STONEFIELD

STORMWATER MANAGEMENT REPORT
522 VALLEY ESTATES LLC

PROPOSED TOWNHOUSE DEVELOPMENT
BLOCK 32.01 / LOT 12
522 VALLEY ROAD (COUNTY ROUTE 621)
CITY OF CLIFTON
PASSAIC COUNTY, NEW JERSEY

PREPARED FOR:
522 VALLEY ESTATES LLC

PREPARED BY:
STONEFIELD ENGINEERING & DESIGN, LLC
92 PARK AVENUE
RUTHERFORD, NEW JERSEY 07070

REPORT DATE:
FEBRUARY 24, 2023

AFTON SAVITZ, PE
NJ PE LICENSE #57674

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1.0 PROJECT DESCRIPTION

522 Valley Estates, LLC is proposing to redevelop Block 32.01, Lot 12, commonly known as 522 Valley Road (County Route 621) located along the southbound side of Valley Road (County Road 621) approximately 50 feet across the street from the intersection with Mount Washington Drive (herein referred to as the "project site") to accommodate three (3) four-story townhouse buildings totaling twenty (20) individual townhouse units. Additional improvements one (1) two-car driveway per townhouse unit, an off-street parking lot for guest parking, lighting, landscaping, utility services, and stormwater management and conveyance systems.

The property is located within the Residential One Family Zoning District (R-A1) and the Steep Slopes Overlay District. The proposed development is surrounded by residential uses within the vicinity and Rifle Camp Park within the Borough of Woodland Park located immediately to the northwest. The site will be accessed via one (1) full-movement driveway along Valley Road (County Route 621) Refer to **APPENDIX A** for project maps of the project site.

The project site is 167,553 SF (3.85 acres), the extent of land disturbance is 108,003 SF (2.49 acres), and 90,185 SF (2.07 acres) of new impervious surfaces, will be created by the project. In addition, the project proposes the addition of 23,658 SF (0.54 acres) of new motor vehicle surface. The overall drainage area was modeled as 215,753 SF (4.95 acres).

This Report has been prepared to analyze the potential stormwater runoff impacts of the proposed project site and outline proposed measures to conform to the stormwater management regulations set forth by the City of Clifton, County of Passaic, Hudson-Essex-Passaic Soil Conservation District, the New Jersey Administrative Code NJAC), and the New Jersey Department of Environmental Protection (NJDEP).

2.0 EXISTING CONDITIONS

EXISTING SITE DEVELOPMENT

The project site fronts Valley Road (County Route 621) to the east. The project site is currently developed with one (1) two-and-a-half story frame building with an associated asphalt driveway and shed, all of which will be removed entirely as part of the proposed redevelopment. An Aerial Map depicting the existing site conditions can be found in **APPENDIX A**.

EXISTING TOPOGRAPHY

The high point of the project site is located at the rear lot line along the cliff face which serves as a municipal border between the City of Clifton and Borough of Woodland Park. Sheet flow within Valley Road (County Route 621) drains to the north, ultimately discharging into the Passaic County conveyance system. On-site topography slopes east toward Valley Road. Grades on site generally range from 20% to 40% within the heavily wooded and rocky terrain within the rear of the site and decreases within the previously developed area to slopes as low as 5% as it approaches Valley Road.

PROJECT SITE SOILS

Soil mapping was obtained from the National Resource Conservation Service (NRCS) for the project site and immediate area. Generally, the project site is underlain with 3 major soil groups: Boonton Silt Loam (BonDb) within the center of the site, Holyoke-Rock Outcrop Complex (HomC) located at the rear cliffside of the site, and Urban-Land Boonton Complex (USBOOC) toward the Valley Road frontage. Overall, the soils have varying drainage, and runoff flows overland directly to Valley Road. The table below provides a summary of soils for the project site:

TABLE 1: NRCS SOIL MAPPING RESULTS

Soil Unit Code	Soil Description	Approximate Project Coverage	Drainage Class	Hydrologic Soil Group
BonDb	Boonton Silt Loam (very stony) 15% to 35% Slopes	69.2%	Well Drained	C
HomC	Holyoke-Rock Outcrop Complex 3% to 15% Slopes	23.6%	Poorly Drained	D
USBOOC	Urban Land-Boonton Complex (red sandstone lowland) 8% to 15% Slopes	7.2%	Poorly Drained	D

Additional information regarding the NRCS soil mapping can be found in **APPENDIX B**.

A Report of Limited Geotechnical Investigation was performed by Whitestone Associates Inc. (report dated August 22, 2022), which consisted of three (3) soil borings being performed onsite. Underlying the two to three inches of topsoil at the surface, natural glacial deposits were encountered primarily consisting of silty sand, sandy silt, and gravel with variable amounts of silt and sand to depths reaching 33 feet below grade. Beneath the glacial deposits, weathered rock and bedrock were encountered at depths of 30 to 35 feet below grade at the central southern portion of the site.

Whitestone Associates Inc. also performed a Stormwater Management Area Evaluation (report dated December 19, 2022), which consisted of nine (9) soil test pits being performed onsite. Soil dampness was not encountered throughout the southeastern portion of the site where test pit infiltration tests were performed at depths of 10 to

12 feet below grade. The table below provides a summary of the tested infiltration rates of the soils for the project site:

TABLE 2: INFILTRATION/PERMEABILITY TEST SUMMARY

Profiled Pit #	Estimated SHGW (fbgs)	USDA Classification @ Test	Depth of Test (fbgs/NAVD88)	In-Situ Rate @ Test (in/hour)
SPP-1	Not Encountered	Fill (Clay Loam)	5.1 / 317.9	<0.2
SPP-2	Not Encountered	Fill (Clay Loam)	5.0 / 316.0	<0.2
SPP-3	Not Encountered	Fill (Clay Loam)	5.2 / 319.8	<0.2
SPP-4	Not Encountered	Fill (Clay Loam)	5.0 / 320.0	<0.2
SPP-5	Not Encountered	Clay Loam	5.0 / 320.0	<0.2
SPP-6	Not Encountered	Sandy Clay Loam	5.2 / 329.8	<0.2
SPP-7	Not Encountered	Clay Loam	5.1 / 333.0	<0.2
SPP-8	Not Encountered	Not Tested	Not Tested	Not Tested
SPP-9	Not Encountered	Not Tested	Not Tested	Not Tested

Based on the investigation, signs of seasonal high groundwater were not encountered in the southeastern portion of the site. Infiltration testing could not be conducted for SPP-8 and SPP-9 due to large rock within the soil subgrade. Based on the depth of excavation required for the proposed BMP's on site, further geotechnical testing will be required to verify the soils infiltration. Refer to **APPENDIX B** for the full Geotechnical Investigation that has been conducted thus far.

WATERSHED / RECEIVING WATERS – TMDL DESIGNATION

Under existing conditions, the site drains to Valley Road conveyance system that ultimately discharges to the Lower Passaic River (State Waterway ID 60460027). The watershed for the development is part of the Lower Passaic and Saddle Watershed Area (State Watershed ID 04BA) as defined by the United States Environmental Protection Agency for Community Waterway Mapping.

EXISTING ENVIRONMENTAL INVENTORY

Based on the effective FEMA flood insurance rate mapping (FEMA Map #34031C0218G issued April 17, 2020), the entirety of the site is within Zone X and is not located within the 100-year flood plain. The FEMA Map can be found in **APPENDIX A** of this Report.

There are no federal (US Army Corps of Engineers) or state (NJDEP) regulated freshwater wetlands within 1,000 feet of the project site. Impacts to nearby freshwater wetlands are not anticipated with the proposed development. No records of endangered or threatened species sightings are located within the vicinity of the proposed improvements.

3.0 PROPOSED CONDITIONS

PROPOSED SITE DEVELOPMENT

The proposed redevelopment will consist of three (3) four-story townhouse buildings with a total of 20 individual townhouse units with ground floor parking. Additional improvements include one (1) single-car driveway per townhouse unit, an off-street parking lot for guest parking, lighting, landscaping, utility services, stormwater management and conveyance systems. The site will be accessed via one full-movement driveway. Refer to **APPENDIX A** for a half-size Overall Site Plan depicting the proposed project improvements.

PROPOSED TOPOGRAPHY

Project site topography and drainage patterns will generally remain similar to existing conditions; however, due to the need for more residentially friendly, ADA compliant grades (1.5% to 5.0%), several retaining walls and stairs (for proposed back patios) will be implemented through the project to make up for the change in grades.

ANTICIPATED ENVIRONMENTAL INVENTORY IMPACTS

The proposed redevelopment will not disturb land within environmentally regulated areas (buffer areas, floodplains, floodways, etc.).

