

---

1300 Wilson Blvd., Suite 450, Arlington, VA 22209 T: 571-366-6800 F: 571-366-6801

---

**To:** Joe Cogswell, PE / Arlington County Department of Environmental Services, Engineering Bureau

**From:** Ronald Manney, PE  
Mark DeMatteo, PE

**Date:** 06 July 2022

**Re:** **Groundwater Level Monitoring for Spout Run Deep Sewer Re-Lining  
Arlington, Virginia  
Contract: 17-084-RFP-11  
Langan Project No.: 270060010**

---

This memorandum presents the results of our subsurface investigation and groundwater monitoring well readings for the Spout Run Deep Sewer Re-lining in Arlington, Virginia. The purpose of this investigation program was to assess the subsurface conditions along the existing storm sewer line, and measure the groundwater levels in the wells. The subsurface investigation consisted of performing two borings and installing two groundwater level monitoring wells. The location of the borings are shown in Figure 2.

All elevations given in this memorandum are referenced to the National American Vertical Datum of 1988 (NAVD88).

## PROJECT DESCRIPTION

It is our understanding that the existing 33-inch diameter, 100-year old storm sewer line within the Spout Run neighborhood is in need of repair and will be relined using a cured-in-place-pipe method. Our scope included performing a subsurface investigation near sewer manholes MH 745 and MH 747 to obtain information of the soil and groundwater conditions for design of the lining system.

## GEOTECHNICAL INVESTIGATION

The geotechnical investigation for this project included two geotechnical borings identified as LB-1 and LB-2 and the installation of two groundwater level monitoring wells within the completed borings identified as MW-01 and MW-02. Boring LB-1 was drilled near manhole MH 747, on North Scott Street, north of 21<sup>st</sup> Road North and boring LB-2 was drilled near manhole MH 745, on 21<sup>st</sup> Street North, east of North Quinn Street. The location of the borings and monitoring wells are shown in Figure 1. Our subcontracted driller, Free State Drilling, completed the borings and the groundwater level monitoring well installation on 23 and 25 May 2022. Miss Utility was contacted prior to the start of drilling and all boring locations were scanned for detectable utilities by a private utility locating firm, GPRS. Transportation Right-of-Way permits were issued by Arlington County prior to accessing the site.

## Borings

The borings were drilled using a CME-55 track-mounted drill rig with a 7-5/8 inch O.D hollow-stem augers until auger refusal on rock encountered at 28 and 51 feet below grade. A standard 2-inch-outer-diameter

# Technical Memorandum

split- spoon sampler was used to obtain samples of the underlying soil. The standard penetration test (SPT)<sup>1</sup> was accomplished at 5-foot-intervals as part of the sampling procedure (in accordance with ASTM D-1586) and the results were recorded by our field engineer. An automatic hammer was used as part of the SPT test for all sampling in the borings. The groundwater level was measured during the drilling of the borings and after the completion of the boring. The boring logs are provided in Attachment A.

## Monitoring Well Installation

Monitoring wells were installed within each completed boring. The well consists of a lower 10-foot-long, 2-inch-diameter slotted screen section and an upper 2-inch-diameter solid pipe up to the ground surface. All pipe consisted of Schedule 40 PVC. The annulus between the pipe and ground surface was filled with clean sand in the bottom 15 feet, followed by a 2-foot-thick bentonite plug, followed by soil cuttings to the ground surface. The top of each monitoring well was patched with concrete and covered with flush-mounted, ductile iron covers. See Figure 3 and 4 for details of the monitoring wells. The wells were developed about 24 hours after installation by purging a minimum of three well volumes using a submersible pump.

Our engineer measured groundwater levels after installation of the well, after well development, three subsequent times in the following weeks.

## SUBSURFACE CONDITIONS

The subsurface conditions at the site generally consisting of a surficial layer of asphalt followed by successive layers of fill, residual soil, weathered rock and probable bedrock. A more detailed description of each is provided below.

Boring LB-1 at North Scott Street was terminated at a depth of 51 feet due to auger refusal on probable bedrock. Soil encountered at boring LB-1 consisted of:

- Surficial materials – A 6-inch-thick layer of asphalt underlain by 4 inches of aggregate subbase was encountered at the surface of LB-1.
- Fill – Fill was observed to extend to a depth of 13.5 feet below grade and to consist of reddish brown fine to coarse gravel with varying amounts of sand and trace amounts of silt to 8.5 feet below the ground surface. Gravelly fill was observed to be dense as evidenced by an SPT  $N_{60}$ -value of 47 blows/foot. Gray and brown clay with some sand and trace amount of mica was observed from 8.5 to 13.5 feet deep. Clay fill was observed to medium stiff as evidenced by an SPT  $N_{60}$ -value of 7 blows/foot.
- Residual Soils – Residual soils were observed from 13.5 to 33.5 feet deep. SPT  $N_{60}$ -values between 17 blows/foot and refusal of the split spoon sampler indicate the stratum to be medium to very dense. Residual soils were observed to consist of brown to reddish brown and black silty fine sand with trace amounts of fine gravel and mica.
- Weathered Rock – Reddish brown, gray, and brown fine- to coarse-grained sand with varying amounts of silt and trace amounts of rock fragments and mica was observed from 33.5 to 51 feet

---

1. The Standard Penetration Test (SPT) is a measure of the soil density and consistency. The SPT N-value is defined as the number of blows required to drive a 2-inch O.D. split-barrel sampler 12 inches, after an initial penetration of 6 inches using a 140-pound hammer falling freely for 30 inches.

