

# **SOR CONSULTING ENGINEERS, INC.**

*Geotechnical Engineering - Materials Testing - Forensic Studies*

98 Sand Park Rd., Cedar Grove, NJ 07009  
(973) 239-6001 Fax (973) 239-8380

## **SUPPLEMENTARY SUBSURFACE INVESTIGATION REPORT SUBSURFACE STORMWATER MANAGEMENT SYSTEM WEST ORANGE, NEW JERSEY**

**FOR**

**GARDEN HOMES/WEST ESSEX HIGHLANDS, INC.  
SHORT HILLS, NEW JERSEY**

**Prepared by: Sor Consulting Engineers, Inc.  
98 Sand Park Road  
Cedar Grove, New Jersey 07009**

**Report No. 24-C-11  
Job No. 24-C-02  
April 4, 2024**

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April 4, 2024  
Job No. 24-C-02  
Report No. 24-C-11

Garden Homes / West Essex Highlands, Inc.  
820 Morris Turnpike, Suite 301  
Short Hills, NJ 07078

Attention: Mark Hoffman  
E-Mail: MarkH@gardenhomes.com

Re: Supplementary Subsurface Investigation Report  
Subsurface Stormwater Management System  
West Orange, New Jersey

## **INTRODUCTION**

Sor Consulting Engineers, Inc. (SCE) is pleased to present the results of a supplementary subsurface investigation performed for a proposed stormwater management system to be constructed at a site in West Orange, New Jersey. The site is identified as Lot 32, Block 179 on the municipal tax maps. Based on a concept plan dated September 23, 2022, the proposed development will reportedly include a combination of stormwater detention basins as well as underground perforated pipes installed at various locations beneath pavements.

## **PURPOSE AND SCOPE OF WORK**

The purpose of this study was to:

- further explore the subsurface soil and groundwater conditions within the proposed stormwater management system area;
- estimate the geotechnical engineering properties of the encountered subsurface materials including soil permeability;
- estimate the depth to the seasonal high water table; and
- present recommendations for stormwater infiltration system design.

To accomplish this, an exploration program consisting of eight (8) test pits was conducted on March 28, 2024. The test pits were performed by D. Willis Excavating, Inc. using a Case Extendhoe rubber tire backhoe and extended to depths ranging from 2 to 8 feet below the existing ground surface. Tube and bag soil samples suitable for identification and laboratory testing purposes were extracted from the test pits. Upon completion, the test pits were backfilled so as not to leave any open holes.

The test pits were performed under the direct technical observation of a geologist from Sor Consulting Engineers. Our geologist logged the explorations during excavation and sampled the soils to obtain the appropriate subsurface information. The exploration locations are shown relative to the existing site features on the Exploration Location Plan included in Appendix I of this report. Detailed descriptions of the encountered subsurface conditions are presented on the individual test pit logs included in Appendix II. The subsurface profile and soil conditions at the test pit locations were logged in general accordance with the terminology and protocols described in the NJDEP Stormwater BMP Manual Appendix E and USDA and Burmeister Soil Classification Systems.

All soil samples were brought to our office where they were further examined in our soil mechanics laboratory. Mechanical grain size distribution, moisture content and falling head tube permeability test were performed on eight (8) samples to assist in sample identification and evaluation of their engineering soil properties. Laboratory test results are presented in Appendix III.

The results of the subsurface exploration and geotechnical laboratory testing programs have provided the basis for our engineering analysis and geotechnical recommendations. The following discussions of our findings and recommendations are subject to the limitations contained in Appendix IV of this report.

## **SITE CONDITIONS**

Geologic Overview: The subject is located within the New Jersey Piedmont Physiographic Province. The province is primarily a low rolling plain divided by a series of higher ridges formed by intruding magma of Jurassic age. Locally, glacial till deposits

can be found deposited directly by glacial ice during the Wisconsinian glaciation. The bedrock underlying the site is composed of a Jurassic aged basalt formation called the Preakness Basalt, a fine to coarse grained basalt that composes the second Watchung Mountain.

Surface Features: The entire property is currently moderately to heavily wooded and contains some areas of rock outcrops. Large boulders are scattered throughout the site. Several areas identified as wetlands traverse the property in a general northeast to southwest orientation. Surface grades throughout the site reportedly range from a high of Elevation +630 feet in the extreme northern section to Elevation +530 feet along the townhomes.

