CIVIL ENGINEERING
ENVIRONMENTAL
SURVEYING
LANDSCAPE ARCHITECTURE
GEOTECHNICAL

KARSTIC GEOLOGY INVESTIGATION REPORT

Clinton Moebus 34, LLC
65 ½ Center Street
Block 14 Lot 32
Town of Clinton,
Hunterdon County,
New Jersey

Prepared For:
AMBE Holdings at Clinton, LLC
3 Meha Court
Manalapan, NJ 07726

March 5, 2020

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Professional Engineer
License No. 24GEB04258200

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

As authorized by AMBE Holdings at Clinton, LLC, Engineering & Land Planning Associates, Inc. (E&LP) has completed a Phase I Geological Investigation on subsurface conditions at Block 14, Lot 32 ("the Site"), a property within the Carbonate Area District of the Town of Clinton. This report is a summary of the karst terrain conditions of the referenced property based on previous field evaluation. The property is approximately 30-acres.

This report, prepared by a New Jersey Licensed Professional Engineer, provides the factual account of the subsurface conditions based on observations made during the completion of soil borings and laboratory test results.

Since the property is underlain by carbonate bedrock, precautions should be taken when developing the land. The property had no visible karst activity at the time of field inspection. Activity appears limited for this part of the Allentown formation. The fill that was placed on the property does not reveal any common signs of karstic distress. Overall, the subsurface conditions should not preclude nor restrict the development of this property.

1.1 Project Description

The project proposes 56 apartment units and approximately 30,500 SF of commercial space at the site. Block 14 Lot 32 has been previously approved for a three-lot subdivision. The proposed Block 14 Lot 32.01 consists of 313,695 square feet (7.201 acres) and is intended for commercial use. Block 14 Lot 32.02 consists of 521,021 square feet (11.961 acres) and is intended for residential use. Block 14 Lot 32 now consists of 387,777 square feet (8.902 acres) and will be conserved land dedicated to the Town as open space.

1.2 Site Description

The Site, is located at 65 ½ Center Street in the Town of Clinton, Hunterdon County, New Jersey, as shown in Figure 2. The Site is approximately 30-acres and currently consists of one unoccupied single-family home with a shed in otherwise undeveloped agricultural lands with wooded areas around the property. Route 31 is directly north of the property and the South Branch of the Raritan River and associated wetlands border the west and south-west edges of the property. Residential neighborhoods are to the south and east of the property. The majority of the property consists of agricultural fields with limited to no development over the last thirty years.

1.3 Physiographic & Topographic Setting

The Site rests within the Reading Prong Physiographic Province. This province is heavily folded and faulted, resulting in complex geological conditions. The site gently slopes downward to the west/southwest toward the South Branch of the Raritan River. An extensive thick fill has been placed across most of the property, which has altered the original slopes and drainage patterns. See Appendices A and B, Soil Logs.

2. PHASE I GEOLOGICAL INVESTIGATION

As required by the Town's Carbonate Area District Ordinance, the Phase I Geological Investigation includes geologic research, site mapping of karst features, review of aerial photography, review of historical activity and existing activity relevant to sinkhole prone conditions. E&LP performed a subsurface field investigation that consisted of ten (10) hollow stem auger borings with split spoon sampling and a review of mapped site geology on June 16, 2009. Fifteen (15) more soil pits were sampled on February 17, 2020 to analyze subsurface conditions. The following provides a detailed summary of this work.

2.1 Field Observation

On June 16, 2009 Engineering & Land Planning Associates, Inc. conducted soil borings using conventional hollow stem augers and split spoon sampling to a maximum termination depth of 11.7 feet below existing grades. Bedrock was encountered in seven of the ten test locations. Neither groundwater nor soil mottling was encountered in the test pits.

On April 17, 2020 Engineering & Land Planning Associates, Inc. conducted fifteen test pits to confirm the findings of the 2009 soil sampling. Bedrock was encountered in all of the test pits, excluding SL-2 and SL-3, shown on Figure 6. Neither groundwater nor soil mottling was encountered in the test pits, excluding SL-2, SL-3, and SL-6. SL-2 contained many signs of mottling at a depth of 95". SL-3 contained no mottling but evidenced seepage at a depth of 123". SL-6 contained common signs of mottling and evidence of seepage at a depth of 96".

No karstic terrane features were visible at the surface at the times of field reconnaissance. No solution activity or other karstic characteristics were observed. Bedding and fracturing were very prevalent and distinct. The majority of the site is underlain by shallow bedrock at around 3'. The encountered bedrock was quite variable in its lithology with a shaley prevalence, which is consistent with the lack of observed karstic features. The fill material has an extensive amount of clayey material and that combined with the general moderate slope has minimized the infiltration. That condition should be continued. This property appeared very stable at the times of field reconnaissance.

The northern and eastern portions of the site are underlain by fill dirt consistent with the area soils. The central portion of the property is a valley with predominantly clay soils and shall limestone bedrock. The ridge on the southern portion of the site likewise consists of clay soils underlain by shallow bedrock.

Other than the fill soils evidenced on the northern portion of the site which were gravelly, the majority of the native site soils consisted of clays which are of very low permeability and likely not suitable for infiltration. As seen in the most recent soil logs (Appendix B), it is recommended that stormwater management systems be located in the vicinity of SL-2 and SL-3.

2.2 Geology & Rock Lithology

The bedrock geology beneath the site is known as Allentown Dolomite and Lower Beekmantown Group, which are both part of the Kittatinny Supergroup, aging to the Lower Ordovician and Upper Cambrian. The Allentown Dolomite bedrock beneath the Site has been folded, refolded, and thrust faulted. These deformation systems have resulted in an apparent regional bedding dip of about 70 degrees to 80 degrees to the west-northwest with a bedding strike of approximately north south to north-northeast, see Appendix A. There is a single thrust fault plane bisect to the property, see Figure 7. However, it appears to be refolded and therefore should not create any unusual geotechnical conditions. There are no observed rock outcrops naturally existing on the property.

In this part of New Jersey, this formation (Allentown Dolomite) is medium to light gray very thin to thick bedded dolomite with minor orthoquartzite and shale beds (Drake et.al., 1996). Bedding surfaces and some fractures display dissolution surfaces but the degree and extent do not appear wide spread. Karstic terrane characteristics are commonly pinnacled and troughed because of the variable lithologies and weathering variability. However, the orthoquartzite and shale beds do reduce the scale and extend of the potential karstic cavities.

2.3 Aerial Photography Analysis

Numerous stereo pairs from the USGS & USDA photo archive in the Library were studied for historical karst terrain features. Limited Karst activity can be observed from aerial photography in the surrounding properties. The base photo for Figure 8 is a 2002 USGS NAPP color infra-red (CIR). EpiKarst features are very distinct on CIR, due to the surface to subsurface temperature differentials. The actual subject property has very few epikarst features (closed depressions) and most of those are phantom features manifested on the surface through the fill.