4.0 STORMWATER MANAGEMENT METHODOLOGY & PARAMETERS

HYDROLOGIC METHODOLOGY

The analysis program "HydroCAD" Version 10.2 by HydroCAD Software Solutions was utilized to calculate and plot the runoff hydrographs. The program incorporates the time of concentration, C values, rainfall data, and project drainage areas to calculate the runoff characteristics. The existing and proposed drainage areas have been analyzed utilizing Intensity-Duration-Frequency data obtained from NOAA for the project area; specifics of the rainfall distribution can be found in **APPENDIX C.** Additional key variables utilized in the analysis include:

TABLE 2: HYDROCAD DESIGN VARIABLES

Variable	Input	Variable	Input
Runoff Calculation Method	SCS TR-20	NRCS Rainfall Frequency Data Set	Passaic
Pervious/Impervious CN Calculations	Separate	Storm Intervals (Year Events)	2, 10, 100
Stage-Storage Relationship	Dynamic	Storm Duration	24 Hours
Minimum time of concentration	6 minutes	Storm Curve	NOAA D

Additional information regarding the hydrologic calculations can be found in **APPENDIX C**.

HYDRAULIC METHODOLOGY

The onsite stormwater conveyance system has been sized for the 25-year storm event and is able to safely convey runoff to the proposed stormwater management facilities without overflow or bypass.

5.0 STORMWATER ANALYSIS

EXISTING DRAINAGE AREAS

Under current conditions, the project site is subdivided into three (3) Points of Interest (POI's). POI-1 is an ultimate point of interest which is taken as the existing stormwater management system with Valley Road (County Route 621) along the northeast corner of the property along the roadway. This POI was chosen due to the nature of the drainage on site eventually discharges into the Roadway. POI-2 and POI-3 are neighboring properties where a portion of the site drains to under existing conditions which eventually sheet flow into Valley Road. See below for a short summary of each area:

TABLE 4: SUMMARY OF EXISTING DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
E-1A	Existing Drainage from Undeveloped Area	91,865 SF	5,226 SF	12.9 Minutes
E-1B	Existing Drainage from Developed Area	108,912 SF	0 SF	12.6 Minutes
POI (E-1)	Ultimate Point of Interest: Valley Road	**200,777 SF**	**5,226 SF**	N/A
E-2	Existing Drainage to Lots 12 & 13	13,212 SF	0 SF	7.7 Minutes
POI (E-2)	Ultimate Point of Interest: Lots 12 & 13	13,212 SF	0 SF	N/A
E-3	Existing Drainage to Lot 11	1,764 SF	0 SF	4.3 Minutes*
POI (E-3)	Ultimate Point of Interest: Lot 11	1,764 SF	0 SF	N/A

***The minimum time of concentration was utilized due to the high level of impervious coverage and proximity to the corresponding POI (the calculated TOC value is 4.3 minutes (E-3).**

All existing drainage areas were delineated based on field surveying data and the United States Geological Survey Map, Orange & Paterson Quadrangle, New Jersey 2019, 7.5 Minute Series. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX D.**

PROPOSED DRAINAGE AREAS

Under proposed conditions, the general drainage patterns and ultimate points of interest will be maintained. The intent behind the proposed delineations is to reduce the amount of direct runoff to Valley Road (County Route 621), Lot 11, and Lots 12 and 14. The diverted sheet flow from drainage areas P-1A, P-1B, P-1C, and P-1D are proposed to be sent to various stormwater management features on site to meet the NJAC 7:8-1.2. code requirements as outlined in the next Report section in accordance with the New Jersey Department of Environmental Protection Best Management Practices Manual (BMP). See below for a short summary of each area:

TABLE 5: SUMMARY OF PROPOSED DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
P-1A	Proposed Drainage to Bioretention Area B	17,717 SF	3,688 SF	6.0 Minutes*
P-1B	Proposed Drainage to Bioretention Area A	5,136 SF	715 SF	13.4 Minutes
P-1C	Proposed Drainage to Bioretention Area A	39,200 SF	18,734 SF	8.7 Minutes
P-1D	Porous Pavement Systems	25,269 SF	24,416 SF	6.0 Minutes*
P-1E	Proposed Drainage undetainted to Valley Road	124,291 SF	47,553 SF	20.9 Minutes
POI (P-1)	**Ultimate Point of Interest: Valley Road**	**87,333 SF**	**95,106 SF**	**N/A**
P-2A	Proposed Drainage to Lot 12 & 13	1,247 SF	0 SF	6.0 Minutes*
P-2B	Proposed Drainage to Lot 12 & 13	1,010 SF	305 SF	6.0 Minutes*
POI (P-2)	**Ultimate Point of Interest: Lots 12 & 13**	**2,257 SF**	**305 SF**	**N/A**
P-3	Proposed Drainage to Lot 11	1,578 SF	0 SF	6.0 Minutes*
POI (P-3)	**Ultimate Point of Interest: Lot 11**	**1,578 SF**	**0 SF**	**N/A**

***The minimum time of concentration was utilized due to the high level of impervious coverage / land disturbance and proximity to existing and proposed stormwater pipe conveyance systems (P-1A, P-1D, P-2A, P-2B, P-3).**

All proposed drainage areas were delineated based on the proposed grading design overlain on field survey data data and the United States Geological Survey Map, Orange & Paterson Quadrangle, New Jersey 2019, 7.5 Minute Series. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX E.**

STORMWATER MANAGEMENT DESIGN PARAMETERS

The extent of redevelopment proposes to disturb more than one acre of land and add more than one-quarter acre of new impervious surfaces and new motor vehicle surfaces; as such, the project is considered a Major Development as defined in the City of Clifton Ordinance and NJAC 7:8-1.2. A Major Development is subject to stormwater quantity, quality, and groundwater recharge requirements. See below for a summary of each design parameter and compliance requirements:

TABLE 6: STORMWATER MANAGEMENT DESIGN TARGET SUMMARY TABLE

Design Parameter	Design Target for Compliance
Stormwater Runoff Quantity	Design stormwater management measures so that the post-construction peak runoff rates for the 2-, 10-, and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2-, 10-, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events.
Stormwater Runoff Quality	Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality storm by 80% of the anticipated load from the developed site, expressed as an annual average.
Groundwater Recharge	Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated.

STORMWATER RUNOFF QUANTITY

Porous pavement systems (A1-A7; B1-B7; C1-C6 - 20 systems total) are proposed to discharge to Bioretention Area (B-1). An additional Bioretention Area (B-2) collects a majority of the proposed drive aisles and the rear parking area prior to discharging to Bioretention Area (B-1). Bioretention Area (B-1) also collects the lowest portion of the driveway. All systems are proposed to attenuate peak runoff rates to the mandatory regulatory levels. The tables below summarize the various drainage areas in relation to flow rates during regulatory storm events:

TABLE 7: SUMMARY OF EXISTING DRAINAGE AREA FLOW RATES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
E-1A	2.28 CFS	4.92 CFS	10.52 CFS
E-1B	2.43 CFS	5.47 CFS	12.07 CFS
POI (E-1)	22.59 CFS	10.40 CFS	22.59 CFS
E-2	0.36 CFS	0.79 CFS	1.74 CFS
POI (E-2)	0.36 CFS	0.79 CFS	1.74 CFS
E-3	0.05 CFS	0.12 CFS	0.26 CFS
POI (E-3)	0.05 CFS	0.12 CFS	0.26 CFS

TABLE 8: SUMMARY OF PROPOSED DRAINAGE AREA FLOW RATES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
P-1A	0.89 CFS	1.58 CFS	2.96 CFS
P-1B	0.15 CFS	0.30 CFS	0.60 CFS
P-1C	1.88 CFS	3.22 CFS	5.93 CFS
P-1D	2.56 CFS	1.63 CFS	2.56 CFS
P-1E	2.20 CFS	4.98 CFS	11.04 CFS
POI (P-1)	0.94 CFS	3.03 CFS	6.91 CFS
P-2A	0.40 CFS	0.09 CFS	0.18 CFS
P-2B	0.06 CFS	0.10 CFS	0.20 CFS
POI (P-2)	0.10 CFS	0.26 CFS	0.39 CFS
P-3	0.05 CFS	0.11 CFS	0.23 CFS
POI (P-3)	0.05 CFS	0.11 CFS	0.23 CFS

Under post-development conditions the runoff flow rates are reduced to the undetained drainage areas including the connection to the existing municipal system within Valley Road (County Route 621). The diverted runoff from these areas is collected in the on-site stormwater management systems for runoff attenuation. The table below outlines the regulatory compliance parameters for runoff quantity on the project site:

TABLE 9: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY (E-1A / P-1A, P-1B, P-1C, P-1D)

