ENGINEERING INVESTIGATION & ANALYSIS
GEOTECHNICAL & STRUCTURAL
ASSESSMENT REPORT

6 SYLVAN ROAD
FAIRFIELD, NEW JERSEY 08203

MATRIXNEWORLD
Engineering Progress

Prepared for:

State of New Jersey
Department of Community Affairs
PO Box 800
Trenton, NJ 08625-0800

Prepared by:

Matrix New World Engineering, Land Surveying
and Landscape Architecture, PC
26 Columbia Turnpike
Florham Park, New Jersey 07932

Matrix No. 20-1052

August 2021

Michael J. Soltys, P.E.
Director of Structural & Geotechnical Engineering

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 PROJECT BACKGROUND

The State of New Jersey Department of Community Affairs (DCA), Division of Disaster Recovery and Mitigation, anticipates receiving approval for grant funding through FEMA's Flood Mitigation Assistance (FMA) appropriation. This funding is provided through FMA to states and local communities to reduce or eliminate flood risk due to repetitive flood damage to buildings insured by the National Flood Insurance Program (NFIP). The DCA intends to use the funding for the State's Mitigation Assistance Program (MAP) to elevate residential properties located in a floodplain in the Township of Fairfield. The properties are to be elevated at least 3 feet above the base flood elevation (BFE). The DCA hosted a town hall meeting for homeowners in Fairfield, focused on homeowners with properties that experience Repetitive Losses or Severe Repetitive Losses.

In preparation of procuring a Design-Build firm to conduct the effort, the DCA has contracted Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C. (Matrix) to conduct a geotechnical analysis, preliminary structural analysis, and elevation certificate for residences anticipated to be included in the program. It is understood that this document will serve as the basis for the development of a Request for Proposal (RFP) to procure Design-Build firms to do final structural design and perform the elevation of the properties.

2.0 PROJECT SCOPE

Matrix has completed a geotechnical and structural assessment and elevation certificate to evaluate the viability of elevating the residential building located at 6 Sylvan Road in Fairfield, New Jersey (Site). Matrix provided geotechnical and structural engineering and land surveying services as a consultant to the DCA. The project location is shown on the attached Site Location Map (Figure 1).

The purpose of the engineering study was to compile comprehensive data regarding the existing building's foundations and overall structural composition and condition at the Site. The information obtained will be further utilized to determine the feasibility and proposed design of raising the existing residence 3 feet above the base flood elevation (BFE) as determined by FEMA. A team of Matrix engineers and surveyors performed the evaluation, consisting of a geotechnical soil inspection, test pits to reveal the existing building foundations, an interior inspection of the building's visible foundation walls and frame, and topographic surveying for the development of a flood elevation certificate. One test pit (TP-1) was completed to a depth of 53 inches below the ground surface (bgs) and 2 geotechnical borings (B-1 and B-2) were completed to a depth of 27 feet bgs (see Figure 2).

Matrix's geotechnical characterization of the property is based on an engineering evaluation of the subsurface conditions as indicated by the field exploration data and geotechnical laboratory test results on representative soil samples.

3.0 SITE LOCATION & PROJECT DESCRIPTION

The project site is located at 6 Sylvan Road in Fairfield, New Jersey. The property consists of a 1.5-story timber-framed ranch-style house with an approximately 2,125 square foot footprint. The house is situated atop concrete masonry unit (CMU) foundation walls on cast-in-place concrete foundations. The substructure of the house is comprised of a finished basement, crawl space, and garage area. The timber frame of the residential structure is covered with a vinyl siding throughout most of its exterior. The front entrance doorway, and the front above-ground foundation walls, are covered with a decorative stone façade. The rest of the visible foundation walls contain a stucco finish on the exterior. The property also contains a timber-framed painted timber deck adjacent to the rear side of the house.

The building includes a mezzanine/half-story level above the garage on the west side of the house. This area is only approximately 5 feet above the first floor, and contains a sliding doorway to an outdoor timber deck located on the west side of the building exterior.

To assist with the geotechnical and structural evaluation, test pits and geotechnical borings were advanced in areas around the residence to obtain information regarding the soil's structural properties and building's existing foundation. The test pit and 2 borings were located to provide the most useful information about the subsurface conditions. Refer to Figure 2 of this report for a map of the test pit and boring locations.

4.0 GEOLOGIC SETTING

According to the USDA Soil Survey of Essex County, the site is situated atop Pompton – Urban land. The subsurface composition is typically sand and loamy sands from 8 to 60 inches bgs.

According to the 2014 Bedrock Geologic Map of New Jersey, the Site is underlain by the Sedimentary and Bedded Volcanic Rocks Towaco Formation. Specifically, the subsurface consists of micaceous, reddish-brown sandstone, siltstone and silty mudstone in upward-fining sequences. The Bedrock Geologic Map is shown in Figure 3.

From the Surficial Geologic Map of Northern New Jersey, compiled by and edited by Byron D. Stone, Scott D. Stanford, and Ron W. White in 2002, the natural surface material (beyond fill) is suggested to be in the Pine Brook terrace deposit, which contains sand and gravel, moderately to poorly sorted. The Surficial Geology map is shown in Figure 4.

The documented site conditions presented above are consistent with the findings from the subsurface investigation, in which Sand was encountered followed by a layer of Silt. Groundwater was encountered in the borings at approximately 6 to 7 feet bgs. Bedrock was not encountered during this subsurface program.

5.0 SUBSURFACE FIELD PROGRAM

The subsurface investigation was completed by generally accepted practices in the Geotechnical Engineering field and consisted of the advancement of 2 test pits and 2 Standard Penetration Test (SPT) borings using mud rotary drilling methods. Matrix retained Boring Brothers, Inc., located in Egg Harbor Township, NJ, to complete the subsurface field program.

A Matrix Geotechnical Engineer provided full-time drilling oversight, soil logging, and sample collection. Matrix prepared the field test pit and boring logs, which included sample depths, SPT-N blow counts, soil recovery, and soil descriptions based on the Burmister Soil Classification System followed by the Unified Soil Classification System (USCS) letter symbol. Test pit and soil boring logs are provided in Appendix A. Classification tables and charts used to determine the soil attributes are included in Appendix B.

Upon the completion of the field program, representative samples were subjected to geotechnical laboratory analyses. Laboratory results aided in soil classification and assessing the relevant engineering properties of the stratigraphic layers which were used in developing the revised geotechnical parameters outlined herein. Geotechnical laboratory reports are included in Appendix C.

5.1 Test Pits

On May 17, 2021, Boring Brothers completed a foundation survey which included 1 test pit, TP-1 (West Wall of Building) to a depth of 53 inches below the ground surface. The test pit was dug using a Bobcat E55 and shovel to prevent any damage to the existing building foundations. The exterior edge of the building footing was exposed to accurately measure the structure's dimensions, as well as to analyze the conditions of the concrete foundation.

The Matrix Geotechnical Engineer also observed the subsurface soil conditions encountered within the test pits, noting the type and composition of the soils surrounding and beneath the existing footing. The test pit was backfilled with the original soils upon completion of the test pit logs. No test pit samples were collected at the site for further analysis.

5.2 SPT Borings

On May 20, 2021, Boring Brothers advanced 2 geotechnical borings with a Mobile CME 55 track-mounted drill rig using mud rotary drilling techniques.

Split spoon (SS) samples were collected in accordance with *ASTM D-1586*, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*. A standard 2-inch outer diameter split spoon, two feet in length, was used to collect the soil samples. An automatic 140-pound hammer having a 30-inch drop was used to drive the split spoon sampler. As a part of boring observation, the SPT blow counts were recorded for the 0- to 6-inch interval, the 6- to 12-inch interval, the 12- to 18-inch interval and the 18- to 24-inch interval. The SPT N-values for design purposes are reported as the sum of the SPT N values observed for the above referenced 6- to 12-inch interval and the 12- to 18-inch interval that the split spoon sampler was driven.

The Matrix Geotechnical Engineer observed the split spoon samples and collected representative samples in sealed containers for further examination. All borings were continuously sampled to 12 feet bgs and at every subsequent 5-foot interval thereafter. The 2 borings were each advanced to a depth of 27 feet bgs. The borings were backfilled with soil cuttings and bentonite hole plug (if necessary) upon completion of the borehole.

5.3 Laboratory Testing

In addition to the field investigation, a laboratory testing program was conducted to determine additional pertinent engineering characteristics of representative samples of on-site soils. The laboratory testing program was performed in general accordance with applicable ASTM standard test methods and included physical/textural testing of representative samples of various strata.

Upon review of the boring logs, Matrix selected representative samples for laboratory testing. Laboratory testing of selected samples was completed by TerraSense, LLC, located in Totowa, New Jersey. The following table presents a summary of the testing program.

The results of the laboratory testing program were utilized to assist in developing geotechnical design parameters and recommendations, and are provided in Appendix C.

Table 5.3-1: Laboratory Testing Program

Test	Testing Procedure	Quantity Performed	Sample Locations and Depth Intervals
Water Content	ASTM D2216	6	B-1: 4-6’, 20-22’, 25-27’ B-2: 4-6’, 20-22’, 25-27’
Sieve Analysis	ASTM D422	1	B-2: 20-22’
Atterberg Limits	ASTM D4318	2	B-1: 25-27’ B-2: 4-6’
Percent Fines	ASTM D1140	2	B-1: 20-22’ B-2: 25-27’
Combined Sieve & Hydrometer	ASTM D422	1	B-1: 4-6’

6.0 SUBSURFACE CONDITIONS

The subsurface conditions beneath the site can be characterized by the following stratigraphy, proceeding from the surface materials downward, unless noted otherwise below. Classification tables and charts used to determine the soil attributes are included in Appendix B.