2.4 Findings and Conclusions

The karstic geological setting described above is one of limited risk to for residential or commercial property development. In comparison to other karstic terrains within the region, this area is very limited in the sinkhole surface manifestations and therefore lower risk to construction activities. This particular rock formation, in part of Pennsylvania and New Jersey, is usually very karstic with open throats and collapsed sinks (dolines) visible. The dolomitic change (More Mg in the $CaCO3$ in the formula) is the lithology, the quartz content and the shale beds reduce the dissolution potential of the bedrock. Care will be required during regrading of these areas. Proof rolling, as well as other remedial techniques and other rehabilitation methods can be employed to alleviate any activity. Caution should always be observed when developing the design of the drainage systems these types of areas, but given the wide spread karstic terrain in the region and engineering controls available the development of this property in this manner would not be precluded by the subsurface conditions of this property (Sowers, 1996). These findings can be confirmed or validated with a modified drilling plan for the building foundation design. Either appropriately placed borings or a few additional locations can confirm the precise condition of the subsurface.

3. RECOMMENDATIONS

As mentioned above, the epikarst depressions (sinks or dolines) from the photography were not field observed are not considered severe. The foundation investigation's placement of boring can aid in confirming there are no unforeseen subsurface conditions. These may be easily remedied with construction proofing protocols. This is always prudent and is considered standard practice within the region (Sowers, 1996). The boring plan may be modified as mentioned above. If significant subsurface voids are found, a geophysical investigation or additional borings may be warranted.

3.1 Karst Conditions

Proof Rolling: Use a 30-50 ton vibrating roller (typical compactor) Conduct proof rolling (3-5 passes) across the subgrade in sensitive areas (determined by the construction engineer or his representative). This will collapse any minor soil piping openings and the surface construction will reduce or eliminate infiltration.

3.2 Precautionary Options

Foundation Construction

If unforeseen soil voids, soft pockets, or bedrock voids are encountered during construction a geologist and the foundation engineer should evaluate the conditions. The following provides optional remedial actions. Performance specifications can be created to eliminate or reduce the soil migration into the karstic rock and restore the subgrade integrity.

1. Open (dental) excavation & backfill (throat and bridge opening)
    - **a.** Aggregate backfill, stone plugs
    - **b.** Lean concrete backfill, sand mortar plugs
2. Grouting (good option in this application)
    - **a.** Compaction
    - **b.** Fill aggregate compaction
    - **c.** Chemical (not applicable to this karstic or soils morphology)

3.3 Drainage Control Options

In karstic conditions, even minor conditions the reduction of infiltration is recommended (Ralston et. al., 1999). The following provides avoidance options where activity is encountered during construction.

1. Redirect the flow to the lease active karst areas, if possible.
2. Reduce single point of contact flow.
3. Minimize infiltration in active or suspected areas.

Stormwater control options:

1. Synthetically line the basin and swales.
2. Use a clay/bentonite liner to line the basin and swales.
3. Pipe the flow with watertight systems.
4. Concrete line the basin and swales.

STATEMENT OF LIMITATIONS

The recommendations contained in this report are recommendations, based upon subsurface data collected from the site investigation. If conditions arise that differ from those that are specifically stated herein, Engineering & Land Planning Associates, Inc. (E&LP) should be notified immediately, so that our recommendations can be reviewed and revised, if necessary.

This report has been prepared by E&LP for AMBE Holdings at Clinton, LLC to be used solely by AMBE Holdings at Clinton, LLC in the evaluation and performance of the proposed work related to the Site in the Town of Clinton, New Jersey. The report has not been prepared for use by other parties and may not necessarily contain sufficient information for the purposes of other parties or other uses. Any undisclosed and/or unpermitted alternate use shall be at that party's own risk and without liability to E&LP.

This geotechnical study did not include investigation or evaluation of any environmental issues, such as wetlands or hazardous/toxic materials on, below or in the vicinity of the subject property.

In preparing this report, E&LP relied on and presumed accurate certain information (or the absence thereof) about the site and adjacent properties provided by governmental officials and agencies, the client, other consultants, and others identified herein. Except as otherwise stated, E&LP has not attempted to verify the accuracy or completeness of any such information. E&LP derived the data in this report primarily from visual inspections, examination of records in the public domain, and a limited number of tests where we were granted access. The passage of time, manifestation of latent conditions, or occurrence of future events may require further exploration at the site; analysis of the data; and reevaluation of the findings, observations, and conclusions expressed in the report.

Our professional geotechnical engineering services for this project have been performed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No warranty or guarantee, whether express or implied, is made with respect to the data reported or findings, observations, and conclusions expressed in this report. Further, such data, findings, observations, and conclusions are based solely on-site conditions in existence at the time of investigation.

The data reported and the findings, observations, and conclusions expressed in the report are limited by the scope of services, including the extent of subsurface exploration and other tests. The scope of services was defined by the requests of the client, the time and budgetary constraints imposed by the client, and the availability of access to the site. This report has been prepared on behalf of and for the exclusive use of the client and is subject to and issued in connection with the agreement and the provisions thereof.

E&LP is not responsible for any claims, damages or liability associated with interpretation of subsurface data. The recommendations given in this report are unique to the locations of the proposed development on the property and are not transferable to other areas not specifically stated above.

REFERENCES

Bedrock Geologic Map of New Jersey, NJDEP Division of Water Supply and Geoscience, 2014.

Kribbs, Gary M. B. P.G, Preliminary Karstic Geology Evaluation Report, AEON Geoscience, Inc. Environmental & Geological Consulting, June 25, 2009.

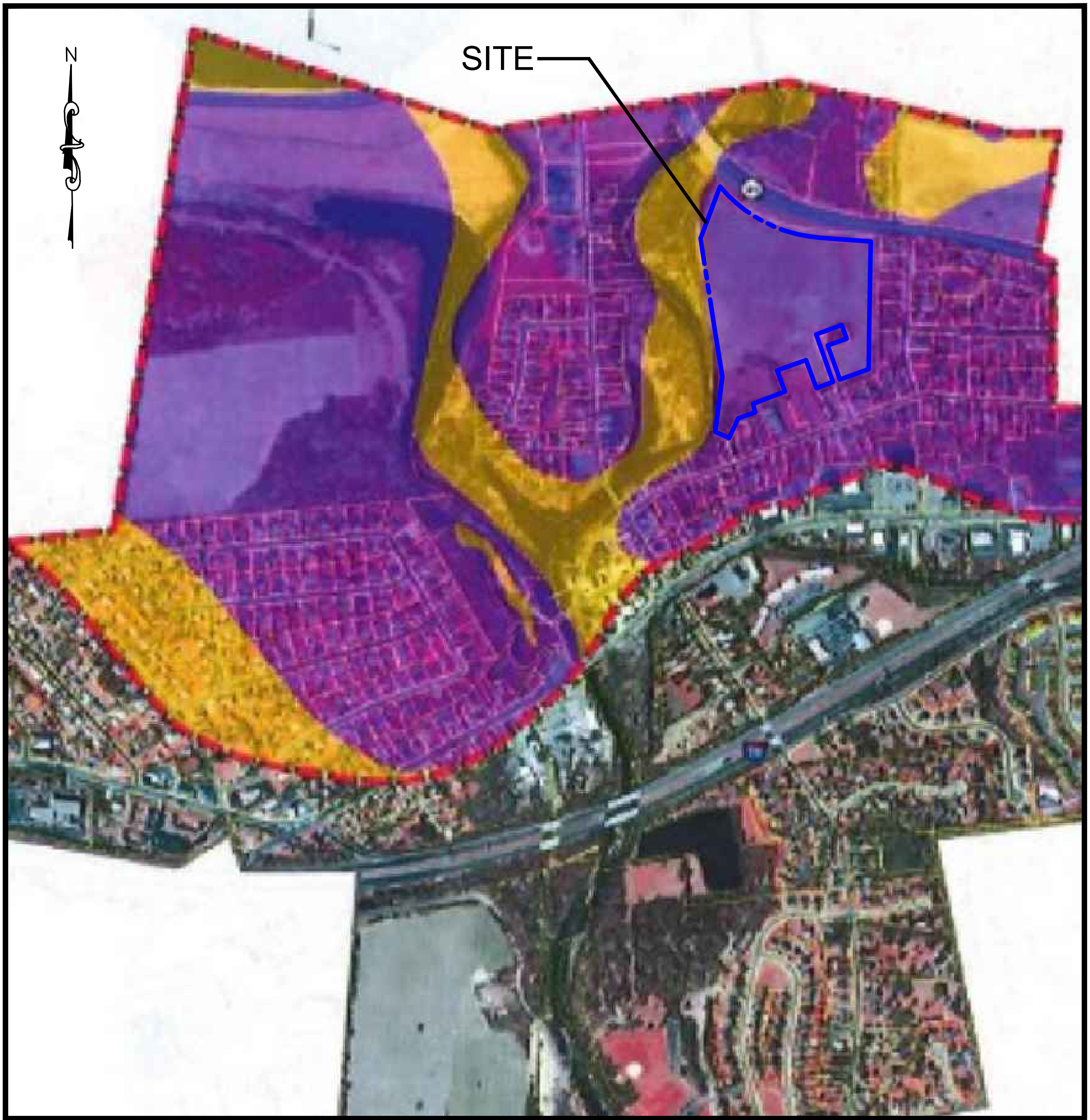
Ralston, M.R., Oweis, I.S., 1999, Geotechnical Engineering Considerations for Stormwater Management in Karst Terrain, Pennsylvania Stormwater Management Symposium, Villanova University, Villanova, Pennsylvania. October 20-21, 1999.