# Technical Memorandum

deep. The material is similar in composition to residual soils but retains relic rock structure and is very dense as evidenced by refusal of the split spoon sampler.

Boring LB-2 on 21<sup>st</sup> Street North was terminated at a depth of 28 feet due to auger refusal on probable bedrock. Soil encountered at boring LB-2 consisted of:

- Surficial materials – A 6-inch-thick layer of asphalt was encountered at the surface of LB-2. No aggregate subbase was observed.
- Fill – Brown sandy clay and clayey fine- to coarse-grained sand with trace amounts of silt, fine gravel, and asphalt was observed to 23.5 feet deep. Granular fill was observed to be loose as evidenced by SPT  $N_{60}$ -values of 8 blows/foot. Fine-grained fill was observed to be medium stiff to hard as evidenced by an SPT  $N_{60}$ -value of 5 blows/foot and refusal of the split spoon sampler. Refusal was likely due to gravel or cobbles within the fine-grained portion of the fill.
- Residual Soils – Gray fine- to coarse-grained sand with trace amounts of fine gravel was observed from 23.5 to 27.5 feet deep. An SPT  $N_{60}$ -value of 100 blows/foot indicates the residual soils to be very dense.
- Weathered Rock – Brown and gray fine to medium sand with trace amounts of clay was encountered from 27.5 to 28 feet deep. Split spoon refusal indicates the stratum to be very dense. The material is similar in composition to residual soils but retains relic rock structure and is very dense as evidenced by refusal of the split spoon sampler.

## GROUNDWATER LEVEL MEASUREMENTS

A summary of the groundwater level measurements are given in Table 1. The monitoring well logs are provided in Attachment B.

**Summary of Groundwater Level Measurements**

Well ID	First Encountered	Upon Completion	24 Hours After Drilling	Extended Measurements			
				26 May 2022	06 June 2022	13 June 2022	22 June 2022
MW-01	51	31	25.5	N.A.	25.2	25.2	25.3
MW-02	N.E.	N.E.	N.E.	26.7	26.8	26.9	N.A.

**Table 1**

**Notes:**

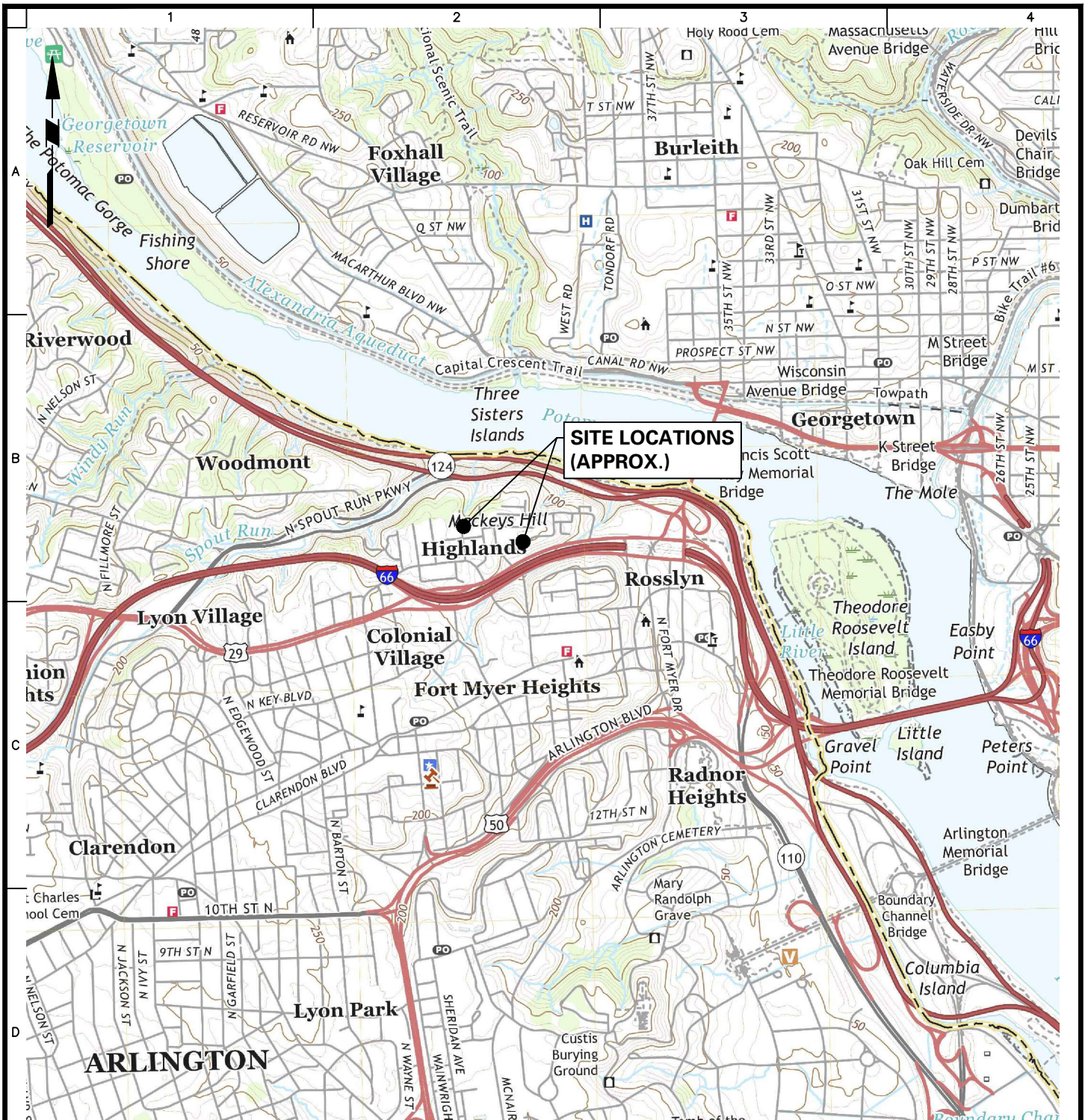
1. All measurements are in feet.
2. N.E. = not encountered
3. N.A. = not accessible due to vehicle parked over monitoring well