Rainfall Event	Existing Flow Rate	Required % Reduction	Proposed Flow Rate	Proposed % Reduction
2-Year Storm	2.28 CFS	50%	0.94 CFS	58.77%
10-Year Storm	4.92 CFS	25%	3.03 CFS	38.41%
100-Year Storm	10.52 CFS	20%	6.91 CFS	34.31%

TABLE 9: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY (E-2 / P-2A, P-2B)

Rainfall Event	Existing Flow Rate	Proposed Flow Rate	Existing Volumes	Proposed Volumes
2-Year Storm	0.36 CFS	0.10 CFS	1,213 CF	312 CF
10-Year Storm	0.79 CFS	0.19 CFS	2,616 CF	606 CF
100-Year Storm	1.74 CFS	0.39 CFS	5,772 CF	1,244 CF

TABLE 9: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY (E-3 / P-3)

Rainfall Event	Existing Flow Rate	Proposed Flow Rate	Existing Volumes	Proposed Volumes
2-Year Storm	0.05 CFS	0.05 CFS	162 CF	160 CF
10-Year Storm	0.12 CFS	0.11 CFS	492 CF	335 CF
100-Year Storm	0.26 CFS	0.23 CFS	771 CF	721 CF

The proposed porous pavement systems and bioretention areas provide sufficient flow rate attenuation to ensure that no adverse impacts are anticipated downstream of the project site. Detailed hydrologic calculations for each drainage area can be found in **APPENDIX C**.

STORMWATER RUNOFF QUALITY

As a Major Development, all proposed motor vehicle surfaces are subject to stormwater runoff quality requirements. More specifically, proposed motor vehicle surfaces developed over existing vehicular travel surfaces may meet or exceed the existing treatment rates of the existing vehicular travel surfaces and all new motor vehicle surfaces shall be required to remove 80% of total suspended solids. Non-vehicular travel surfaces (building roofs, plaza/amenity areas, sidewalks, etc.) are not subject to runoff quality regulations.

The proposed aboveground bioretention areas (A and B) will provide water quality treatment for motor vehicle surfaces. As outlined in the New Jersey Stormwater Best Management Practices (NJDEP BMP) Manual, bioretention areas may quality for TSS removal rates up to 90% based on the soil bed depth and vegetation within soil bed. More specifically, in the case of the project site, a TSS removal rate of 80% is achieved through the use of a 24" soil bed depth and a site-tolerant grasses. The basin conveys the entirety of the water quality design storm (WQDS) through the soil bed prior to infiltrating into the subsoil.

The proposed porous pavement systems (PV- A1-A7, PV-B1-B7, PV-C1-6) will also provide water quality treatment for motor vehicle surfaces. As outlined in the New Jersey Stormwater Best Management Practices Manual, permeable pavement may quality for TSS removal rates up to 80% as long as the additional inflow of the contributory drainage area to surface area of the permeable pavement is a maximum ratio of 3:1 and all motor vehicle surfaces enter the system through the surface course. The systems convey the entirety of the water quality design storm (WQDS) through the stone storage prior to infiltration to the underlying soils. The systems conform to the requirements for the loading ratio set forth in Chapter 9.6 – Pervious Paver Systems of the New Jersey Stormwater Best Management Practices (NJDEP BMP) Manual as shown in the following table:

TABLE 12: SUMMARY OF POROUS PAVEMENT LOADING RATIOS

Permeable Pavement System	Treatment Drainage Area	Permeable Pavement Surface Area	Additional Inflow Area	Ratio
PV-A1	1,273 SF	435 SF	838 SF	**1.92**
PV-A2	1,316 SF	424 SF	892 SF	**2.91**
PV-A3	1,238 SF	305 SF	933 SF	**2.39**
PV-A4	1,301 SF	350 SF	951 SF	**2.27**
PV-A5	1,297 SF	345 SF	952 SF	**1.98**
PV-A6	1,349 SF	350 SF	999 SF	**2.12**
PV-A7	1,335 SF	345 SF	990 SF	**2.07**
PV-B1	1,206 SF	350 SF	856 SF	**2.95**
PV-B1	1,338 SF	345 SF	993 SF	**2.82**
PV-B3	1,246 SF	322 SF	924 SF	**2.61**
PV-B4	1,238 SF	367 SF	871 SF	**2.53**
PV-B5	1,246 SF	333 SF	913 SF	**2.61**
PV-B6	1,238 SF	333 SF	905 SF	**2.53**
PV-B7	1,201 SF	343 SF	858 SF	**2.48**
PV-C1	1,226 SF	343 SF	883 SF	**2.81**
PV-C2	1,222 SF	334 SF	888 SF	**2.33**
PV-C3	1,231 SF	435 SF	796 SF	**2.57**
PV-C4	1,188 SF	424 SF	764 SF	**2.70**
PV-C5	1,270 SF	305 SF	965 SF	**2.56**
PV-C6	1,222 SF	350 SF	872 SF	**2.69**

GROUNDWATER RECHARGE

Groundwater recharge is required if the site is a Major Development, not located within the Metropolitan Planning Area (PA-1) per the State Plan Policy Map, and the soils are considered suitable for infiltration. The project is located within the Metropolitan Planning Area (PA-1) but due to the Woods presently on site, the project will be required to provide recharge for the developed area within the limit of the existing woods. Under post-construction conditions, 8,224 CF of additional runoff is generated on site. The incorporation of the proposed Pervious Pavement Systems and Bioretention Areas reduce the overall site runoff below pre-construction conditions via infiltration as outlined in the table below:

TABLE 13: TWO-YEAR RUNOFF EVENT VOLUMES

Point of Interest	Pre-Construction Runoff Volume	Post-Construction Runoff Volume (Undetained)	Post-Construction Infiltrated Volume (After BMPs)	Difference In Volume
POI - 1	6,562 CF	14,786 CF	13,252 CF	8,224 CF
Total Site	**6,562 CF**	**14,786 CF**	**13,252 CF**	**8,224 CF**

STORMWATER PIPE CONVEYANCE SYSTEM

The on-site stormwater conveyance system has been sized for the 25-year storm event and is able to safely convey runoff to the proposed stormwater management facilities without overflow or bypass. Detailed hydraulic calculations for the conveyance system can be found in **APPENDIX C**.

The runoff flow rate directly tributary to the existing County stormwater pipe conveyance system within Valley Road (County Route 621) are significantly reduced under proposed conditions. As such, no adverse impacts to the existing County stormwater infrastructure is anticipated.

6.0 STORMWATER FACILITY OPERATIONS & MAINTENANCE

A Stormwater Operations & Maintenance Manual has been submitted for review to the City and will be forwarded to the relevant jurisdictional agencies prior to obtaining final land use approvals and permits. Any necessary easements or covenants associated with the stormwater improvements will be recorded prior to the start of construction.

7.0 EROSION & SEDIMENT CONTROL

A Soil Erosion & Sediment Control Plan has been prepared in accordance with the latest edition of the Standards for Soil Erosion and Sediment Control in New Jersey. This plan can be found within the Preliminary & Final Major Site Plans prepared by Stonefield in conjunction with this Report. Proposed temporary measures during construction include super silt fencing, stabilized construction entrances, inlet filters, and temporary seeding for soil stabilization. No land disturbance will occur until certification and permits have been obtained from the Hudson-Essex-Passaic Soil Conservation District.

8.0 CONCLUSIONS

As demonstrated in this Report, the increase in runoff flow rate and volume generated by the proposed redevelopment will be satisfactorily mitigated by the introduction of porous pavement systems, bioretention area A and bioretention area B and on-site stormwater conveyance system. Runoff water quality will be impacted by the increase in impervious surfaces and motor vehicle surfaces and Pervious Pavement Systems, Bioretention Area A and Bioretention Area B will provide treatment to remove total suspended solids to a satisfactory regulatory level. The site will also be required to provide groundwater recharge for the developed area within the wooded area currently existing on site. The recharged water on site exceeds the increase of volume from pre- to post-existing conditions within the wooded area via infiltration from the proposed BMP's.

The proposed project complies with all applicable stormwater management regulations and standards. As such, the project is not anticipated to have any adverse drainage impacts on neighboring properties, downstream watercourses, or adjoining conveyance systems.

