OVID HAZEN WELLS PARK IMPROVEMENTS

12001 Skylark Road

Clarksburg, Maryland 20871

STORMWATER MANAGEMENT CONCEPT

ENGINEERING REPORT

Prepared: July 2015

Revised August 2015

Prepared by: Dana Wilder Clark, P.E. & Debbie Savage, P.E.

Approved by: Jason Azar, P.E.

Project No.: 87360.02

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO.: 12548 EXPIRATION DATE: 7/29/17

STATE OF MARYLAND
RICHARD EDWARD HURNEY
No. 12548
REGISTERED
PROFESSIONAL ENGINEER

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Nobis

I. STORMWATER MANAGEMENT CONCEPT NARRATIVE

Nobis

Stormwater Management Concept Narrative

Ovid Hazen Wells Park Improvements

Date: August 14, 2015

I. Site Introduction

Maryland-National Capital Park and Planning Commission (M-NCPPC) is proposing extensive improvements to the existing Ovid Hazen Wells Park which is located at 12001 Skylark Drive in Clarksburg, Maryland. The park is bound by residential communities on all sides.

II. Existing Conditions

a. Park Overview

The existing park consists of 290 acres of passive and active park area. The proposed improvements are within the active area of the park, which is adjacent to Skylark Drive. This area of the park currently consists of one baseball field, two softballs fields and two rectangular fields, a playground, small picnic pavilions, associated trails and parking.

b. Stormwater Management

The existing park includes a network of stormwater management facilities including bioretention areas, infiltrations trenches and two very large sand filters. The existing stormwater facilities were designed prior to Environmental Site Design requirements implementation. The facilities were also designed for an ultimate build out of construction including an aqua center which did not come to fruition. Therefore, the existing facilities, primarily the two large surface sand filters, are significantly oversized. The drainage area and impervious areas that they were designed for are significantly larger than the drainage areas that are actually draining to them in the present condition. The modifications to these facilities will be discussed further in the Stormwater Management section of this report.

c. Environmental Features

There is a stream than runs through the park property and along the northeastern boundary of the proposed project limits. The existing stream buffers and wetland limits have been shown on the enclosed plan. There are also areas of forest in conservation easement which are not proposed to be disturbed.

III. Proposed Conditions

The proposed improvements to the existing Ovid Hazen Wells Park include the relocation of a carousel from Wheaton Regional Park to Ovid Hazen Wells Park. An enclosure building will house the carousel and will also include gathering space and restroom facilities. The additional park improvements include: a splash pad, a skate park, a dog park area, running track facility, open lawn area, additional parking areas, amended trails, a maintenance building, a new playground and new picnic pavilion areas. New utility connections will be provided to serve the proposed amenities. The existing ballfields are not proposed to be disturbed.

The park was subject to an evaluation for ADA compliance. The deficiencies found as a result of the investigation will also be addressed as part of this project.

IV. Stormwater Management

a. Existing Stormwater Management

As previously discussed, the two existing sand filters were designed for a future phase which was not constructed. This phase included an aquatic center and an extensive amount of additional parking and other impervious areas.

Table 1: Existing Sand Filter Drainage Area Summary

Sand Filter	Design		Actual	
	Drainage Area (ac)	Impervious Area (ac)	Drainage Area (ac)	Impervious Area (ac)
Sand Filter #1	5.12	2.62	3.43	1.30
Sand Filter #2	7.87	2.29	3.81	0.27

b. Environmental Site Design

The project area within the limits of disturbance was designed using Environmental Site Design criteria per the Maryland Stormwater Design Manual and Montgomery County Stormwater Regulations and in compliance with the Stormwater Management Act of 2007 to the Maximum Extent Practicable (MEP). The stormwater management design strategy for this project was to seek to replicate the natural hydrology of the site by utilizing small-scale stormwater management practices to minimize the impact of land development on downstream water resources.

Per current Montgomery County DSP standards, the Pe required for treatment was calculated using the total property area to each study point. There are two study points: discharge points at Skylark Drive, Persimmon Ridge Road and discharge to the existing stream. The majority of the disturbance is within the stream drainage area. The forest conservation easement areas were included in the developable area as requested by DPS.

Table 2: ESDv Requirements Summary

Study Point	Property Area (sf)	Proposed Impervious Area (sf)	% Impervious	Soil Type	Target Pe (in)	Limits of Disturbed Area (sf)*	LOD Rv	ESDv Required (cf)	ESDv Provided (cf)
Stream (A)	12,416,707	483,834	3.9%	C	1.0	1,078,859	0.329	29,562	32,189
Persimmon Ridge Road (B)	307,048	61,125	19.9%	C	1.0	126,690	0.310	3,270	5,275

The ESDv will be provided with 22 micro-bioretention facilities. The drainage areas and treatment volumes of each facility are listed in Table 3.

Table 3: Drainage Area Summary

Proposed Facility	Drainage Area (sf)*	Impervious Area (sf)	Treatment Volume Provided (cf)
Micro-Bioretention Area "A"	19,763	8,404	1,853
Micro-Bioretention Area "B"	10,721	5,601	1,208
Micro-Bioretention Area "C"	12,257	10,674	2,214

Micro-Bioretention Area “D”	17,722	4,523	1,074
Micro-Bioretention Area “E”	8,568	4,584	987
Micro-Bioretention Area “F”	10,544	5,273	1,025
Micro-Bioretention Area “G”	7,090	3,218	704
Micro-Bioretention Area “H”	11,729	8,215	1,729
Micro-Bioretention Area “I”	18,358	13,846	2,436
Micro-Bioretention Area “J”	13,878	10,601	991
Micro-Bioretention Area “K”	19,736	5,232	1,234
Micro-Bioretention Area “L”	13,878	10,601	1,688
Micro-Bioretention Area “M”	19,736	16,561	2,766
Micro-Bioretention Area “N”	19,718	14,204	2,983
Micro-Bioretention Area “O”	14,758	5,637	1,259
Micro-Bioretention Area “P”	16,940	7,479	1,642
Micro-Bioretention Area “Q”	19,461	9,843	2,130
Micro-Bioretention Area “R”	18,442	10,765	1,467
Micro-Bioretention Area “S”	14,861	10,708	2,249
Micro-Bioretention Area “T”	19,426	12,953	2,736
Micro-Bioretention Area “U”	16,590	11,843	1,812
Micro-Bioretention Area “V”	12,795	5,831	1,276

*Drainage area does not include the area of the facility as permitted by DPS.

The full ESDv is provided for the limits of disturbance, therefore no CPv will be required.

c. Existing Stormwater Management Facility

As previously mentioned, there are two existing sand filter facilities onsite whose drainage areas are within the limits of disturbance. Also as previously mentioned, the full ESDv for the site has been met via the 22 micro-bioretention areas.

Both of the existing sand filters were sized for an ultimate build out condition of the park that included a large amount of impervious area that was not built. Much of the current proposed impervious area is to be treated with ESD making the sand filters vastly oversized. Part of this development will be to reduce the sand filter sizes to an appropriate size based on what is actually draining to them. While ESD has been met for the entire site for the Pe of 1", the carousel building and amphitheater area next to it have no treatment provided. The proposed location of the carousel building is on a slope. The only downhill location from the structure is in a stream buffer that cannot be built in. Therefore, ESD cannot feasibly be provided for the carousel building and surrounding area. As an additional treatment measure, those areas will be directed to the existing sand filter adjacent to them. This treatment will be above and beyond the required ESD. In addition to resizing the facilities, the surface material will also be enhanced with planting soil to allow planting in the sand beds and not be an eye sore in the park. Gravel windows will be added to allow water into the sand and stone treatment below.

The proposed reduction in size of the sand filters will be designed to meet Pond-378 code, including the required freeboard and volume based on the proposed drainage areas. All necessary computations will be provided at the final design stage. The proposed planting soil mix to be used is SHA BSM.

Table 3: Existing Sand Filter #1 Drainage Area Summary

Design Drainage Area		Proposed Drainage Area		Decrease in Drainage Area from Design (ac)	Decrease in Impervious Area from Design (ac)
Total Area (ac)	Impervious Area (ac)	Total Area (ac)*	Impervious Area (ac)*		
5.12	2.62	3.53	1.74	1.59	0.88

*Includes 0.70 ac (30,343 sf) of impervious drainage area that is not proposed to be altered

V. Stormwater Quantity

a. Methodology

A stormwater quantity analysis was conducted for each outfall point, at the stream, at Persimmon Ridge Road and at Skylark Road. The storage of the proposed micro-bioretention areas was conservatively taken into account with the storage above the media and 1' of the storage within the media included in the analysis.

b. Stream Outfall

The majority of the limits of disturbance outfalls to the stream at the east side of the site. This stream feeds into Little Seneca Creek which eventually discharges into Little Seneca Lake.

c. Persimmon Ridge Road Outfall

Only proposed micro-bioretention areas A, B, and C outfall to the Persimmon Ridge Road drainage system. Micro-bioretention area A will outfall to a grass swale which will lead to a curb inlet along Skylark Road at the intersection of Persimmon Ridge Road. Micro-bioretention areas B and C will outfall to grate inlets that discharge to an existing 21" pipe at Skylark Road and Persimmon Ridge Road. The analysis shows that this pipe has sufficient capacity for the proposed discharge and the HGL of the inlet is well below grade. Additional analysis indicates that the downstream storm drain system is also sufficient for the proposed improvements.

VI. Conclusions

Full ESD requirements are being met for the proposed improvements, and as a result of the proposed improvements, water quality is being increased for the park. The existing sand filters are being retrofitted to appropriate sizes and providing additional treatment beyond the required ESD. Existing drainage patterns are being maintained to the greatest extent allowable. The outfall drainage systems are sufficient for the proposed developments per the quantity analysis.