## CLOSURE

This memorandum presents the results of our limited geotechnical investigation and short-term monitoring of the groundwater elevations for the Spout Run Deep Sewer Re-Lining in Arlington, Virginia. Langan Engineering and Environmental Services, Inc. cannot assume responsibility for the use of this memorandum to generate information or recommendations for any sites other than the specific site addressed in this memorandum.

## **FIGURES**

<b>Figure 1</b>	<b>Site Location Map</b>
<b>Figure 2</b>	<b>Investigation Location Plan</b>
<b>Figure 3</b>	<b>MW-01 Diagram</b>
<b>Figure 4</b>	<b>MW-02 Diagram</b>



**SOURCE:** WASHINGTON WEST QUADRANGLE, DISTRICT OF COLUMBIA-MARYLAND-VIRGINIA 7.5-MINUTES SERIES, PUBLISHED BY THE UNITED STATE GEOLOGICAL SURVEY (USGS) IN 2019.



**LANGAN**  
 Langan Engineering and  
 Environmental Services, Inc.  
 1300 Wilson Boulevard, Suite 450  
 Arlington, VA 22209

Project  
**SPOUT RUN SEWER  
 RE-LINING**

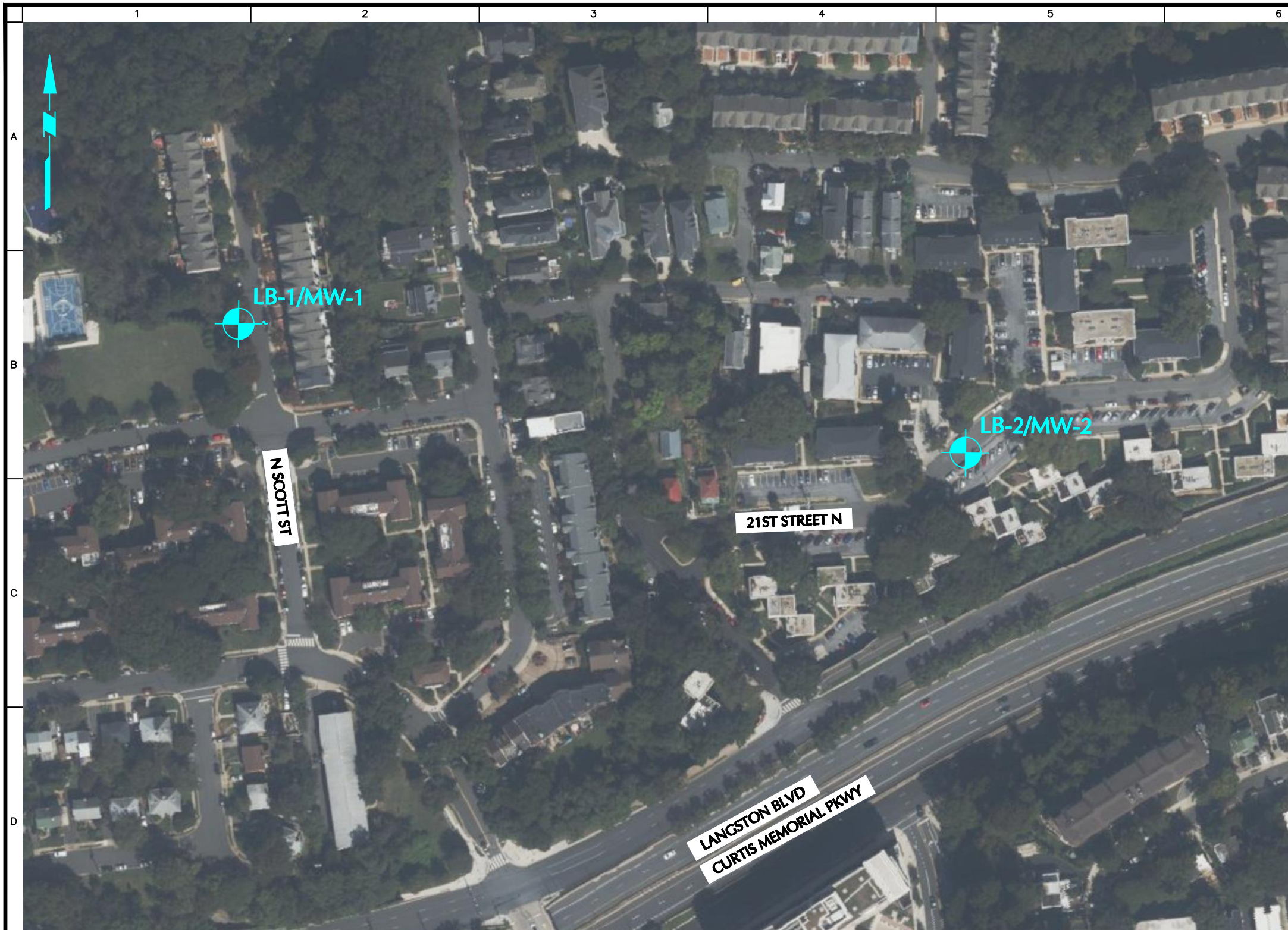
Drawing Title  
**SITE LOCATION  
 MAP**