Test Pits

The top of concrete was uncovered in TP-1(North Side) at 47” bgs. The test pit revealed the concrete protrudes 12” from the wall and extends 6” deep at this location.

Surface Cover

The surface cover for boring B-1 and B-2 consisted of grass cover and topsoil, approximately 4 inches thick.

Stratum 1: Sand (SP, SM)

Beneath the surface cover in each boring, a soil layer was encountered consisting of brown to grey coarse-to-fine grained Sand with varying amounts of Silt or Clay, and fine Gravel. This Sand layer extended from the bottom of the surface cover to 18.5 feet below the ground surface (bgs) in boring B-1 and to 23.5 bgs in boring B-2.

With similar properties to Stratum 2 (below), a thin lens of Silty Clay was encountered in the upper portion of both borings. A roughly 5” layer of Silty Clay was discovered in B-1 at 2.5 feet bgs and an approximately 17” layer of Silty Clay and fine Sand was encountered in B-2 from about 4.5 to 6 feet bgs.

The SPT-N values in this layer ranged from 2 to 18 blows per foot (bpf), which is indicative of very loose to medium-dense Sand. The SPT N-values for Stratum 1 are summarized in the tables below.

Table 6.0-1: Very Loose to Loose SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SM, SP, SC	0-2.58’, 4-6’, 13.5-18.5’	3-8
B-2	SM, SP	0-4.5’, 13.5-23.5’	2-8

Table 6.0-2: Medium-Dense SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SW, SC	6-13.5’	12-14
B-2	SW-SM, SW	6-13.5’	16-18

Table 6.0-3: SPT N-Values for Silty Clay Layer in Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL	2.58-4’	3
B-2	CL	4.5-6’	2

Stratum 2: Silt (ML)

Beneath the granular material of Stratum 1, a soil layer was encountered consisting of grey Clayey Silt with varying amounts of fine Sand. This Silt layer was encountered at approximately 18.5 feet in boring B-1 and 23.5 feet in boring B-2. Both borings were terminated within this Silt layer at 27 feet bgs.

The SPT-N values in this layer ranged from 7 to 24 blows per foot (bpf), which is indicative of loose to medium Silt. The SPT N-values for Stratum 2 are summarized in the tables below.

Table 6.0-4: Loose SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	ML	18.5-23.5’	7

Table 6.0-5: Medium SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	ML	23.5-27’	13
B-2	ML	23.5-27’	24

Groundwater

Groundwater levels could not be measured during drilling in either boring, due to the use of water and drilling mud to advance the borings. Based on soil saturation levels, the groundwater table lies approximately between 6 and 7 feet bgs. Saturated soils were encountered in B-1 at 7 feet bgs at 08:42 AM and in B-2 at 6 feet bgs at 9:30 AM. It should be noted that the groundwater levels will vary with temperature, precipitation, and other climatic factors.

7.0 GEOTECHNICAL SUBSURFACE PARAMETERS

The geotechnical design parameters in this report are derived from the field program and are based on accepted geotechnical standards and practices. At the time of the geotechnical assessment, loading conditions and the final proposed grading plans were not available. Therefore, certain assumptions were made for the recommendations provided in this report.

Table 7.0-1 summarizes the recommended geotechnical design parameters for the various soil strata encountered at the Site. The values are based on review and interpretation of the subsurface field program and laboratory test data results.

Table 1806.2 of the 2018 International Building Code provides allowable coefficients of friction to be used in the evaluation of resistance to sliding.

Table 7.0-1: Geotechnical Design Parameters

Stratum	**Unit Weight**	**Friction Angle (Φ)**	**Cohesive Strength, c_u**	**Earth Pressure Coefficient**		**Net Allowable Foundation Pressure***	**Lateral Bearing**
				Active	**Passive**		
	(pcf)	**(deg)**	**(psf)**	**(Ka)**	**(Kp)**	**(psf)**	**(psf/ft. bgs)**
Native Medium-Dense to Dense Granular Soil (SP, SP-SM, SM) [SPT N > 10]	$\gamma = 125$ $\gamma' = 63$	32°	0	0.31	3.26	4,000	200
Native Loose Granular Soil (SP, SP-SM, SM) [SPT N ≤ 10]	$\gamma = 105$ $\gamma' = 43$	30°	0	0.33	3.00	2,500	150
Native Silt (ML) Medium [10 ≤ SPT N ≤ 30]	$\gamma = 115$ $\gamma' = 53$	28°	400	0.36	2.77	2,000*	100
Native Silt (ML) Loose [SPT N < 10]	$\gamma = 90$ $\gamma' = 28$	26°	150	0.39	2.56	1,500*	75
Native Clay (CL) Very Soft - Soft [SPT N < 4]	$\gamma = 90$ $\gamma' = 28$	-	500	-	-	1,000*	N/A

Notations: γ = moist unit weight, γ' = buoyant unit weight, and c_u = average undrained shear strength.

\+ Allowable foundation pressure is contingent upon either replacement of at least two feet of existing fill below the bottom of footing by a Controlled Fill, or upon confirmation that the field density of the existing fill material down to four feet below the bottom of footing meets 95% of the maximum dry density of the existing fill material observed in Modified Proctor Tests.

* These values are based on the 2018 International Building Code, New Jersey Edition, and adjusted for field conditions encountered. To increase the allowable foundation pressure above the values recommended in the table given above, further testing of soil will be required. In Cohesive soils, it should be noted that the shallow footing may fail under the settlement criteria before the footing pressure approaches the anticipated allowable bearing capacity. Allowable Foundation Pressure values assume the water table is below the influence depth of the foundation.

- Coefficient of earth pressure at rest may be computed using Jaky's equation, $K_o = 1 - \sin \phi'$.

8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 6 Sylvan Road in Fairfield, New Jersey. The conclusions presented herein are derived from Matrix's geotechnical and structural investigation of the existing soils and building foundations and framing configurations, along with pertinent survey data as compiled by Matrix's team of land surveyors.

Matrix conducted a subsurface investigation that included both a test pit and soil borings to obtain maximum pertinent information regarding the existing site conditions (refer to Section 6.0 of this report). The test pit performed at the site exposed the exterior portion of the building's foundation wall footings, allowing for measurement of dimensions of the structure and assessment of the construction methods utilized. Two geotechnical borings were also conducted to gain further information regarding the existing soils beneath the site.

In addition to the geotechnical investigation, Matrix also conducted a structural site inspection to observe the existing foundation walls and framing of the building. Matrix's structural engineer was granted access to the residence's cellar and crawl spaces to observe the building's foundation structure. Substructure composition was recorded, including beam/girder type, building dimensions, and spacing of structural components. Structural defects, if any, were also noted during the inspection and have been included within Section 8.3.

8.1 Existing Building Foundations

The building at 6 Sylvan Road sits atop three separate foundation areas – the rear basement, main crawl space, and garage area. The timber frame and subfloor of the house is supported by timber joists and girders spanning the CMU (8x8x18 block) foundation walls.

The crawl space of the building, measuring 41'-8" long x 25'-3" wide, encompasses the central area of the living space. The crawl space contains CMU foundation walls ranging in height from 46.5" to 48" (measured from crawl space floor). A 4" bump out was observed on the south and east walls of the crawl space, located approximately 15" above the floor surface. The first floor above the crawl space is supported by nominal 2x8 timber floor joists, spaced 16" on center, running from front to rear of the building (north to south). A set of (3) connected nominal 2x8 timber members acts as a girder for the floor joists, located at midspan of the joists. The girder itself is supported throughout its span, between the edge foundation walls, by (3) CMU block pedestals. The longest clear span of the girder measured 11'-1" along the east-central span.

Within the crawl space, an area of lower floor joists was observed to support the first-floor entrance vestibule, which is approximately 6" below the rest of the first floor. Still nominal 2x8 joists, these beams were supported by the north CMU wall of the crawl space as well as two rows of timber nominal 2x4 studs bearing on either nominal 2x4 flat timber planks or CMU block pedestals. Above the north CMU wall of the crawl space, blocks had been removed to accommodate the lower elevation of these floor joists.

South of the crawl space area, at the rear of the building, is an adjacent basement area measuring 30'-8" long x 13'-3" wide. This area was finished at the time of the inspection, its walls constructed with metal studs and sheetrock. However, a narrow opening was left between the finished basement and the original foundation walls on the north and west sides (16" to 19" of open space between walls). From these openings, the nominal 2x10 timber first-floor joists were visible running front to rear. These joists were connected to a nominal 2x8 perpendicular timber beam above the north foundation wall (south crawl space wall) using steel wall hangers. The foundation walls in the basement area consist of CMU block walls ranging from 70" to 72" high. The lower 40" of these walls were 4" thicker than the rest of the wall, similar to the south and east walls of the crawl space. The concrete floor of this basement area is approximately 26" below the concrete floor of the crawl space.

West of the crawl space, a ground-level garage was observed. The garage consists of timber framing supported by CMU foundation walls ranging in height from 25.5" to 26" (top of wall at same elevation as crawl space walls). To the rear of the garage area, a laundry/storage room had been constructed at the same ground level. The CMU foundation walls continue into this area, and a set of stairs along the east wall connects the laundry room to the first floor of the building.

A test pit excavation along the west wall of the garage revealed an approximately 32" wide concrete spread footing with a bottom approximately 53" below the exterior grade. The water table was observed to be about level with the bottom of the footing at the time of the test pit excavation. Based on our findings within the test pit and from conventional foundation construction, Matrix utilized a 16" wide footing as a minimum value for analysis, but believes the actual footings for the building to likely range from 16" to 24" in width. Prior to raising the house, Matrix recommends that the contractor confirm the foundation size and bearing adequacy with multiple test pits around the building perimeter.