9.0 REFERENCES

1. New Jersey Administrative Code Title 7, Chapter 8 Stormwater Management, last amended March 2, 2020

   https://www.nj.gov/dep/rules/rules/njac7_8.pdf

2. New Jersey Stormwater Best Management Practices Manual, last revised March 2, 2020

   https://www.njstormwater.org/bmp_manual2.htm

3. City of Clifton Zoning Ordinance, adopted May 1, 1979

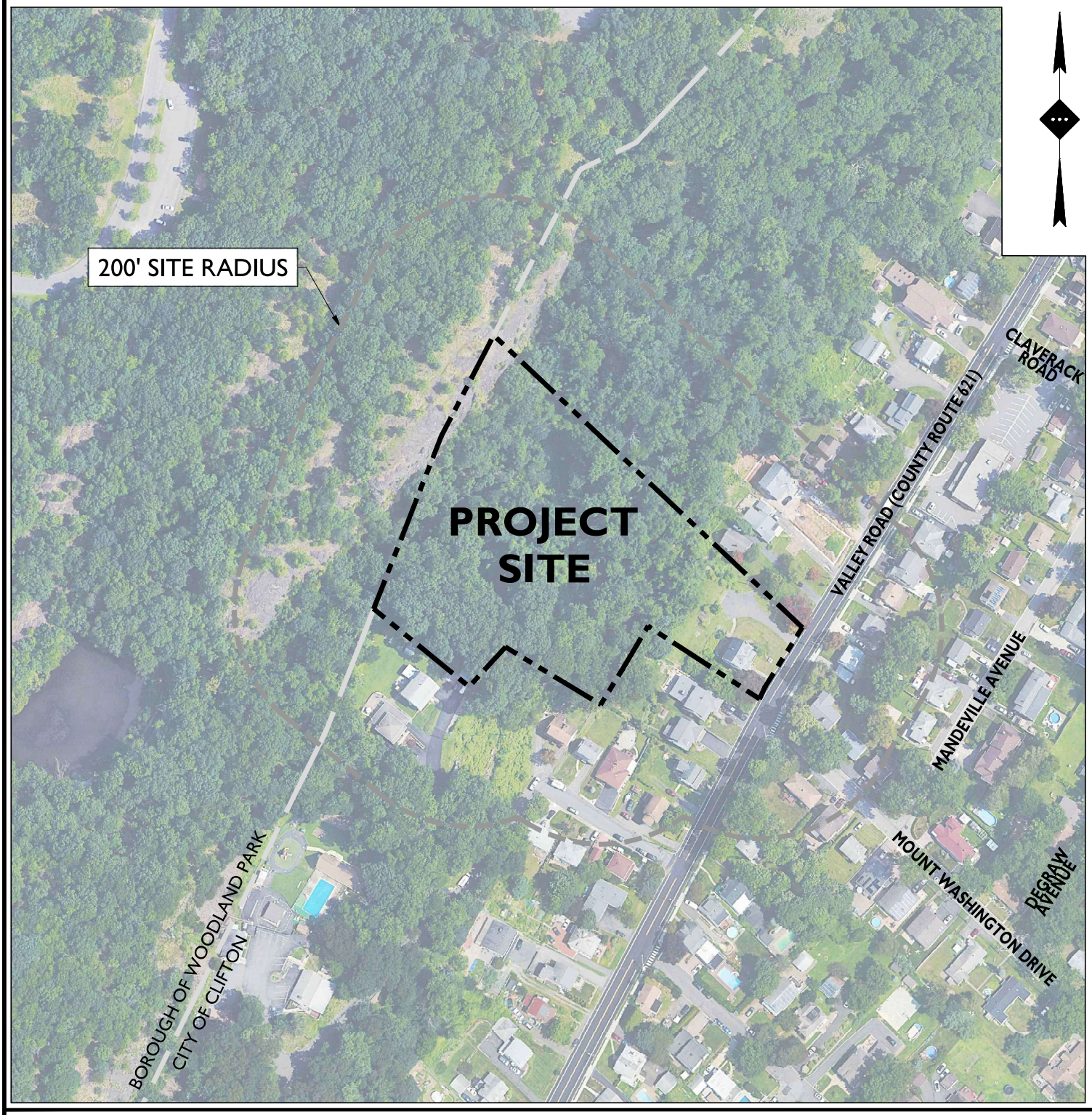
   https://ecode360.com/8520554

4. City of Clifton Stormwater Control Ordinance, adopted March 2, 2021

   https://ecode360.com/8519106

APPENDIX A
PROJECT FIGURES

INVENTORY



AERIAL MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1"= 200'

SOURCE: GOOGLE EARTH PRO. IMAGE DATED 07/22/2022

GARDEN STATE REALTY AND INVESTMENTS

PROPOSED TOWNHOUSE DEVELOPMENT

BLOCK 32.01, LOT 12
522 VALLEY ROAD (COUNTY ROUTE 621)
CITY OF CLIFTON, PASSAIC COUNTY, NEW JERSEY

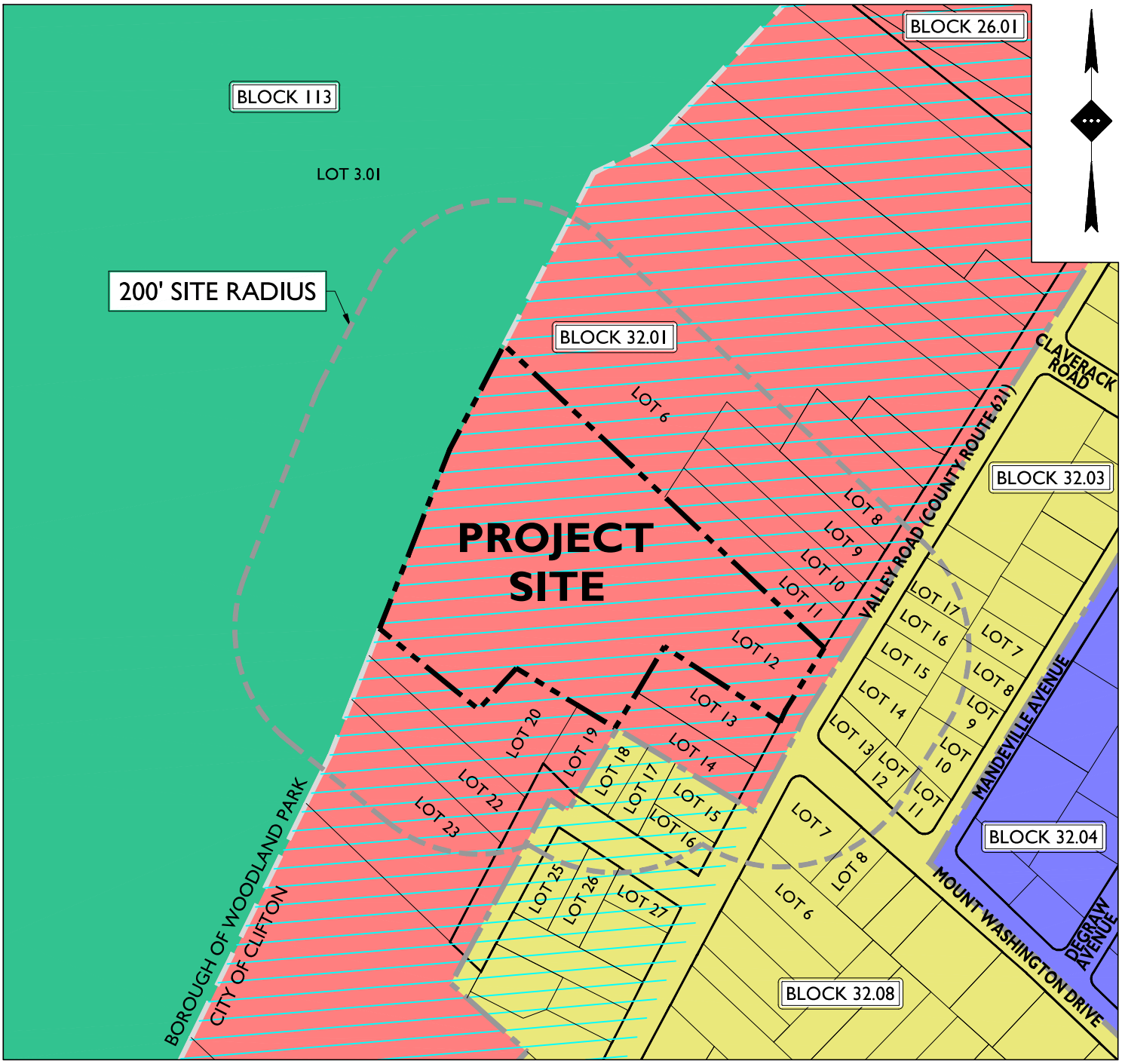
DRAWN BY:	DV
CHECKED BY:	SM
DATE:	01/05/2023
SCALE:	1"=200'
PROJECT ID:	RUT-220013

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

Headquarters: 92 Park Avenue, Rutherford, NJ 07070
Phone 201.340.4468 · Fax 201.340.4472

\\us.stonefieldeng.com\Shares\Rutherford\RUT\2022\RUT-220013 Garden State Realty & Investments - 522 Valley Road, Clifton NJ\CADD\Exhibits\2023-01-04_Project Map.dwg