II. STORMWATER MANAGEMENT COMPUTATIONS

A. ESDv REQUIRED COMPUTATIONS

B. ESDv PROVIDED COMPUATIONS

Nobis

Project: Ovid Hazen Wells Park Improvements
Project Number: 87360.02
Calculation: Area Summary & ESDv Required Calculations

Date: 8/14/2015
Calculated by: DWC
Reviewed by: JA

Property Area Summary for ESDv Computations						
Study Point	**Property Area (sf)**	**Total Post Development Impervious Area (sf)**	**% Impervious**	**Rv**	**HSG**	**Target Pe (in)**
A Stream	12,416,707	483,834	3.9%	0.085	C	1.0
B Persimmon Ridge Road	307,048	61,125	19.9%	0.229	C	1.0

Property Area Summary for ESDv Computations							
Study Point	**LOD Area (sf)**	**Total Post Development Impervious Area (sf)**	**% Impervious**	**Rv**	**HSG**	**Target Pe (in)**	ESDv Required (cf)
A Stream	1,078,859	334,229	31%	0.329	C	1.0	29,562
B Persimmon Ridge Road	126,690	36,563	29%	0.310	C	1.0	3270

Nobis

Project:	Ovid Hazen Wells Park	**Date:**	8/17/2015
Project Number:	87360.02	**Calculated by:**	DWC
Calculation:	ESDv Provided Calculations	**Reviewed by:**	JA

Summary of ESDv Required*			
Study Point	LOD Area	Target Pe	ESDv Required
A	1,078,859	1.0	29,562
B	126,690	1.0	3270

*See ESDv Requirements Computations for detail

Alternative Surfaces		Micro-Scale Practices		Non-Structural Practices	
GR	Green Roof	RH	Rainwater Harvesting	DRR	Disconnection of Roof Runoff
PP	Permeable Pavement	SGW	Submerged Gravel Wetlands	DNR	Disconnection of Non- Roof Runoff
ST	Synthetic Turf	LI	Landscape Infiltration	SCA	Sheetflow to Conservation Areas
		IT	Infiltration Trench		
		DW	Dry Wells		
		MB	Micro-Bioretention		
		RG	Rain Gardens		
		SW-G or B	Swale s (specify grass or bio)		
		EF	Enhanced Filters		

STUDY POINT A

Sub-Basin Drainage Area (sf)	Sub-Basin Total Area* (sf)	Sub-Basin Total Area* (ac)	Sub-Basin Impervious Area sf)	Sub-Basin R_v	Alternative Surfaces: Drainage Area of Surface (sf)	Alternative Surface Used	Filter Media Thickness (in)	P_E Provided by Surface (in)	Rv of DA of Surface	ESDv Provided by Surface (cf)
D	17,722	0.407	4,523	0.280						
E	8,568	0.197	4,584	0.532						
F	10,544	0.242	5,273	0.500						
G	7,090	0.163	3,218	0.458						
H	11,729	0.269	8,215	0.680						
I	18,358	0.421	13,846	0.729						
J	13,878	0.319	10,601	0.737						
K	19,736	0.453	5,232	0.289						
L	13,878	0.319	10,601	0.737						
M	21,375	0.491	16,561	0.747						
N	19,718	0.453	14,204	0.698						
O	14,758	0.339	5,637	0.394						
P	16,940	0.389	7,479	0.447						
Q	19,461	0.447	9,843	0.505						
R	18,442	0.423	10,765	0.575						
S	14,861	0.341	10,708	0.698						
T	19,426	0.446	12,953	0.650						
U	16,590	0.381	11,843	0.692						
V	12,795	0.294	5,831	0.460						

Sub-Basin Drainage Area (sf)	Micro-Scale Practices: Drainage Area to Practice (sf)	Micro-Scale Practice Used	Surface Area of Practice (sf)	Depth of Media (ft)	n	ESDv Provided by Media (cf)	Ponding of ESDv (ft)	ESDv Provided by Ponding (cf)	Total ESDv Provided by Practice (cf)
D	17,722	MB	926	4.50	0.4	1667	1.00	926	2,593
E	8,568	MB	388	4.50	0.4	698	1.00	388	1,086
F	10,544	MB	366	4.50	0.4	659	1.00	366	1,025
G	7,090	MB	567	4.50	0.4	1021	1.00	567	1,588
H	11,729	MB	830	4.50	0.4	1494	1.00	830	2,324
I	18,358	MB	870	4.50	0.4	1566	1.00	870	2,436
J	13,878	MB	354	4.50	0.4	637	1.00	354	991
K	19,736	MB	603	4.50	0.4	1085	1.00	603	1,688
L	13,878	MB	603	4.50	0.4	1085	1.00	603	1,688
M	21,375	MB	988	4.50	0.4	1778	1.00	988	2,766
N	19,718	MB	1176	4.50	0.4	2117	1.00	1176	3,293
O	14,758	MB	505	4.50	0.4	909	1.00	505	1,414
P	16,940	MB	600	4.50	0.4	1080	1.00	600	1,680
Q	19,461	MB	776	4.50	0.4	1397	1.00	776	2,173
R	18,442	MB	524	4.50	0.4	943	1.00	524	1,467
S	14,861	MB	972	4.50	0.4	1750	1.00	972	2,722
T	19,426	MB	1101	4.50	0.4	1982	1.00	1101	3,083
U	16,590	MB	647	4.50	0.4	1165	1.00	647	1,812
V	12,795	MB	561	4.50	0.4	1010	1.00	561	1,571

Sub-Basin Drainage Area (sf)	Non-Structural Practices: Drainage Area to Practice (sf)	Non-Structural Practice Used	Disconnect Length/ Buffer Width (ft)	Ratio of Disconnect Length to Contributing Length	Rv of DA	P_E Provided by Practice (in)	ESDv Provided by Practice (cf)	Total ESDv Provided over Sub-Basin DA (in)	Minimum ESD_V over Sub-Basin (1.0 in)	Maximum ESD_V over Sub-Basin (2.6 in)	Credited ESD_V over Sub-Basin	PE Credited over Sub-Basin
D								2,593	413	1,074	1,074	2.60
E								1,086	380	987	987	2.60
F								1,025	439	1,142	1,025	2.33
G								1,588	271	704	704	2.60
H								2,324	665	1,729	1,729	2.60
I								2,436	1,115	2,899	2,436	2.18
J								991	853	2,218	991	1.16
K								1,688	475	1,234	1,234	2.60
L								1,688	853	2,218	1,688	1.98
M								2,766	1,331	3,461	2,766	2.08
N								3,293	1,147	2,983	2,983	2.60
O								1,414	484	1,259	1,259	2.60
P								1,680	632	1,642	1,642	2.60
Q								2,173	819	2,130	2,130	2.60
R								1,467	884	2,299	1,467	1.66
S								2,722	865	2,249	2,249	2.60
T								3,083	1,052	2,736	2,736	2.60
U								1,812	957	2,489	1,812	1.89
V								1,571	491	1,276	1,276	2.60

*Drainage area to facility minus area of facility and embankment

Sum of ESDv Credited Within Study Area	32,189
P_E Credited Over Required Study Area	1.09

STUDY POINT B

Sub-Basin Drainage Area (sf)	Sub-Basin Total Area* (sf)	Sub-Basin Total Area* (ac)	Sub-Basin Impervious Area sf)	Sub-Basin R_v	Alternative Surfaces: Drainage Area of Surface (sf)	Alternative Surface Used	Filter Media Thickness (in)	P_E Provided by Surface (in)	Rv of DA of Surface	ESDv Provided by Surface (cf)
A	19,763	0.454	8,404	0.433						
B	10,721	0.246	5,601	0.520						
C	12,257	0.281	10,674	0.834						
	42,741		24,679							

Sub-Basin Drainage Area (sf)	Micro-Scale Practices: Drainage Area to Practice (sf)	Micro-Scale Practice Used	Surface Area of Practice (sf)	Depth of Media (ft)	n	ESDv Provided by Media (cf)	Ponding of ESDv (ft)	ESDv Provided by Ponding (cf)	Total ESDv Provided by Practice (cf)
A	19,763	MB	783	4.50	0.4	1,409	1.00	783	2,192
B	10,721	MB	562	4.50	0.4	1,012	1.00	562	1,574
C	12,257	MB	1146	4.50	0.4	2,063	1.00	1146	3,209
			2,491						

Sub-Basin Drainage Area (sf)	Non-Structural Practices: Drainage Area to Practice (sf)	Non-Structural Practice Used	Disconnect Length/ Buffer Width (ft)	Ratio of Disconnect Length to Contributing Length	Rv of DA	P_E Provided by Practice (in)	ESDv Provided by Practice (cf)	Total ESDv Provided over Sub-Basin DA (in)	Minimum ESD_V over Sub-Basin (1.0 in)	Maximum ESD_V over Sub-Basin (2.6 in)	Credited ESD_V over Sub-Basin	PE Credited over Sub-Basin
A								2,192	713	1,853	1,853	2.60
B								1,574	465	1,208	1,208	2.60
C								3,209	852	2,214	2,214	2.60

*Drainage area to facility minus area of facility and embankment

Sum of ESDv Credited Within Study Area	5,275
P_E Credited Over Required Study Area	1.61

III. SOILS INFORMATION

Map Scale: 1:5,690 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Montgomery County, Maryland (MD031)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5B	Glenville silt loam, 3 to 8 percent slopes	C	0.5	0.7%
6A	Baile silt loam, 0 to 3 percent slopes	C/D	6.2	7.7%
16B	Brinklow-Blocktown channery silt loams, 3 to 8 percent slopes	C	27.2	34.1%
16C	Brinklow-Blocktown channery silt loams, 8 to 15 percent slopes	C	29.7	37.3%
16D	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	C	12.7	15.9%
17C	Occoquan loam, 8 to 15 percent slopes	B	0.3	0.4%
54A	Hatboro silt loam, 0 to 3 percent slopes, frequently flooded	B/D	3.2	4.0%
Totals for Area of Interest			**79.8**	**100.0%**

IV. APPROVED FOREST CONSERVATION PLAN

V. ADJACENT DOWNSTREAM PROPERTY OWNER NOTIFICATION LETTER AND LIST OF RECIPIENTS

July 6th, 2015

Re: Stormwater Management Concept Plan

To Whom It May Concern:

In accordance with Montgomery County Executive Regulation 702AM, this letter is to notify you of an application to the Montgomery County Department of Permitting Services (DPS) for the attached project. This application is for approval of a stormwater management concept plan. A copy of the proposed stormwater management concept plan is enclosed.

The stormwater management concept plan will be acted upon by DPS prior to Mandatory Referral, or prior to the review of detailed development plans. You, as an adjacent/downstream landowner, may provide in writing to DPS any information which is pertinent to the proposed stormwater management concept plan, and which you think should influence action taken by DPS. Written comments must be addressed to:

Mark Etheridge, Manager
Montgomery County Department of Permitting Services
Water Resources Section
255 Rockville Pike, 2nd floor
Rockville, MD 20850-4166

Comments must be delivered within three weeks of receipt of this notice which has been sent by Certified Mail. Comments received from landowners will be considered in the review of the stormwater management concept plan.