### **STORMWATER MANAGEMENT SYSTEM DESIGN CONSIDERATIONS**

Basin (TP-40 and TP-41): The area is presently a wooded site. Topographic data provided to us indicates that the ground surface elevations range from approximately +560 to +562 feet. The subsurface conditions revealed in the test pits performed for this study encountered 6 to 10 inches of topsoil/vegetation. The topsoil was underlain by clayey sand soil and extended to depths of 3 to 5 feet below the surface. The clayey sand soil was underlain by bedrock where refusal was encountered. Groundwater seepage was encountered at TP-41 immediately above the bedrock. Seepage was determined to be trapped water. Laboratory tube permeameter testing performed on the silty gravelly sand stratum (loam material) resulted in permeability rates of 0.56 to 0.70 inches per hour (K1 to K2 soils).

However, bedrock encountered at depths of 3 to 5 feet below surface are considered hydraulically restrictive and not suitable for stormwater infiltration.

Basin (TP-42 to TP-43): The area is presently a wooded site. Topographic data provided to us indicates that the ground surface elevations range from approximately +598 to +602 feet. The subsurface conditions revealed in the test pits performed for this study encountered 6 inches of topsoil/vegetation. The topsoil was underlain by clayey soil and extended to a depth of 2 feet below the surface at TP-42 and extended to maximum depths explored at TP-43. The clayey soil was underlain by reddish brown

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silty gravelly sand at TP-42 and extended to the maximum depth explored, 4 feet. Bedrock was encountered below the sandy or clayey soil at depths of 4 to 5 feet. Groundwater seepage was encountered at depths of 4 to 5 feet below the existing ground surface on top of bedrock and determined to be trapped water. Laboratory tube permeameter testing performed on the silty gravelly sand stratum (loam material) resulted in permeability rate of 0.95 inches per hour (K2 soils). However, silt/clay loam encountered at TP-43 resulted in permeability rates less than 0.2 inches per hour (hydraulically restrictive zone). We recommend that the stormwater management system be hydraulically connected to loam materials found at a depth of 2 feet (TP-42). The system should be designed in accordance with the NJDEP Stormwater BMP Manual based on the specific measured permeability rates in each area. We also recommend that the infiltrative surface be covered with a geotextile filter fabric or properly graded soil/aggregate filter material to provide a uniform separation layer and infiltrative surface to minimize the transmission of fines and possible soil clogging. Test Pit 43 encountered clayey soil underlain by bedrock and not suitable for stormwater infiltration.

Basin (TP-44 and TP-45): The area is presently a wooded site. Topographic data provided to us indicate that ground surface elevations range from approximately +570 feet to +574 feet. The subsurface conditions revealed in the test pits performed for this study encountered 6 to 10 inches of topsoil/vegetation. At TP-44, the topsoil was underlain by clayey soil and extended to maximum depths explored. Basalt bedrock was encountered beneath the clayey material at a depth of 2 feet. Groundwater seepage was encountered above the bedrock and considered trap water. Due to the presence of clayey soils which is hydraulically restrictive and shallow bedrock presence, the area is not suitable for stormwater infiltration design.

At TP-45, the topsoil was underlain by clayey soil and extended to a depth of 2.5 feet below the surface. The clayey soil was underlain by silty gravelly sand (loam material) and extended to the maximum depths explored, 8 feet. Bedrock was encountered beneath the loam at a depth of 8 feet below surface. Groundwater seepage was encountered at depths immediately above the bedrock and considered

trap water. Laboratory tube permeameter testing performed on the silty gravelly sand stratum (loam material) resulted in permeability rates of 0.95 inches per hour (K2 soils). We recommend that the stormwater management system be hydraulically connected to these materials found at a depth of 2.5 feet. The system should be designed in accordance with the NJDEP Stormwater BMP Manual based on the specific measured permeability rates in each area. We also recommend that the infiltrative surface be covered with a geotextile filter fabric or properly graded soil/aggregate filter material to provide a uniform separation layer and infiltrative surface to minimize the transmission of fines and possible soil clogging.

