GEOTECHNICAL ENGINEERING SERVICES REPORT

Velocity Project Number: 21-381

Project:

City of Naples – Well 426 & 408
Naples, Collier County, Florida
Parcel #s: 40366240001 & 40691200004

Client:

Ms. Kellie Fissinger, PE, MEnvE
Agnoli, Barber & Brundage, Inc.
7400 Trail Boulevard, Suite 200
Naples, FL 34108

Date: January 20, 2023

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RECORD OF TEST PITS & STATIC CONE PENETROMETER TESTING

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January 20, 2023

Subject: Geotechnical Engineering Services Report
City of Naples – Well 426 & 408
Naples, Collier County, Florida
Parcel #s: 40185880008 & 40868960009
Velocity Project Number: 21-381

Dear Ms. Fissinger:

Velocity Engineering Services, LLC (Velocity) is pleased to submit this Geotechnical Engineering Services Report for the project referenced above. It has been our pleasure to work with you on this project.

1.0 INTRODUCTION

1.1 Project Description

Velocity understands that the proposed project will consist of the following:

- ✓ The construction of a new well house at Existing Well Site No. 408,
- ✓ The construction of a new well house at proposed Well Site No. 426,
- ✓ The installation of approximately 1,315 linear feet of new pipeline between the proposed Well Site No. 426 and the existing Well Site No. 425.

The client requested a geotechnical exploration program consisting of test borings to assist with planning for the project. Specifically, the client requested test borings within the proposed well houses (No. 426 and No. 408) and pipeline footprints.

It should be noted that Velocity performed a test pit within the proposed well No. 408 footprint following the soil conditions encountered in test boring B-3 to further investigate the subsurface soil conditions. Further details can be found in Section 2.4 of this report.

Velocity was provided with Exhibit A and B by Agnoli, Barber & Brundage, Inc., 2 pages, undated. Furthermore, Daniel A. Summers with BSSW Architects, Inc. informed Velocity that maximum structural loads for the project are on the order of 1 kip per linear foot for wall footings.

No other plans or other construction details were available to Velocity at the time of this report.

1.2 Purpose & Scope of Services

The purpose of this exploration program was to evaluate the subsurface soil and groundwater conditions relative to the foundation support of the proposed well houses and the excavation/installation of the proposed pipeline. Velocity therefore performed the following scope of services:

- ✓ Obtaining the necessary drilling permits, obtaining utility locates from Sunshine 811, and mobilizing a drill rig and crew to the site.
- ✓ Locating the test borings based on measured or estimated distances from existing structures and/or GPS coordinates.
- ✓ Performing a total of three (3) Standard Penetration Test (SPT) borings to depths of twenty (20) feet below the ground surface (BGS).
    - Boring B-1 was performed within/near the footprint of the proposed well house No. 426 located in Parcel #: 40185880008.
    - Boring B-2 was performed within/near the footprint of the proposed pipeline from well No. 426 to No. 425 located in Parcel #: 40185880008.
    - Boring B-3 was performed within/near the footprint of the proposed well house No. 408 located in Parcel #: 40868960009
- ✓ Grouting the test borings in accordance with regulatory requirements.
- ✓ Performing two test pits within the footprint of the proposed footprint of well house No. 408.
- ✓ Visually classifying the soil samples recovered from the test borings and test pits.
- ✓ Performing engineering analyses and preparing a Geotechnical Report for the project.

2.0 METHODOLOGY & FINDINGS

2.1 Site Features

The project site consists of multiple municipal properties. For the purposes of this report, Velocity has identified Parcel #40185880008 as the northern site and Parcel #4086960009 as the southern site. All sites are currently vacant with overgrown vegetation. The sites are generally level.

The site to the north is bordered by Randall Boulevard to the north, 24th Avenue Northeast to the south, a canal to the east and residential properties to the west. The site to the south is bordered by a residential property to the to the north and west, 6th Avenue Southeast to the south, a canal to the east.