ZONING LEGEND

ZONE R-A1 | ZONE R-A3 | ZONE R-B1 | STEEP SLOPE OVERLAY | ZONE (WOODLAND OSR PARK)

TAX AND ZONING MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1"= 200'

SOURCE: CITY OF CLIFTON ZONING MAP DATED 5/1/1979 AND CITY OF CLIFTON TAX MAP DATED 01/2003; BOROUGH OF WOODLAND PARK ZONING MAP DATED 3/1/2015 AND BOROUGH OF WOODLAND PARK TAX MAP DATED 11/1962

GARDEN STATE REALTY AND INVESTMENTS

PROPOSED TOWNHOUSE DEVELOPMENT

BLOCK 32.01, LOT 12
522 VALLEY ROAD (COUNTY ROUTE 621)
CITY OF CLIFTON, PASSAIC COUNTY, NEW JERSEY

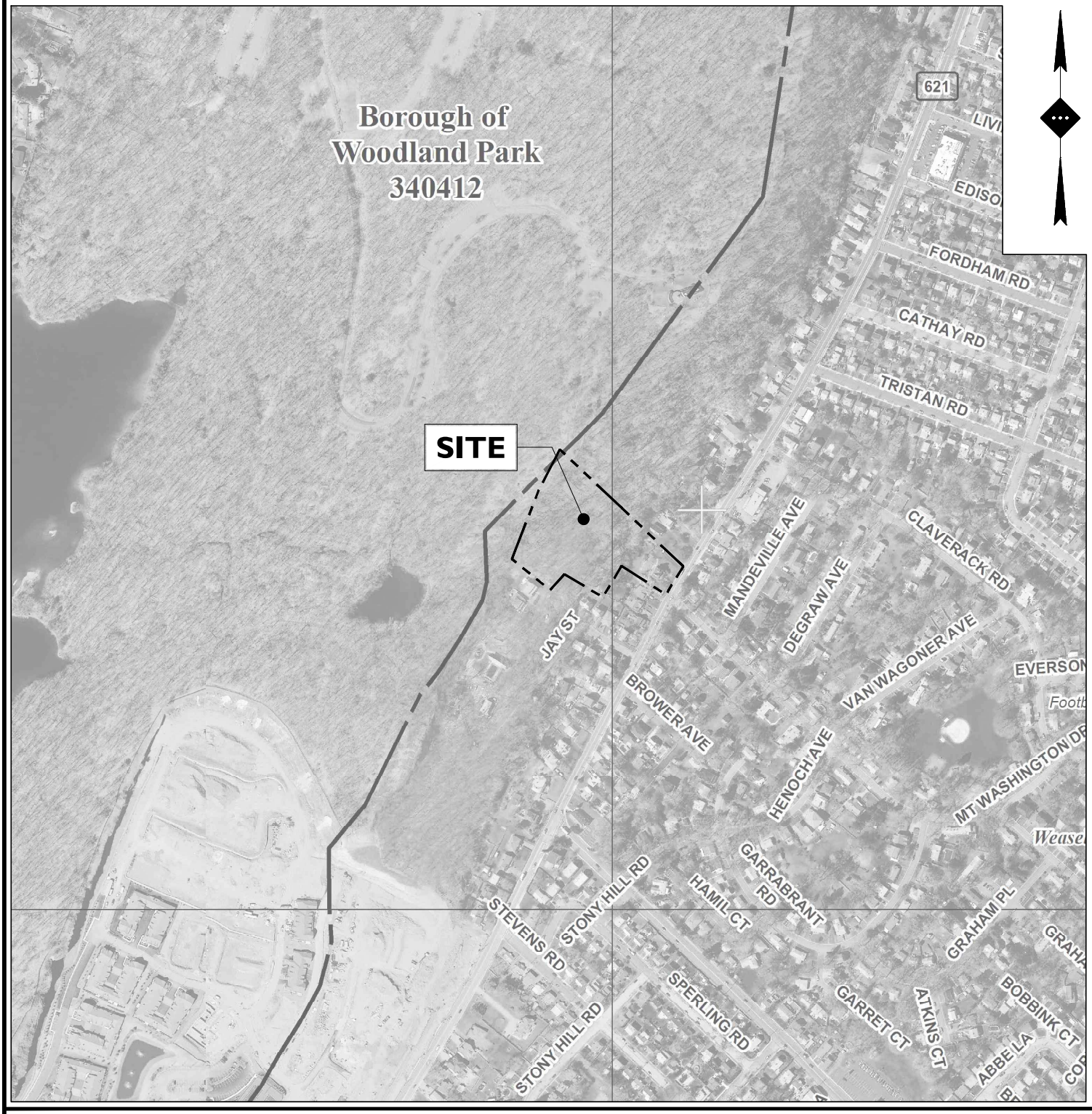
DRAWN BY:	DV
CHECKED BY:	SM
DATE:	01/05/2023
SCALE:	1"=200'
PROJECT ID:	RUT-220013

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

Headquarters: 92 Park Avenue, Rutherford, NJ 07070
Phone 201.340.4468 · Fax 201.340.4472

\\us.stonefieldeng.com\Shares\Rutherford\RUT\2022\RUT-220013 Garden State Realty & Investments - 522 Valley Road, Clifton NJ\CADD\Exhibits\2023-01-04_Project Map.dwg



EFFECTIVE FEMA FLOOD INSURANCE RATE MAP

500' 0' 500' 1000'

GRAPHIC SCALE IN FEET

1"= 500'

SOURCE: FLOOD INSURANCE RATE MAP, PASSAIC COUNTY, NEW JERSEY, 34031C0218G & 34031C0214G
DATED APRIL 17, 2020

GARDEN STATE REALTY AND INVESTMENTS

PROPOSED TOWNHOUSE DEVELOPMENT

BLOCK 32.01, LOT 12
522 VALLEY ROAD (COUNTY ROUTE 621)
CITY OF CLIFTON, PASSAIC COUNTY, NEW JERSEY

DRAWN BY:	DV
CHECKED BY:	SM
DATE:	01/05/2023
SCALE:	1"=500'
PROJECT ID:	RUT-220013

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Headquarters: 92 Park Avenue, Rutherford, NJ 07070
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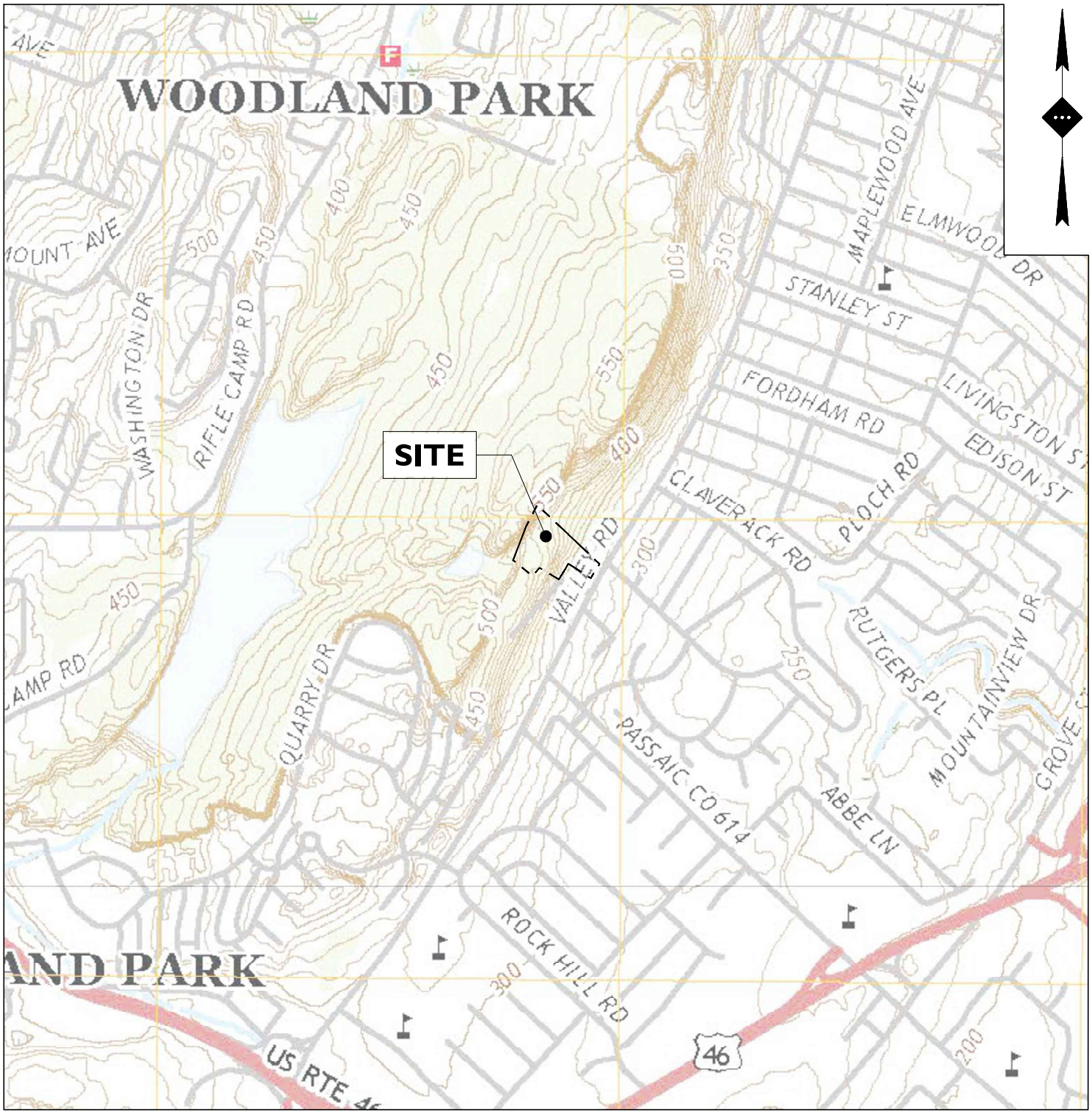