Basin (TP-46 and TP-47): The area is presently a partially wooded site. Topographic data provided to us indicate that ground surface elevations range from approximately +574 feet to +578 feet. The subsurface conditions revealed in the test pits performed for this study encountered 15 inches of topsoil/vegetation. The topsoil was underlain by clayey soil and extended to a depth of 4 feet below the surface. The clayey soil was underlain by reddish brown silty gravelly sand (loam material) extended to the maximum depths explored, 5 to 8 feet where bedrock was encountered. Groundwater seepage was encountered at depths of 5 to 8 feet below the surface immediately above the bedrock and considered trap water. Laboratory tube permeameter testing performed on the silty gravelly sand stratum (loam material) resulted in permeability rates of 0.99 inches per hour (K2 soils). We recommend that the stormwater management system be hydraulically connected to these materials found at a depth of 4 feet. The system should be designed in accordance with the NJDEP Stormwater BMP Manual based on the specific measured permeability rates in each area. We also recommend that the infiltrative surface be covered with a geotextile filter fabric or properly graded soil/aggregate filter material to provide a uniform separation layer and infiltrative surface to minimize the transmission of fines and possible soil clogging.

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**RECOMMENDED SERVICES**

It is recommended that Sor Consulting Engineers be provided the opportunity for a general review of the final design and specifications to assure that the stormwater management system recommendations are properly interpreted and implemented in the construction documents.

We also recommend that controlled compacted fill and backfill operations as well as stormwater management system subgrades be observed by a geotechnical engineer from our firm. This is to ensure compliance with the recommendations contained herein and to address any changes in the subsurface conditions that were not disclosed by the test pits.

Sor Consulting Engineers appreciates the opportunity to be of assistance with this project. Should there be any questions concerning the information provided herein, please do not hesitate to contact us. The following appendices are attached and complete this report:

Appendix I: Exploration Location Plan

Appendix II: Test Pit Logs TP-40 through TP-47

Burmeister and USDA Soil Classification System

Appendix III: Laboratory Soil Test Results

Appendix IV: Limitations

Respectfully submitted,

SOR CONSULTING ENGINEERS, INC.

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Atilla Sencar, P.E.  
Senior Engineer

AS/gs

cc: Anderson Consulting Service, LLC  
Attn: Paul Anderson, P.E., P.P., CME  
E-Mail: pandersonpe@gmail.com