Sowers, G. F. 1996, Building on Sinkholes, ASCE Press American Society of Civil Engineers, New York, New York, pp. 191.

USGS 2019, Google Earth Imagery 2020

Teraserver web site 2009 Aerials 2001, 2002,2004,2006.

FIGURES



LEGEND:

🟪 CARBONATE ROCK DISTRICT

🟧 CARBONATE DRAINAGE AREA

– – – CARBONATE AREA DISTRICT

1,000 0 1,000

SCALE 1" = 1,000 FT

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140 WEST MAIN STREET CLINTON TOWNSHIP, NJ 08829
(908) 238-0544 FAX: (908)238-9572
C.O.A. #: 24GA28021500

A PROFESSIONAL ASSOCIATION

TITLE:

CARBONATE AREA DISTRICT MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE: 1"=1,000'

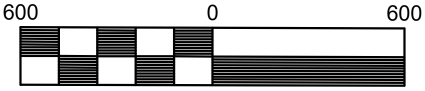
DATE: 2/26/2020

FILENAME: FIGURES.DWG

PROJECT NO.: 8144

DRAWN BY: AAP

SHEET NO.: 1



SCALE 1" = 600 FT

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C.O.A. #: 24GA28021500

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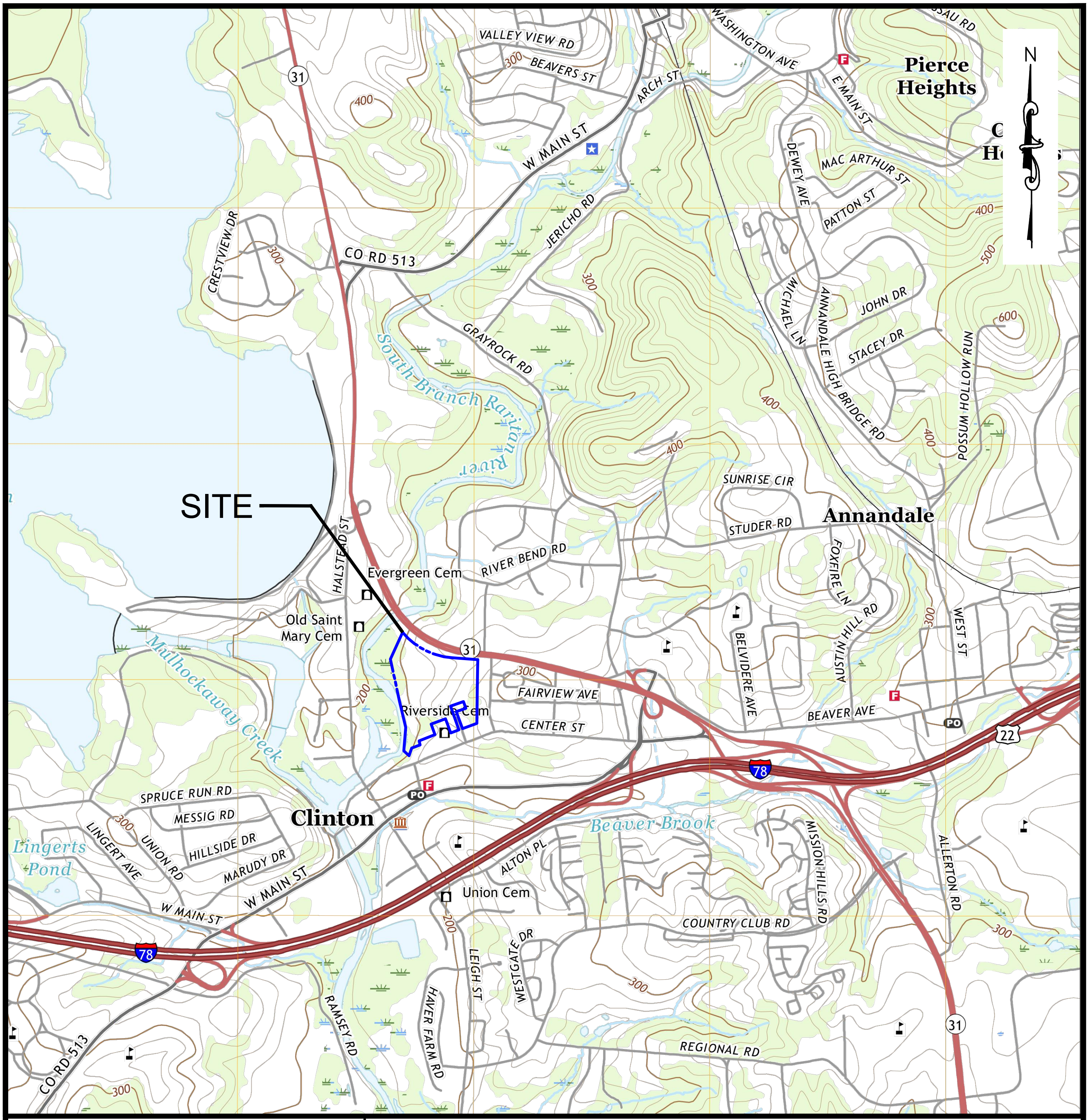
TITLE:

AERIAL MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE:	1"=600'	PROJECT NO.:	8144
DATE:	2/26/2020	DRAWN BY:	AAP
FILENAME:	FIGURES.DWG	SHEET NO.:	2



