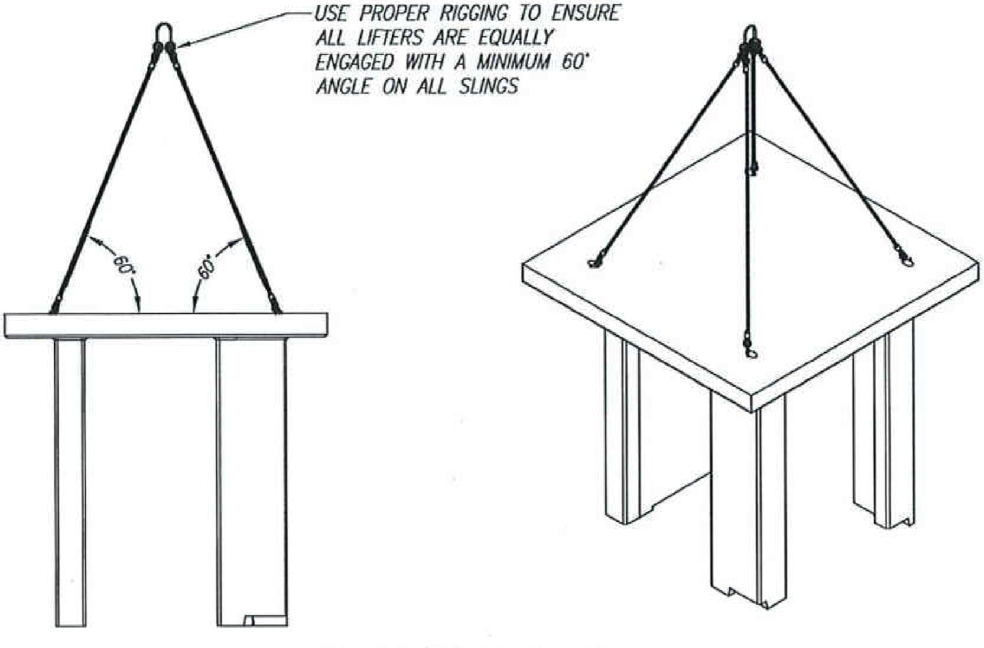
Delivery & Unloading/Lifting

- Bio Clean Environmental Services, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.
- The Contractor is required to provide spreader bars and chains/cables to safely and securely lift the bottom modules, top modules, LinkUp slabs, and exterior walls along with suitable lifting hooks, knuckles, shackles or eyebolts.
- *Please see project specific drawings for weights and lifting details. Contact Bio Clean for additional lifting details.*

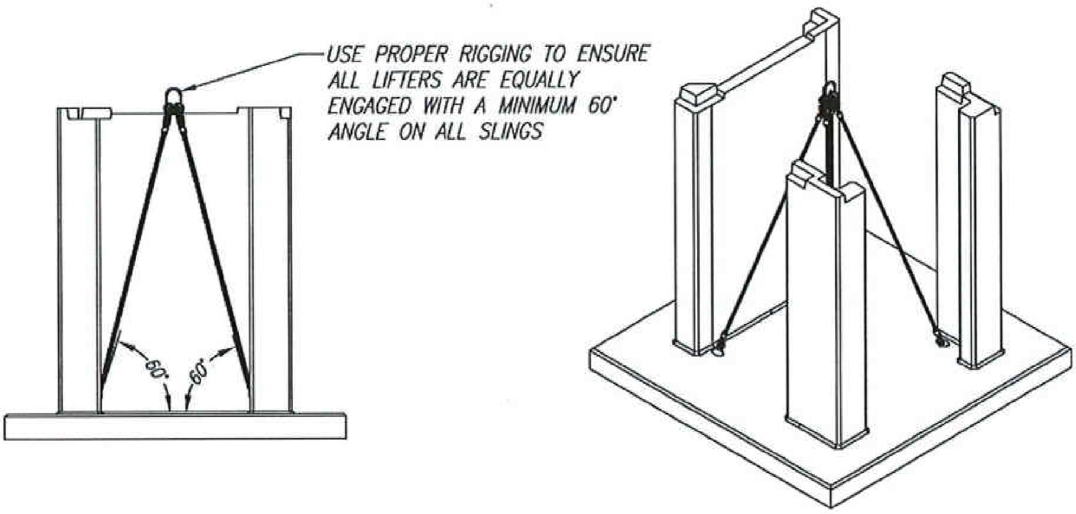


Utility Anchor Lifting System Detail

Rigging Diagrams



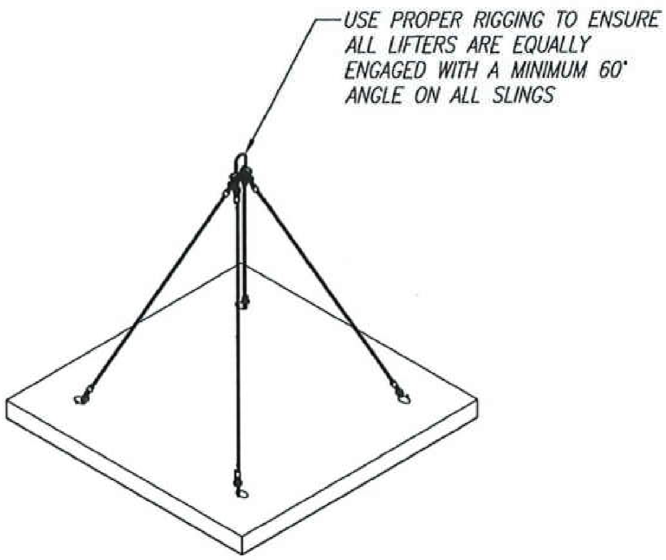
Top Module Rigging Diagram



Bottom Module Rigging Diagram

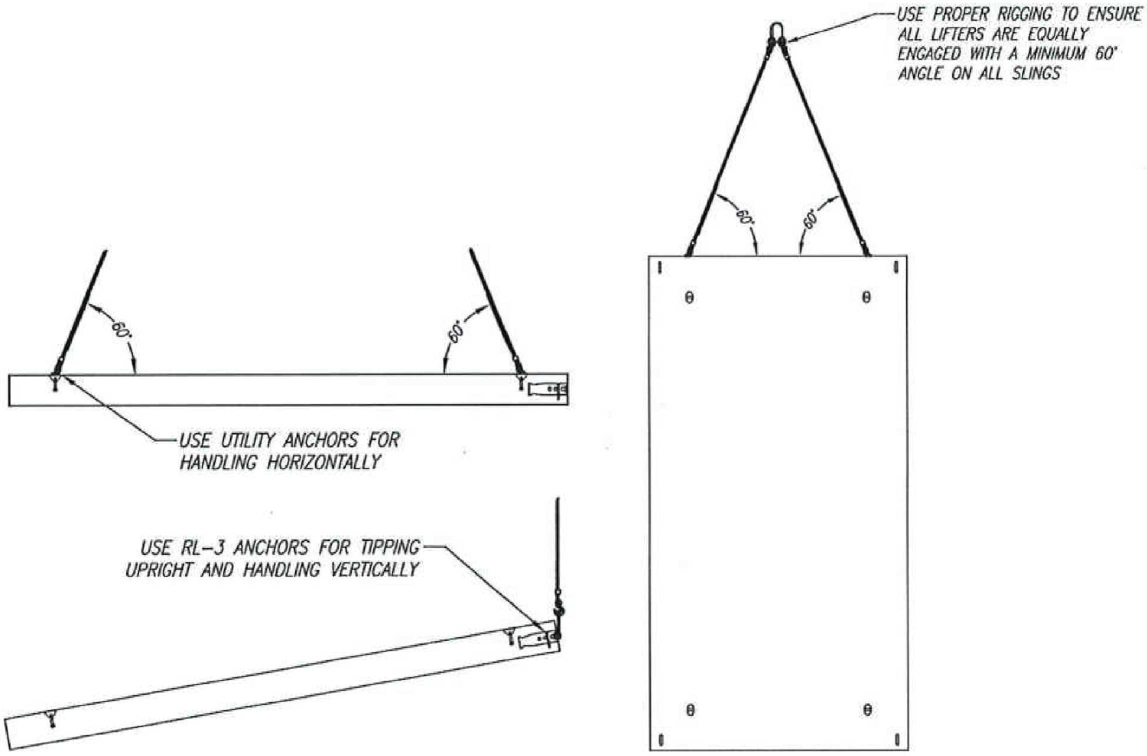
**The top and bottom are for a stacked design. For a top-only placed on a concrete slab, the legs will be smooth and not have the shiplap joints as shown here.*

Rigging Diagrams (cont.)



USE PROPER RIGGING TO ENSURE ALL LIFTERS ARE EQUALLY ENGAGED WITH A MINIMUM 60° ANGLE ON ALL SLINGS

LinkUp Slab Rigging Diagram



USE PROPER RIGGING TO ENSURE ALL LIFTERS ARE EQUALLY ENGAGED WITH A MINIMUM 60° ANGLE ON ALL SLINGS

USE UTILITY ANCHORS FOR HANDLING HORIZONTALLY

USE RL–3 ANCHORS FOR TIPPING UPRIGHT AND HANDLING VERTICALLY

Exterior Wall Rigging Diagram

Inspection

- The UrbanPond^{TM} and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance with approved drawings or damage to any part of the system shall be documented on the Bio Clean shipping ticket. Any damaged sections must be addressed with Bio Clean prior to continuing with installation. No damaged pieces are to be installed without Bio Clean's written approval.
- Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the UrbanPond^{TM} modules, LinkUp slabs, or exterior walls shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

- Excavation and subgrade shall be completed prior to UrbanPond^{TM} delivery.
- Excavation shall be sufficient to allow compaction equipment access around the structure after installation.
- The Contractor is responsible for providing adequate and complete system protection when the UrbanPond^{TM} modules are installed prior to final site stabilization.
- The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.
- To limit water pressure build-up outside of the modules, the site must be graded and prepared for proper drainage.

Installation

UrbanPond^{TM} is to be installed in accordance with ASTM C891-90, Installation of Underground Precast Utility Structures unless specified otherwise in contract documents. Project plan, relevant specifications, and any applicable regulations must be followed.

- Each UrbanPond^{TM} module is lifted by the embedded lifters. Rigging must be used to ensure all lifters are equally engaged with a minimum angle of 60°.

1. Stacked Configuration

- The UrbanPond^{TM} modules shall be placed on level compacted sub-grade with a minimum 6-inch gravel base. Compact undisturbed sub-grade materials per Geotechnical/Soils report. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Place gravel base and compact to state and local standards per the site engineer's requirements.

- If a containment liner is being used for retention or detention applications, place the first layer of geotextile fabric, then the liner, then a second layer of geotextile. The layers of geotextile fabric will help prevent punctures to the liner (see additional Containment Membrane Liner instructions below). An internal sealant option can also be used to make the system leak resistant; more information on this option available from the manufacturer.
- Install modules using the plan line, grade, and elevations shown in the construction documents. Modules shall be placed as close together as possible with gaps no greater than 3/4".
- Joints between exterior unit and next interior unit running parallel to the outer walls shall be grouted using approved non-shrink grout.
- Install (if applicable) exterior wall segments per construction documents using supplied anchor bolts.
- Seal all vertical exterior seams with joint wrap, extending a minimum of 24" over the top. Wrap shall meet the requirements of Drainage Fabric Type A per the following table:

Fabric and Membrane Property	**Test Method**	**Drainage Fabric**
		Type A
AASHTO Class	AASHTO M 288	3 Non-woven
Performance Criteria During Service Life		
ASO, US Standard Sieve	ASTM D4751	40-100
Permittivity, Sec-1	ASTM D4491	0.2 Min
Thickness, Mils	ASTM D5199	---------
Strength Requirements		
Grab Strenght, lbs	ASTM D4632	110
Grab Elongation, %	ASTM D4633	40 Min
Trapezoid Tear Strenght, lbs	ASTM D4533	40
Puncture Strength, lbs	ASTM D6241	220
UV Strength Retentino, %	ASTM D4355	50
Wide Width Strip Tensile Strength, lbs/inch	ASTM D5496	---------

- Seal all seams along the top modules with joint wrap, overlapping the previously placed vertical taping as necessary.
- Wrap the geotextile fabric and liner (if applicable) over the top edge of the modules, or as indicated on the submittal plans. It may be necessary to adhere the fabric and liner to hold them in place until backfill is completed. Note the locations of pipe connections so the fabric and liner can be cut as needed.
- Install pipe connections starting with the outlet first. Pipes can be sealed with boots, grout, or as shown on the submittal plans. When using liners, the pipes will require booted connections in accordance with the liner manufacturer's specifications.
- Install manholes risers, frames and covers as shown on the submittal plans.
- Construction equipment exceeding design load shall not be placed/driven onto structure.

2. *Top Modules on Concrete Slab*

- The concrete slab shall be poured-in-place by the contractor on level compacted sub-grade. Compact undisturbed sub-grade materials per Geotechnical/Soils report. Unsuitable material below sub-grade shall be replaced to site engineer's approval.
- If a containment liner is being used, place the first layer of geotextile fabric, then the liner, then a second layer of geotextile. The layers of geotextile fabric will help prevent punctures to the liner (see additional Containment Membrane Liner instructions below). An internal sealant option can also be used to make the system leak resistant; more information on this option available from the manufacturer.
- The foundation slab shall extend a minimum of 1 foot in each direction beyond the footprint of the UrbanPond™ modules when perimeter modules are used. When bolt-on wall option is used the slab will be the same footprint as the top modules.
- Concrete dimensions and thickness shall be per plan drawings. Reinforcing design shall be as indicated on the plans.
- Concrete shall have a minimum compressive strength of 4,000 psi at 28 days, or as required by site-specific geotechnical recommendations.
- Install modules using the plan line, grade, and elevations shown in the construction documents on top of the concrete slab. Modules shall be placed as close together as possible with gaps no greater than 3/4".
- Joints between exterior unit and next interior unit running parallel to the outer walls shall be grouted using approved non-shrink grout.
- Install (if applicable) exterior wall segments per construction documents using supplied anchor bolts.
- Seal all vertical exterior seams with joint wrap, extending a minimum of 24" over the top.
- Seal all seams along the top modules with joint wrap, overlapping the previously placed vertical taping as necessary.
- Wrap the geotextile fabric and liner (if applicable) over the top edge of the modules, or as indicated on the submittal plans. It may be necessary to tape the fabric and liner to hold them in place until backfill is completed. Note the locations of pipe connections so the fabric and liner can be cut as needed.
- Install pipe connections starting with the outlet first. Pipes can be sealed with boots, grout, or as shown on the submittal plans. When using liners, the pipes will require booted connections in accordance with the liner manufacturer's specifications.
- Install manholes risers, frames and covers as shown on the submittal plans.
- Construction equipment exceeding design load shall not be placed/driven onto structure.

Containment Membrane Liners

UrbanPond™ modules installed with geotextile fabric and / or joint tape are soil tight.

- Leak resistant containment membrane liners can be used in conjunction with the UrbanPond system. If a liner is used, geotextile must be placed on both the inside and outside faces of the liner.
- UrbanPond™ can also be made leak resistant by using a sealant (internally) to fill seems between modules and exterior walls. Sealants must be approved by the project engineer and installed per the manufacturer's recommendations unless otherwise specified.

Backfill Requirements

- Bio Clean recommends backfilling in 1' lifts at 95% minimum proctor density.
- Compaction shall not occur within 6" of structure to avoid damage to joint wrap, liners, and geotextiles.
- Backfill material shall be compacted and capable of supporting loads from traffic at grade.
- When liners are in use, the backfill material shall be free of debris with sharp or jagged edges that may puncture the liner.
- Expansive soils shall not be used for backfill material.
- All recommendations to be verified and approved or modified by the site geotechnical engineer.

Pipe Connection Details

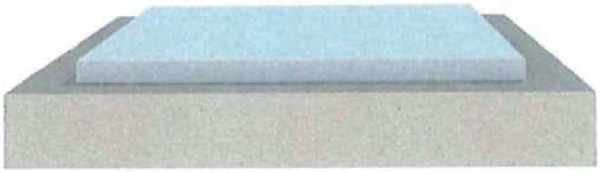
- Pipe material selection should be indicated on the Site Plan. Connect the pipe using a Kor-N-Seal, Press Seal, Fernco, or other approved leak resistant boot connection. In the case of concrete pipes, grout the connection with non-shrink grout.

Example of appropriate pipe connection using a Kor-N-Seal. Note that the pipe connector does not protrude past the structures inside wall.

- Inlet/outlet pipe(s) shall be stubbed in and connected to the UrbanPond™ modules according to the Engineer's requirement or specifications. The Contractor is to grout all inlet/outlet pipes flush with the interior wall of the structure per plans and specifications.
- Once inlet/outlet pipes are connected, carefully backfill and compact in lifts that will not deflect, disturb or damage the pipes.

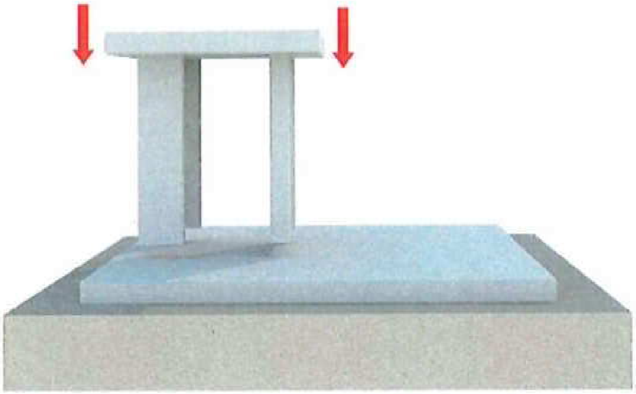
Illustrative Step-by-Step Installation Process – Single Modules

STEP 1



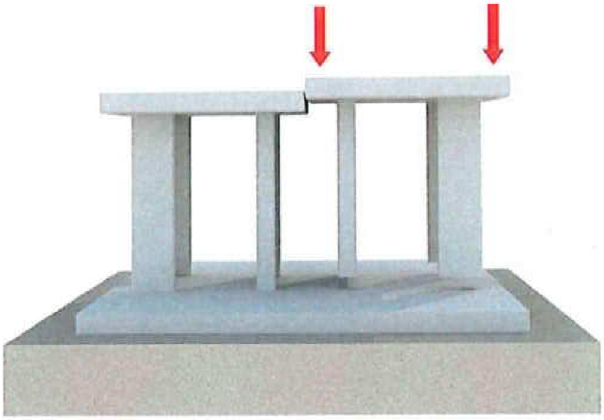
Single module installations require a poured-in-place or precast base slab to be poured prior to setting any modules. Pour base slab as required per the construction documents. Ensure the base slab has cured to proper strength prior to setting modules. If using precast slabs, ensure slabs are set level and at proper elevation.

STEP 2



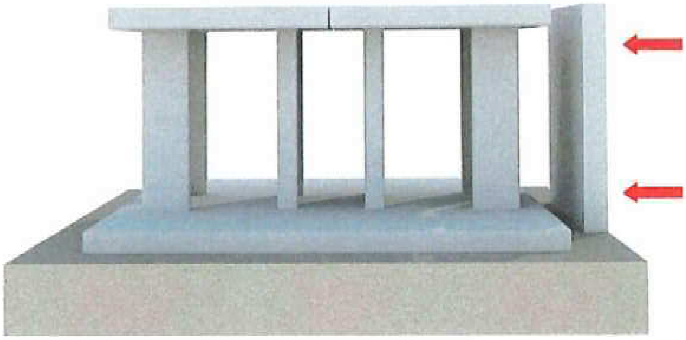
Once the base slab has been installed, set the UrbanPond module using the appropriate rigging and lifting method. Verify the level and elevation of the installed module before setting additional modules.

STEP 3



Set adjacent base modules using the procedures outlined in STEP 2. Modules shall be installed per construction documents to ensure proper module orientation. Modules shall be placed as close together as possible with gaps no greater than ¾".

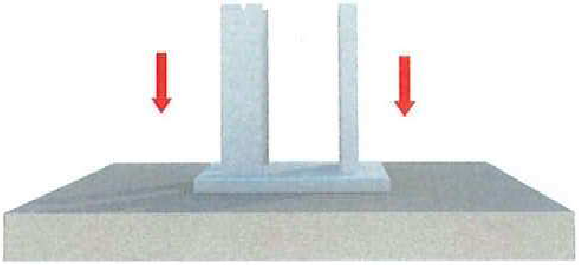
STEP 4



Install exterior walls per the construction documents using supplied anchor bolts. Final backfill is not to occur until all modules/external walls have been installed. Joints between exterior unit and next interior unit running parallel to the outer walls shall be grouted using approved non-shrink grout.

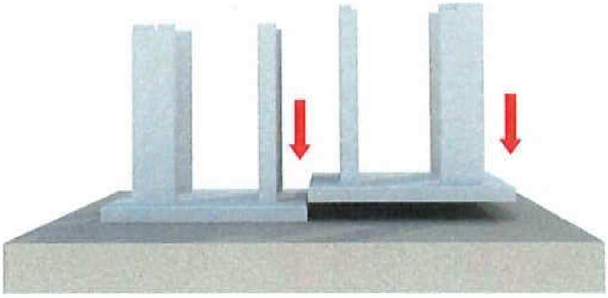
Illustrative Step-by-Step Installation Process – Stacked Modules

STEP 1



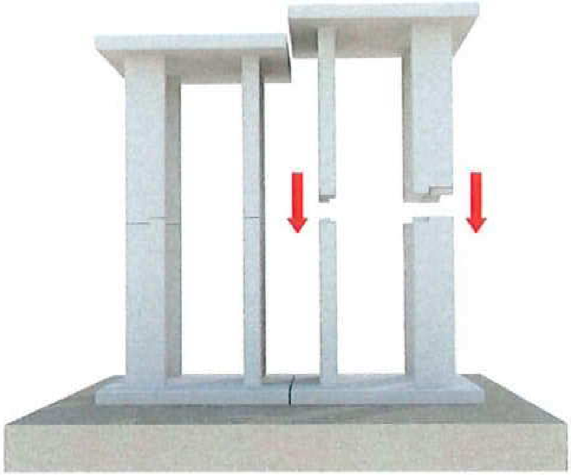
Set the base/bottm module of the UrbanPond on solid sub-grade using appropriate rigging and lifting method. Verify the level and elevation of the base module before installing additional modules.

STEP 2



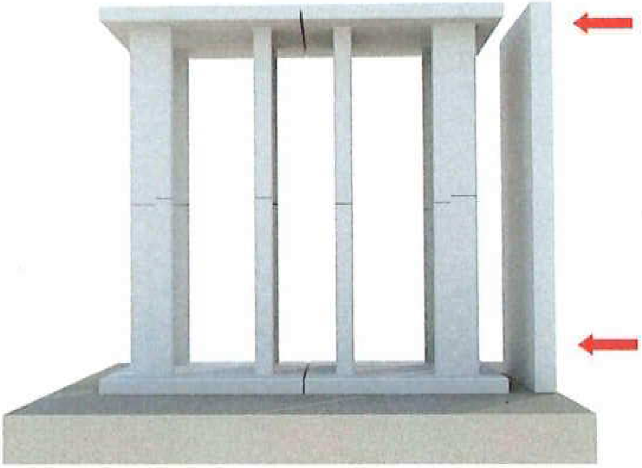
Set adjacent base modules using the procedures outlined in STEP 1. Modules shall be installed per construction documents to ensure proper module orientation. Modules shall be placed as close together as possible with gaps no greater than ¾".

STEP 3



Set UrbanPond^{TM} top modules on leveled base modules using the appropriate rigging and lifting method. Verify the level and elevation of the top module before proceeding to install additional modules.

STEP 4



Install exterior walls per the construction documents using supplied anchor bolts. Final backfill is not to occur until all modules/external walls have been installed. Joints between exterior unit and next interior unit running parallel to the outer walls shall be grouted using approved non-shrink grout.

For Installation Support or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Bio Clean

A Forterra Company

UrbanPond™

A Stormwater Storage Solution

INSPECTION & MAINTENANCE MANUAL

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stormwater@forterrabp.com | biocleanenvironmental.com

URBAN POND INSPECTION & MAINTENANCE

Inspection and maintenance of the Urban Pond underground detention, retention, or infiltration system is vital for the performance and life cycle of the stormwater management system. All local, state, and federal permits and regulations must be followed for system compliance. Manway access locations are provided on each system for ease of ingress and egress for routine inspection and maintenance activities. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed and providing protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific conditions. Inspection after the first significant rainfall event and at quarterly intervals is typical. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP can exceed its storage capacity, become blocked, or damaged, which can negatively affect its continued performance.

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the underground detention, retention, or infiltration system:

- Bio Clean Environmental Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The key to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Urban Pond underground detention, retention, or infiltration system are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long term inspection and maintenance interval requirements.

The Urban Pond underground detention, retention, or infiltration system can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
- Observe the upstream drainage area and look for sources of pollution, sediment, trash and debris.
- Observe the inside of the system through the access manholes. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its modules.
- Look for any out of the ordinary obstructions in the inflow and outflow pipes. Check pipes for movement or leakage. Write down any observations on the inspection form.
- Observe any movement of modules.
- Observe concrete for cracks and signs of deterioration.
- In detention and retention systems inspect for any signs of leakage.
- In infiltration systems inspect for any signs of blockage or reasons that the soils are not infiltrating.
- Through observation and/or digital photographs, estimate the amount of floatable debris accumulated in the system. Record this information on the inspection form. Next, utilizing a tape measure or measuring stick, estimate the amount of sediment accumulated in the system. Sediment depth may vary throughout the system, depending on the flow path. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Damaged inlet and outlet pipes.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatables.
- Excessive accumulation of sediment of more than 6" in depth.
- Damaged joint sealant.

Maintenance Equipment

While maintenance can be done fully by hand it is recommended that a vacuum truck be utilized to minimize time requirements required to maintain the Urban Pond underground detention, retention, or infiltration system:

- Bio Clean Environmental Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Vacuum truck
- Trash can
- Pressure washer
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system. Entry into the system will be required if maintenance is required.

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of the system and any upstream detention systems designed to drain down over an extended period of time. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Once all safety measures have been set up cleaning of the system can proceed as follows:

- Using an extension on a boom on the vacuum truck, position the hose over the opened manway and lower into the system. Remove all floating debris, standing water (as needed) and sediment from the system. A power washer can be used to assist if sediments have become hardened and stuck to the walls and columns. Repeat the same procedure at each manway until the system has been fully maintained. Be sure not to pressure wash the infiltration area as it may scour.

If maintenance requires entry into the vault:

- Following rules for confined space entry use a gas meter to detect the presence of any hazardous gases. If hazardous gases are present do not enter the vault. Follow appropriate confined space procedures, such as utilizing venting system, to address the hazard. Once it is determined to be safe, enter utilizing appropriate entry equipment such as a ladder and tripod with harness.

- The last step is to close up and replace all manhole covers and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.

For Maintenance Services please contact Bio Clean at 760-433-7640, or email info@biocleanenvironmental.com.

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Underground Detention, Retention, or Infiltration

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Project Name ____________________

Project Address ____________________ (city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone ( ) –

Inspector Name ____________________ Date ___/___/______ Time __________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ____________________ Additional Notes ____________________

Site Map #	GPS Coordinates of Vault	Model #	Inspection of Inlet and Outlet Pipes, Joints, and Connections Between Modules	Trash or Sediment Accumulation (lbs) & Depth (inches)	Structural Notes	Operational Per Manufacturer's Specifications (If not, why?)
	Lat: Long:					
	Lat: Long:					
	Lat: Long:					

Comments:

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-18 Micro-Bioretention Facility

Drainage Area: R

Area to Facility:	21,705 s.f. or	0.50 ac.
Impervious Area:	8,491 s.f. or	0.19 ac.
Surface Area of Filter:	1,040 s.f.	

Surface area of filter must be at least 2% of the contributing drainage area.
1,040 s.f. / 21,705 s.f. = 4.8%

Percentage of Imperviousness: 8,491 s.f. / 21,705 s.f. = 39 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 39)
Rv = 0.401

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 40%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.410 x 21,705 s.f. / 12
ESDv = 1,302 c.f.

Storage Volume Provided:
2,636 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,636 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.401 x 0.50 ac./12
1 YR Vol. = 1,958 c.f.

ESDv Treated = 1,958 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 1,958 c.f. / 0.401 x 21,705 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Micro-Bioretention Facility #18
Drainage Area #R
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
432.00	0	0.000				0.000	0
432.00	1,040	0.024	0.00	0.012	0.000	0.000	0
433.00	1,527	0.035	1.00	0.029	0.029	0.029	1,284

Interpolated Values

elevation [ft]	volume [acre·ft]	volume [ft³]
433.00	0.029	1,284

volume [acre·ft]	volume [ft³]	elevation [ft]

Storage Volume Provided within Planting Media:
1,040 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,352 c.f.

Total volume provided:
1,284 c.f. surface storage + 1,352 c.f. planting media storage = 2,636 c.f. total

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

SWM-19 Micro-Bioretention Facility

Drainage Area: S
Area to Facility: 9,028 s.f. or 0.21 ac.
Impervious Area: 4,440 s.f. or 0.10 ac.
Surface Area of Filter: 944 s.f.

Surface area of filter must be at least 2% of the contributing drainage area.
944 s.f. / 9,028 s.f. = 10.5%

Percentage of Imperviousness: 4,440 s.f. / 9,028 s.f. = 49 %

Determine Rv for Drainage Area:
Rv = 0.05 + (0.009 x % Imperv.)
Rv = 0.05 + (0.009 x 49)
Rv = 0.491

ESDv based on drainage to the facility:
Pe = 1.8" (See table 5.3, ('B' Soils, 50%))
ESDv = Pe x Rv x A / 12
ESDv = 1.8" x 0.491 x 9,028 s.f. / 12
ESDv = 665 c.f.

Storage Volume Provided:
2,406 c.f. (See "Storage Volume" table computations on the next page.)

ESDv Provided = 2,406 c.f.

Determine 1-Year Runoff Volume: Pe = 2.7 "
1 YR Vol. = [(Pe) x (Rv) x (A)] / 12
1 YR Vol. = 2.7 " x 0.491 x 0.21 ac./12
1 YR Vol. = 997 c.f.

ESDv Treated = 997 c.f.

Determine Total ESDv Provided = 34,148 c.f.
Pe = 12 x ESDv (treated) / Rv x A
Pe = 12 x 997 c.f. / 0.491 x 9,028 s.f.
Pe (Treated) = 2.70 "

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/19/2021

Micro-Bioretention Facility #19
Drainage Area #S
Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
432.00	0	0.000				0.000	0
432.00	944	0.022	0.00	0.011	0.000	0.000	0
433.00	1,414	0.032	1.00	0.027	0.027	0.027	1,179

Interpolated Values

elevation	volume	
[ft]	[acre·ft]	[ft³]
433.00	0.027	1,179

volume		elevation
[acre·ft]	[ft³]	[ft]

Storage Volume Provided within Planting Media:
944 surface s.f. x 3.25' deep filter @ 40% void ratio = 1,227 c.f.

Total volume provided:
1,179 c.f. surface storage + 1,227 c.f. planting media storage = 2,406 c.f. total

DA	SWM Area #	Total drainage area (SF)	Proposed impervious area (SF)	ESD Type	ESD facility #	ESDv treat	Pe		DA AC	IMP AC	WQV	ESDv stored
POI 1	A	21274	8968	microbio	1	2049	2.7		0.49	0.21	0.047	
POI 1	B	19303	8738	microbio	2	1976	2.7		0.44	0.20	0.045	
POI 1	C	12016	4605	microbio	3	1060	2.7		0.28	0.11	0.024	
POI 1	D	21478	9078	microbio	4	2068	2.7		0.49	0.21	0.047	
POI 1	E	15682	7914	microbio	5	1764	2.7		0.36	0.18	0.040	
POI 1	F	12623	6478	microbio	6	1446	2.7		0.29	0.15	0.033	
POI 1	G	18768	14103	microbio	7	3062	2.7		0.43	0.32	0.070	
POI 1	H	5830	2778	microbio	8	632	2.7		0.13	0.06	0.015	
POI 1	I	14989	4122	microbio	9	1019	2.7		0.34	0.09	0.023	
POI 1	J	21514	13438	microbio	10	2943	2.7		0.49	0.31	0.068	
POI 1	R	21705	8491	microbio	18	1958	2.7		0.50	0.19	0.045	
POI 1	S	9028	4440	microbio	19	997	2.7		0.21	0.10	0.023	
										0.00	0.000	
POI 2	K	18818	9497	microbio	11	2117	2.7		0.43	0.22	0.049	
POI 2	L	18860	14480	microbio	12	2421	2.07		0.43	0.33	0.056	
POI 2	M	18848	12815	microbio	13	2479	258		0.43	0.29	0.057	
POI 2	N	20240	14953	microbio	14	2928	2.42		0.46	0.34	0.067	
POI 2	O	18215	13657	microbio	15	2317	2.11		0.42	0.31	0.053	
POI 2	P	18474	12740	microbio	16	2789	2.7		0.42	0.29	0.064	
POI 2	Q	101171	75566	Underground Facilit	17	16504	2.7		2.32	1.73	0.379	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	
									0.00	0.00	0.000	

Project: Brunswick Elementary School
MK Job #: 20030
Date: 12/19/2021

Plunge Pool

Storage Volume

Elevation [ft.]	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre·ft]	Cumulative Volume [acre·ft]	Cumulative Volume [ft³]
408.99	0	0.000				0.000	0
409.00	5,621	0.129	0.01	0.065	0.001	0.001	28
410.00	6,669	0.153	1.00	0.141	0.141	0.142	6,173
410.50	7,193	0.165	0.50	0.159	0.080	0.221	9,639

Interpolated Values

elevation	volume	
[ft]	[acre·ft]	[ft³]
424.00	0.221	9,639

volume		elevation
[acre·ft]	[ft³]	[ft]

Total volume provided:
9,639 c.f. surface storage

QUANTITY CONTROL OR LARGER STORM MANAGEMENT

4.) Overbank Flood Protection
(10-Year Design Storm)

Overbank Flood Protection (QP) Analysis:

Drainage Area A (Point of Investigation 1) Existing Conditions 10 Year Q = 32.92 cfs

Drainage Area A (Point of Investigation 1) Proposed Conditions 10 Year Q (no SWM) = 39.40 cfs

Drainage Area B (Point of Investigation 2) Existing Conditions 10 Year Q = 31.99 cfs

Drainage Area B (Point of Investigation 2) Proposed Conditions 10 Year Q (no SWM) = 43.83 cfs

Drainage Area C (Point of Investigation 3) Existing Conditions 10 Year Q = 28.59 cfs

Drainage Area C (Point of Investigation 3) Proposed Conditions 10 Year Q (no SWM) = 16.64 cfs

Allowable 10 Year Q for Suitable Outfall:

Drainage Area A = existing conditions Q is 32.92 cfs, and in the proposed conditions the Q is 39.40 cfs and therefore is unacceptable and will require QP management. Reducing CN calculation were performed (are also included in the TR-55 calculation) and the resulting Q calculates as 30.14 cfs. With the QP management the outfall is suitable. MK also took it a step further and calculated the QP with the plunge pool installation to ensure downstream flooding in this area. The CN reduction with the plunge pool calculates out to 24.89 cfs.

Drainage Area B = existing conditions Q is 31.99 cfs, and in the proposed conditions the Q is 43.83 cfs and therefore is unacceptable and will require QP management. Reducing CN calculation were performed (are also included in the TR-55 calculation) and the resulting Q calculates as 30.37 cfs. With the QP management the outfall is suitable.

Drainage Area C = existing conditions Q is 28.59 cfs, and in the proposed conditions the Q is 16.64 cfs and therefore the outfall is suitable.

```
                        WinTR-55 Current Data Description


                         --- Identification Data ---


User:     CTB                                Date:        12/16/2021
Project:  Brunswick ES                       Units:       English
SubTitle: Existing Site Discharge to Outfall - POI 1
                                             Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Ex Site POI 1.w55



                             --- Sub-Area Data ---


Name           Description             Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
A                                     Outlet          11.89       67    .111

Total area: 11.89 (ac)



                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
A              32.92     60.76      6.71


REACHES

OUTLET         32.92     60.76      6.71
```

```
CTB                                Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
A              32.92     60.76      6.71
           11.95     11.94     12.02


REACHES

OUTLET         32.92     60.76      6.71
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
A               11.89     0.111        67     Outlet

Total Area:   11.89 (ac)
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                     Sub-Area Time of Concentration Details


 Sub-Area      Flow           Mannings's    End     Wetted              Travel
Identifier/   Length    Slope      n        Area    Perimeter  Velocity  Time
               (ft)    (ft/ft)             (sq ft)    (ft)     (ft/sec)  (hr)
--------------------------------------------------------------------------------
A
  SHEET          75   0.0150     0.011                                   0.018
  SHALLOW       116   0.0150     0.025                                   0.013
  SHALLOW       658   0.0200     0.050                                   0.080

                                                 Time of Concentration    .111
                                                                      ========
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                          Hydrologic   Sub-Area   Curve
Identifier           Land Use                         Soil        Area     Number
                                                      Group       (ac)
--------------------------------------------------------------------------------
A         Open space; grass cover > 75%       (good)     B          3.23       61
          Paved parking lots, roofs, driveways           B          1.99       98
          Woods                               (fair)     B          6.67       60

          Total Area / Weighted Curve Number                       11.89       67
                                                                   =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---

User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Proposed Site Discharge to Outfall - POI 1
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 1.w55


                             --- Sub-Area Data ---

Name           Description                Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
A                                        Outlet          14.76       66    .105

Total area: 14.76 (ac)


                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2          .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                                Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
A              39.40     73.79      7.59


REACHES

OUTLET         39.40     73.79      7.59
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
A              39.40     73.79      7.59
           11.95     11.94     12.02


REACHES

OUTLET         39.40     73.79      7.59
```

```
CTB                               Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
A               14.76     0.105        66     Outlet

Total Area:   14.76 (ac)
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted              Travel
Identifier/   Length    Slope      n         Area    Perimeter  Velocity  Time
               (ft)    (ft/ft)             (sq ft)     (ft)     (ft/sec)  (hr)
--------------------------------------------------------------------------------
A
  SHEET          75   0.0200     0.011                                    0.016
  SHALLOW       370   0.0200     0.050                                    0.045
  CHANNEL       630                                              4.000    0.044

                                                Time of Concentration      .105
                                                                       ========
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 1
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                          Hydrologic   Sub-Area   Curve
Identifier           Land Use                         Soil        Area     Number
                                                      Group       (ac)
--------------------------------------------------------------------------------
A         Open space; grass cover > 75%       (good)    B           6.65       61
          Paved parking lots, roofs, driveways          B            2.2       98
          Woods                               (fair)    B           5.91       60

          Total Area / Weighted Curve Number                       14.76       66
                                                                   =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---

User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 1 - W CN


                             --- Sub-Area Data ---

Name           Description             Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
A                                      Outlet          14.76       61    0.105

Total area: 14.76 (ac)


                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
A              30.14     61.60      3.86


REACHES

OUTLET         30.14     61.60      3.86
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
A              30.14     61.60      3.86
           11.95     11.94     12.03


REACHES

OUTLET         30.14     61.60      3.86
```

```
WinTR-55, Version 1.00.10           Page   1                    12/16/2021   7:34:37 AM
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
A               14.76     0.105        61     Outlet

Total Area:   14.76 (ac)
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted               Travel
Identifier/   Length    Slope      n        Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)             (sq ft)    (ft)      (ft/sec)   (hr)
--------------------------------------------------------------------------------

A
  SHEET           75   0.0200     0.011                                    0.016
  SHALLOW        370   0.0200     0.050                                    0.045
  CHANNEL        630                                            4.000      0.044

                                                 Time of Concentration     0.105
                                                                        ========
```

```
CTB                                Brunswick ES
          Proposed Site Discharge to Outfall - POI 1 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                Sub-Area Land Use and Curve Number Details


 Sub-Area                                           Hydrologic   Sub-Area   Curve
Identifier           Land Use                          Soil        Area     Number
                                                       Group       (ac)
--------------------------------------------------------------------------------
A         User defined urban (Click button or         B         14.76        61

          Total Area / Weighted Curve Number                    14.76        61
                                                                =====        ==
```

```
                    WinTR-55 Current Data Description

                     --- Identification Data ---

User:     CTB                                 Date:        12/16/2021
Project:  Brunswick ES                        Units:       English
SubTitle: Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                                              Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 1 - W CN


                         --- Sub-Area Data ---

Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
A                                      Outlet          14.76       58    0.105

Total area: 14.76 (ac)


                         --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                                Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2          .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                                Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
A              24.89     54.28      1.97


REACHES

OUTLET         24.89     54.28      1.97
```

```
CTB                              Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
A              24.89     54.28      1.97
           11.96     11.95     12.04


REACHES

OUTLET         24.89     54.28      1.97
```

```
CTB                              Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
A               14.76     0.105        58     Outlet

Total Area:   14.76 (ac)
```

```
CTB                              Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted               Travel
Identifier/   Length    Slope      n        Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)             (sq ft)    (ft)      (ft/sec)   (hr)
--------------------------------------------------------------------------------
A
  SHEET           75   0.0200     0.011                                    0.016
  SHALLOW        370   0.0200     0.050                                    0.045
  CHANNEL        630                                            4.000      0.044

                                                 Time of Concentration     0.105
                                                                        ========
```

```
CTB                              Brunswick ES
         Prop Site Discharge to Outfall - POI 1 W/CN Red Plunge Pool
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                           Hydrologic   Sub-Area   Curve
Identifier           Land Use                          Soil        Area     Number
                                                      Group        (ac)
--------------------------------------------------------------------------------
A         User defined urban (Click button or           B         14.76       58

          Total Area / Weighted Curve Number                      14.76       58
                                                                  =====       ==
```

```
                        WinTR-55 Current Data Description


                         --- Identification Data ---


User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Existing Site Discharge to Outfall - POI 2
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Ex Site POI 2.w55



                             --- Sub-Area Data ---


Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
B                                      Outlet          12.47       65    .1

Total area: 12.47 (ac)



                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                            Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
---------------------------------------------------------------------------------
SUBAREAS
B              31.99     60.88      5.79


REACHES

OUTLET         31.99     60.88      5.79
```

```
CTB                               Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
B              31.99     60.88      5.79
           11.94     11.94     12.02


REACHES

OUTLET         31.99     60.88      5.79
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
B               12.47     0.100        65     Outlet

Total Area:   12.47 (ac)
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted               Travel
Identifier/   Length    Slope      n        Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)             (sq ft)    (ft)      (ft/sec)   (hr)
--------------------------------------------------------------------------------
B
  SHEET           75   0.0200     0.011                                    0.016
  SHALLOW        694   0.0200     0.050                                    0.084

                                                 Time of Concentration        .1
                                                                        ========
```

```
CTB                               Brunswick ES
                  Existing Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                         Hydrologic   Sub-Area   Curve
Identifier           Land Use                        Soil        Area     Number
                                                     Group       (ac)
--------------------------------------------------------------------------------
B         Open space; grass cover > 75%       (good)    B          5.44       61
          Paved parking lots, roofs, driveways          B           .74       98
          Woods - grass combination           (fair)    B          6.29       65

          Total Area / Weighted Curve Number                      12.47       65
                                                                  =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---


User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Proposed Site Discharge to Outfall - POI 2
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 2.w55



                             --- Sub-Area Data ---

Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
B                                      Outlet          13.88       71    .135

Total area: 13.88 (ac)



                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                             Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                                 Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
B              43.83     76.71     10.91


REACHES

OUTLET         43.83     76.71     10.91
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
B              43.83     76.71     10.91
           11.96     11.96     12.02


REACHES

OUTLET         43.83     76.71     10.91
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
B               13.88     0.135        71     Outlet

Total Area:   13.88 (ac)
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted               Travel
Identifier/   Length    Slope      n        Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)             (sq ft)    (ft)      (ft/sec)   (hr)
--------------------------------------------------------------------------------

B
  SHEET           75   0.0200     0.050                                    0.054
  SHALLOW        294   0.0200     0.025                                    0.028
  CHANNEL        458                                            4.000      0.032
  CHANNEL        298                                            4.000      0.021

                                                 Time of Concentration      .135
                                                                        ========
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 2
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                           Hydrologic   Sub-Area   Curve
Identifier           Land Use                          Soil        Area     Number
                                                      Group        (ac)
--------------------------------------------------------------------------------
B         Open space; grass cover > 75%       (good)    B          6.13       61
          Paved parking lots, roofs, driveways          B          3.43       98
          Woods - grass combination           (fair)    B          4.32       65

          Total Area / Weighted Curve Number                      13.88       71
                                                                  =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---


User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 2 - W CN


                             --- Sub-Area Data ---

Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
B                                      Outlet          13.88       63    .135

Total area: 13.88 (ac)



                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                                 Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2          .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------

SUBAREAS
B              30.37     59.39      4.59


REACHES

OUTLET         30.37     59.39      4.59
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
B              30.37     59.39      4.59
           11.99     11.97     12.04


REACHES

OUTLET         30.37     59.39      4.59
```

```
CTB                              Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)        (hr)
--------------------------------------------------------------------------------
B               13.88     0.135        63     Outlet

Total Area:   13.88 (ac)





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```

```
CTB                                Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End     Wetted              Travel
Identifier/   Length    Slope      n        Area    Perimeter   Velocity  Time
               (ft)    (ft/ft)             (sq ft)    (ft)      (ft/sec)  (hr)
--------------------------------------------------------------------------------
B
  SHEET          75   0.0200     0.050                                     0.054
  SHALLOW       294   0.0200     0.025                                     0.028
  CHANNEL       458                                            4.000       0.032
  CHANNEL       298                                            4.000       0.021

                                                Time of Concentration       .135
                                                                        ========
```

```
CTB                               Brunswick ES
          Proposed Site Discharge to Outfall - POI 2 W/ CN Reduction
                       Frederick NOAA_C County, Maryland

                Sub-Area Land Use and Curve Number Details


 Sub-Area                                         Hydrologic   Sub-Area   Curve
Identifier           Land Use                        Soil        Area     Number
                                                     Group       (ac)
--------------------------------------------------------------------------------
B         User defined urban (Click button or          B          13.88       63

          Total Area / Weighted Curve Number                     13.88       63
                                                                 =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---

User:     CTB                                    Date:        12/16/2021
Project:  Brunswick ES                           Units:       English
SubTitle: Existing Site Discharge to Outfall - POI 3
                                                 Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Ex Site POI 3.w55


                             --- Sub-Area Data ---

Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
C                                      Outlet          13.77       62    0.134

Total area: 13.77 (ac)


                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                                  Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2         .0          5.1         .0          .0          7.1         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                                Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
C              28.59     56.87      3.91


REACHES

OUTLET         28.59     56.87      3.91
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
C              28.59     56.87      3.91
           11.99     11.96     12.04


REACHES

OUTLET         28.59     56.87      3.91
```

```
CTB                                Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)         (hr)
--------------------------------------------------------------------------------
C               13.77     0.134        62     Outlet

Total Area:   13.77 (ac)
```

```
CTB                             Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                     Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End      Wetted                Travel
Identifier/   Length    Slope       n        Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)              (sq ft)    (ft)      (ft/sec)   (hr)
--------------------------------------------------------------------------------
C
  SHEET          75   0.0200     0.011                                      0.016
  SHALLOW       800   0.0200     0.050                                      0.097
  SHALLOW       222   0.0200     0.025                                      0.021

                                                  Time of Concentration     0.134
                                                                          ========
```

```
CTB                              Brunswick ES
                  Existing Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                         Hydrologic   Sub-Area   Curve
Identifier           Land Use                        Soil        Area     Number
                                                    Group        (ac)
--------------------------------------------------------------------------------
C         Open space; grass cover > 75%       (good)    B          11.8       61
          Paved parking lots, roofs, driveways          B           .36       98
          Woods                               (fair)    B          1.61       60

          Total Area / Weighted Curve Number                      13.77       62
                                                                  =====       ==
```

```
                        WinTR-55 Current Data Description

                         --- Identification Data ---

User:     CTB                                     Date:        12/16/2021
Project:  Brunswick ES                            Units:       English
SubTitle: Proposed Site Discharge to Outfall - POI 3
                                                  Areal Units: Acres
State:    Maryland
County:   Frederick NOAA_C
Filename: G:\2020\20030 - FCPS - Brunswick Elementary School\Engineering\SWM\BES - Prop Site POI 3.w55


                             --- Sub-Area Data ---

Name           Description              Reach        Area(ac)     RCN     Tc
------------------------------------------------------------------------------
C                                      Outlet          6.89        63    0.1

Total area: 6.89 (ac)


                             --- Storm Data  --

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2          .0          5.2          .0          .0          7.4         2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                             Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                                Storm Data

                   Rainfall Depth by Rainfall Return Period

   2-Yr        5-Yr        10-Yr       25-Yr       50-Yr       100-Yr      1-Yr
   (in)        (in)        (in)        (in)        (in)        (in)        (in)
--------------------------------------------------------------------------------
    3.2          .0          5.2          .0          .0          7.4          2.7


Storm Data Source:              User-provided custom storm data
Rainfall Distribution Type:     Type II
Dimensionless Unit Hydrograph:  <standard>
```

```
CTB                               Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                             Watershed Peak Table


 Sub-Area           Peak Flow by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
----------------------------------------------------------------------------------
SUBAREAS
C              16.64     33.83      2.50


REACHES

OUTLET         16.64     33.83      2.50
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                       Hydrograph Peak/Peak Time Table

 Sub-Area       Peak Flow and Peak Time (hr) by Rainfall Return Period
 or Reach      10-Yr    100-Yr      1-Yr
Identifier     (cfs)     (cfs)     (cfs)
            (hr)      (hr)      (hr)
----------------------------------------------------------------------------------
SUBAREAS
C              16.64     33.83      2.50
           11.94     11.94     12.02


REACHES

OUTLET         16.64     33.83      2.50
```

```
CTB                               Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                            Sub-Area Summary Table

 Sub-Area   Drainage     Time of     Curve   Receiving     Sub-Area
Identifier    Area    Concentration  Number    Reach      Description
              (ac)         (hr)
--------------------------------------------------------------------------------
C                6.89     0.100        63     Outlet

Total Area:   6.89 (ac)
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                    Sub-Area Time of Concentration Details


 Sub-Area      Flow            Mannings's    End      Wetted               Travel
Identifier/   Length    Slope      n         Area    Perimeter   Velocity   Time
               (ft)    (ft/ft)             (sq ft)    (ft)       (ft/sec)   (hr)
--------------------------------------------------------------------------------

C
  SHEET          75   0.0200     0.011                                       0.016
  SHALLOW       306   0.0200     0.050                                       0.037
  SHALLOW       222   0.0200     0.025                                       0.021

                                                 Time of Concentration       0.1
                                                                        ========
```

```
CTB                              Brunswick ES
                  Proposed Site Discharge to Outfall - POI 3
                       Frederick NOAA_C County, Maryland

                  Sub-Area Land Use and Curve Number Details


 Sub-Area                                           Hydrologic   Sub-Area   Curve
Identifier           Land Use                          Soil        Area     Number
                                                      Group        (ac)
--------------------------------------------------------------------------------
C         Open space; grass cover > 75%       (good)    B          5.82       61
          Paved parking lots, roofs, driveways          B           .36       98
          Woods                               (fair)    B           .71       60