**APPENDIX I**  
**EXPLORATION LOCATION PLAN**

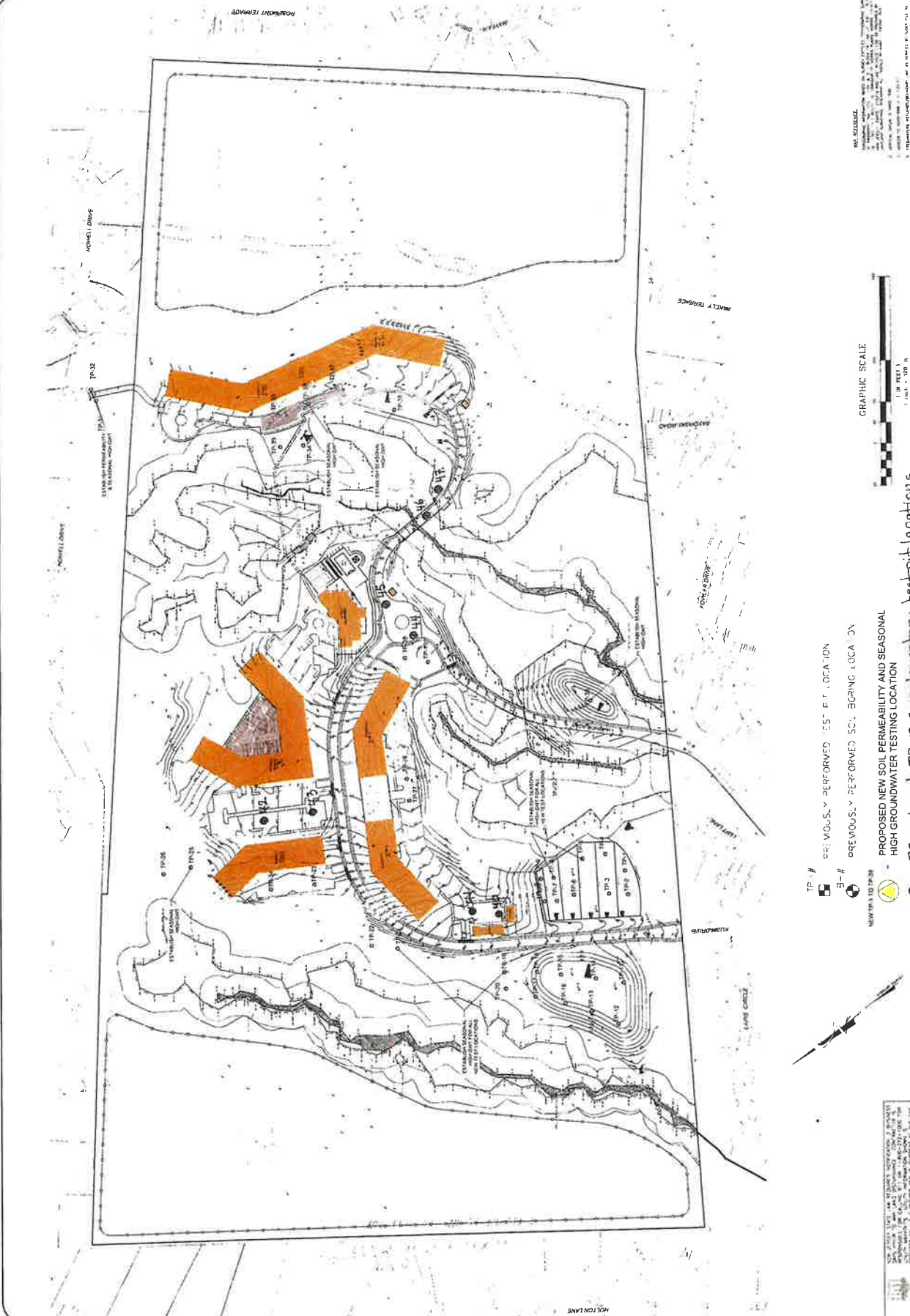
PRELIMINARY AND FINAL SITE PLAN  
 WEST ST & SSEX HIGHLANDS  
 BLOCK 19, LOT 12  
 TOWNSHIP OF WEST JARVIS  
 SSEX COUNTY, NEW JERSEY  
 OVERALL SOIL TESTING PLAN

OA

SHEET 04 OF 56

PAUL W. ANDERSON  
 N.J. PROFESSIONAL ENGINEER  
 No. 12010

APCS  
 400 Middle Street  
 Asbury Park, NJ 07921-0703  
 Tel: 908.939.0703  
 Fax: 908.939.0703  
 www.apcsnj.com



- TP # 1 - PREVIOUSLY PERFORMED TEST PIT LOCATION
- TP # 2 - PREVIOUSLY PERFORMED SOIL BORING LOCATION
- PROPOSED NEW SOIL PERMEABILITY AND SEASONAL HIGH GROUNDWATER TESTING LOCATION
- TP 40 through TP 47 - Supplementary test pit locations

GRAPHIC SCALE



NOT TO SCALE

THIS PLAN IS A PRELIMINARY DESIGN AND IS NOT TO BE USED FOR CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CLIENT TO OBTAIN ALL NECESSARY PERMITS AND APPROVALS. THE CLIENT SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS. THE CLIENT SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS.