USGS QUADRANGLE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1"= 1000'

SOURCE: UNITED STATES GEOLOGICAL SURVEY MAP, ORANGE & PATERSON QUADRANGLE, NEW JERSEY 2019, 7.5 MINUTE SERIES

GARDEN STATE REALTY AND INVESTMENTS

PROPOSED TOWNHOUSE DEVELOPMENT

BLOCK 32.01, LOT 12
522 VALLEY ROAD (COUNTY ROUTE 621)
CITY OF CLIFTON, PASSAIC COUNTY, NEW JERSEY

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APPENDIX B
PROJECT SOILS

INVENTORY

B-1: NRCS SOILS REPORT

B-2: WHITESTONE REPORT OF LIMITED GEOTECHNICAL INVESTIGATION

B-3: WHITESTONE STORMWATER MANAGEMENT AREA EVALUATION

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Passaic County, New Jersey

November 30, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,250 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Passaic County, New Jersey
Survey Area Data: Version 17, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 15, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BonDb	Boonton silt loam, 15 to 35 percent slopes, very stony	2.7	69.2%
HomC	Holyoke-Rock outcrop complex, 3 to 15 percent slopes	0.9	23.6%
USBOOC	Urban land-Boonton complex, red sandstone lowland, 8 to 15 percent slopes	0.3	7.2%
Totals for Area of Interest		**3.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Passaic County, New Jersey

BonDb—Boonton silt loam, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 1kgy8
Elevation: 100 to 640 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Boonton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boonton, Very Stony

Setting

Landform: Ground moraines
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy basal till derived from basalt

Typical profile

Ap - 0 to 8 inches: silt loam
BA1 - 8 to 15 inches: fine sandy loam
BA2 - 15 to 23 inches: gravelly loam
Bt - 23 to 30 inches: gravelly fine sandy loam
Bx - 30 to 50 inches: gravelly sandy loam
Cx - 50 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 30 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 24 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Haledon, very stony

Percent of map unit: 10 percent
Landform: Ground moraines
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Holyoke, rocky

Percent of map unit: 5 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Summit
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

HomC—Holyoke-Rock outcrop complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: b0py
Elevation: 50 to 870 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Holyoke and similar soils: 80 percent
Rock outcrop: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Holyoke

Setting

Landform: Ground moraines, hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Loamy till derived from basalt

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 3 inches: highly decomposed plant material
A - 3 to 5 inches: silt loam
Bw1 - 5 to 14 inches: silt loam
Bw2 - 14 to 18 inches: loam
R - 18 to 80 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: F145XY011CT - Well Drained Shallow Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

Typical profile

R - 0 to 80 inches: bedrock

Properties and qualities

Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Yalesville, extremely stony

Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

USBOOC—Urban land-Boonton complex, red sandstone lowland, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1krjy
Elevation: 20 to 590 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, boonton red sandstone lowland substratum: 60 percent
Boonton, red sandstone lowland, and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Boonton Red Sandstone Lowland Substratum

Setting

Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

H1 - 0 to 12 inches: material
H2 - 12 to 67 inches: gravelly loam
2CB - 67 to 83 inches: gravelly sandy loam

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Boonton, Red Sandstone Lowland

Setting

Landform: Ground moraines
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy till derived from sandstone and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
BE - 3 to 10 inches: loam

Bw - 10 to 27 inches: gravelly loam
Bx1 - 27 to 40 inches: gravelly fine sandy loam
Bx2 - 40 to 67 inches: gravelly fine sandy loam
BCx - 67 to 83 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Udorthents, boonton red sandstone lowland substratum

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WHITESTONE
An Employee-Owned Company

30 INDEPENDENCE BOULEVARD
SUITE 250
WARREN, NJ 07059
908.668.7777
whitestoneassoc.com

August 22, 2022

via email

522 VALLEY ESTATES, LLC
164 Getty Avenue
Clifton, New Jersey 07011

Attention: Ms. Gina Gufarotti
Associate

Regarding: REPORT OF LIMITED GEOTECHNICAL INVESTIGATION & SLOPE STABILITY ANALYSIS PROPOSED RESIDENTIAL DEVELOPMENT 522 VALLEY ROAD BLOCK 32.01, LOT 12 CLIFTON, PASSAIC COUNTY, NEW JERSEY WHITESTONE PROJECT NO.: GJ2219439.000

Dear Ms. Gufarotti:

Whitestone Associates, Inc. (Whitestone) has completed a limited geotechnical investigation at the above-referenced site. The purpose of the investigation was to evaluate the existing subsurface conditions and conduct a slope stability analysis in support of the proposed development referenced above. Whitestone's scope of services included conducting test borings across the subject site, evaluating the conditions encountered, and developing geotechnical recommendations for the proposed residential redevelopment and related earthwork.

1.0 PROJECT DESCRIPTION

1.1 Site Location & Existing Conditions

The approximately 3.3-acre subject property located at 522 Valley Road (Block 32.01, Lot 12) in Clifton, Passaic County, New Jersey currently houses a single-family residential dwelling with associated pavements, landscaped areas, and utilities. Based on the October 14, 2021 *Civil Plan Set* prepared by Koestner Associates (Koestner), the subject site is characterized by steep easterly dipping slopes with grade changes on the order of approximately 240 feet. A natural cliff was observed within the northwestern portion of the site with an exposed height of approximately 120 feet.

1.2 Site Geology

The subject property is situated within a section of the Piedmont Physiographic Province known as the Newark Basin. Specifically, the subject site is underlain by the Lower Jurassic-age and Upper Triassic-age Conglomeratic Sandstone member of the Passaic Formation, which is part of the Brunswick Group, and the Lower Jurassic-age Orange Mountain Basalt.

The Conglomeratic Sandstone member generally consists of brownish-red pebble conglomerate with medium-grained to coarse-grained feldspathic sandstone and micaceous siltstone that is cross laminated, burrowed, and locally contains pebble layers. The Orange Mountain Basalt generally consists of dark greenish gray to greenish black basalt composed of mostly calcic plagioclase and clinopyroxene.

The overburden materials at the site include Rahway Till associated with the Wisconsinan Glacier that presumably reached its most southerly advance approximately 20,000 years ago and ended approximately 10,000 years ago. The glacial deposits are expected to overlay the weathered rock. Glacial till in the area typically contains a heterogeneous mixture of sand, silt, clay and gravel mixed with variable amounts of boulders and cobbles. Overburden materials also include man-made fill associated with past and present development of the subject site.

1.3 Proposed Construction

Based on the aforementioned *Civil Plan Set* and correspondence with 522 Valley Estates, LLC, the proposed redevelopment includes demolition of the existing site structure and construction of 21 townhomes with retaining walls, pavements, landscaped areas, and utilities. The proposed redevelopment is anticipated to have cuts and fills upward of 40 feet. Maximum column and wall loads are anticipated to be less than 75 kips and 3.0 kips per linear foot, respectively.

2.0 FIELD & LABORATORY WORK

2.1 Field Exploration

Field exploration at the project site was conducted by means of three soil test borings (identified as B-1 and B-3) and one offset boring (identified as B-1A) conducted with a truck-mounted drill rig and tripod-mounted drilling equipment using hollow stem augers and split-spoon sampling techniques. The subsurface tests were conducted within accessible portions of the subject site to depths ranging from 4.8 feet below ground surface (fbgs) to 35 fbgs. Test locations subsequently were backfilled to the surface with excavated soils from the investigation or grout, as necessary. The locations of the tests are shown on the accompanying *Boring Location Plan* included as Figure 1.