Sincerely,

Sean Lindaman, P.E.
Project Engineer

Enclosures – SWM Plan

MNCPPC
9500 Brunett Avenue
Silver Spring, MD 20901

Christopher and Allison Smith
12200 Skylark Road
Clarksburg, MD 20871

Arora Hills Homeowners Association Inc.
1425 Clarkview Road
Baltimore, MD 21209

Thai Nguyen
23224 Ridge Road
Germantown, MD 20876

Jafar Omidvar
7720 Tremayne Place
Mclean, VA 22102

Vincent Lufsey
21944 Greenbrook Drive
Boyds, MD 20841

David and Gail Fredrick
23406 Ridge Road
Germantown, MD 20876

E C Richard Enterprises Inc
26719 Ridge Road
Damascus, MD 20872

Grace Farm Estates
1355 Beverly Road, Ste. 240
McLean, VA 22101

Grace Farm Homeowners Assoc.
c/o Vanguard Management Company
19536 Amaranth Drive
Germantown, MD 20874

Stuart & Megan Fishbein
11402 Piedmont Court
Clarksburg, MD 20871

Karie Ellen Foley
11404 Piedmont Ct
Clarksburg, MD 20871

Victor Chukwudi Anohu
11801 Kigger Jack Lane
Clarksburg, MD 20871

Park Ridge Homeowners Assoc.
c/o Vangurd Management Company
19536 Amaranth Drive
Germantown, MD 20874

Park Ridge Homeowners Assoc. Inc
1355 Beverly Road, Ste. 240
McLean, VA 22101

Craig & Dawn Walton
12200 Piedmont Court
Clarksburg, MD 20871

Pamela Johnson
12316 Piedmont Court
Clarksburg, MD 20871

APPENDIX A: GEOTECHNICAL REPORT

REPORT OF

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING ANALYSIS

OVID HAZEN WELLS ACTIVE RECREATION AREA
FREDERICK, MARYLAND

FOR

NORTON LAND DESIGN, LLC

JUNE 25, 2015

June 25, 2015

Mr. Michael Norton
Norton Land Design, LLC
17830 New Hampshire Avenue, Suite 101
Ashton, Maryland 20861

ECS Job No.: 13-7004

Reference: Report of Subsurface Exploration and Geotechnical Engineering Analysis, Ovid Hazen Wells Active Recreation Area, 12001 Skylark Drive, Clarksburg, Maryland

Dear Mr. Norton:

As authorized by acceptance of our proposal 13-8013-GP dated March 18, 2015, ECS Mid-Atlantic, LLC (ECS) has completed subsurface exploration and geotechnical engineering analysis for the Ovid Hazen Wells Active Recreation Area located in Clarksburg, Maryland. Our report, including the results of our subsurface exploration program, laboratory analysis, infiltration testing and geotechnical engineering analysis is enclosed with this letter, along with a Site Vicinity Map and a Boring Location Diagram.

Among other planned site improvements, we understand that the project will consist of construction of a Carousel & Roundhouse Structure, a park structure with reception area, ticketing booths, restrooms, outdoor terraces, a terraced seating and lounge area, picnic area, park shelters, a skate spot, an architectural folly, a dog park, a maintenance building (3,500 SF) to house staff and equipment, one or more bridges to cross streams or wetlands, new paved roads and parking for 270 additional cars and busses, trail alignment for the Clarksburg Greenway between Skylark and Ridge Road, and new stormwater management facilities.

We appreciate this opportunity to be of service to Norton Land Design, LLC on this project. If you have any questions regarding the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC

STATE OF MARYLAND
JEFFREY A. McGREGOR
No. 30901
PROFESSIONAL ENGINEER

Gregory A. Ratkowski
Senior Project Engineer

Jeffrey A. McGregor, P.E.
Principal Engineer

Enclosures: (1) Report

I:\Department 3 Geotechnical\GEOTECHNICAL\PROJECTS\7000's\13-7004 Ovid Hazen Wells Active Rec Area\13-7004 Ovid Hazen Wells Active Rec Area - Report.doc

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS

PROJECT

Ovid Hazen Wells Active Recreation Area
12001 Skylark Drive
Clarksburg, Maryland

CLIENT

Mr. Michael Norton
Norton Land Design, LLC
17830 New Hampshire Avenue, Suite 101
Ashton, Maryland 20861

Submitted by
ECS Mid-Atlantic, LLC
5112 Pegasus Court
Suite S
Frederick, Maryland 21704

PROJECT 13-7004

DATE June 25, 2015

OVID HAZEN WELLS ACTIVE RECREATION AREA

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PROJECT OVERVIEW

Project Location and Proposed Construction

The project site is located 12001 Skylark Drive in Clarksburg, Maryland. The project site is located within the Active Recreation Area of the Ovid Hazen Wells Park. The project site is bordered on the east by a portion of the park identified as the Central Area and single family homes, on the north by a farm house and field, Piedmont Road and single family homes, on the west by Skylark Drive and single family homes and on the south by the property line of the park and a stream. A Site Location Diagram, included in the Appendix of this report, shows the approximate location of this project.

We understand that the project will consist of construction of a Carousel & Roundhouse Structure, a park structure with reception area, ticketing booths, restrooms, event space and outdoor terraces, a terraced seating and lounge area, picnic area, park shelters and renovated playground, a teen activity area to possibly include a skate spot, an architectural folly (envisioned as a tall, sculptural and functional element), a dog park, a maintenance building (3,500 SF) to house staff and equipment, community open space and one or more bridges to cross streams or wetlands. The construction will also include new paved roads and parking for 270 additional cars and busses, trail alignment for the Clarksburg Greenway between Skylark and Ridge Road and new stormwater management facilities throughout the active recreational area of the park.

Existing site grades within the site vary from gently sloping to steeply sloping. Elevations were not available at the time of this report.

Scope of Work

The conclusions and recommendations contained in this report are based on our field subsurface explorations and review of available geologic and/or geotechnical data. The subsurface exploration program included a total of ten (10) soil borings (B-1 to B-10), extended to depths of up to 20 feet below the existing ground surface. Visual classifications were then performed on soil samples to classify the soils and to assist in determination of the properties of the on-site soils. We also visited the site to conduct a site reconnaissance of current conditions.

The boring and infiltration test locations were selected and located in the field by Norton Land Design, LLC. The Boring Location Diagram in the Appendix indicates the approximate physical location of the borings performed at the site.

Soil samples were also collected from areas of the site for horticultural analysis. The sample locations were selected by Norton Land Design, LLC and located in the field by ECS. The results of the horticultural analysis will be submitted under a separate cover following the completion of the soil analysis.

Purposes of Exploration

The purpose of our subsurface exploration was to explore current soil and groundwater conditions at the site and to develop preliminary engineering recommendations to guide in the design and construction of the proposed project. We accomplished these purposes by:

1. drilling borings to explore the subsurface soil and groundwater conditions,
2. performing in-situ infiltration testing,
3. performing visual classification and laboratory testing on the soil samples from the borings to evaluate pertinent engineering properties,
4. analyzing the field, laboratory, and classification test results to develop appropriate preliminary engineering recommendations.

EXPLORATION PROCEDURES

The soil borings were performed using an all-terrain vehicle (ATV) mounted drill rig (Auto Hammer CME 550), which utilized continuous flight, hollow stem augers to advance the boreholes. Drilling fluid was not used in this process.

Representative soil samples were obtained by means of the split-spoon sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-spoon sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through the last 12-inch interval is termed the Standard Penetration Test (SPT) value, or N value, and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of noncohesive soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the soils encountered in the borings was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and brought to our laboratory for further visual examination.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included with this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ the transitions may be gradual.

Soil samples received from the soil borings will be retained in our soil laboratory for a period of 60 days after which they will be discarded unless other instructions are received as to their disposition.

EXPLORATION RESULTS

Current Site Conditions

The site is located along the northeast side of Skylark Road within the Active Recreation Area of the Ovid Hazen Wells Park. Adjacent properties include single family homes and farm fields to the north, south and west and the Central Area of the park to the east.

Elevations were not provided but the site varies from gently to steeply sloping. The site is currently developed with athletic fields, a group picnic area, playground, three shelters, portable restrooms, looped hard surface trails connecting the park features, drive lanes and associated parking spaces.

Regional Geology

According to the Physiographic Map of Maryland (2008), the site is located within the Mt. Airy Upland District of the Piedmont Plateau Province. The Piedmont Plateau Province is an area underlain by ancient igneous and metamorphic rock. The virgin soils encountered in this area are the residual product of in-place chemical weathering of the parent rock presently underlying the site. The typical residual soil profile consists of silty to clayey soils near the surface where soil weathering is more advanced, underlain by more sandy silts and silty sands that generally become harder and denser with depth to the top of parent bedrock. The boundary between soil and rock, termed weathered or decomposed rock, is not sharply defined. This transitional zone can contain boulders of more resistant rock as well as highly weathered materials.

The Mt. Airy Upland District is described as upland; herringbone texture due to interaction of thin siltstones and quartzites with stream reaches controlled by joints oblique to bedrock strike; streams often incised.

According to the Geologic Map of the Frederick 30' x 60' Quadrangle, Maryland, Virginia, and West Virginia (2007), the project site is located within the Metasiltstone of the Marburg Formation. The Metasiltstone is described as Greenish-gray to light-olive-gray, quartz-sericite-chlorite phyllitic metasiltstone containing thin (0.25 cm) light-gray quartz laminae and ribbons; and dusky-blue, grayish-blue, dusky-reddish-purple, and greenish-gray to paleolive muscovite-chlorite-paragonite-hematite phyllite. Porphyroblasts of albite and chloritoid occur locally. Much of unit is transposed, phyllonitized, and has abundant pods and folded stringers of white vein quartz.

Soil Conditions

Subsurface conditions within the proposed improvement areas were evaluated with ten (10) soil borings (B-1 to B-10), extended to depths of up to 20 feet below the existing ground surface. The approximate boring locations are presented on the enclosed Boring Location Diagram.