8.2 Existing Equipment

The crawl space area of the building was mostly empty, except for a small water pump connected to the water utility line entering the building from the front of the property. Multiple metal conduits, of various size and elevation, were observed throughout the area, as well.

The only machinery observed within the rear basement area were two sump pits – one in each of the northern corners, and both in the unfinished portion of the basement. PVC piping and electrical wires were also observed running below the floor joists in the unfinished portion of the basement.

A boiler was observed in the garage (along the rear wall) situated atop CMU block pedestals. The blocks raised the boiler approximately 15.5” above the garage floor. An electrical panel was also seen on the garage’s west wall, with the bottom approximately 35” above the floor surface.

The laundry room, adjacent to the garage area, contained a refrigerator, washer/dryer, and a water heater. All of the equipment in this room was located at the floor level.

Along the exterior of the building, an air conditioning unit and water filter for the backyard pool were observed next to the east wall. The pool filter tank was at ground level, while the air conditioning unit was situated atop an approximately 9” high CMU pedestal.

8.3 Site Observations

The building at 6 Sylvan Road contains a half story level directly above the garage area. The type of subfloor of this level could not be confirmed at the time of the inspection due to the presence of drywall along the garage walls. However, timber wall studs could be seen running up the east wall of the garage to the half story floor in a ceiling opening near the crawl space entrance.

In the crawl space, insulation was exposed throughout the area between the floor joists. Two large holes were observed at the top of the west CMU wall, adjacent to the garage (these were likely openings for pipelines that have since been removed). The concrete steps leading from the garage to the crawl space exhibited significant cracking and spalling at the time of the inspection.

The rear basement area of the building appears to be an addition to the original structure, as a former opening in the south wall of the crawl space had been boarded up (likely a former rear entrance to the crawl space).

Two timber decks were observed at the Site, each connected to the main building. Both decks are comprised of timber decking, beams, and girders. The rear deck's girders are supported intermittently by CMU block pedestals extending into the ground surface. The west deck – which is attached to the half story level – is supported on its west side by two 4x4 timber posts atop concrete Sonotube footings.

A brick chimney was observed in the rear of the building, adjacent to the rear basement area. The chimney measured 52" wide and extended 24" outward from the building's exterior wall.

8.4 Elevation Requirements

The FEMA 100-year flood elevation at 6 Sylvan Road is El. +174 (NAVD88). As per the New Jersey Department of Community Affairs (DCA), and in accordance with the New Jersey Flood Hazard Area Control Act, the lowest floor of newly elevated buildings must be at least 3 feet above the base flood elevation. Therefore, the new first floor elevation must be at El. +177 or higher to meet the requirements set forth in the program.

The current first-floor elevation at the Site is at El. +171.37, with the adjacent garage floor at El. +168.81. To achieve the elevation requirements, the existing building would need to be raised at least 5.7 feet.

8.5 Recommendations for Building Elevation

Matrix recommends that the existing foundation system of the residential building 6 Sylvan Road be kept and extended to achieve the required design flood elevation. The existing CMU foundation walls are expected to provide sufficient support for the additional height of the newly raised building. Based on loading estimation and analysis for the existing building, Matrix estimates that the anticipated additional dead load of the required new courses of CMU would remain under an allowable bearing capacity of 2,500 psf for the shallow concrete strip footings at the Site.

In accordance with NFIP requirements, it is required that the existing basement and crawl space be filled in to match the lowest adjacent exterior grade following raising. The newly raised house will have over 8 feet of space beneath (down to existing finished grade), which is enough vertical height for a ground-floor level. This additional space beneath the raised building can be used for storage at the resident's discretion.

The most feasible method of elevation for the building consists of jacking up the entire residential structure from below using steel beams and jack posts. The building will then sit atop temporary cribbing while the existing CMU foundation walls are heightened with additional courses of masonry block units. Additional vertical reinforcement would need to be installed in ungrouted masonry cells to properly transfer loads through the new heightened wall to the existing wall, and horizontal ladder reinforcement should be installed at a minimum of every other course. The garage door located in the front of the house will need to be removed prior to raising the house, and the opening replaced with a new timber-framed wall to match the rest of the building. The garage door will then be replaced at the ground level once the house is elevated. The existing brick chimney located along the rear wall of the house will also require extending during raising of the house to keep the top of the chimney above the roof level.

The existing concrete block pedestals intermittently supporting the building's girders, as well as the timber studs supporting the lower entrance vestibule floor, must be removed and replaced by new concrete or masonry block columns. These new columns will need to include a spread footing beneath to sufficiently support the building loads. Additionally, the balcony and deck are anticipated to require raising to match the current ingress/egress heights of the main structure. This would require replacement or extension of the timber support posts.

Raising of the building should be undertaken with special attention to preserve the existing stone façade covering the timber frame in the front of the building. If the façade is kept in place during raising, the process is liable to lead to some cracking in the existing façade. Alternatively, the stone façade can be removed prior to raising, then replaced with a similar or more flexible finish after completion of the elevation process. The materials and labor involved in exterior façade restoration of the house are not within the scope of this project.

Within the new foundation walls, permanent openings are required to allow floodwater to enter the ground level and equalize the hydrostatic pressure during a flood event. As per the 2018 International Residential Code, New Jersey Edition, the total net area of non-engineered openings must comprise at least 1 square inch for every square foot of enclosed space within the building's ground floor. This equates to approximately 14.77 square feet of total flood openings in the building's new foundation walls.

Additionally, a minimum of two openings must be provided for each enclosed area of the new ground floor. These openings must be located no higher than one foot above the adjacent finished exterior grade along the building perimeter. Matrix recommends the use of engineered openings in lieu of non-engineered openings to maximize efficiency and minimize the quantity of openings required.

Additionally, any service equipment, whether outside or in the basement/crawl space/garage, such as air conditioning, heat pump compressors, gas meters, electric meters, and hot water heaters, must be elevated 3 feet above the BFE. For interior elements, this may include relocation to an upper floor and thus less usable living space. For this residence, the hot water heater, boiler, electrical panel, and water pump in the building interior would require elevating 3 feet above the BFE onto the raised first floor. The exterior air conditioning unit would also require elevating 3 feet above the BFE on a new or extended exterior platform.

9.0 CLOSURE

This report has been prepared to assist the State of New Jersey Department of Community Affairs with the structural and geotechnical evaluation of the residential building at 6 Sylvan Road in Fairfield, New Jersey. The conclusions and recommendations provided within this report were prepared based on our understanding of the project and through the application of generally accepted soils and foundations engineering practices. No warranties, expressed or implied, are made. Matrix should be notified of any changes to the existing building foundation system or if subsurface conditions differing from those described herein are encountered, so the impact on the geotechnical and/or structural recommendations can be evaluated.

10.0 REPRESENTATIVE SITE PHOTOS

Structural Inspection Photos

Photo 1. 6 Sylvan Road (Front of Building)

Photo 2. 6 Sylvan Road (Rear of Building)

Photo 3. Rear of Building with Timber Deck

Photo 4. Timber Deck Along West Wall of Building

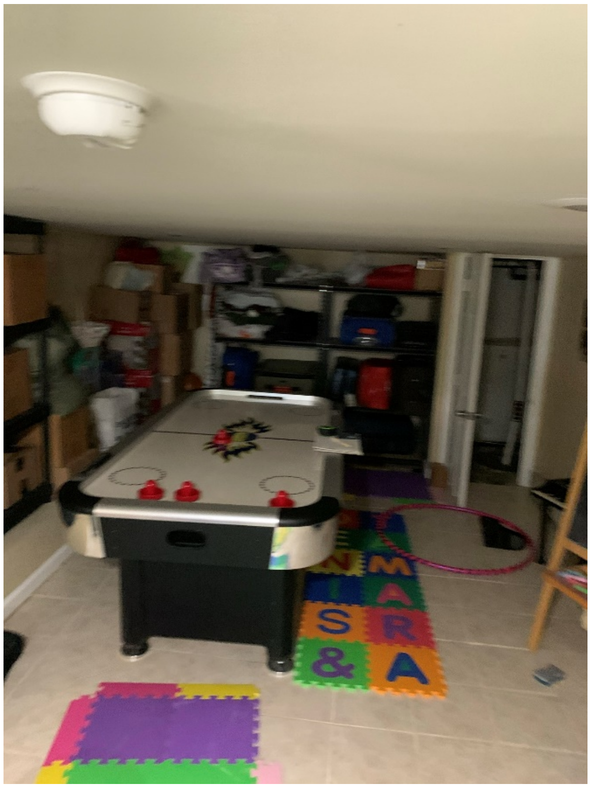


Photo 5. Finished Portion of Rear Basement

Photo 6. Sump Pump in Unfinished Portion of Basement (Typ.)

Photo 7. Floor Joists Visible in Unfinished Portion of Basement (Looking East)

Photo 8. Basement Foundation Walls (Looking South)

Photo 9. Washer/Dryer in Laundry Room

Photo 10. Boiler in Garage (Rear Wall)

Photo 11. Crawl Space South CMU Wall (Typ.)

Photo 12. Lowered Vestibule Subfloor in Crawl Space

Photo 13. Crawl Space Central Girder and CMU Pedestal (Typ.)