          Total Area / Weighted Curve Number                       6.89       63
                                                                   ====       ==
```

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

Drainage Area A CN Adjustment

POI 1

ESD storage provided within drainage area:
V_{stored} = 20,974 cf 20,974 cf from facilities 1 thru 10 and 18 & 19.

Compute the runoof depth stored in the devices:
Q_{stored} (inches) = [V_{stored}(cf) x 12 (inch/foot)] / DA (Ac) x 43,560 (ft^2)

Q_{stored} =

DA = 14.76 Ac.

$$\frac{\text{Vstored} \times 12}{\text{DA} \times 43{,}560}$$

$$\frac{20{,}974 \times 12}{14.76 \times 43{,}560}$$

Q_{stored} = 0.39 "

Compute the post development runoff depth for the 10 year 24 hour design storm

(Q_{dev}) = 1.796 "

Calculate CN* (Change in curve number based on storage)

CN* = 200 / [(P+2Q+2) - √(5PQ+4Q^2)]
Q = Q_{dev} - Q_{stored} (inches) Q = 1.40 "
P = 10 year rainfall depth (5.1 inches) P = 5.1 "

CN* = 61
Use reduced CN* with TR-55

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

Drainage Area A CN Adjustment

POI 1 W/ PLUNGE POOL

ESD storage provided within drainage area:
V_{stored} = 30,613 cf 20,974 cf from facilities 1 thru 10 and 18 & 19. 9,639 cf from plunge pool.

Compute the runoof depth stored in the devices:
Q_{stored} (inches) = [V_{stored}(cf) x 12 (inch/foot)] / DA (Ac) x 43,560 (ft^2)

Q_{stored} =

DA = 14.76 Ac.

$$\frac{\text{Vstored} \quad \text{x} \quad 12}{\text{DA} \quad \text{x} \quad 43{,}560}$$

$$\frac{30{,}613 \quad \text{x} \quad 12}{14.76 \quad \text{x} \quad 43{,}560}$$

Q_{stored} = 0.57 "

Compute the post development runoff depth for the 10 year 24 hour design storm

(Q_{dev}) = 1.796 "

Calculate CN* (Change in curve number based on storage)

CN* = 200 / [(P+2Q+2) - √(5PQ+4Q^2)]
Q = Q_{dev} - Q_{stored} (inches) Q = 1.22 "
P = 10 year rainfall depth (5.1 inches) P = 5.1 "

CN* = 58
Use reduced CN* with TR-55

Project: Brunswick Elementary School
MK Job #: 20030 Date: 12/16/2021

Drainage Area A CN Adjustment

POI 2

ESD storage provided within drainage area:

V_{stored} = 31,555 cf 31,555 cf from facilities 11 thru 17.

Compute the runoof depth stored in the devices:

Q_{stored} (inches) = [V_{stored}(cf) x 12 (inch/foot)] / DA (Ac) x 43,560 (ft^2)

Q_{stored} =

DA = 13.88 Ac.

$$\frac{\text{Vstored} \times 12}{\text{DA} \times 43{,}560}$$

$$\frac{31{,}555 \times 12}{13.88 \times 43{,}560}$$

Q_{stored} = 0.63 "

Compute the post development runoff depth for the 10 year 24 hour design storm

(Q_{dev}) = 2.19 "

Calculate CN* (Change in curve number based on storage)

CN* = 200 / [(P+2Q+2) - √(5PQ+4Q^2)]

Q = Q_{dev} - Q_{stored} (inches) Q = 1.56 "

P = 10 year rainfall depth (5.1 inches) P = 5.1 "

CN* = 63

Use reduced CN* with TR-55

5.) Storm Drain Computations

MK Consulting Engineers, LLC
Storm Drain Flow Tabulation Form

Location: Frederick County **Date:** **12/17/2021**
Development: Brunswick ES
MK Job No.: 20030
Storm Frequency 10 YR. Except As Noted

LOCATION		AREA	AREA		COEFF.	CA	$\sum$CA	TIME CONC. - MIN.			INTEN.	Q = CIA	PIPE N =		0.01		REMARKS
FROM	TO		SUB	TOTAL	"C"			INLET	DRAIN	TOTAL	"I"	C.F.S.	SIZE	SLOPE	VEL.	LGTH.	
I-11	I-10	A	0.05		0.64	0.03		5.0		5.0	7.00	0.22	12"	0.03	0.50	75	
	I-10	B	0.17		0.80	0.14		5.0		5.0	8.00	1.09					25 YR SUMP
I-10	I-9	A+B		0.22		0.00	0.17	5.0	2.5	7.5	6.43	1.09	12"	0.04	1.35	119	
	I-9	C	0.16		0.79	0.13		5.0		5.0	8.00	1.01					25 YR SUMP
I-9	I-8	A-C		0.38		0.00	0.30	7.5	1.5	9.0	6.17	1.85	15"	0.04	1.45	80	
	I-8	D	0.11		0.20	0.02		5.0		5.0	8.00	0.18					25 YR SUMP
I-8	I-7	A-D		0.49		0.00	0.32	9.0	0.9	9.9	5.89	1.88	12"	0.12	2.35	9	
I-12	I-7	E	0.34		0.34	0.12		5.0		5.0	7.00	0.81	12"	0.05	1.00	27	
I-13	I-7	F	0.08		0.68	0.05		5.0		5.0	7.00	0.38	12"	0.05	0.50	130	
	I-7	G	0.06		0.20	0.01		5.0		5.0	8.00	0.10					25 YR SUMP
I-7	I-6	A-G		0.97		0.00	0.82	9.9	0.1	10.0	5.86	4.81	15"	0.05	0.50	37	
ROOF	CONN 1A	H	0.03		0.86	0.03		5.0		5.0	7.00	0.18	6"	0.06	1.00	36	
ROOF	CONN IA	I	0.07		0.86	0.06		5.0		5.0	7.00	0.42	6"	0.32	2.00	13	
CONN 1A	MH-1	H+I		0.10		0.00	0.09	5.0	0.6	5.6	6.86	0.62	8"	0.15	1.75	124	
ROOF	CONN 1B	J	0.08		0.86	0.07		5.0		5.0	7.00	0.48	8"	0.09	1.35	44	
ROOF	CONN 1B	K	0.15		0.86	0.13		5.0		5.0	7.00	0.90	8"	0.31	2.50	6	
CONN 1B	MH-1	J+K		0.23		0.00	0.20	5.0	0.5	5.5	6.89	1.38	8"	0.55	3.35	16	
MH-1	I-6	H-K		0.33		0.00	0.29	5.6	1.2	6.8	6.59	1.91	12"	0.16	2.40	177	
	I-6	L	0.11		0.20	0.02		5.0		5.0	8.00	0.18					25 YR SUMP
I-6	I-5	A-L		1.41		0.00	1.13	10.0	1.2	11.2	5.67	6.41	18"	0.23	3.80	132	
	I-5	M	0.29		0.59	0.17		5.0		5.0	8.00	1.37					25 YR SUMP
I-5	I-4	A-M		1.70		0.00	1.30	11.2	0.6	11.8	5.57	7.24	24"	0.06	2.25	137	
	I-4	N	0.36		0.58	0.21		5.0		5.0	8.00	1.67					25 YR SUMP
I-4	I-3	A-N		2.06		0.00	1.51	11.8	1.0	12.8	5.40	8.15	24"	0.07	2.50	43	
ROOF	MH-2	O	0.14		0.86	0.12		5.0		5.0	7.00	0.84	6"	1.20	4.00	102	
PLAY	MH-2	P	0.11		0.23	0.03		5.0		5.0	7.00	0.18	6"	0.06	0.90	33	
MH-2	I-3	O+P		0.25		0.00	0.15	5.0	0.7	5.7	6.22	0.93	12"	0.04	1.18	178	
	I-3	Q	0.24		0.39	0.09		5.0		5.0	8.00	0.75					25 YR SUMP
I-3	I-2	A-Q		2.55		0.00	1.75	12.8	0.3	13.1	5.35	9.36	30"	0.04	1.85	48	
	I-2	R	0.28		0.50	0.14		5.0		5.0	8.00	1.12					25 YR SUMP
I-2	I-1	A-R		2.89		0.00	1.89	13.1	0.4	13.5	5.29	10.00	30"	0.04	2.00	21	
ROOF	MH-3	S	0.14		0.86	0.12		5.0		5.0	7.00	0.84	8"	0.27	2.40	137	
MH-3	I-14	S	0.14		0.86	0.12		5.0	1.0	6.0	6.77	0.82	10"	0.08	1.50	64	
	I-14	T	0.22		0.41	0.09		5.0		5.0	8.00	0.72					25 YR SUMP
I-14	I-1	S+T		0.35		0.00	0.33	6.0	0.7	6.7	6.61	2.18	12"	0.20	2.70	128	
ROOF	MH-4	U	0.15		0.86	0.13		5.0		5.0	7.00	0.90	8"	0.32	2.50	233	

MK Consulting Engineers, LLC
Storm Drain Flow Tabulation Form

Location: Frederick County **Date:** 12/17/2021
Development: Brunswick ES
MK Job No.: 20030
Storm Frequency 10 YR. Except As Noted

LOCATION		AREA	AREA		COEFF.	CA	$\sum$CA	TIME CONC. - MIN.			INTEN.	Q = CIA	PIPE N =		0.01		REMARKS
FROM	TO		SUB	TOTAL	"C"			INLET	DRAIN	TOTAL	"I"	C.F.S.	SIZE	SLOPE	VEL.	LGTH.	
PLAY	MH-4	V	0.06		0.28	0.02		5.0		5.0	7.00	0.12	6"	0.04	0.50	9	
MH-4	I-15	U+V		0.25		0.00	0.15	5.0	1.6	6.6	6.63	0.99	12"	0.04	1.20	65	
	I-15	W	0.28		0.34	0.10		5.0		5.0	8.00	0.76					25 YR SUMP
I-15	I-1	U-W		0.53		0.00	0.25	6.6	0.9	7.5	6.43	1.61	12"	0.12	2.00	77	
	I-1	X	0.08		0.20	0.02		5.0		5.0	8.00	0.13					25 YR SUMP
I-1	EW-1	A-X		3.76		0.00	2.49	13.5	0.2	13.7	5.26	13.10	36"	0.04	1.84	35	
						0.00				0.0		0.00					
ROOF	MH-9	Y	0.20		0.86	0.17		5.0		5.0	7.00	1.20	8"	0.57	3.40	313	
ROOF	MH-9	Z	0.10		0.86	0.09		5.0		5.0	7.00	0.60	8"	0.14	1.65	146	
ROOF	MH-9	AA	0.01		0.86	0.01		5.0		5.0	7.00	0.06	8"	0.02	0.20	17	
MH-9	I-18	Y-AA		0.31		0.00	0.27	5.0	1.5	6.5	6.66	1.80	12"	0.14	2.25	103	
I-19	I-18	BB	0.41		0.84	0.34		5.0		5.0	7.00	2.41	12"	0.26	3.00	199	
	I-18	CC	0.47		0.83	0.39		5.0		5.0	7.00	2.73					
I-18	MH-8	Y-CC		1.19		0.00	1.00	6.5	0.8	7.3	6.47	6.47	15"	0.55	5.10	20	
MH-8	UGF #17	Y-CC		1.19		0.00	1.00	7.3	0.1	7.4	6.45	6.45	15"	0.50	5.00	15	
I-20	MH-10	DD	0.67		0.32	0.21		5.0		5.0	7.00	1.50	12"	0.10	1.80	91	
I-21	MH-10	EE	0.43		0.79	0.34		5.0		5.0	7.00	2.38	12"	0.25	2.95	32	
MH-10	UGF #17	DD+EE		1.10		0.00	0.55	5.0	0.8	5.8	6.81	3.75	15"	0.18	3.00	85	
UGF #17	MH-7	Y-EE		2.29		0.00	1.55	7.4	0.1	7.5	6.43	9.97	18"	0.50	5.50	55	
MH-7	MH-6	Y-EE		2.29		0.00	1.55	7.5	0.2	7.7	6.38	9.89	18"	0.49	5.45	58	
I-22	MH-6	FF	0.43		0.64	0.28		5.0		5.0	7.00	1.93	12"	0.16	2.40	151	
MH-6	MH-5	Y-FF		2.72		0.00	1.83	7.7	0.2	7.9	6.33	11.58	24"	0.14	3.60	161	
						0.00				0.0		0.00					
ROOF	MH-11	GG	0.04		0.86	0.03		5.0		5.0	7.00	0.24	6"	0.10	1.20	108	
ROOF	I-26	HH	0.15		0.86	0.13		5.0		5.0	7.00	0.90	8	0.31	2.50	13	
	I-26	II	0.14		0.36	0.05		5.0		5.0	7.00	0.35					25 YR SUMP
I-26	MH-11	HH+II		0.29		0.00	0.18	5.0	0.1	5.1	6.98	1.26	12"	0.07	1.55	65	
MH-11	I-25	GG-II		0.33		0.00	0.21	5.0	1.5	6.5	6.66	1.40	15"	0.04	0.95	27	
	I-25	JJ	0.10		0.20	0.02		5.0		5.0	7.00	0.14					25 YR SUMP
I-25	I-24	GG-JJ		0.43		0.00	0.23	6.5	0.5	7.0	6.54	1.50	15"	0.04	1.20	18	
ROOF	CONN-25A	KK	0.05		0.86	0.04		5.0		5.0	7.00	0.30	8"	0.04	0.85	68	
ROOF	CONN-25A	LL	0.08		0.86	0.07		5.0		5.0	7.00	0.48	6"	0.04	2.50	33	
CONN-25A	I-28	KK+LL		0.13		0.00	0.11	5.0	1.3	6.3	6.70	0.74	8"	0.20	2.10	46	
ROOF	I-28	MM	0.12		0.86	0.10		5.0		5.0	7.00	0.72	8"	0.20	2.00	32	
	I-28	NN	0.05		0.63	0.03		5.0		5.0	7.00	0.22					
I-28	I-29	KK-NN		0.30		0.00	0.24	5.0	1.3	6.3	6.70	1.61	12"	0.12	2.00	48	
						0.00				0.0		0.00					

MK Consulting Engineers, LLC
Storm Drain Flow Tabulation Form

Location: Frederick County
Development: Brunswick ES
MK Job No.: 20030
Storm Frequency 10 YR. Except As Noted

Date: **12/17/2021**

LOCATION		AREA	AREA		COEFF.	CA	∑CA	TIME CONC. - MIN.			INTEN.		Q = CIA	PIPE N =		0.01		REMARKS
FROM	TO		SUB	TOTAL	"C"			INLET	DRAIN	TOTAL	"I"		C.F.S.	SIZE	SLOPE	VEL.	LGTH.	
	I-29	OO	0.04		0.77	0.03		5.0		5.0	7.00		0.22					
I-29	MH-12	KK-OO		0.34		0.00	0.27	6.3	0.4	6.7	6.61		1.78	15"	0.04	1.40	72	
MH-12	I-24	KK-OO		0.34		0.00	0.27	6.7	0.9	7.6	6.40		1.73	15"	0.04	1.18	104	
	I-24	PP	0.09		0.20	0.02		5.0		5.0	7.00		0.13					25 YR SUMP
I-24	I-23	GG-PP		0.86		0.00	0.52	7.0	0.3	7.3	6.47		3.36	15"	0.15	2.60	68	
I-29	I-23	QQ	0.33		0.80	0.26		5.0		5.0	7.00		1.85	12"	0.12	2.25	39	
	I-23	RR	0.10		0.20	0.02		5.0		5.0	8.00		0.16					25 YR SUMP
I-23	MH-5	GG-RR		1.29		0.00	0.80	7.3	0.4	7.7	6.38		5.10	18"	0.12	2.80	47	
						0.00				0.0			0.00					
I-33	I-32	SS	0.17		0.86	0.15		5.0		5.0	7.00		1.02	12"	0.05	1.25	123	
	I-32	TT	0.16		0.82	0.13		5.0		5.0	7.00		0.92					
I-32	I-31	SS+TT		0.33		0.00	0.28	5.0	1.6	6.6	6.63		1.86	12"	0.12	2.40	40	
	I-31	UU	0.09		0.20	0.02		5.0		5.0	8.00		0.14					25 YR SUMP
I-31	I-30	SS-UU		0.42		0.00	0.30	6.6	0.3	6.9	6.56		1.97	12"	0.17	2.45	54	
I-34	I-30	VV	0.36		0.82	0.30		5.0		5.0	7.00		2.07	12"	0.16	2.55	41	
	I-30	WW	0.10		0.20	0.02		5.0		5.0	8.00		0.16					25 YR SUMP
I-30	MH-5	SS-WW		0.88		0.00	0.62	6.9	0.4	7.3	6.47		4.01	15"	0.22	3.20	21	
MH-5	EW-2	Y-WW		4.89		0.00	3.25	7.9	0.7	8.6	6.23		20.25	30"	0.18	4.50	19	
						0.00				0.0			0.00					
I-37	I-36	XX	0.16		0.68	0.11		5.0		5.0	7.00		0.76	12"	0.04	0.95	144	
PLAY	I-36	YY	0.19		0.34	0.06		5.0		5.0	7.00		0.45	6"	0.30	2.00	35	
	I-36	ZZ	0.12		0.26	0.03		5.0		5.0	8.00		0.25					25 YR SUMP
I-36	I-35	XX-ZZ		0.47		0.00	0.20	5.0	2.5	7.5	6.43		1.29	12"	1.57	7.90	66	
	I-35	AAA	0.22		0.55	0.12		5.0		5.0	8.00		0.97					25 YR SUMP
I-35	ES-13	XX-AAA		0.69		0.00	0.32	7.5	0.1	7.6	6.43		2.06	12"	0.16	2.60	30	
						0.00				0.0			0.00					
I-17	I-16	BBB	0.56		0.20	0.11		5.0		5.0	8.00		0.90	12"	0.04	1.60	178	25 YR SUMP
	I-16	CCC	0.97		0.20	0.19		5.0		5.0	8.00		1.55					25 YR SUMP
I-16	ES-7	BBB+CCC		1.53		0.00	0.30	5.0	1.9	6.9	6.56		1.97	12"	0.17	2.40	86	
						0.00				0.0			0.00					
						0.00				0.0			0.00					
						0.00				0.0			0.00					
						0.00				0.0			0.00					
						0.00				0.0			0.00					

6.) Rip-Rap Outfall Computations

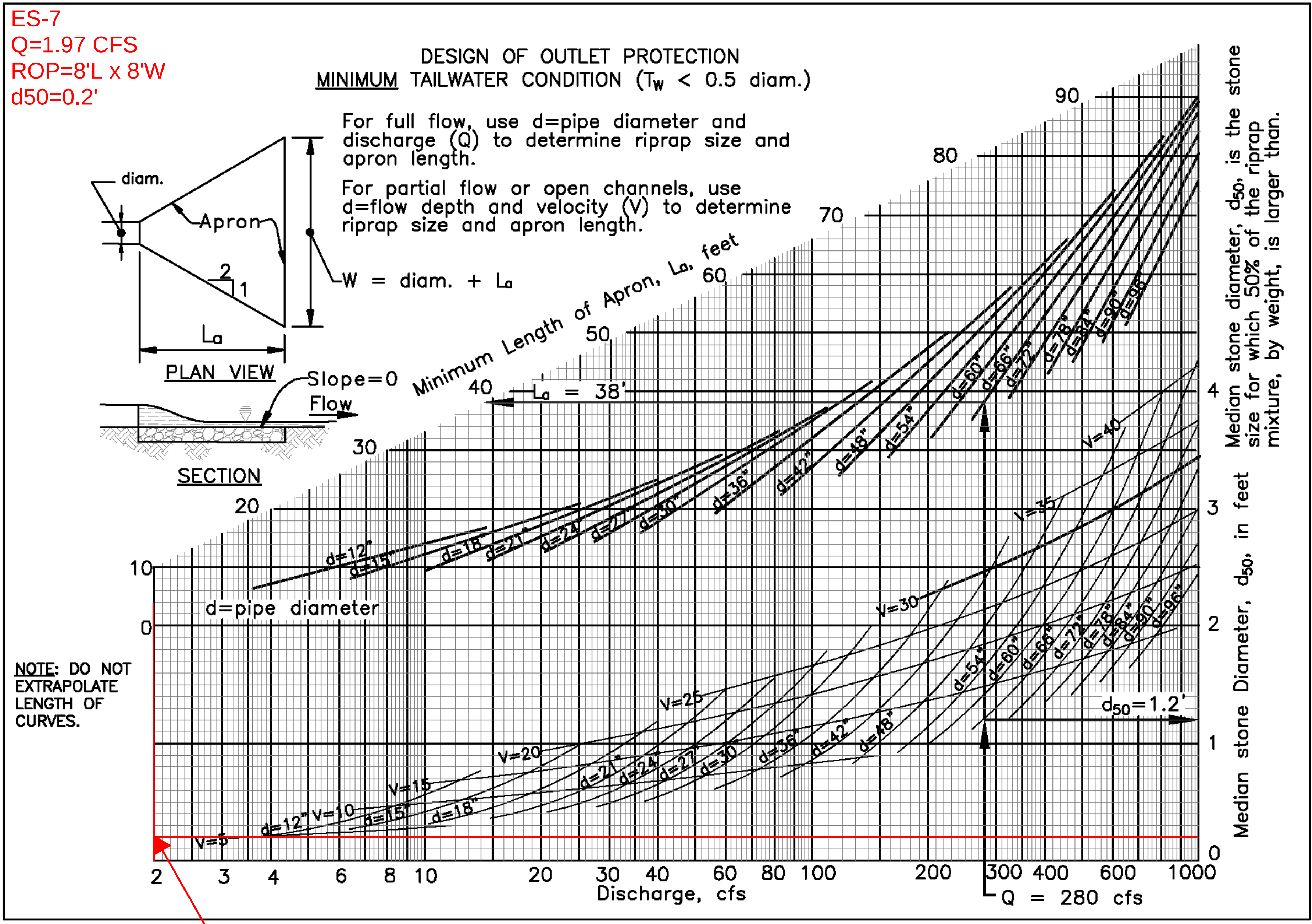


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

Q=1.97
CFS

EW-13
Q=2.06 CFS
ROP=8'L x 6'W
d50=0.2'

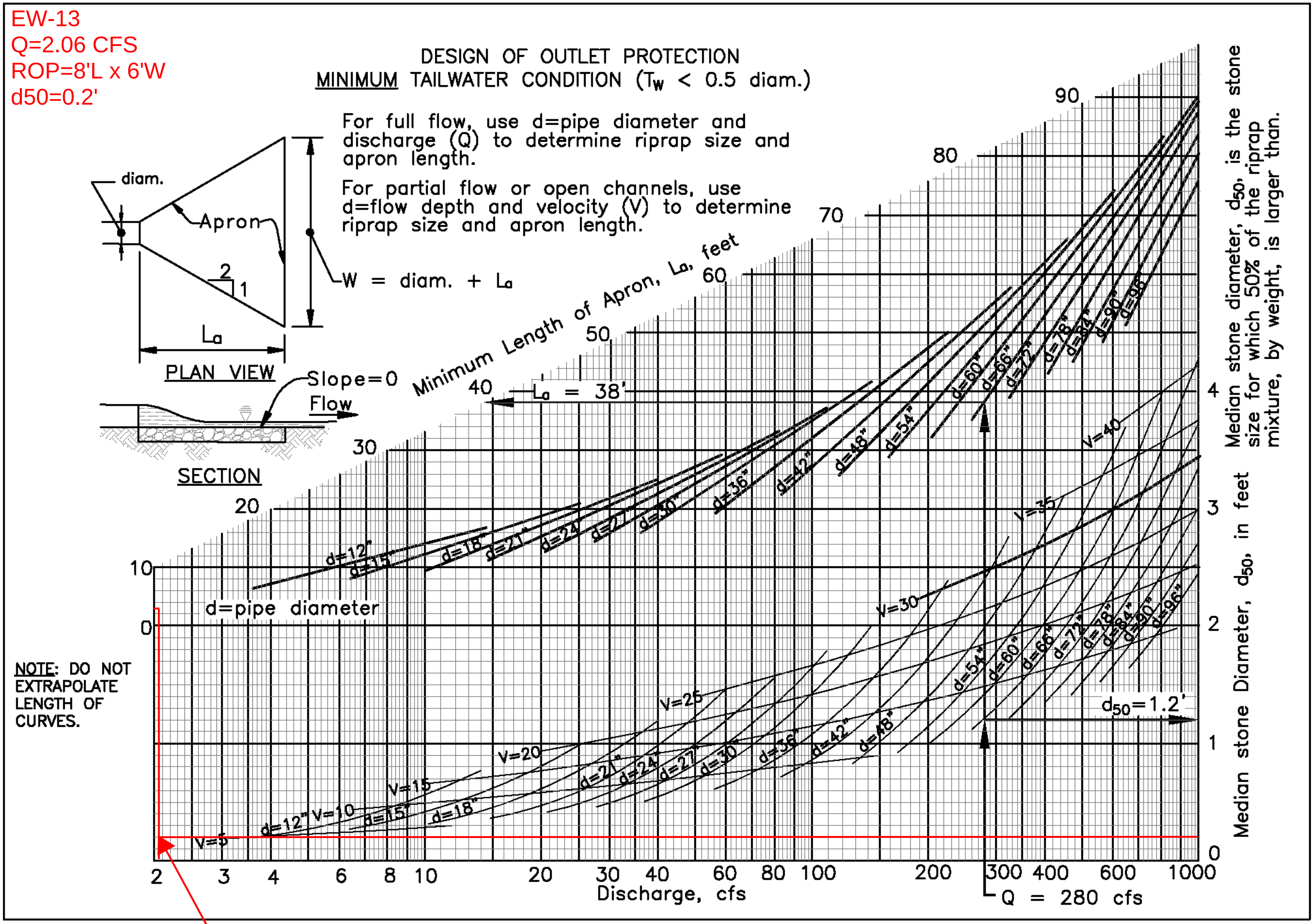


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

Q=2.06
CFS

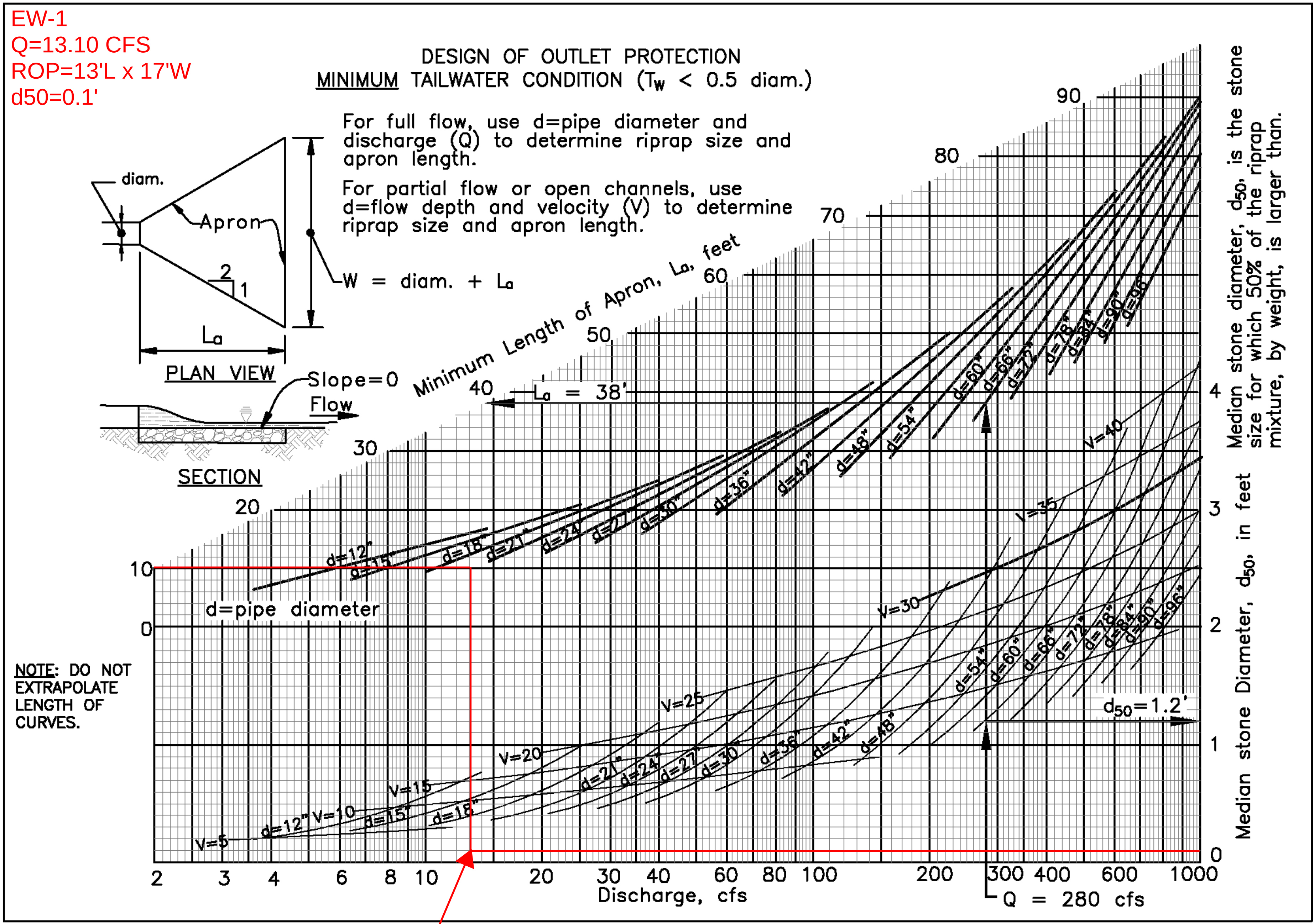

EW-1
Q=13.10 CFS
ROP=13'L x 17'W
d50=0.1'

Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

Q=13.10
CFS

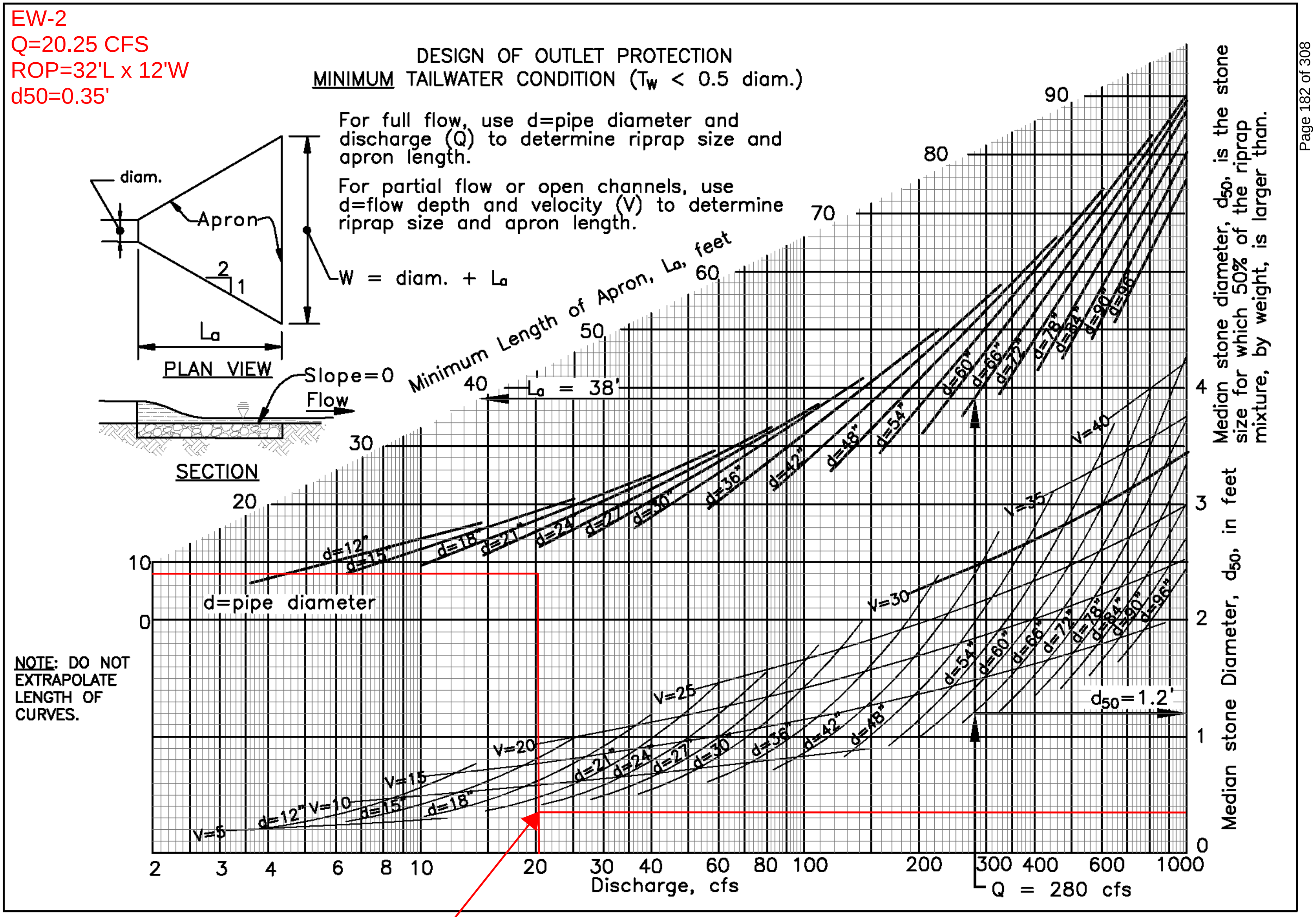
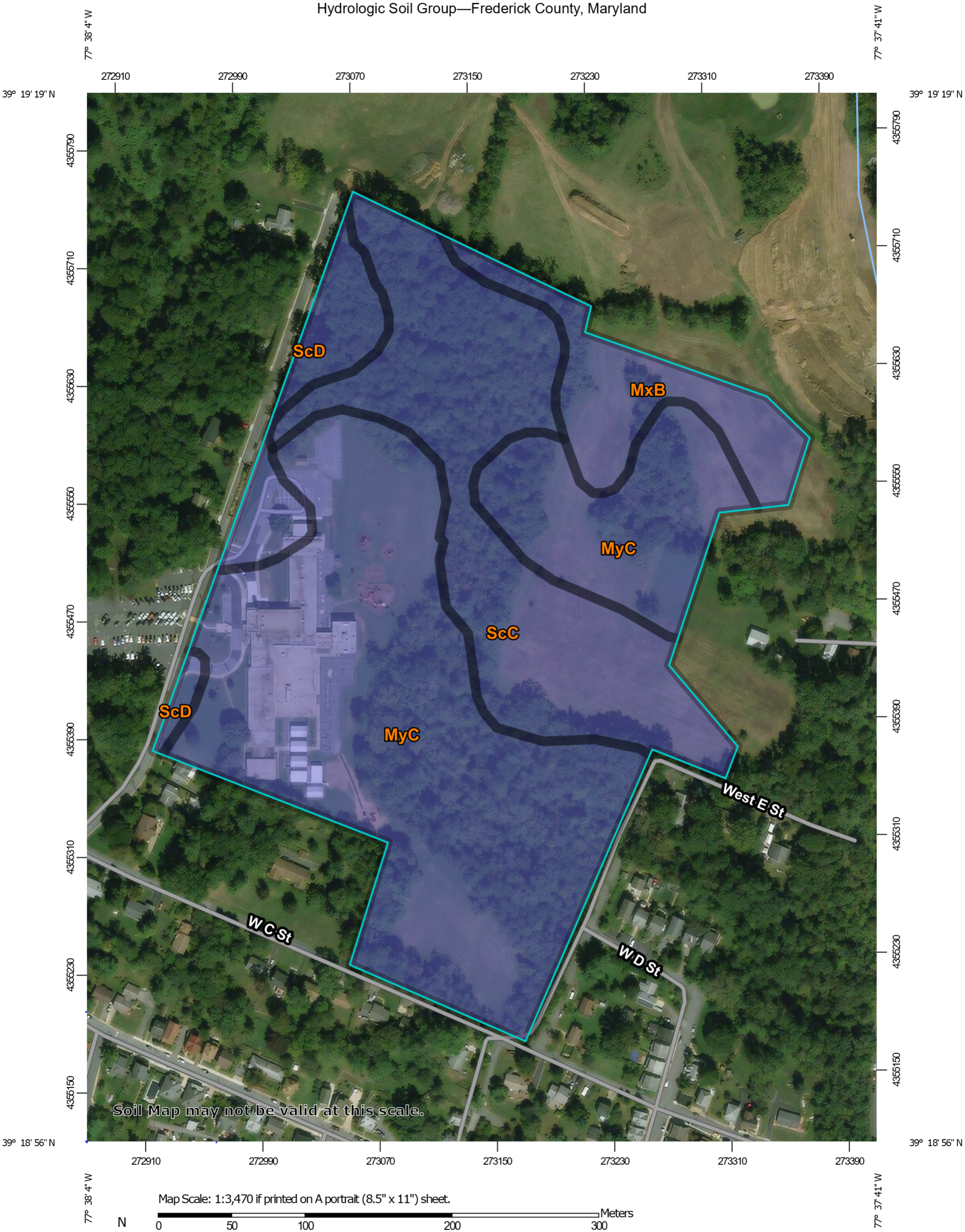


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

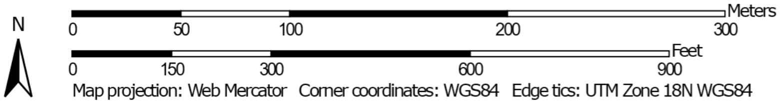
Q=20.25 CFS

7.) Soils

Hydrologic Soil Group—Frederick County, Maryland



Map Scale: 1:3,470 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- ▭ Area of Interest (AOI)

Soils

Soil Rating Polygons

- ■ A
- ■ A/D
- ■ B
- ■ B/D
- ■ C
- ■ C/D
- ■ D
- □ Not rated or not available

Soil Rating Lines

- ∿ A
- ∿ A/D
- ∿ B
- ∿ B/D
- ∿ C
- ∿ C/D
- ∿ D
- ∿ Not rated or not available

Soil Rating Points

- ▪ A
- ▪ A/D
- ▪ B
- ▪ B/D
- ▪ C
- ▪ C/D
- ▪ D
- ▫ Not rated or not available

Water Features

- ∿ Streams and Canals

Transportation

- ┼┼┼ Rails
- ∿ Interstate Highways
- ∿ US Routes
- ∿ Major Roads
- ∿ Local Roads

Background

- ■ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Frederick County, Maryland
Survey Area Data: Version 17, Jun 12, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 25, 2014—Mar 10, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
MxB	Myersville-Burkittsville complex, 3 to 8 percent slopes	B	2.9	8.6%
MyC	Myersville-Catoctin-Urban land complex, 8 to 15 percent slopes	B	20.3	59.0%
ScC	Spoolsville-Burkittsville complex, 8 to 15 percent slopes	B	9.0	26.2%
ScD	Spoolsville-Burkittsville complex, 15 to 25 percent slopes	B	2.1	6.1%
Totals for Area of Interest			**34.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

8.) Geotechnical Report

HILLIS-CARNES
ENGINEERING ASSOCIATES

Final Report of Subsurface Exploration and Geotechnical Engineering Services
Brunswick Elementary School Replacement
400 Central Avenue
Brunswick, MD
HCEA Project Number: 22820A

April 14, 2021

Prepared For:

Mr. H Robert Mock III
GWWO Inc/Architects
800 Wayman Park Drive, Suite 300
Baltimore, MD 21211

HILLIS-CARNES
ENGINEERING ASSOCIATES

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April 14, 2021

Mr. H Robert Mock III, AIA/Associate
GWWO Inc/Architects
800 Wayman Park Drive, Suite 300
Baltimore, MD 21211

Subject: Final Report of Geotechnical Engineering Services
Brunswick Elementary School Replacement
400 Central Avenue, Brunswick, MD
HCEA Project Number: 22820A

Mr. Moir:

Hillis-Carnes Engineering Associates, Inc. (HCEA) is pleased to submit this final report concerning the subsurface exploration and subsequent geotechnical evaluation for the proposed construction of an elementary school at the above referenced project site in the City of Brunswick, Maryland.

We wish to advise you that the boring samples will be stored at our Frederick, Maryland office for a period of 30 days from the date of this letter. Should you wish the samples to be stored for a longer period of time or to be delivered to you or another party, please advise us in writing prior to the end of the 30-day period. Otherwise, the samples will be discarded at the end of the 30-day storage period.

HCEA appreciates having had the opportunity to provide the geotechnical consultation for this project, and we will remain available for further consultation during the various design stages. In order to provide complete professional services, we strongly recommend that inspection of the geotechnical aspects of construction be conducted by HCEA. This will help to verify that the construction operations are performed in accordance with the design recommendations of this report and the overall project plans and specifications. Should you have any questions concerning the contents of this report, or require additional consultation, design, inspection, or testing services, please contact our Office.

Very truly yours,
HILLIS-CARNES ENGINEERING ASSOCIATES, INC.

32289

Robel Gibbe, P.E.
Project Engineer

Rajesh K. Goel, P.E.
Principal Engineer

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Final Report of Geotechnical Engineering Services
Brunswick Elementary School Replacement
400 Central Avenue, Brunswick, MD
HCEA Project Number: 22820A

1.0 PURPOSE AND SCOPE

The purpose of this study was to determine the general subsurface conditions at the boring locations and to evaluate those conditions with respect to concept and design of foundations for the proposed construction. More precisely, the scope of the study included the following objectives:

1. To determine the existing subsurface conditions, including the soil, rock, and groundwater conditions, within the area of the proposed construction.
2. To recommend the appropriate foundation and slab systems for the proposed building along with necessary design criteria.
3. To provide our recommendations for pavement subgrade preparations along with pavement cross section design.
4. To evaluate the site relative to the proposed construction of storm water management (SWM) facilities.
5. To determine and discuss any likely geotechnical-related design or construction problems.

The evaluations and recommendations presented in this report were developed from an analysis of project characteristics and an interpretation of the general subsurface conditions at the site based on the boring information. The stratification lines indicated on the boring logs represent the approximate boundaries between soil types. In-situ, however, the transitions may be gradual. Such variations can best be evaluated during construction and, if necessary, any minor design changes can be made at that time.

An evaluation of the site with respect to potential construction problems and recommendations dealing with the earthwork and inspection during construction are also included. The inspection is considered necessary to verify the subsurface conditions and to verify that the soils-related construction phases are performed properly.

2.0 PROJECT CHARACTERISTICS

The project site currently consists of existing Brunswick Elementary School. The proposed project consists of demolition of the existing school structures and construction of a new elementary school building and associated parking, and storm water management (SWM) facilities. The new school building will be constructed on the wooded and grass covered areas located on the east side of the existing school building. The location and existing conditions of the site are shown in the project location diagrams in the Appendix.

Precise loading information has not been provided but is anticipated to be moderate. Based on the grading plan we reviewed, it is our understanding that the finished floor slab elevation of the building is planned at 441 feet. Accordingly, to attain the proposed finished floor slab elevation, cuts up to 11 +/- feet and fills up to 12.5 +/- feet will be required in various areas of the proposed building. Settlements on the order of 1-inch total and ½ inch differential have been assumed to be tolerable by the structure.

Should any of the project characteristics, site grading, structural loading conditions or listed criteria differ from those outlined above, then this office should be contacted for a re-evaluation of the site.

3.0 FIELD EXPLORATION