Project No. 270060010	<b>1</b>
Date 07/06/2022	
Drawn By FS	
Checked By MD	

T: 571.366.6800 F: 571.366.6801 www.langan.com

ARLINGTON VIRGINIA

Sheet 1 of 4

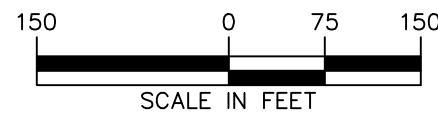


**NOTES:**

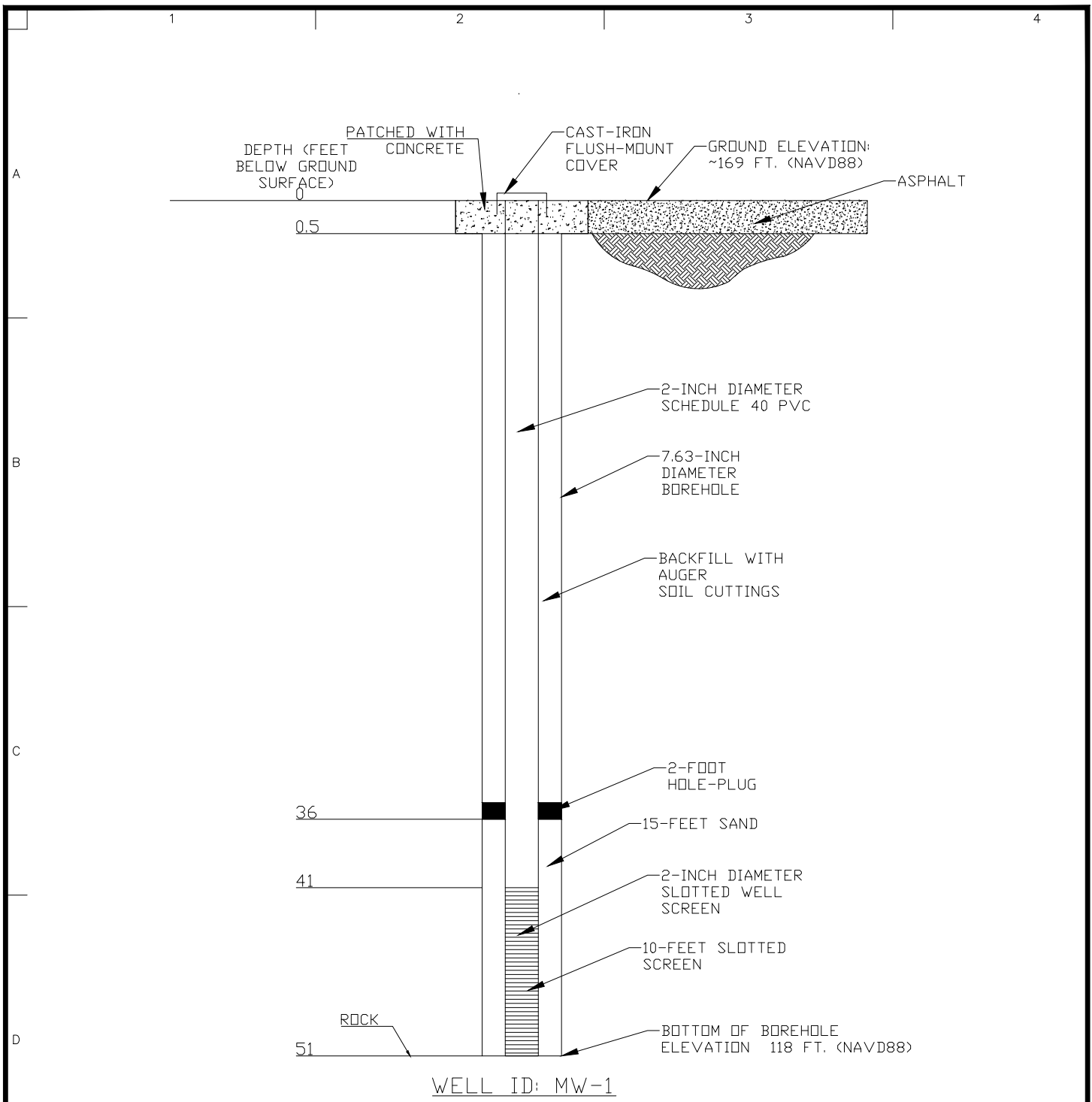
1. BACKGROUND AERIAL FROM BING MAPS, ACCESSED 9 JUNE 2022.
2. BORINGS AND MONITORING WELLS LB-1/MW-1 AND LB-2/MW-2 WERE COMPLETED BY FREE STATE DRILLING, INC. BETWEEN 23 AND 25 MAY 2022 UNDER THE DIRECT SUPERVISION OF LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
3. ALL BORING LOCATIONS ARE APPROXIMATE.