The approximate project locations of both sites are depicted in Figure 1, Project Location Plan.

2.2 Field Exploration Program

The test borings were performed in general accordance with ASTM D1586 "*Standard Test Method for Standard Penetration Test (SPT) and Split Barrel Sampling of Soils*". This procedure uses a 140 pound hammer with a 30 inch drop to drive a 2 inch (outside) diameter hollow tube called a "split-spoon". The number of hammer blows required to drive the split-spoon 12 inches is called the "N Value" and is an indication of the relative density of the soil(s). The split-spoon also captures samples of the soil(s) so they can be retrieved.

Borings B-1 and B-2 were performed in the northern site and Boring B-3 was performed in the southern site. The approximate boring locations are depicted in Figure 2, Boring Location Plan.

Test Pits were excavated using a Takeuchi Compact Excavator, Model TB370. Static cone penetrometer testing was also used to measure the relative density of the surficial soils at each test pit location. The static cone penetrometer testing was performed using a Durham Geo Slope Indicator Portable Static Cone Penetrometer operated in accordance with the manufacturer's operating instructions. The static cone penetrometer measures the soil's resistance to the penetration of an isolated 60^{o} cone tip with a section area of 1.5 cm^2. The static cone penetrometer reads in units of kg/cm^2 which is essentially equal to tons/ft^2.

The approximate test pit locations are depicted in Figure 3, Test Pit Location Plan.

2.3 Laboratory Examination

The soil samples retrieved during the field exploration program were visually examined in general accordance with ASTM D2488 "*Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*". Each soil sample was classified in general accordance with the Unified Soil Classification System (USCS), modified as necessary to describe typical southwest Florida soils. Additional laboratory testing was not included in our scope of services, nor was it deemed necessary at this time.

The soil samples will be retained at Velocity's office for 30 days from the date of this report. The samples will then be disposed of unless other arrangements, such as the client taking possession of them or Velocity retaining them beyond this date, have been agreed upon in writing.

2.4 Subsurface Soil Conditions

The subsurface soil conditions at the site encountered in the test borings generally consist of very loose to medium dense sand (SP), sand with silt (SP-SM), silty sand (SM) and weathered limestone (WLS) from the existing ground surface to the boring termination depths of approximately 20 feet BGS. Detailed records of each boring are attached to this report.

It should be noted that "weight of hammer" sands and weathered limestone (i.e., the drilling rod/split-spoon advanced through the material under the weight of the hammer without striking it) was encountered in Borings B-2 and B-3 at depths ranging from 13.5 to 15 feet and 3 to 5 feet BGS, respectively.

Due to the subsurface soil conditions encountered in Boring B-3, Velocity performed a test pit exploration program within the footprint of the proposed well house No. 408. It should be noted that Velocity did not perform further investigation at/near test Boring B-2 as the "weight of hammer" weathered limestone encountered will likely not affect the proposed excavation.

The subsurface soil conditions encountered in the test pits generally consist of sands (SP) and sands with silt (SP-SM) with varying amounts of rock, and weathered limestone (WLS) from the ground surface to depths of 3

to 4 feet BGS followed by a layer of limestone to the termination depths of 4 feet. It should be noted that Velocity encountered areas of very loose soils in between the limestone layer during the test pit program. It is likely that the very loose soils are the result of the sands (SP) from up above raveling downwards into the voids between the limestone.

2.5 Groundwater

At the time of our field exploration program, the ground water depth was measured at approximately 3 feet below the existing ground surface in the test borings and test pits. The ground water measurements in the test borings were obtained prior to initiation of mud rotary drilling.

Fluctuation in groundwater depths should be anticipated due to seasonal changes, local rainfall, surface water runoff, and other site-specific considerations. Ponding of storm water should be anticipated after heavy rain events. These ground water depths and possible fluctuations should be considered when planning any excavations at the site. Dewatering may be required to facilitate the proposed construction.