2,000 0 2,000

SCALE 1" = 2,000 FT

HIGH BRIDGE QUADRANGLE 2019

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C.O.A. #: 24GA28021500

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TITLE:

USGS MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE:	1"=2,000'	PROJECT NO.:	8144
DATE:	2/26/2020	DRAWN BY:	AAP
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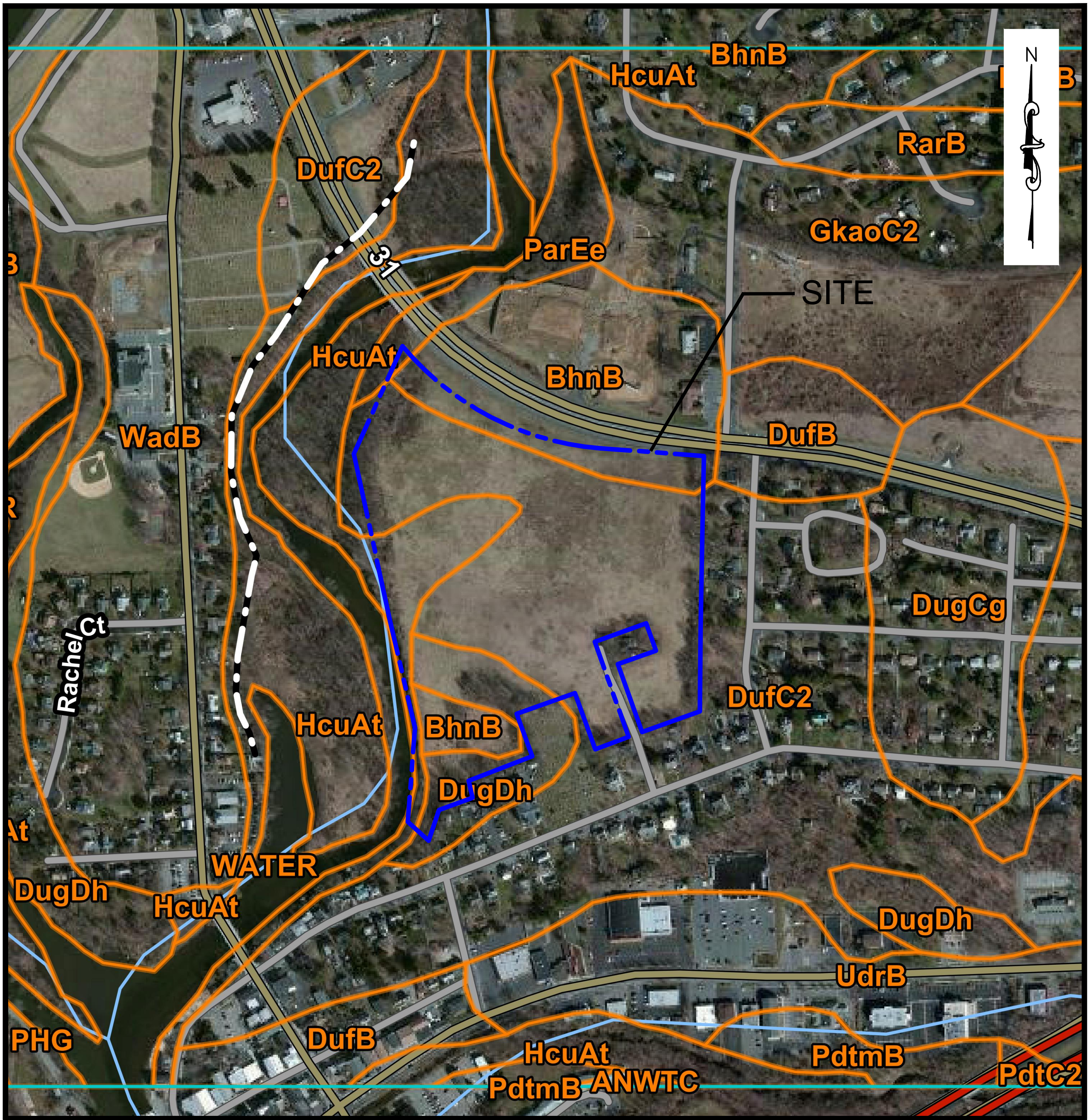

SOILS

BhnB: BIRDSBORO SILT LOAM,
2 TO 6 PERCENT SLOPES

DugDh: DUFFIELD SILT LAOM,
12 TO 18 PERCENT SLOPES, VERY ROCKY

DufC2: DUFFIELD SILT LOAM,
6 TO 12 PERCENT SLOPES, ERODED

HcuAt: HATBORO-CODORUS COMPLEX
0 TO 3 PERCENT SLOPES, FREQUENTLY FLOODED

ParEe: PARKER COBBLY LOAM,
18 TO 40 PERCENT SLOPES, EXTREMELY STONY

500 0 500

SCALE 1" = 500 FT

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C.O.A. #: 24GA28021500
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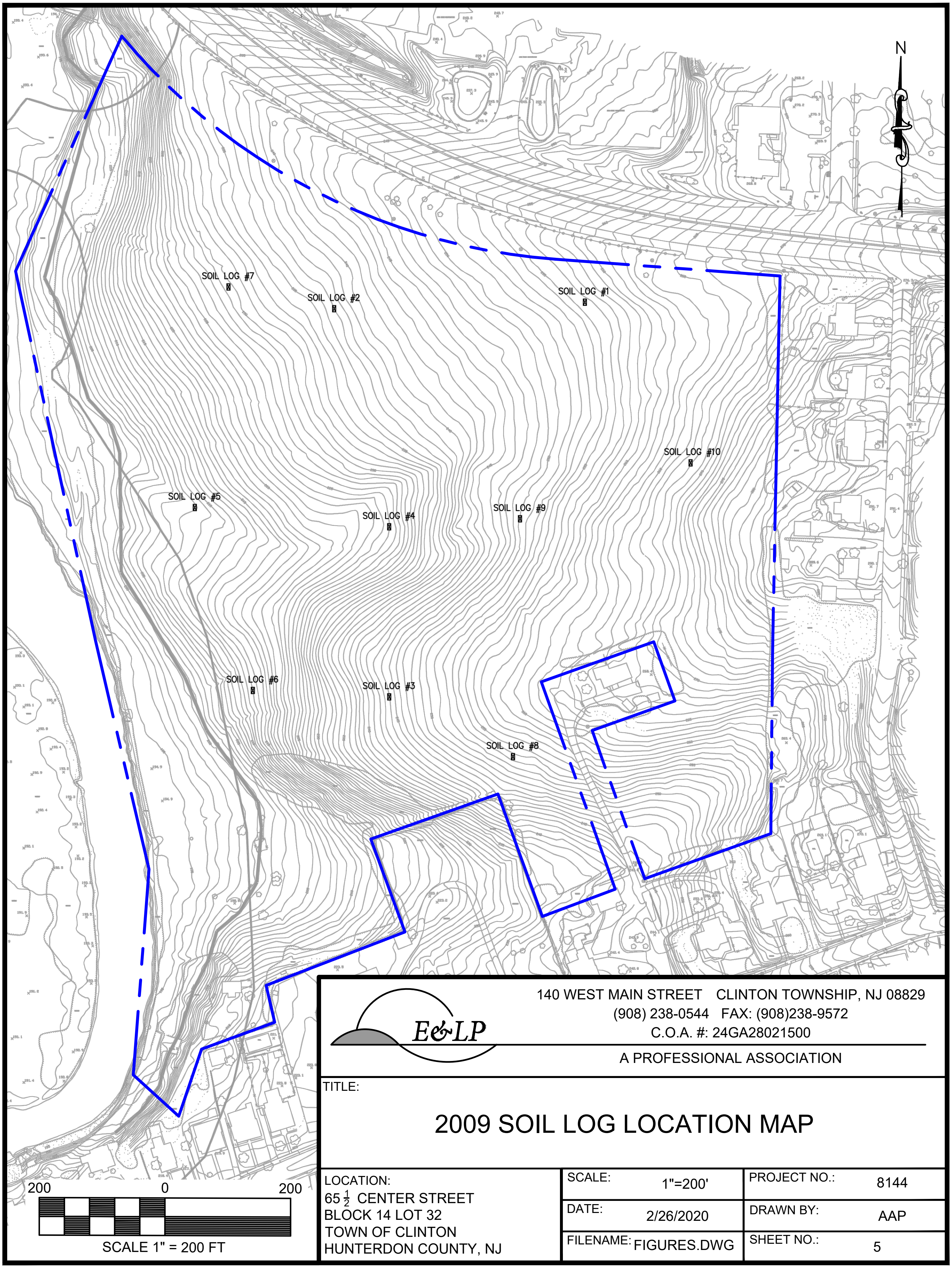
TITLE:

USDA WEB SOIL SURVEY MAP

LOCATION:
65 ½ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE: 1"=500'
DATE: 2/26/2020
FILENAME: FIGURES.DWG
PROJECT NO.: 8144
DRAWN BY: AAP
SHEET NO.: 4



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C.O.A. #: 24GA28021500
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TITLE:

2009 SOIL LOG LOCATION MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE:	1"=200'	PROJECT NO.:	8144
DATE:	2/26/2020	DRAWN BY:	AAP
FILENAME:	FIGURES.DWG	SHEET NO.:	5

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C.O.A. #: 24GA28021500
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TITLE:

2020 SOIL LOG LOCATION MAP

LOCATION:
$65\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE:	1"=200'	PROJECT NO.:	8144
DATE:	2/26/2020	DRAWN BY:	AAP
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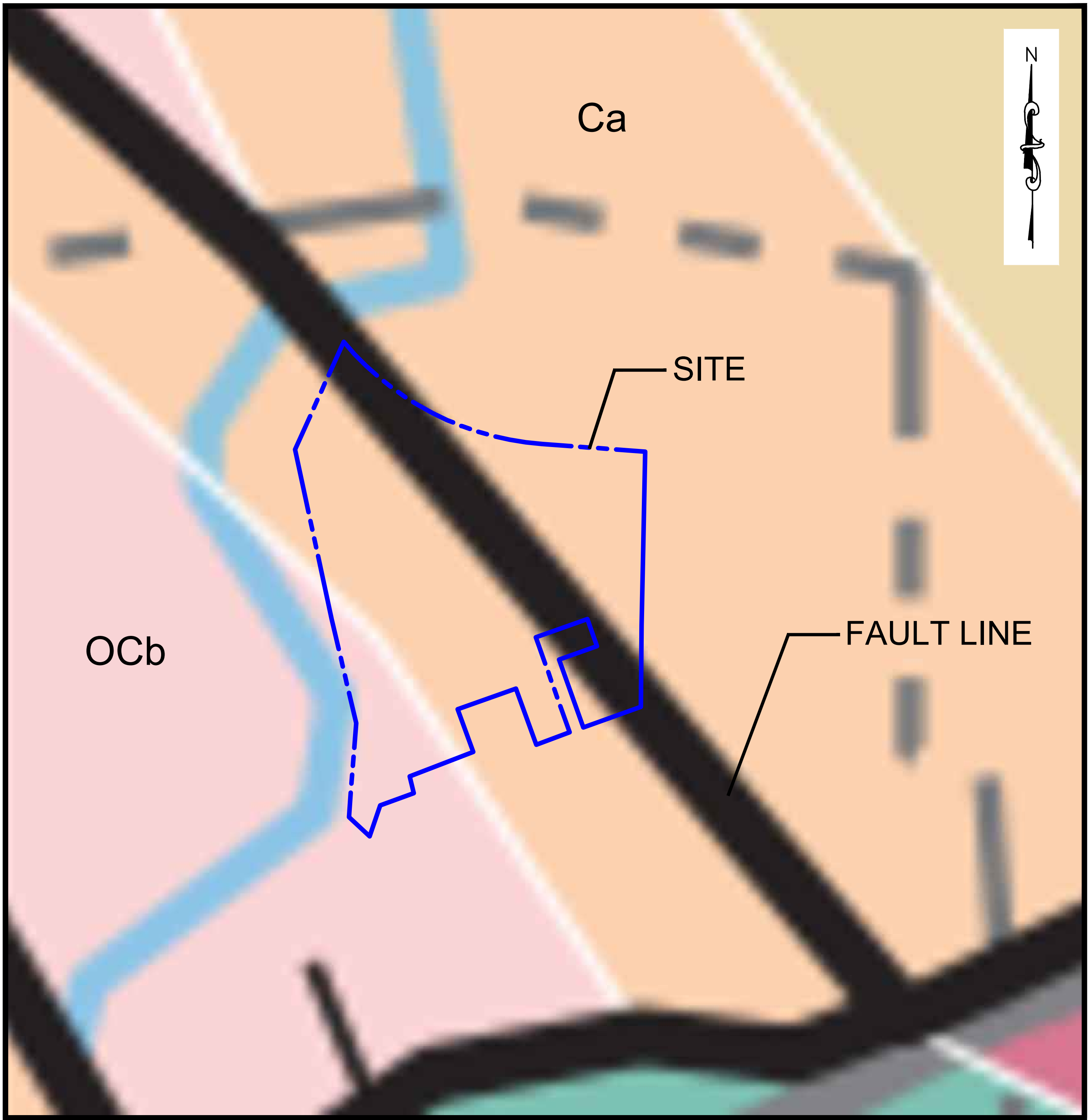

LEGEND:

OCb: BEEKMANTOWN GROUP

Ca: ALLENTOWN DOLOMITE

600 0 600

SCALE 1" = 600 FT

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C.O.A. #: 24GA28021500
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TITLE:

BEDROCK GEOLOGY MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE:	1"=600'	PROJECT NO.:	8144
DATE:	2/26/2020	DRAWN BY:	AAP
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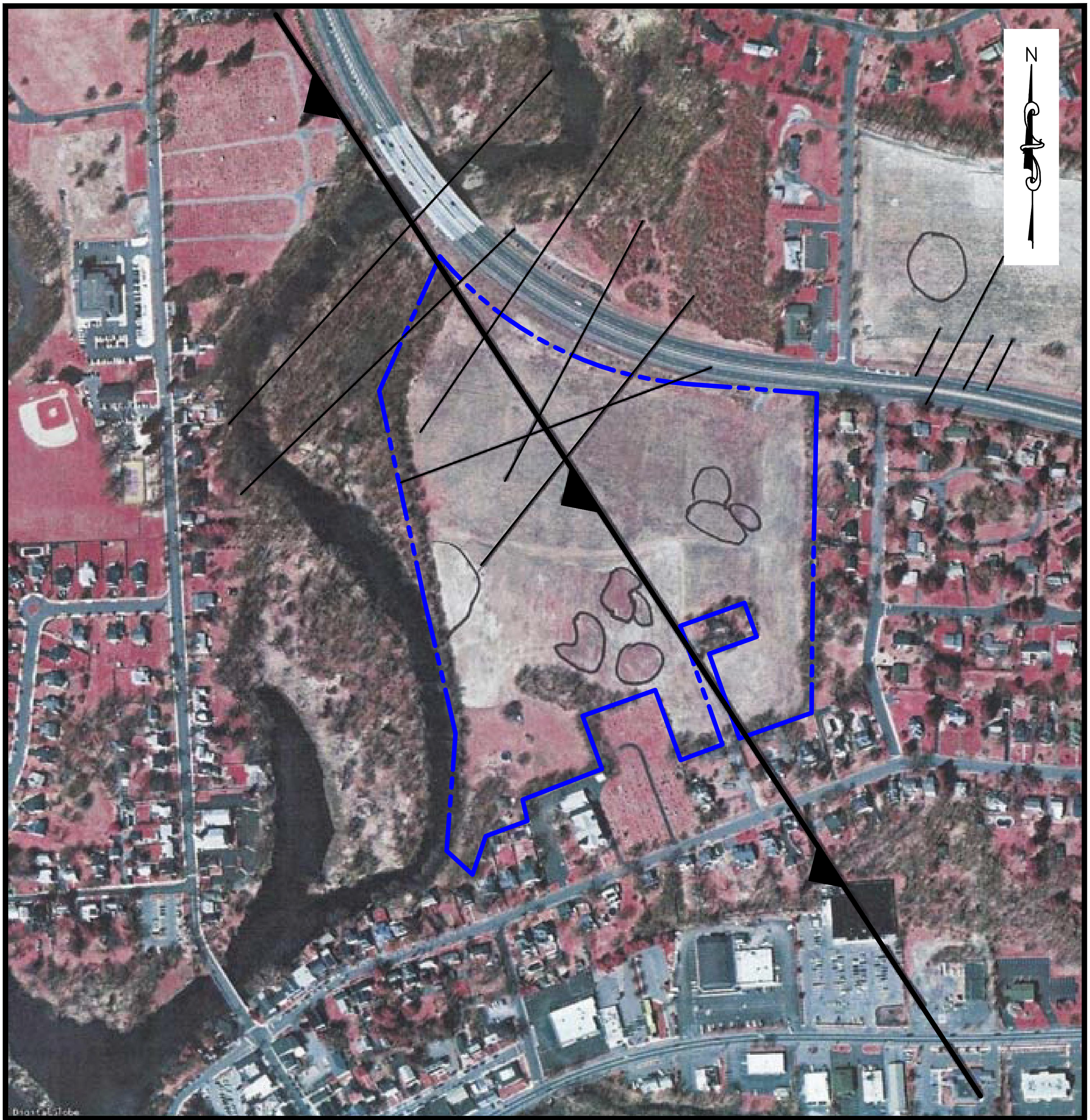

LEGEND:

— FRACTURE TRACE

○ SINKHOLE OR DOLINE PHANTOM

▼ THRUST FAULT (ARROWS IN DIRECTION OF FAULT)

- - - PROPERTY LINE

400 0 400

SCALE 1" = 400 FT

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TITLE:

KARSTIC FEATURE MAP

LOCATION:
65 $\frac{1}{2}$ CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY, NJ

SCALE: 1"=400'

DATE: 2/26/2020

FILENAME: FIGURES.DWG

PROJECT NO.: 8144

DRAWN BY: AAP

SHEET NO.: 8

APPENDIX A: JUNE 16, 2009 SOIL LOGS

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-1
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil; Clay Loam; 7.5 YR 6/4; 5% Gravel; SAB; Moist; Friable	No mottling or evidence of groundwater; Fill dirt	0.0
0.5							0.5
1.0							1.0
1.5							1.5
2.0							2.0
2.5					Clay; 7.5 YR 4/3; 10% Gravel; Platy; Moist; Friable	No mottling or evidence of groundwater; Fill dirt	2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0					Sandy Loam; 7.5 YR 4/6; 30% Gravel, 20% Cobbles, 10% Stone SAB; Dry; Loose	No mottling or evidence of groundwater; Fill dirt	6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0					Silty Clay; 7.5 YR 6/2; 40% Gravel, 30% Cobbles, 20% Stone SAB; Moist; Friable	No mottling or evidence of groundwater; Fill dirt	10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-2
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0 1.5					10" Topsoil; Clay Loam; 7.5 YR 4/4; 20% Gravel; Platy; Moist; Friable	No mottling or evidence of groundwater; Fill dirt	0.0 0.5 1.0 1.5
2.0 2.5 3.0					Sandy Loam; 7.5 YR 6/4; 30% Gravel, 25% Cobbles, 25% Stone SAB; Dry; Loose	No mottling or evidence of groundwater; Fill dirt	2.0 2.5 3.0
3.5 4.0 4.5 5.0					Clay; 7.5 YR 5/3; 60% Gravel, 20% Cobbles, 10% Stone Platy; Moist; Friable	No mottling or evidence of groundwater, Fill dirt	3.5 4.0 4.5 5.0
5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5					Sandy Loam; 7.5 YR 6/2; 85% Gravel, 10% Cobbles SAB; Dry; Loose	No mottling or evidence of groundwater; Fill dirt	5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
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20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-3
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					12" Topsoil;		0.5
1.0						No mottling or evidence of groundwater	1.0
1.5							1.5
2.0					Clay Loam; 7.5 YR 5/4; 20% Gravel; 30% Cobbles. 30% Stone		2.0
2.5					SAB; Moist; Friable		2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5					Loam; 7.5 YR 5/4; 15% Gravel, 30% Cobbles, 30% Stone		5.5
6.0					SAB; Moist; Friable	No mottling or evidence of groundwater	6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0					**Refusal at 8 feet**		8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-4
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					12" Topsoil;		0.5
1.0							1.0
1.5					Clay; 10 YR 6/8; 5% Gravel; Platy; Moist; Friable		1.5
2.0							2.0
2.5					**Solid Rock at 30 inches**		2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5						No mottling or evidence of groundwater	4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0					**Refusal at 112 inches**		9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-5
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					14" Topsoil;		0.5
1.0					Clay; 10 YR 5/6; 15% Gravel; 20% Cobbles, 35% Stone	No mottling or evidence of groundwater	1.0
1.5					Platy; Moist; Friable		1.5
2.0							2.0
2.5					**Refusal at 30 inches**		2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-6
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					12" Topsoil;		0.5
1.0							1.0
1.5					Clay; 5 YR 5/6; 15% Gravel; 20% Cobbles, 30% Stone Platy; Moist; Friable	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0					Clay; 7.5 YR 8/2; 25% Gravel; 35% Cobbles, 30% Stone Platy; Moist; Friable	No mottling or evidence of groundwater	5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0					**Refusal at 88 inches**		7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-7
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					12" Topsoil;		0.5
1.0							1.0
1.5							1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5					Clay Loam; 10 YR 4/4; 30% Gravel; 20% Cobbles, 10% Stone		4.5
5.0					SAB; Loose; Dry	No mottling or evidence of groundwater; Fill dirt.	5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-8
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					12" Topsoil;		0.5
1.0						No mottling or evidence of groundwater	1.0
1.5					Clay; 7.5 YR 6/8; 5% Gravel; SAB; Loose; Dry		1.5
2.0							2.0
2.5							2.5
3.0					Clay; 7.5 YR 5/6; 25% Gravel; 30% Cobbles, 25% Stone;	No mottling or evidence of groundwater	3.0
3.5					SAB; Moist; Friable		3.5
4.0					**Refusal at 50 inches**		4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-9
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil; Clay Loam; 7.5 YR 4/4; 5% Gravel; SAB; Moist; Friable	No mottling or evidence of groundwater; Fill dirt.	0.0
0.5							0.5
1.0							1.0
1.5							1.5
2.0							2.0
2.5							2.5
3.0					Clay; 7.5 YR 4/4; 10% Gravel; 15% Cobbles; SAB; Moist; Friable	No mottling or evidence of groundwater; Fill dirt.	3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0					Loam; 7.5 YR 5/1; 30% Gravel; 30% Cobbles; 15% Stone SAB; Moist; Friable **Refusal at 8 feet**	No mottling or evidence of groundwater; Fill dirt.	5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-10
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	6/16/2009	Static Groundwater Level:	
Drilling Contractor:	Boring Brothers	Ground Surface Elevation:	Not Surveyed
Drilling Method:	Hollow Stem Auger	Sampling Equipment:	--
Drilling Equipment:	Split Spoon (SPT)	Casing Equipment:	--
Drilling Angle:	-90˚	Logged by:	