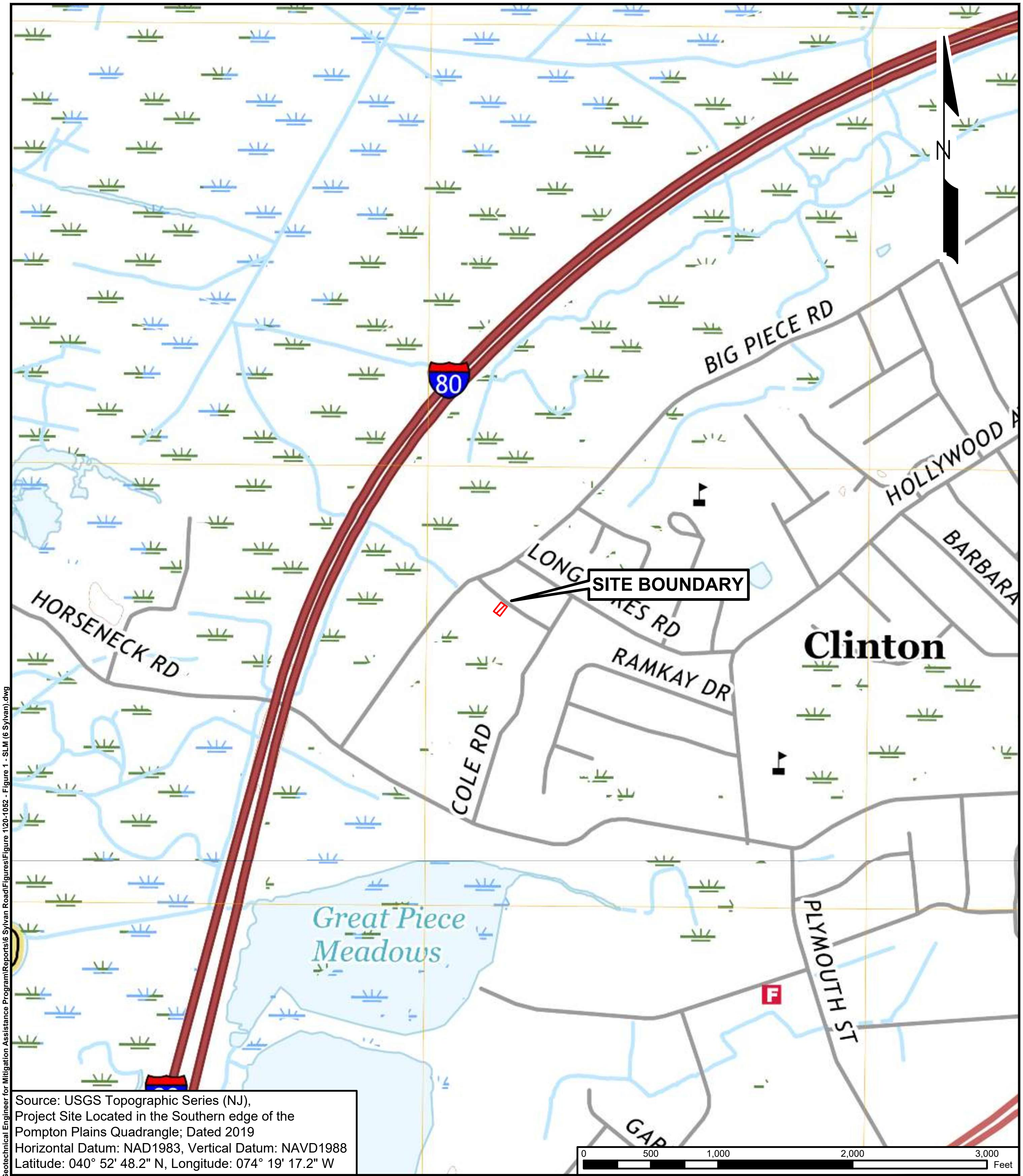
Photo 14. Boarded Up Opening in Crawl Space South Wall

Test Pit Photos

Photo 15. Test Pit TP-1 Location (West Wall of Building – Garage)

Photo 16. Test Pit TP-1 Location (West Wall of Building – Garage)

FIGURES



Source: USGS Topographic Series (NJ),
Project Site Located in the Southern edge of the
Pompton Plains Quadrangle; Dated 2019
Horizontal Datum: NAD1983, Vertical Datum: NAVD1988
Latitude: 040° 52' 48.2" N, Longitude: 074° 19' 17.2" W

SITE LOCATION MAP

MATRIXNEWORLD
Engineering Progress

Matrix New World Engineering, Land Surveying
and Landscape Architecture, P.C.
26 Columbia Turnpike
Florham Park, New Jersey 07932
WBE / DBE / SBE

Tel: 973-240-1800
Fax: 973-240-1818
www.matrixneworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
6 SYLVAN ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 1,000'	20-1052	JUNE 2021	1

© MATRIXNEWORLD\F:\2020\20-1052 NJDCA Geotechnical Engineer for Mitigation Assistance Program\Reports\6 Sylvan Road\Figures\Figure 1\20-1052 - Figure 1 - SLM (6 Sylvan).dwg

NOTES:

1. THIS FIGURE IS BASED ON IMAGERY PROVIDED BY GOOGLE EARTH PRO AND TAX CARDS FROM FAIRFIELD TOWNSHIP, NEW JERSEY.
2. BORING LOCATIONS WERE IDENTIFIED IN THE FIELD BY MATRIX PERSONNEL BY TAPING AND LINE OF SIGHT MEASUREMENTS.
3. THE BORINGS WERE PERFORMED BY BORING BROTHERS, INC. ON MAY 17 THROUGH 20, 2021 UNDER THE DIRECTION OF A MATRIX REPRESENTATIVE.
4. ALL ELEVATIONS SHOWN ON THIS PLAN REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

B-# ⌖	AS-DRILLED BORING LOCATION
TP-# ⌖	TEST PIT LOCATION

0 10 20 30 40 80

SCALE: 1" = 40'

NO.	DESCRIPTION	DATE:	BY:	APR:
	REVISIONS			

DESIGNED BY: WB

REVIEWED BY: MS

RELEASED BY: MS

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Engineering Progress

Matrix New World Engineering, Land Surveying
and Landscape Architecture, P.C.
26 Columbia Turnpike
Florham Park, New Jersey 07932
WBE / DBE / SBE

Tel: 973-240-1800
Fax: 973-240-1818
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AS-DRILLED BORING LOCATION PLAN