3.0 EVALUATION & RECOMMENDATIONS

3.1 Building Foundations

The evaluation of foundation options is generally governed by 2 primary considerations, bearing capacity and settlement. Bearing capacity is the soil's ability to support the foundation load without experiencing a plunging failure. The selected foundation must be able to provide adequate bearing capacity within an acceptable range of settlement.

During our geotechnical exploration program, Velocity encountered a variation in the subsurface soil conditions within the test borings performed at the northern and southern sites. Based on the soil conditions encountered in Boring B-1 and the structural loads provided, Velocity considers the subsurface soil conditions suitable for supporting the proposed well house No. 426 on a shallow foundation system in accordance with Section 3.2 of this report.

As detailed in Section 2.4, Velocity encountered very loose "weight of hammer" sands/weathered limestone at depths of approximately 3 to feet 5 BGS in Boring B-3. Velocity therefore performed a test pit program to further evaluate the shallow subsurface soil conditions at/near the location of Boring B-3 and investigate the "weight of hammer" material encountered relative to the foundation support of the proposed well house No. 408.

The results of the test pits indicated that very loose zones of sand (SP) exist in between the limestone layer encountered at depths of 3 to 5 feet BGS. It is likely that the sands from above have raveled downwards overtime resulting in the "weight of hammer" zones. Based upon the subsurface soil conditions encountered, Velocity recommends that the footprint of well house No. 408 and 10 feet beyond the proposed building footprint be over excavated to depths of approximately 3 to 5 feet to depths where hard limestone is encountered and backfilled with #57 stone or similar clean gravel. The #57 stone should be placed in lifts of no greater than 12 inches and each lift should be tamped firmly using mechanical equipment. Density testing will not be required for the #57 stone or similar clean gravel (it is not possible due to the nature of the material).

Upon installation of the #57 stone, well house No.408 can then be supported on a shallow foundation system in accordance with Section 3.2 of this report.

Based on the soils conditions encountered in Boring B-2, excavation of the sand (SP) and weathered limestone (WLS) can generally be accomplished using normal heavy earthwork equipment. It should be noted that the test boring results indicate the subsurface soil conditions at the boring location only and the possibility that hard rock may exist at shallower depths or in other locations cannot be ruled out.

The foundation recommendations presented herein are contingent upon site preparation being performed in accordance with the specifications presented in Section 3.4 of this report.

3.2 Shallow Foundation Systems

An allowable soil bearing pressure of 2,500 psf may be used for shallow spread footing foundation design. Isolated column footings should have a minimum dimension of 24 inches and should bear at a depth of at least 24 inches below the lowest adjacent grade. Continuous wall footings should have a minimum width of 18 inches and should bear at a depth of at least 18 inches below the lowest adjacent grade. Settlement is projected to be less than 1 inch total and 1/2 inch differential.

3.3 Ground Floor Slab(s)

Ground floor slabs may be designed as traditionally reinforced concrete slabs-on-grade using a modulus of subgrade reaction ("K") of 150 pci. The ground floor slabs-on-grade should be structurally separated from all foundations, walls, and columns unless a monolithic "thickened edge" slab foundation is utilized. If a monolithic "thickened edge" slab is utilized, it should be properly reinforced to resist the bending moments that will occur due to the loading differences between the thickened foundation elements and the remainder of the slab.

A moisture vapor barrier should be placed beneath the ground floor slab-on-grade to minimize vapor intrusion in accordance with the Florida Building Code. Care should be taken to ensure that all seams, penetrations, and punctures in the barrier are properly sealed prior to the slab being poured.

3.4 Site Preparation

The building pads should be stripped and cleared of all organic material, roots, topsoil, and any other deleterious materials to a distance of at least 10 feet beyond the building limits. The stripped surface should be proof rolled and tested for compaction prior to any structural fill being placed. Structural fill may then be placed in lifts of not more than 12 inches and each lift should be compacted and tested prior to placement of the next lift.