In order to determine the general foundation soil types and to develop design parameters, a total of forty (40) SPT borings (20 building, 6 pavement, and 14 SWM) were drilled at the site during this investigation. It should be noted that 10 borings (B-1 through B-10) were previously drilled during the preliminary investigation stage of the project. The building borings (B-11 through B-30) were extended to a depth of 20 feet except for borings B-14, B-16, and B-21. Borings B-14, B-16, and B-21 were extended to auger refusal that was attained at depths of 16, 13, and 17 feet below existing site grades, respectively. The pavement borings (P-1 through P-6) and the SWM borings (SWM-1 to SWM-14) were extended to a depth of 12 feet. PVC pipes were installed in 10 of the SWM borings (SWM-1, SWM-2, SWM-4, SWM-5, SWM-8, SWM-10, SWM-11, SWM-12, SWM-14, and SWM-14) at an approximate depth of 8 feet to perform in-situ infiltration testing. In-situ infiltration testing was not performed in the remaining 4 SWM borings. The boring locations were staked in the field by the project Civil Engineer. The approximate boring locations are shown on the Boring Location Plan (Drawing 3) included in Appendix B.

The borings were advanced with hollow-stem augers and the subsurface soils were sampled at 2.5 ft and 5.0 ft intervals. Samples were taken by driving a 1-3/8-inch I.D. (2-inch O.D.) split-spoon sampler from a 140-pound hammer falling 30 inches in accordance with ASTM D-1586 specifications. The number of hammer blows required to drive the sampler three consecutive 6-inch increments is recorded and the blows of the last two increments are summed to obtain “Penetration Resistance” or “N” value. The penetration resistance, when properly evaluated, is an index to the soil strength and compression characteristics.

Representative portions of each soil sample were placed in glass jars and transported to HCEA's laboratory. In the laboratory, the samples were visually examined by the Geotechnical Engineer to verify the driller's field classifications. The samples were classified in accordance with the Unified and USDA Soil Classification Systems and the field classifications were revised where necessary. The Unified Soil Classification Symbols (USCS) appear on the Boring Logs and the system nomenclature is briefly described in Appendix B.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are shown on the Records of Soil Exploration (Boring Logs) in Appendix B. A brief description of the subsurface conditions and pertinent engineering characteristics of the soils are given below.

Strata divisions shown on the Boring Logs have been estimated based on visual examinations of the recovered boring samples. In the field, strata changes could occur gradually and/or at slightly different levels than indicated. Also, groundwater conditions indicated on the Boring Logs are those observed during the period of the subsurface exploration. Fluctuations in groundwater levels could occur seasonally and might also be influenced by changes in grading, runoff and infiltration rates, and other influencing factors.

Generalized subsurface conditions based on the results of the borings are discussed below:

4.1 Site Geology

The USGS geological map of Frederick County indicates that the project site is underlain by Granodiorite and Biotite Granite Gneiss of the Precambrian geologic period. The geology is reported to consist of light gray to pale green, fine-grained, granodiorite gneiss, and dark gray biotite granite gneiss with some augen gneiss; in places a sheared muscovite-biotite gneiss; local biotite schist bands; intruded by metadiabase feeder dikes of Catoctin Metabasalt.

In-situ chemical decomposition of the materials generally occurs as the result of percolating groundwater charged with carbon dioxide. The process typically produces a surficial layer of residual soils (soils formed in place and hence a resident of the area) having variable thickness and situated over the parent bedrock materials. Typically, the residual soils are silty and generally quite high in mica content. With depth, the soils generally increase in density and develop a remnant rock structure.

4.2 Surface Materials

The locations of all borings, except borings SWM-3 and SWM-14, were covered with grass and tree litter at the time of our subsurface exploration. Hence, commencing from the ground surface, approximate 3 to 6 inches of topsoil was encountered in the borings. The locations of borings SWM-3 and SWM-14 were covered with asphalt pavement. The pavement at the locations of these borings consisted of 2 to 3 inches of asphalt concrete underlain by 6 to 8 inches of aggregate base. Topsoil or asphalt pavement thickness should be expected to vary across the site.

4.3 Fill Materials

Apparent fill materials were identified in some of the borings. The fill materials encountered in the building and pavement borings were limited in the surface layers except for the borings located on the northeast corner of the proposed building (B-

21, B-22, and P-5). The materials encountered in these 3 borings extended to a depth of 8.5 feet. Fill materials that extended to depths that ranged from 5 to the boring termination depth of 12 feet were also encountered in SWM borings SWM-2, SWM-5, SWM-6, SWM-10, SWM-12, SWM-13, and SWM-14.

The fill soils consisted of various combinations of lean clay, elastic silt, silt, sand, and rock fragments. The stiffness of the cohesive fill soils generally ranged from soft to stiff. The relative density of the cohesionless fill materials varied from very loose to medium dense. Existing fill, especially those encountered in borings B-21, B-22, P-5, SWM-10, SWM-12, and SWM-13, appeared to be related to previous grading activities in the area. Hence, fill soils should be expected to be encountered in other areas of the site.

Since the size of the samples obtained is relatively small in comparison to the area extent of the site and since fill materials could be of similar composition to the natural soils encountered at the site, it is often difficult to determine the presence and composition of fill materials from the SPT samples.

We have reviewed the fill placement records for this project site (observation and testing performed by HCEA under separate project number/client on behalf of Frederick County Public Schools). Based on the fill placement records we reviewed and the results of test borings, the previously placed fill soils are expected to be encountered on the eastern portion of the site outside of the proposed building footprint except for a small area located on the northeast corner of the building in the areas of borings B-21 and B-22. Based on our visual observations of the samples, SPT data and information gathered about the previous grading activities performed on the project site, it is our professional opinion that the fill soils in the eastern portion were placed in a controlled manner with adequate compaction effort applied during placement. Accordingly, the fill soils are expected to be capable of supporting the proposed structures. However, the surficial fill soils encountered in the borings located in the proposed building and pavement areas may have to be removed and replaced with controlled fills depending on the results of a proofroll.

4.4 Natural Soil Materials

Below the surface or fill layers, natural soil materials were encountered in the test borings. The natural materials generally consisted of lean CLAY (CL) and SILT (ML) with varying amounts of sand, silty SAND (SM), and silty ROCK fragments with sand (GM). The stiffness of the cohesive natural soils varied from soft to very stiff. The relative densities of the cohesionless natural soils ranged from very loose to very dense.

4.5 Disintegrated Rock

Disintegrated Rock (also known as decomposed rock) is defined as a residual material with a penetration resistance (N-value) ranging from 60 blows per foot to 50 blows per 1-inch penetration. It typically retains the rock structure of the parent rock (i.e., is saprolitic) but exhibits the engineering characteristics of a soil when removed. Within a disintegrated rock zone, it is not uncommon to encounter slabs of rock, rock lenses, and/or boulders of intact rock. Disintegrated rock was encountered in all building borings and some of the pavement and SWM borings. A summary of the disintegrated Rock levels is provided below in Table 1.

4.6 Rock

Rock is defined as natural material with a penetration resistance of at least 50 blows per 1 inch of penetration. Refusal to augering, probable top of ROCK, was encountered in borings B-14, B-16, and B-21. Rock was not encountered in the remaining borings within the drilled depths.

A summary of the approximate disintegrated rock and rock levels is shown in Table 1 as follows:

Table 1 - Depth to Disintegrated Rock and Rock

Test Boring Number	Surface Elevation (feet)	Depth to Disintegrated Rock ft. (Elv.)	Depth of Rock ft. (Elv.)
B-11	437.7(+/-)	2.5 (435.2 +/-)	> 20
B-12	440.4 (+/-)	8.5 (431.9 +/-)	> 20
B-13	451.6(+/-)	8.5 (443.1 +/-)	> 20
B-14	450.4(+/-)	8.5 (441.9 +/-)	16 (434.4 +/-)
B-15	446.4(+/-)	13.5 (432.9 +/-)	> 20
B-16	443.7(+/-)	8.5 (435.2 +/-)	13 (430.7 +/-)
B-17	436.6(+/-)	18.5 (418.1 +/-)	> 20
B-18	434.4 (+/-)	13.5 (420.9 +/-)	> 20
B-19	441.6(+/-)	8.5 (433.1 +/-)	> 20
B-20	436.6(+/-)	8.5 (428.1 +/-)	> 20
B-21	428.8(+/-)	13.5 (415.3 +/-)	17 (411.8 +/-)
B-22	428.6(+/-)	18.5 (410.1 +/-)	> 20
B-23	438.7(+/-)	2.5 (436.2 +/-)	> 20
B-24	449.3(+/-)	13.5 (435.8 +/-)	> 20
B-25	450.1(+/-)	13.5 (436.6 +/-)	> 20
B-26	447.3(+/-)	13.5 (433.8 +/-)	> 20
B-27	442.6(+/-)	13.5 (429.1 +/-)	> 20
B-28	439.5(+/-)	13.5 (426 +/-)	> 20
B-29	447.2(+/-)	13.5 (433.7 +/-)	> 20
B-30	441.6(+/-)	13.5 (428.1 +/-)	> 20
P-2	436.7(+/-)	2.5 (434.2 +/-)	> 12
P-3	445.3(+/-)	2.5 (442.8 +/-)	> 12
P-5	429.3(+/-)	8.5 (420.8 +/-)	> 12
P-6	437.1 (+/-)	10.5 (426.6 +/-)	> 12
SWM-1	434.1(+/-)	8.5 (425.6 +/-)	> 12
SWM-3	436.4(+/-)	5 (431.4 +/-)	> 12
SWM-4	440(+/-)	2.5 (437.5 +/-)	> 12
SWM-8	439.6(+/-)	10.5 (429.1 +/-)	> 12
SWM-9	433(+/-)	10.5 (422.5 +/-)	> 12

It must be stressed that the composition of the material described on the test boring logs are based on a visual observation of material removed with the auger. In situ, the materials are very dense rock-like to rock materials. Excavation difficulty as well as specialized excavation techniques should be anticipated in the decomposed rock materials especially in denser intrusive rock lenses and/or deeper portions of the media.

4.7 Groundwater

Groundwater was monitored in the borings during and 24 hrs after completion of drilling activities. During these times, groundwater was not encountered in any of the borings. All borings caved-in after drilling completion.

A more accurate determination of the hydrostatic water table would require the installation of perforated pipes or piezometers which could be monitored over an extended period of time. The actual level of the hydrostatic water table and the amount and level of perched water should be anticipated to fluctuate throughout the year, depending on variations in precipitation, surface run-off, infiltration, site topography, and drainage.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following findings and recommendations are based on our observations at the site, an interpretation of the field data obtained during the subsurface exploration, and our experience with similar subsurface conditions and projects. Soil penetration data has been used to estimate a net allowable soil design bearing pressure using established correlations. Subsurface conditions in unexplored locations may vary from those encountered. If structure location, loading, or elevations are changed, we request that we be advised so that we may re-evaluate our recommendations.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil/subsurface conditions, permissible settlement, and construction constraints such as proximity to other structures, etc. The subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations with regard to both allowable bearing capacity and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction.

5.2 Foundation Design

Based upon the results of our geotechnical study done to date, it is currently the opinion of Hillis-Carnes Engineering Associates that the proposed school building, from a geotechnical loading viewpoint, may be supported on a spread footing foundation system bearing on controlled (structural) fill placed over approved materials, on existing natural soils or on a combination thereof.

The finished floor of the school building is planned at elevation of 441 feet based on the grading plan we reviewed. With this finished floor elevation, the footings are expected to bear at elevation 439 feet or lower. Existing natural materials and new controlled fills are expected to be encountered at the anticipated footing elevation as shown in the Boring Profile Sheet included in Appendix B of this report.

Our current study indicates that conventional spread footing foundations founded on existing natural soils and/or new controlled fill can be designed for a maximum net allowable soil design bearing pressure not in excess of 3,000 pounds per square foot. To reduce the possibility of localized shear failures, column and strip footings should be a minimum of 36 inches square and 18 inches wide, respectively.

It should be noted that to attain the recommended allowable bearing pressure, fill materials placed in the building area should be compacted in a controlled manner to at least 95 percent of the modified Proctor maximum dry density as detailed in *Section 7.3 – Controlled Structural Fill* section of the report.

During construction, approved footing subgrades should be protected from freezing temperatures, excessive loses of natural moisture (desiccation), excessive moisture accumulation, abusive construction trafficking/equipment, and other activities or elements considered detrimental to an otherwise suitable subgrade. Spread footings that will be subjected to freezing temperatures and associated frost susceptible materials subsequent to construction should be constructed at least 30 inches below adjacent exterior grades in order to bear below normal frost depth.

Footing lines to be located along a transition zone from natural soils to recently placed compacted structural fill, shall be reinforced with a minimum of two (2) #5 bars, which extend at least 60 inches horizontally in each direction from the transition plane in order to lessen the detrimental effects of differential settlement along the transition plane. For foundations situated on structural fill placed over approved materials, it is considered essential that the structural fill extend a minimum of 9 inches laterally beyond the footing perimeters for each vertical 12 inches of structural fill placed beneath the subject footing.

We consider it imperative that the footing excavations be observed and approved by a representative of Hillis-Carnes Engineering Associates directly prior to the placement of reinforcing steel and/or concrete. The purpose of the inspection would be to verify that the exposed materials have not been disturbed and will be capable of supporting the design bearing pressure. If soft or loose pockets are encountered in the footing excavations, the unsuitable material should be removed and replaced with structural fill or concrete.

5.3 Settlement

Based on the boring data and the anticipated loading, we estimate that total geotechnical related settlements for the foundations should not exceed one inch with differential settlement expected to be about half the total settlement. The magnitude of differential settlements will be influenced by the distribution of loads and the variability of underlying bearing materials. Quality control during construction is considered to be of extreme importance to ensure that subsequent settlements, following the construction process, are kept to a minimum.

5.4 Ground-Supported Floor Slabs

Based upon the results of our current study, it is the opinion of Hillis-Carnes Engineering Associates that the floor slabs may be designed as a slab-on-grade unit supported by the approved naturally occurring soils and/or structural fill placed over approved materials.

A crushed stone or washed gravel capillary beak, at least 6 inches thick, should be installed below floor slabs-on-grade. The contractor should compact the stone in place for particle interlock with at least two passes of suitable vibratory rollers. A vapor retardant should be used beneath basement/ground floor slabs that will be covered by tile, wood, carpet, impermeable floor coatings, and/or if other moisture-sensitive equipment or materials will be in contact with the floor. However, the use of vapor retardants may result in excessive curling of floor slabs during curing. We refer the floor slab designer to ACI 302.1R-89, Sections 8.4 and 11.11, for further discussion on vapor retardants, curling, and the means to minimize concrete shrinkage and curling.

Proper jointing of the ground floor slab is also essential to minimize cracking. ACI suggests that unreinforced, plain concrete slabs have joints at a spacing of 24 to 36 times the slab thickness, up to a maximum spacing of 18 feet. Floor slab construction should incorporate isolation joints along bearing walls and around column locations to allow minor movements to occur without damage. Utility or other construction excavations in the prepared floor subgrade should be backfilled to controlled fill criteria to provide uniform floor slab support.

New controlled (structural) fill and/or natural soils are expected to be present at the floor slab subgrades based on the proposed finished floor elevation. A subgrade modulus (k) of 125 pounds per cubic inch can be used for the floor slab design. This recommended value is based on 6 inches of crushed stone being present below the floor slab. Once again, quality control during construction is important to ensure that the floor slab subgrade is comprised of suitable soil materials.

On most projects, there is a substantial time difference between the initial grading and the actual construction of the floor slab. As a result, the subgrade soils are often disturbed by seasonal conditions and construction traffic. Therefore, provisions should be included for restoring the subgrade to a stable condition prior to the construction of the floor slab. It is recommended that the structural framing and the roof system be completed prior to attempting the restoration if at all feasible. Also, a representative of Hillis-Carnes Engineering Associates should inspect the floor slab areas prior to placing the crushed stone.

5.5 International Building Code (IBC) Site Classification