Approximately one (1) to two (2) inches of topsoil was encountered at the boring locations. Fill materials were encountered below the surface cover at boring locations B-4 and B-7 and extended to depths of 5.5 feet and 3 feet respectively, below the ground surface. The fill materials consisted of Clayey SILT (ML/CL FILL), SILT with Sand (ML FILL) and SILT (ML FILL) with trace amounts of sand clay and gravel. Based on Standard Penetration Test (SPT) results, the consistency of the cohesive (ML/CL FILL) soils were medium stiff and the density of the cohesionless (ML FILL) soils ranged from very loose to medium dense. The color of the fill soils was generally brown and grayish brown and the moisture content of these fill soils was characterized as moist.

Natural soils were encountered below the existing fill or surface cover and consisted of SILT (ML), Sandy SILT (ML), SILT with Sand (ML), SILT with Gravel (ML), Gravely SILT (ML), Sandy SILT/Silty SAND (ML/SM), Silty SAND/Sandy SILT (SM/ML), and Silty SAND with Gravel (SM). Some of the natural soils contained clay, sand and gravel. Based on Standard Penetration Test (SPT) results, the density of the natural cohesionless (ML, ML/SM, SM/ML and SM) soils ranged from loose to dense. The color of the natural soils was generally brown, light brown and grayish brown. The moisture content of these soils was characterized as moist.

Below the natural soils, very dense material with a blow count greater than 60 has been noted on the boring logs as decomposed rock. Decomposed rock materials were encountered at four of the boring locations (B-3, B-5, B-8, and B-10) at depths ranging from 3.5 feet to 18.5 feet below existing grades. These materials exhibit rock like qualities and depending on various parameters may be extremely difficult to excavate.

Auger refusal was encountered at the same four borings where decomposed rock was encountered. Auger refusal occurred at depths ranging from 13 feet to 19.25 feet below existing grades. The auger refusal depths encountered at the boring locations are assumed to be the depth to bedrock. The following chart shows the boring locations and depths where decomposed rock and auger refusal was encountered

Boring Location	Depth to Decomposed Rock (ft)	Depth to Auger Refusal (ft)
B-3	8.5	18.6
B-5	18.5	19.25
B-8	12	18
B-10	3.5	13

More detailed descriptions of the soils encountered are presented on the Boring Logs in the Appendix.

<u>**Infiltration Testing**</u>

In order to evaluate potential infiltration at this property, in-situ infiltration tests were performed on June 11, 2015 at depths between 5.5 and 5.9 feet below existing grades.

The in-situ infiltration testing consisted of auguring a soil probe down to the test depth and installing a solid length of five inch diameter PVC pipe. The pipe was then presoaked for 24 hours by filling the pipe with approximately two feet of water. After the initial filling of the pipe, infiltration testing was completed by monitoring the drop in the water level at 60-minute intervals for four hours. The rate of drop over the four total hours is considered the infiltration rate. The test results are as shown in the table on the following page.

Test Location	Test Depth (ft)	Soil Encountered at Test Depth	Field Infiltration Rate (in/hr)
B-1	5.9	Medium Dense Sandy SILT (ML)	4.11
B-2	5.8	Loose to Medium Dense SILT with Sand (ML)	1.8
B-6	5.5	Medium Dense Sandy SILT/Silty SAND (ML/SM)	7.41
B-7	5.9	Medium Dense SILT with Sand (ML)	0.57
B-10	5.5	Very Dense Decomposed Rock	0.12

The results reported above are based on field measurements. We recommend that the design rate be calculated as 2/3 of the field rate to account for siltation over time.

Groundwater Observations

In auger drilling operations, water is not introduced into the boreholes, and the groundwater position can often be determined by observing water flowing into or out of the boreholes. Furthermore, visual observation of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions. Observations for groundwater were made during sampling and upon completion of the drilling operations at each boring location. Groundwater was not encountered during drilling at the boring locations.

The highest groundwater observations are normally encountered in winter and early spring. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of exploration. Free water may also be encountered at the interface of fill soils, if present, and natural soils, or at the interface of natural soils and decomposed rock or bedrock.

ANALYSIS AND ENGINEERING RECOMMENDATIONS

The recommendations presented in this report are based on the project information provided to us, the results of the soil test borings and our engineering analysis. Considering the results of our field exploration, and based on our experience with similar projects, we believe that the proposed park structures may be supported on shallow foundation systems consisting of spread footings. The foundations should be founded on the natural silty or sandy soils or new compacted structural fill. The on-site natural soils are considered suitable for the support of slabs on grade, provided that the subgrade soils have been properly prepared, as described in this report, and approved by the Geotechnical Engineer or their authorized representative.

Foundation Recommendations

Based on the test borings, the soils anticipated at foundation subgrade levels are expected to consist of natural silty or sandy soil. Based on the results of the subsurface exploration, recommendations outlined in the "**Earthwork Operations**" section, and our engineering analysis, the proposed park structures can be supported on spread footing foundations when founded on new structural fill or suitable natural soils. The geotechnical analysis of the soil indicates that footings supported on natural silty or clayey soils may be designed for a bearing pressure of 3,000 psf.

It is anticipated that footing subgrades will generally be supported on natural ground or new compacted fill. The bases of all foundation excavations should be observed and tested by the Geotechnical Engineer. If encountered at planned subgrade levels for any footing, existing fill soils shall be completely undercut to suitable bearing materials. The footing can be directly supported on competent soils at greater depths or, alternatively, the design footing bearing level can be restored through placement of lean (2,500 psi) concrete, flowable fill (200 psi), or engineered fill materials. If lean concrete or flowable fill is to be used to restore foundation bearing levels, the undercut excavations can be made “neat” with the dimension of the footing. Lean concrete shall conform to Maryland State Highway Mix No. 1. Flowable fill shall conform to ACI 299. If the design bearing level is restored using engineered fill, however, then the excavation to remove the unsuitable soils shall extend at least 0.5 foot laterally beyond the bottom edge of the footing for each 1 foot of vertical undercut below the footing bearing level. All foundations should be constructed with Type I Portland cement concrete.

Based on the assumed relatively light loading conditions, we believe that higher bearing pressures will not be necessary; however, this can be evaluated once final site plans and foundation elevations are made available. The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure.

Settlement of individual footings, designed in accordance with the recommendations outlined above, is expected to be within tolerable limits for the proposed structures. Within the proposed construction, total settlements on the order of one inch are anticipated, with differential settlement on the order of about half the total settlement.

To reduce the possibility of excessive settlement from local shear or "punching" action, the column footings shall have a minimum lateral dimension of 2 feet and continuous wall footings shall have a minimum width of 1.5 feet. In addition, footings shall be placed at sufficient depths to provide adequate protection from frost heave. It is recommended that exterior footings or footings in unheated areas shall be placed at minimum depths of 30 inches below final exterior grades for frost protection. Interior footings in heated areas can be located at minimum depths of 18 inches below finished floor grades, provided that architectural and structural considerations are also satisfied. If interior footings in future heated areas are constructed at levels above 30 inches and subsequently are subjected to freezing temperatures, there is a possibility for frost heave of those footings during periods of sustained freezing temperatures. Therefore, the Contractor shall take precautions to protect shallow footing during periods of freezing weather prior to enclosure and heating of the building.

Floor Slab Design

According to the test borings, the soils anticipated below floor slabs should consist of natural silty or sandy soils. These soils are expected to be suitable for support of the floor slabs.

If encountered, any existing fill soils should be evaluated by the Geotechnical Engineer with test pits. Some undercutting and replacement of excessively loose or soft materials should be budgeted for. The floor slab subgrade should be prepared in accordance with our recommendations outlined in the section entitled "**Earthwork Operations**", which includes stripping and fill placement.

We recommend that floor slabs be isolated from the foundation footings so that differential settlement of the structures will not induce stresses on the floor slab. Also, in order to minimize the crack width of any shrinkage cracks that may develop near the surface of the slab, we recommend mesh reinforcement be included in the design of the floor slab. The mesh should be in the top half of the slab to be effective.

Groundwater observations performed in the borings did not indicate the presence of groundwater near the anticipated finished floor levels. Therefore, it is our opinion that a special under slab subdrainage system will not be necessary for the proposed project.

We recommend that a capillary cutoff layer be provided under the floor slab to prevent the rise of moisture through the floor slab. The capillary layer should consist of a minimum of 6 inches of graded aggregate, with a maximum 2% fines passing the No. 200 sieve. AASHTO No. 57 stone should be suitable for this purpose. A vapor barrier should be placed on top of the stone to provide additional moisture protection. Placement of this vapor barrier should occur immediately before the placement of floor slab concrete in order to minimize damage to the layer. However, special attention should be given to the surface curing of the slab in order to minimize uneven drying of the slab and associated cracking.

Seismic Site Class

Based on our interpretation of the International Building Code, it is our opinion that the site soils can be characterized as Site Class D. ECS can provide additional analysis and testing, if desired, to further evaluate the site class or to develop site specific response spectra.

The Mapped Spectral Response Acceleration at Short Periods and 1-second periods, S_S and S_1, respectively, are as follows for the project site. The approximate S_S and S_1 values, as shown below, are calculated through the United States Geological Survey's (USGS) Seismic Hazard Curves and Uniform Hazard Response Spectra program according to the 2012 International Building Code (IBC) and correspond to Montgomery County requirements.

$$S_S = 0.125 \text{ g}$$
$$S_1 = 0.055 \text{ g}$$

Based on our experience, the site soils have a relatively low potential for liquefaction, and tying adjoining foundations together with grade beams or other methods should not be needed from a seismic standpoint.

Earthwork Operations

Proper monitoring of newly placed fill with respect to lift thickness and compaction of each lift is expected to be necessary at this site. The following paragraphs detail our recommendations regarding earthwork operations.

Fill, Floor, and Foundation Subgrades

The existing ground surface in the proposed structural areas should be stripped of all asphalt, vegetation, rootmat, topsoil, and any soft or unsuitable material. When existing fill material is encountered at footing, slab, or new fill subgrades, it should be thoroughly evaluated by the Geotechnical Engineer. Some undercutting of soft or loose fill soils is also expected for floor slab subgrades, and this should be budgeted for. The stripping within the proposed structural areas should be extended to at least 10 feet, where possible, beyond the planned limits.

After removing all unsuitable materials, cutting to the desired grade, and prior to engineered fill placement, the exposed subgrade soils shall be examined by a qualified representative of the Geotechnical Engineer. The exposed subgrade shall be thoroughly proofrolled by a vehicle having an axle weight of at least 10 tons, such as a loaded, tandem-axle dump truck. Areas subject to proofrolling shall be traversed by the equipment in two orthogonal directions and witnessed by the representative of the Geotechnical Engineer. This procedure is intended to assist in identifying any localized yielding materials. In the event that any yielding areas are encountered during the proofrolling operations, the subgrade shall be either thoroughly densified in-place, scarified/aerated and re-compacted, or undercut to firm ground and replaced with controlled, compacted fill, based on the observations made by the Geotechnical Engineer personnel to determine the cause of the unsuitable subgrade.