Velocity recommends the following compaction requirements for this project. The specified compaction percentages are based upon the maximum dry density as determined by a "modified proctor test" in accordance with ASTM D1557 "*Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))*".

- ✓ Proof Roll.....95%
- ✓ Structural Fill.....95%
- ✓ Bottom of Footings.....95%

All density testing should be performed in accordance with ASTM D6938 "*Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*". Tests should be performed to a depth of 12 inches below the surface being tested, or the thickness of the soil layer if thinner than 12 inches, unless specified otherwise. Any areas not in compliance with the compaction requirements should be reworked and retested prior to placement of the next lift of fill. The following minimum testing frequencies are recommended:

- Building Pad Proof Roll & Fill ..... 1 test per 2,500 sq.ft. (minimum 4) per lift
- Isolated Column Footings ..... 1 test per footing
- Continuous Wall Footings ..... 1 test per each 50 lineal feet
- Paved Areas..... 1 test per 5,000 sq.ft. (minimum 4) per lift

All structural fill material placed should be well graded and conform to the following requirements:

- Fines Content per ASTM D1140..... 12% maximum
- Organic Content per ASTM D2974..... 5% maximum
- Plasticity per ASTM D4318..... Non Plastic
- Maximum Particle Size..... 2 inches

Using vibratory compaction equipment at the site may disturb nearby structures. We recommend that vibration levels reaching any nearby structures be monitored during any operations utilizing vibratory equipment.

4.0 LIMITATIONS

4.1 Unanticipated Conditions

Velocity cannot be responsible for any unanticipated conditions that may be discovered on the site that were not encountered in our test borings. However, should any such unanticipated conditions be discovered, Velocity should be notified of them immediately in writing so that we may observe them and review their impact upon our recommendations presented herein.

If any of the project details stated herein are modified or changed, Velocity must be notified in writing so that we may review the applicability of our recommendations.

4.2 Boring Logs & Figures

The soil and groundwater conditions shown in the boring logs and reported herein reflect the conditions at the specific boring locations at the time of our exploration only. Conditions will vary across the site and will also vary with time. Soil layer transitions depicted on the boring logs should be considered approximate and variations in depth should be anticipated. The boring locations indicated were not surveyed and should be considered approximate.

4.3 Reliance

This report has been prepared for the exclusive use of the client, the project owner, and the design team for the indicated project only. No other parties are entitled to rely upon this report. Contractors should not rely upon this report for preparation of their bids and should perform their own investigations to confirm any details that may impact their bids. This report should not be relied upon to plan any other project at this site, or the same project at any other site.

4.4 Standard of Care

These geotechnical engineering services have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the location where the Work was performed. No other warranty, expressed or implied, is made including, without limitation, any warranty of fitness for a particular purpose other than those expressly stated herein.

4.5 Reproduction

No portion of this report should be reproduced or used unless the entire report is reproduced in full.

4.6 Out of Scope Considerations

The depths of the test borings performed herein were limited to the depths to which the anticipated foundation loads are likely to influence. Evaluation of potential hazards at deeper depths, such as karst (sinkhole) activity, is beyond the scope of this investigation.

The following items are considered out of scope considerations and have not been evaluated by Velocity: examination or testing of the soil samples recovered for chemical contamination or other environmental hazards; determination or evaluation of the seasonal high water table; and constructability review.

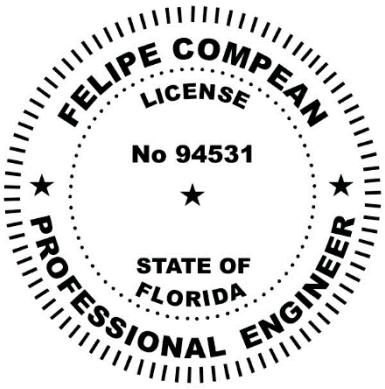
5.0 CLOSING & CERTIFICATION

We appreciate the opportunity to be of service to you on this project. Please do not hesitate to contact us if you have any questions or if we may further assist you.