Our scope of services did not include a seismic condition survey to determine site-specific shear wave velocity information. IBC 2018 provides a methodology for interpretation of Standard Penetration Test resistance values (N-values) to determine a Site Class Definition. However, this method requires averaging N-values over the top 100 feet of the subsurface profile.

We note that the test borings for this project generally encountered loose to dense residual materials. In general accordance with the 2018 IBC, a Site Classification of “D” was established for the project site. To obtain a more accurate site class, a deeper boring (100 feet, as per the code) or more extensive testing must be used to evaluate the subsurface conditions.

5.6 Pavement Recommendations

Based on our review of the provided development plans, we understand that the new school will have new asphalt paved drives and parking areas. It is very important that the pavement subgrades be proofrolled under our observation. Soft soils encountered during proofrolling should be removed and replaced with new compacted fill. Note that relatively soft/loose layer of surficial soils was encountered in the borings which may require removal based on the actual moisture contents and proofroll tests. The surface of the pavement subgrades should be compacted to 97 percent of the maximum dry density, in accordance with the modified Proctor (AASHTO T-180).

Both cuts and fills will be required to reach the proposed pavement grades. California Bearing Ratio (CBR) tests were performed on three bulk samples obtained from the pavement borings. The laboratory results indicated a CBR of 2.5 to 3.3 for the on-site soils with a maximum swell of 4.5 to 6.9 % and the samples were classified as lean CLAY (CL). Due to the low CBR and high swell potential, these select onsite soils, when encountered at the proposed pavement subgrade, are NOT considered suitable as a pavement subgrade material, and should be kept a minimum of 2 feet below the design subgrade elevations. The pavement grades should then be restored with approved controlled fill materials (Liquid Limit less than 40, a plasticity index less than 12, a maximum dry density of no less than 110 pcf, and a minimum CBR of 4). We recommend that any controlled fills placed within top 2 feet of the paved areas also meet this criteria. Select cut soils, specially from deeper cut areas, are expected to be suitable for this use and their suitability should be determined during construction prior to use as pavement subgrade.

In order to provide design pavement sections, we have utilized a design CBR value of 4. Accordingly, any fill materials placed in the top 2 feet of the pavements should have a minimum CBR of 4. The recommended pavement CBR value requires the upper 12 inches of the subgrade to be compacted to at least 97% of the maximum dry density as determined by the modified Proctor (AASHTO T-180). It is recommended that exposed pavement subgrades be observed, tested, and evaluated by the Geotechnical Engineer prior to paving to determine that the design CBR value is present.

Asphalt pavement recommendations for light and heavy-duty pavements area are provided below in Table 2. Light duty pavements should be used in areas where mostly passenger cars will drive and/or park. Heavy duty pavement sections should be used in high traffic and heavy traffic areas. Some examples of heavy-duty pavement areas include entries and exits, drop off zones, truck loading and delivery zones, truck parking, and trash dumpster pads. The heavy-duty section was designed utilizing a design ESAL of 150,000. However, if a different traffic volume is developed during further project design and tenant usage, this office should be notified for a re-evaluation of the pavement section.

Table 2 – Pavement Sections

Pavement Material	Light Duty	Heavy Duty (ESAL=150,000)
Asphalt Concrete	4”	5.5”
Graded Aggregate Base	6”	6”
Approved Subgrade (min. CBR of 4)		

The recommended pavement sections are not intended to accommodate construction traffic. If the asphalt base course is placed prior to the substantial completion of the project, portions of the asphalt should be expected to be damaged and require replacement prior to the placement of the surface course. Pavement subgrade preparation and paving should be performed during the dryer portions of the year, typically June to October. Pavement edge drains may be required at low areas where water may accumulate within the graded aggregate base.

All structural fill below pavements should be placed in horizontal loose lifts not in excess of 8 inches thick and compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor (AASHTO T-180). However, the pavement subgrade should be compacted to at least 97 percent per same standard. The moisture content of the fill should be maintained within 3% of the optimum moisture content as determined by AASHTO T-180.

6.0 IN-SITU INFILTRATION TESTING

The primary criteria for a site to be deemed suitable for infiltration practices are:

1. Bedrock must be deeper than 4 feet below the bottom of the infiltration.
2. Typical groundwater levels must be deeper than 4 feet below the bottom of the infiltration facility.
3. Infiltration must take place in natural ground.
4. The natural soils below the placed infiltration media must be capable of sustaining a minimum infiltration rate of 0.52 inches per hour over the course of a four-hour field infiltration test.

PVC pipes were placed approximately at a depth of 8 feet at drilled locations offset from borings SWM-1, SWM-2, SWM-4, SWM-5, SWM-8, SWM-10, SWM-11, SWM-

12, SWM-13, and SWM-14. The pipe at each location was gently tapped to seat it into the base of the boring. The annular space was backfilled with soil material. Subsequent to the installation, a minimum 24-inch head of water was added to each PVC pipe at completion of the installation for pre-soak purposes. The in-situ infiltration testing was conducted following the pre-soak period for 4-hours. To comply with Maryland Department of the Environment requirements, a laboratory-testing program consisting of moisture content determinations and classification (Hydrometer and gradation) testing was conducted. The laboratory test results and the field infiltration test results for the locations tested are included in Appendix D and summarized below in Table 3.

Table 3 - Infiltration Summary

Test Boring No.	Surface Elevation (ft)	Test Depth Below Existing Grade ft (Elv.)	USDA Classification	Infiltration Rate (in/hr)
SWM-1	434.1+/-	8 (426.1)	SANDY LOAM	0
SWM-2	437.4+/-	8 (429.4)	SILT LOAM	0
SWM-4	439.9+/-	8 (431.9)	SANDY LOAM	0
SWM-5	434.4+/-	8 (426.4)	SANDY LOAM	0
SWM-8	439.6+/-	8 (431.6)	SANDY LOAM	0.03
SWM-10	426.3+/-	8 (418.3)	SANDY LOAM	0.06
SWM-11	435.9+/-	8 (427.9)	LOAM	0.06
SWM-12	430.8+/-	8 (422.8)	SANDY LOAM	0.06
SWM-13	421.8+/-	8 (413.8)	SANDY LOAM	0.03
SWM-14	436.7+/-	8 (428.7)	LOAM	0.06

No bedrock or groundwater were encountered in the SWM borings. However, the infiltration rates estimated in the pipes were less than the required 0.52 in/hr as shown above in Table 3. Therefore, the project site at the tested locations and depths are not deemed to be suitable for infiltration practices. We recommend all SWM facilities planned at this site to be designed with underdrains.

7.0 CONSTRUCTION RECOMMENDATIONS

7.1 Site Preparation

Before proceeding with construction, existing structures (including all above and below grade construction) within the areas to be developed should be removed prior to the initiation of new construction. In addition, organic materials and other deleterious non-soil materials (if present) should be stripped and/or removed from the proposed construction areas. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water. Existing underground utilities, if present, should be re-routed to locations a suitable distance outside of the proposed structure footprints.

A geotechnical engineer should evaluate the exposed subgrade. At that time, the engineer should require proofrolling of the subgrade with a 20-ton payload dump truck or other pneumatic-tired vehicle of similar size and weight. Proofrolling should be performed during an interval of acceptable weather conditions and not while the site is wet, frozen, or severely desiccated. The purpose of the proofrolling would be to locate soft, weak, or excessively wet soils present at the time of construction.

Particular attention should be given to existing utility trenches, if present within the proposed construction limits. Our experience is that utility trenches are sometimes backfilled with very little compactive effort. Accordingly, the utilities and the associated backfill should be removed during the initial phase of the construction process. Where utility lines are removed, the trench subgrade should be verified by a representative of Hillis-Carnes Engineering Associates prior to backfilling in accordance with the controlled structural fill recommendations provided in this report.

The proofrolling observation is an opportunity for the geotechnical engineer to locate inconsistencies intermediate of our boring locations in the existing subgrade. Any unsuitable materials observed during the evaluation and proofrolling operations should be undercut and replaced with compacted fill or stabilized in-place. The possible need for, and extent of, undercutting and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction. Once the site has been properly prepared, the construction process may proceed.

The action of heavy equipment may very well create pumping and a general deterioration of the soils. This may especially be applicable if the work is conducted in the presence of high moisture contents. This situation could impede the progress of the construction activities and/or necessitate the implementation of remedial work to permit the construction process to continue. If such problems arise, the geotechnical engineer should be consulted for an evaluation of the conditions.

7.2 Foundation Construction

All foundation subgrades should be observed, evaluated, and verified for the design bearing pressure by the geotechnical engineer after excavation and prior to reinforcement steel placement. If relatively deep or soft fill are encountered during foundation construction, localized undercutting and/or in-place stabilization of foundation subgrades will be required. The actual need for, and extent of, undercutting should be based on field observations made by the geotechnical engineer at the time of construction.

Excavations for footings should be made in such a way so as to provide bearing surfaces that are firm, level, and free of loose, soft, wet, or otherwise unsuitable soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements magnitudes will increase. Foundation excavations should be concreted as soon as practical after they are excavated. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation.

7.3 Controlled Structural Fill

Based on the results of the test borings and provided grading plan, controlled structural fill will be required in the building and pavement areas. Controlled structural fill may be constructed using approved non-organic on-site soils or an approved off-site borrow material. Any fill imported from off site should be free of debris and organic material. It should have a Liquid Limit less than 40 and a Plasticity Index less than 12. The moisture content of the fill should be within three percentage points of the optimum moisture content as determined by the modified Proctor density test or drier if necessary so as to attain proper compaction. This may require the contractor to dry soils during wet weather or add water during dry, hot weather. The geotechnical engineer should individually evaluate structural fill material. Based on the lab test results, selective on-site materials are expected to meet these controlled fill specifications.

Controlled structural fill should be free of boulders, organic matter, debris, or other deleterious materials and should have a maximum particle size no greater than 4 inches. In addition, we recommend a minimum modified Proctor (ASTM D 1557) maximum dry density of 110 pounds per cubic feet for fill materials.

It is not anticipated that some material larger than the specified 4 inches will be encountered, but if it is, such material should not be used for utility trench or foundation backfill but may be suitable for initial portions of the site in the deeper fill areas in green or parking lot areas. More specific determinations can best be made in the field after assessing the site-specific situation. The material should be enveloped with filter fabric or ‘choked off’ with graded aggregate prior to overlaying the stone with soil material. Also, the material should not be used in the upper 12 inches of the pavement/floor slab subgrade as grading difficulty will result.

Fill materials should be placed in horizontal lifts with maximum height of 8 inches loose measure. New fill should be adequately keyed into stripped and scarified subgrade soils and should, where applicable, be properly benched into existing slopes or laid-back portions of excavations. During fill operations, positive surface drainage should be maintained to prevent the accumulation of water. We recommend that structural fill be compacted to at least 95 percent of the modified Proctor maximum dry density. In confined areas such as utility trenches and foundation walls, portable compaction equipment and thinner lifts of 3 to 4 inches may be required to achieve adequate degrees of compaction.

Based on the materials sampled in the borings and our experience with similar materials, the on-site coarse-grained soils (free of any organic materials) are generally considered suitable for controlled fill. However, some of the existing fine-grained soils are considered to have moderate swell potential and are not considered to be suitable for controlled fill. Therefore, there may be a need for an outside borrow source depending on the amount of controlled fill required on site.

We recommend that the contractor have equipment on site during earthwork for both drying and wetting of the soils as moisture alterations could very well be necessary at the time of construction. Moisture control may be especially difficult during winter months or extended periods of rain. Attempts to work the soils when wet can be expected to result in deterioration of otherwise suitable soil conditions of previously placed and properly compacted fill.

Where construction traffic or weather has disturbed the subgrade, the affected soils intended for structural support should be scarified and re-compacted. Each lift of fill should be tested in order to confirm that the recommended degree of compaction is attained. Field density tests to verify fill compaction should be performed for every 5000 square feet (approximately 70 feet square) of fill area, with a minimum of two tests per lift.

7.4 Subsurface Water Conditions and Site Drainage

Subsurface water for the purposes of this report is defined as water encountered below the existing ground surface. Based on the subsurface water data obtained during our exploration program and the proposed construction, subsurface water is not anticipated during the anticipated earthwork, shallow foundation excavations and is estimated to occur below foundation levels. Of course, fluctuations in subsurface water levels and soil moisture can be anticipated with seasonal changes, as well as changes in precipitation amounts and rainfall runoff characteristics.

It is considered essential that adequate drainage is provided at the site at all times to minimize any increase in moisture content of the subsurface materials. This is considered to be critical for paved areas due to the potential loss of subgrade strength, freeze thaw activity of the soils, and potential dissolution related activity. All areas should be sloped away from the structure to prevent the collection of water around the building. The site drainage should also be such that the run-off onto adjacent properties is properly controlled. Gutters, downspouts and planter areas should be properly designed and maintained so that water is routed away from the various facilities and into the storm drain system.

7.5 Rock Excavation

Based on the test borings results, excavations for the foundations, storm drain, and other utilities are expected to encounter disintegrated rock. Excavations that extend into disintegrated rock may also encounter zones of hard and/or intact rock. We note that geotechnical drilling equipment used in our exploration is sometimes capable of penetrating material that would not be rippable using conventional excavating equipment. We recommend that an air-track investigation be performed along the proposed utilities, once the invert grades are determined, to create a profile of the rock surface.

Rock excavation quantities are frequently an issue of contention, therefore the following definition of rock is provided for general use at this site. Rock is defined as any material which cannot be dislodged by a Caterpillar D-8 tractor with a hydraulic ripper (or a Caterpillar 235 excavator with a rock bucket), or equivalent, without the use of blasting. Excavation of boulders or masses of rock exceeding one cubic yard in volume should also be considered rock excavation.

We recommend an unclassified earthwork specification. The unclassified excavation pays for any and all excavation on either a lump sum or single unit price basis. Minimal record keeping is required for the unclassified specification; however, the contractor assumes much of the risk for variability in subsurface conditions and may result in an increased cost contingency in the bid. The unclassified classification is appropriate if an upfront excavation cost is desired. Alternatively, the classified Rock excavation specification pays for Rock excavation on a unit rate basis.

8.0 CONTINUATION OF SERVICES

Additional construction related services recommended for the project are as follows:

General Reviews

It is recommended that Hillis-Carnes Engineering Associates be given the opportunity to review the various design information, drawings, and specifications as the design process advances. This review evaluates whether the recommendations and comments provided herein are appropriate and have been understood and properly implemented.

Site Preparation