4. FOR DETAILED DESCRIPTIONS OF THE SUBSURFACE CONDITIONS ENCOUNTERED, SEE APPENDIX A.

**LEGEND:**

 **LB-1/MW-1**  
BORING / MONITORING WELL LOCATION



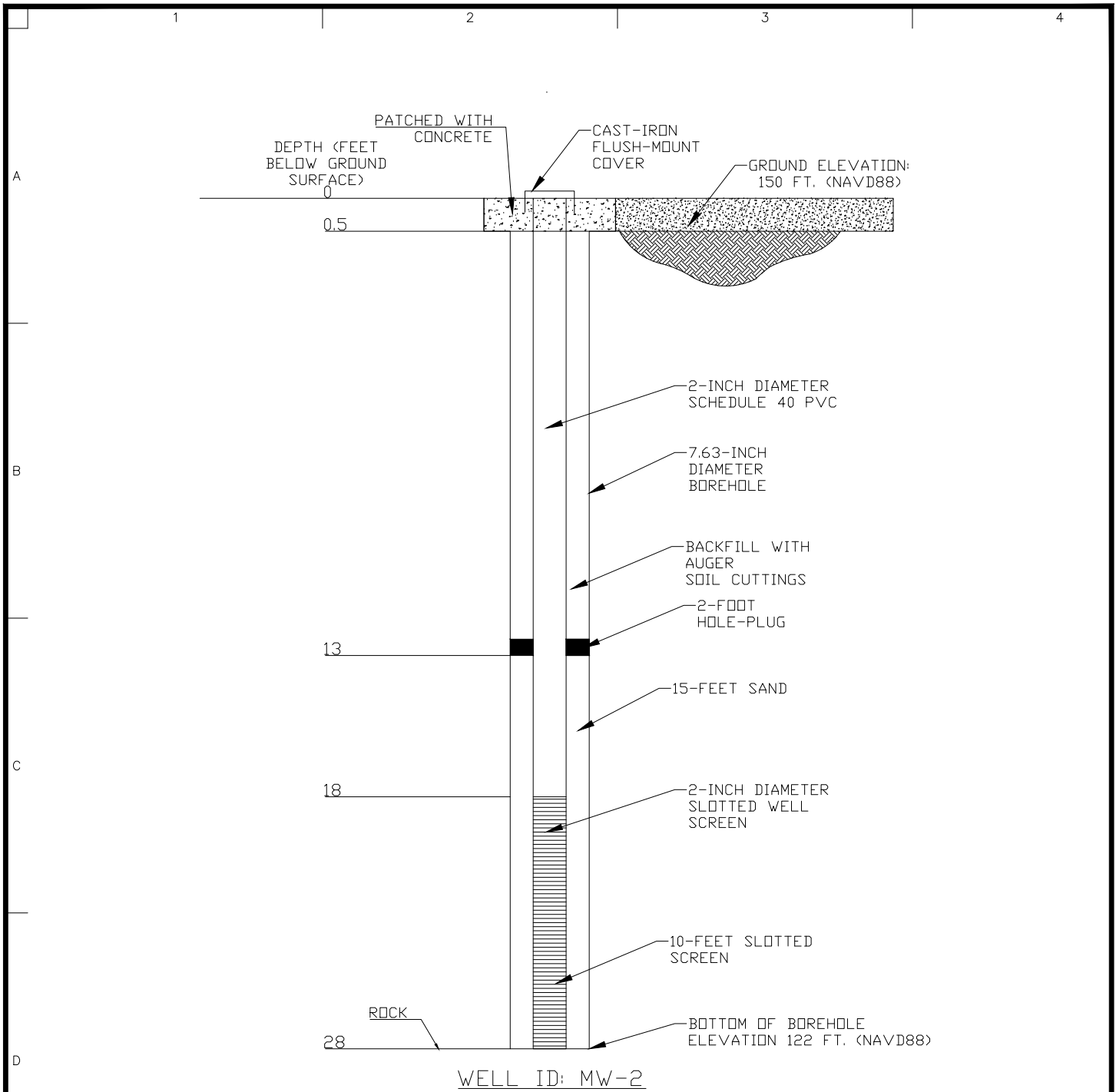
<p><b>LANGAN</b> Langan Engineering and Environmental Services, Inc. 1300 Wilson Boulevard, Suite 450 Arlington, VA 22209 T: 571.366.6800 F: 571.366.6801 www.langan.com</p>	Project	Drawing Title	Project No.	Drawing No.
	<b>SPOUT RUN SEWER RE-LINING</b>	<b>BORING LOCATION PLAN</b>	270060010	<b>2</b>
	ARLINGTON	VIRGINIA	Date	
			07/06/2022	
			Drawn By	Sheet
			FS / ANG	2 of 4
			Checked By	
			MJD	