Sincerely,

Velocity Engineering Services, LLC
12821 Commerce Lakes Drive, Suite 7
Fort Myers, FL 33913
FBPE CA# 30362

Felipe Compean, P.E.
Geotechnical Manager



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Date: 2023-01-20 13:51:01

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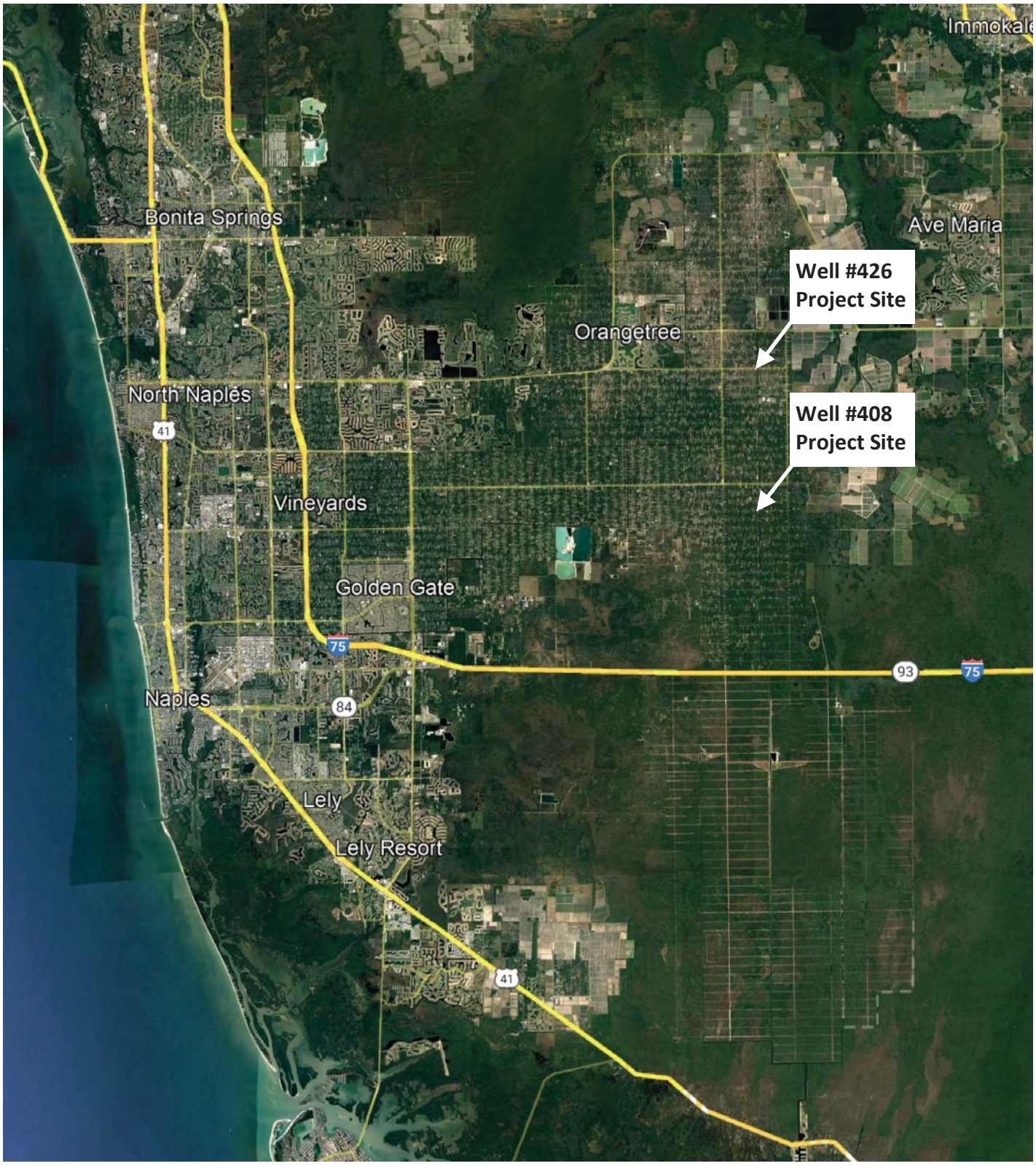