The geotechnical engineer should observe the site after it has been stripped and excavated. The individual should determine if any precautionary measures, undercutting, and/or or in-place densification is necessary to prepare a subgrade for structural fill placement, foundation construction and floor slab construction, and pavement construction.

Fill Placement and Compaction

The geotechnical engineer should witness any required fill operations and should verify that an adequate degree of compaction is achieved. The individual should observe and approve all on-site or borrow materials used and should determine if they are suitable.

Foundation Excavations

The geotechnical engineer should observe the various excavations for the project. He should verify that the design bearing pressure is available and that no loose or soft areas exist directly beneath the bearing surfaces of the excavations.

9.0 LIMITATIONS

This report has been prepared for the exclusive use of the project site. Our services were performed in accordance with contemporary soil and foundation engineering practices. No warranty, either expressed or implied, is made. Our conclusions and recommendations are based on design information furnished to us, the data obtained from the previously described subsurface exploration program, and current geotechnical engineering practice. The findings and recommendations do not reflect variations in subsurface conditions that could exist between the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon on-site observations of the conditions.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions in other areas will differ from those at the boring locations and the conditions may not be as anticipated by the designers. Additionally, the construction process may alter the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork and foundation construction to the extent feasible to verify that the conditions anticipated in design actually exist in the field at the time of construction. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

In the event that changes are made in the design or location of the proposed structure, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

It is important to note that our study was done in an effort to assist planning and design personnel in the preparation of generalized drawings and specifications for the project. As a result of this, potential contractors should be encouraged to conduct their own individually tailored studies to assess surface conditions, soil types and conditions, rock levels and conditions, excavation slope gradients, and ground water/perched water levels and conditions. Specifically, our report has been prepared for generalized information for planning and design purposes not for bid preparation purposes.

APPENDIX

Appendix A
Drawing 1: Site Vicinity Plan
Drawing 2: Site Location Plan

Appendix B
Drawing 3: Boring Location Plan
Records of Soil Exploration (Test Boring Logs)
Soil Boring Profile
General Notes for Subsurface Records
Soil Identification Sheet

Appendix C
Drawing 4: Site Aerial
Drawing 5: Site Geological Excerpt

Appendix D
Laboratory Results
Infiltration Logs

Important Information about This
Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

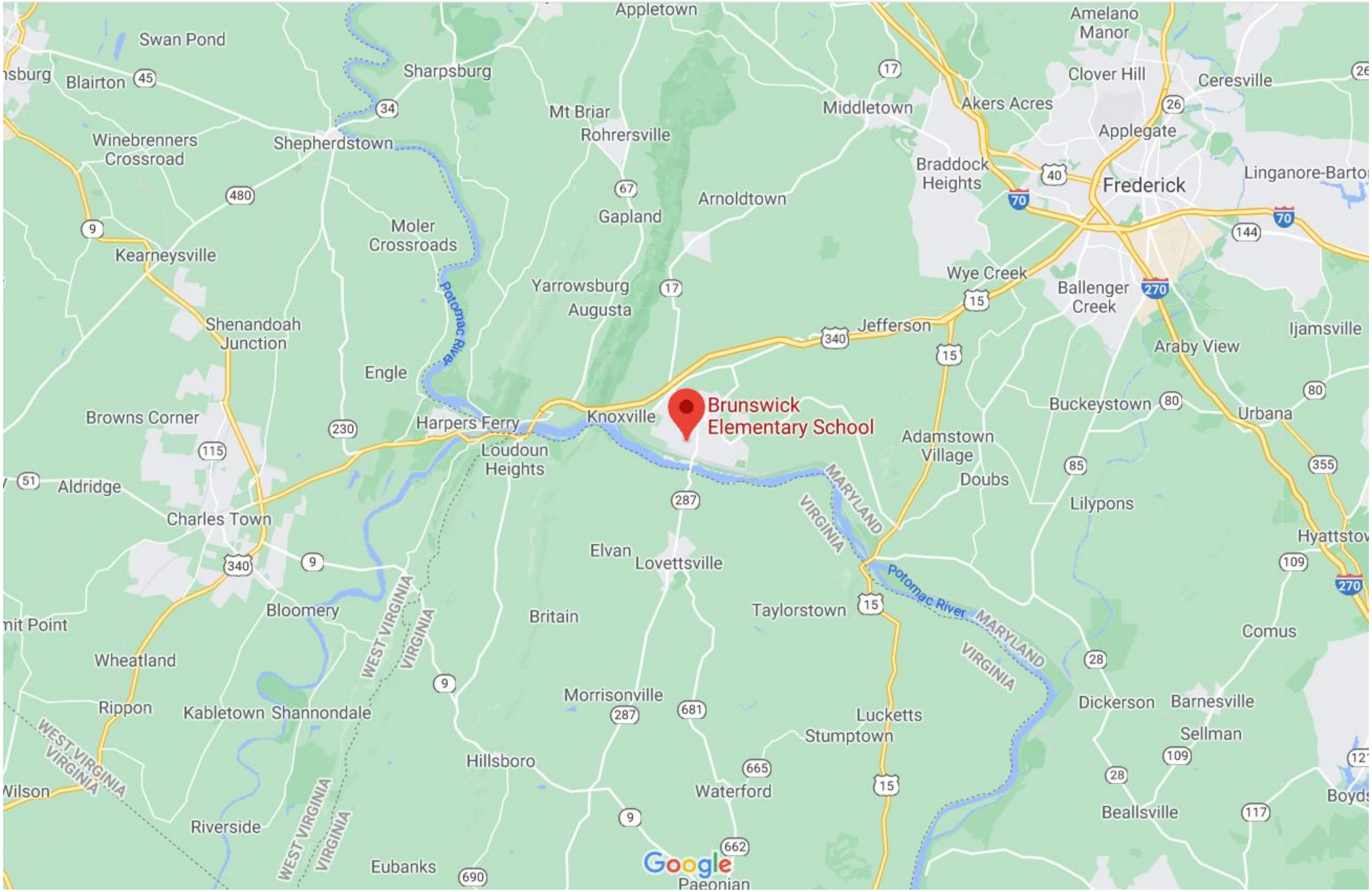
Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GBA
GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Appendix A



HILLIS-CARNES
Engineering Associates, Inc.

PROJECT NO.: 22820A

SCALE: NTS

DATE: April 12, 2021

Site Vicinity, Brunswick Elementary School, Brunswick, MD

Drawing No.
1

HILLIS-CARNES
Engineering Associates, Inc.

PROJECT NO.: 22820A

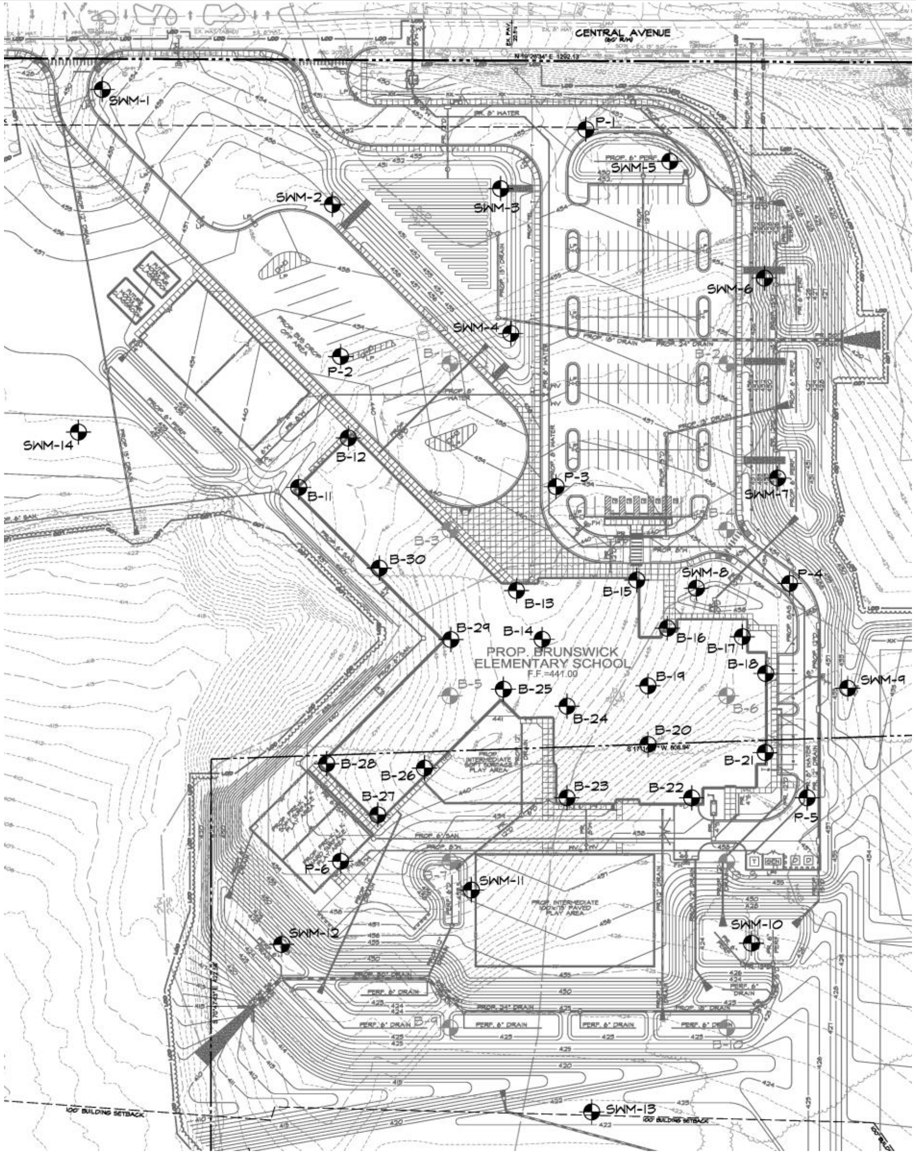
SCALE: NTS

DATE: April 12, 2021

Site Location, Brunswick Elementary School, Brunswick, MD

Drawing No.
2

Appendix B



HILLIS-CARNES

Engineering Associates, Inc.

PROJECT NO.: 22820A

SCALE: NTS

DATE: April 12, 2021

Boring Location Plan, Brunswick Elementary School Replacement, Brunswick, MD

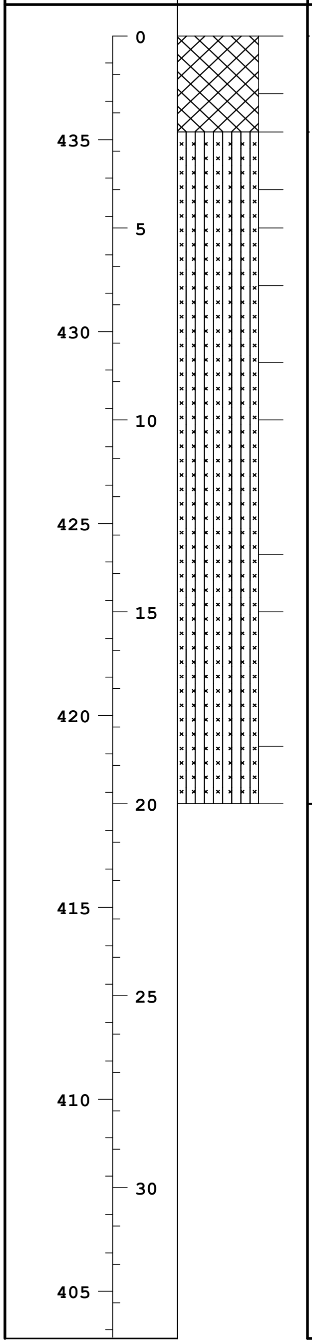
DRAWING NO.
3

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

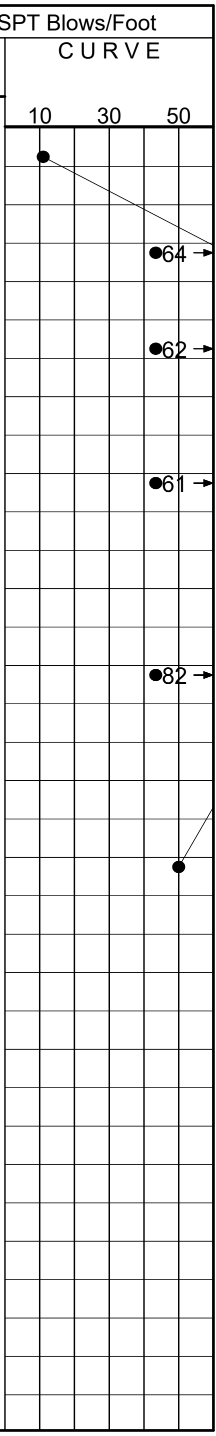
Project Name Brunswick Elementary School
Boring No. B-11
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 437.7 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/17/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/17/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown and light brown sandy SILT, with trace of rock fragments, moist, medium dense, (Probable FILL as ML)	3" topsoil	14		3-4-7	11
Light gray disintegrated ROCK, moist, very dense		18		10-33-31	64
		18		10-26-36	62
- brown		10		18-27-34	61
- brown with light gray		14		21-36-46	82
		1		50/1"	50/1"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	14.5 ft.
AFTER 24 HRS.	Dry ft.	14 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS.

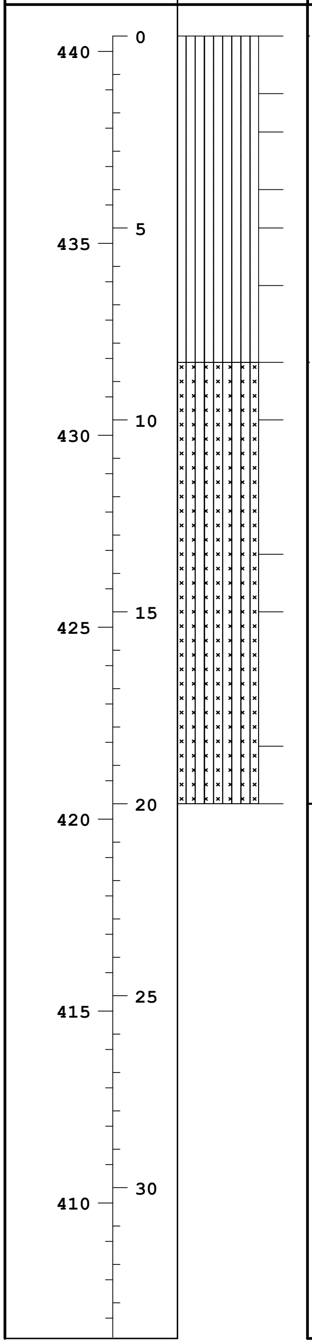
HILLIS - CARNES ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

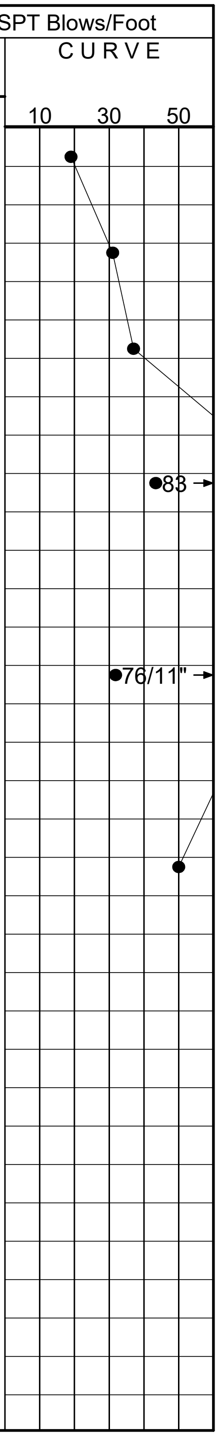
Project Name **Brunswick Elementary School** Boring No. **B-12**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **440.4** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/17/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/17/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with trace of rock fragments, moist, medium dense, (ML-Natural)	6" mulch 1" gravel	16		3-7-12	19
Brown and light gray sandy SILT with rock fragments, moist, dense, (ML)		14		3-13-18	31
- light gray		16		4-15-22	37
Brown with light gray disintegrated ROCK, moist, very dense		18		31-33-50	83
		14		16-26-50/5"	76/ 11"
		3		38-50/5"	50/5"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	13.5 ft.
AFTER 24 HRS.	ft.	ft.
AFTER ___ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **B-13**

Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

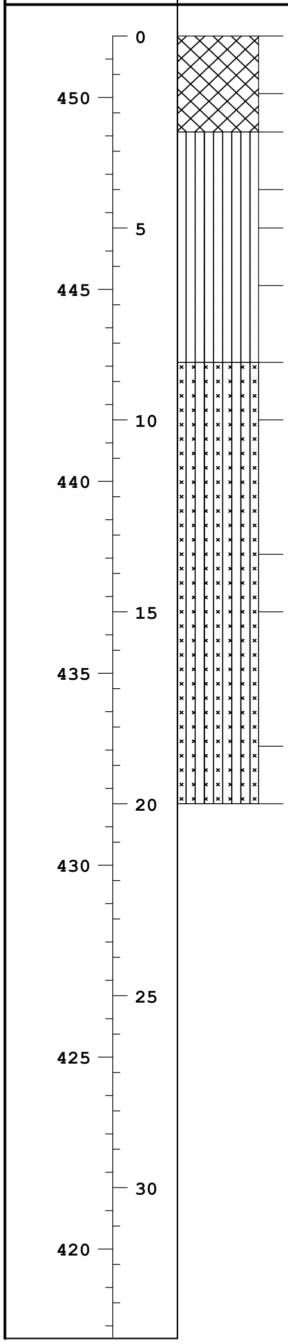
SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **451.6** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

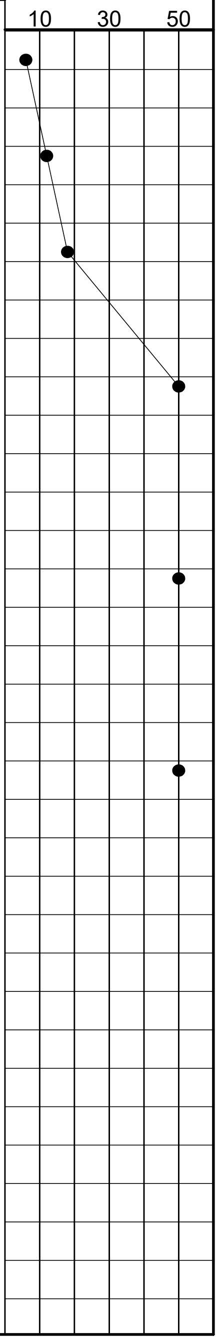
Date Started **03/15/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/15/2021**

ELEVATION/ DEPTH — SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown Elastic SILT with sand, moist, loose, (Probable FILL as MH)	3" topsoil	8		2-2-4	6
Reddish brown sandy SILT, moist, medium dense, (ML-Natural)		18		3-5-7	12
- light brown		18		4-6-12	18
Light brown disintegrated ROCK, moist, very dense		6		44-50/2"	50/2"
- brown		5		50/5"	50/5"
- white		2		50/2"	50/2"
	End of boring at 20 feet below grade.				

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	13 ft.
AFTER 24 HRS.	Dry ft.	13 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

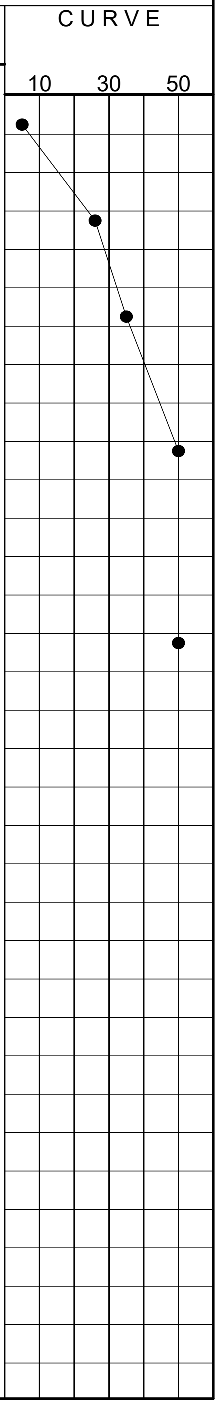
RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **B-14**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **450.4** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/13/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/13/2021**

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
450 / 0		Brown with dark brown sandy SILT, moist, loose, (Probable FILL as ML)	4" topsoil	10		1-2-3	5
		Light gray sandy SILT, moist, medium dense, (ML-Natural)		18		9-13-13	26
445 / 5		- dense		18		9-13-22	35
		Light brown disintegrated ROCK, moist, very dense		9		40-50/3"	50/3"
440 / 10							
		- very light gray		1		50/1"	50/1"
435 / 15							
		Probable ROCK	Auger Refusal at 16 feet below grade.				
430 / 20							
425 / 25							
420 / 30							



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	10.5 ft.
AFTER 24 HRS.	Dry ft.	10.5 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

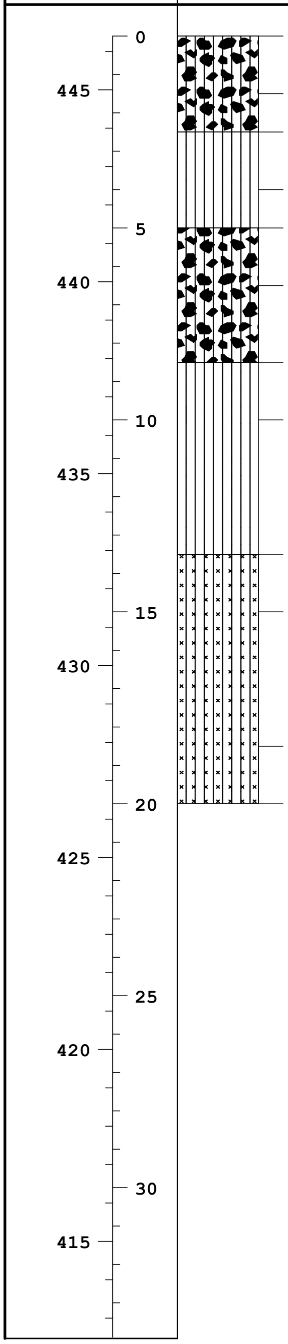
RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. B-15
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

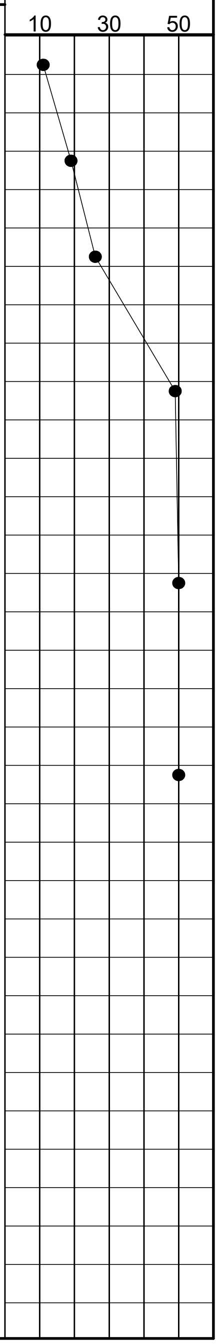
Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 446.4 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/19/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/19/2021

ELEVATION/ DEPTH — SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown silty ROCK fragments with sand, moist, medium dense, (GM-Natural)	4" topsoil	10		1-4-7	11
Light gray sandy SILT with rock fragments, moist, medium dense, (ML)		18		3-9-10	19
Brown and light gray silty ROCK fragments with sand, moist, medium dense, (GM)		14		10-12-14	26
Light brown sandy SILT, moist, dense, (ML)		16		13-23-26	49
Very light gray disintegrated ROCK, moist, very dense		3		33-50/4"	50/4"
- white		1		50/2"	50/2"
	End of boring at 20 feet below grade.				

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	14.5 ft.
AFTER 24 HRS.	Dry ft.	14.2 ft.
AFTER ____ HRS.	______ ft.	______ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

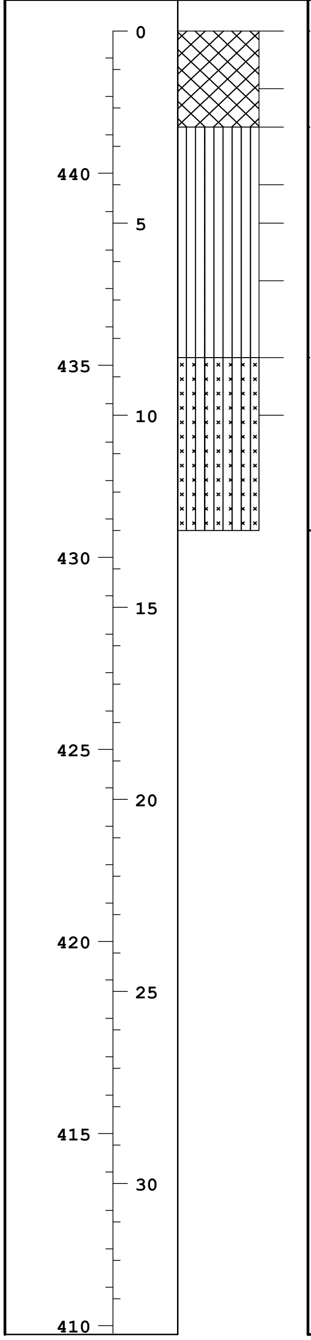
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

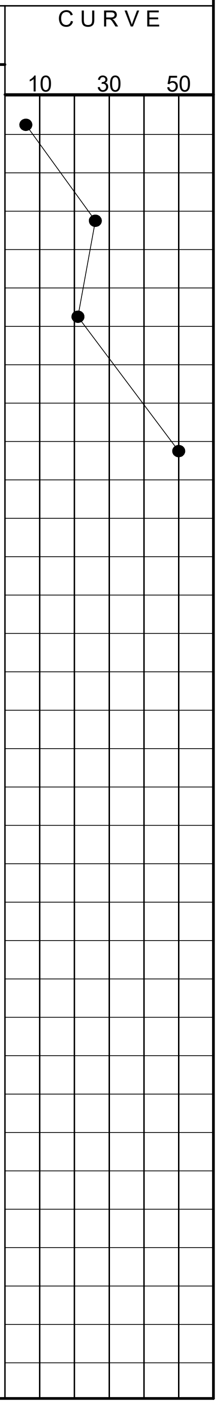
Project Name **Brunswick Elementary School** Boring No. **B-16**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **443.7** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/12/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/12/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown and brown sandy SILT, moist, loose, (Probable FILL as ML)	6" topsoil	10		2-2-4	6
Light brown sandy SILT, moist, medium dense, (ML-Natural)		15		14-13-13	26
- grayish brown		16		7-11-10	21
Brown disintegrated ROCK, moist, very dense		9		40-50/3"	50/3"
Probable ROCK	Auger Refusal at 13 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	6.8 ft.
AFTER 24 HRS.	Dry ft.	6.6 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS.

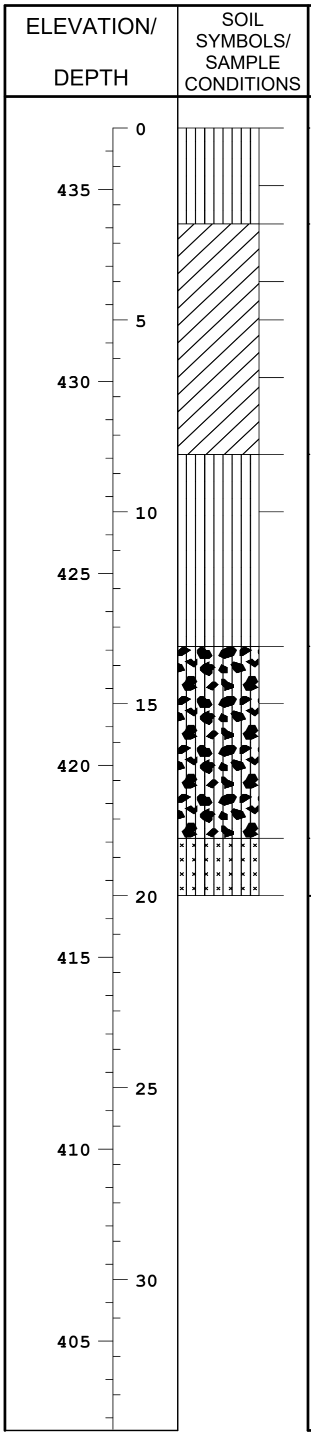
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

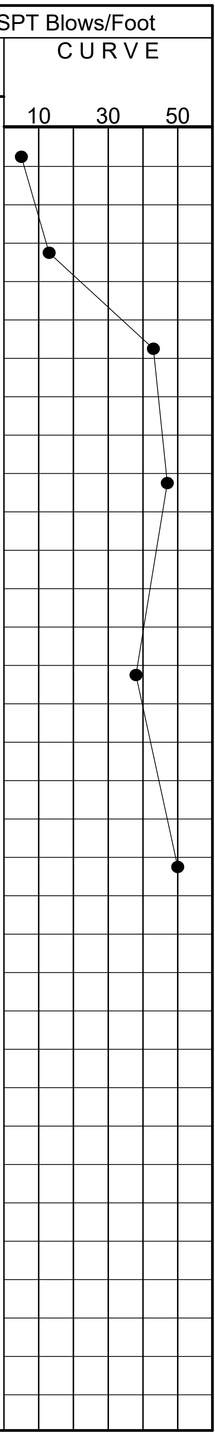
Project Name: Brunswick Elementary School
Boring No.: B-17
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 436.6 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/19/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/19/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with fine roots, moist, loose, (ML-Natural)	4" topsoil	14		1-2-3	5
Brown lean CLAY with sand, moist, stiff, (CL)		16		5-6-7	13
- light brown and dark brown, hard	with tree roots	14		7-16-27	43
Grayish brown sandy SILT, moist, dense, (ML)		14		13-23-26	47
Dark greenish gray silty ROCK fragments with sand, moist, dense, (GM)		18		14-16-22	38
Brown disintegrated ROCK, moist, very dense		2		50/2"	50/2"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	14.5 ft.
AFTER 24 HRS.	Dry ft.	14.5 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School Boring No. B-18

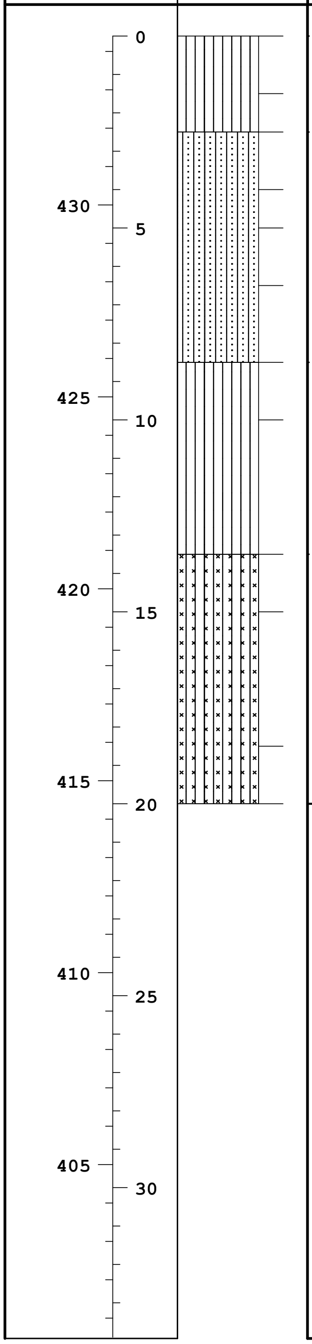
Location 400 Central Avenue, Brunswick, MD Job # 22820A

SAMPLER

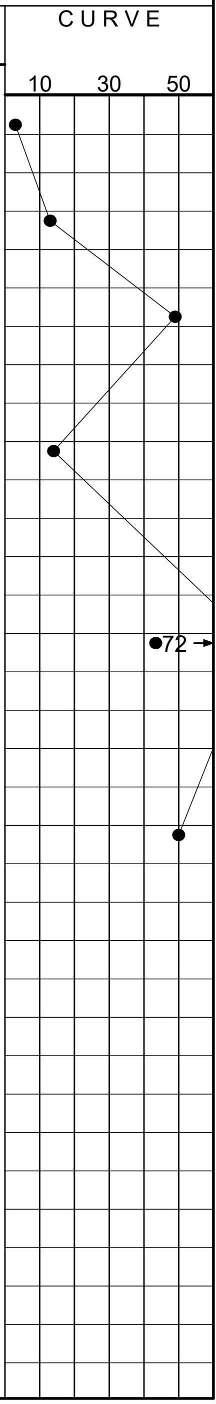
Datum MSL Hammer Wt. 140 lbs. Hole Diameter 3.25 in. Foreman Jim Russell

Surf. Elev. 434.4 Ft. Hammer Drop 30 in. Rock Core Diameter NA Inspector Robel Gibbe

Date Started 03/17/2021 Pipe Size 2 O.D. in. Boring Method HSA-SPT Date Completed 03/17/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown sandy SILT, with fine roots, moist, very loose, (ML-Natural)	4" topsoil	10		1-1-2	3
Light brown silty SAND with rock fragments, moist, medium dense, (SM)		12		5-6-7	13
- dense		18		10-19-30	49
Brown sandy SILT, moist, medium dense, (ML)		10		4-5-9	14
Brown and white disintegrated ROCK, moist, very dense		16		16-22-50	72
- light gray		4		33-50/3"	50/3"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	14.5 ft.
AFTER 24 HRS.	Dry ft.	14.2 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School

Boring No. B-19

Location 400 Central Avenue, Brunswick, MD

Job # 22820A

SAMPLER

Datum MSL

Hammer Wt. 140 lbs.

Hole Diameter 3.25 in.

Foreman Jim Russell

Surf. Elev. 441.6 Ft.

Hammer Drop 30 in.

Rock Core Diameter NA

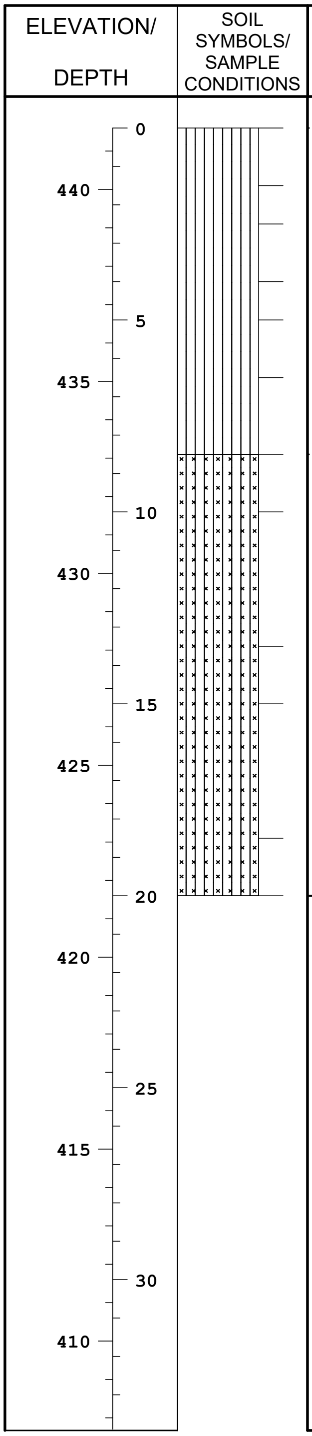
Inspector Robel Gibbe

Date Started 03/12/2021

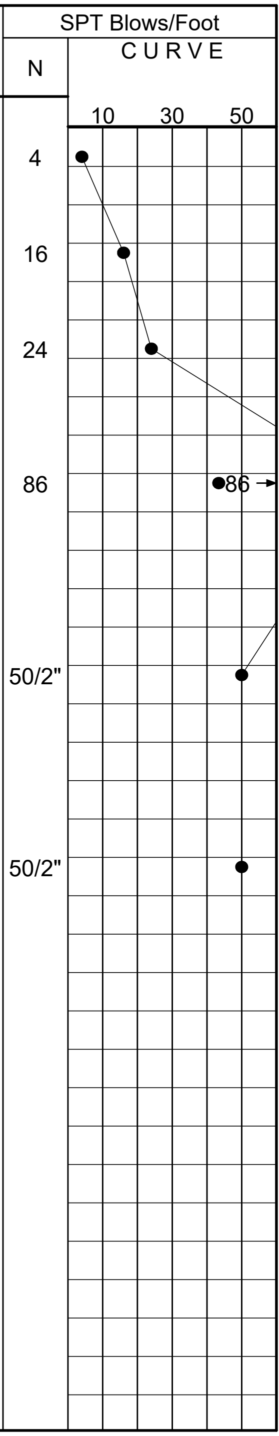
Pipe Size 2 O.D. in.

Boring Method HSA-SPT

Date Completed 03/12/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with trace of rock fragments and roots, moist, very loose, (ML-Natural)	6" topsoil	12		2-2-2	4
Light brown sandy SILT, moist, medium dense, (ML)		16		4-7-9	16
		18		6-11-13	24
Multicolored disintegrated ROCK, moist, very dense		16		21-39-47	86
- light gray		2		50/2"	50/2"
- white		1		50/2"	50/2"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	13.4	ft.
AFTER 24 HRS.	Dry	ft.	13	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

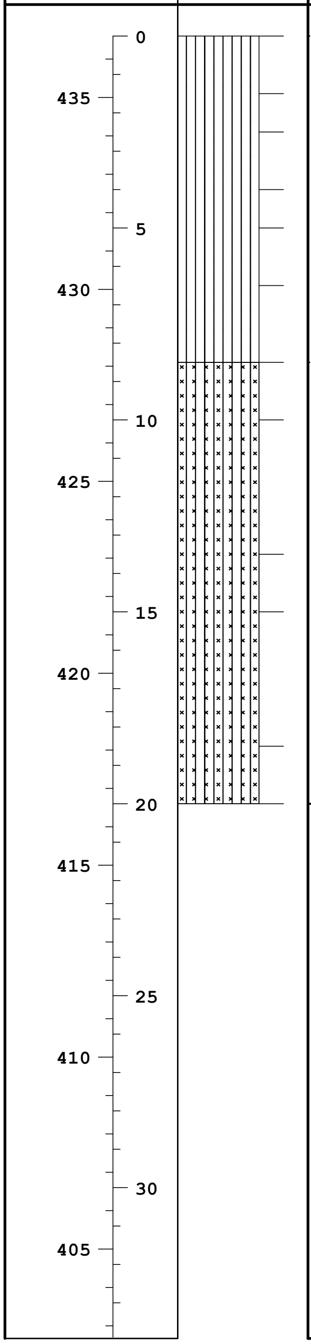
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

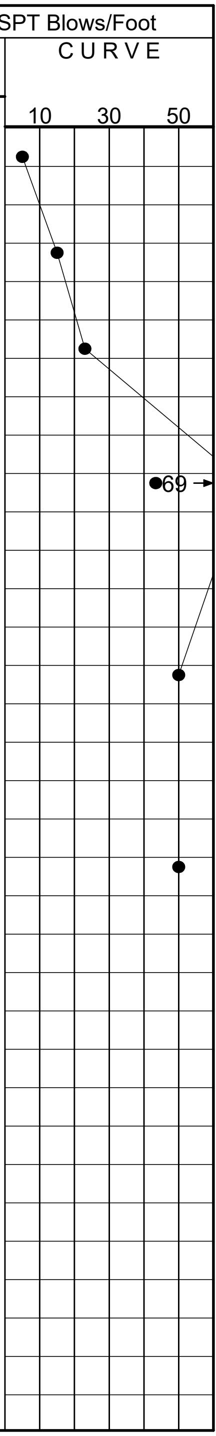
Project Name **Brunswick Elementary School** Boring No. **B-20**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **436.6** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/12/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/12/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, moist, loose, (ML-Natural)	6" topsoil	11		2-2-3	5
- grayish brown, medium dense		10		3-5-10	15
		18		7-12-11	23
Light brown disintegrated ROCK, moist, very dense		5		17-40-29	69
		5		50/5"	50/5"
- light gray		2		50/2"	50/2"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	8.9	ft.
AFTER 24 HRS.	Dry	ft.	8	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

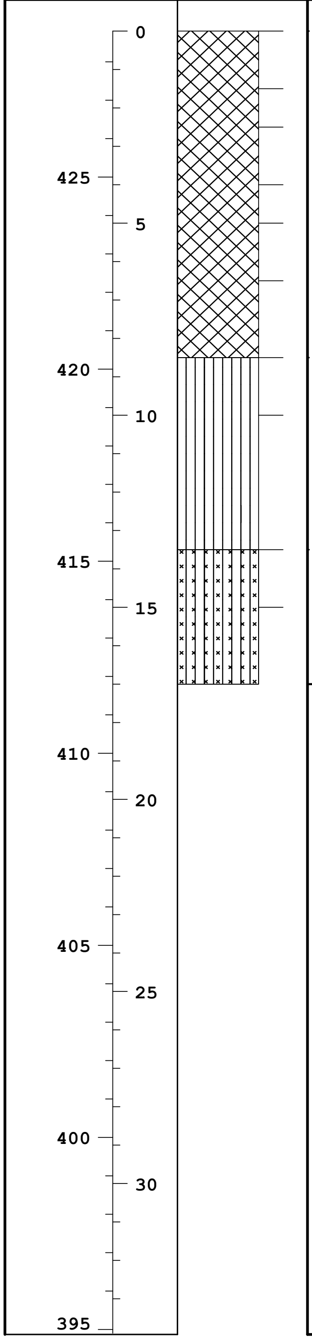
RECORD OF SOIL EXPLORATION

Project Name: Brunswick Elementary School
Boring No.: B-21
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

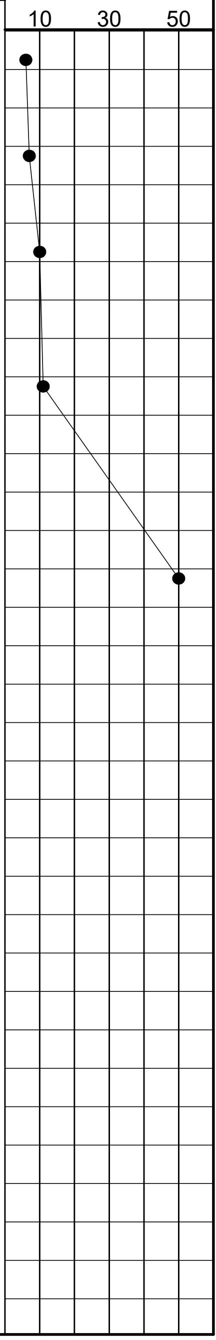
Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 428.8 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/12/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/12/2021

ELEVATION/ DEPTH — SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with trace of rock fragments, moist, loose, (Controlled FILL as ML)	3" topsoil	14		1-2-4	6
- dark brown		13		2-3-4	7
Brown sandy SILT, with trace of rock fragments, moist, loose, (Controlled FILL as ML)		15		2-4-6	10
Brown sandy SILT, moist, medium dense, (ML-Natural)		18		4-5-6	11
Light gray disintegrated ROCK, moist, very dense		9		48-50/3"	50/3"
Probable ROCK	Auger Refusal at 17 feet below grade				

SPT Blows/Foot — CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	12.4 ft.
AFTER 24 HRS.	Dry ft.	12.2 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

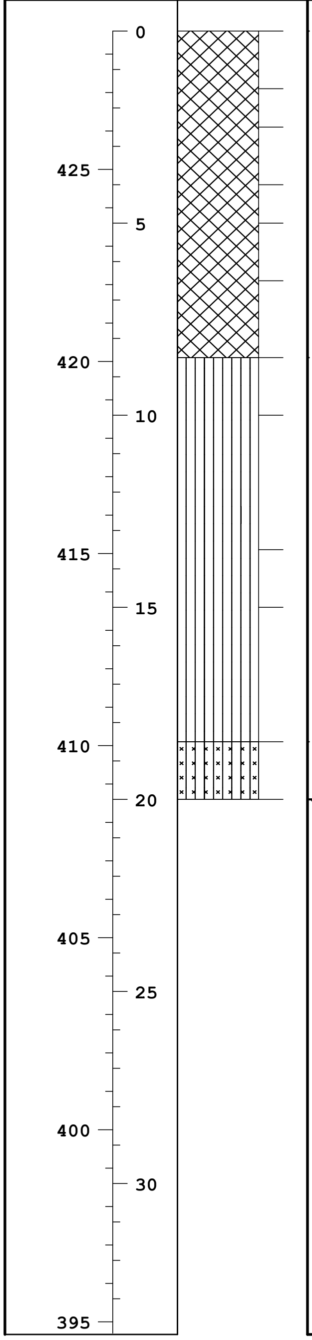
RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. B-22
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

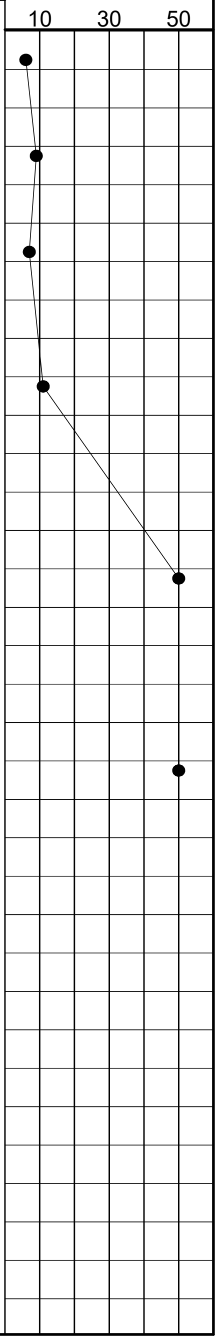
Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 428.6 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/12/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/12/2021

ELEVATION/ DEPTH — SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with trace of rock fragments, moist, loose, (Controlled FILL as ML)	3" topsoil	12		2-2-4	6
- with trace of organic		4		4-4-5	9
- very dark brown, with organic		11		3-3-4	7
Light gray and reddish brown sandy SILT with rock fragments, moist, medium dense, (ML-Natural)		14		5-6-5	11
- dense		17		12-20-30	50
Light gray disintegrated ROCK, moist, very dense	End of boring at 20 feet below grade.	5		50/5"	50/5"

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	15.4	ft.
AFTER 24 HRS.	Dry	ft.	15	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

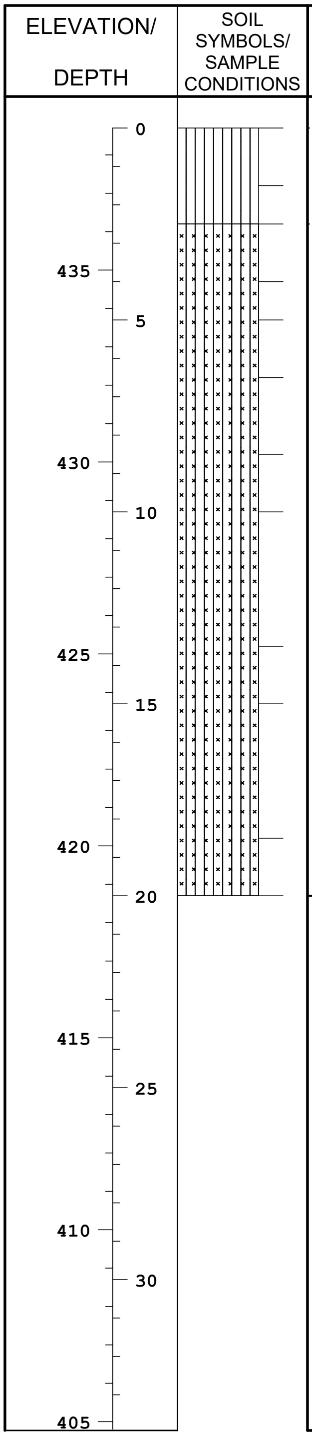
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

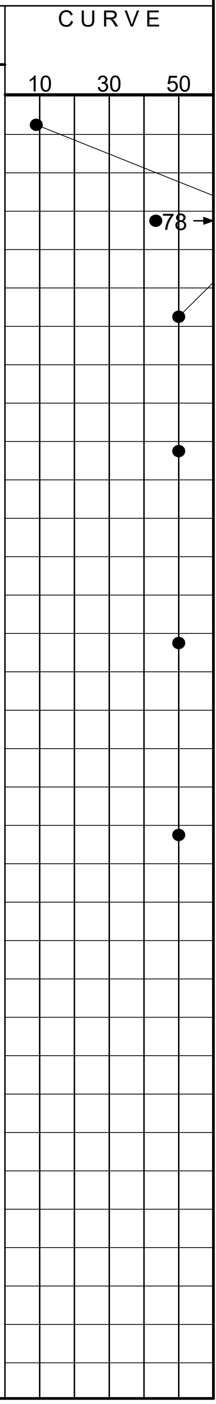
Project Name Brunswick Elementary School
Boring No. B-23
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 438.7 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/13/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/13/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
Dark brown sandy SILT, with trace of rock fragments and fine roots, moist, loose, (Probable FILL as ML)	4" topsoil	10		3-4-5	9
Very light gray disintegrated ROCK, moist, very dense		14		13-28-50	78
		4		50/4"	50/4"
- light gray		11		49-50/5"	50/5"
		5		50/5"	50/5"
		4		50/4"	50/4"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	12.2 ft.
AFTER 24 HRS.	Dry ft.	12 ft.
AFTER ___ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES ENGINEERING ASSOCIATES, INC.

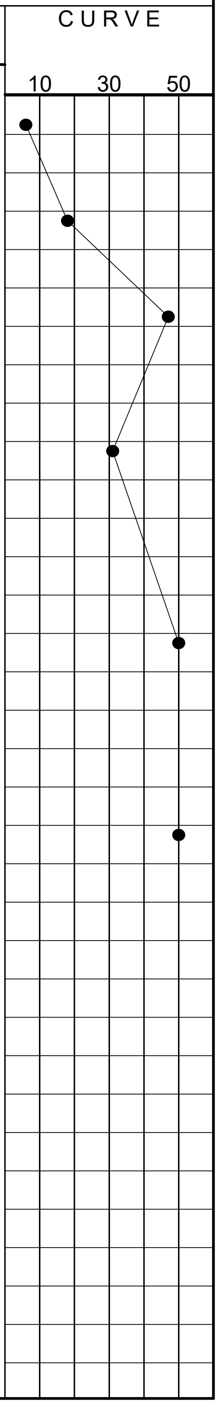
RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. B-24
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 449.3 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/24/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/24/2021

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
0		Brown sandy SILT, moist, loose, (ML-Natural)	3" topsoil	11		1-2-4	6
445		Greenish gray and light gray silty ROCK fragments with sand, moist, medium dense, (GM)		18		6-7-11	18
5		- very light gray		16		11-29-18	47
440 10		Light grayish brown sandy SILT, moist, dense, (ML)		17		11-14-17	31
435 15		Brown disintegrated ROCK, moist, very dense		11		22-50/5"	50/5"
430 20				7		25-50/2"	50/2"
			End of boring at 20 feet below grade.				
425 25							
420 30							



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	13 ft.
AFTER 24 HRS.	Dry ft.	12.5 ft.
AFTER ___ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

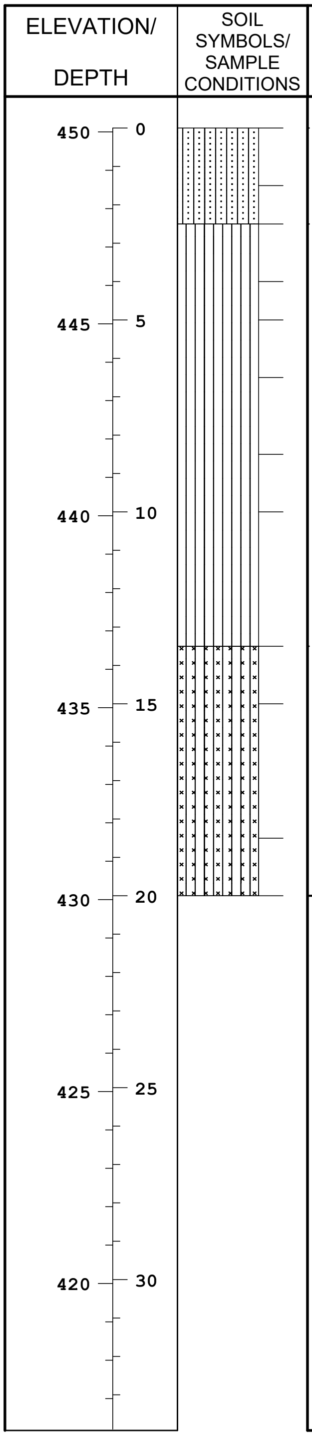
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

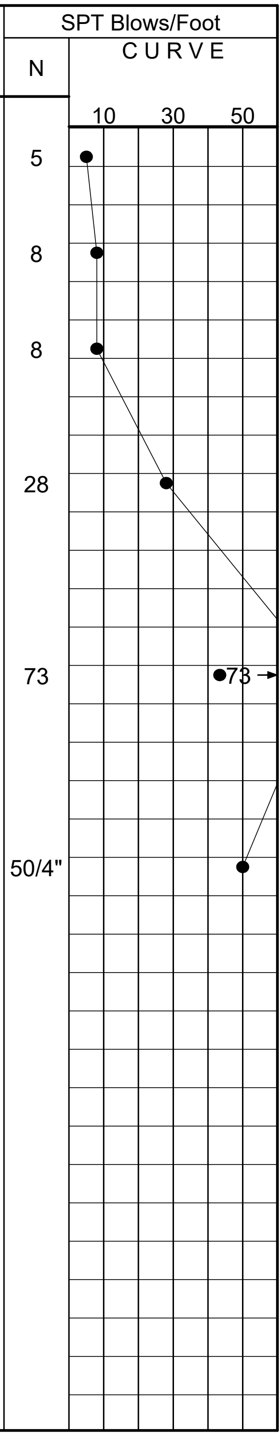
Project Name: Brunswick Elementary School
Boring No.: B-25
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 450.1 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/13/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/13/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown silty SAND, moist, loose, (SM-Natural)	4" topsoil	18		2-3-2	5
Grayish brown sandy SILT, moist, loose, (ML)		17		2-3-5	8
		17		3-4-4	8
- medium dense		15		7-10-18	28
Light gray disintegrated ROCK, moist, very dense		13		19-31-42	73
		10		47-50/4"	50/4"
	End of boring at 20 feet below grade.				



	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	10.4	ft.
AFTER 24 HRS.	Dry	ft.	10	ft.
AFTER ____ HRS.		ft.		ft.

SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **B-26**

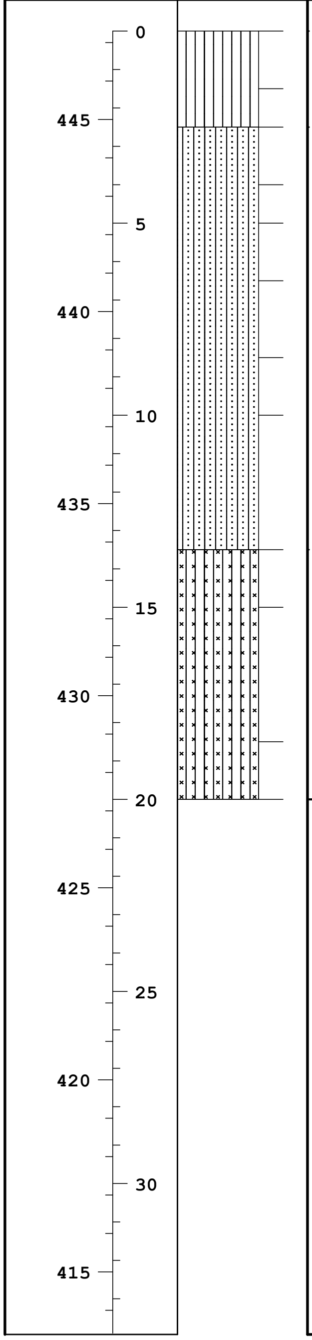
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

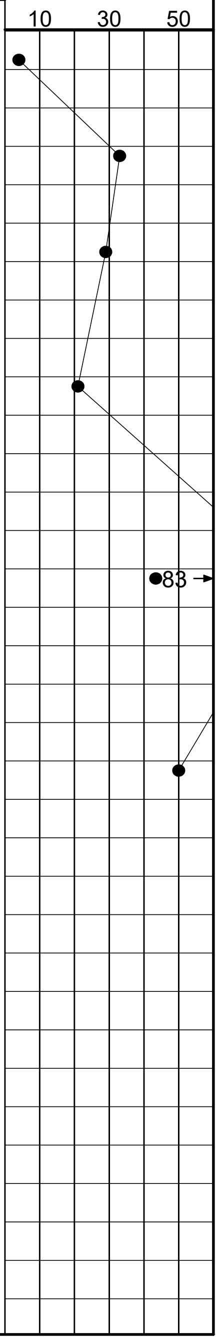
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **447.3** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/16/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/16/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
Dark brown sandy SILT, with trace of rock fragments, moist, very loose, (ML-Natural)	4" topsoil	10		1-2-2	4
Light grayish brown silty SAND, moist, dense, (SM)		12		13-16-17	33