NJDCA GEOTECHNICAL ENGINEER
FOR MITIGATION ASSISTANCE PROGRAM

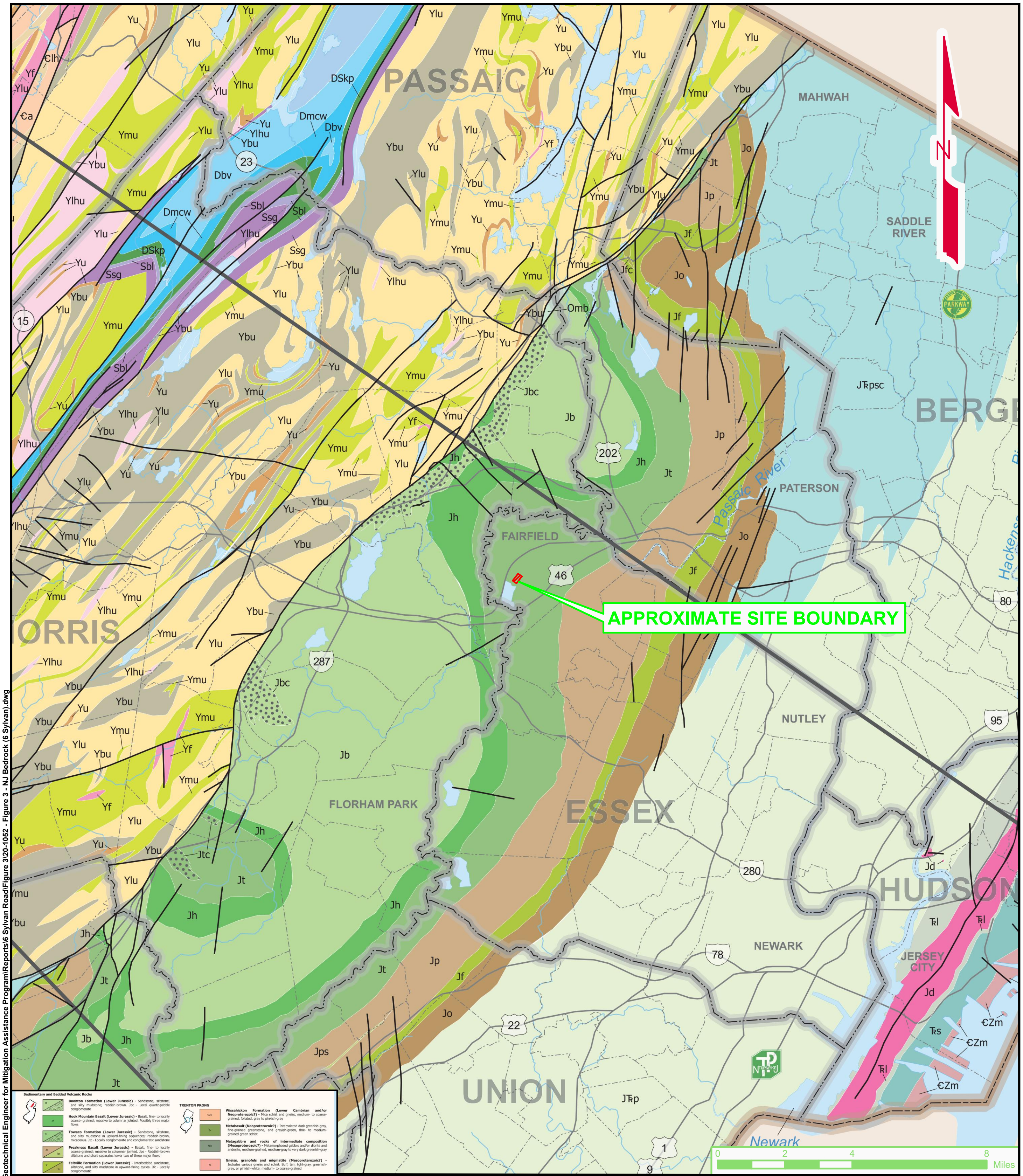
6 SYLVAN ROAD
FAIRFIELD, NJ 07004

PROJECT NUMBER: 20-1052

SCALE: AS NOTED

DATE: JUNE 2021

2



Sedimentary and Bedded Volcanic Rocks

Jb / Jbc	**Boonton Formation (Lower Jurassic)** - Sandstone, siltstone, and silty mudstone; reddish-brown. Jbc - Local quartz-pebble conglomerate
Jh	**Hook Mountain Basalt (Lower Jurassic)** - Basalt, fine- to locally coarse- grained; massive to columnar jointed. Possibly three major flows
Jt / Jtc	**Towaco Formation (Lower Jurassic)** - Sandstone, siltstone, and silty mudstone in upward-fining sequences; reddish-brown, micaceous. Jtc - Locally conglomerate and conglomeratic sandstone
Jp / Jps	**Preakness Basalt (Lower Jurassic)** - Basalt, fine- to locally coarse-grained; massive to columnar jointed. Jps - Reddish-brown siltstone and shale separates lower two of three major flows
Jf / Jfc	**Feltville Formation (Lower Jurassic)** - Interbedded sandstone, siltstone, and silty mudstone in upward-fining cycles. Jfc - Locally conglomeratic

TRENTON PRONG

ꞒZw	**Wissahickon Formation (Lower Cambrian and/or Neoproterozoic?)** - Mica schist and gneiss, medium- to coarse-grained, foliated, gray to pinkish-gray
Zv	**Metabasalt (Neoproterozoic?)** - Intercalated dark greenish-gray, fine-grained greenstone, and grayish-green, fine- to medium-grained green schist
Ygb	**Metagabbro and rocks of intermediate composition (Mesoproterozoic?)** - Metamorphosed gabbro and/or diorite and andesite, medium-grained, medium-gray to very dark greenish-gray
Yg	**Gneiss, granofels and migmatite (Mesoproterozoic?)** - Includes various gneiss and schist. Buff, tan, light-gray, greenish-gray, or pinkish-white, medium- to coarse-grained

BEDROCK GEOLOGY LOCATION MAP

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and Landscape Architecture, P.C.
26 Columbia Turnpike
Florham Park, New Jersey 07932
WBE / DBE / SBE
Tel: 973-240-1800
Fax: 973-240-1818
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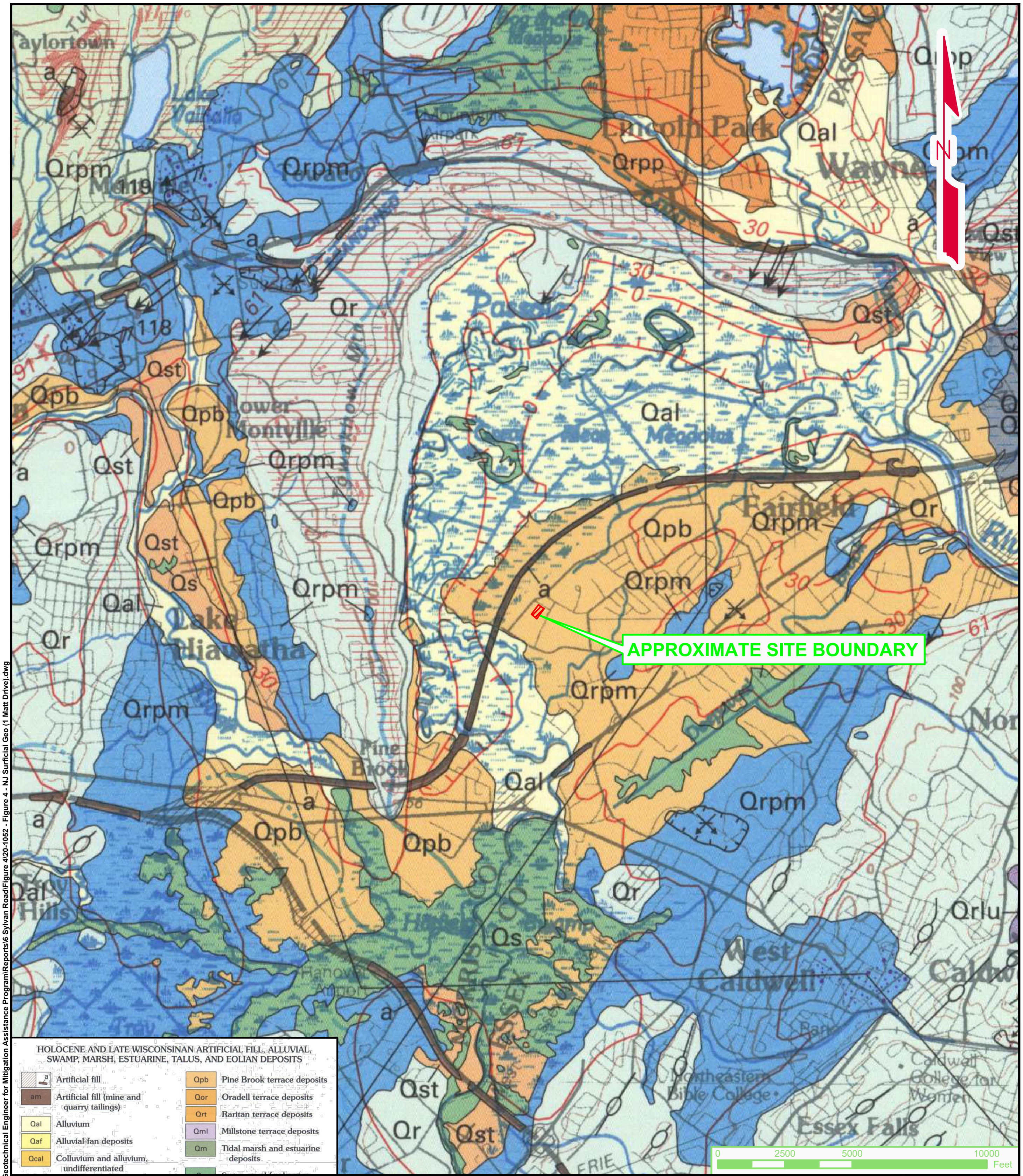
NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
6 SYLVAN ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 4 Miles	20-1052	JUNE 2021	3



SURFICIAL GEOLOGY LOCATION MAP

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26 Columbia Turnpike
Florham Park, New Jersey 07932
WBE / DBE

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6 SYLVAN ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 5000'	20-1052	JUNE 2021	4

© MATRIXNEWORLD\F:\2020\20-1052 NJDCA Geotechnical Engineer for Mitigation Assistance Program\Reports\6 Sylvan Road\Figure 4\20-1052 - Figure 4 - NJ Surficial Geo (1 Matt Drive).dwg

APPENDIX A

SOIL BORING & TEST PIT LOGS

MATRIXNEWORLD
Engineering Progress

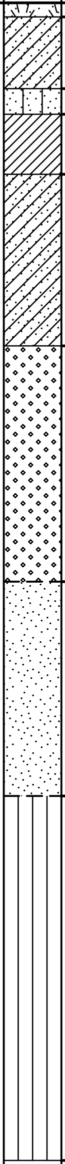
BORING LOG

BORING NO.: **B-1**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **5/20/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **6 Sylvan Road, Front Lawn-Windows**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** INSPECTOR: **D. Alia**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**5/20/21**	**8:42 am**	**7.0**	
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING	SAMPLE				Graphic Symbol	Description Of Material	Laboratory Tests
	Blows/ Foot	No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]			
	4" Casing	S-1	SS	0-2	3-2-3-4 (75%)		4" Topsoil S-1: Brown-Gray mf SAND, little Silty Clay, dry (SC)	
		S-2	SS	2-4	3-2-1-1 (50%)		S-2A (Top 7"): Brown mf SAND, little Silt, moist (SM) S-2B (Bottom 5"): Black Silty CLAY, trace fine Sand, moist (CL)	
5		S-3	SS	4-6	2-1-2-2 (58%)		S-3: Brown mf* SAND and Silty Clay, moist (SC) WC: 22.1%, Gravel: 0.2%, Sand: 63.7%, Fines: 36.1%, <2 µm: 10%	Sieve; Hydrometer
▼		S-4	SS	6-8	7-9-5-7 (92%)		S-4: Gray mf SAND, little Silty Clay, wet (SC)	
		S-5	SS	8-10	8-7-5-5 (100%)		S-5: Gray cmf SAND, trace Silt, trace fine Gravel, wet (SW)	
10		S-6	SS	10-12	6-6-7-8 (100%)		S-6: Gray cmf SAND, little cf Gravel, trace Silt, wet (SW)	
15		S-7	SS	15-17	5-4-4-4 (33%)		S-7: Brown mf SAND, trace Silt, trace fine Gravel, wet (SP)	
20		S-8	SS	20-22	2-3-4-5 (54%)		S-8: Gray Clayey SILT and fine Sand, wet (ML) WC: 26.8%, Fines: 58.6%	Pass No 200
25		S-9	SS	25-27	11-7-6-7 (58%)		S-9: Same as Above, wet (ML) WC: 17.3%, LL: 19, PL: 18, PI: 1	Atterberg Limits
							Bottom of Borehole @ 27 ft.	