**NOTES:**

1. WELL CONSTRUCTION DETAIL IS NOT DRAWN TO SCALE.
2. NAVD88 = NORTH AMERICAN VERTICAL DATUM 1988.
3. MONITORING WELL MW-1 WAS INSTALLED IN LB-1 TO A DEPTH OF 51-FEET.
4. TOP OF ROCK ELEVATION WAS DETERMINED BASED ON THE SPT AUGER AND SPLIT-SPOON REFUSAL.

<p>Langan Engineering and Environmental Services, Inc. 1300 Wilson Boulevard, Suite 450 Arlington, VA 22209 T: 571.366.6800 F: 571.366.6801 www.langan.com</p>	Project	Drawing Title	Project No.	Drawing No.
	<b>SPOUT RUN SEWER RE-LINING</b>	<b>WELL CONSTRUCTION DETAIL (LB-1/MW-1)</b>	270060010	<b>3</b>
	ARLINGTON	VIRGINIA	Date	
			07/06/2022	
			Drawn By	Sheet 3 of 4
			FS	
			Checked By	
			MD	



**NOTES:**

1. WELL CONSTRUCTION DETAIL IS NOT DRAWN TO SCALE.
2. NAVD88 = NORTH AMERICAN VERTICAL DATUM 1988.
3. MONITORING WELL MW-2 WAS INSTALLED IN LB-2 TO A DEPTH OF 28-FEET.
4. TOP OF ROCK ELEVATION WAS DETERMINED BASED ON THE SPT AUGER AND SPLIT-SPOON REFUSAL.

<p><b>LANGAN</b> Langan Engineering and Environmental Services, Inc. 1300 Wilson Boulevard, Suite 450 Arlington, VA 22209 T: 571.366.6800 F: 571.366.6801 www.langan.com</p>	<p>Project <b>SPOUT RUN SEWER RE-LINING</b> ARLINGTON VIRGINIA</p>	<p>Drawing Title <b>WELL CONSTRUCTION DETAIL (LB-2/MW-2)</b></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Project No. 270060010</td> <td rowspan="4" style="width: 50%; text-align: center; vertical-align: middle; font-size: 2em;"><b>4</b></td> </tr> <tr> <td>Date 07/06/2022</td> </tr> <tr> <td>Drawn By FS</td> </tr> <tr> <td>Checked By MD</td> </tr> <tr> <td colspan="2" style="text-align: right;">Sheet 4 of 4</td> </tr> </table>	Project No. 270060010	<b>4</b>	Date 07/06/2022	Drawn By FS	Checked By MD	Sheet 4 of 4	
	Project No. 270060010	<b>4</b>								
	Date 07/06/2022									
	Drawn By FS									
Checked By MD										
Sheet 4 of 4										