- medium dense		18		8-13-16	29
- with rock fragments		14		8-9-12	21
Brown disintegrated ROCK, moist, very dense		10		22-33-50	83
		4		50/4"	50/4"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	13 ft.
AFTER 24 HRS.	Dry ft.	13 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

Project Name: Brunswick Elementary School — Boring No.: B-27

Location: 400 Central Avenue, Brunswick, MD — Job #: 22820A

SAMPLER

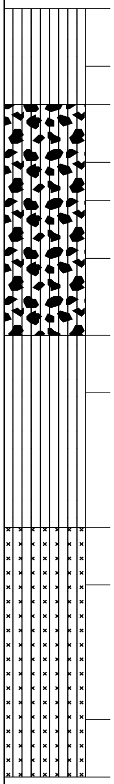
Datum: MSL — Hammer Wt.: 140 lbs. — Hole Diameter: 3.25 in. — Foreman: Jim Russell

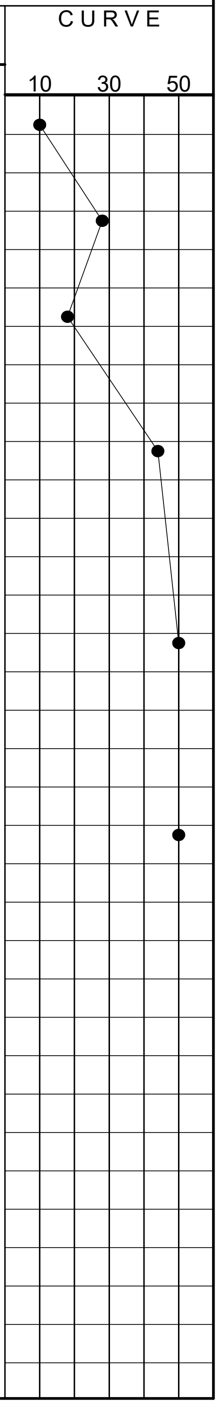
Surf. Elev.: 442.6 Ft. — Hammer Drop: 30 in. — Rock Core Diameter: NA — Inspector: Robel Gibbe

Date Started: 03/15/2021 — Pipe Size: 2 O.D. in. — Boring Method: HSA-SPT — Date Completed: 03/15/2021

ELEVATION/ DEPTH	Description	Boring and Sampling Notes	Rec.	NM	SPT	N
442.6 / 0	Brown sandy SILT with rock fragments, moist, loose, (ML-Natural)	4" topsoil	16		1-4-6	10
440 / 2.6	Light gray silty ROCK fragments with sand, moist, medium dense, (GM)		12		5-12-16	28
			10		5-11-7	18
8.6	Brown sandy SILT with rock fragments, moist, dense, (ML)		10		10-18-26	44
13.6	Light gray disintegrated ROCK, moist, very dense		3		50/3"	50/3"
			1		50/2"	50/2"
20		End of boring at 20 feet below grade.				

Elevation scale: 440, 435, 430, 425, 420, 415, 410; Depth scale: 0, 5, 10, 15, 20, 25, 30





SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	12.5 ft.
AFTER 24 HRS.	Dry ft.	12.5 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

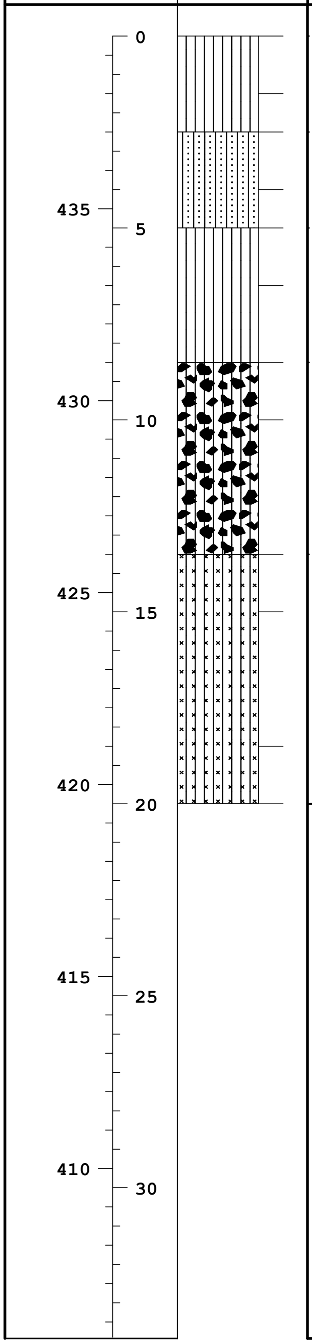
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

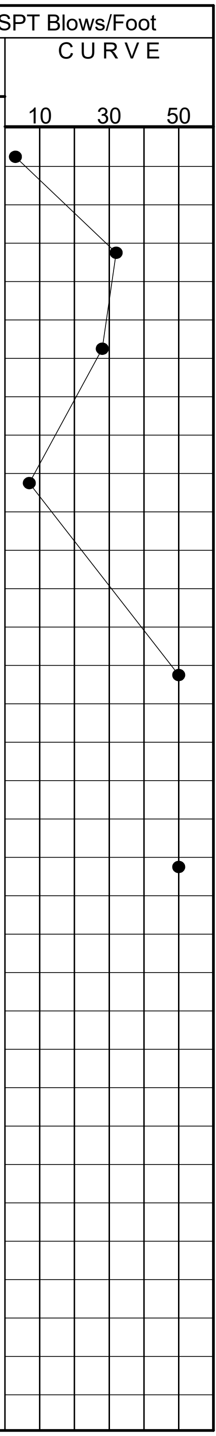
Project Name **Brunswick Elementary School** Boring No. **B-28**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **439.5** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/16/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/16/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT with rock fragments, moist, very loose, (ML-Natural)	4" topsoil	10		1-1-2	3
Light gray silty SAND with rock fragments, moist, dense, (SM)		18		12-16-16	32
Dark gray sandy SILT, with trace of rock fragments, moist, medium dense, (ML)		18		6-12-16	28
Light gray silty ROCK fragments with sand, moist, loose, (GM)		12		4-2-5	7
Brown disintegrated ROCK, moist, very dense		10		48-50/4"	50/4"
		4		50/4"	50/4"
	End of boring at 20 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	13 ft.
AFTER 24 HRS.	Dry ft.	13 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

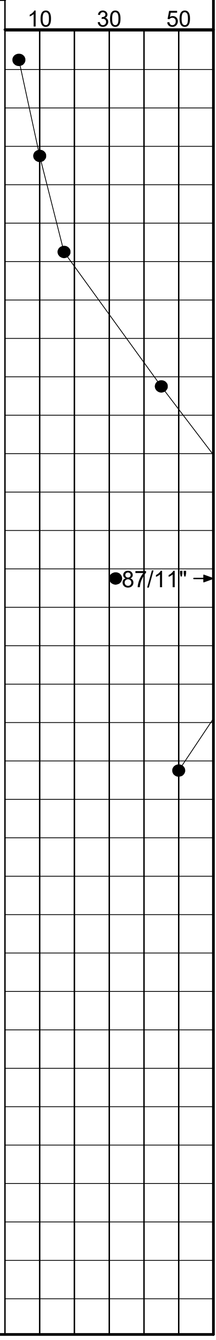
Project Name **Brunswick Elementary School** Boring No. **B-29**
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**
Surf. Elev. **447.2** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**
Date Started **03/16/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/16/2021**

ELEVATION/	DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
	0		Light reddish brown with dark brown sandy lean CLAY, with roots, moist, soft (CL-Natural)	4" topsoil	12		2-1-3	4
445								
			Brown sandy SILT, moist, loose, (ML)		18		5-5-5	10
	5		- grayish brown, medium dense		18		4-7-10	17
440								
			- brown, dense		12		14-20-25	45
	10							
435								
			Light gray disintegrated ROCK, moist, very dense		14		33-37-50/5"	87/ 11"
	15							
430								
					6		18-50/5"	50/5"
	20			End of boring at 20 feet below grade.				
425								
	25							
420								
	30							
415								

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	13	ft.
AFTER 24 HRS.	Dry	ft.	13	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

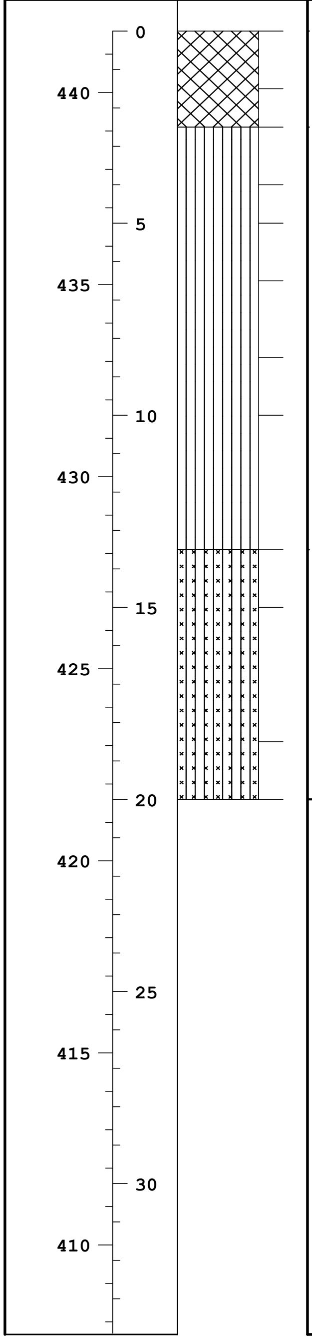
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

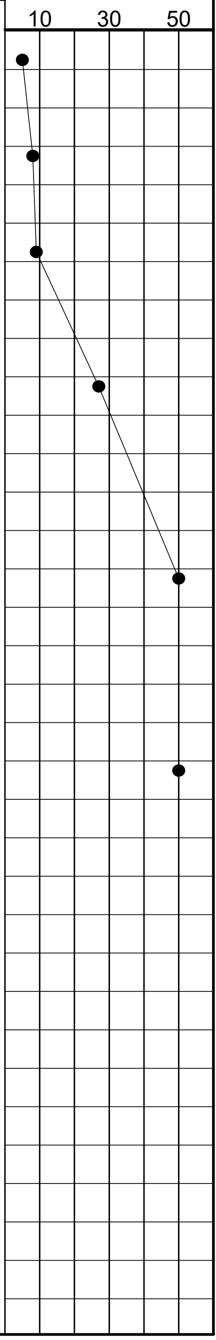
Project Name Brunswick Elementary School Boring No. B-30
Location 400 Central Avenue, Brunswick, MD Job # 22820A

SAMPLER

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 3.25 in. Foreman Jim Russell
Surf. Elev. 441.6 Ft. Hammer Drop 30 in. Rock Core Diameter NA Inspector Robel Gibbe
Date Started 03/17/2021 Pipe Size 2 O.D. in. Boring Method HSA-SPT Date Completed 03/17/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
Dark brown sandy SILT, moist, loose, (Probable FILL as ML)	4" topsoil	18		2-2-3	5
Brown SILT with sand, moist, medium stiff, (ML-Natural)		18		3-3-5	8
- light brown, stiff		16		3-4-5	9
Dark gray sandy SILT, moist, medium dense, (ML)		18		5-8-19	27
Light gray disintegrated ROCK, moist, very dense		9		46-50/3"	50/3"
- brown		2		50/2"	50/2"
	End of boring at 20 feet below grade.				



SAMPLER TYPE	**SAMPLE CONDITIONS**		**GROUND WATER**	**CAVE IN DEPTH**
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED	D - DISINTEGRATED	AT COMPLETION	Dry ft.	14 ft.
PT - PRESSED SHELBY TUBE	I - INTACT	AFTER 24 HRS.	Dry ft.	14 ft.
CA - CONTINUOUS FLIGHT AUGER	U - UNDISTURBED	AFTER ___ HRS.	___ ft.	___ ft.
RC - ROCK CORE	L - LOST			

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School Boring No. P-1

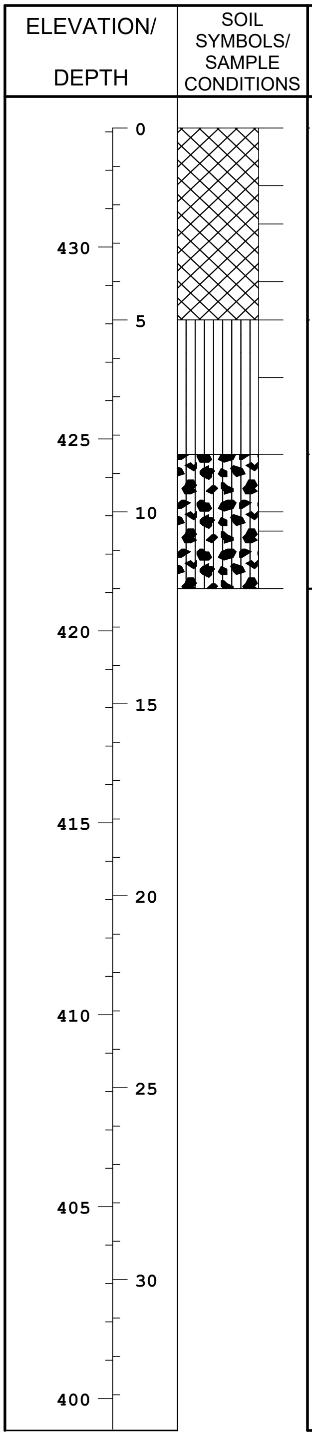
Location 400 Central Avenue, Brunswick, MD Job # 22820A

SAMPLER

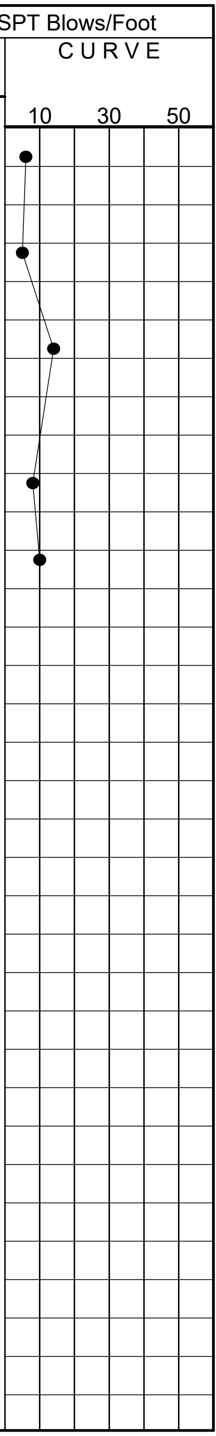
Datum MSL Hammer Wt. 140 lbs. Hole Diameter 3.25 in. Foreman Jim Russell

Surf. Elev. 433.1 Ft. Hammer Drop 30 in. Rock Core Diameter NA Inspector Robel Gibbe

Date Started 03/22/2021 Pipe Size 2 O.D. in. Boring Method HSA-SPT Date Completed 03/22/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
Brown sandy SILT, with trace of rock fragments, moist, medium stiff, (Probable FILL as ML)	4" topsoil	12		2-3-3	6
Reddish brown sandy lean CLAY, moist, medium stiff, (Probable FILL as CL)		10		2-2-3	5
Brown sandy SILT, with trace of rock fragments, moist, medium dense, (ML-Natural)		15		4-5-9	14
Light gray silty ROCK fragments with sand, moist, loose, (GM)		17		5-4-4	8
Brown sandy SILT, moist, loose, (ML)		11		5-5-5	10
	End of boring at 12 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	5.9	ft.
AFTER 24 HRS.	Dry	ft.	5.6	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School Boring No. P-2

Location 400 Central Avenue, Brunswick, MD Job # 22820A

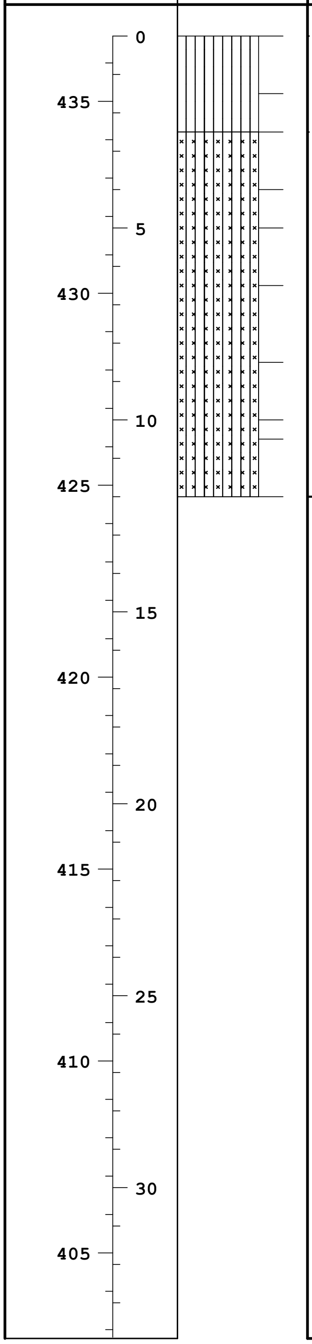
SAMPLER

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 3.25 in. Foreman Jim Russell

Surf. Elev. 436.7 Ft. Hammer Drop 30 in. Rock Core Diameter NA Inspector Robel Gibbe

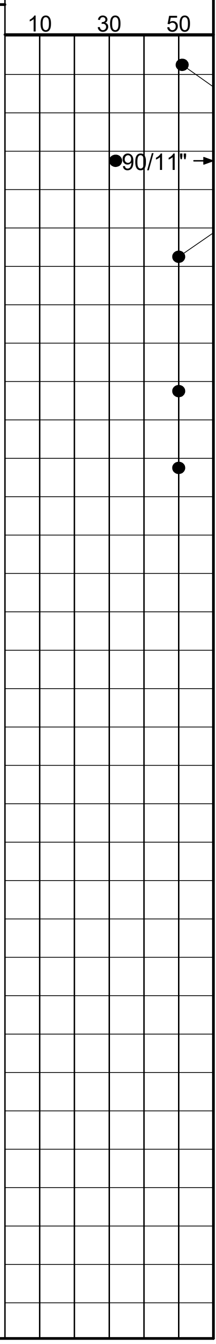
Date Started 03/22/2021 Pipe Size 2 O.D. in. Boring Method HSA-SPT Date Completed 03/22/2021

ELEVATION/ DEPTH — SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
Light gray sandy SILT with rock fragments, moist, very dense, (ML-Natural)	4" topsoil	12		6-11-40	51
Light gray disintegrated ROCK, moist, very dense		17		31-40-50/5"	90/ 11"
		9		41-50/3"	50/3"
		5		50/5"	50/5"
		3		50/3"	50/3"
	End of boring at 12 feet below grade.				

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	6	ft.
AFTER 24 HRS.	Dry	ft.	6	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School Boring No. P-3

Location 400 Central Avenue, Brunswick, MD Job # 22820A

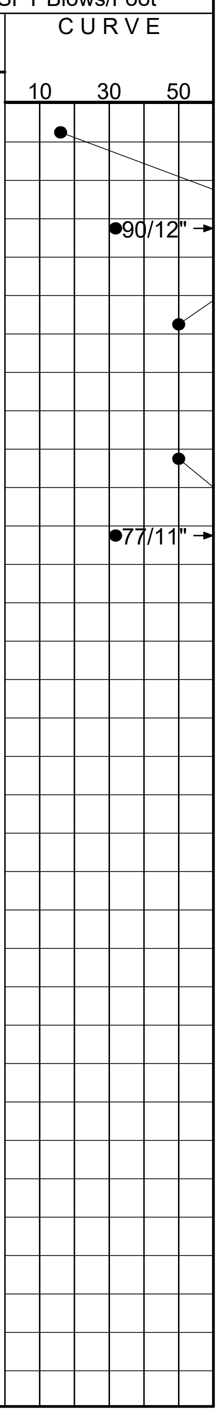
SAMPLER

Datum MSL Hammer Wt. 140 lbs. Hole Diameter 3.25 in. Foreman Jim Russell

Surf. Elev. 445.3 Ft. Hammer Drop 30 in. Rock Core Diameter NA Inspector Robel Gibbe

Date Started 03/17/2021 Pipe Size 2 O.D. in. Boring Method HSA-SPT Date Completed 03/17/2021

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
445 / 0		Grayish brown sandy lean CLAY, with trace of rock fragments, moist, very stiff, (CL-Natural)	4" topsoil	16		2-2-14	16
		Light gray disintegrated ROCK, moist, very dense		14		16-40-50/6"	90/ 12"
440 / 5				9		36-50/5"	50/5"
				3		50/4"	50/4"
435 / 10		- multicolored		14		26-27-50/5"	77/ 11"
			End of boring at 12 feet below grade.				
430 / 15							
425 / 20							
420 / 25							
415 / 30							



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	7	ft.
AFTER 24 HRS.	Dry	ft.	7	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **P-4**

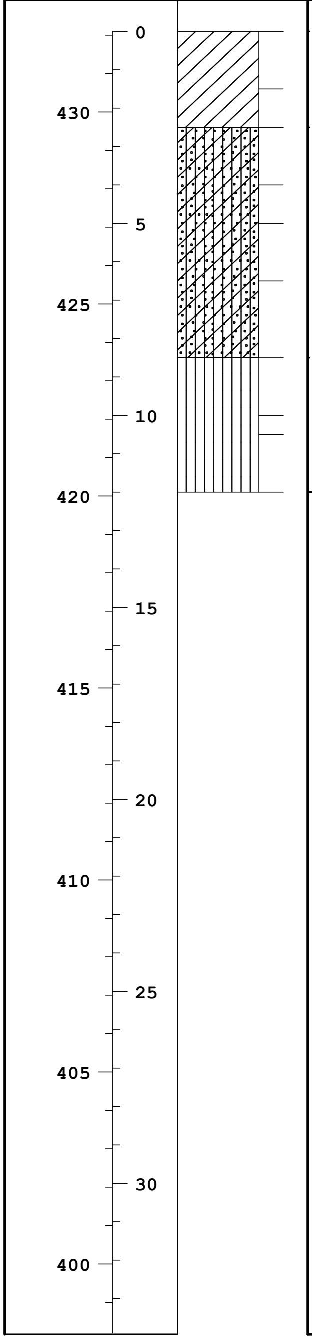
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

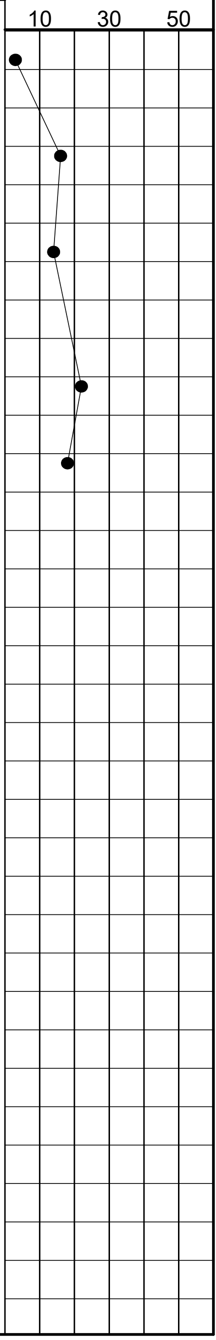
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **432.1** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/19/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/19/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy lean CLAY, with trace of rock fragments, moist, soft, (CL-Natural)	4" topsoil	12		2-1-2	3
Brown silty clayey SAND with rock fragments, moist, medium dense, (SC-SM)		18		3-6-10	16
		16		6-6-8	14
Grayish brown sandy SILT with rock fragments, moist, medium dense, (ML)		3		6-11-11	22
- light brown		12		7-8-10	18
	End of boring at 12 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	6.5 ft.
AFTER 24 HRS.	Dry ft.	6.5 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

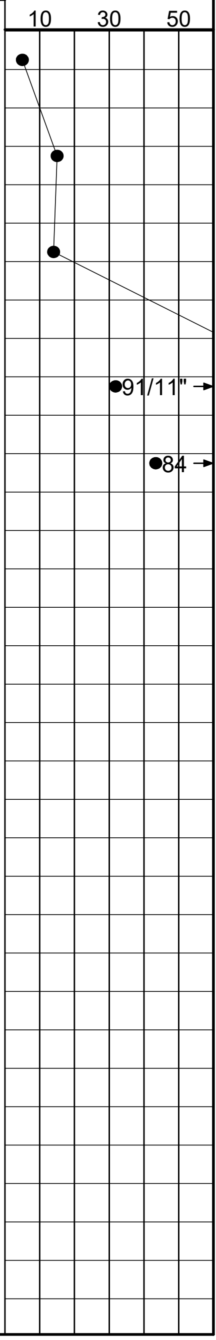
Project Name: Brunswick Elementary School
Boring No.: P-5
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 429.3 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/12/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/12/2021

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	N
0	▨	Light brown sandy SILT, with trace of rock fragments, moist, loose, (Controlled FILL as ML)	3" topsoil	11		2-2-3	5
	▨	Very dark brown sandy SILT, with trace of rock fragments, with organic, moist, medium dense, (Controlled FILL as ML)		16		9-8-7	15
425 / 5	▨	- brown		18		3-6-8	14
420 / 10		Light gray disintegrated ROCK, moist, very dense, (Natural)		17		20-41-50/5"	91/ 11"
				18		32-47-37	84
			End of boring at 12 feet below grade.				
415 / 15							
410 / 20							
405 / 25							
400 / 30							

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	7.9	ft.
AFTER 24 HRS.	Dry	ft.	7.5	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **P-6**

Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

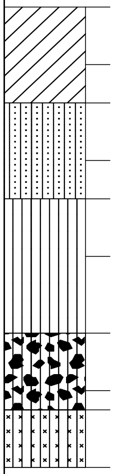
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

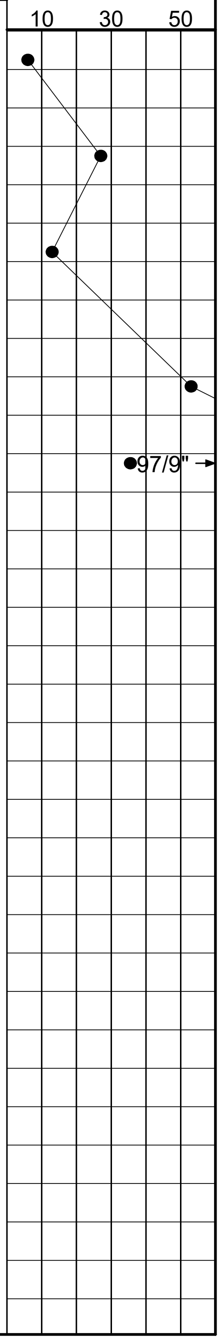
Surf. Elev. **437.1** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/15/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/15/2021**

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N
0		Dark reddish brown sandy lean CLAY, moist, medium stiff, (CL-Natural)	4" topsoil	14		1-2-4	6
435		Light gray silty SAND, with trace of rock fragments, moist, medium dense, (SM-Natural)		12		7-12-15	27
5		Brown sandy SILT, with trace of rock fragments, medium dense, (ML)		14		8-5-8	13
430							
		Light gray silty ROCK fragments with sand, moist, very dense, (GM)		16		13-20-33	53
10		Light gray disintegrated ROCK, moist, very dense		10		12-47-50/3"	97/9"
425			End of boring at 12 feet below grade.				

Depth scale: 0, 5, 10, 15, 20, 25, 30; Elevation scale: 435, 430, 425, 420, 415, 410, 405





SAMPLER TYPE	SAMPLE CONDITIONS		GROUND WATER	CAVE IN DEPTH	BORING METHOD
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED	D - DISINTEGRATED	AT COMPLETION	Dry ft.	7 ft.	HSA - HOLLOW STEM AUGERS
PT - PRESSED SHELBY TUBE	I - INTACT	AFTER 24 HRS.	Dry ft.	7 ft.	CFA - CONTINUOUS FLIGHT AUGERS
CA - CONTINUOUS FLIGHT AUGER	U - UNDISTURBED	AFTER ___ HRS.	ft.	ft.	DC - DRIVING CASING
RC - ROCK CORE	L - LOST				MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **SWM-1**

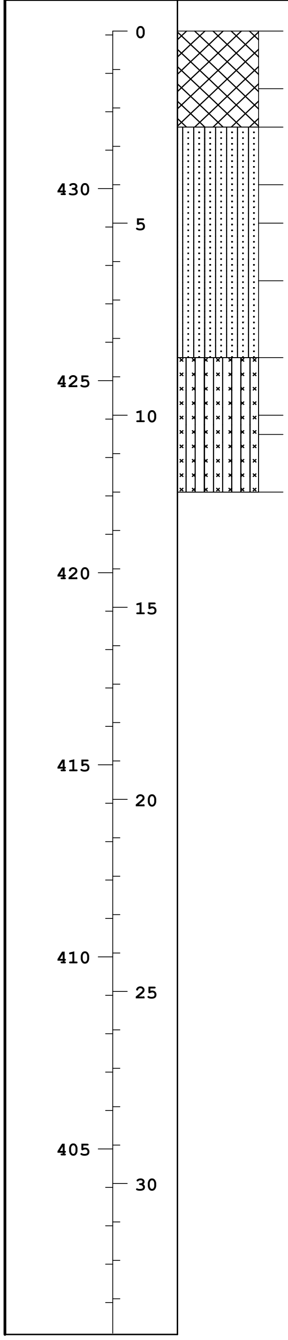
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

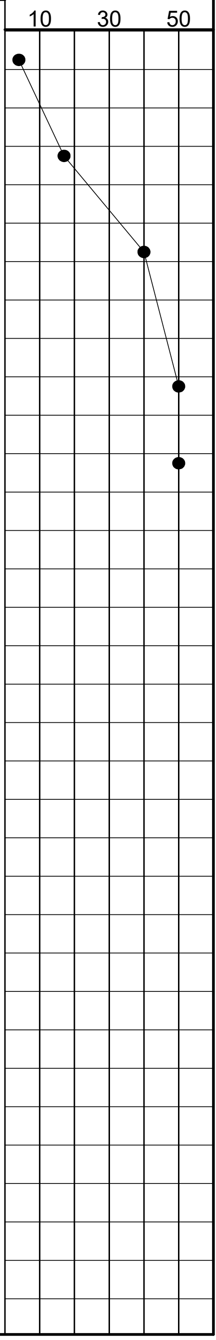
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **434.1** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/22/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/22/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown sandy SILT with gravel, moist, very loose, (Probable FILL as ML)	3" topsoil	4		1-1-3	4
Brown silty SAND with rock fragments, moist, medium dense, (SM-Natural)		17		3-5-12	17
- light gray, dense		18		13-18-22	40
<SANDY LOAM>	Infiltration Rate = 0 in/hr				
Grayish brown disintegrated ROCK, moist, very dense		5		50/5"	50/5"
		11		31-50/5"	50/5"
	End of boring at 12 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	5.8	ft.
AFTER 24 HRS.	Dry	ft.	5.6	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

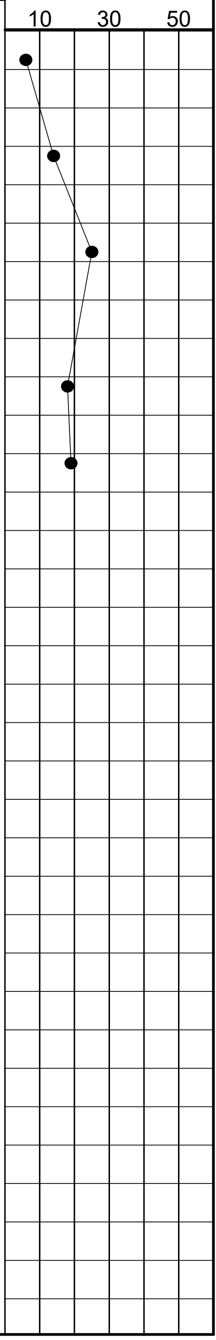
Project Name Brunswick Elementary School
Boring No. SWM-2
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 437.4 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/22/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/22/2021

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	N
0		Brown sandy SILT with gravel, moist, loose, (Probable FILL as ML)	5" topsoil	8		1-2-4	6
435		- medium dense		17		4-6-8	14
5		Light brown silty SAND, with trace of rock fragments, moist, medium dense, (SM-Natural)		15		7-12-13	25
430		<SILT LOAM>	Infiltration Rate = 0 in/hr				
		Brown SILT with sand, moist, medium dense, (ML)		13		5-9-9	18
10				12		6-9-9	19
425			End of boring at 12 feet below grade.				
15							
420							
20							
415							
25							
410							
30							
405							

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	6 ft.
AFTER 24 HRS.	Dry ft.	5.6 ft.
AFTER ___ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **SWM-3**

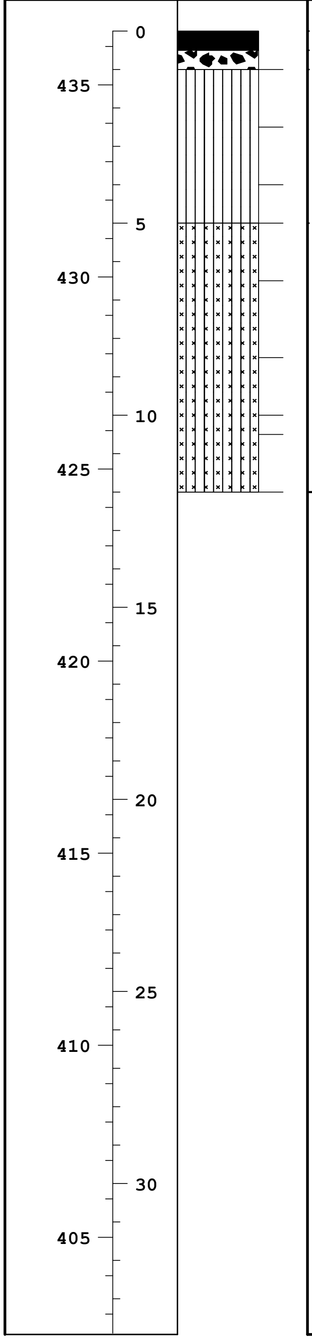
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

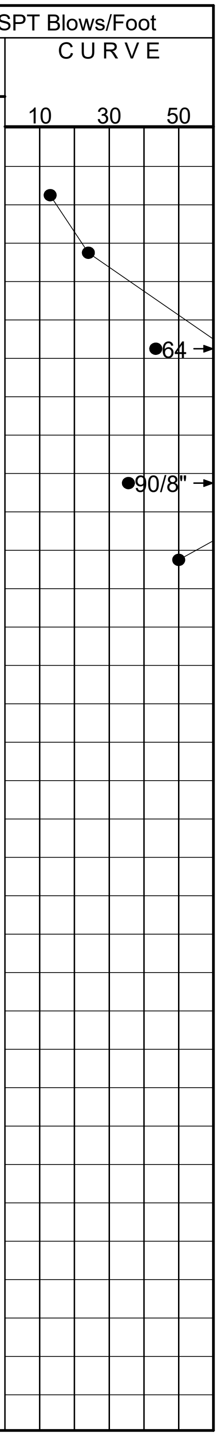
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **436.4** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/22/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/22/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
3" Asphalt Concrete					
6" Aggregate Base					
Grayish brown sandy SILT, moist, medium dense, (ML-Natural)		11		5-6-7	13
- brown		13		6-9-15	24
Light brown disintegrated ROCK, moist, very dense		18		13-24-40	64
- brown		14		22-40-50/2"	90/8"
		11		41-50/5"	50/5"
	End of boring at 12 feet below grade.				



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	5 ft.
AFTER 24 HRS.	ft.	ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30"; COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **SWM-4**

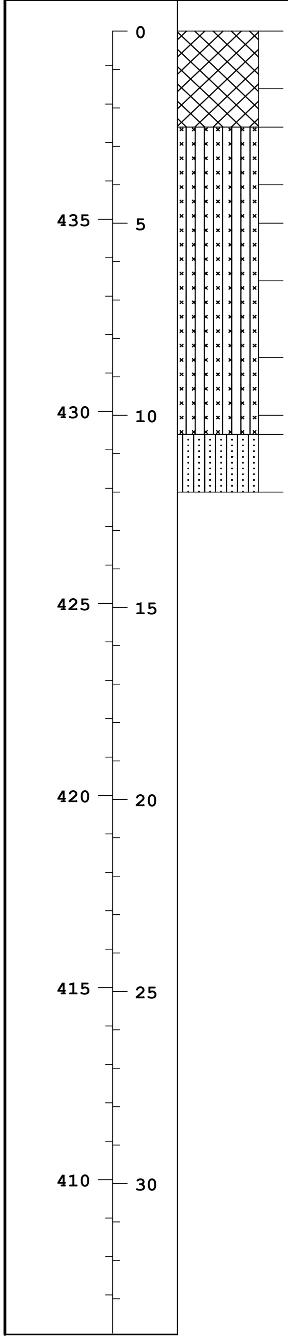
Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

SAMPLER

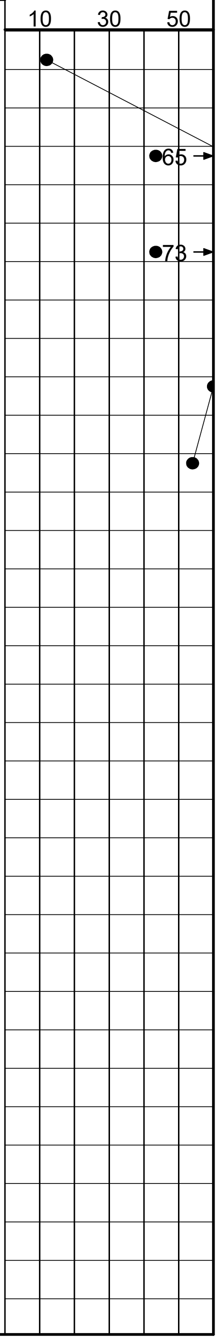
Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **439.9** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

Date Started **03/17/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/17/2021**



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Reddish brown and brown sandy SILT, moist, medium dense, (Probable FILL as ML)	4" topsoil	10		3-4-8	12
Light gray disintegrated ROCK, moist, very dense, (Natural)		16		26-29-36	65
		14		21-23-30	73
<SANDY LOAM> - light brown	Infiltration Rate = 0 in/hr	18		24-33-27	60
Light brown silty SAND, with trace of rock fragments, moist, very dense, (SM)	End of boring at 12 feet below grade.	18		14-24-30	54



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	5.5 ft.
AFTER 24 HRS.	Dry ft.	5.5 ft.
AFTER ___ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. SWM-5
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

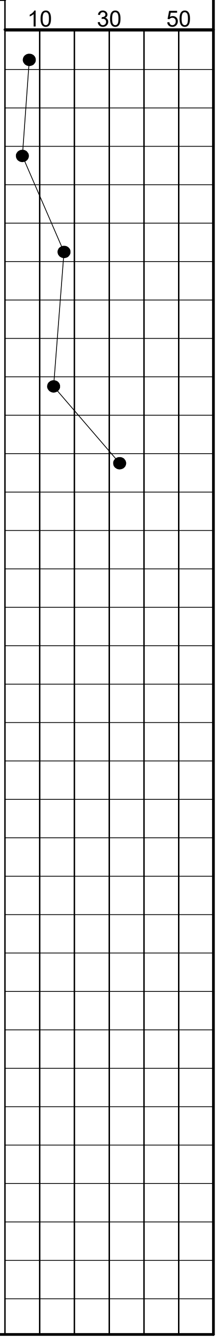
SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 434.4 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/22/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/22/2021

ELEVATION/ DEPTH	Description	Boring and Sampling Notes	Rec.	NM	SPT	N
0	Dark brown sandy SILT with gravel, moist, loose, (Probable FILL as ML)	5" topsoil	12		2-3-4	7
	Dark brown sandy lean CLAY, with trace of organic, moist, medium stiff, (Probable FILL as CL)		12		2-2-3	5
430 / 5	Grayish brown sandy SILT, with trace of rock fragments, moist, medium dense, (ML-Natural)		11		3-6-11	17
	<SANDY LOAM>	Infiltration Rate = 0 in/hr				
425 / 10	Dark grayish brown silty SAND with rock fragments, moist, medium dense, (SM)		13		4-6-8	14
	- brown, dense		10		8-15-18	33
		End of boring at 12 feet below grade.				
420 / 15						
415 / 20						
410 / 25						
405 / 30						

SPT Blows/Foot

CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	5.9 ft.
AFTER 24 HRS.	Dry ft.	5.8 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

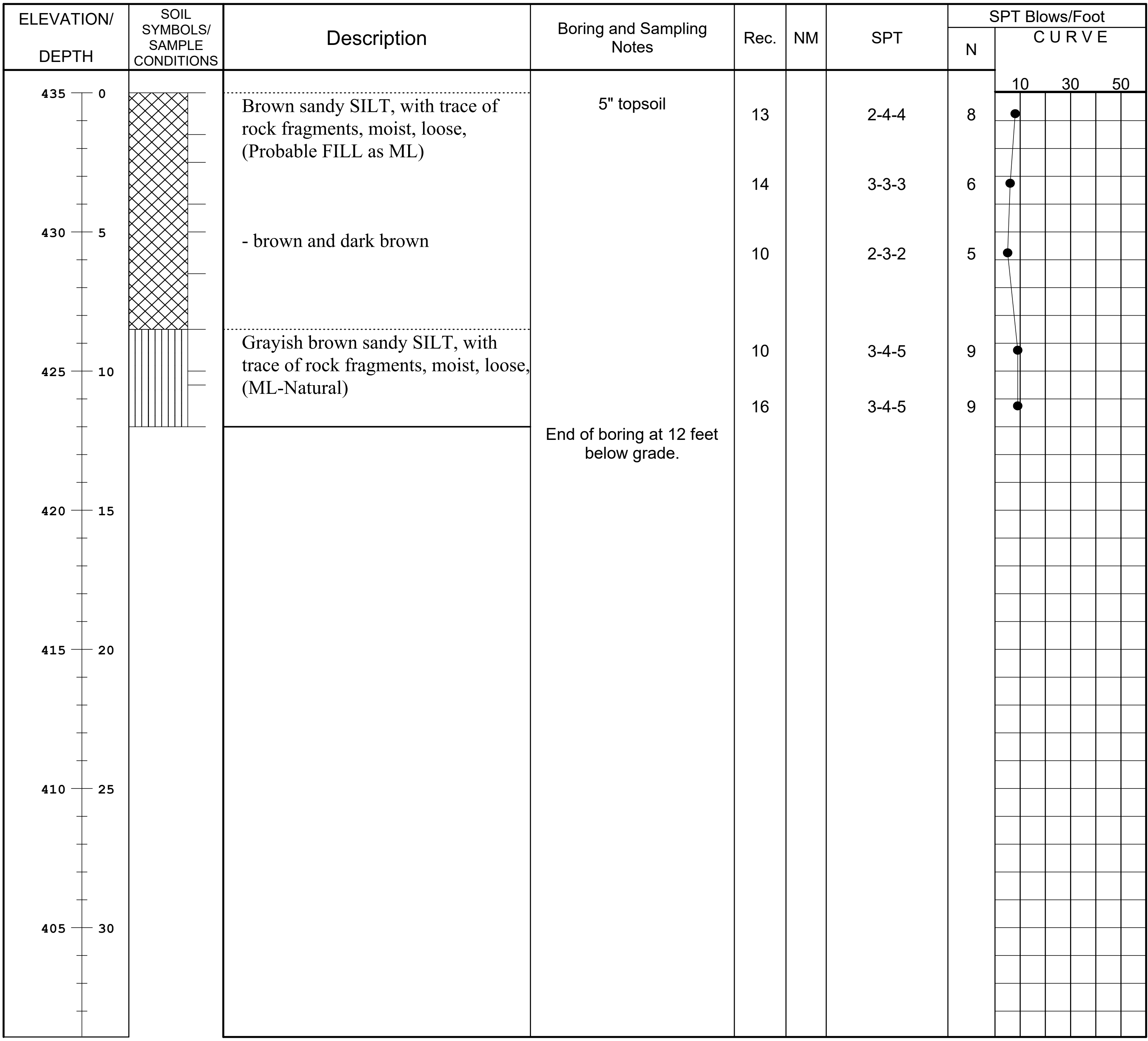
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. SWM-6
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 435 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/22/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/22/2021



ELEVATION/ DEPTH		Description	Boring and Sampling Notes	Rec.	NM	SPT	N
435	0	Brown sandy SILT, with trace of rock fragments, moist, loose, (Probable FILL as ML)	5" topsoil	13		2-4-4	8
				14		3-3-3	6
430	5	- brown and dark brown		10		2-3-2	5
		Grayish brown sandy SILT, with trace of rock fragments, moist, loose, (ML-Natural)		10		3-4-5	9
425	10			16		3-4-5	9
			End of boring at 12 feet below grade.				
420	15						
415	20						
410	25						
405	30						

SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	5.9 ft.
AFTER 24 HRS.	Dry ft.	5.6 ft.
AFTER ____ HRS.	____ ft.	____ ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

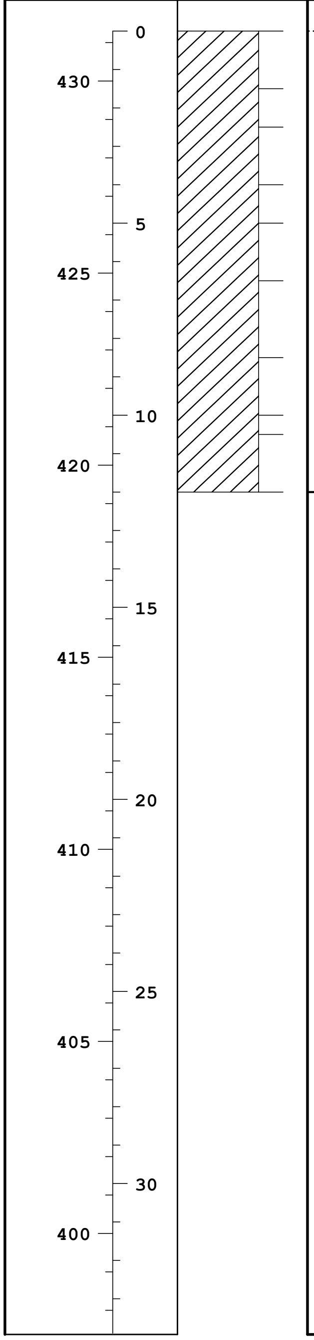
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

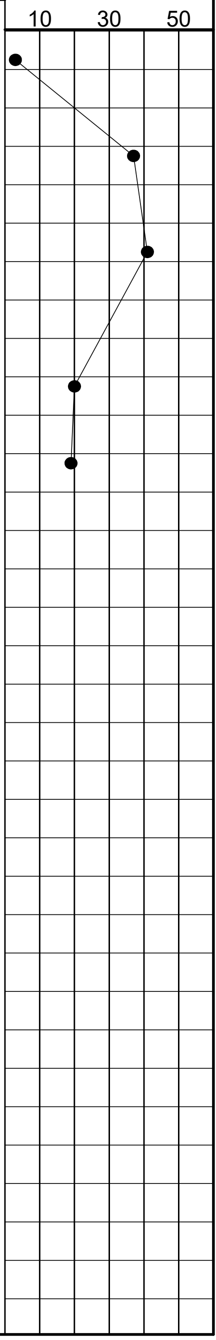
Project Name Brunswick Elementary School
Boring No. SWM-7
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 431.3 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/22/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/22/2021



ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	SPT Blows/Foot N	CURVE
		Brown sandy lean CLAY, with trace of rock fragments, moist, soft, (CL-Natural)	4" topsoil	10		1-1-2	3	
		Grayish brown sandy SILT, moist, dense, (ML)		18		8-16-21	37	
		Light gray sandy SILT with rock fragments, moist, dense, (ML)		18		8-21-20	41	
		- medium dense		18		7-9-11	20	
				15		7-9-10	19	
			End of boring at 12 feet below grade.					



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	6.4	ft.
AFTER 24 HRS.	Dry	ft.	6.3	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

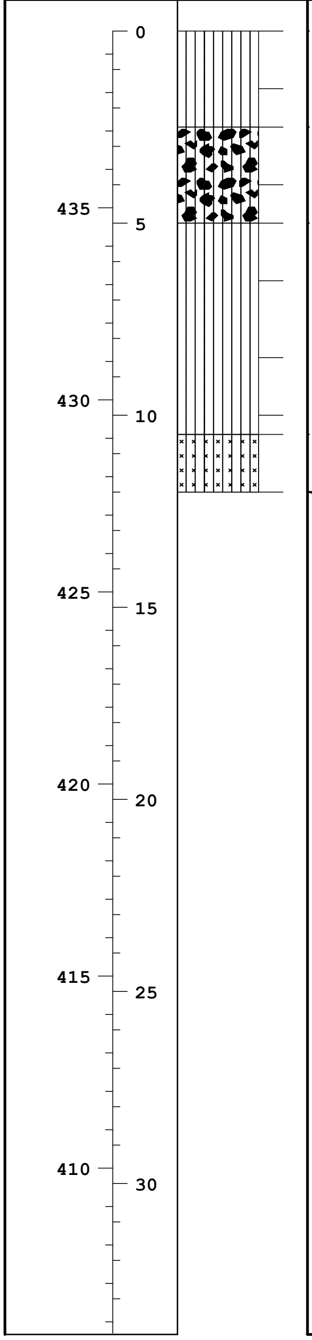
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

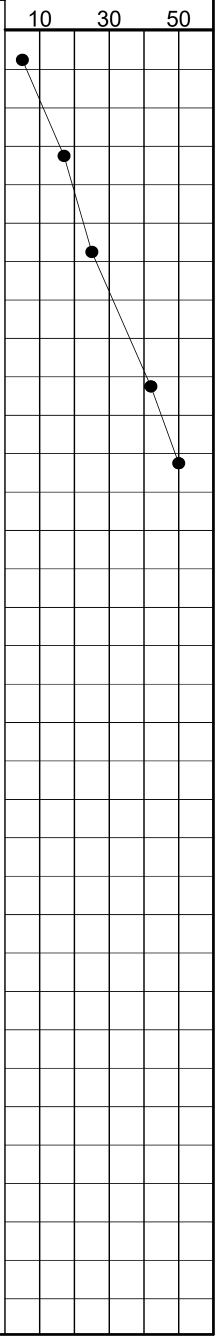
Project Name: Brunswick Elementary School
Boring No.: SWM-8
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 439.6 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/19/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/19/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown SILT with sand, moist, loose, (ML-Natural)	4" topsoil	10		1-1-4	5
Brown silty ROCK fragments with sand, moist, medium dense, (GM)		18		4-7-10	17
Dark gray sandy SILT with rock fragments, moist, medium dense, (ML)		16		7-14-11	25