Upon completion of the proofrolling process, the entire exposed subgrade shall be densified in place with suitable equipment (minimum 10-ton roller) to assure compactive effort is applied to the top 12 inches of the subgrade. The exposed soils shall be compacted to a firm and unyielding condition.

The preparation of any areas to receive engineered fill, as well as proposed building subgrades or pavement areas should be observed on a full-time basis. These observations should be performed by a qualified representative of the Geotechnical Engineer, to document that any unsuitable materials have been removed, that the subgrade is suitable for support of the proposed construction and/or fills, and that the subgrade has achieved the required density and moisture content in accordance with project specifications.

We recommend the use of a reinforcing geotextile or geogrid where excessively soft materials are encountered and cannot be effectively removed by over excavation. These materials shall be covered by a minimum of 1 foot of select granular materials. Alternate reinforcing or stabilization of soft subgrades shall be determined in the field by a qualified representative of the Geotechnical Engineer, and in accordance with project specifications.

Existing fill material was encountered at boring locations B-4 and B-7 and may be encountered in areas of the site not currently explored. In proposed slab and pavement areas, any encountered existing fill to remain shall be thoroughly proofrolled as described below. If an unstable surface is encountered, we recommend the removal and replacement of the soft/yielding soils to expose a stable surface. Existing fill may remain in place to support new fill, slab and pavement areas, provided it is determined to be stable during proofrolling and has been thoroughly evaluated by the Geotechnical Engineer at the time of construction by examining excavations for utilities, test pits and hand-auger borings to adequately assess the quality and supportive characteristics of the fill.

Fill Placement

Compacted engineered fill and backfill for utilities or undercuts should consist of soils classified as ML, SM, SC, or more granular per ASTM D-2487 and have a liquid limit less than 45 and plasticity index less than 20. Unacceptable backfill materials include topsoil, organic materials (OH, OL) and high plasticity silts and clays (MH, CH). All such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved disposal areas either on site or off site.

An examination of the soils recovered during our current exploration and our previous experience in the area indicates that a majority of the silty and sandy site soils should generally be suitable for reuse as controlled, compacted fill with moisture adjustment during placement.

All fill should be placed in loose lifts, not exceeding 8 inches in thickness, and should be compacted to at least 95 percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D-698). Generally, the moisture content of the fill materials should be maintained within ± 2 percent of the optimum moisture content for the fill material, as determined by ASTM D-698. Fill placed in non-structural areas (e.g. grassed areas) should be compacted to at least 90 percent of the maximum dry density according to ASTM D-698, in order to avoid significant subsidence. The upper 18 inches of soil supporting slabs-on-grade and pavements should be compacted to a minimum of 100% of the maximum dry density obtained in accordance with ASTM D-698, Standard Proctor Method discussed above.

Construction Considerations

Precautionary measures should be taken to ensure that preparation of the subgrade and footing bearing surfaces are accomplished by the recommended procedures. These precautions are necessary, as the materials observed in the borings will become weakened if exposed to water. Therefore, we recommend that all excavations be properly dewatered, if necessary, using conventional sump pit and pumping operations. The site should be graded such that surface water runoff is directed away from the excavations.

Exposure to the environment may weaken the soils at the footing bearing level if foundation excavations remain open for extended periods of time. Therefore, foundation concrete should be placed the same day that footings are excavated. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1-to 3-inch thick "mud-mat" of "lean" concrete be placed on the bearing soils before the placement of reinforcing steel.

The on-site soils contain fines which are considered highly erodible. The Contractor should provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surface soils. The surface of the site should be kept properly graded in order to enhance drainage of the surface water away from the proposed construction areas during the earthwork phase. Other practices would involve sealing the exposed soils daily with a smooth drum roller to reduce the potential for infiltration of surface water in the exposed soils. All erosion and sedimentation shall be controlled in accordance with sound engineering practice and current County requirements.

In their undisturbed state, the upper soils at the site will generally provide fair subgrade support for fill placement and construction operations. However, when disturbed or wet, these soils will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations, which will help maintain the integrity of the soil.

Closing

This report has been prepared to aid in the evaluation of this site and to assist the design team with the design of the proposed park improvements. This report is limited to the locations described.

We have appreciated the opportunity to be of service to you and hope to continue our involvement on the project during the final design and construction phases. ECS-Mid-Atlantic, LLC (ECS) is capable of providing all construction materials testing services for the project, and we would appreciate the opportunity to offer our services.

APPENDIX

Site Location Diagram

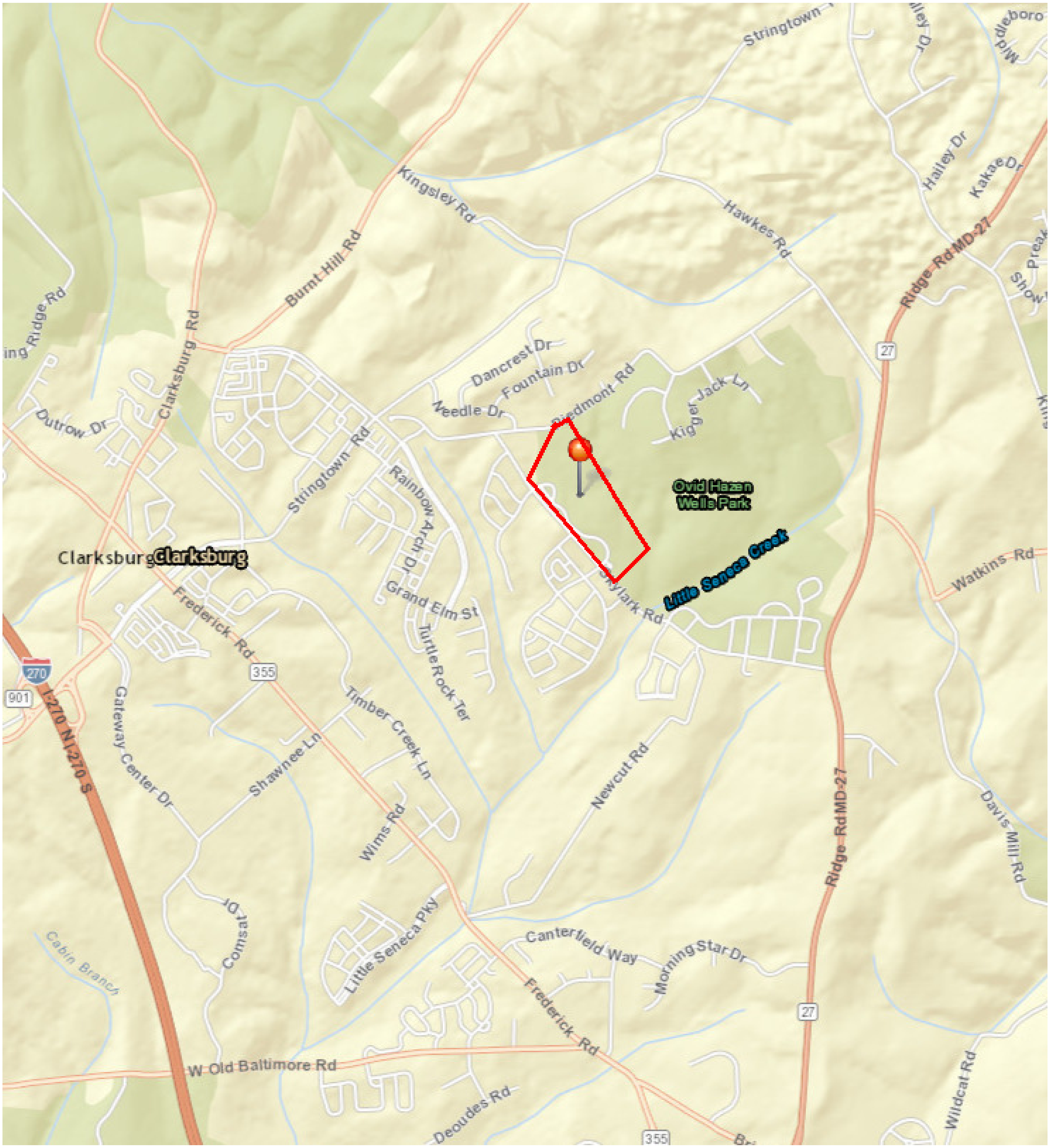
Lateral Earth Pressure Diagram

Unified Soil Classification System

Reference Notes for Boring Logs

Boring Logs (B-1 to B-10)