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FIGURE 1 — PROJECT LOCATION PLAN

City of Naples—Well 426 & 408

Naples, Collier County, Florida

Velocity Project Number: 21-381

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FIGURE 2A — BORING LOCATION PLAN

City of Naples—Well 426

Naples, Collier County, Florida

Velocity Project Number: 21-381

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FIGURE 2B — BORING LOCATION PLAN

City of Naples—Well 408

Naples, Collier County, Florida

Velocity Project Number: 21-381

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FIGURE 3 — TEST PIT LOCATION PLAN

City of Naples—Well 408

Naples, Collier County, Florida

Velocity Project Number: 21-381

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KEY TO BORING LOGS

Major Division			Group Symbols	Typical Names
COARSE-GRAINED SOILS (50% of the material retained on No. 200 sieve)	Gravels (>50% retained on No. 4 sieve)	Clean Gravel	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		Gravel w/Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-silt mixtures
	Sands (<50% passes No. 4 sieve)	Clean Sands	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sands, little or no fines
		Sand w/ Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand clay mixtures
FINE-GRAINED SOILS (>50% of the material passes No. 200 sieve)	Silts and Clays (Liquid limit < 60)		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 > 60)		MH	Inorganic silts micaceous or distomaceous fine sandy or silty soils, organic 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
Limestones			LS	Limestone layer
			WLS	Weathered and/or deteriorated limestone

DENSITY of SANDS, GRAVELS, and WEATHERED LIMESTONE

N Value	Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
50+	Very Dense

CONSISTENCY of SILTS & CLAYS

N Value	Density
0-2	Very Soft
3-4	Soft
5-8	Firm
9-15	Stiff
16-30	Very Stiff
30+	Hard

HARDNESS OF LIMESTONE

N Value	Density
50-99	Soft
100+	Hard

PROPORTIONS

Content	Description
0-10%	With a Trace
10-25%	With Some
25-50%	With

*Recovery is 100% unless noted otherwise

ORGANIC SOIL PROPORTIONS

Organic Content	Description
0-2%	With a Trace of Organics
2-5%	With Some Organics
5-20%	With Organics / Peat
20-100%	Highly Organic / Peat

ABBREVIATIONS

WT	Water table at time of boring	**Moisture**	Moisture Content per ASTM D2216
HA	Boring advanced using Hand Auger	**-200**	% passing #200 sieve per ASTM D1140
~	Approximated N value due to refusal	**Organics**	Organic Content per ASTM D2974
		LL, PL, PI	Atterberg Limits per ASTM D4318

Velocity ENGINEERING SERVICES

BORING LOG NUMBER: B-1

PROJECT: City of Naples Well Site No 426 & 408

PROJECT No.: 21-381 **DATE:** 9/6/22 **GROUNDWATER:** 3.0 ft

NOTES:

DEPTH (FEET) & Water Table	SAMPLE	BLOWS / 6"	"N" VALUE BLOWS / FT.	SYMBOL	SOIL DESCRIPTION	NOTES
0		1 2 2 3	4		SAND (SP) Very Loose to Loose	Light gray with a trace of root
WT		3 3 4 5	7			Dark brown
5		3 3 3 4	6			Dark brown
		2 2 2 2	4		SAND WITH SILT (SP-SM) Very Loose	Brown
		2 3 3 2	6		SILTY SAND (SM) Loose	Brown to tan with some weathered limestone
10						
		2 2 2	4		WEATHERED LIMESTONE (WLS) Very Loose to Loose	Tan with some silt and a trace of phosphate
15						
		2 4 4	8			Tan with a trace of phosphate
20						Boring terminated at 20 feet
25						
30						