MATRIX**NEW**ORLD
Engineering Progress

BORING LOG

BORING NO.: **B-2**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **5/20/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **6 Sylvan Road, Front Lawn-Door**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** INSPECTOR: **D. Alia**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**5/20/21**	**9:30 am**	**6.0**	
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING Blows/ Foot	SAMPLE No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]	Graphic Symbol	Description Of Material	Laboratory Tests
		S-1	SS	0-2	1-1-2-3 (58%)		S-1: Tan mf SAND, trace Silt, trace roots, dry (SP)	
		S-2	SS	2-4	3-4-1-1 (67%)		S-2: Tan-Gray fine SAND, trace fine Gravel, trace Silt, moist (SP)	
5		S-3	SS	4-6	1-1-1-3 (96%)		S-3A (Top 6"): Brown-Black mf SAND, little Silt, moist (SM) S-3B (Bottom 17"): Brown-Gray Silty CLAY and fine Sand, moist (CL) WC" 27.7%, LL: 42. PL: 18, PI: 24	Atterberg Limits
▼	4" Casing	S-4	SS	6-8	11-8-10-8 (83%)		S-4: Gray cmf SAND, little fine Gravel, little Silt, wet (SW-SM)	
		S-5	SS	8-10	9-8-9-9 (100%)		S-5: Gray cmf SAND, little fine Gravel, trace Silt, wet (SW)	
10		S-6	SS	10-12	10-9-7-8 (100%)		S-6: Same as Above, wet (SW)	
15		S-7	SS	15-17	3-4-3-4 (42%)		S-7: Brown cmf SAND, little fine Gravel, trace Silt, wet (SP)	
20		S-8	SS	20-22	3-4-4-4 (33%)		S-8: Brown mf* SAND, trace Silt, wet (SP) WC: 23.9%, Gravel: 0.0%, Sand: 96.3%, Fines: 3.7%	Sieve
25		S-9	SS	25-27	10-12-12-13 (79%)		S-9: Gray Clayey SILT, some fine Sand, moist (ML) WC: 17.9%, Fines: 79.3%	Pass No 200
							Bottom of Borehole @ 27 ft.	

MATRIX**NEW**ORLD
Engineering Progress

TEST PIT LOG

TEST PIT NO.: **TP-1**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **5/17/2021**

PROJECT LOCATION: **Fairfield, NJ** ELEV.: TIME STARTED: **10:00:00 AM**

TEST PIT LOCATION: **6 Sylvan Drive (West Wall of Building)** DATUM: **NAVD88** TIME FINISHED: **11:30:00 AM**

CONTRACTOR: **Boring Brothers, Inc.** GROUNDWATER LEVEL:

EQUIPMENT: **Bobcat E55** OPERATOR: **Steve** INSPECTOR: **A. Bangar**

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
5 10		0-12		Topsoil, grass surface cover	
15 20 25 30 35 40 45		12-53		Brown fine SAND and Silt, little fine gravel, moist-wet (SM)	
50		47-53		Top of concrete encountered at 47" bgs, protrudes 12" from the face of the wall and extends 6" downward. Water found beneath the footing.	
				Bottom of Test pit @ 53 in. Test Pit Backfilled.	

TEST PIT INCH 20-1052 TEST PIT LOGS.GPJ MATRIX EGS.GDT 7/9/21

TEST PIT NO.: **TP-03**

LOG NOTATION

Sample Classifications

SS = Split Spoon

NR = No Recovery

NX = Rock Core

SH = Shelby Tube

REC = Soil Recovery

RQD = Rock Quality Designation

Sand Classifications

c = Coarse

m = Medium

f = Fine

* = Predominant Grain Size

Soil Properties

WC = Water Content

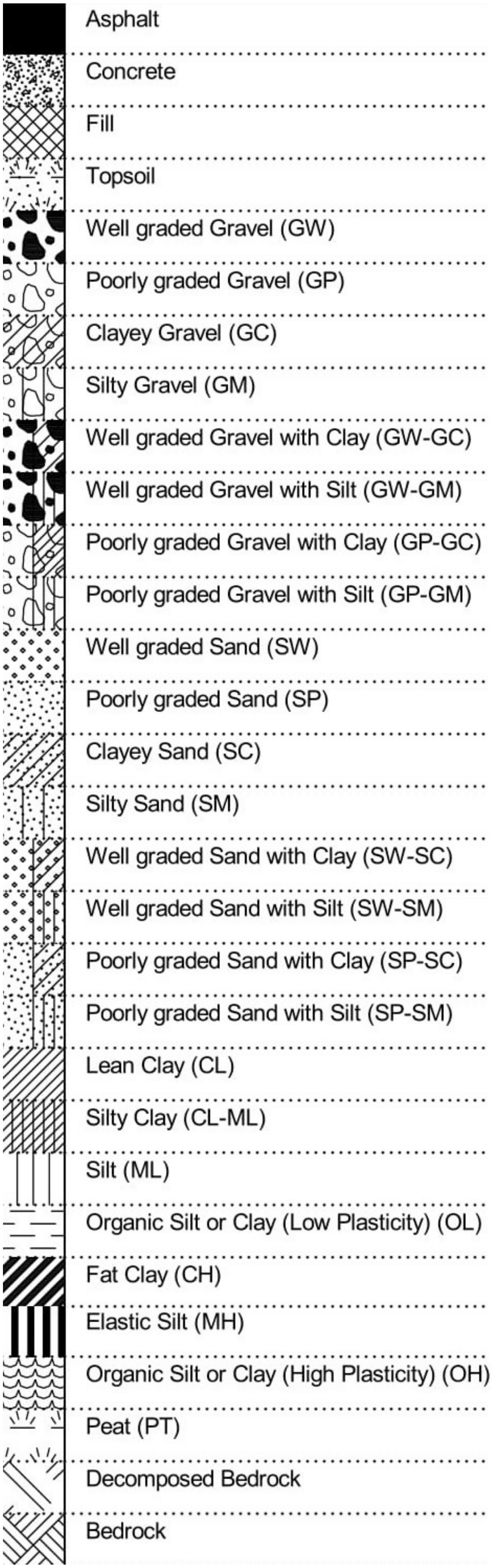
PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