The subsurface tests were conducted in the presence of a Whitestone geologist who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. The tests were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D 1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, where encountered, were recorded during and immediately after the completion of field operations prior to backfilling the subsurface tests. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

2.2 Laboratory Program

Representative samples of the various strata encountered were subjected to a laboratory program that included Atterberg limits determination (ASTM D-4318), moisture content determinations (ASTM D-2216) and washed gradation analyses (ASTM D-422) in order to conduct supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table. The engineering classifications are useful when considered in conjunction with the additional site data to estimate properties of the soil types encountered and to predict the soil's behavior under construction and service loads. Laboratory test results are provided in Appendix B.

PHYSICAL/TEXTURAL ANALYSES SUMMARY							
Boring	**Sample**	**Depth (fbgs)**	**% Passing No. 200 Sieve**	**Moisture Content (%)**	**Liquid Limit (%)**	**Plastic Index (%)**	**USCS Classification**
B-1	S-3	5.0 - 7.0	34.6	14.0	21	3.0	SM
B-3	S-2/S-3	2.0 - 4.75	20.8	4.4	NP	NP	GM

Notes: NP = Non-Plastic

3.0 EXISTING CONDITIONS

3.1 Subsurface Conditions

The subsurface soil conditions encountered within the subsurface tests consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

Surface Cover: The subsurface tests were conducted within existing landscaped areas and encountered approximately two inches to three inches of topsoil at the surface.

Glacial Deposits: Underlying the surface cover, the subsurface tests encountered natural glacial deposits generally consisting of silty sand (USCS: SM), sandy silt (USCS: ML), and gravel with variable amounts of silt and sand (USCS: GM & GP-GM). The glacial deposits extended to a maximum depth of approximately 33 fbgs. SPT N-values within this stratum ranged from 13 blows per foot (bpf) to refusal (defined as greater than 50 blows per six-inch advancement of the split-spoon sampler), indicating a medium dense to very dense relative density and averaging greater than 50 bpf.

Weathered Rock/Bedrock: Top of weathered rock materials were encountered in the deeper soil borings (identified as B-1 and B-1A) at depths ranging between approximately 30 fbgs and 33 fbgs. SPT N-Values recorded within the weathered rock materials generally were within refusal range. Equipment refusal on apparent bedrock was encountered at approximate depths ranging between 33.1 fbgs and 35 fbgs.

Groundwater: Static groundwater was not encountered within the soil borings to a maximum explored depth of approximately 35 fbgs. However, perched/trapped water was encountered within the deeper borings conducted above weathered rock at depths ranging between approximately 30 fbgs and 33 fbgs. Perched/trapped water and groundwater levels should be expected to fluctuate seasonally and following periods of precipitation.

3.2 Existing Geology & Exposed Bedrock

As outlined in the *Civil Plan Set,* the northwestern portion of the subject site has approximately 9,000 square feet of exposed bedrock consisting of conglomerate sandstone. The results of Whitestone's visual observations indicated that the existing rock is generally in a massive condition with few indications of erosion or potential rockfall, however, maintenance of the existing exposed rock should be executed as detailed below.

Rockfall is the movement of rock along a steep slope where natural rock slope excavations exist. The rockfall process can be accelerated due to freeze-thaw and ongoing weathering of the exposed rock. As such, a rockfall catchment zone should be installed beneath the proposed rock walls at the subject site. For this site, a rockfall catchment area is defined as the area between the edge of pavement/walkway and the base of a cut slope, used to restrict rockfalls. The use of catchment areas to contain and restrict rockfall from the roadways and/or walkways is one of the best and most effective rockfall protective measures.

Should site constraints make the rockfall catchment zone unfeasible, alternate methods such as shotcrete, wire mesh, catch fences, or tied-back walls may be evaluated as a replacement. Whitestone should be contacted for further evaluation if it is determined that the rockfall catchment zone option is not possible.

4.0 GLOBAL STABILITY EVALUATION

4.1 General

The proposed redevelopment will include the construction of 21 townhomes with retaining walls, pavements, landscaped areas, and utilities. The proposed redevelopment is anticipated to have cuts and fills upward of 40 feet to the existing gabion wall. As such, a slope stability analysis was conducted to assess the conditions of the existing slope and evaluation global stability for areas of concern based on current and potential proposed conditions.

4.2 Method of Analysis

Whitestone evaluated the global stability for the existing slope and proposed conditions using classical limit equilibrium methods that assume full development of shear strength along the rupture surface at failure. The limit equilibrium method requires information about the soil strength characteristics to compute a factor of safety along a potential sliding mass. Information regarding stress strain behavior is not used and no information regarding slope movements are produced. Movements are usually analyzed by the finite element analysis, which is outside the scope of this study. The factor of safety is the ratio between the soil shear strength and the shear stress required to stabilize the slope. The computer program Geostase was used to conduct the slope stability analysis. The method of analysis selected for this evaluation included a random search of potential failure surfaces using the Modified Bishop Method.

4.3 Existing Soil Parameters

EXISTING SOIL PARAMETERS			
Soil Type	**Total Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Internal Friction Angle (degrees)**
Glacial Deposits	125	135	30
Weathered Rock	135	145	32
Bedrock	140	140	35

4.4 Summary of Findings

Based on the project information, Whitestone conducted a slope stability analysis across the subject site to determine the most critical failure paths along the existing slope. Based on Whitestone's analyses, the most critical profile for the proposed development exhibited a minimum factor of safety of 1.850 (factor of safety of 1.5 typically required for stability). Furthermore, the existing factor of safety for the subject site is 2.434. As such, contingent upon adequate design of the proposed retaining structures for the proposed redevelopment, the proposed improvements are not anticipated to negatively impact global stability for the proposed development. Detailed slope stability analyses are provided herein as Figures 2A and 2B.

5.0 CONCLUSIONS & RECOMMENDATIONS

The results of the investigation indicate that the proposed structures may be supported on conventional shallow foundations designed to bear within the underlying natural materials and/or controlled structural backfill. The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered within the limited exploration. If there are any significant changes to the project characteristics or if significantly different subsurface conditions are encountered during construction, Whitestone should be consulted such that the recommendations of this report can be reviewed.

5.1 Site Preparation & Earthwork

Surface Cover Stripping and Demolition: Prior to stripping operations, all utilities should be identified and secured. Any remaining vegetation, trees, topsoil, organic matter, portions of the existing building and pavements to be demolished and stripped should be removed from within the limits of areas requiring structural fill. Existing structural elements, such as foundation walls, or any concrete foundations, walls or slabs encountered during excavations, should be removed entirely from below proposed foundations and their zones of influence (as determined by lines extending at least one foot laterally beyond footing edges for each vertical foot of depth) and excavated to at least two feet below proposed construction subgrade levels elsewhere. Foundations and slabs may remain in place below these depths below proposed pavements and landscaped areas, where interference with future construction is avoided, however, any existing slab to remain should be thoroughly broken such that maximum particle size is 12 inches to allow vertical drainage of water. The demolition contractor should be required to conduct all earthwork in accordance with the recommendations in this report including backfilling any excavation, utility, etc. with structural fill. All fill or backfill placed in structural areas during any demolition operations should be placed as structural fill in accordance with the recommendations provided in this report.

Excavation Difficulties: Cobbles/boulders and apparent obstructions encountered at the site will present excavation difficulties for foundations, utilities, and similar excavations at variable depths below the surface. Excavation difficulties will be affected by the size of the excavation depth and equipment used. Heavy excavating equipment with ripping tools will probably be effective in removing cobbles/boulders and most obstructions during site grading. The speed and ease of excavation will depend on the type of grading equipment, the skill of the equipment operators, and the size of the excavation. Planned excavation depths beyond refusal depths and in confined excavations, such as for foundation embedment or utility trenches, may require ripping tools, extreme service buckets, or pneumatic hammers.

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton vibratory roller. The

roller should be operated in the static mode or a kneading "sheepsfoot" roller should be used if silt and/or clay soils are encountered at subgrade elevations. The surface then should be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets which may require removal and replacement or further investigation. Proofrolling should be conducted after a suitable period of dry weather to avoid degrading an otherwise stable subgrade. Any fill or backfill should be placed and compacted in accordance with Section 5.2.

Weather Performance Criteria: Because the site soils are, at least, moderately moisture sensitive and will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations and prepared subgrades to rainfall. Accordingly, excavation and fill placement procedures should be conducted during warm, dry weather conditions. Overexcavation of saturated soils and replacement with controlled structural fill per Section 5.2 of this report may be required prior to resuming work on disturbed subgrade soils. The site contractors should employ necessary means and methods to protect the subgrade including, but not limited to the following:

- leaving the existing pavement in place as long as practical to protect the subgrade from freeze-thaw cycles and exposure to inclement weather;
- sealing exposed subgrade soils on a daily basis with a smooth drum roller operated in static mode;
- regrading the site as needed to maintain positive drainage away from construction areas;
- removing wet surficial soils and ruts immediately; and
- limiting exposure to construction traffic especially following inclement weather and subgrade thawing.