BORING LOG NUMBER: B-2

PROJECT: City of Naples Well Site No 426 & 408

PROJECT No.: 21-381 **DATE:** 9/6/22 **GROUNDWATER:** 3.0 ft

NOTES:

DEPTH (FEET) & Water Table	SAMPLE	BLOWS / 6"	"N" VALUE BLOWS / FT.	SYMBOL	SOIL DESCRIPTION	NOTES
0		1 1 2 2	3		SAND (SP)	Gray
		2 2 3 4	5			Brown
WT						
5		1 2 3 3	5			Brown
		2 4 7 7	11			Brown
		7 8 9 8	17		Very Loose to Medium Dense	Brown
10						
		0 0 0	0		WEATHERED LIMESTONE (WLS)	Tan with a trace of phosphate The drill string advanced from 13.5 to 15 feet under the weight of the hammer
15					Very Loose	
		1 2 2	4			Tan with some silt and a trace of phosphate
20						Boring terminated at 20 feet
25						
30						

Velocity ENGINEERING SERVICES

BORING LOG NUMBER: B-3

PROJECT: City of Naples Well Site No 426 & 408

PROJECT No.: 21-381 **DATE:** 9/6/22 **GROUNDWATER:** 3.0 ft

NOTES:

DEPTH (FEET) & Water Table	SAMPLE	BLOWS / 6"	"N" VALUE BLOWS / FT.	SYMBOL	SOIL DESCRIPTION	NOTES
0		3 6 4 3	10		SAND (SP)	Tan with some rock
		3 1 0 0	1		Very Loose to Loose	Dark gray Gray
WT						The drill string advanced from 3 to 5 feet under the weight of the hammer
		0 0 2 2	2			Light brown with a trace of phosphate
5		2 3 13 14	16			Tan
		4 3 39 25	42			Tan
10					WEATHERED LIMESTONE (WLS)	
		25 38 40	78		Very Loose to Very Dense	Tan with a trace of phosphate
15						
		3 5 11	16			Tan
20						Boring terminated at 20 feet
25						
30						

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RECORD OF TEST PITS & STATIC CONE PENETROMETER TESTING

Project: City of Naples - Well site No. 426 & 408

Project No.: 21-381

Date: 1/18/2023

Test Number: TP-1 **Date Performed: 12/6/2022** **Water Table: 3.0 feet**

Depth (ft)	Resistance (kg/cm2)
0.0 - 0.5	50+
0.5 - 2.0	50+
2.0 - 2.5	25
2.5 - 3.0	50+
3.0 - 3.5	50+
5.0 - 8.0	10+

Depth (ft)	Soil Description
0.0 - 1.5	Gray sand (SP) with root and a trace of rock
1.5 - 2.0	Gray weathered limestone (WLS)
2.0 - 2.5	Gray sand (SP) with rock
2.5 - 3.0	Brown sand with silt (SP-SM) with rock
3.0 - 4.0	Brown silty sand (SM) with rock
4.0 -	Tan limestone (LS) - Terminated due to refusal

Notes: Limestone was encountered at 3 feet. Loose soils were encountered between the limestone

Test Number: TP-2 **Date Performed: 12/6/2022** **Water Table: 3.0 feet**

Depth (ft)	Resistance (kg/cm2)
0 - 1.0	50+
1.0 - 2.0	50+
2.0 - 3.0	50+
3.0 - 3.5	10
3.5 - 4.0	40
4.0 - 7.0	10

Depth (ft)	Soil Description
0.0 - 1.0	Gray sand (SP) with root
1.0 - 3.0	Tan sand with silt (SP-SM)
3.0 - 3.5	Tan limestone (LS)
3.5 - 4.0	Tan weathered limestone (WLS) with silt
4.0 -	Tan Limestone (LS) - Terminated due to refusal

Notes: Limestone was encountered at 3 to 3.5 feet. Loose soils were encountered between the limestone