## **APPENDIX II**

### **TEST PIT LOGS TP-40 THROUGH TP-47**

### **BURMEISTER AND USDA SOIL CLASSIFICATION SYSTEMS**

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-40</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +560'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | NE        |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                                       | REMARKS                                |
|--------------|---------|----------|------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Firm    | Moist    | Topsoil/Vegetation                                                                                   | Permeability @ 2'<br>K=0.56 in/hr (K1) |
| 2            |         |          | Reddish Brown coarse to fine Sand, and Silt, little coarse to fine Gravel (Loam)<br>Bedrock at 3'-0" |                                        |
| 3            |         |          |                                                                                                      |                                        |
| 4            |         |          | Test Pit completed at 3'-0"                                                                          |                                        |
| 5            |         |          |                                                                                                      |                                        |
| 6            |         |          |                                                                                                      |                                        |
| 7            |         |          |                                                                                                      |                                        |
| 8            |         |          |                                                                                                      |                                        |
| 9            |         |          |                                                                                                      |                                        |
| 10           |         |          |                                                                                                      |                                        |
| 11           |         |          |                                                                                                      |                                        |
| 12           |         |          |                                                                                                      |                                        |
| 13           |         |          |                                                                                                      |                                        |
| 14           |         |          |                                                                                                      |                                        |
| 15           |         |          |                                                                                                      |                                        |
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| 19           |         |          |                                                                                                      |                                        |
| 20           |         |          |                                                                                                      |                                        |

EXCAVATOR : D. Willis Excavating  
 EQUIPMENT : Backhoe  
 STL REPRESENTATIVE : T. Maravegias

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-41</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +562'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | 5'-0"     |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                               | REMARKS                                |
|--------------|---------|----------|----------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Soft    | Moist    | Topsoil/Vegetation 0'-10"                                                                    | Permeability @ 2'<br>K=0.71 in/hr (K2) |
| 2            |         |          | Yellowish Brown coarse to fine Sand, and Clayey Silt, some coarse to fine Gravel (Silt Loam) |                                        |
| 3            | Firm    | Wet      | Reddish Brown coarse to fine Sand, and Silt, little coarse to fine Gravel (Loam)             |                                        |
| 4            |         |          |                                                                                              |                                        |
| 5            |         |          | Bedrock at 5'-0"                                                                             |                                        |
| 6            |         |          | Test Pit completed at 5'-0"                                                                  |                                        |
| 7            |         |          |                                                                                              |                                        |
| 8            |         |          |                                                                                              |                                        |
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**EXCAVATOR :** D. Willis Excavating  
**EQUIPMENT :** Backhoe  
**STL REPRESENTATIVE :** T. Maravegias

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-42</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +602'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | 4'-0"     |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                               | REMARKS                                |
|--------------|---------|----------|----------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Soft    | Moist    | Topsoil/Vegetation                                                                           | Permeability @ 2'<br>K=0.95 in/hr (K2) |
| 2            |         |          | Yellowish Brown coarse to fine Sand, and Clayey Silt, some coarse to fine Gravel (Silt Loam) |                                        |
| 3            | Firm    | Wet      | Reddish Brown coarse to fine SAND, some Silt, trace coarse to fine Gravel (Sandy Loam)       |                                        |
| 4            |         |          | Bedrock at 4'-0"                                                                             |                                        |
| 5            |         |          | Test Pit completed at 4'-0"                                                                  |                                        |
| 6            |         |          |                                                                                              |                                        |
| 7            |         |          |                                                                                              |                                        |
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EXCAVATOR : D. Willis Excavating  
EQUIPMENT : Backhoe  
STL REPRESENTATIVE : T. Maravegias

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-43</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +598'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | 5'-0"     |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                               | REMARKS                                |  |
|--------------|---------|----------|----------------------------------------------------------------------------------------------|----------------------------------------|--|
| 1            | Soft    | Moist    | Topsoil/Vegetation                                                                           | Permeability @ 3'<br>K=0.05 in/hr (K0) |  |
| 2            |         |          | Yellowish Brown coarse to fine Sand, and Clayey Silt, some coarse to fine Gravel (Silt Loam) |                                        |  |
| 3            | Firm    |          | Reddish Brown Clayey SILT, and coarse to fine Sand, trace fine Gravel (Silt Loam)            |                                        |  |
| 4            |         |          |                                                                                              |                                        |  |
| 5            |         |          |                                                                                              |                                        |  |
| 6            | Wet     |          | Bedrock at 5'-0"                                                                             |                                        |  |
| 7            |         |          | Test Pit completed at 5'-0"                                                                  |                                        |  |
| 8            |         |          |                                                                                              |                                        |  |
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**EXCAVATOR :** D. Willis Excavating  
**EQUIPMENT :** Backhoe  
**STL REPRESENTATIVE :** T. Maravegias