## **Attachment A**

### **Boring Logs**

Project Spout Run Deep Sewer Re-Lining			Project No. 270060010		
Location Arlington, VA			Elevation and Datum Approx. el 169 (NAVD88)		
Drilling Company Free State Drilling, Inc.		Date Started 05/23/2022		Date Finished 05/23/2022	
Drilling Equipment CME-55 Track -Mounted Rig			Completion Depth 51 ft		Rock Depth N.E
Size and Type of Bit 4-1/4-inch Hollow-Stem Augers			Number of Samples	Disturbed 11	Undisturbed -
Casing Diameter (in)			Casing Depth (ft)	Water Level (ft.) First 51	Completion 31
Casing Hammer		Weight (lbs)	Drop (in)	Drilling Foreman Joe Scribellito	
Sampler 2-inch-OD Split Spoon Sampler			Field Engineer Amber Ganapathy		
Sampler Hammer Automatic		Weight (lbs) 140	Drop (in) 30		


I:\LANGAN.COM\DATA\ARLIDATA\0270060010\PROJECT DATA\ DISCIPLINE\GEO\TECHNICAL\GINTLOGS\270060010.GPJ ... 7/1/2022 11:43:54 AM ... Report: Log - LANGAN

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)	
				Number	Type	Recov. (in)	Penetr. resist. BL/6in	N-Value (Blows/ft)		
	169.0		0							Began drilling at 09:00. Augered to 3.5 ft.
	168.5	ASPHALT (6 inches thick)								
	168.2	SUBBASE (4 inches thick)								Auger grinding at 3.5 ft.
		Reddish brown Sandy f-c GRAVEL, trace silt (moist) [FILL] - observed in soil cuttings	1							
		Brown f-c SAND, some f-c gravel, trace silt (moist) [FILL]	2							
		Gray f-c GRAVEL (moist) [FILL] - possible fractured cobble	3	S-1	SS	18	20	22	42	
			4							Augered to 8.5 ft.
			5							
			6							q <sub>u</sub> = 1.75 tsf (PP) Augered to 13.5 ft.
			7							
			8							
	160.5	Gray-brown CLAY, some fine sand, trace silt, trace mica (moist) [FILL]	9	S-2	SS	16	2	4	6	
			10							
			11							
			12							
			13							
			14	S-3	SS	18	5	5	13	
	155.5	Reddish brown Silty fine SAND, trace mica (moist) [RESIDUAL SOIL]	14							
			15							

Project Spout Run Deep Sewer Re-Lining	Project No. 270060010
Location Arlington, VA	Elevation and Datum Approx. el 169 (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data				Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)		
				Number	Type	Recov. (in)	Penetr. resist. BL/6in		N-Value (Blows/ft)	
	154.0		15						Augered to 18.5 ft.	
		Brown and black Silty fine SAND, trace mica (moist) [RESIDUAL SOIL]	16							
			17							
			18							
			19	S-4	SS	12	8	20	16	Augered to 23.5 ft.
			20							
			21							
			22							
			23							
		Brown Silty fine SAND, trace f-c gravel, trace mica (moist) [RESIDUAL SOIL]	24	S-5	SS	6	50/6"		50/6"	Augered to 28.5 ft.
			25							
			26							
			27							
			28							
		Brown, reddish brown, and black Silty fine SAND, trace mica (moist to wet) [RESIDUAL SOIL]	29	S-6	SS	18	15	10		Observed soft spot; possible perched water.
			30						48	Augered to 33.5 ft.
			31							
			32							
			33							

I:\LANGAN.COM\DATA\ARL\DATA0270060010\PROJECT DATA\ DISCIPLINE\GEO\TECHNICAL\GINTLOGS\270060010.GPJ ... 7/1/2022 11:43:54 AM ... Report: Log - LANGAN

Project		Project No.							
Spout Run Deep Sewer Re-Lining		270060010							
Location		Elevation and Datum							
Arlington, VA		Approx. el 169 (NAVD88)							
MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data				Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)	
				Number	Type	Recov. (in)	Penetr. resist. BL/6in		N-Value (Blows/ft)
	135.3								
	135.2	Gray-brown Silty f-m SAND, trace f-c rock fragments, trace mica (moist) [WEATHERED ROCK]	34	S-7	SS	5	50/5"	50/5"	Augered to 38.5 ft.
			35						
			36						
			37						
			38						
			39	S-8	SS	5	50/5"	50/5"	
			40						
			41						
			42						
			43						
		Reddish brown and gray Silty f-m SAND, trace f-c rock fragments, trace mica (moist) [WEATHERED ROCK]	39	S-8	SS	5	50/5"	50/5"	Augered to 43.5 ft; slight auger grinding.
			40						
			41						
			42						
			43						
			44	S-9	SS	3	50/3"	50/3"	
			45						
			46						
			47						
			48						
		Gray Silty f-c SAND, trace mica (moist) [WEATHERED ROCK]	44	S-9	SS	3	50/3"	50/3"	Augered to 48.5 ft; slight auger grinding.
			45						
			46						
			47						
			48						
			49	S-10	SS	4.5	50/4.5"	50/4.5"	
			50						
			51						
			52						
			52.5						
		Gray f-c SAND, some silt, trace mica (moist) [WEATHERED ROCK]	49	S-10	SS	4.5	50/4.5"	50/4.5"	Augered to 51 ft; auger refusal.
			50						
			51						
			52						
			52.5						
		End of Boring at 51 ft	51	S-11	SS	0	50/0"	50/0"	
			52						
			52.5						
			52.5						