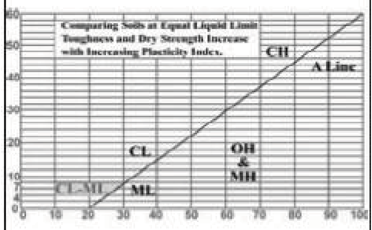
OC = Organic Content

LOG GRAPHICAL LEGEND



APPENDIX B

SOIL CLASSIFICATION TABLES

<table>
<tr><th colspan="3">MAJOR DIVISIONS</th><th>GROUP SYMBOLS</th><th>TYPICAL NAMES</th><th colspan="3">FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 3 IN. AND BASING FRACTIONS ON ESTIMATED WEIGHTS)</th><th>INFORMATION REQUIRED FOR DESCRIBING SOILS</th><th colspan="4">LABORATORY CLASSIFICATION CRITERIA</th></tr>
<tr><td>1</td><td colspan="2">2</td><td>3</td><td>4</td><td colspan="3">5</td><td>6</td><td colspan="4">7</td></tr>
<tr><td rowspan="16">Coarse-grained Soils
More than half of material is larger than No. 200 sieve size.
The No. 200 sieve size is about the smallest visible to the naked eye.
Fine-grained Soils
More than half of material is smaller than No. 200 sieve size.</td><td rowspan="8">Gravels
More than half of coarse fraction is larger than No. 4 sieve size.
Sands
More than half of coarse fraction is smaller than No .4 sieve size.
(For visual classification. the $^1/_4$-in. size may be used as equivalent to the No. 4 sieve size.)</td><td rowspan="2">Clean Gravels (Little or no fines)</td><td>GW</td><td>Well-graded gravels, gravel-sand mixture, little or no fines.</td><td colspan="3">Wide range in grain size and substantial amounts of all intermediate particle sizes.</td><td rowspan="2">For undisturbed soils add information on stratification, degree of compactness, cementation, moisture condition, and drainage characteristics.</td><td rowspan="17">Use grain-size curve in identifying the fractions as given under field identification.</td><td rowspan="8">Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fine (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows:
Less than 5% GW, GP, SW, SP,
More than 12% GM, GC, SM, SC.
5% to 12% Borderline cases requiring use of dual symbols.</td><td colspan="2">$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4
$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3</td></tr>
<tr><td>GP</td><td>Poorly graded gravels or gravel-sand mixture, little or no fines.</td><td colspan="3">Predominantly one size or a range of sizes with some intermediate sizes missing.</td><td colspan="2">Not meeting all gradation requirements for GW</td></tr>
<tr><td rowspan="2">Gravels with Fines (Appreciable amount of fines)</td><td>GM</td><td>Silty gravels, gravel and silt mixtures.</td><td colspan="3">Nonplastic fines or fines with low plasticity (for identification procedures see ML below).</td><td rowspan="3">Give typical name; indicate approximate percentages of sand and gravel, maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.</td><td>Atterberg limits below “A” line or P1 less than 4</td><td rowspan="2">Above “A” line with P1 between 4 and 7 are borderline cases requiring use of dual symbols.</td></tr>
<tr><td>GC</td><td>Clayey gravels, gravel and clay mixtures.</td><td colspan="3">Plastic fines
(for identification procedures see CL below).</td><td>Atterberg limits above “A” line with P1 greater than 7</td></tr>
<tr><td rowspan="2">Clean Sand (Little or no fines)</td><td>SW</td><td>Well-graded sands, gravelly sands, little or no fines.</td><td colspan="3">Wide range in grain size and substantial amounts of all intermediate particle sizes.</td><td colspan="2">$Cu = \frac{D_{60}}{D_{10}}$ Greater than 6
$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3</td></tr>
<tr><td>SP</td><td>Poorly graded sands or gravelly sands, little or no fines.</td><td colspan="3">Predominantly one size or a range of sizes with some intermediate sizes missing.</td><td rowspan="3">Example:
Silty sand, gravelly; about 20% hard, angular gravel particles $^1/_2$-in. maximum size; rounded and subangular sand grains, coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).</td><td colspan="2">Not meeting all gradation requirements for SW</td></tr>
<tr><td rowspan="2">Sands with Fines (Appreciable amount of fines)</td><td>SM</td><td>Silty sands, sand-silt mixtures.</td><td colspan="3">Nonplastic fines or fines with low plasticity (for identification procedures see ML below).</td><td>Atterberg limits above “A” line or P1 less than 4</td><td rowspan="2">Limits plotting in hatched zone with P1 between 4 and 7 are borderline cases requiring use of dual symbols.</td></tr>
<tr><td>SC</td><td>Clayey sands, sand-clay mixtures.</td><td colspan="3">Plastic fines
(for identification procedures see CL below).</td><td>Atterberg limits above “A” line with Pl greater than 7</td></tr>
<tr><td colspan="4" rowspan="2"></td><td colspan="3">Identification Procedure on Fraction Smaller than No. 40 Sieve Size.</td><td rowspan="2"></td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Dry Strength (Crushing Characteristics)</td><td>Dilatancy (Reaction to shaking)</td><td>Toughness (Consistency near PL)</td></tr>
<tr><td colspan="2" rowspan="2">Silts and Clays Liquid limit is less than 50</td><td>ML</td><td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.</td><td>None to slight</td><td>Quick to slow</td><td>None</td><td rowspan="2">For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions</td><td rowspan="7">Plasticity Index</td><td colspan="2" rowspan="7">LIQUID LIMIT PLASTICITY CHART
For laboratory classification of fine-grained soils
 </td></tr>
<tr><td>CL</td><td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.</td><td>Medium to high</td><td>None to very slow</td><td>Medium</td></tr>
<tr><td colspan="2" rowspan="4">Silts and Clays Liquid limit is greater than 50</td><td>OL</td><td>Organic silts and organic silty clays of low plasticity.</td><td>Slight to medium</td><td>Slow</td><td>Slight</td><td rowspan="3">Give typical name; indicate degree and character of plasticity; amount and maximum size of coarse grains; color in wet condition; odor, if any; local or geologic name and other pertinent descriptive information; and symbol in parentheses.</td></tr>
<tr><td>MH</td><td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.</td><td>Slight to medium</td><td>Slow to none</td><td>Slight to medium</td></tr>
<tr><td>CH</td><td>Inorganic clays of high plasticity, fat clays.</td><td>High to very high</td><td>None</td><td>High</td></tr>
<tr><td>OH</td><td>Organic clays of medium to high plasticity, organic silts.</td><td>Medium to high</td><td>None to very slow</td><td>Slight to medium</td><td rowspan="2">Example:
Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML)</td></tr>
<tr><td colspan="3">Highly Organic Soils</td><td>Pt</td><td>Peat and other highly organic soils.</td><td colspan="3">Readily identified by color, odor, spongy feel and frequently by fibrous texture</td></tr>
</table>

1. Boundary classifications: Soils possessing characteristics of two groups are designed by combinations of group symbols. For example GM-GC, well-graded gravel-sand mixture with clay binder.
2. All sieve sizes on this chart are U.S. standard.
3. Adopted by Corps of Engineers and Bureau of Reclamation, January 1952.

032058C

BURMISTER SOIL IDENTIFICATION METHOD

BURMISTER SOIL IDENTIFICATION METHOD

1. SOIL MATERIAL Composition, Gradation, and Plasticity Characteristics

a) Soil Components and Soil Fractions

Sieve	3"	1"	3/8"	No. 10 2 mm	No. 30	No. 60	No. 200 0.076 mm	0.02 mm
Granular Component Fractions	GRAVEL			SAND			SILT	
	coarse	medium	fine	coarse	medium	fine	coarse	fine
Clay Soil Components							CLAY-SOIL Defined and Named on a Plasticity Basis	

b) Identifying Terms for Granular Soils
Composition and Proportion Terms for Components

Component		Proportion Terms	Defining Range of Percentages
Principal Components- (all Uppercase)	GRAVEL, SAND, SILT		50% or more
Minor Components-	Gravel	and	35 to 50%
	Sand	some	20 to 35%
	Silt	little	10 to 20%
		trace	1 to 10%

Gradation Terms for Granular Soils		ORGANIC SOILS
coarse to fine	all fractions more than 10%	Plasticity Basis, as
coarse to medium	fine less than 10%	
medium to fine	coarse less than 10%	Organic SILT, H. PI
medium	coarse and fine less than 10%	
fine	coarse and medium less than 10%	Organic SILT, L. PI

PLUS or MINUS signs used to indicate upper or lower limits.

c) Identifying Terms for CLAY SOILS. Plasticity Basis for Combined Silt and Clay Components, Expressing the Relative Dominance of Clay

Overall Plasticity	Plasticity Index	Principal Component	Minor Component
Non-Plastic	0	SILT	Silt
Slight	1 to 5	Clayey SILT	Clayey Silt
Low	5 to 10	SILT & CLAY	Silt & Clay
Medium	10 to 20	CLAY & SILT	Clay & Silt
High	20 to 40	Silty CLAY	
Very High	more than 40	CLAY	

Example: Soil 60% coarse to fine Sand, 25% medium to fine Gravel, 15% Clayey Silt and color-brown.

Identification: Br. coarse to fine SAND, some medium to fine Gravel, little Clayey Silt.

References:
1) D. M. Burmister, "Principles and Techniques of Soil Identification" 29th Highway Research Board Proceedings, 1949.
2) "Identification and Classification of Soils – An appraisal and Statement of Principles", ASTM Special Technical Publication No. 113, 1951.

Field Classification of Soil Using the USCS

Apparent Density of Coarse-Grained Soils

SPT N-Value (corrected)	Apparent Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

Consistency of Fine-Grained Soils

SPT N-Value (uncorrected)	Consistency	Compressive Strength (ksf)	Results of Manual Manipulation
< 2	Very Soft	< 0.5	Specimen (height = twice the diameter) sags under its own weight; extrudes between fingers when squeezed
3 - 4	Soft	> 0.5 - 1.0	Speciment can be pinched in to between the thumb and forefinger; remolded by light finger pressure
5 - 8	Medium stiff	> 1.0 - 2.0	Can be imprinted easily with fingers; remolded by strong finger pressure
9 - 15	Stiff	> 2.0 - 4.0	Can be imprinted with considerable pressure from fingers or indented by thumbnail
16 - 30	Very stiff	> 4.0 - 8.0	Can be barely imprinted by pressure from the fingers or indented by thumbnail
> 30	Hard	> 8.0	Cannot be imprinted by fingers or difficult to indent by thumbnail