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					2" Topsoil;		0.5
1.0					Clay Loam; 7.5 YR 4/6; 10% Gravel; 10% Cobbles	No mottling or evidence of groundwater; Fill dirt.	1.0
1.5					SAB; Moist; Friable		1.5
2.0					**Refusal at 2 feet**		2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

APPENDIX B: FEBRUARY 17, 2020 SOIL LOGS

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-1
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					11" Topsoil;		0.5
1.0						No mottling or evidence of groundwater	1.0
1.5					Silty Clay; 10 YR 5/6; 5% Gravel; Subang Blocky; Dry; Friable		1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0					Gneiss Rock & Very Fine Silt; 10 YR 6/2; 10% Gravel, 10% Cobble; 80% Stone; Subgang Blocky; Dry; Friable	No mottling or evidence of groundwater	4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0					**Refusal @ 70"**		6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-2
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Silty Clay; 10 YR 4/6; Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5					Silty Clay; 10 YR 6/6; 10% Gravel, 10% Cobble Subang Blocky; Moist; Friable	No mottling or evidence of groundwater	6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5					Silty Clay;10 YR 5/3; 10% Gravel, 10% Cobble Subang Blocky; Moist; Friable	Many signs of mottling (20%<) Distinct, Coarse (>15mm) Depth to 95"	8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-3
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					15" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5							1.5
2.0					Silty Clay; 10 YR 4/6; Subang Blocky; Moist; Friable	No mottling or evidence of groundwater	2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5					Silty Clay; 10 YR 6/6; Subang Blocky; Moist; Friable	No mottling. Evidence of seepage @ 127"	6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-4
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0 1.5					15" Topsoil;	No mottling or evidence of groundwater	0.0 0.5 1.0 1.5
2.0 2.5 3.0 3.5 4.0 4.5 5.0					Silty Clay; 10 YR 4/4; 20% Cobble, 10% Stone Subang Blocky; Moist; Friable	No mottling or evidence of groundwater Unconsolidated Fill. Asphalt.	2.0 2.5 3.0 3.5 4.0 4.5 5.0
5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0					Silty Clay; 10 YR 3/2; 15% Cobble, 15% Stone Subang Blocky; Moist; Friable	No mottling or evidence of groundwater. Unconsolidated Fill. Asphalt.	5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0
10.5 11.0 11.5							10.5 11.0 11.5
12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0							12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-5
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0					12" Topsoil;	No mottling or evidence of groundwater	0.0 0.5 1.0
1.5 2.0 2.5 3.0					Silt; 10 YR 4/2; 5% Gravel; 10% Cobble, 5% Stone Subang Blocky; Dry; Loose	No mottling or evidence of groundwater Fill material.	1.5 2.0 2.5 3.0
3.5 4.0 4.5 5.0 5.5					Silty Clay; 10 YR 4/6; 5% Gravel, 5% Cobble Subang Blocky; Moist; Friable	No mottling or evidence of groundwater Fill material.	3.5 4.0 4.5 5.0 5.5
6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5					Silty Clay; 10 YR 4/3; 10% Gravel, 15% Cobble, 15% Stone Subang Blocky; Moist; Friable	No mottling or evidence of groundwater Fill material.	6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-6
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0					10" Topsoil;	No mottling or evidence of groundwater	0.0 0.5 1.0
1.5 2.0					Silty Clay; 10 YR 3/3; Subang Blocky; Dry; Loose	No mottling or evidence of groundwater. Fill material	1.5 2.0
2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0					Silty Clay; 10 YR 4/4; 5% Gravel, 5% Cobble; Subang Blocky; Moist; Friable	No mottling or evidence of groundwater. Fill material	2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0
8.5 9.0 9.5					Silty Clay; 10 YR 6/1; 5% Gravel, 5% Cobble; Subang Blocky; Moist; Firm **Refusal @ 110"**	Common signs of mottling (5-20%) Distinct, Medium (<15mm) Evidence of seepage @ 96"	8.5 9.0 9.5
10.0 10.5 11.0 11.5							10.0 10.5 11.0 11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-7
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					11" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0					Silty Clay; 10 YR 4/6; 5% Gravel Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.0
1.5							1.5
2.0					Silty Clay; 10 YR 4/4; 5% Gravel, 10% Cobble; Subang Blocky; Dry; Firm **Refusal @ 34"**	No mottling or evidence of groundwater	2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-8
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5					10" Topsoil;	No mottling or evidence of groundwater	0.0 0.5
1.0 1.5 2.0 2.5 3.0					Silty Clay; 10 YR 4/6; 5% Gravel; Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.0 1.5 2.0 2.5 3.0
3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5					Silty Clay; 10 YR 3/4; 10% Gravel, 15% Cobble, 15% Stone; Subang Blocky; Dry; Friable **Refusal @ 88"**	No mottling or evidence of groundwater	3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5
8.0 8.5 9.0 9.5							8.0 8.5 9.0 9.5
10.0 10.5 11.0 11.5							10.0 10.5 11.0 11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-9
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					10" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5							1.5
2.0					Silty Clay; 10 YR 5/6; 5% Gravel; Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5					Silty Clay; 10 YR 4/6; 5% Gravel, 5% Cobble, 10% Stone Subang Blocky, Moist; Friable	No mottling or evidence of groundwater	5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5					**Refusal @ 111"**		9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-10
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0					8" Topsoil;	No mottling or evidence of groundwater	0.0 0.5 1.0
1.5 2.0 2.5 3.0					Silt Loam; 10 YR 5/4; 10% Gravel, 15% Cobble, 20% Stone Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.5 2.0 2.5 3.0
3.5 4.0 4.5 5.0					Silt Clay Loam; 10 YR 4/3; 5% Gravel, 10% Cobble, 80% Stone Subang Blocky; Dry; Firm	No mottling or evidence of groundwater	3.5 4.0 4.5 5.0
5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5							5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5
10.0 10.5 11.0 11.5							10.0 10.5 11.0 11.5
12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0							12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-11
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Loamy Sand; 10 YR 4/3; 20% Gravel, 30% Cobble, 10% Stone Suband Blocky; Dry; Friable	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-12
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Loamy Sand; 10 YR 4/3; 20% Gravel, 20% Cobble, 10% Stone	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5					Loamy Sand; 10 YR 4/3; 20% Gravel, 20% Cobble, 10% Stone Subang Blocky, Dry, Friable	No mottling or evidence of groundwater. @ 5FT: 10 YR 6/6 Clay Layer (Fill Material) @ 9FT: 3-5" Layer Gneiss Rock and Very Fine Silt	5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-13
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					10" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Silty Clay; 10 YR 5/8; Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5						Side of depressed land is very very rocky @ 4FT	3.5
4.0							4.0
4.5					Silty Clay; 10 YR 4/6; 10% Gravel, 30% Cobble, 30% Stone Subang Blocky; Dry; Friable	No mottling or evidence of groundwater.	4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0					**Refusal @ 96"**		8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
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16.0							16.0
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17.0							17.0
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18.0							18.0
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19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-14
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0 0.5 1.0					8" Topsoil;	No mottling or evidence of groundwater	0.0 0.5 1.0
1.5 2.0					Clay Loam; 10 YR 4/6; Subang Blocky; Dry; Friable	No mottling or evidence of groundwater	1.5 2.0
2.5 3.0 3.5 4.0 4.5 5.0					Clay Loam; 10 YR 5/4; 20% Gravel, 30% Cobble, 20% Stone Subang Blocky; Dry; Friable **Refusal @ 60"**	No mottling or evidence of groundwater	2.5 3.0 3.5 4.0 4.5 5.0
5.5 6.0 6.5 7.0 7.5 8.0							5.5 6.0 6.5 7.0 7.5 8.0
8.5 9.0 9.5 10.0							8.5 9.0 9.5 10.0
10.5 11.0 11.5							10.5 11.0 11.5
12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0							12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-15
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					9" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Loamy Sand; 10 YR 4/4; 20% Gravel, 40% Cobble, 20% Stone Subang Blocky; Dry; Loose	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
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17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