I:\LANGAN.COM\DATA\ARLIDATA\0270060010\PROJECT DATA\DISCIPLINE\GEO\TECHNICAL\GINTLOGS\270060010.GPJ ... 7/1/2022 11:43:54 AM ... Report: Log - LANGAN

Project Spout Run Deep Sewer Re-Lining			Project No. 270060010		
Location Arlington, VA			Elevation and Datum Approx. el 150 (NAVD88)		
Drilling Company Free State Drilling, Inc.			Date Started 05/25/2022		Date Finished 05/25/2022
Drilling Equipment CME-55 Track -Mounted Rig			Completion Depth 28 ft		Rock Depth N.E
Size and Type of Bit 4-1/4-inch Hollow-Stem Augers			Number of Samples	Disturbed 6	Undisturbed -
Casing Diameter (in)			Casing Depth (ft)	Water Level (ft.) First N.E	Completion N.E
Casing Hammer	Weight (lbs)	Drop (in)	Drilling Foreman Joe Scribellito		
Sampler 2-inch-OD Split Spoon Sampler			Field Engineer Fahim Shahi		
Sampler Hammer Automatic	Weight (lbs) 140	Drop (in) 30			

I:\LANGAN.COM\DATA\ARLIDATA\0270060010\PROJECT DATA\DISCIPLINE\GEO\TECHNICAL\GINTLOGS\270060010.GPJ ... 7/1/2022 11:43:56 AM ... Report: Log - LANGAN

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data						Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)	
				Number	Type	Recov. (in)	Penetr. resist. BL/6in	N-Value (Blows/ft)			
	150.0	ASPHALT (6 inches thick)	0								Began drilling at 09:00. Augered to 3.5 ft.
	149.5	Brown Clayey f-c SAND, trace fine gravel (moist) [FILL] - observed in soil cuttings	1								
		Brown Clayey f-c SAND, trace mica (moist) [FILL]	2								
		Gray f-c GRAVEL, trace fine sand (moist) [FILL]	3								
	145.8		4	S-1	SS	13	3	7			Auger grinding at 3.5 ft.
			5				4				Augered to 8.5 ft.
			6								
			7								
			8								
	141.5	Brown Sandy CLAY, some f-c gravel (moist) [FILL]	9	S-2	SS	13	3	7			q <sub>u</sub> = 0.25 tsf (PP)
			10				4				Augered to 13.5 ft.
			11								
			12								
			13								
	136.5	Brown Sandy CLAY, trace mica (moist) [FILL]	14	S-3	SS	4	7	2			
			15				2	4			

Project		Project No.								
Spout Run Deep Sewer Re-Lining		270060010								
Location		Elevation and Datum								
Arlington, VA		Approx. el 150 (NAVD88)								
MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data				Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)		
				Number	Type	Recov. (in)	Penetr. resist. BL/6in		N-Value (Blows/ft)	
	135.0		15							
			16							
			17							
			18							
	131.5	Brown Sandy CLAY, some f-c gravel, trace asphalt, trace rock fragments (moist) [FILL]	19	S-4	SS	6	3			
			20				9		59/10"	Augered to 23.5 ft.
			21							
			22							
			23							
	126.5	Gray f-c SAND, trace fine gravel (moist) [RESIDUAL SOIL]	24	S-5	SS	17	13			
			25				43		82"	Augered to 28 ft; refusal on possible bedrock.
			26				39			
			27							
	122.5	Brown and gray f-m SAND, trace clay (moist) [WEATHERED ROCK]	28	S-6	SS	2				
	122.0	End of Boring at 28 ft	28				50/0"		50/0"	Completed drilling at 10:15. Completed installation of well at 11:15. Groundwater not encountered upon completion.
			29							
			30							
			31							
			32							
			33							

I:\LANGAN.COM\DATA\ARL\DATA0270060010\PROJECT DATA\DISCIPLINE\GEO\TECHNICAL\GINT\LOGS\270060010.GPJ ... 7/1/2022 11:43:56 AM ... Report: Log - LANGAN