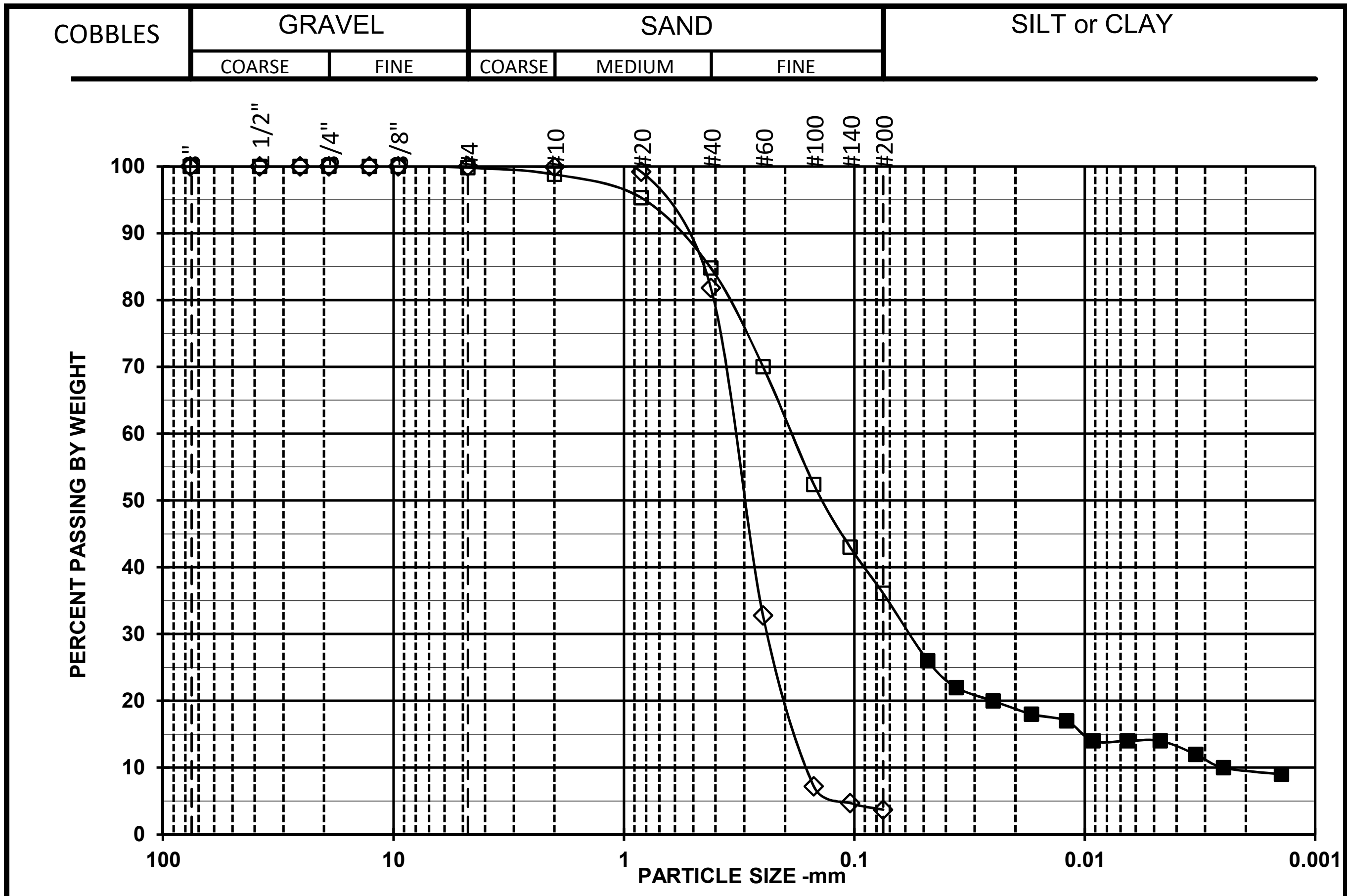
APPENDIX C

GEOTECHNICAL LABORATORY TESTING RESULTS

Matrix New World Engineering, P.C. #20-1052-002
NJDCA MAP - 6 Sylvan Road
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
B-1	S-3	4-6	22.1				SC	36.1	10	
B-1	S-8	20-22	26.8				ML	58.6		
B-1	S-9	25-27	17.3	19	18	1	ML			
B-2	S-3B	4-6	27.7	42	18	24	CL			
B-2	S-8	20-22	23.9				SP	3.7		
B-2	S-9	25-27	17.9				ML	79.3		

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

Symbol	□	◇	○
Boring	B-1	B-2	
Sample	S-3	S-8	
Depth	4-6	20-22	
% +3"	0	0	
% Gravel	0.2	0	
% SAND	63.7	96.3	
%C SAND	1	0.1	
%M SAND	14	18.1	
%F SAND	48.7	78.1	
% FINES	36.1	3.7	
D$_{100}$ (mm)	9.53	4.75	
D$_{60}$ (mm)	0.187	0.332	
D$_{30}$ (mm)	0.057	0.24	
D$_{10}$ (mm)	0.003	0.16	
Cc	6.9	1.1	
Cu	74.8	2.1	

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	100.0	100.0	
1/2"	100.0	100.0	
3/8"	100.0	100.0	
#4	99.8	100.0	
#10	98.8	99.9	
#20	95.3	99.2	
#40	84.8	81.8	
#60	70.0	32.8	
#100	52.4	7.2	
#140	43.0	4.7	
#200	36.1	3.7	
5μ m	14		
2μ m	10		
1μ m	8		

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	22.1				SC		Brown, Clayey sand	06/25/21
◇	23.9				SP		Brown, Poorly graded sand	06/29/21
○								

Matrix New World Engineering, P.C. #20-1052-002

TerraSense, LLC #7783-21028

NJDCA MAP
6 Sylvan Road

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

APPENDIX D

FEMA NFIP ELEVATION CERTIFICATE

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB No. 1660-0008
Expiration Date: November 30, 2022

ELEVATION CERTIFICATE

Important: Follow the instructions on pages 1–9.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

A1. Building Owner's Name
[redacted]

Policy Number:

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
6 Sylvan Road

Company NAIC Number:

City	State	ZIP Code
Town of Fairfield	New Jersey	07004-1112

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Block 5402, Lot 9

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) Residential

A5. Latitude/Longitude: Lat. N40°52'49" Long. W74°19'17" Horizontal Datum: ☐ NAD 1927 ☒ NAD 1983

A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.

A7. Building Diagram Number 2A

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s) 1485.00 sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A8.b ______ sq in

d) Engineered flood openings? ☐ Yes ☒ No

A9. For a building with an attached garage:

a) Square footage of attached garage 336.00 sq ft

b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A9.b 0.00 sq in

d) Engineered flood openings? ☐ Yes ☒ No

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number	B2. County Name	B3. State
Fairfield, Township of	Essex	New Jersey

B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/ Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth)
34013C0014	G	04-03-2020	04-03-2020	AE	174' (NAVD88')

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9:
☐ FIS Profile ☒ FIRM ☐ Community Determined ☐ Other/Source: ______

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source: ______

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No

Designation Date: ______ ☐ CBRS ☐ OPA

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.

FOR INSURANCE COMPANY USE

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
6 Sylvan Road

Policy Number:

City
Town of Fairfield

State
New Jersey

ZIP Code
07004-1112

Company NAIC Number

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☒ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO. Complete Items C2.a–h below according to the building diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: CORS Network NGS Monuments Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.

☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

Datum used for building elevations must be the same as that used for the BFE.

Check the measurement used.

a) Top of bottom floor (including basement, crawlspace, or enclosure floor)	164.3	☒ feet	☐ meters
b) Top of the next higher floor	168.8	☒ feet	☐ meters
c) Bottom of the lowest horizontal structural member (V Zones only)	N/A	☐ feet	☐ meters
d) Attached garage (top of slab)	168.8	☒ feet	☐ meters
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	168.8	☒ feet	☐ meters
f) Lowest adjacent (finished) grade next to building (LAG)	168.4	☒ feet	☐ meters
g) Highest adjacent (finished) grade next to building (HAG)	169.3	☒ feet	☐ meters
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	168.4	☒ feet	☐ meters

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☒ Yes ☐ No ☐ Check here if attachments.

Certifier's Name
Frank J. Barlowski

License Number
24GS03973500

Title
Professional Land Surveyor

Company Name
Matrix New World Engineering, Land Surveying and Architecture, P.C.

Address
442 State Route 35, Second Floor

City
Eatontown

State
New Jersey

ZIP Code
07724

Place Seal Here

Signature

Date

Telephone

Ext.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including type of equipment and location, per C2(e), if applicable)
C2(e): Base of hot water heater and washer/dryer located in room at the back of garage floor Elev=168.8'(NAVD88)

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.

FOR INSURANCE COMPANY USE

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
6 Sylvan Road

Policy Number:

City: Town of Fairfield
State: New Jersey
ZIP Code: 07004-1112

Company NAIC Number

SECTION E – BUILDING ELEVATION INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO AND ZONE A (WITHOUT BFE)

For Zones AO and A (without BFE), complete Items E1–E5. If the Certificate is intended to support a LOMA or LOMR-F request, complete Sections A, B,and C. For Items E1–E4, use natural grade, if available. Check the measurement used. In Puerto Rico only, enter meters.

E1. Provide elevation information for the following and check the appropriate boxes to show whether the elevation is above or below the highest adjacent grade (HAG) and the lowest adjacent grade (LAG).

a) Top of bottom floor (including basement, crawlspace, or enclosure) is ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is ______ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (elevation C2.b in the diagrams) of the building is ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown. The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without a FEMA-issued or community-issued BFE) or Zone AO must sign here. The statements in Sections A, B, and E are correct to the best of my knowledge.

Property Owner or Owner's Authorized Representative's Name

Address | City | State | ZIP Code

Signature | Date | Telephone

Comments

☐ Check here if attachments.

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.

FOR INSURANCE COMPANY USE

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
6 Sylvan Road

Policy Number:

City	State	ZIP Code
Town of Fairfield	New Jersey	07004-1112

Company NAIC Number

SECTION G – COMMUNITY INFORMATION (OPTIONAL)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Sections A, B, C (or E), and G of this Elevation Certificate. Complete the applicable item(s) and sign below. Check the measurement used in Items G8–G10. In Puerto Rico only, enter meters.

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2. ☐ A community official completed Section E for a building located in Zone A (without a FEMA-issued or community-issued BFE) or Zone AO.

G3. ☐ The following information (Items G4–G10) is provided for community floodplain management purposes.

G4. Permit Number	G5. Date Permit Issued	G6. Date Certificate of Compliance/Occupancy Issued

G7. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G8. Elevation of as-built lowest floor (including basement) of the building: ____________ ☐ feet ☐ meters Datum ________

G9. BFE or (in Zone AO) depth of flooding at the building site: ____________ ☐ feet ☐ meters Datum ________

G10. Community's design flood elevation: ____________ ☐ feet ☐ meters Datum ________

Local Official's Name	Title

Community Name	Telephone

Signature	Date

Comments (including type of equipment and location, per C2(e), if applicable)

☐ Check here if attachments.

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.	FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 6 Sylvan Road	Policy Number:
City: Town of Fairfield — State: New Jersey — ZIP Code: 07004-1112	Company NAIC Number

If using the Elevation Certificate to obtain NFIP flood insurance, affix at least 2 building photographs below according to the instructions for Item A6. Identify all photographs with date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8. If submitting more photographs than will fit on this page, use the Continuation Page.

Photo One

Photo One Caption Front View

Clear Photo One

Photo Two

Photo Two Caption Rear View

Clear Photo Two

ELEVATION CERTIFICATE

BUILDING PHOTOGRAPHS

Continuation Page

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 6 Sylvan Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

If submitting more photographs than will fit on the preceding page, affix the additional photographs below. Identify all photographs with: date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8.

Photo Three

Photo Three Caption Right Side View

Clear Photo Three

Photo Four

Photo Four Caption Left Side View

Clear Photo Four