APPENDIX C:

TOWN OF CLINTON TABLE OF DESIGN ELEMENT, RISK, TESTING REQUIREMENTS, PERFORMANCE STANDARDS, PREFERRED DESIGN ELEMENT AND REMEDIAL PLAN ELEMENTS FOR DEVELOPMENT IN KARST TERRAIN.

88 Attachment 6

Town of Clinton

Carbonate Area District
Table 1
Design Element, Risks, Testing Requirements, Performances Standards, Preferred Design Element and Remedial Plan Elements for Development in Karst Terrain
[Added 8-26-2008 by Ord. No. 08-12]

Design Element	**Risks**	**Testing Requirements**	**Performance Standards**	**Preferred Design Element and Remedial Plan Elements**
High-load and broad-load structures (high-rise buildings, parking decks, warehouses, water towers, etc.)	Settlement Structural damage/loss Personal injury/death	Evaluate available data Reconnaissance – prior to design Test pits – to confirm shallow bedrock where suspected Borings – 1 per 5,000 square foot area of building footprint; depth based on column/slab load proposed Geophysics – at foundation elements Conceptual failure model – discretionary Bridging analysis – discretionary Inspection of footings – intermittent during construction	Optimal layout Redundancy of support elements Pre-drill foundation sites, depths determined by proposed loads High-tensile strength slabs, with load transfer capability Use pile tips Drill caisson sites, depths determined by proposed loads Pre-construction grouting	Inspection Evaluation plan Remedial grouting plan Remedial designs
Low-load structures (single-family homes, small offices, stores, etc.)	Settlement Collapse Property damage Personal injury	Evaluate available data Inspection of footings – during installation of trench or footing	Foundation areas show no evidence of creep or settlement Drainage directed away from foundation	Foundation reinforcement Occasional inspection by owner
Bridges	Settlement Collapse Embankment failure	Test pits – to competent bedrock Borings – 5 to 10 feet into competent bedrock	Piles, caissons to competent bedrock Redundancy Footing with bridging of anticipated failure Pre-construction grouting	Alternate route Abutment reinforcement modifications Evacuation plans Escrow to recover repair
Underground tanks	Settlement/failure Undermining/failure Undetected leaks	Test pits – in excavation Borings – in or near excavation, 10 feet into competent bedrock	Soil and rock void-free Voids grouted Aboveground tanks	

Design Element	Risks	Testing Requirements	Performance Standards	Preferred Design Element and Remedial Plan Elements
Roads and parking areas	Settlement Undermining Collapse Contaminated runoff	Analysis of existing data Reconnaissance of route Test pits or borings – installed in depressions, or other likely karst features Geophysics – where warranted, and to link boring/test pit data	Layout to avoid karst features Minimize paved areas Control drainage under pavement Controls on blasting Use of ripping Compaction of roadbase Reinforced roadbed	Alternative route Evacuation route Repair procedures Subsidence monitoring Bridging over sinkholes
Drainage features: Conduits Swales Catch basins Detention basins Ponds Injection pits	Settlement Leaks Collapse Undermining of adjacent areas Injection of pollutants to groundwater	Analysis of existing data Reconnaissance of route – prior to design Test pits, probes at select catch basin sites Inspection schedule – continuous during construction Borings into bedrock – locations and depth based on geology, and practical considerations, ± 2 per acre Permeability lasting – for injection sites	Route consistent with site evaluation results Swales/lined swales Watertight joints Impermeable backfill Layout to avoid karst features Liners/compacted substrate Velocity reducers Ponds at water table elevation On-stream ponds Facilities remote from structures	Inspection schedule Repair proposal/escrow Reserve area Grouting specifications Repair escrow Abandonment plan
Utility conduits	Leaks Conduit failure Pollution/explosion/fire Property damage	Reconnaissance of route – prior to design Inspection schedule – continuous during construction Test pits, borings, probes – at key locations to identify possible areas of undermining	Route consistent with site evaluation results Backfill with native soils Geotextiles Piers, where appropriate Strong, flexible conduit Proper backfill procedures	Evacuation plan Shutoffs in key locations Alternate routes
Subsurface sewage disposal systems	Groundwater contamination Structural failure	Test pits – one per 1,000 square feet, 2 at a minimum	Pressure-closed disposal beds Beds not located next to rock pinnacles, nor in natural depressions	Alternate sites Closed systems (holding tanks)
Wells	Washed-out subsidence during drilling Subsidence due to dewatering Excessive grout needs Turbidity Natural water-quality hardness, metals, radium, radon	Careful oversight Intermittent reconnaissance, monitoring Sampling of parameters of concern	Well screen and gravel pack Minimize well loss Reconnaissance/monitoring of subsidence	Alternate site Grout modifications Pumpage modifications Casing off of mud zones Well screen and gravel pack

APPENDIX D: SITE PLANS (ATTACHED SEPARATELY)