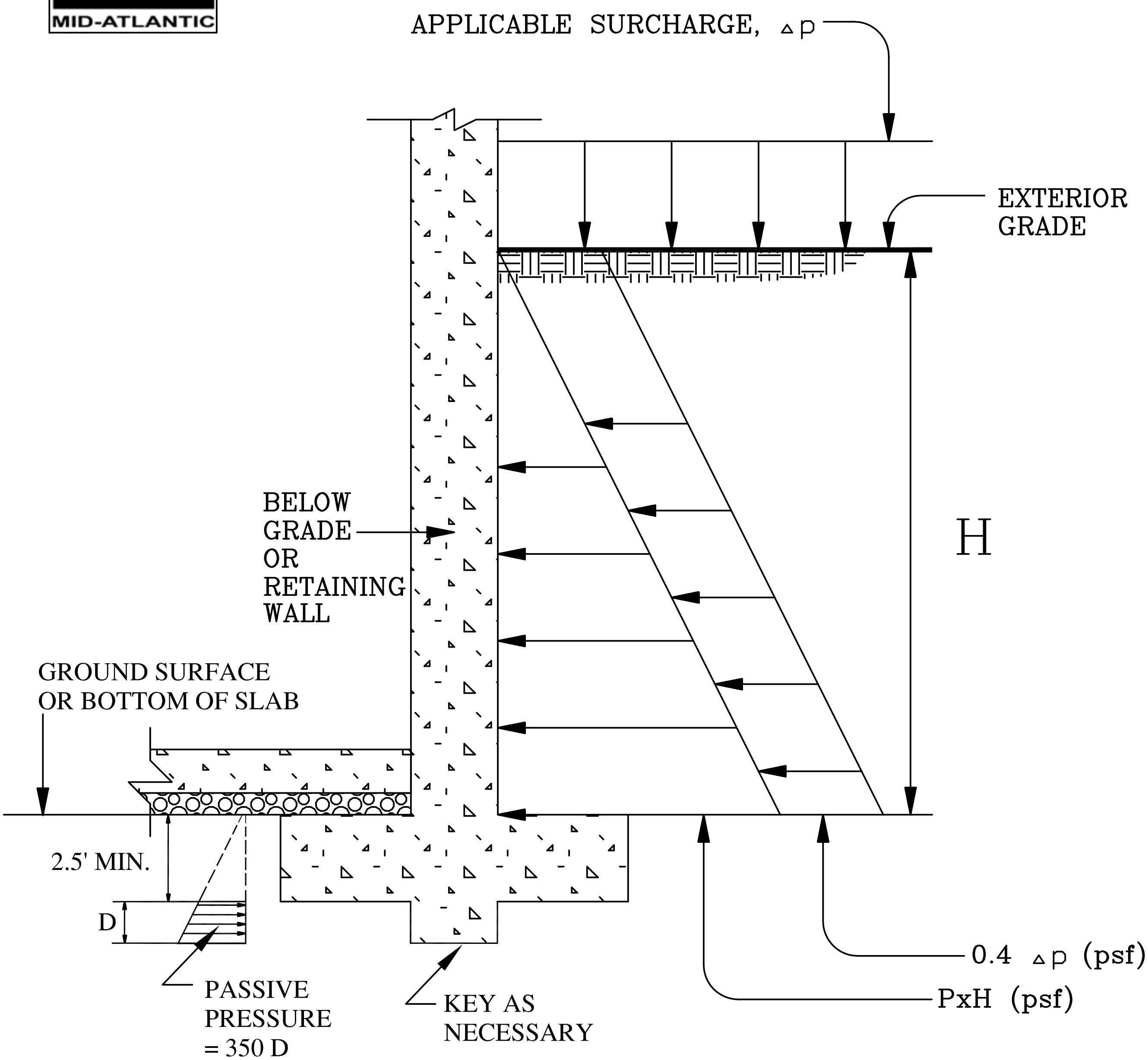
Boring Location Diagram



Source: World Street Map	Scale: 1 inch = 0.4mi	6/4/2015

SITE LOCATION DIAGRAM
Frederick office
5112 Pegasus Court
Suite S
Frederick MD 21704

ECS PROJECT NO.13:7004
Ovid Hazen Wells Active Recreation Area
12001 Skylark Drive
Clarksburg MD



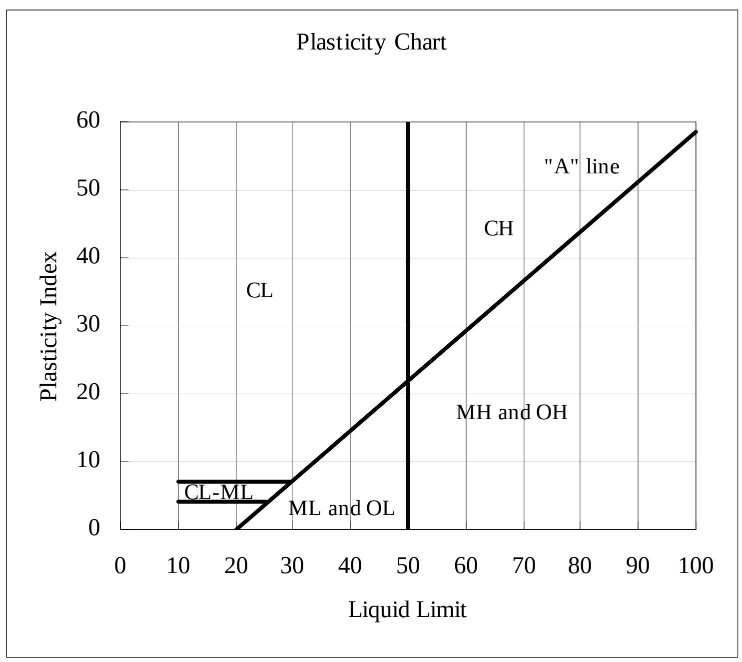
LEGEND:

P = LATERAL EARTH PRESSURE (60 plf) FOR RIGID WALLS
(40 plf) FOR RETAINING WALLS

LATERAL EARTH PRESSURE DIAGRAM

FOR BELOW GRADE & RETAINING WALLS

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt		Peat and other highly organic soils			

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash sample
REC	Rock Sample Recovery %	RQD	Rock Quality Designation %

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00–8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	▼	Est. Seasonal High GWT

The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

SITE LOCATION

12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% REC%

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Topsoil Depth [2"]				
	S-1	SS	18	18	(ML) SILT, Trace Clay, Trace Sand, Brown, Moist, Medium Dense			2 4 7	11
	S-2	SS	18	18	(ML) SANDY SILT, Trace Gravel, Light Brown, Moist, Medium Dense			5 8 10	18
5									
	S-3	SS	18	18				5 7 13	20
	S-4	SS	18	12				8 6 8	14
10									
	S-5	SS	18	18	(ML) SILT WITH SAND, Trace Gravel, Brown, Moist, Medium Dense			3 5 9	14
15									
	S-6	SS	18	16				6 9 13	22
20					END OF BORING @ 20.0'				
25									
30									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 06/10/15	CAVE IN DEPTH @ 14.6'
WL(BCR) WL(ACR)	BORING COMPLETED 06/10/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

SITE LOCATION

12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – — –   REC% ———

PLASTIC LIMIT% ✕   WATER CONTENT% ●   LIQUID LIMIT% △

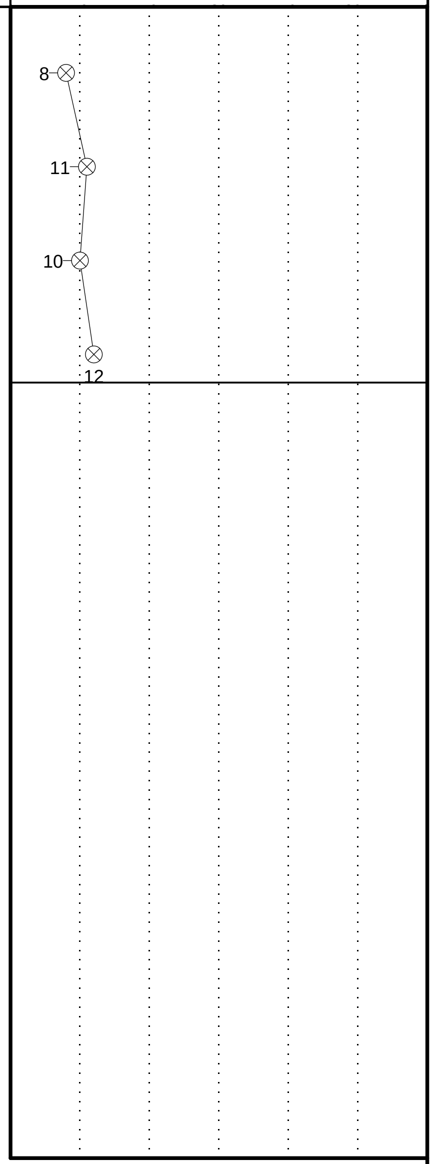
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING   LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [2"]			
	S-1	SS	18	12	(ML) SILT WITH SAND, Trace Gravel, Light Brown, Moist, Loose to Medium Dense			3 3 5
	S-2	SS	18	18				4 5 6
5								
	S-3	SS	18	10	(ML) SILT, Trace Clay, Trace Sand, Light Brown, Moist, Loose to Medium Dense			4 5 5
	S-4	SS	18	16				4 5 7
10					END OF BORING @ 10.0'			
15								
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 06/10/15	CAVE IN DEPTH @ 5.8'
WL(BCR) WL(ACR)	BORING COMPLETED 06/10/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

SITE LOCATION

12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

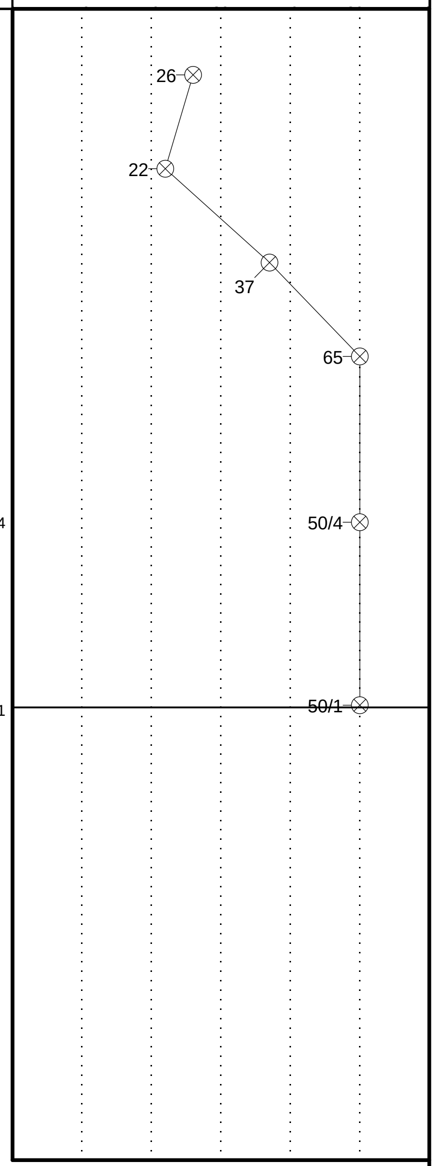
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – – – REC% ———

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [2"]			
					(ML) SANDY SILT, Trace Gravel, Light Brown, Moist, Medium Dense to Dense			
	S-1	SS	18	18				8 11 15
	S-2	SS	18	18				5 10 12
5								
	S-3	SS	18	18				8 15 22
	S-4	SS	18	14	(SM/ML) DECOMPOSED ROCK SAMPLED AS SILTY SAND/SANDY SILT WITH GRAVEL, Light Brown, Moist, Very Dense			12 20 45
10								
	S-5	SS	4	4				50/4
15								
	S-6	SS	1	1				50/1
					AUGER REFUSAL @ 18.6'			
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 06/12/15	CAVE IN DEPTH @ 13.5'
WL(BCR) WL(ACR)	BORING COMPLETED 06/12/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-4	1 OF 1