<SANDY LOAM> - dense	Infiltration Rate=0.03 in/hr	10		5-9-33	42
Brown disintegrated ROCK, moist, very dense	End of boring at 12 feet below grade.	8		30-50/4"	50/4"



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	6.5	ft.
AFTER 24 HRS.	Dry	ft.	6.3	ft.
AFTER ___ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

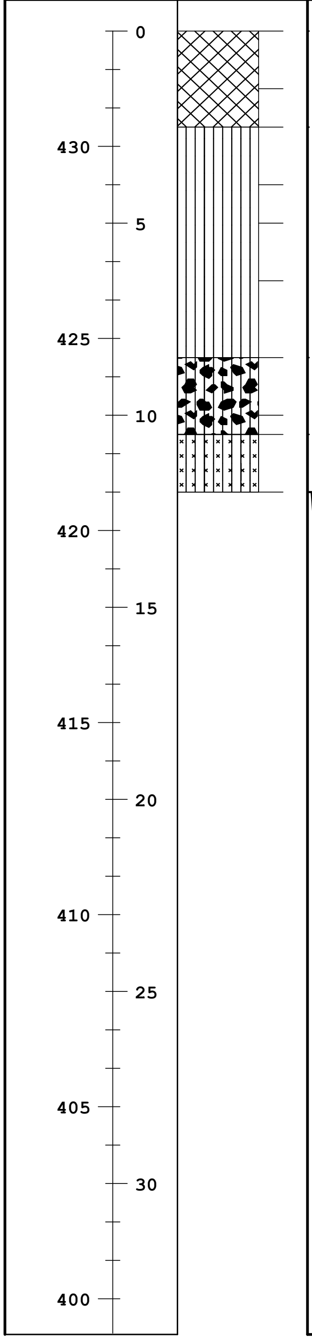
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

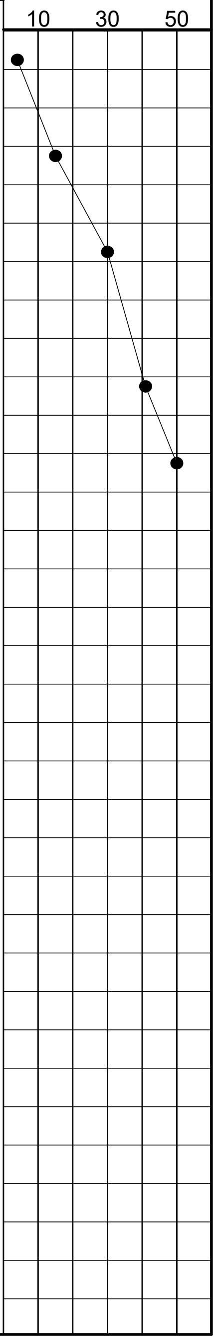
Project Name: Brunswick Elementary School
Boring No.: SWM-9
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 433 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/19/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/19/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy lean CLAY, with trace of rock fragments, moist, soft, (Probable FILL as CL)	4" topsoil	10		1-2-2	4
Multicolored sandy SILT with rock fragments, moist, medium dense, (ML-Natural)		14		3-6-9	15
- dark gray		10		8-14-16	30
Grayish brown silty ROCK fragments with sand, moist, dense, (GM)		10		10-12-29	41
Brown and reddish brown disintegrated ROCK, moist, very dense	End of boring at 12 feet below grade.	8		34-50/3"	50/3"



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER	CAVE IN DEPTH
AT COMPLETION	Dry ft.	7 ft.
AFTER 24 HRS.	Dry ft.	6.9 ft.
AFTER ____ HRS.	ft.	ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

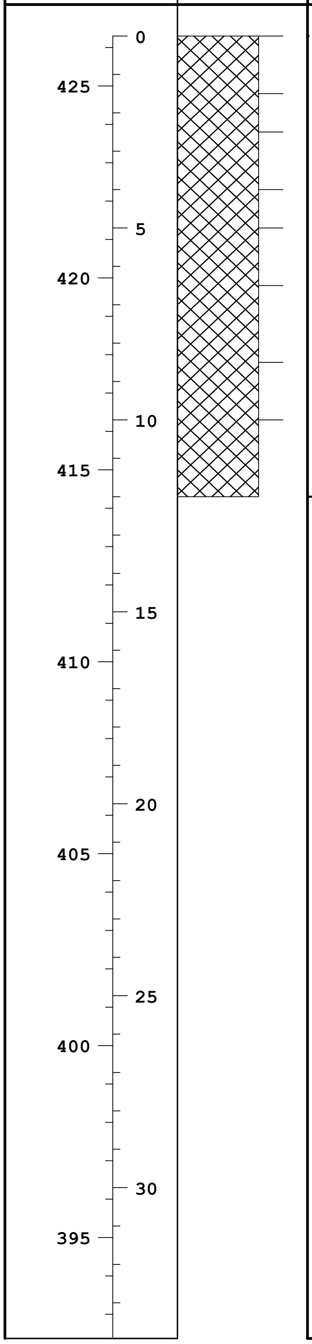
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

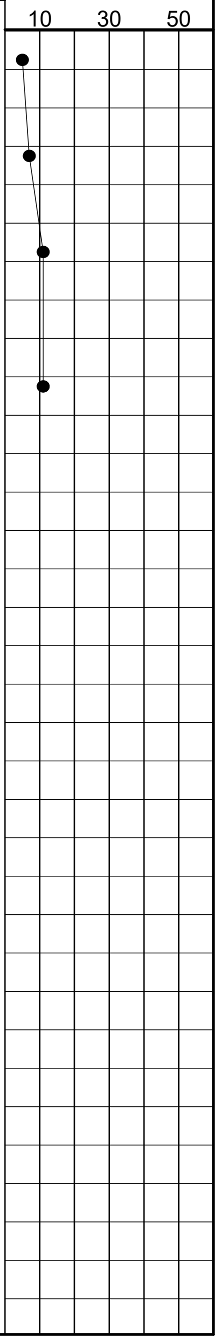
Project Name: Brunswick Elementary School
Boring No.: SWM-10
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum	MSL	Hammer Wt.	140 lbs.	Hole Diameter	3.25 in.	Foreman	Jim Russell
Surf. Elev.	426.3 Ft.	Hammer Drop	30 in.	Rock Core Diameter	NA	Inspector	Robel Gibbe
Date Started	03/13/2021	Pipe Size	2 O.D. in.	Boring Method	HSA-SPT	Date Completed	03/13/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown sandy SILT, moist, loose, (Controlled FILL as ML)	3" topsoil	12		2-2-3	5
Brown sandy SILT with rock fragments, moist, loose, (Controlled FILL as ML)		12		3-4-3	7
- dark brown, medium dense		8		3-5-6	11
<SANDY LOAM> - grayish brown	Infiltration Rate=0.06 in/hr	18		4-5-7	11
	End of boring at 12 feet below grade.				



		GROUND WATER		CAVE IN DEPTH	
AT COMPLETION		Dry	ft.	6.5	ft.
AFTER 24 HRS.		Dry	ft.	6.4	ft.
AFTER ____ HRS.			ft.		ft.

SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name Brunswick Elementary School
Boring No. SWM-11
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

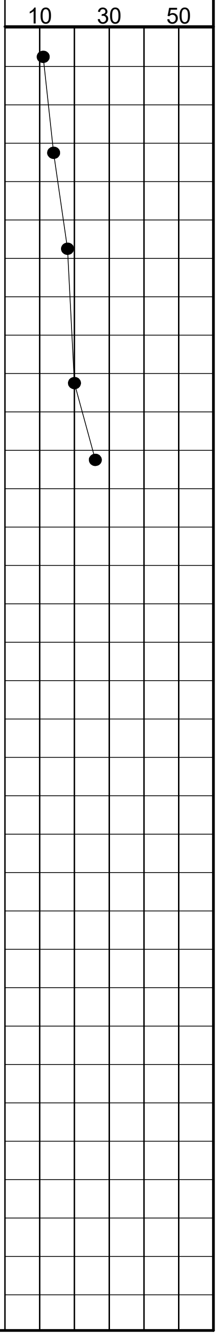
SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 435.9 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/16/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/16/2021

ELEVATION/ DEPTH	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM	SPT	N
0		Brown silty SAND with rock fragments, moist, medium dense, (SM-Natural)	4" topsoil	12		4-5-6	11
		- light reddish brown		18		5-7-7	14
5		- grayish brown		10		7-8-10	18
		<LOAM> Light brown silty SAND with rock fragments, moist, medium dense, (SM)	Infiltration Rate=0.06 in/hr	8		4-8-12	20
10		- dark gray		6		9-12-14	26
			End of boring at 12 feet below grade.				

Elevation scale: 435, 430, 425, 420, 415, 410, 405
Depth scale: 0, 5, 10, 15, 20, 25, 30

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	7	ft.
AFTER 24 HRS.	Dry	ft.	7	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

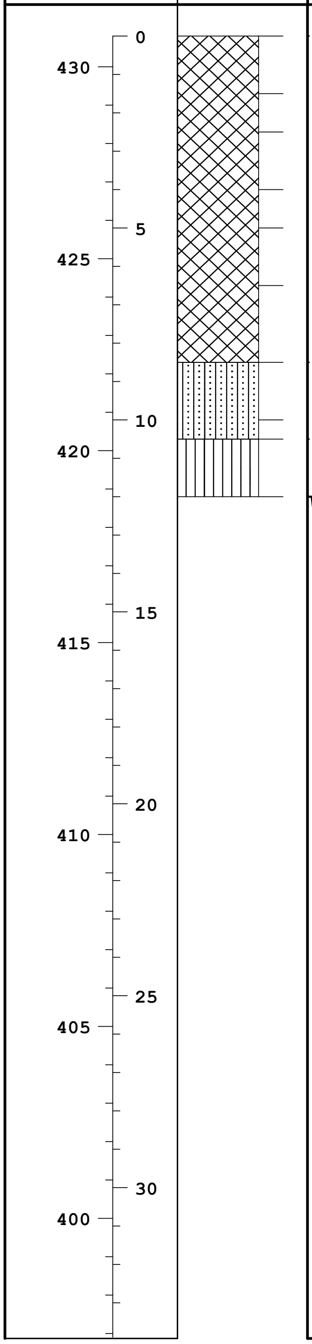
STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.
RECORD OF SOIL EXPLORATION

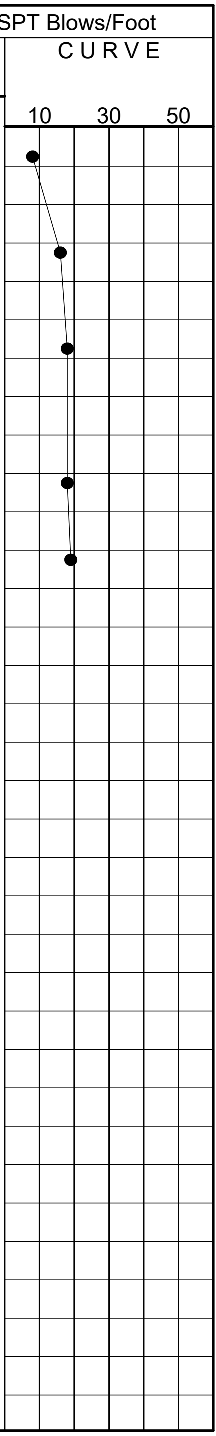
Project Name: Brunswick Elementary School
Boring No.: SWM-12
Location: 400 Central Avenue, Brunswick, MD
Job #: 22820A

SAMPLER

Datum: MSL
Hammer Wt.: 140 lbs.
Hole Diameter: 3.25 in.
Foreman: Jim Russell
Surf. Elev.: 430.8 Ft.
Hammer Drop: 30 in.
Rock Core Diameter: NA
Inspector: Robel Gibbe
Date Started: 03/15/2021
Pipe Size: 2 O.D. in.
Boring Method: HSA-SPT
Date Completed: 03/15/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Dark brown and light brown sandy SILT with rock fragments, with fine roots, moist, loose, (Controlled FILL as ML)	3" topsoil	10		2-3-5	8
Brown silty SAND, with trace of rock fragments, moist, medium dense, (Controlled FILL as SM)		18		7-7-9	16
- dark brown		12		6-8-10	18
<SANDY LOAM>	Infiltration Rate=0.06 in/hr				
Grayish brown silty SAND with rock fragments, moist, medium dense, (SM-Natural)		14		8-10-18	18
Brown sandy SILT, moist, medium dense, (ML)		16		5-8-11	19
	End of boring at 12 feet below grade.				



	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	7	ft.
AFTER 24 HRS.	Dry	ft.	7	ft.
AFTER ____ HRS.		ft.		ft.

SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

Project Name **Brunswick Elementary School** Boring No. **SWM-13**

Location **400 Central Avenue, Brunswick, MD** Job # **22820A**

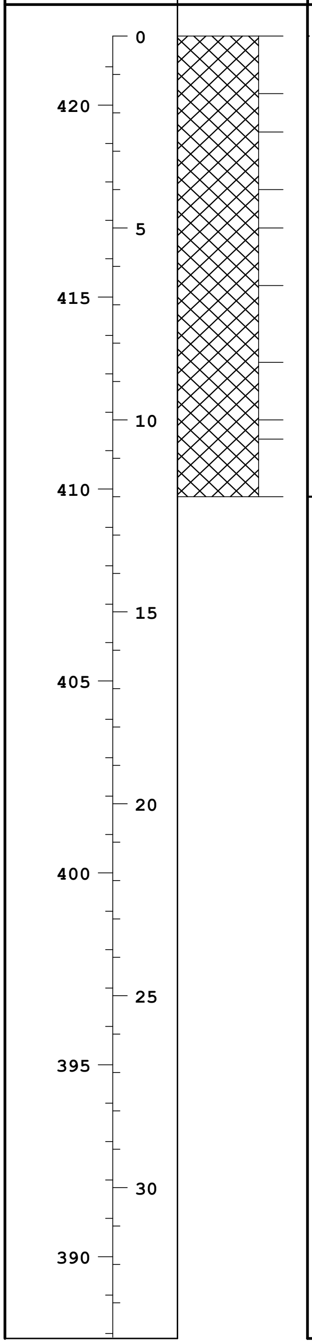
SAMPLER

Datum **MSL** Hammer Wt. **140** lbs. Hole Diameter **3.25 in.** Foreman **Jim Russell**

Surf. Elev. **421.8** Ft. Hammer Drop **30** in. Rock Core Diameter **NA** Inspector **Robel Gibbe**

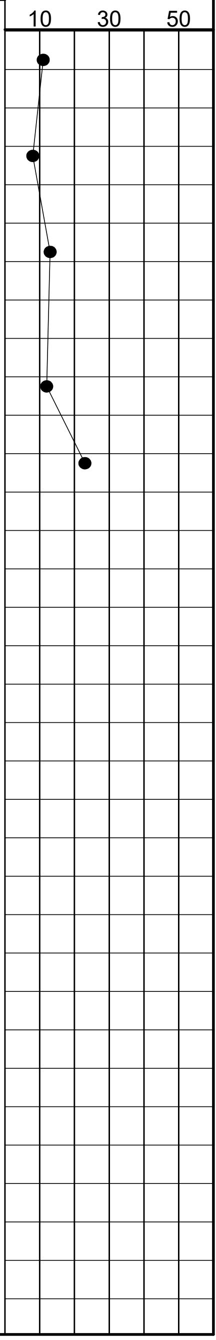
Date Started **03/15/2021** Pipe Size **2 O.D.** in. Boring Method **HSA-SPT** Date Completed **03/15/2021**

ELEVATION/ DEPTH | SOIL SYMBOLS/ SAMPLE CONDITIONS



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
Brown sandy SILT, with trace of rock fragments, moist, medium dense, (Controlled FILL as ML)	3" topsoil	11		3-5-6	11
- with fine roots, loose		6		6-3-5	8
- brown, medium dense		18		4-5-8	13
<SANDY LOAM> Grayish brown silty SAND with rock fragments, moist, medium dense, (Controlled FILL as SM)	Infiltration Rate=0.06 in/hr	10		5-6-6	12
	End of boring at 12 feet below grade.	18		4-6-17	23

SPT Blows/Foot CURVE



SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	7	ft.
AFTER 24 HRS.	Dry	ft.	7	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

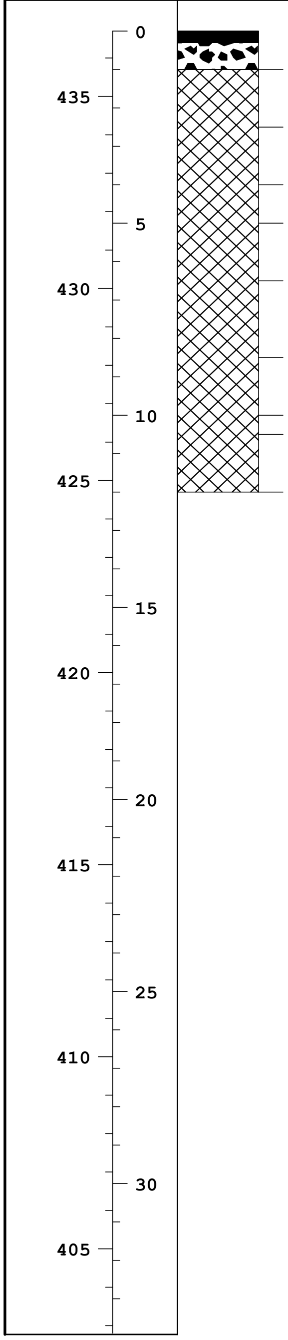
HILLIS - CARNES
ENGINEERING ASSOCIATES, INC.

RECORD OF SOIL EXPLORATION

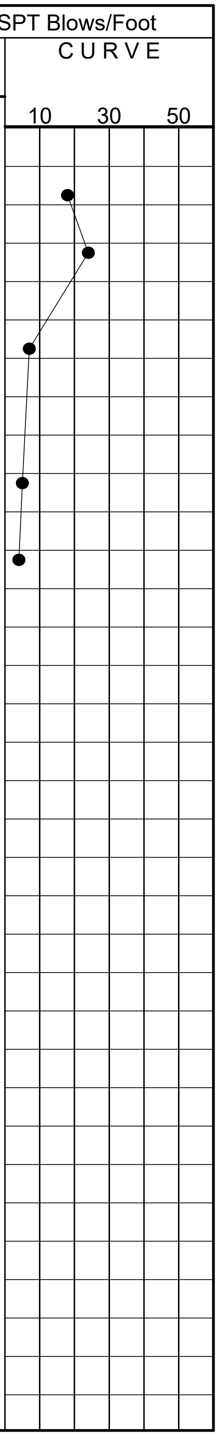
Project Name Brunswick Elementary School
Boring No. SWM-14
Location 400 Central Avenue, Brunswick, MD
Job # 22820A

SAMPLER

Datum MSL
Hammer Wt. 140 lbs.
Hole Diameter 3.25 in.
Foreman Jim Russell
Surf. Elev. 436.7 Ft.
Hammer Drop 30 in.
Rock Core Diameter NA
Inspector Robel Gibbe
Date Started 03/22/2021
Pipe Size 2 O.D. in.
Boring Method HSA-SPT
Date Completed 03/22/2021



Description	Boring and Sampling Notes	Rec.	NM	SPT	N
2" Asphalt Concrete					
8" Aggregate Base					
Dark gray sandy SILT with gravel, moist, medium dense, (Probable FILL as ML)		8		6-9-9	18
- brown		14		7-13-11	24
- dark gray, loose		6		7-5-2	7
<LOAM> Brown sandy SILT, with trace of rock fragments, moist, loose, (Probable FILL as ML)	Infiltration Rate=0.06 in/hr	10		2-2-3	5
- dark brown, very loose		5		1-2-2	4
	End of boring at 12 feet below grade.				



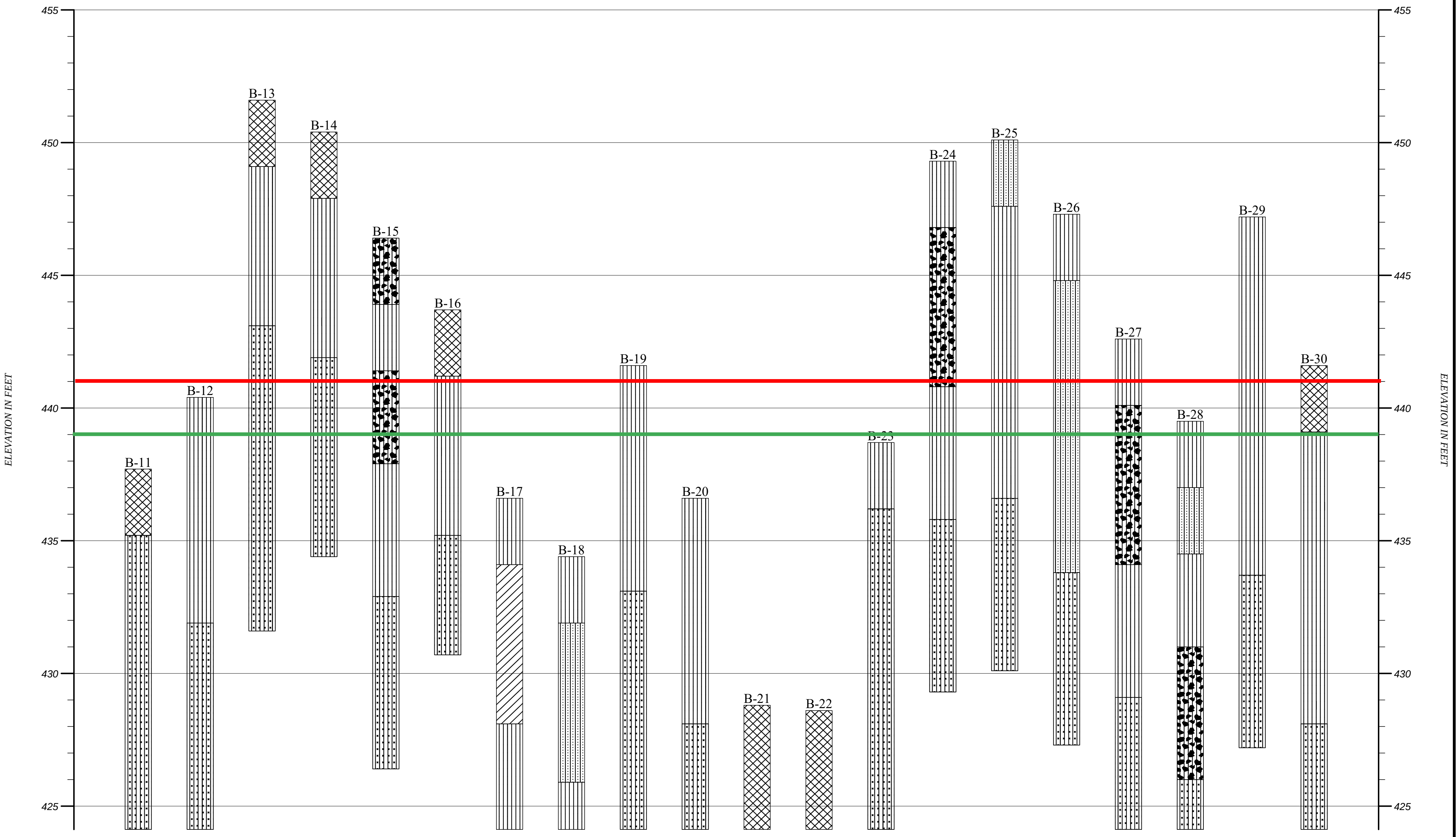
SAMPLER TYPE
DRIVEN SPLIT SPOON UNLESS OTHERWISE NOTED
PT - PRESSED SHELBY TUBE
CA - CONTINUOUS FLIGHT AUGER
RC - ROCK CORE

SAMPLE CONDITIONS
D - DISINTEGRATED
I - INTACT
U - UNDISTURBED
L - LOST

	GROUND WATER		CAVE IN DEPTH	
AT COMPLETION	Dry	ft.	5.5	ft.
AFTER 24 HRS.	Dry	ft.	5	ft.
AFTER ____ HRS.		ft.		ft.

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
DC - DRIVING CASING
MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.



Plan View

Strata symbols

- ☒ Fill
- ▥ Disintegrated Rock
- ▥ Silt
- ■ Silty gravel
- ▨ Low plasticity clay
- ▥ Silty sand

Proposed Finished Floor Elevation

Anticipated Footing Elevation

HILLIS-CARNES ENGINEERING ASSOCIATES
GENERALIZED SOIL PROFILE

HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=5'		4/12/2021

Brunswick Elementary School

FIGURE NUMBER

PROJECT NO. 22820A

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
▩	Fill
▥	Description not given for: "ZX"
▥	Silt
▥	Silty gravel
▨	Low plasticity clay
▥	Silty sand
■	Paving
●	Gravel
▨	Poorly graded clayey silty sand

Notes:

1. Exploratory borings were drilled on 03/15/2021 using a 6-inch outside diameter hand-auger.

2. Water level readings were taken during drilling and upon completion of each boring. Borings were backfilled upon completion.

3. Boring locations were selected by project HCEA and staked in the field by HCEA using existing site features as reference.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

GENERAL NOTES FOR SUBSURFACE RECORDS

1. Numbers in the sampling data column (5, 9, 12) indicate blows required to drive a 2-inch OD, 1-3/8-inch ID sampling spoon 6 inch, using a 140-pound hammer, falling 30 inches, according to ASTM-D-1586.
2. Visual classification of soil is in accordance with terminology set forth in the “Soil Identification” sheet (attached). The unified soil classification symbols shown are based on visual inspection, in accordance with ASTM-D2487.
3. Water level readings that were obtained in the borings during and after completion are noted on the subsurface records.
4. Refusal at the surface of rock, boulder, or obstruction is defined as a penetration resistance of 50 blows for 1-inch penetration or less.
5. The subsurface records and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions including the material properties of soil (and rock) and water levels at other locations may differ from conditions as reported on subsurface records with the passage of time.
6. The depth and thickness of the surface strata indicated on the section profile (if any) were generalized from and interpolated between the test borings. The transition between materials is most likely more gradual than indicated. These stratification lines were used for our analytical purposes and should be used as a basis of design or construction cost estimates.
7. Rock coring is in accordance with ASTM-2113: NQ size rock core, 2-inch OD.
8. Undisturbed samples were obtained in accordance with ASTM 01587-94: 2- or 3-inch thin walled shelby tubes.
9. Transitions between soil strata are represented on the subsurface records. A solid line represents an observed transition, and a dashed line represents an estimated change.
10. Keys to symbols and abbreviations:

    RQD = rock quality designation

    REC = recovery %

    WOH = weight of hammer advanced sample spoon 6 inches

    WOR = weight of drilling rods advanced sample spoon 6 inches

    %M = natural moisture content

Cohesive Soils (Clay, Silt, and Combinations)		Non-Cohesive Soils (Silt, Sand, Gravel, and Combinations)	
Consistency		Density	
Very Soft	2 blows/ft or less	Very Loose	4 blows/ft or less
Soft	3 to 4 blows/ft	Loose	5 to 10 blows/ft
Medium Stiff	5 to 8 blows/ft	Medium Dense	11 to 30 blows/ft
Stiff	9 to 15 blows/ft	Dense	31 to 50 blows/ft
Very Stiff	16 to 30 blows/ft	Very Dense	51 blows/ft or more
Hard	31 blows/ft or more		

SOIL IDENTIFICATION

A. DEFINITION OF SOIL GROUP NAMES (ASTM D-2487-83)

Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾” to 3” Fine, No. 4 to ¾”	Clean gravels Less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with fines More than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	Sands – 50% or more of coarse fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	Well-graded sand
			SP	Poorly graded sand
		Sands with fines More than 12% fines	SM	Silty sand
			SC	Clayey sand
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit Less than 50 Low to medium plasticity	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay
				Organic silt
	Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic Clay
				Organic silt
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT	Peat

B. DEFINITION OF MINOR COMPONENT PROPORTIONS

Minor Component	Approximate Percentage of Fraction by Weight
Adjective Form Gravelly, Sandy Silty, Clayey	30% or more of gravel or sand 12% or more of silt or clay
With Silt, Sand, Gravel and Clay	15% or more of sand or gravel 5% to 12% of silt or clay
Trace Sand, Gravel Silt, Clay	Less than 15% of sand or gravel Less than 5% of silt or clay

C. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS – Unified Soil Classification Symbols are shown above as group symbols. Dual symbols are used for borderline classifications.

BOULDERS & COBBLES – Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3- to 12-inch size.

ROCK FRAGMENTS – Angular pieces of rock within residual soils resulting from differential weathering of the underlying bedrock.

QUARTZ – A hard silica mineral often found in residual soils.

IRONITE – Iron oxide deposited within a soil layer forming cemented deposits.

CEMENTED SAND – Localized rock-like deposits within a soil stratum composed of sand grains cemented by iron oxide or other materials.

MICA – A soft plate of silica mineral found in many rocks and in residual or transported soils derived therefrom.

TOPSOIL – Surface soils that support plant life and which contain more than 5% organic matter.

FILL – Manmade deposit containing soil, rock, and often foreign matter.

PROBABLE FILL – Soils which contain no visually detected foreign matter but which are suspect with regard to origin.

LENSES – 0 to ½-inch seam of minor soil component.

LAYERS – ½- to 12-inch seam of minor soil component.

POCKET – Discontinuous body of minor soil component.

MOISTURE CONDITIONS – Wet, very moist, moist, or dry to indicate visual appearance of specimen.

Appendix C

HILLIS-CARNES
Engineering Associates, Inc.

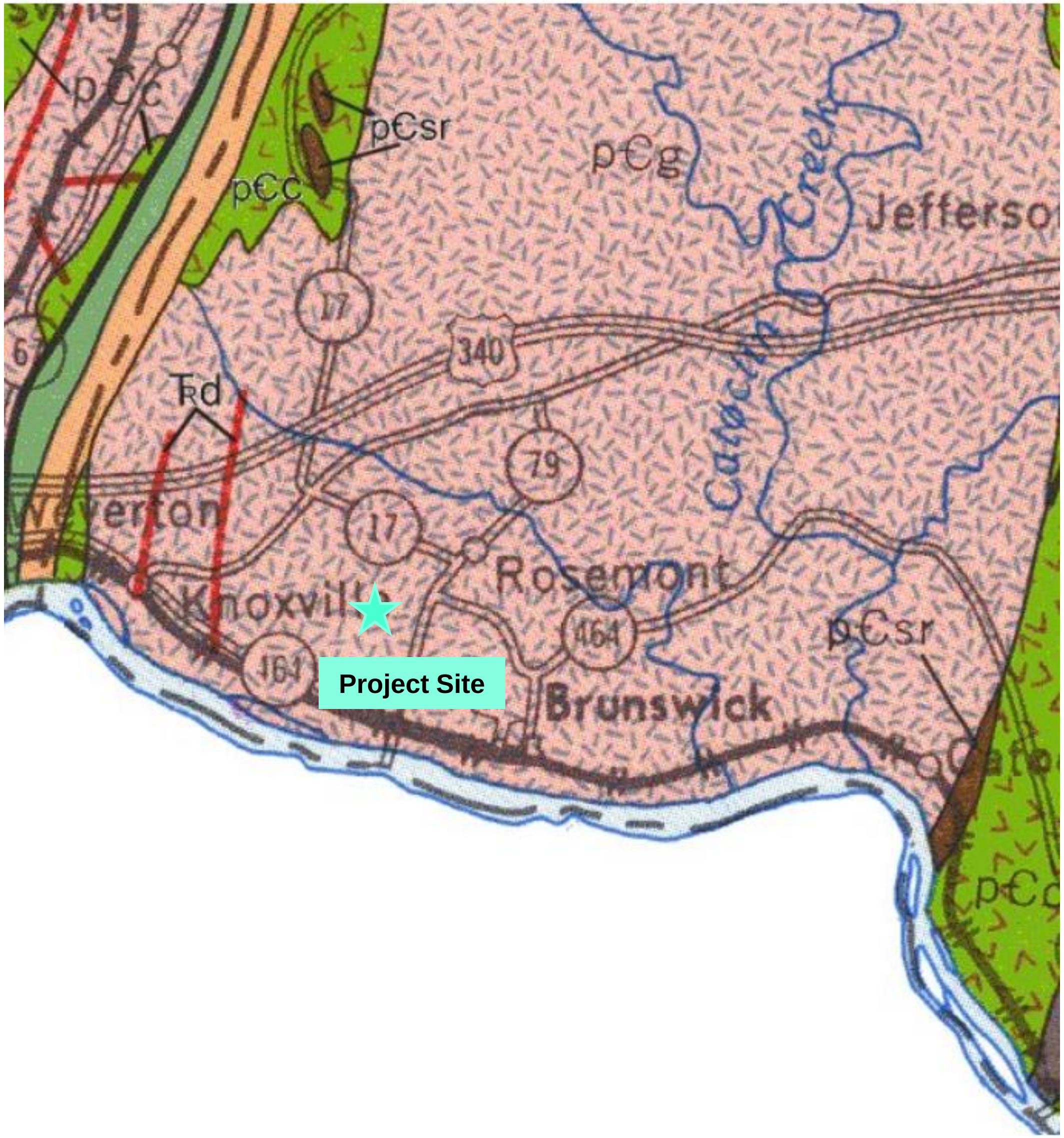
PROJECT NO.: 22820A

SCALE: NTS

DATE: April 12, 2021

Project Location Plan, Brunswick Elementary School Replacement, Brunswick, MD

DRAWING NO.
4



HILLIS-CARNES
Engineering Associates, Inc.

PROJECT NO.: 22820A

SCALE: NTS

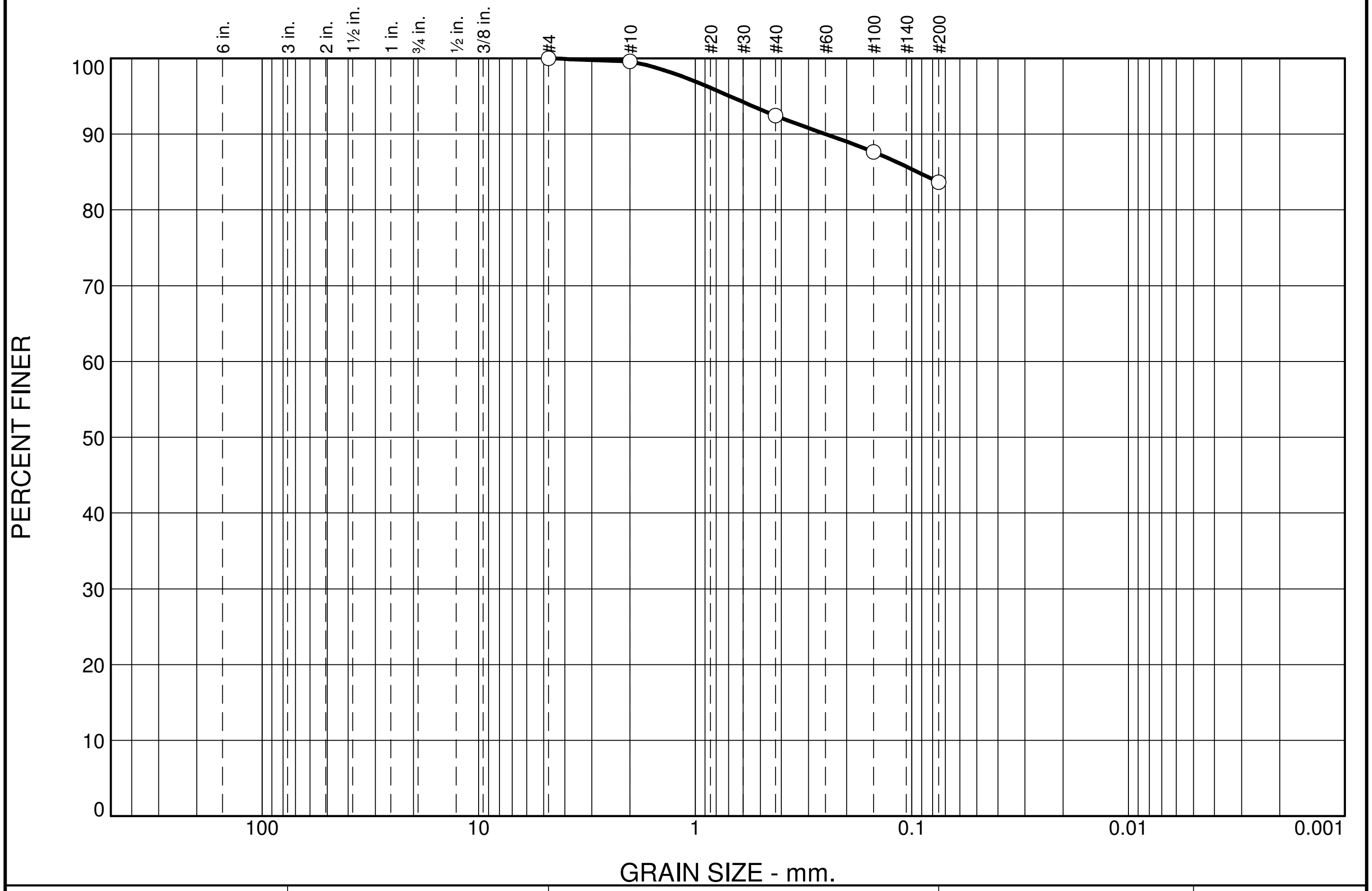
DATE: April 12, 2021

Site Geology, Brunswick Elementary School Replacement, Brunswick, MD

DRAWING NO.
5

Appendix D

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	16.4	83.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#40	92.4		
#100	87.6		
#200	83.6		

* (no specification provided)

Material Description

Reddish brown Elastic SILT with sand

Atterberg Limits

PL= 33 LL= 60 PI= 27

Coefficients

D_{90}= 0.2493 D_{85}= 0.0940 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= MH AASHTO= A-7-5(26)

Remarks

Moisture Content: 25.2%

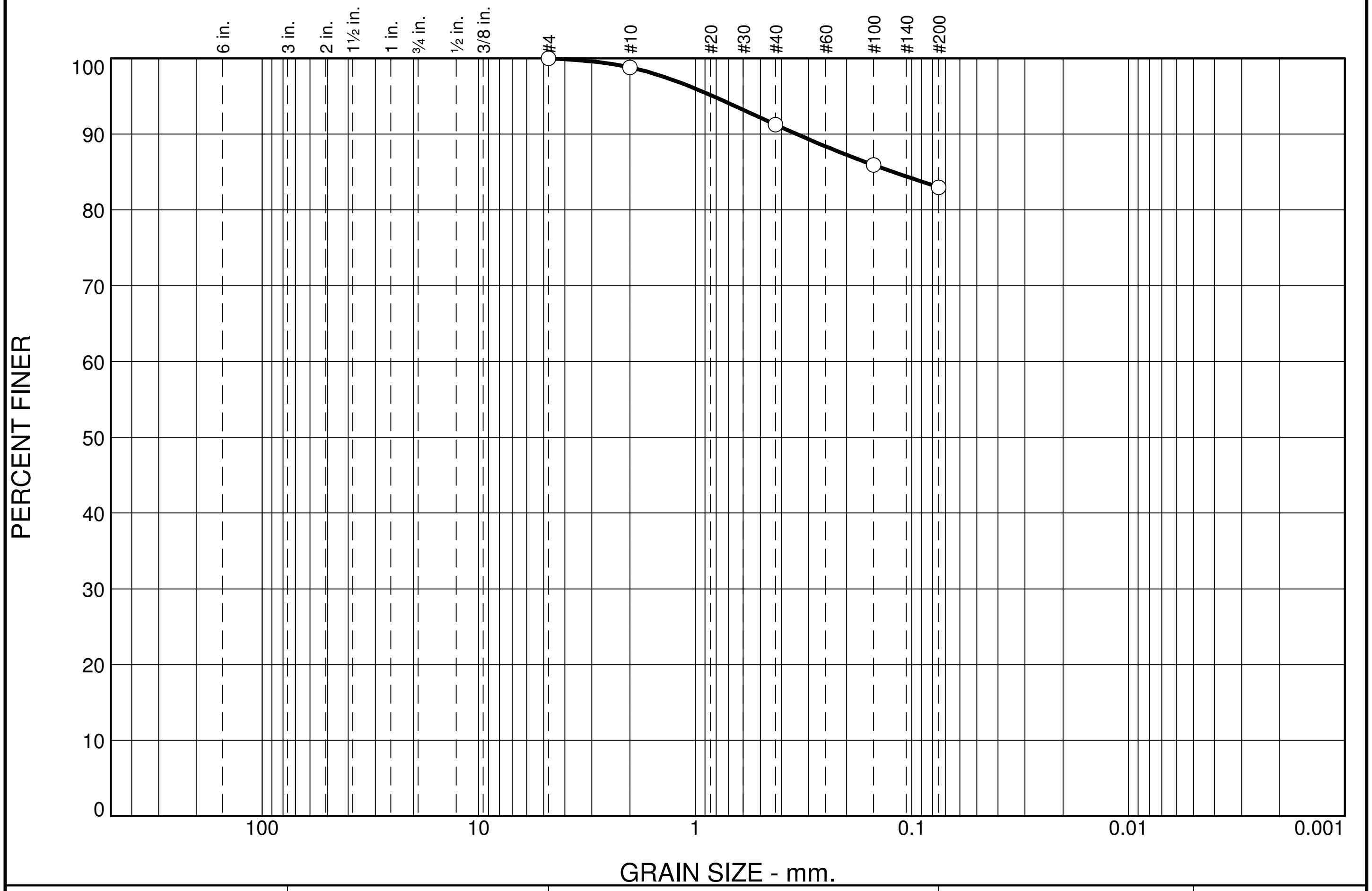
Location: B-13
Sample Number: S-1 **Depth:** 0.0'-1.5' **Date:** 04-12-21

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES
Project No: 22820A **Figure** #1332

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	17.0	83.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.8		
#40	91.2		
#100	85.9		
#200	83.0		

* (no specification provided)

Material Description

Brown Lean CLAY with sand

Atterberg Limits

PL= 24 LL= 39 PI= 15

Coefficients

D_{90}= 0.3395 D_{85}= 0.1219 D_{60}=

D_{50}= D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

Moistu Content: 23.0%

Location: B-17

Sample Number: S-2 **Depth:** 2.5'-4.0' **Date:** 04-12-21

HILLIS-CARNES ENGINEERING ASSOCIATES

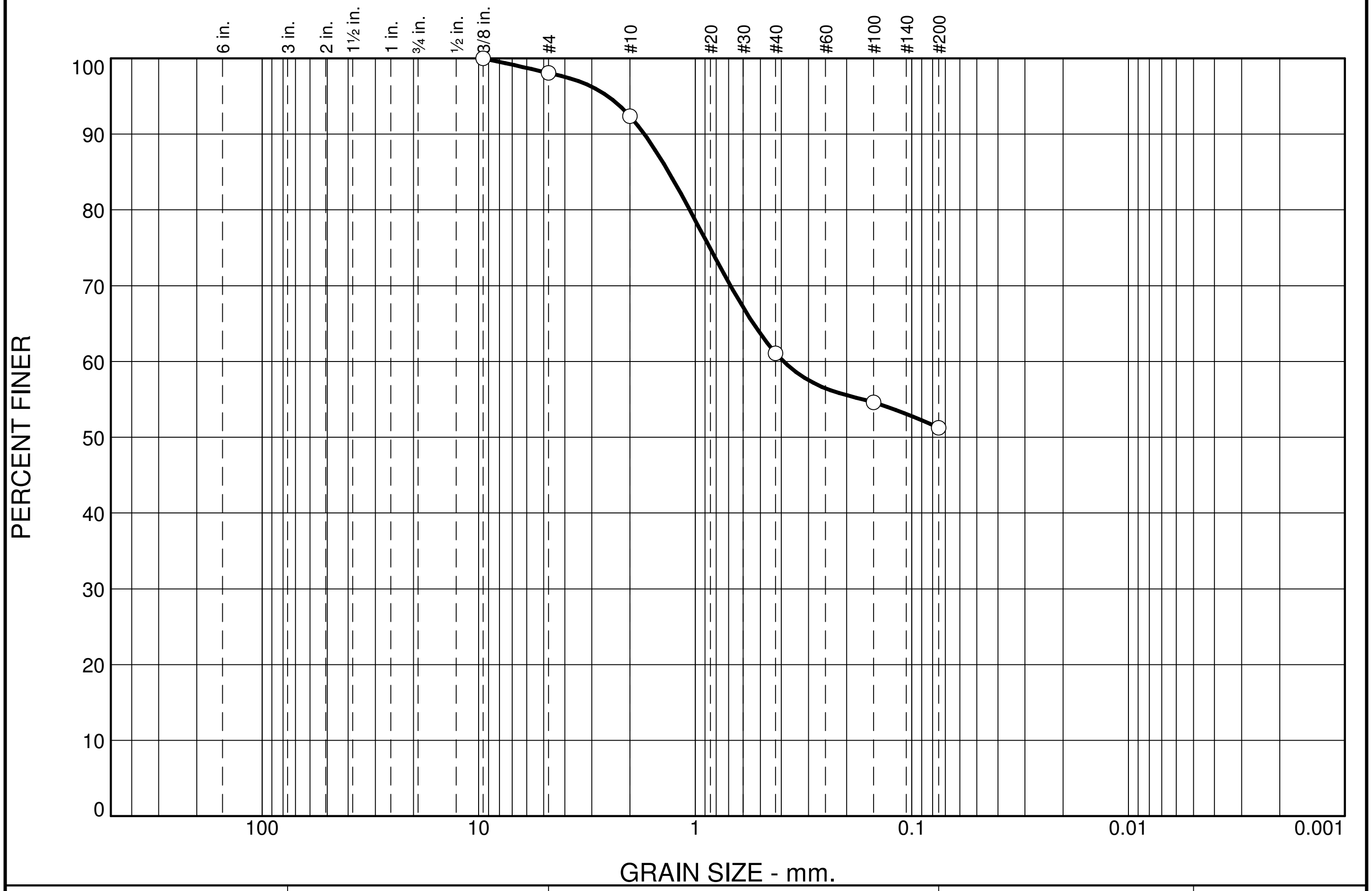
FREDERICK, MD

Client: GWWO Inc. Architects

Project: Brunswick ES

Project No: 22820A **Figure** #1333

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	1.9	46.8	51.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	98.1		
#10	92.4		
#40	61.1		
#100	54.6		
#200	51.3		

* (no specification provided)

Material Description

Brown Sandy SILT, trace rock fragments

Atterberg Limits

PL= NP
LL= NP
PI= NP

Coefficients

D_{90}= 1.7176
D_{85}= 1.3269
D_{60}= 0.3905
D_{50}=
D_{30}=
D_{15}=
D_{10}=
C_u=
C_c=

Classification

USCS= ML
AASHTO= A-4(0)

Remarks

Moisture Content: 17.5%

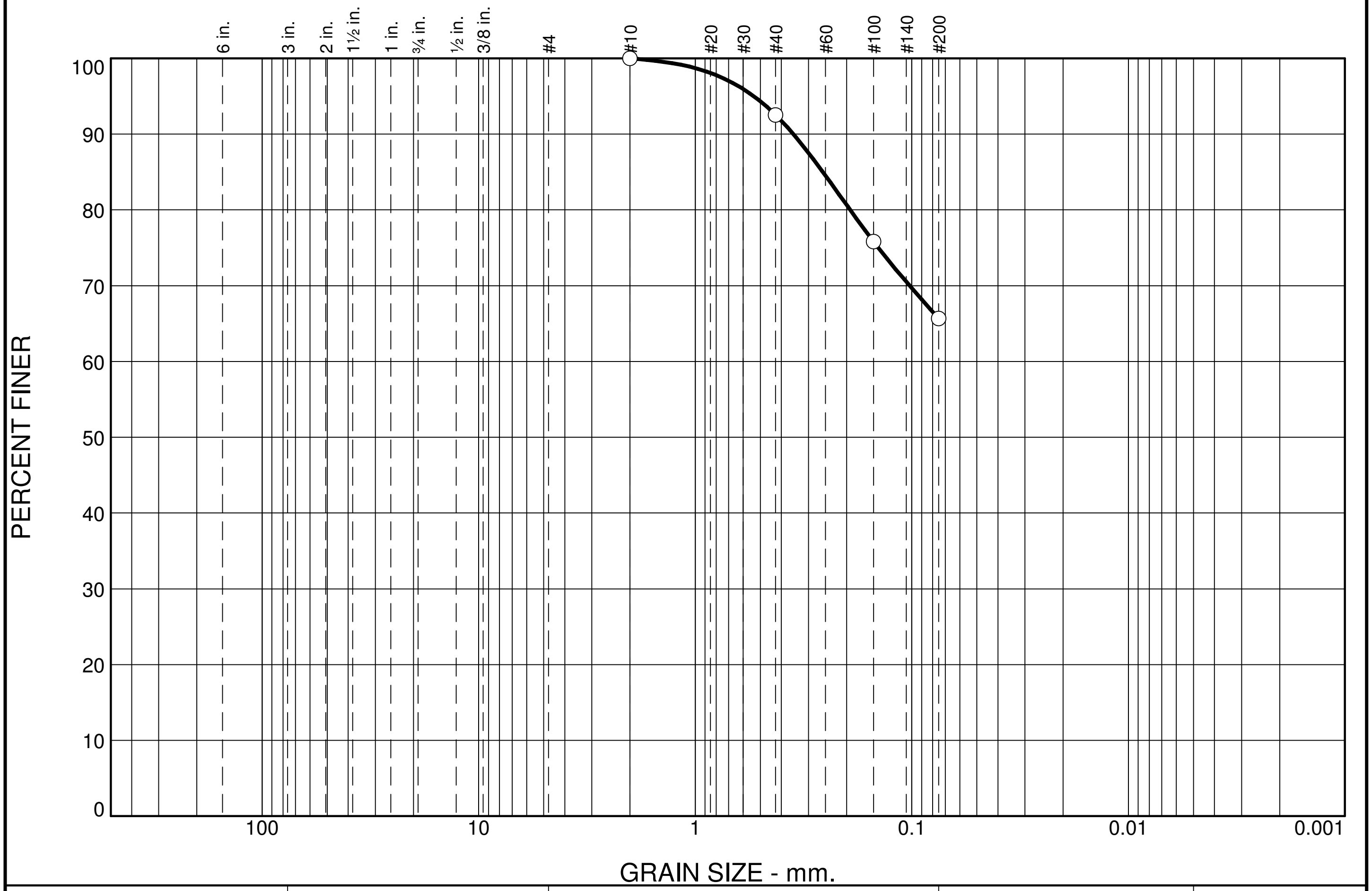
Location: B-21
Sample Number: S-3 **Depth:** 5.0'-6.5' **Date:** 04-12-21

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES
Project No: 22820A **Figure** #1334

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	34.4	65.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	92.5		
#100	75.8		
#200	65.6		

* (no specification provided)

Material Description

Light brown Sandy SILT

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.3525 D_{85}= 0.2573 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content: 16.1%

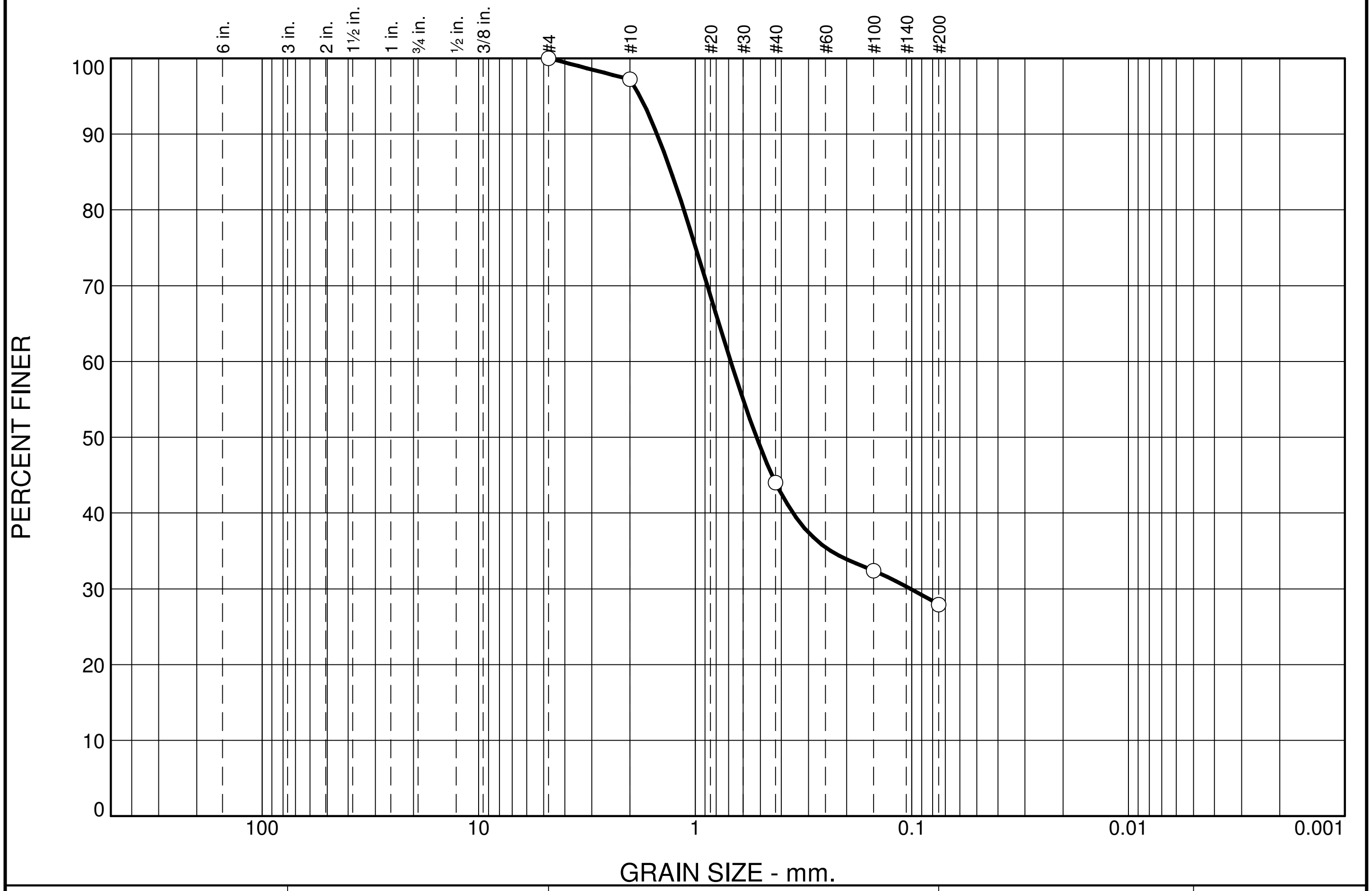
Location: B-24
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-12-21

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES
Project No: 22820A **Figure** #1335

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	72.1	27.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	97.2		
#40	44.0		
#100	32.4		
#200	27.9		

* (no specification provided)

Material Description

Tan Silty SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 1.5008 D_{85}= 1.2919 D_{60}= 0.6853

D_{50}= 0.5210 D_{30}= 0.1012 D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Moisture Content: 9.2%

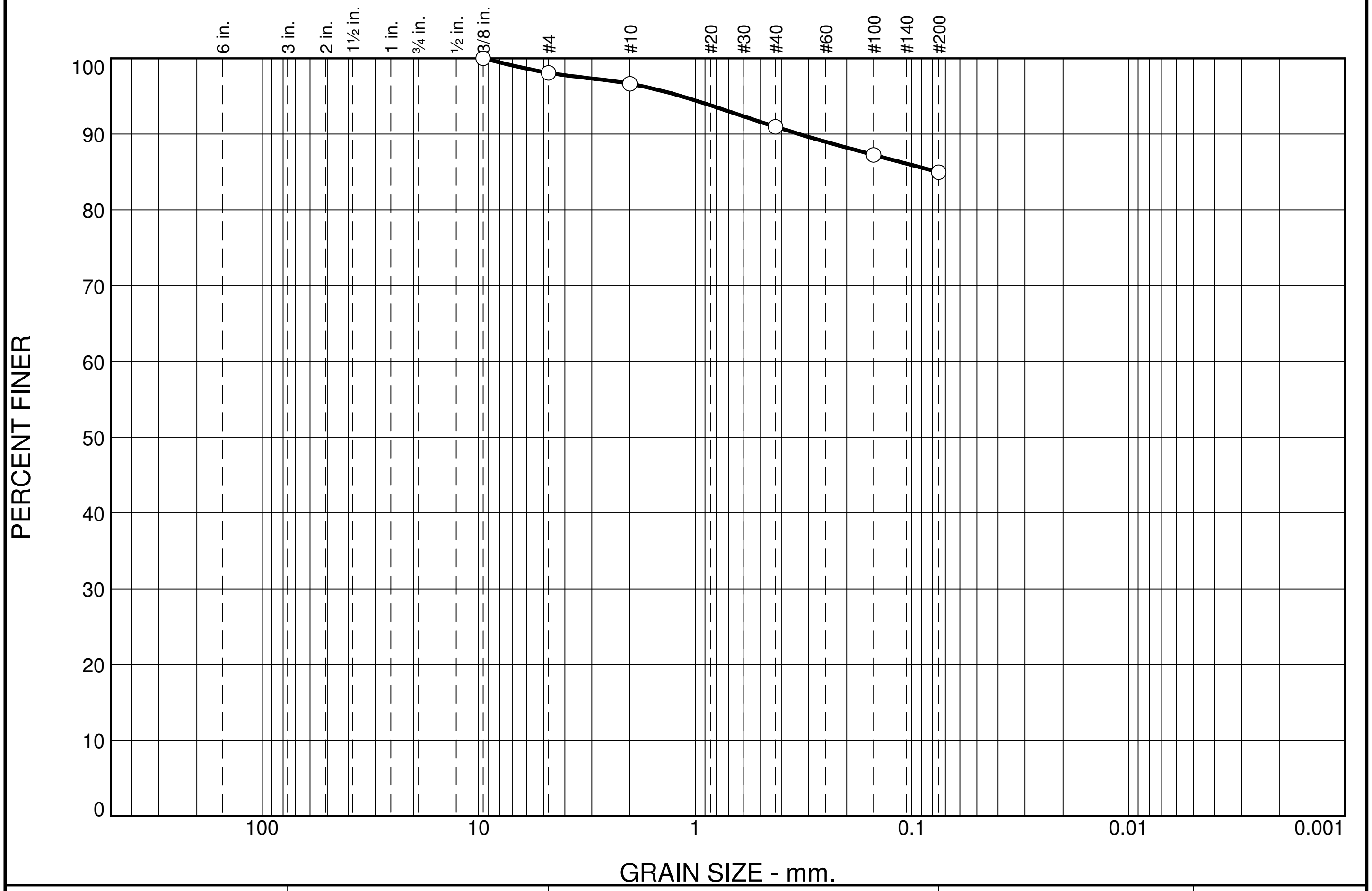
Location: B-26
Sample Number: S-2 **Depth:** 2.5'-4.0' **Date:** 04-12-21

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES
Project No: 22820A **Figure** #1336

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	1.9	13.1	85.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	98.1		
#10	96.6		
#40	91.0		
#100	87.3		
#200	85.0		

* (no specification provided)

Material Description

Brown SILT with sand, trace rock fragments

Atterberg Limits

PL= 27 LL= 44 PI= 17

Coefficients

D_{90}= 0.3314 D_{85}= 0.0756 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-7-6(16)

Remarks

Moisture Content: 24.2%

Location: B-30
Sample Number: S-2 **Depth:** 2.5'-4.0' **Date:** 04-12-21

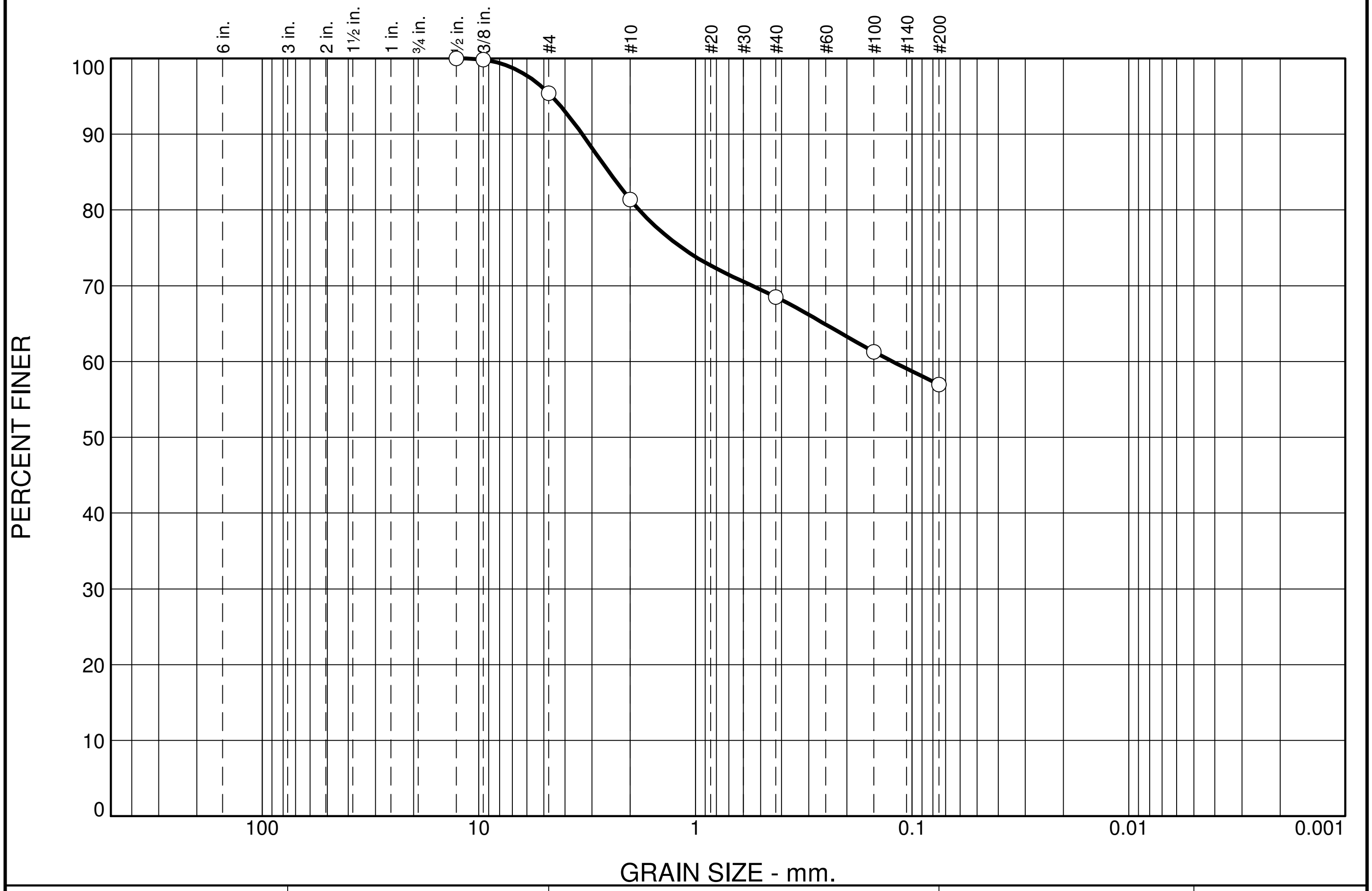
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1337

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.6	38.4	57.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.5	100.0		
0.375	99.8		
#4	95.4		
#10	81.4		
#40	68.5		
#100	61.3		
#200	57.0		

* (no specification provided)

Material Description

Tan sandy Lean CLAY, trace rock fragments

Atterberg Limits

PL= 23 LL= 39 PI= 16

Coefficients

D_{90}= 3.3299 D_{85}= 2.5000 D_{60}= 0.1233

D_{50}= D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

Location: P-1
Depth: 0.0'-5.0'

Date: 04-01-21

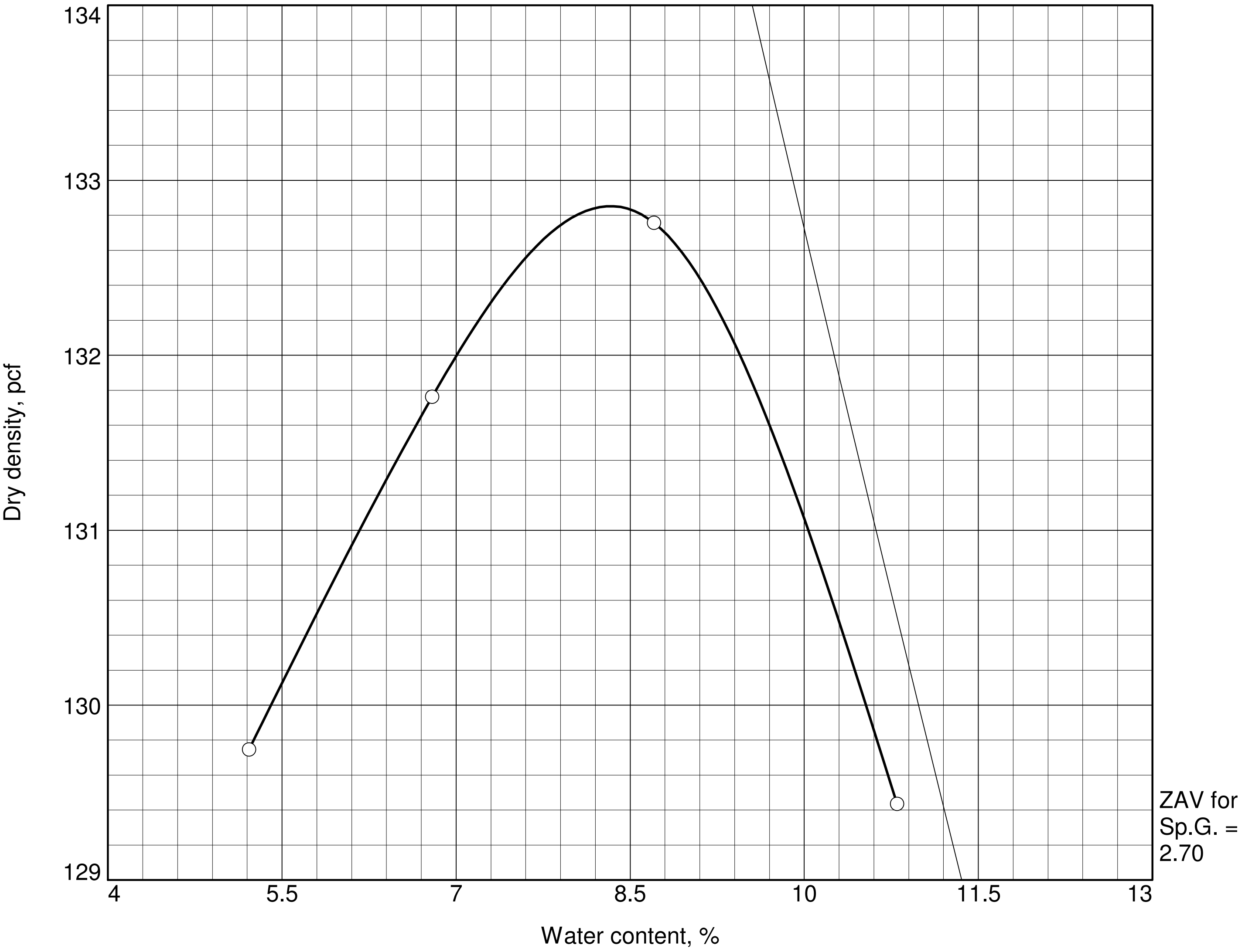
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1304

COMPACTION TEST REPORT



Test specification: AASHTO T 180 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-6(7)	5.5%		39	16	0.0	57.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 132.9 pcf Optimum moisture = 8.3 %	Tan sandy Lean CLAY, trace rock fragments

Project No. 22820A **Client:** GWWO Inc. Architects