Subgrade Protection and Inspection: Every effort should be made to minimize disturbance of the on-site soils by construction traffic and surface runoff. The on-site soils may deteriorate when subjected to repeated construction traffic and may require removal and replacement. These materials also may require wetting and recompaction during dry periods or discing, drying and aeration during wet periods. The contractor should be responsible for protection of subgrades and minimization of exposure of the site soils to precipitation by covering stockpiles and subgrades with plastic and preventing ponding of water by sealing subgrades before precipitation events and grading the site to allow proper drainage of surface water. All rutting from construction equipment should be removed prior to any forecasted or actual precipitation. The services of the geotechnical engineer should be retained to inspect soils conditions immediately prior to concrete placement to verify the suitability of prepared foundation subgrades for support of design loads.

5.2 Structural Fill & Backfill

Imported Fill Material: Any imported material placed as structural fill or backfill to restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 10 percent of material finer than a #200 sieve. Silts, clays, and silty or clayey sands and gravels with higher percentage of fines and with a liquid limit less than 40 and a plasticity index less than 20 may be considered subject to the owner's approval, provided that the required moisture content and compaction controls are met. The material should be free of clay lumps, organics, and deleterious material. Any imported structural fill material should be approved by a qualified geotechnical engineer prior to delivery to the site.

Soil Reusability: Whitestone anticipates that the majority of the underlying natural site soils will be suitable for selective reuse as structural backfill materials provided that any deleterious materials, oversized, and/or objectionable debris encountered are segregated and moisture contents are controlled within two percent of the optimum moisture content. Reuse of the fine-grained natural soils will be contingent on careful inspection by the owner's geotechnical engineer during construction. Soils that become exceedingly wet will require extensive drying prior to reuse. The reuse of the granular soils with a high percentage of plastic fines typically is possible only during ideal weather conditions. Reuse of these soils may require mixing with a more granular material, extensive moisture conditioning, and/or drying to facilitate their reuse, workability, and compaction in fill areas.

Alternatively, imported materials may be required to expedite earthwork operations, especially if the construction schedule or the site area restricts moisture control operations, such as spreading and air drying the soil.

Compaction and Placement Requirements: All fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Whitestone recommends using a small hand-held vibratory compactor to compact the on-site soils within any footing excavations.

5.3 Groundwater Control

Static groundwater was not encountered within the borings to a maximum explored depth of approximately 35 fbgs. However, perched groundwater may be encountered following periods of wet weather within fine-grained portions of the natural site soils, especially following precipitation events. Therefore, temporary groundwater control measures should be implemented as described below. Whitestone anticipates that dewatering typically would include numerous sump pumps along the excavation perimeter.

Because the subsurface soils will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations to rainfall. Overexcavation of saturated soils and replacement with controlled structural fill and/or one foot to two feet of open graded gravel (such as ¾-inch clean crushed stone) may be required prior to resuming work on disturbed subgrade soils.

5.4 Shallow Foundation Design Criteria

Whitestone recommends that the proposed structures be supported on conventional shallow foundations designed to bear within the underlying natural soils and/or properly placed structural fill provided these materials are properly evaluated, placed, and compacted in accordance with this report. Foundations bearing within these materials may be designed using a maximum allowable net bearing pressure of 4,000 pounds per square foot. Alternatively, the proposed foundations may be designed to bear entirely in the underlying weathered rock/bedrock and be designed using a maximum allowable net bearing pressure of 6,000 pounds per square foot.

All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings (if planned).

Below-grade footings should be designed so that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the

footings such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when proportioning the footings so that lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.35 is recommended for use in the design of the foundations bearing within the existing site soils or imported structural fill soils.

Partial Weathered Rock/Bedrock Support: Foundations should not be supported partially on weathered rock, weathered rock-sized cobbles/boulders, or bedrock and partially on soil because of the risk of brittle fracture due to a hinging effect. If the proposed bearing elevations result with partial bearing on such materials, Whitestone recommends removing a minimum of six inches of the weathered rock/bedrock and restoring the bearing elevation with structural fill. As such, rock should be overexcavated for a transition length of 20 feet and backfilled with structural backfill per recommendations outlined in this report for any foundation that results in partial rock and partial soil conditions.

Inspection/Overexcavation Criteria: Whitestone recommends that the suitability of the bearing soils along the footing bottoms be verified by a geotechnical engineer immediately prior to placing concrete for the footings. In the event that areas of unsuitable materials are encountered, additional overexcavation and replacement of the materials may be necessary to provide a suitable footing subgrade. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation may be eliminated if grades are restored with lean concrete. The bottom of overexcavations should be compacted with walk-behind compactors, vibrating plates, or plate tampers ("jumping jacks"), as appropriate, to compact locally disturbed materials.

Settlement: Whitestone estimates post construction settlements of proposed foundations to be less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one-half inch.

Seismic Site Class: Based on a review of the subsurface conditions relevant to the *2018 International Building Code - New Jersey Edition*, the subject site may be assigned a Site Class C. As such, liquefaction considerations are not expected to have a substantial impact on design.

Frost Coverage: Footings subject to frost action should be placed at least 36 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration. Because competent rock is not susceptible to frost heaving conditions, foundations bearing directly on top of competent rock, as verified during construction by the geotechnical engineer are not required to extend to typical frost protection depths.

5.5 Lateral Earth Pressures

General: Due to the significant grade changes across the property, the proposed redevelopment is anticipated to have retaining walls with cuts and fills upward of 40 feet. While the design of the retaining structures is beyond Whitestone's current scope of work, Whitestone would be pleased to assist with the calculation of lateral earth pressures based on the soil parameters presented herein during the structural design phase when final grading and wall geometries are available.

Lateral Earth Pressures: Temporary retaining structures and permanent below-grade walls may be required to resist lateral earth pressures. Proposed below-grade walls must be capable of withstanding active and at-rest earth pressures. Retaining/below-grade walls free to rotate generally can be designed to resist active earth pressures. Retaining/below-grade walls corners and restrained walls need to be

designed to resist at-rest earth pressures. Such structures should be properly designed by the Owner's engineer. The following soil parameters apply to the encountered subsurface strata and may be used for design of the proposed temporary and permanent retaining structures.

LATERAL EARTH PRESSURE PARAMETERS			
Parameter	**On-Site Granular Soils**	**On-Site Fine-Grained Soils**	**Imported Granular Backfill**
Moist Density (γ_{moist})	140 pcf	135 pcf	130 pcf
Internal Friction Angle (φ)	30°	28°	30°
Active Earth Pressure Coefficient (K_a)	0.33	0.39	0.33
Passive Earth Pressure Coefficient (K_p)	3.00	2.56	3.00
At-Rest Earth Pressure Coefficient (K_o)	0.50	0.56	0.50

Lateral earth pressure will depend on the backfill slope angle and the wall batter angle. A sloped backfill will add surcharge load and affect the angle of the resultant force. The effect of other surcharges will also need to be included in earth pressure calculations, including the loads imposed by adjacent structures and traffic. The effects of proposed sloped backfill surface grades, and proposed slopes beyond the toe of the retaining structure, if applicable, must be considered when calculating resultant forces to be resisted by the retaining structure. A coefficient of friction of 0.35 against sliding can be used for concrete on the existing site soils. Retaining wall footings should be designed so that the combined effect of vertical and horizontal resultants and overturning moment does not exceed the maximum soil bearing capacity provided in Section 5.4.

Backfill Criteria: Whitestone recommends that granular soils be used to backfill behind the proposed retaining walls. The granular backfill materials should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 15 percent of material finer than a #200 sieve. The material should be free of clay lumps, organics, and deleterious material. Portions of the on-site soils may be suitable for retaining wall backfill, pending approval from the wall designer. Imported granular soils also may be required. A maximum density of 140 pcf should not be exceeded to avoid creating excessive lateral pressure on the walls during compaction operations.

Whitestone recommends that backfill directly behind any walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone of influence measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

6.0 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Inspection and Monitoring: The owner's geotechnical engineer should conduct inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be conducted to verify that the existing surface cover materials are properly removed, and suitable materials, used for controlled fill, are properly placed and compacted over suitable subgrade soils. Any overexcavation of existing fill (although not anticipated) within the proposed building footprint area should be witnessed and documented by the owner's geotechnical engineer. The placement of structural backfill within the building structures and behind retaining walls as well as the placement and overexcavation of unsuitable soils also should be documented by the owner's geotechnical engineer.