PROJECT NAME: Ovid Hazen Wells Active Recreation Area

ARCHITECT-ENGINEER:

SITE LOCATION: 12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING: | EASTING: | STATION:

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT (BLOWS/FT)
0					Topsoil Depth [2"]				
					(ML/CL FILL) CLAYEY SILT, Trace Sand, Brown, Moist, Medium Stiff to Soft				
	S-1	SS	18	18				3 4 4	8
	S-2	SS	18	12				3 2 2	4
5					(ML) SILT, Trace Clay, Brown, Moist, Loose				
	S-3	SS	18	18				2 3 4	7
	S-4	SS	18	18	(ML) SILT WITH SAND, Trace Gravel, Trace Clay, Brown, Moist, Medium Dense			3 4 6	10
10									
	S-5	SS	18	10				4 5 7	12
15									
	S-6	SS	18	18	(ML) SILT, Trace Gravel, Trace Sand, Trace Clay, Brown, Moist, Medium Dense			5 8 11	19
20					END OF BORING @ 20.0'				
25									
30									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS ☐ WD ☐	BORING STARTED 06/11/15	CAVE IN DEPTH @ 15.7'
WL(BCR) — WL(ACR)	BORING COMPLETED 06/11/15	HAMMER TYPE Auto
WL	RIG CME 550 — FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-5	1 OF 1

PROJECT NAME: Ovid Hazen Wells Active Recreation Area

ARCHITECT-ENGINEER:

SITE LOCATION: 12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING | EASTING | STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

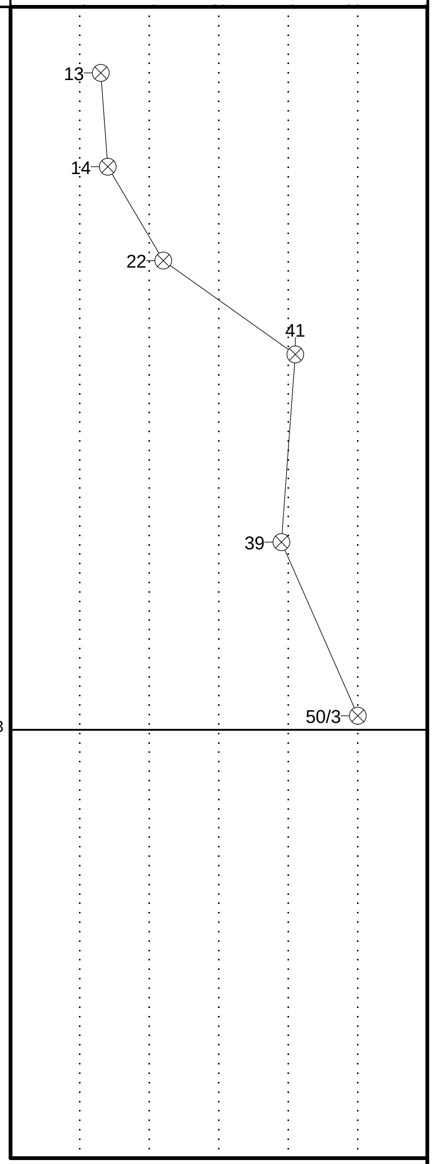
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – – – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT BLOWS/FT
0					Topsoil Depth [1"]				
	S-1	SS	18	18	(ML) SILT WITH SAND, Trace Clay, Trace Gravel, Brown, Moist, Medium Dense			3 5 8	13
	S-2	SS	18	18	(ML/SM) SANDY SILT/SILTY SAND, Trace Gravel, Light Brown, Moist, Medium Dense			5 7 7	14
5	S-3	SS	18	18				5 9 13	22
	S-4	SS	18	18	(ML/SM) SANDY SILT/SILTY SAND WITH GRAVEL, Light Brown, Moist, Dense			11 15 26	41
10									
	S-5	SS	18	18				14 16 23	39
15									
	S-6	SS	9	8	(SM/ML) DECOMPOSED ROCK SAMPLED AS SILTY SAND/SANDY SILT WITH GRAVEL, Light Brown, Moist, Very Dense			37 50/3	50/3
20					AUGER REFUSAL @ 19.25'				
25									
30									



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 06/11/15	CAVE IN DEPTH @ 13.8'
WL(BCR) WL(ACR)	BORING COMPLETED 06/11/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

SITE LOCATION

12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – – – REC% ———

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%

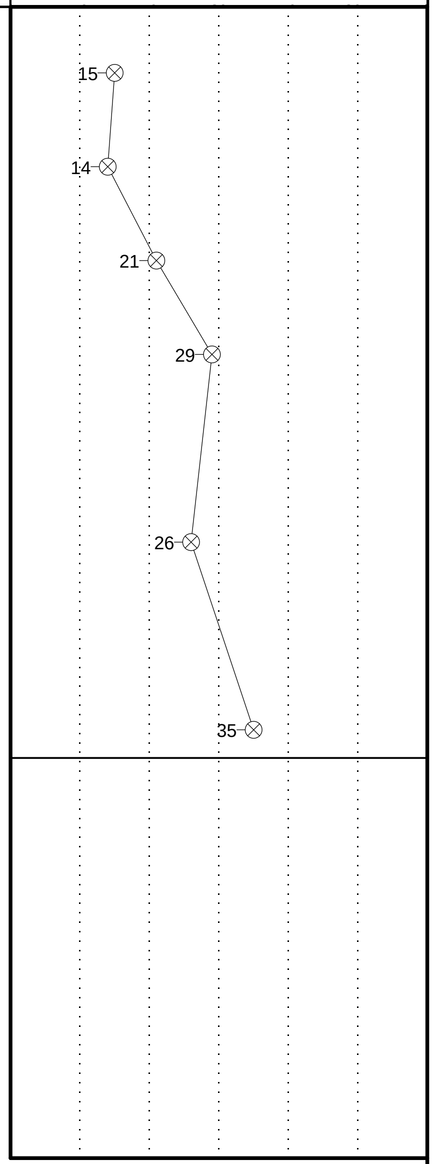
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Topsoil Depth [2"]				
					(ML/SM) SANDY SILT/SILTY SAND, Trace Gravel, Brown, Moist, Medium Dense				
	S-1	SS	18	18				4 6 9	15
	S-2	SS	18	18				5 6 8	14
5									
	S-3	SS	18	18				6 8 13	21
	S-4	SS	18	18				10 13 16	29
10									
	S-5	SS	18	18	(SM/ML) SILTY SAND/SANDY SILT, Trace Gravel, Grayish Brown, Moist, Medium Dense			8 11 15	26
15									
	S-6	SS	18	5	(SM) SILTY SAND WITH GRAVEL, Grayish Brown, Moist, Dense			6 11 24	35
20					END OF BORING @ 20.0'				
25									
30									



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 06/10/15	CAVE IN DEPTH @ 14.5'
WL(BCR) WL(ACR)	BORING COMPLETED 06/10/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-7	1 OF 1

PROJECT NAME: Ovid Hazen Wells Active Recreation Area

ARCHITECT-ENGINEER:

SITE LOCATION: 12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC% ———

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%

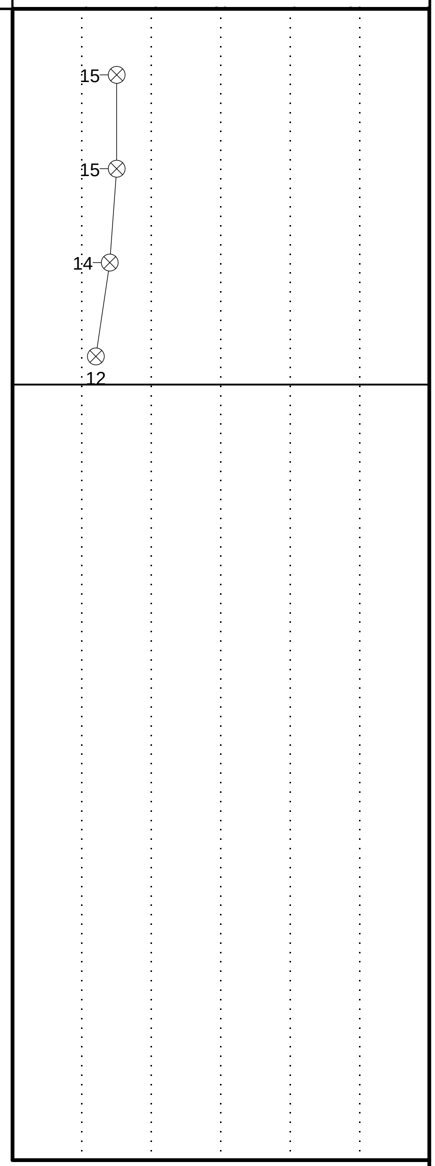
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [1"]			
	S-1	SS	18	18	(ML FILL) SILT WITH SAND, Trace Clay, Trace Gravel, Grayish Brown, Moist, Medium Dense			5 6 9
	S-2	SS	18	18	(ML) SILT WITH SAND, Trace Gravel, Grayish Brown, Moist, Medium Dense			5 7 8
5								
	S-3	SS	18	18				4 6 8
	S-4	SS	18	16				4 5 7
10					END OF BORING @ 10.0'			
15								
20								
25								
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 06/10/15	CAVE IN DEPTH @ 6.2'
WL(BCR) WL(ACR)	BORING COMPLETED 06/10/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-8	1 OF 1

PROJECT NAME: Ovid Hazen Wells Active Recreation Area

ARCHITECT-ENGINEER:

SITE LOCATION: 12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING | EASTING | STATION