Project: Brunswick ES

Date: 04-01-21

○ **Location:** P-1

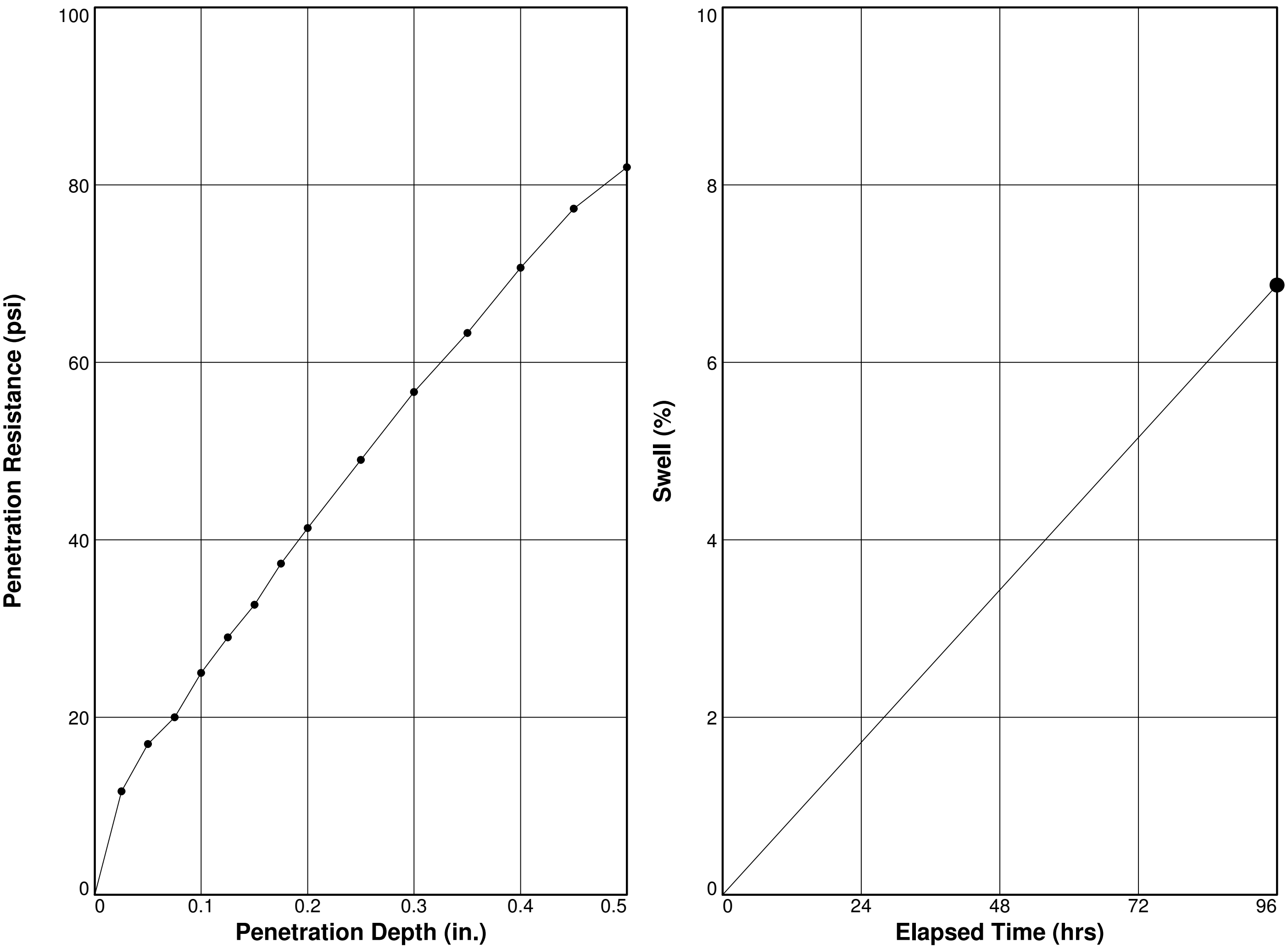
Remarks:

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Figure #1304

BEARING RATIO TEST REPORT
ASTM D 1883-99



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	127.5	95.9	8.5	119.3	89.8	16.3	2.5	2.8	0.000	10	6.9
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan sandy Lean CLAY, trace rock fragments	CL	132.9	8.3	39	16

Project No: 22820A

Project: Brunswick ES

Location: P-1

Depth: 0.0'-5.0'

Date: 04-01-21

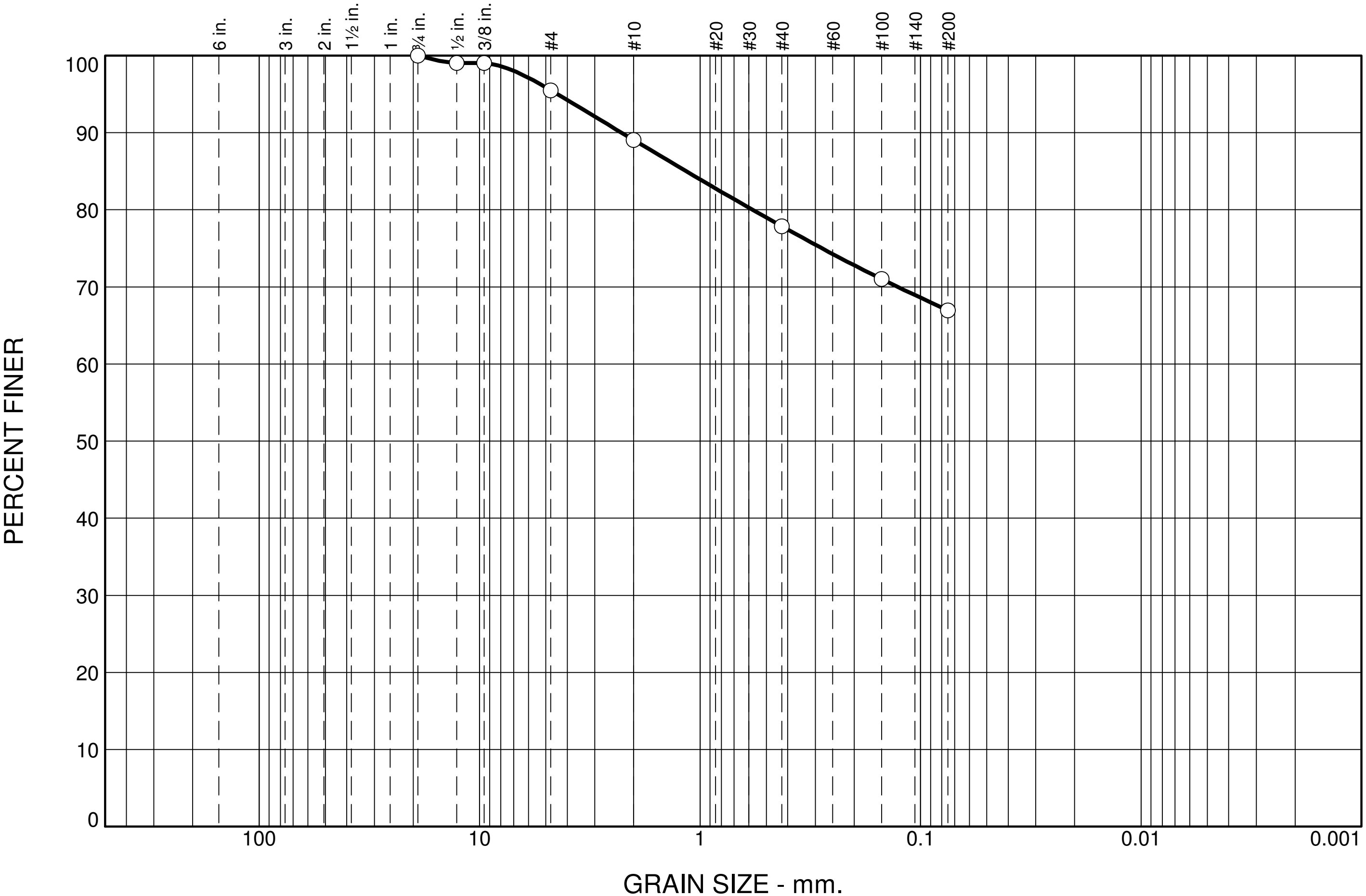
BEARING RATIO TEST REPORT

HILLIS-CARNES ENGINEERING ASSOCIATES

Test Description/Remarks:

Figure #1304

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.5	28.5	67.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.5	99.0		
0.375	99.0		
#4	95.5		
#10	89.1		
#40	77.9		
#100	71.0		
#200	67.0		

* (no specification provided)

Material Description

Tan sandy Lean CLAY, trace rock fragments

Atterberg Limits

PL= 21 LL= 30 PI= 9

Coefficients

D_{90}= 2.2705 D_{85}= 1.1559 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(4)

Remarks

Location: P-3
Depth: 0.0'-5.0'

Date: 04-01-21

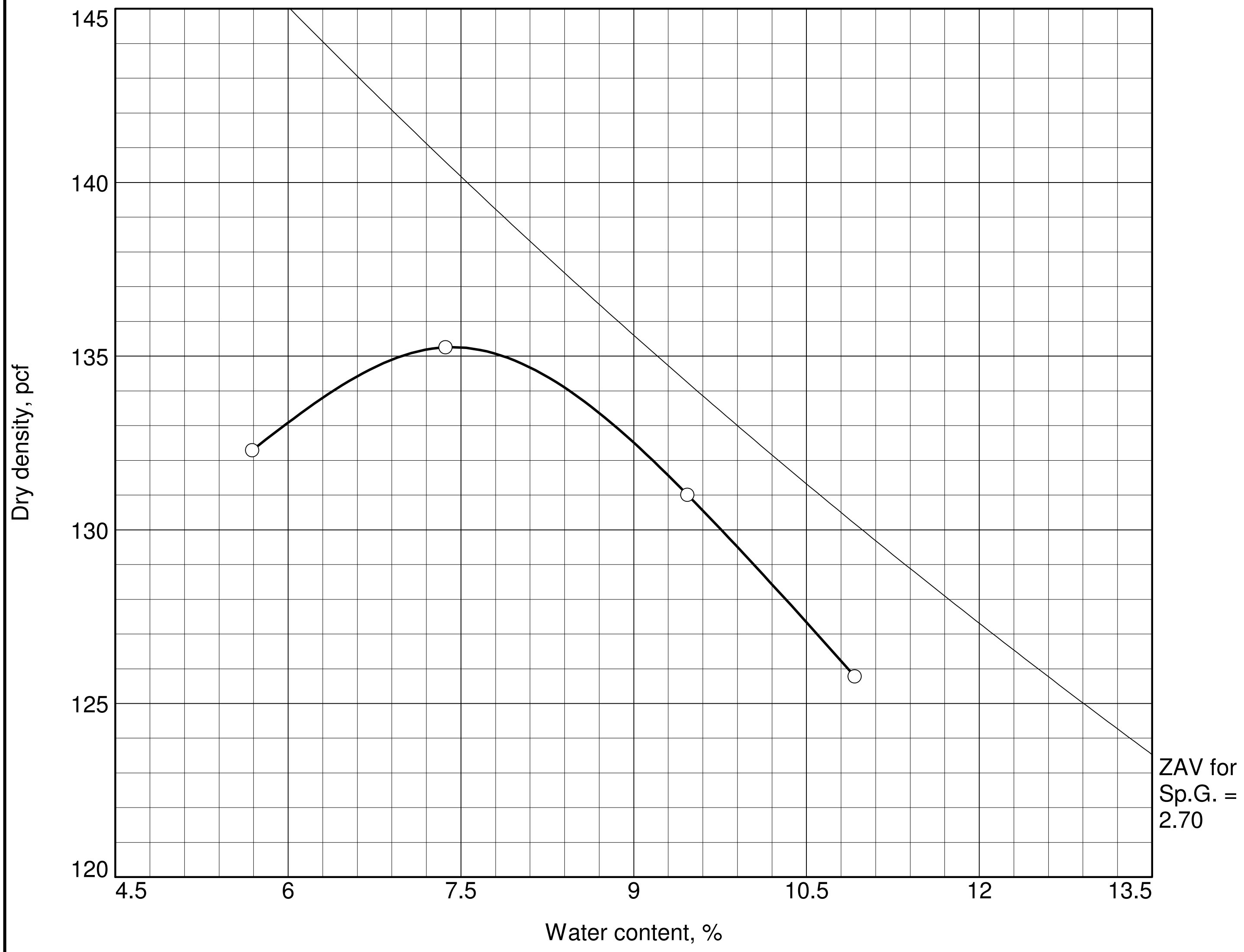
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1305

COMPACTION TEST REPORT



Test specification: AASHTO T 180 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-4(4)	1.7%		30	9	0.0	67.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 135.3 pcf Optimum moisture = 7.4 %	Tan sandy Lean CLAY, trace rock fragments

Project No. 22820A **Client:** GWWO Inc. Architects

Project: Brunswick ES

Date: 04-01-21

○ **Location:** P-3

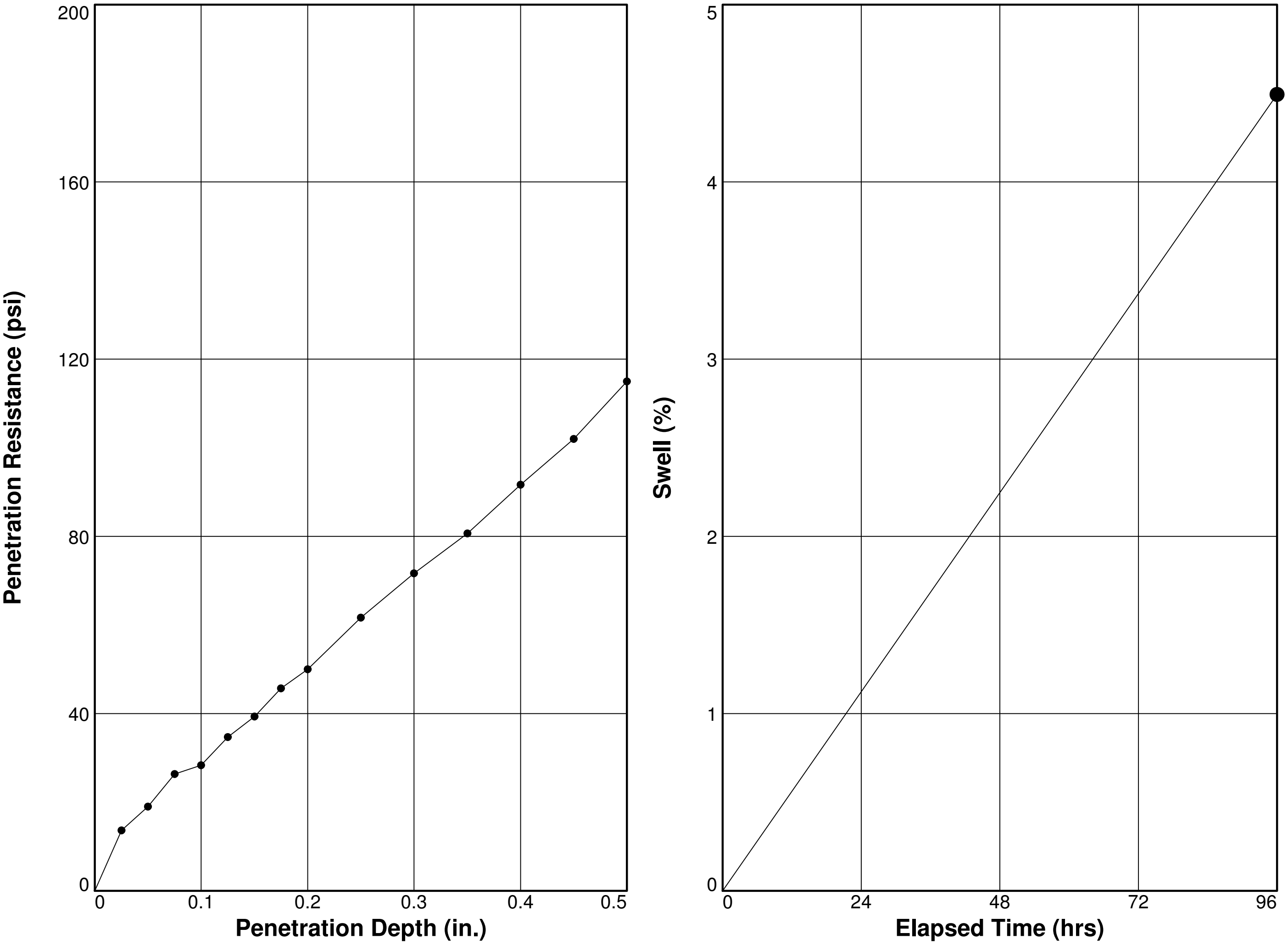
Remarks:

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Figure #1305

BEARING RATIO TEST REPORT
ASTM D 1883-99



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	128.8	95.2	6.5	123.3	91.1	12.2	2.8	3.3	0.000	10	4.5
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan sandy Lean CLAY, trace rock fragments	CL	135.3	7.4	30	9

Project No: 22820A

Project: Brunswick ES

Location: P-3

Depth: 0.0'-5.0'

Date: 04-01-21

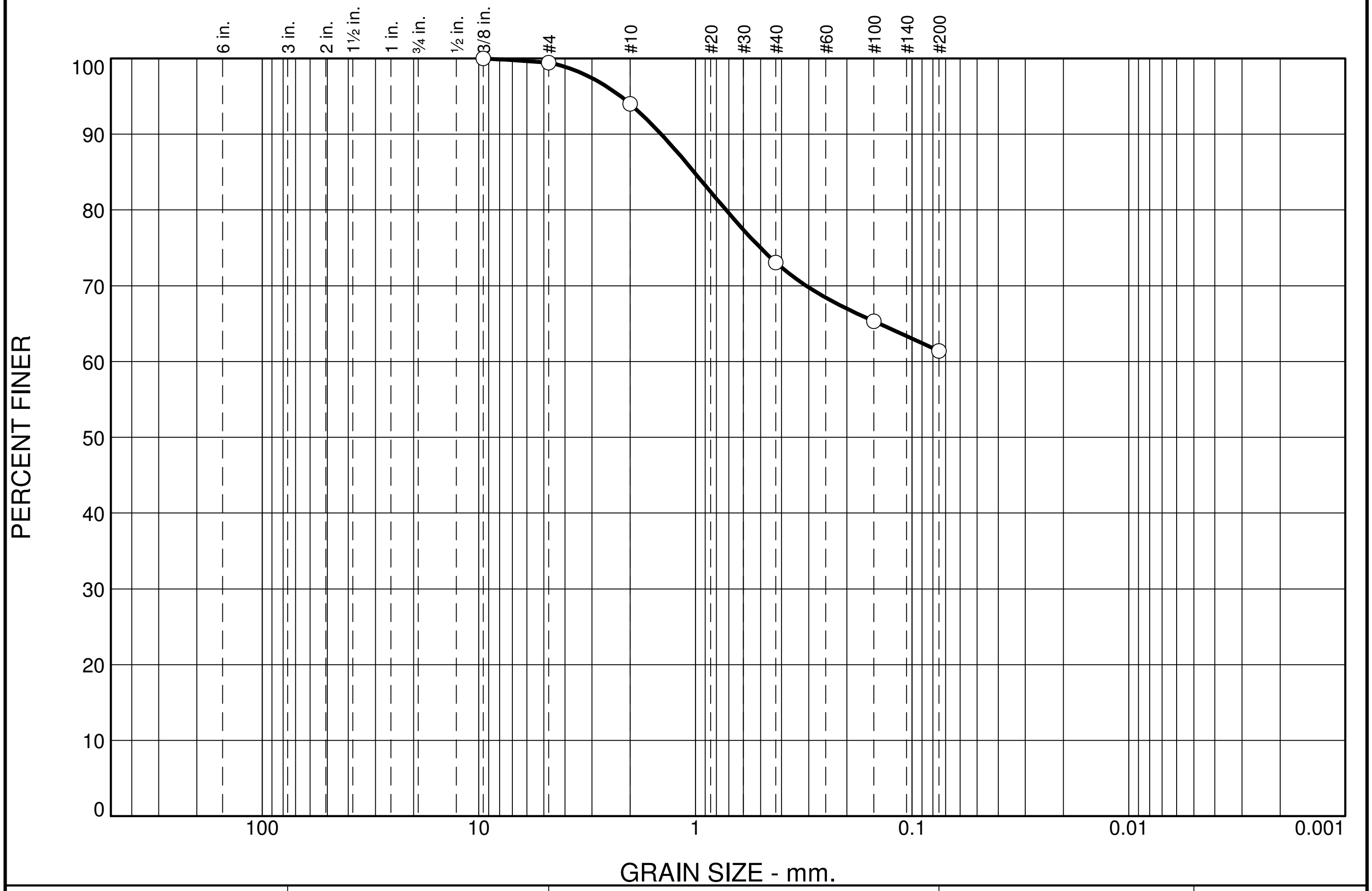
BEARING RATIO TEST REPORT

HILLIS-CARNES ENGINEERING ASSOCIATES

Test Description/Remarks:

Figure #1305

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.5	38.1	61.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.5		
#10	94.0		
#40	73.1		
#100	65.3		
#200	61.4		

* (no specification provided)

Material Description

Tan sandy Lean CLAY, trace rock fragments

Atterberg Limits

PL= 24 LL= 37 PI= 13

Coefficients

D_{90}= 1.4390 D_{85}= 1.0124 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

Location: P-6
Depth: 0.0'-5.0'

Date: 04-01-21

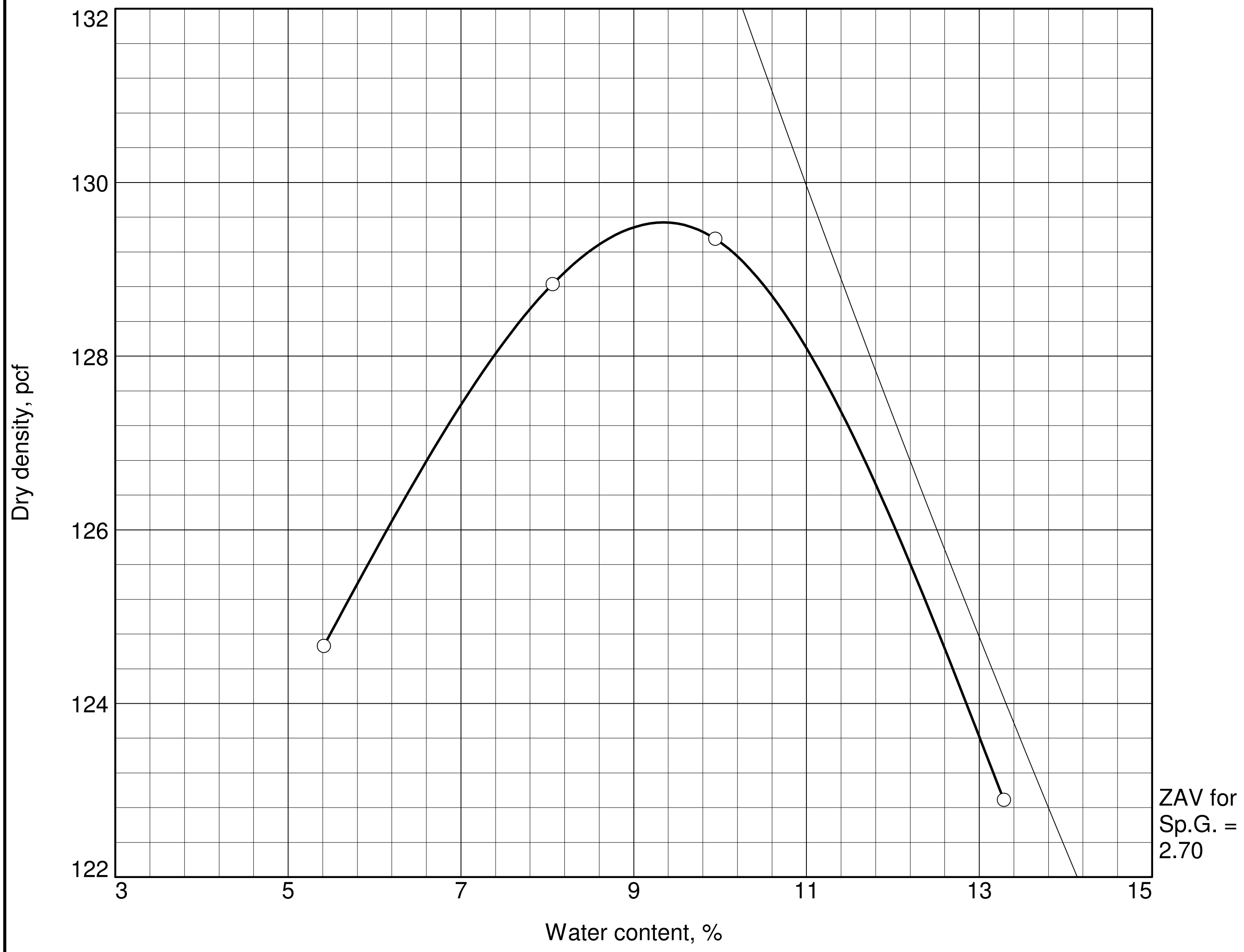
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1306

COMPACTION TEST REPORT



Test specification: AASHTO T 180 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-6(6)	5.6%		37	13	0.0	61.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 129.5 pcf Optimum moisture = 9.3 %	Tan sandy Lean CLAY, trace rock fragments

Project No. 22820A **Client:** GWWO Inc. Architects

Project: Brunswick ES

Date: 04-01-21

○ **Location:** P-6

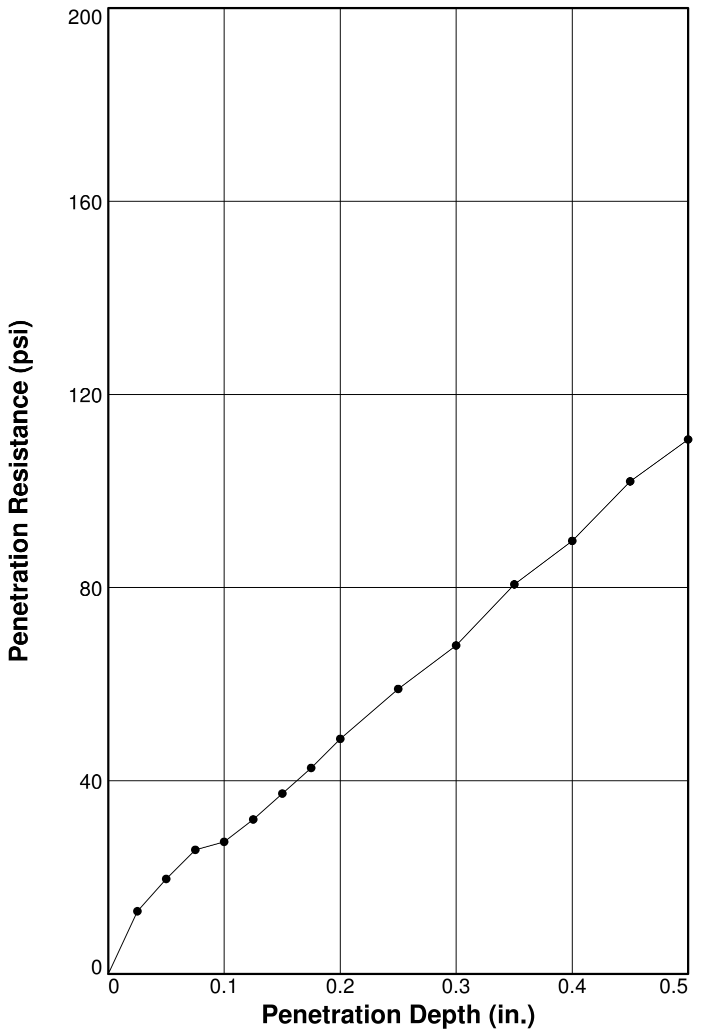
Remarks:

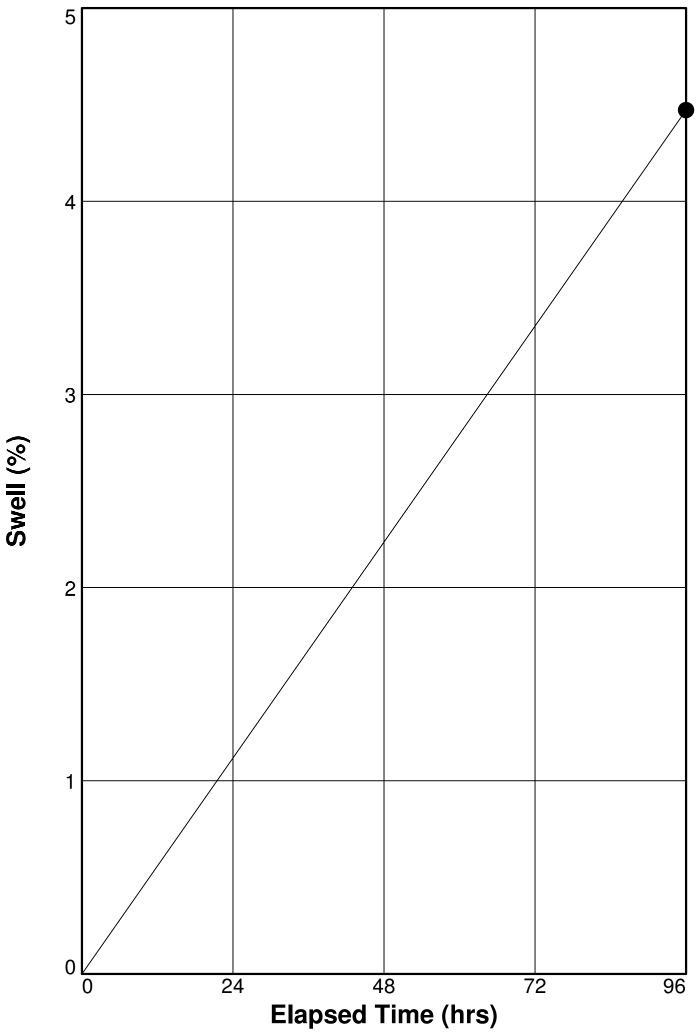
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Figure #1306

BEARING RATIO TEST REPORT
ASTM D 1883-99





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	125.5	96.9	8.8	120.1	92.8	17.1	2.7	3.2	0.000	10	4.5
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan sandy Lean CLAY, trace rock fragments	CL	129.5	9.3	37	13

Project No: 22820A

Project: Brunswick ES

Location: P-6

Depth: 0.0'-5.0'

Date: 04-01-21

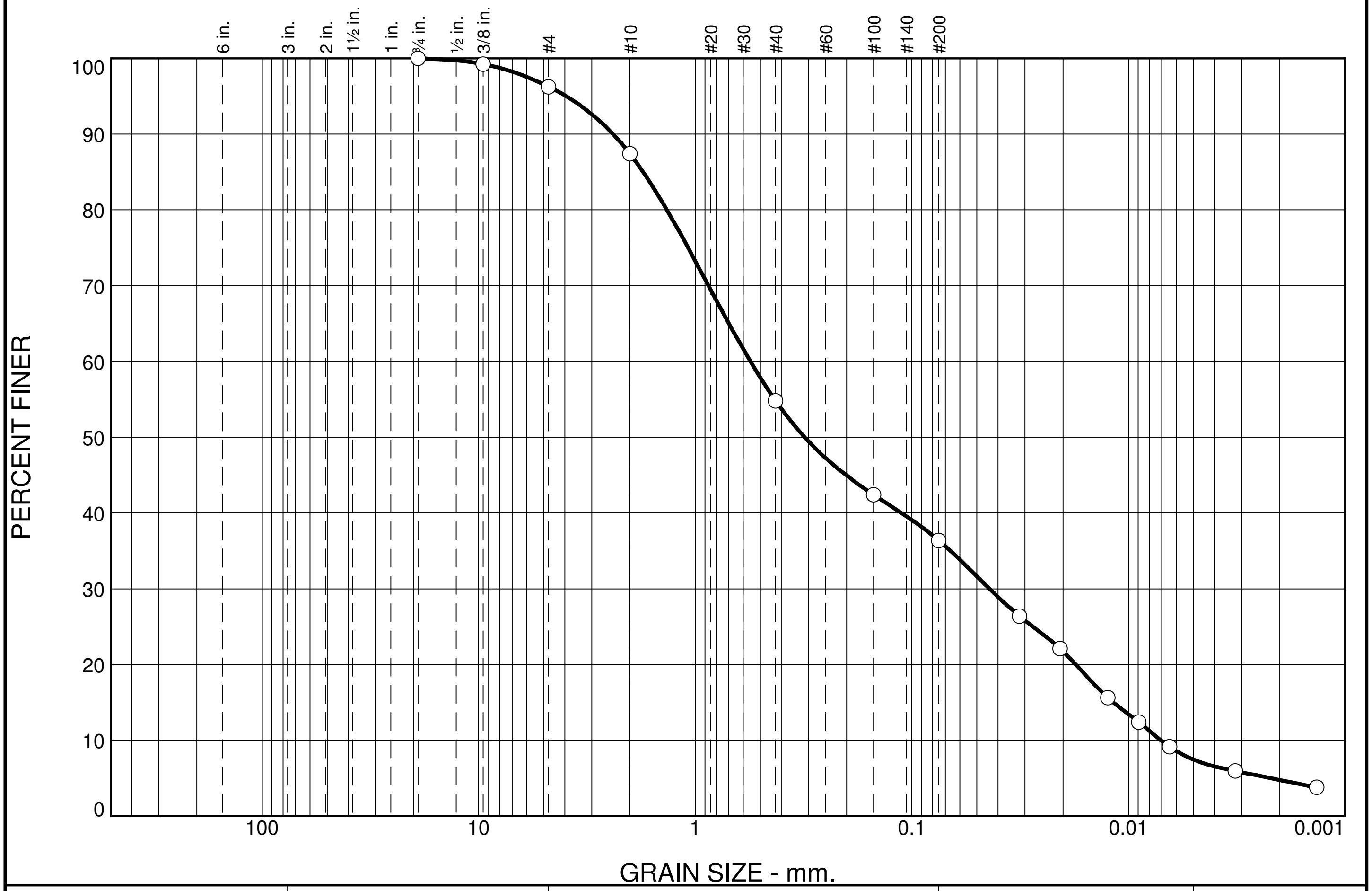
BEARING RATIO TEST REPORT

HILLIS-CARNES ENGINEERING ASSOCIATES

Test Description/Remarks:

Figure #1306

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	3.8	59.8	28.9	7.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	99.2		
#4	96.2		
#10	87.4		
#40	54.8		
#100	42.4		
#200	36.4		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 62.9% SILT: 31.6% CLAY: 5.5%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.3912	D_{85}= 1.7390	D_{60}= 0.5557
D_{50}= 0.3120	D_{30}= 0.0437	D_{15}= 0.0117
D_{10}= 0.0071	C_u= 78.66	C_c= 0.49

Classification

USCS= AASHTO=

Remarks

Moisture Content: 7.2%

Location: SWM-1
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-06-21

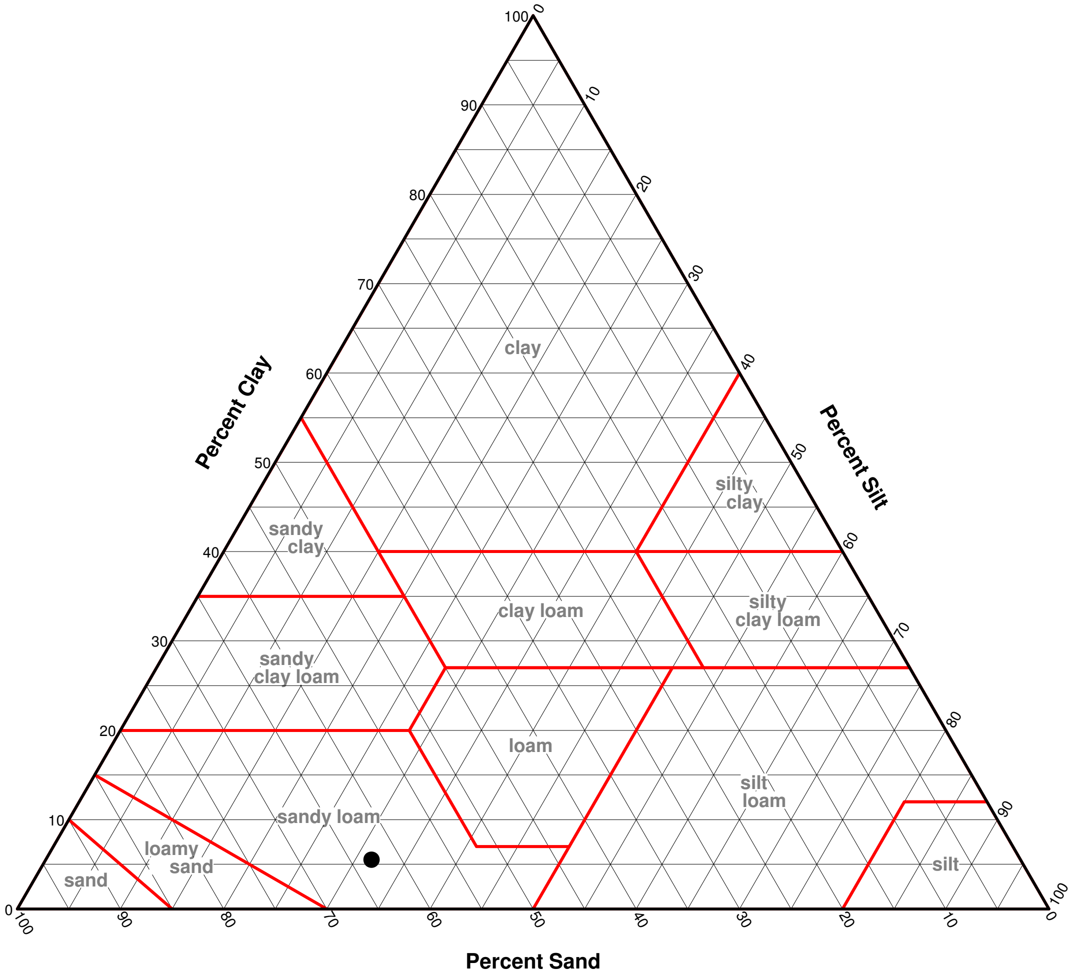
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1323

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve Sand	Silt	Clay	Classification
●	#1323	S-4	8.5'-10.0'	62.9	31.6	5.5	Sandy loam

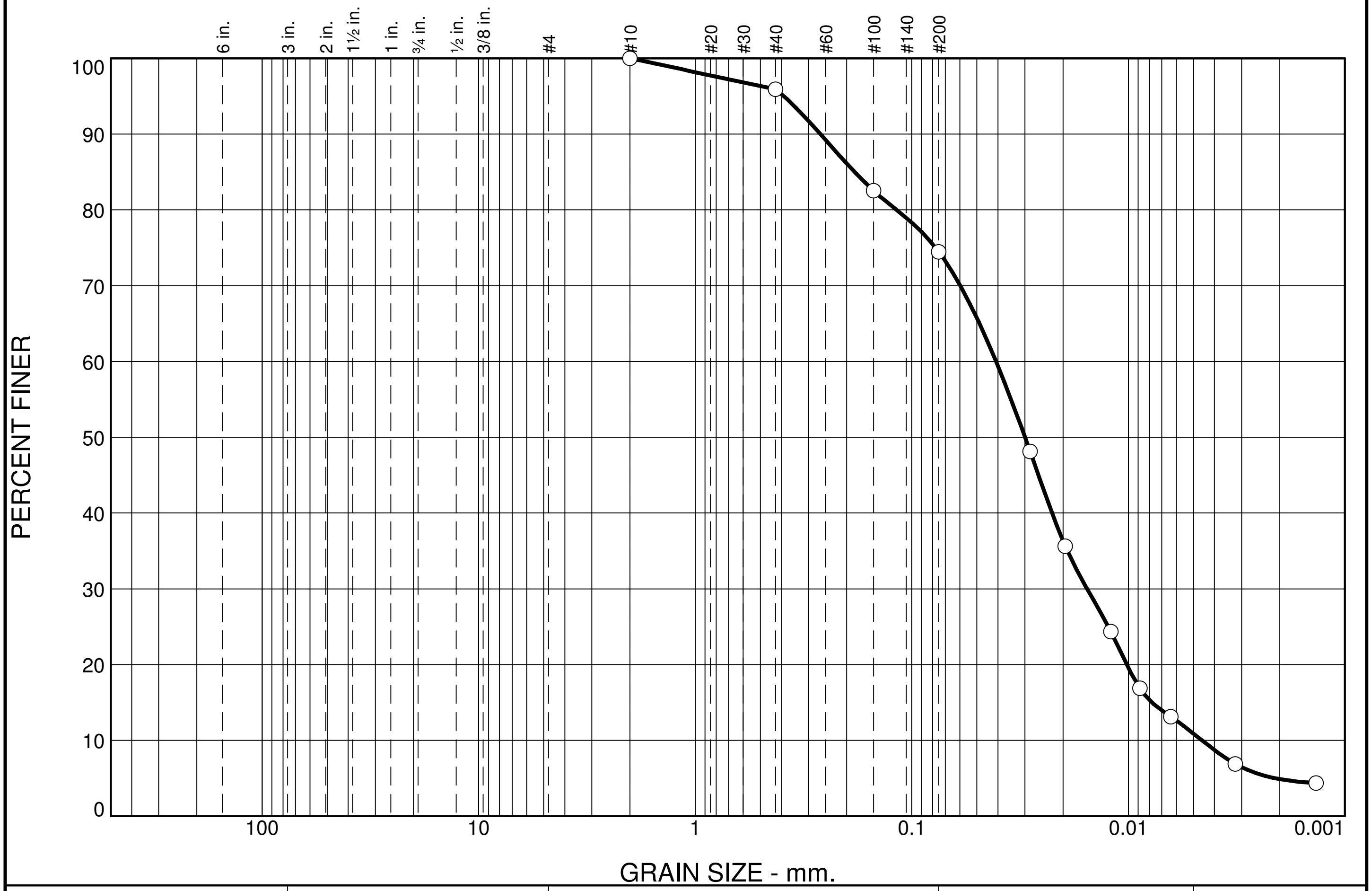
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No.: 22820A **Figure** #1323

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	25.5	63.6	10.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	95.9		
#100	82.5		
#200	74.5		

* (no specification provided)

Material Description

USDA Classification: Silt Loam
USDA Fraction: SAND: 32.8% SILT: 62.3% CLAY: 4.9%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2639 D_{85}= 0.1836 D_{60}= 0.0408
D_{50}= 0.0300 D_{30}= 0.0155 D_{15}= 0.0078
D_{10}= 0.0046 C_u= 8.94 C_c= 1.29

Classification

USCS= AASHTO=

Remarks

Moisture Content: 17.1%

Location: SWM-2
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-06-21

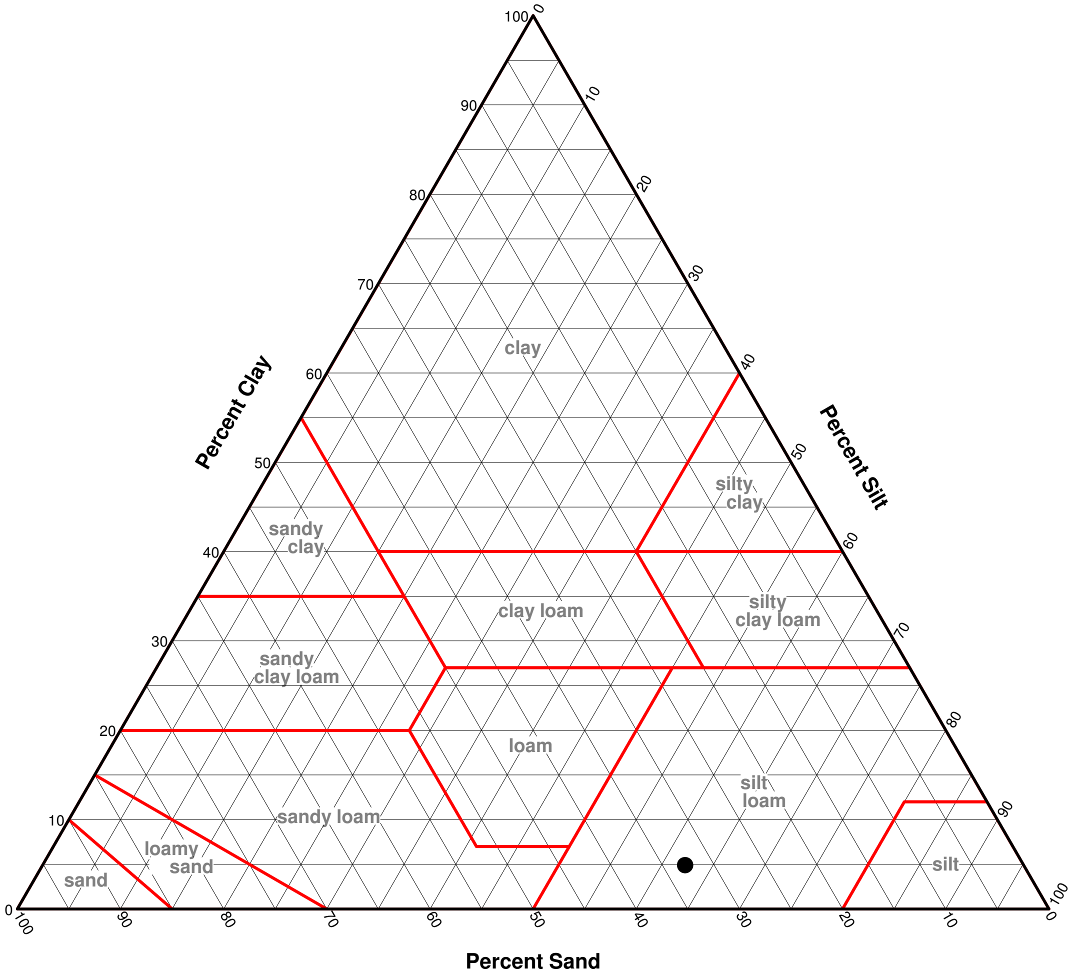
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1324

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve Sand	Silt	Clay	Classification
●	#1324	S-4	8.5'-10.0'	32.8	62.3	4.9	Silt loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

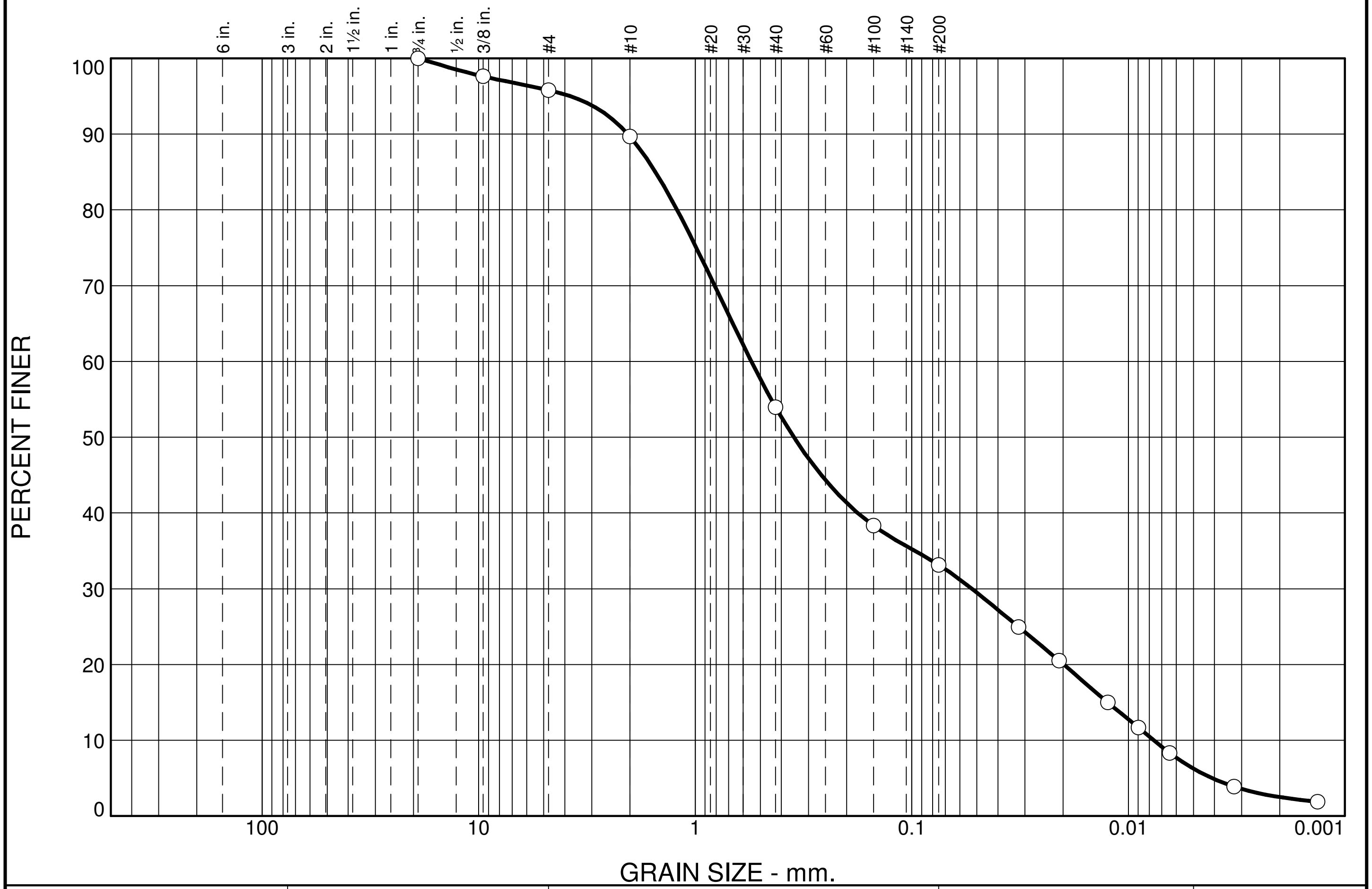
Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1324

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.2	62.7	26.8	6.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	97.6		
#4	95.8		
#10	89.7		
#40	54.0		
#100	38.3		
#200	33.1		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 66.4% SILT: 30.8% CLAY: 2.8%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.0477	D_{85}= 1.5272	D_{60}= 0.5502
D_{50}= 0.3500	D_{30}= 0.0527	D_{15}= 0.0125
D_{10}= 0.0076	C_u= 72.12	C_c= 0.66

Classification

USCS= AASHTO=

Remarks

Moisture Content: 5.1%

Location: SWM-4
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-07-21

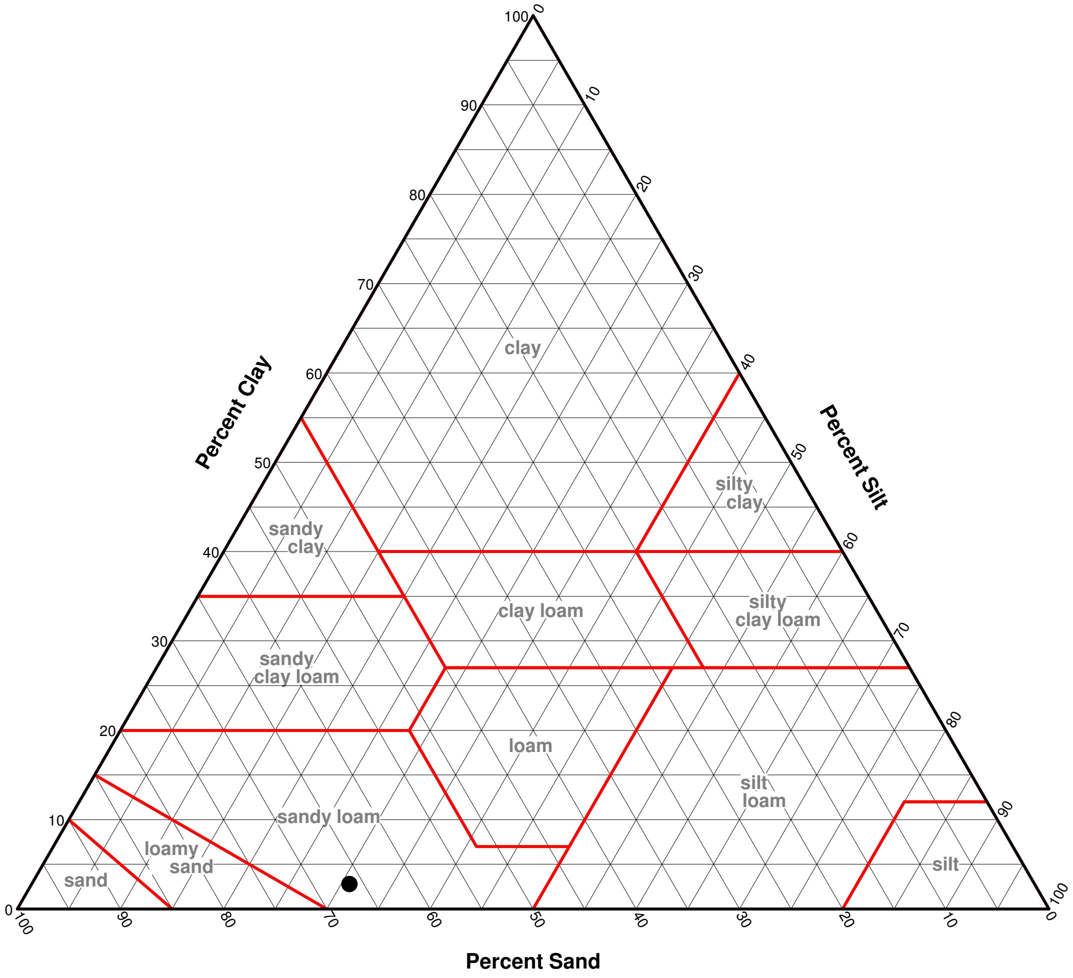
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1325

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1325	S-4	8.5'-10.0'	66.4	30.8	2.8	Sandy loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

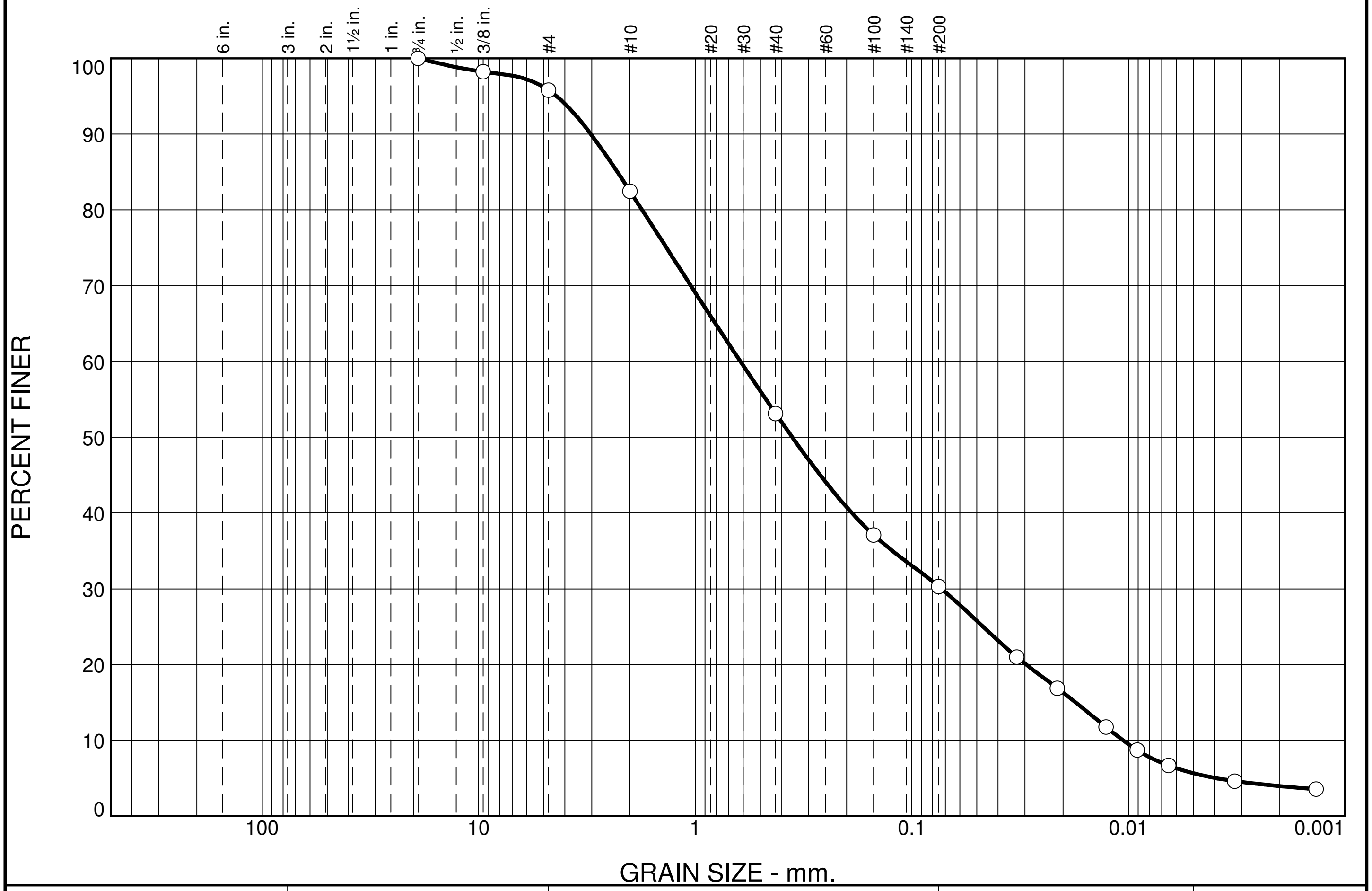
Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1325

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.2	65.5	24.6	5.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	98.2		
#4	95.8		
#10	82.5		
#40	53.1		
#100	37.1		
#200	30.3		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 68.0% SILT: 27.2% CLAY: 4.8%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.0301 D_{85}= 2.2876 D_{60}= 0.6181
D_{50}= 0.3563 D_{30}= 0.0728 D_{15}= 0.0175
D_{10}= 0.0106 C_u= 58.52 C_c= 0.81

Classification

USCS= AASHTO=

Remarks

Moisture Content: 7.7%

Location: SWM-5
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-07-21

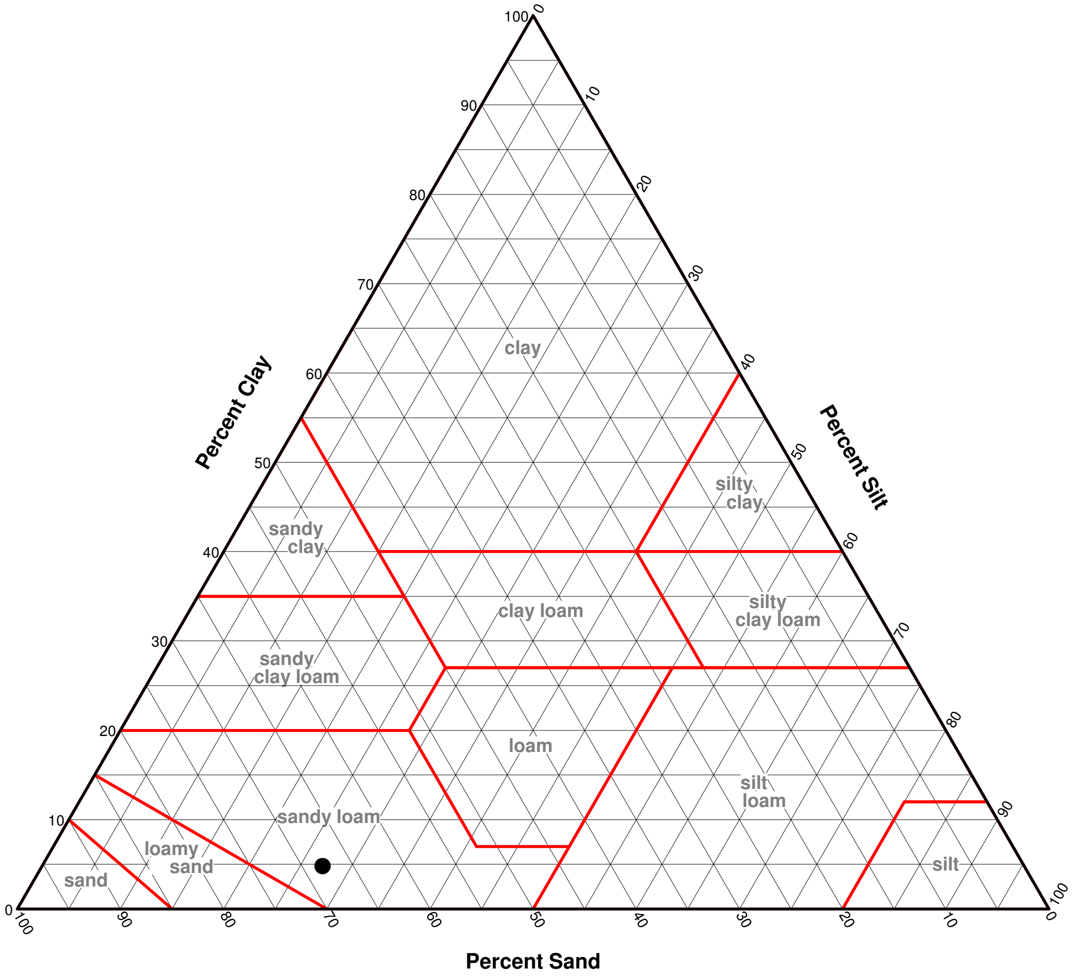
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1326

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1326	S-4	8.5'-10.0'	68.0	27.2	4.8	Sandy loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

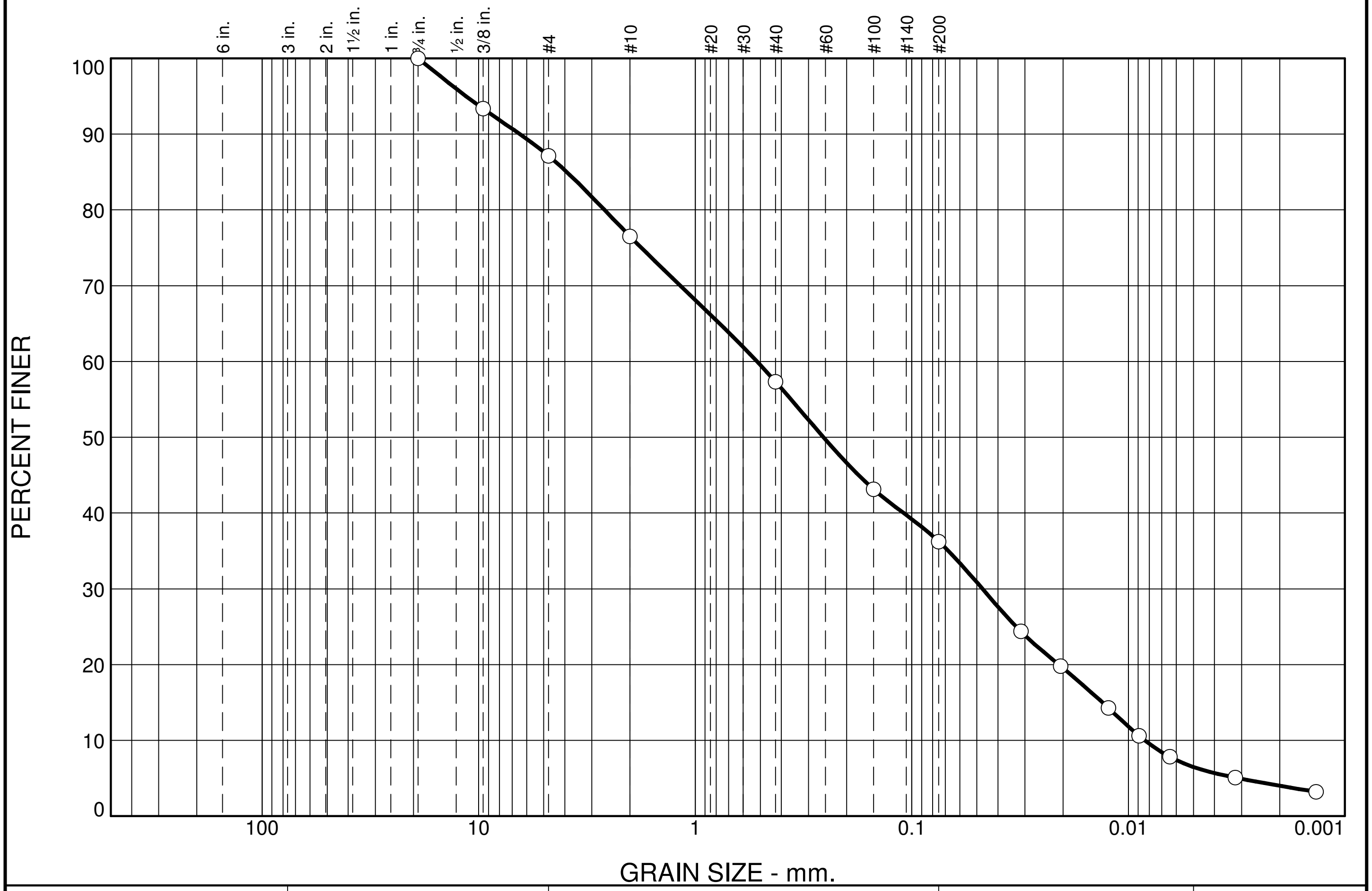
Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1326

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	12.9	50.9	29.7	6.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	93.3		
#4	87.1		
#10	76.5		
#40	57.3		
#100	43.1		
#200	36.2		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 58.6% SILT: 36.2% CLAY: 5.2%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.4513 D_{85}= 3.9225 D_{60}= 0.5189
D_{50}= 0.2556 D_{30}= 0.0471 D_{15}= 0.0132
D_{10}= 0.0084 C_u= 61.77 C_c= 0.51

Classification

USCS= AASHTO=

Remarks

Moisture Content: 9.3%

Location: SWM-9
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-07-21

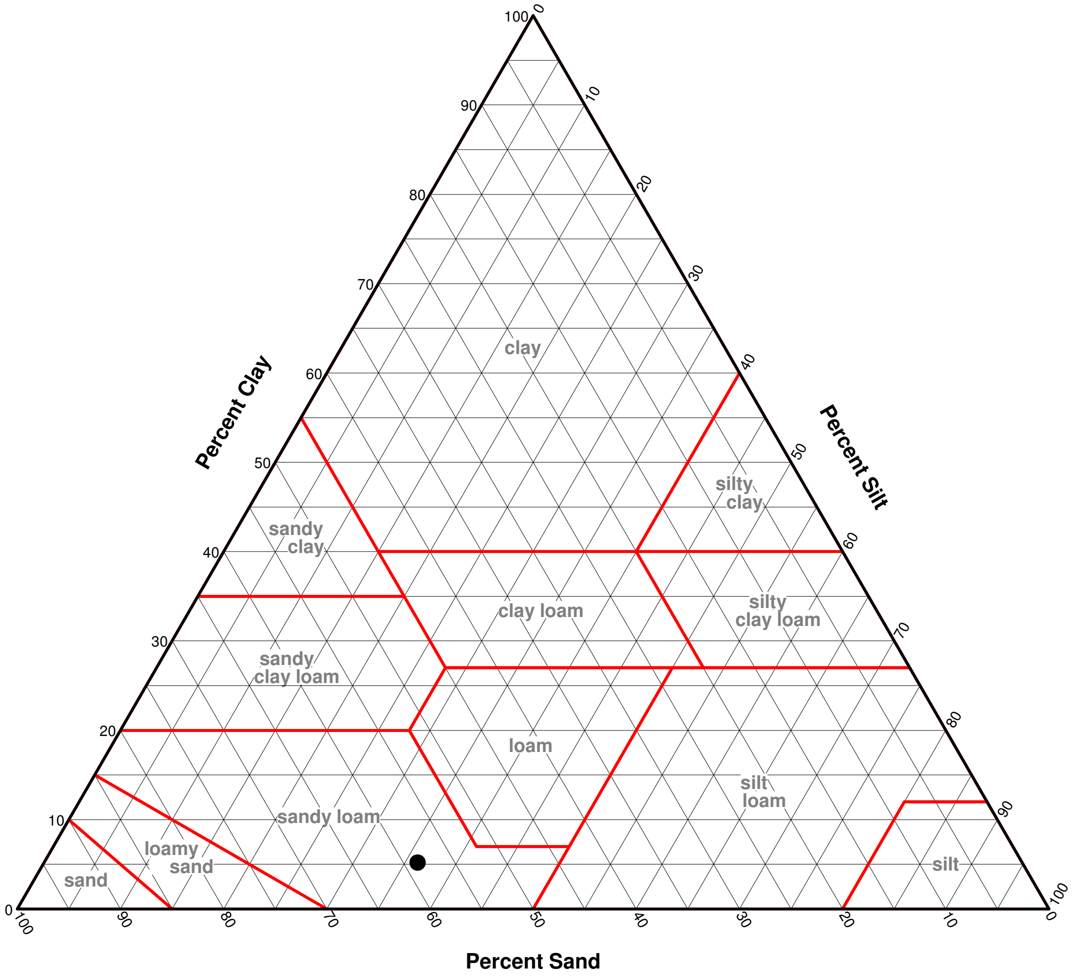
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1327

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1327	S-4	8.5'-10.0'	58.6	36.2	5.2	Sandy loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

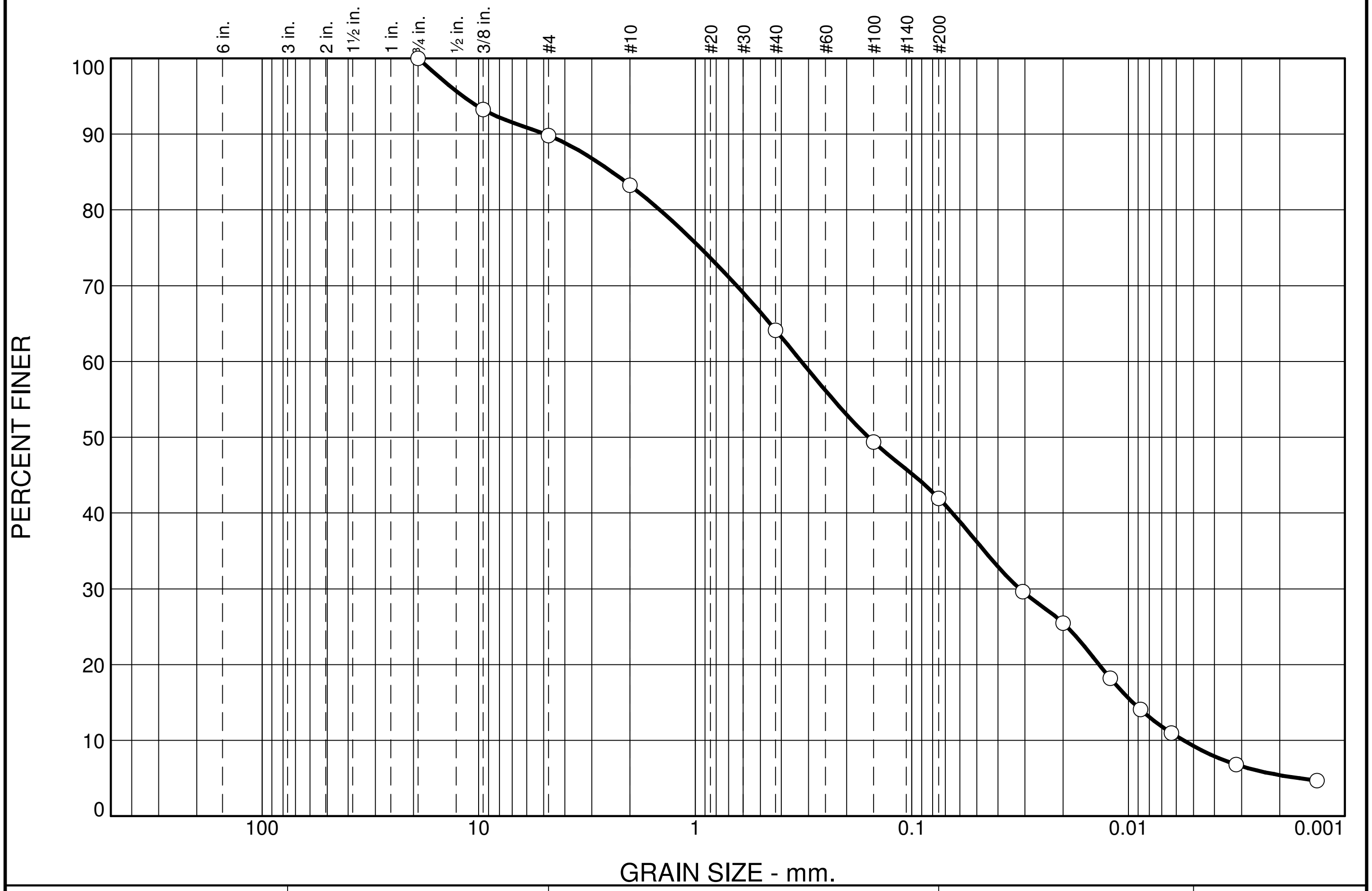
Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1327

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	10.2	47.8	32.7	9.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	93.2		
#4	89.8		
#10	83.2		
#40	64.1		
#100	49.4		
#200	42.0		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 55.4% SILT: 38.1% CLAY: 6.5%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.9428	D_{85}= 2.4176	D_{60}= 0.3233
D_{50}= 0.1583	D_{30}= 0.0318	D_{15}= 0.0095
D_{10}= 0.0056	C_u= 58.12	C_c= 0.56

Classification

USCS= AASHTO=

Remarks

Moisture Content: 13.1%

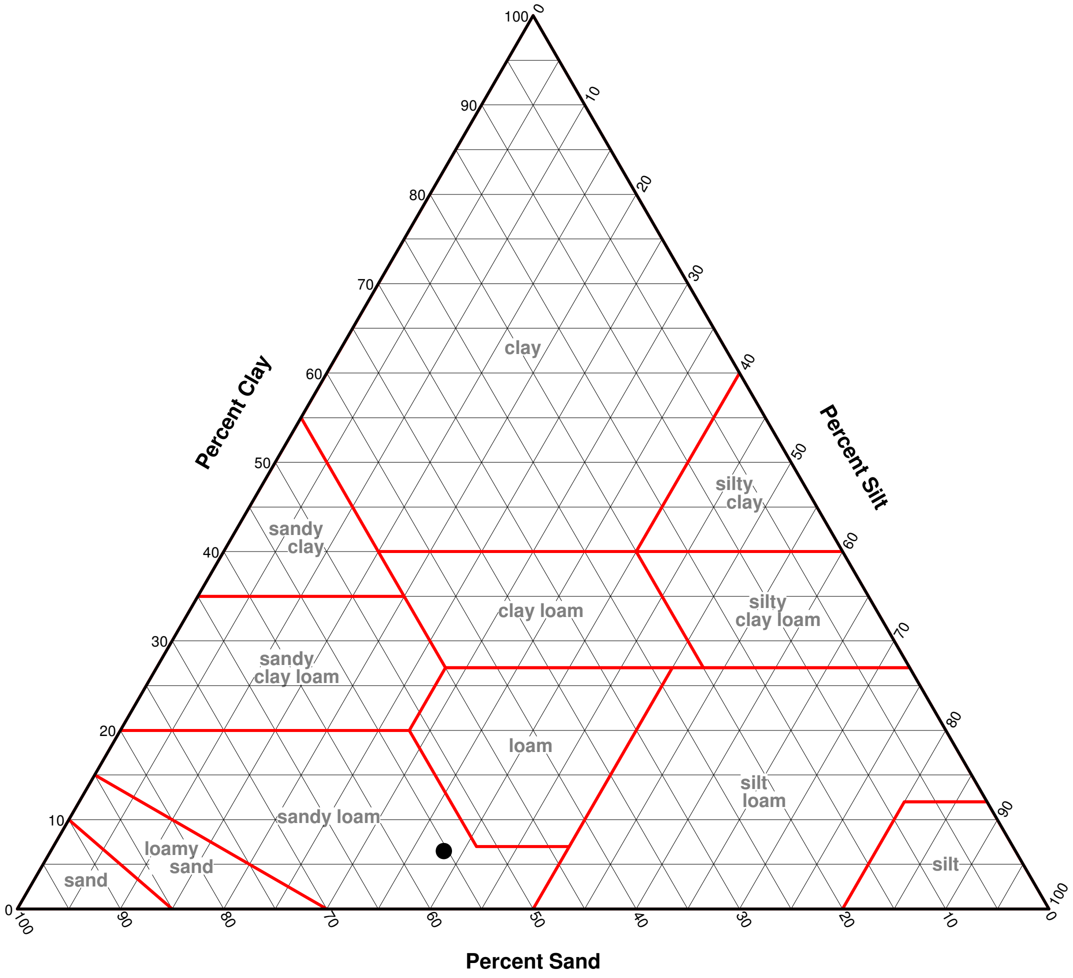
Location: SWM-10
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-07-21

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES
Project No: 22820A **Figure** #1328

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1328	S-4	8.5'-10.0'	55.4	38.1	6.5	Sandy loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

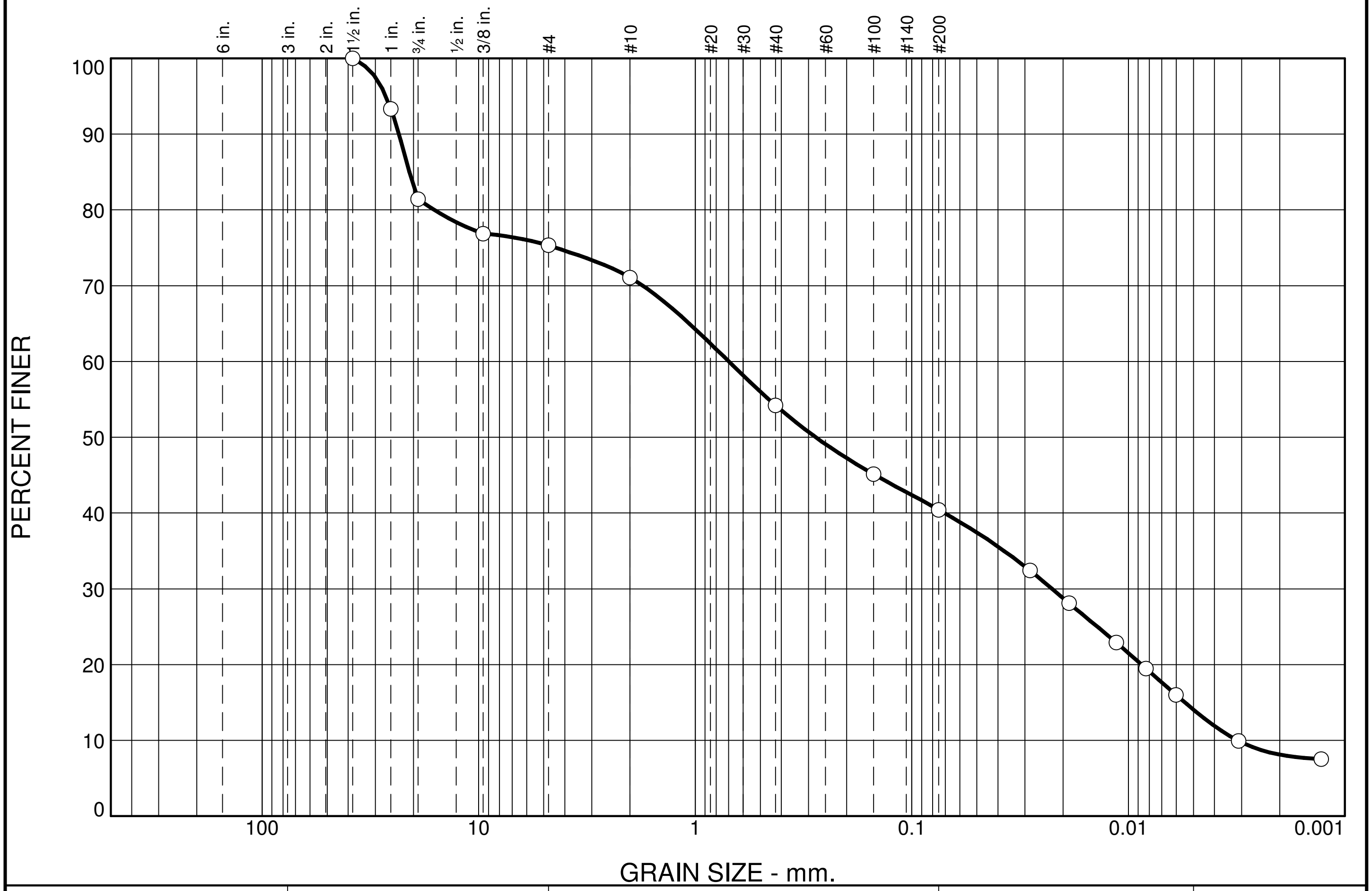
Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1328

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	24.7	34.9	26.3	14.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	93.3		
0.75	81.4		
0.375	76.9		
#4	75.3		
#10	71.1		
#40	54.2		
#100	45.1		
#200	40.4		

* (no specification provided)

Material Description

USDA Classification: Loam
USDA Fraction: SAND: 46.7% SILT: 41.9% CLAY: 11.4%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 23.3435	D_{85}= 20.8495	D_{60}= 0.6996
D_{50}= 0.2773	D_{30}= 0.0225	D_{15}= 0.0055
D_{10}= 0.0031	C_u= 223.59	C_c= 0.23

Classification

USCS= AASHTO=

Remarks

Moisture Content: 9.4%

Location: SWM-11
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-08-21

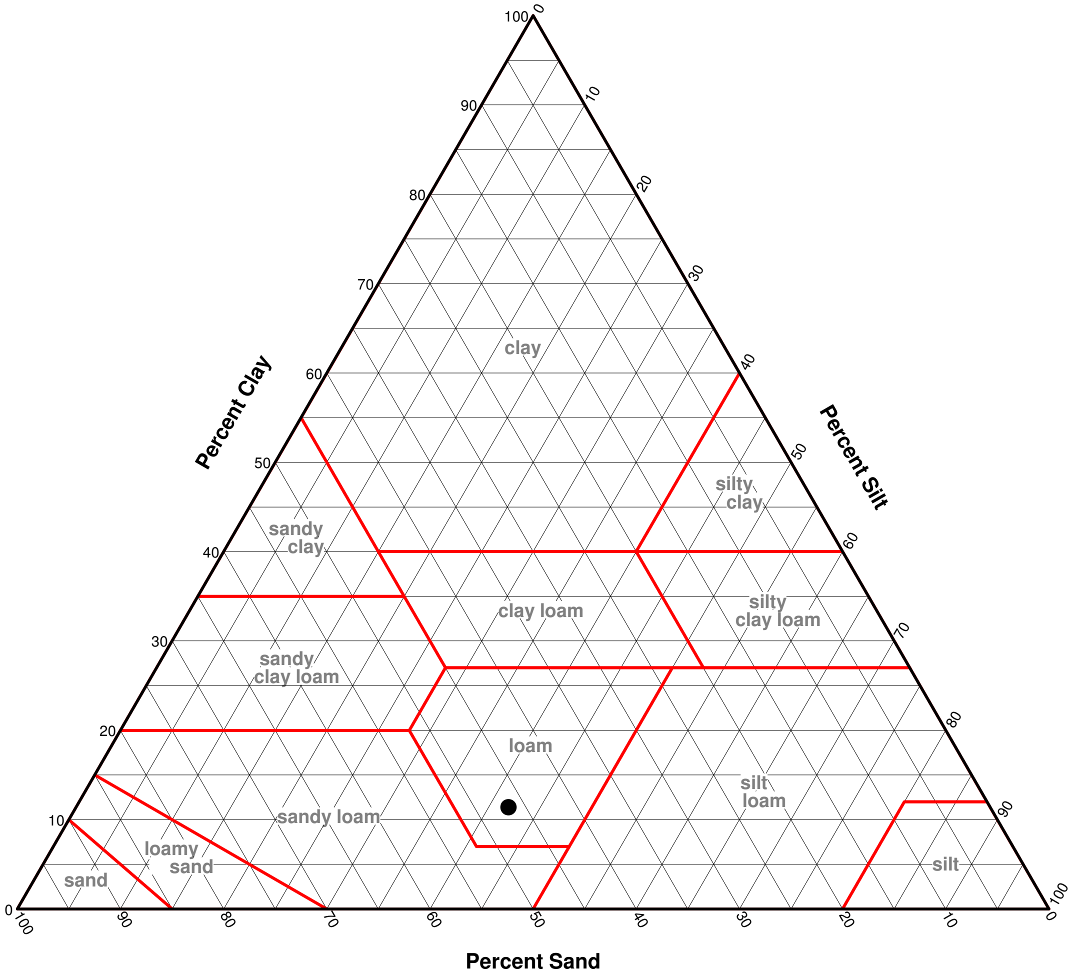
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1329

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1329	S-4	8.5'-10.0'	46.7	41.9	11.4	Loam

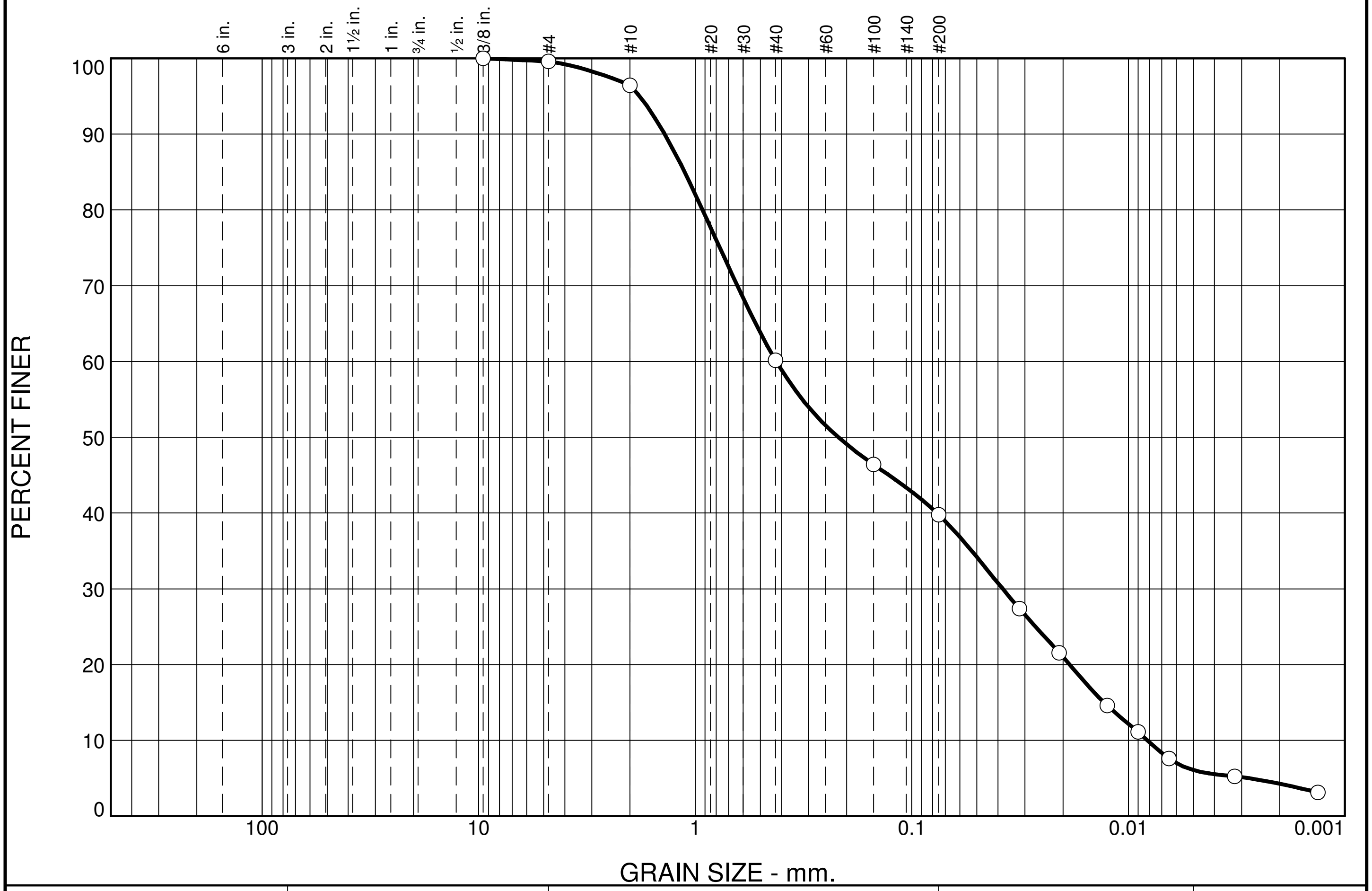
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No.: 22820A **Figure** #1329

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.4	59.8	33.7	6.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.6		
#10	96.4		
#40	60.1		
#100	46.4		
#200	39.8		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 63.7% SILT: 31.8% CLAY: 4.5%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.3842 D_{85}= 1.1199 D_{60}= 0.4222
D_{50}= 0.2181 D_{30}= 0.0380 D_{15}= 0.0129
D_{10}= 0.0082 C_u= 51.75 C_c= 0.42

Classification

USCS= AASHTO=

Remarks

Moisture Content: 6.5%

Location: SWM-12
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-08-21

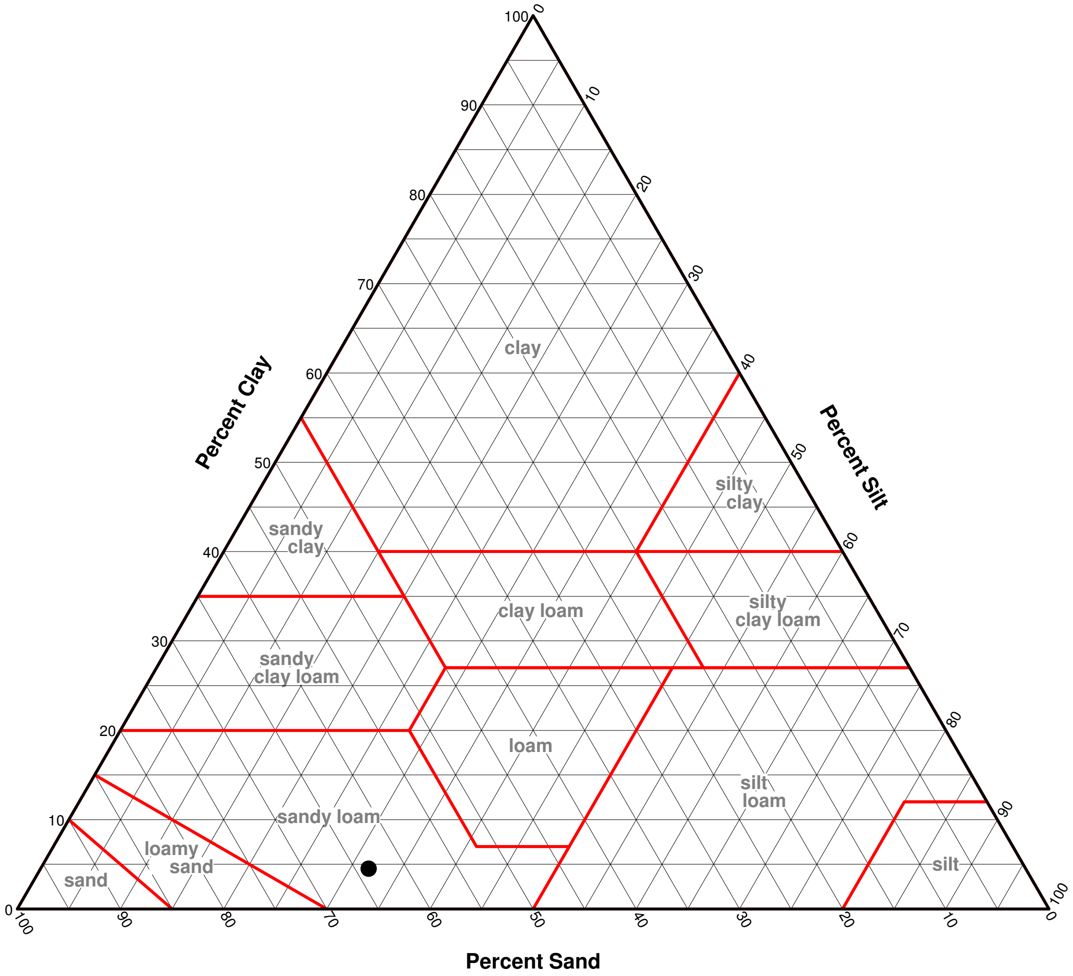
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1330

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	#1330	S-4	8.5'-10.0'	63.7	31.8	4.5	Sandy loam

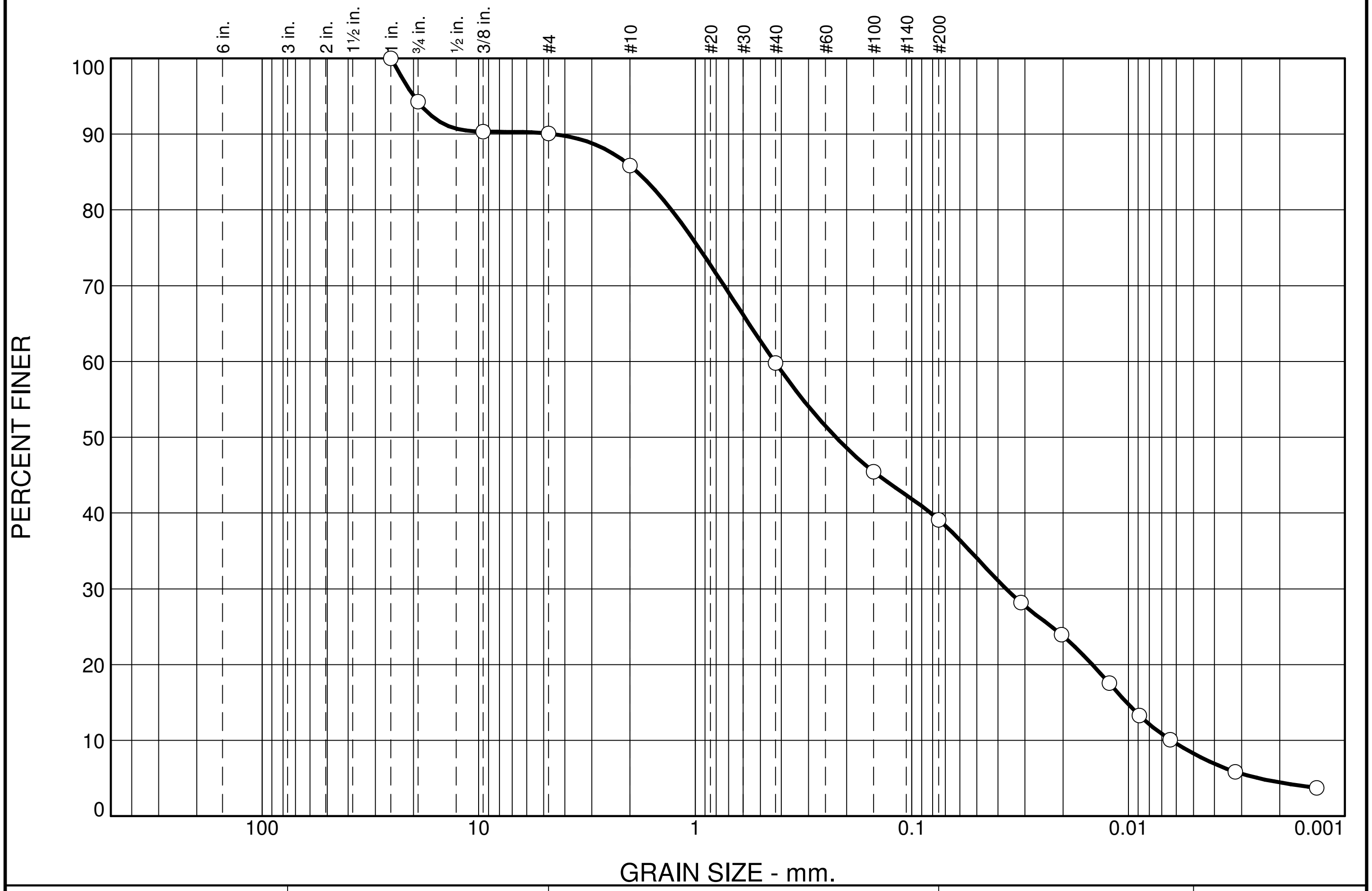
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No.: 22820A **Figure** #1330

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	9.9	51.0	30.8	8.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
0.75	94.3		
0.375	90.3		
#4	90.1		
#10	85.9		
#40	59.8		
#100	45.5		
#200	39.1		

* (no specification provided)

Material Description

USDA Classification: Sandy Loam
USDA Fraction: SAND: 59.5% SILT: 35.3% CLAY: 5.2%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.5234 D_{85}= 1.8481 D_{60}= 0.4303
D_{50}= 0.2239 D_{30}= 0.0366 D_{15}= 0.0102
D_{10}= 0.0063 C_u= 68.11 C_c= 0.49

Classification

USCS= AASHTO=

Remarks

Moisture Content: 7.8%

Location: SWM-13
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-06-21

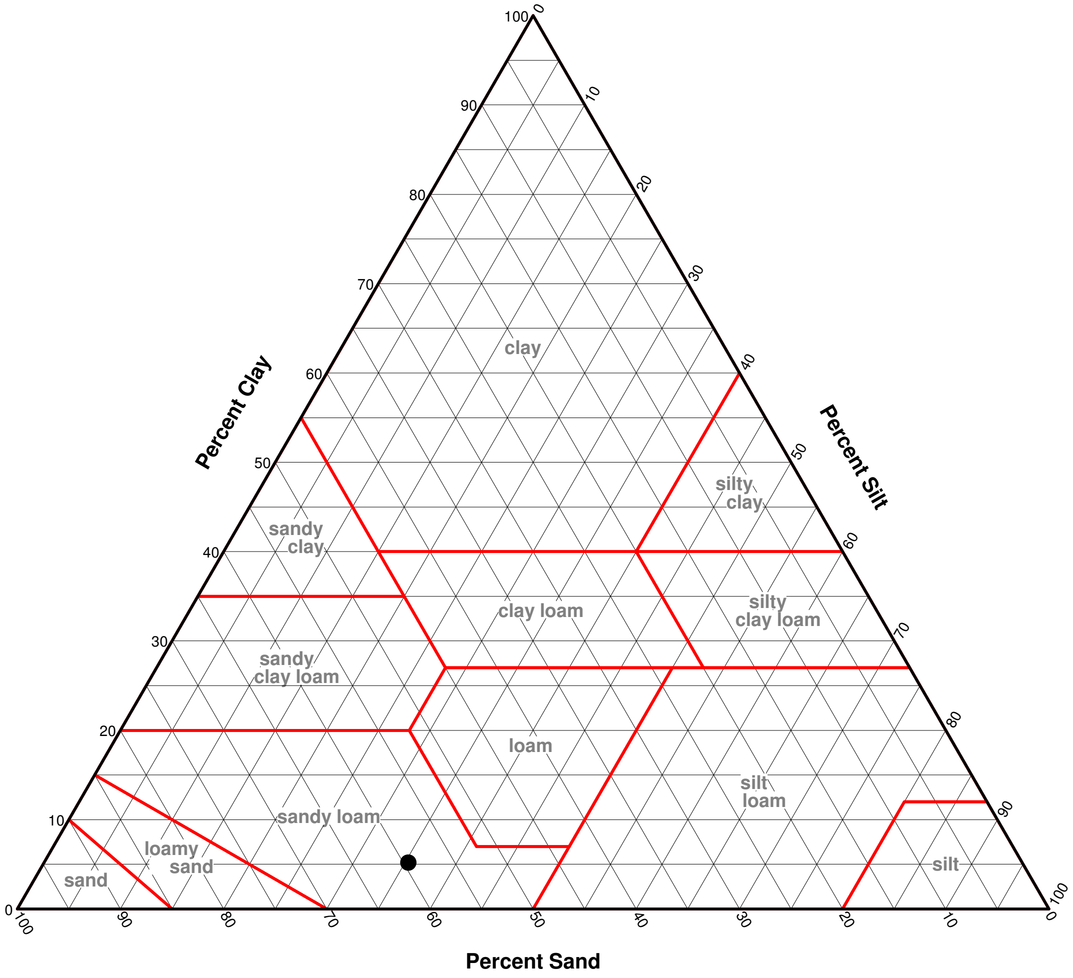
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1322

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve Sand	Silt	Clay	Classification
●	#1322	S-4	8.5'-10.0'	59.5	35.3	5.2	Sandy loam

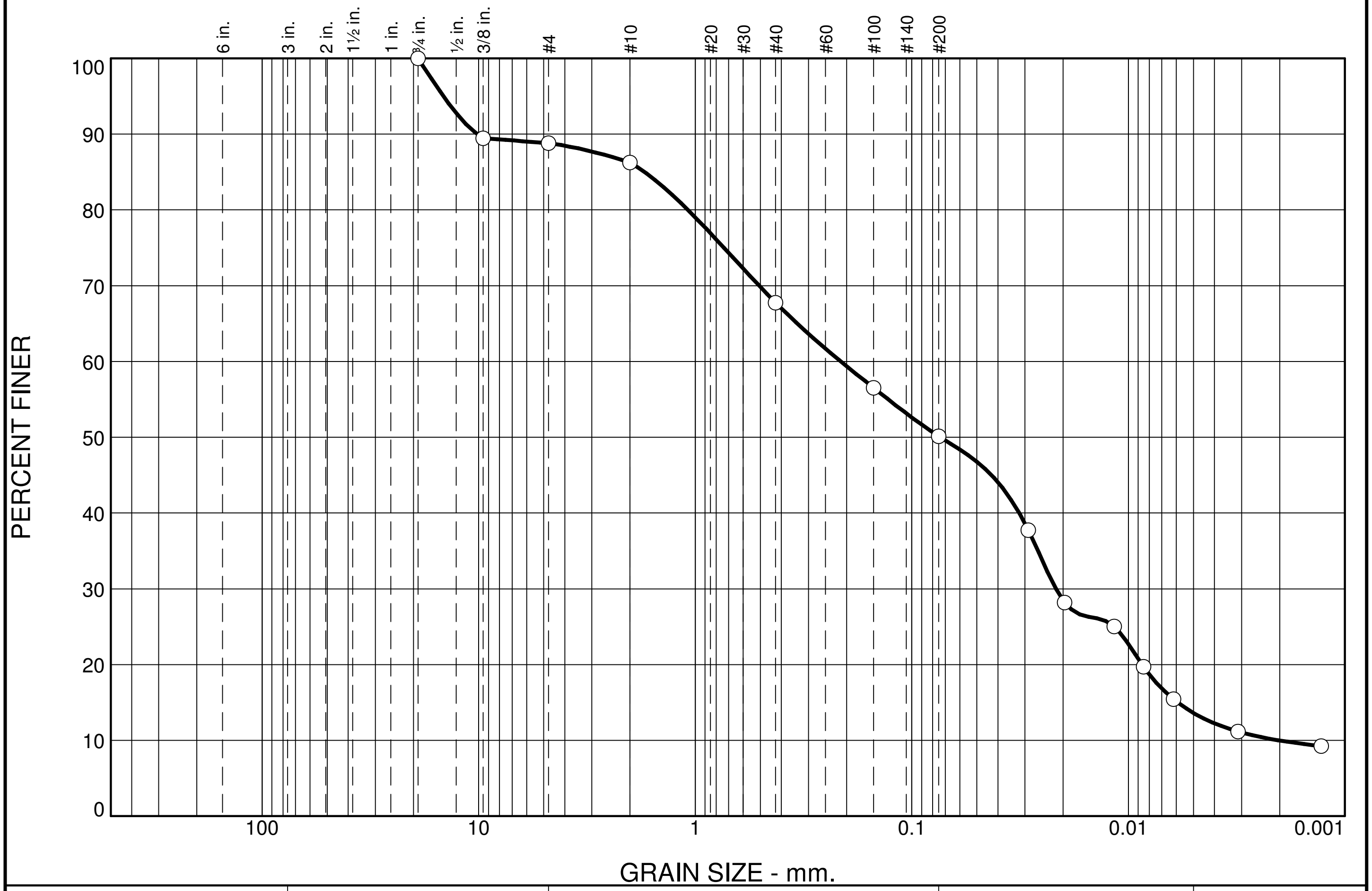
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No.: 22820A **Figure** #1322

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	11.2	38.7	36.5	13.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75	100.0		
0.375	89.4		
#4	88.8		
#10	86.3		
#40	67.7		
#100	56.5		
#200	50.1		

* (no specification provided)

Material Description

USDA Classification: Loam
USDA Fraction: SAND: 45.2% SILT: 43.2% CLAY: 11.6%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.1584 D_{85}= 1.7144 D_{60}= 0.2124
D_{50}= 0.0738 D_{30}= 0.0216 D_{15}= 0.0059
D_{10}= 0.0020 C_u= 106.05 C_c= 1.10

Classification

USCS= AASHTO=

Remarks

Moisture Content: 18.8%

Location: SWM-14
Sample Number: S-4 **Depth:** 8.5'-10.0' **Date:** 04-08-21

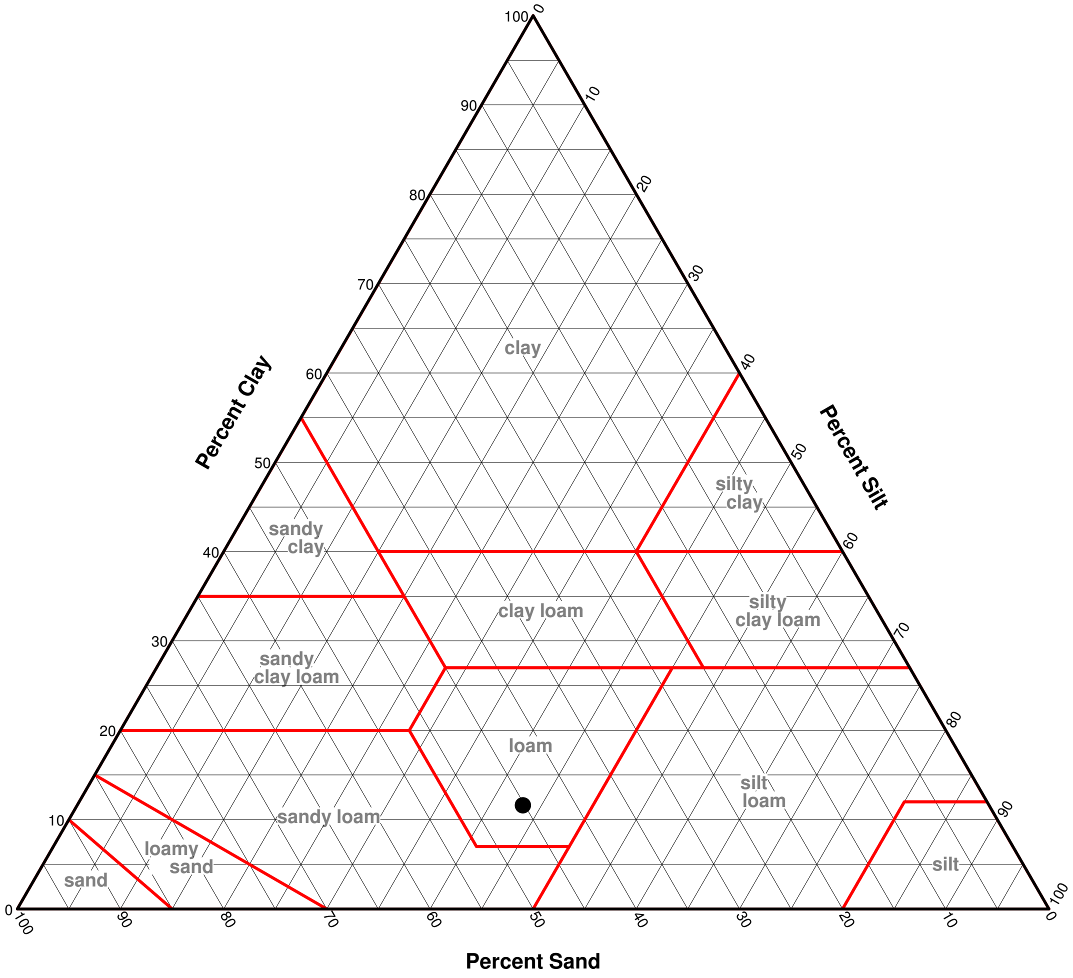
HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects
Project: Brunswick ES

Project No: 22820A **Figure** #1331

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve Sand	Silt	Clay	Classification
●	#1331	S-4	8.5'-10.0'	45.2	43.2	11.6	Loam

HILLIS-CARNES ENGINEERING ASSOCIATES

FREDERICK, MD

Client: GWWO Inc. Architects

Project: Brunswick ES

Project No.: 22820A

Figure #1331

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:25am	72 5/8	-	-	-
10:55am	72 5/8	0.5	0	0.000
11:25am	72 5/8	0.5	0	0.000
11:55am	72 5/8	0.5	0	0.000
12:25pm	72 5/8	0.5	0	0.000
12:55pm	72 5/8	0.5	0	0.000
1:25pm	72 5/8	0.5	0	0.000
1:55pm	72 5/8	0.5	0	0.000
2:25pm	72 5/8	0.5	0	0.000

Depth of test beneath existing grades _____8.0 feet______

Date of test _____03/24/2021_______

Estimated Infiltration Rate: ____0.____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 12, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-1

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:25am	72	-	-	-
10:55am	72	0.5	0	0.000
11:25am	72	0.5	0	0.000
11:55am	72	0.5	0	0.000
12:25pm	72	0.5	0	0.000
12:55pm	72	0.5	0	0.000
1:25pm	72	0.5	0	0.000
1:55pm	72	0.5	0	0.000
2:25pm	72	0.5	0	0.000

Depth of test beneath existing grades _____8.0 feet______

Date of test _____03/24/2021________

Estimated Infiltration Rate: ____0.____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 12, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-2

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:25am	72	-	-	-
10:55am	72	0.5	0	0.000
11:25am	72	0.5	0	0.000
11:55am	72	0.5	0	0.000
12:25pm	72	0.5	0	0.000
12:55pm	72	0.5	0	0.000
1:25pm	72	0.5	0	0.000
1:55pm	72	0.5	0	0.000
2:25pm	72	0.5	0	0.000

Depth of test beneath existing grades _____8.0 feet______

Date of test ____03/24/2021______

Estimated Infiltration Rate: ____0.____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 12, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-4

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:25am	72	-	-	-
10:55am	72	0.5	0	0.000
11:25am	72	0.5	0	0.000
11:55am	72	0.5	0	0.000
12:25pm	72	0.5	0	0.000
12:55pm	72	0.5	0	0.000
1:25pm	72	0.5	0	0.000
1:55pm	72	0.5	0	0.000
2:25pm	72	0.5	0	0.000

Depth of test beneath existing grades _____8.0 feet______

Date of test _____03/24/2021_______

Estimated Infiltration Rate: ____0.____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 12, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-5

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:25am	72 5/8	-	-	-
10:55am	72 5/8	0.5	0	0.000
11:25am	72 5/8	0.5	0	0.000
11:55am	72 5/8	0.5	0	0.000
12:25pm	72 5/8	0.5	0	0.000
12:55pm	72 11/16	0.5	1/16	0.125
1:25pm	72 11/16	0.5	0	0.000
1:55pm	72 11/16	0.5	0	0.000
2:25pm	72 11/16	0.5	0	0.000

Depth of test beneath existing grades _____8.0 feet______

Date of test _____4/02/21_______

Estimated Infiltration Rate: ____0.031____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-8

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:27am	79 7/8	-	-	-
10:57am	79 7/8	0.5	0	0.000
11:27am	79 7/8	0.5	0	0.000
11:57am	79 15/16	0.5	1/16	0.125
12:27pm	80	0.5	1/16	0.125
12:57pm	80	0.5	0	0.000
1:27pm	80 1/16	0.5	1/16	0.125
1:57pm	80 1/16	0.5	0	0.000
2:27pm	80 1/8	0.5	1/16	0.125

Depth of test beneath existing grades _____8.0 feet______

Date of test _____4/02/21______

Estimated Infiltration Rate: ____0.063____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-10

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:31am	67 3/8	-	-	-
11:01am	67 3/8	0.5	0	0.000
11:31am	67 7/16	0.5	1/16	0.125
12:01pm	67 7/16	0.5	0	0.000
12:31pm	67 1/2	0.5	1/16	0.125
1:01pm	67 1/2	0.5	0	0.000
1:31pm	67 9/16	0.5	1/16	0.125
2:01pm	67 9/16	0.5	0	0.000
2:31pm	67 5/8	0.5	1/16	0.125

Depth of test beneath existing grades ____8.0 feet____

Date of test ____4/02/21____

Estimated Infiltration Rate: ___0.063___in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-11

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:33am	72 ½	-	-	-
11:03am	72 9/16	0.5	1/16	0.125
11:33am	72 9/16	0.5	0	0.000
12:03pm	72 9/16	0.5	0	0.000
12:33pm	72 9/16	0.5	0	0.000
1:03pm	72 9/16	0.5	0	0.000
1:33pm	72 5/8	0.5	1/16	0.125
2:03pm	72 5/8	0.5	0	0.000
2:33pm	72 11/16	0.5	1/16	0.125

Depth of test beneath existing grades _____8.0 feet______

Date of test _____4/02/21_______

Estimated Infiltration Rate: ____0.063____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-12

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:35am	67	-	-	-
11:05am	67	0.5	0	0.000
11:35am	67	0.5	0	0.000
12:05pm	67	0.5	0	0.000
12:35pm	67	0.5	0	0.000
1:05pm	67	0.5	0	0.000
1:35pm	67 1/16	0.5	1/16	0.125
2:05pm	67 1/16	0.5	0	0.000
2:35pm	67 1/6	0.5	0	0.000

Depth of test beneath existing grades 8.0 feet

Date of test 4/02/21

Estimated Infiltration Rate: 0.031 in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-13

TIME OF READING	DEPTH TO WATER, INCHES	TIME CHANGE, HOURS	DEPTH CHANGE, INCHES	RATE, INCHES/HOUR
10:33am	72 ½	-	-	-
11:03am	72 9/16	0.5	1/16	0.125
11:33am	72 9/16	0.5	0	0.000
12:03pm	72 9/16	0.5	0	0.000
12:33pm	72 9/16	0.5	0	0.000
1:03pm	72 9/16	0.5	0	0.000
1:33pm	72 5/8	0.5	1/16	0.125
2:03pm	72 5/8	0.5	0	0.000
2:33pm	72 5/8	0.5	1/16	0.125

Depth of test beneath existing grades _____8.0 feet______

Date of test _____03/24/2021______

Estimated Infiltration Rate: ____0.063____in/hr

HILLIS-CARNES

ENGINEERING ASSOCIATES, INC.

HCEA Project No.:

SCALE: NTS

DATE: April 4, 2021

Infiltration Test Log
Brunswick Elementary School

LOG NO.
SWM-14