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

-○- CALIBRATED PENETROMETER TONS/FT^2

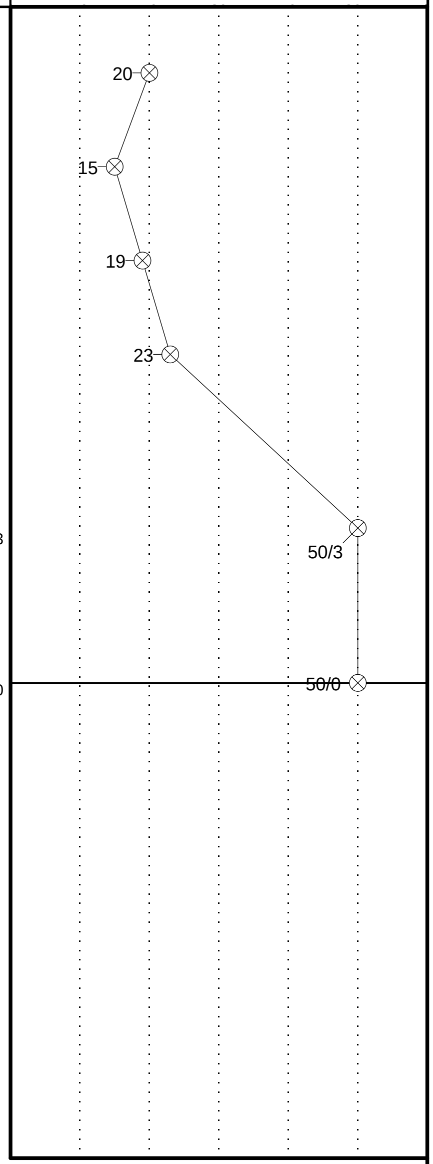
ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC% ———

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%

⊗ STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Topsoil Depth [1"]				
					(ML) GRAVELLY SILT, Trace Sand, Brown, Moist, Medium Dense				
	S-1	SS	18	18				5 8 12	20
	S-2	SS	18	18	(ML/SM) SANDY SILT/SILTY SAND WITH GRAVEL, Grayish Brown, Moist, Medium Dense			4 6 9	15
5									
	S-3	SS	18	18				5 8 11	19
	S-4	SS	18	14				6 9 14	23
10									
					(ML) DECOMPOSED ROCK SAMPLED AS GRAVELLY SILT WITH SAND, Brown, Moist, Very Dense				
	S-5	SS	9	9				29 50/3	50/3
15									
	S-6	SS	0	0	AUGER REFUSAL @ 18.0'			50/0	50/0
20									
25									
30									



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL — WS☐ WD☐	BORING STARTED 06/11/15	CAVE IN DEPTH @ 14.3'
WL(BCR) — WL(ACR)	BORING COMPLETED 06/11/15	HAMMER TYPE Auto
WL	RIG CME 550 — FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-9	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

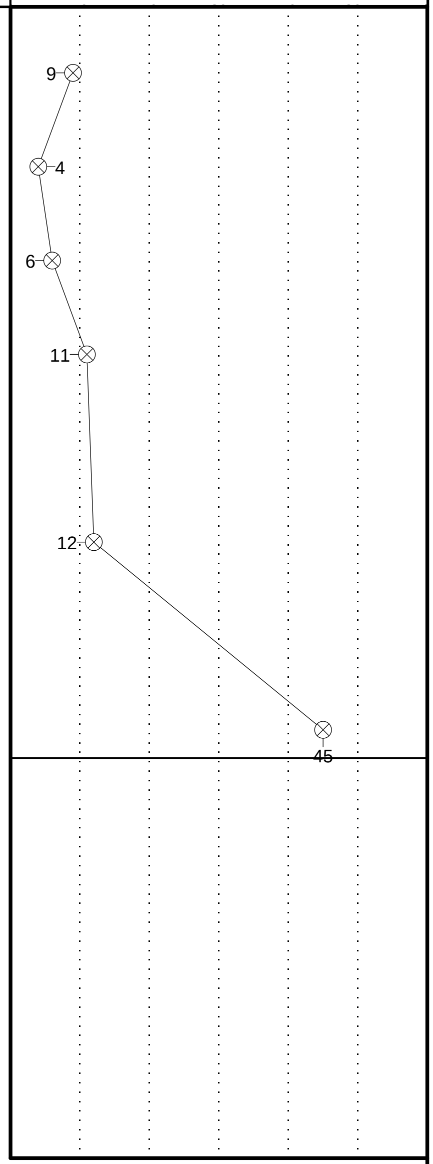
SITE LOCATION
12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION

CALIBRATED PENETROMETER TONS/FT^2
ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———
PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	SPT (BLOWS/FT)
0					Topsoil Depth [2"]				
					(ML FILL) SILT, Trace Clay, Trace Sand, Trace Gravel, Brown, Moist, Very Loose to Loose				
	S-1	SS	18	12				3 4 5	9
	S-2	SS	18	18				3 2 2	4
5									
	S-3	SS	18	14				2 2 4	6
					(ML) SILT WITH SAND, Trace Gravel, Brown, Moist, Medium Dense				
	S-4	SS	18	14				3 5 6	11
10									
	S-5	SS	18	14				4 5 7	12
15									
					(ML) SANDY SILT WITH GRAVEL, Brown, Moist, Dense				
	S-6	SS	18	14				11 18 27	45
20					END OF BORING @ 20.0'				
25									
30									



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 06/11/15	CAVE IN DEPTH @ 15.2'
WL(BCR) WL(ACR)	BORING COMPLETED 06/11/15	HAMMER TYPE Auto
WL	RIG CME 550 FOREMAN Dale Price	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
Norton Land Design, LLC	13:7004	B-10	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Ovid Hazen Wells Active Recreation Area	

SITE LOCATION

12001 Skylark Drive, Clarksburg, Montgomery County, MD

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC% ———

PLASTIC LIMIT% · WATER CONTENT% · LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL · ENGLISH UNITS

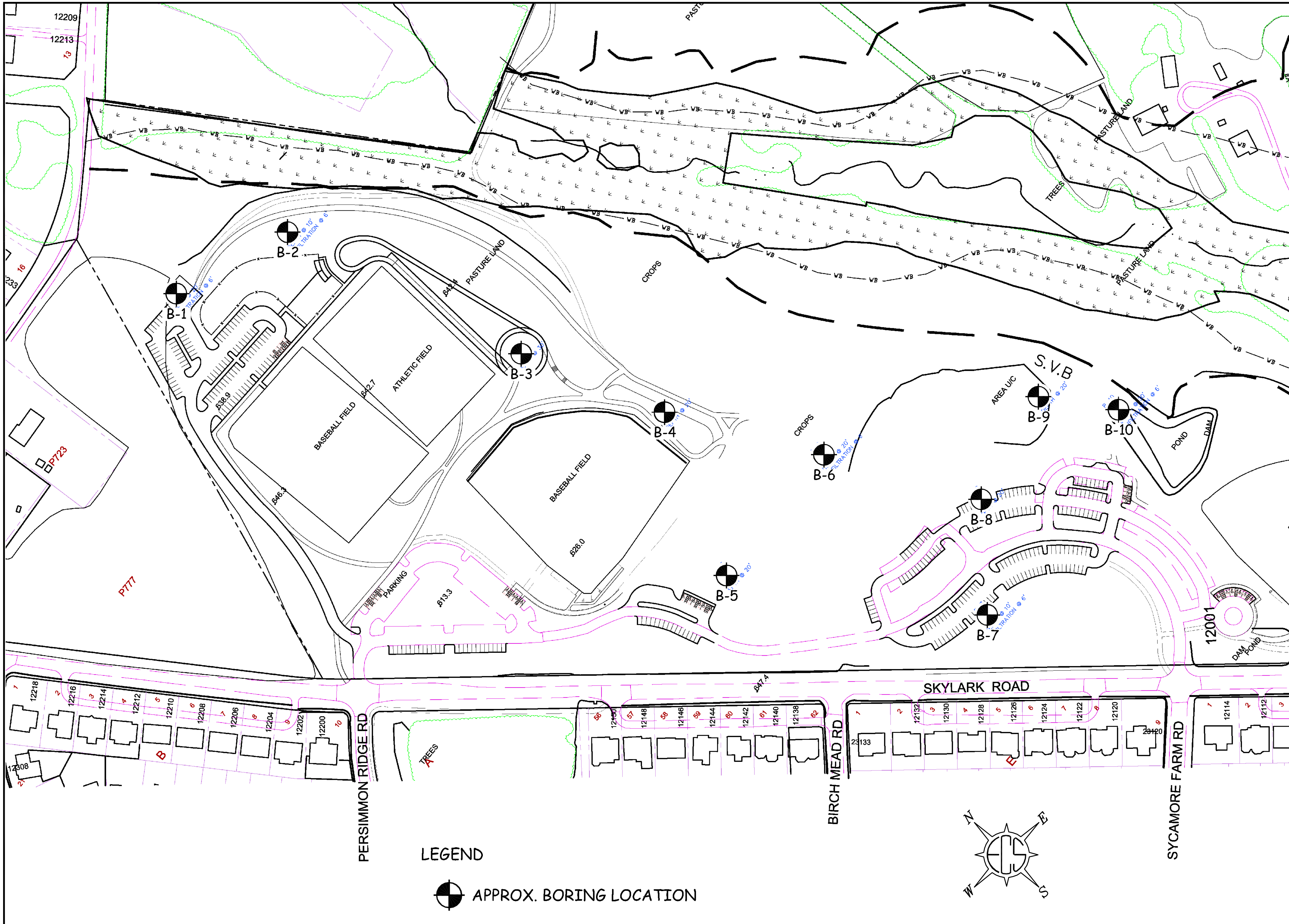
BOTTOM OF CASING · LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Topsoil Depth [1"]				
					(ML) GRAVELLY SILT, Trace Sand, Grayish Brown, Moist, Dense				
	S-1	SS	18	18				9 13 18	31
	S-2	SS	18	15	(ML/GM) DECOMPOSED ROCK SAMPLED AS GRAVELLY SILT/SILTY GRAVEL WITH SAND, Grayish Brown, Moist, Very Dense			19 27 37	64
5									
	S-3	SS	12	8				39 50/6	50/6
	S-4	SS	17	14				29 35 50/5	85/11
10									
	S-5	SS	0	0	AUGER REFUSAL @ 13.0'			50/0	50/0
15									
20									
25									
30									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL · WS ☐ · WD ☐	BORING STARTED 06/10/15	CAVE IN DEPTH @ 8.0'
WL(BCR) · WL(ACR)	BORING COMPLETED 06/10/15	HAMMER TYPE Auto
WL	RIG CME 550 · FOREMAN Dale Price	DRILLING METHOD HSA



OVID HAZEN WELLS
ACTIVE RECREATION AREA
CLARKSBURG, MARYLAND

ECS

BORING LOCATION DIAGRAM

NORTON LAND DESIGN, LLC

ECS REVISIONS	
ENGINEER GAR	DRAFTING AMH
SCALE NTS	
PROJECT NO. 13-7004	
SHEET 1 OF 1	
DATE 06-22-15	