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|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-44</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +570'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | 2'-0"     |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE     | GROUND SURFACE                                                                                                   | REMARKS                                |
|--------------|---------|--------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Soft    | Moist<br>Wet | Topsoil/Vegetation 0'-6"                                                                                         | Permeability @ 1'<br>K=0.14 in/hr (K0) |
| 2            |         |              | Yellowish Brown coarse to fine Sand, and Clayey Silt, some coarse to fine Gravel (Silt Loam)<br>Bedrock at 2'-0" |                                        |
| 3            |         |              | Test Pit completed at 2'-0"                                                                                      |                                        |
| 4            |         |              |                                                                                                                  |                                        |
| 5            |         |              |                                                                                                                  |                                        |
| 6            |         |              |                                                                                                                  |                                        |
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| 20           |         |              |                                                                                                                  |                                        |

**EXCAVATOR :** D. Willis Excavating  
**EQUIPMENT :** Backhoe  
**STL REPRESENTATIVE :** T. Maravegias

|                                                          |  |                        |  |                           |
|----------------------------------------------------------|--|------------------------|--|---------------------------|
| <b>SOR CONSULTING ENGINEERS, INC.</b>                    |  | <b>TEST PIT LOG</b>    |  | <b>TEST PIT NO. TP-45</b> |
| <b>CLIENT :</b> Garden Homes/ West Essex Highlands, Inc. |  | <b>GSE</b> +574'       |  | <b>WATER LEVEL</b> 8'-0"  |
| <b>PROJECT :</b> Stormwater Management System            |  | <b>DATE</b> 3/29/2024  |  |                           |
| <b>LOCATION :</b> West Orange, New Jersey                |  | <b>JOB NO.</b> 24-C-02 |  | <b>REPORT NO.</b> 24-C-11 |

| DEPTH FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                                | REMARKS                                |
|-----------|---------|----------|-----------------------------------------------------------------------------------------------|----------------------------------------|
| 1         | Soft    | Moist    | Topsoil/Vegetation                                                                            | Permeability @ 6'<br>K=0.95 in/hr (K2) |
| 2         |         |          |                                                                                               |                                        |
| 3         |         |          |                                                                                               |                                        |
| 4         | Stiff   |          | Light Brown Clayey Silt, little coarse to fine Sand, little coarse to fine Gravel (Clay Loam) |                                        |
| 5         |         |          |                                                                                               |                                        |
| 6         |         |          |                                                                                               |                                        |
| 7         |         |          |                                                                                               |                                        |
| 8         |         |          |                                                                                               |                                        |
| 9         |         |          |                                                                                               |                                        |
| 10        |         |          |                                                                                               |                                        |
| 11        | Wet     |          | Bedrock at 8'-0"                                                                              |                                        |
| 12        |         |          |                                                                                               |                                        |
| 13        |         |          |                                                                                               |                                        |
| 14        |         |          |                                                                                               |                                        |
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| 16        |         |          |                                                                                               |                                        |
| 17        |         |          |                                                                                               |                                        |
| 18        |         |          |                                                                                               |                                        |
| 19        |         |          |                                                                                               |                                        |
| 20        |         |          |                                                                                               |                                        |

EXCAVATOR : D. Willis Excavating  
EQUIPMENT : Backhoe  
STL REPRESENTATIVE : T. Maravegias

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-46</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +574'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | 8'-0"     |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                                          | REMARKS                                |
|--------------|---------|----------|---------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Soft    | Moist    | Topsoil/Vegetation<br>1'-3"                                                                             | Permeability @ 6'<br>K=0.99 in/hr (K2) |
| 2            |         |          | Gray to Reddish Brown Clayey Silt, little coarse to fine Sand, little coarse to fine Gravel (Clay Loam) |                                        |
| 3            |         |          | 2'-6"                                                                                                   |                                        |
| 4            |         |          | Light Brown Clayey Silt, little coarse to fine Sand, little coarse to fine Gravel (Clay Loam)<br>4'-0"  |                                        |
| 5            | Stiff   |          | Reddish Brown coarse to fine Sand, some Silt, and medium to fine Gravel (Sandy Loam)                    |                                        |
| 6            |         |          |                                                                                                         |                                        |
| 7            |         |          |                                                                                                         |                                        |
| 8            |         |          |                                                                                                         |                                        |
| 9            | Wet     |          | Bedrock at 8'-0"                                                                                        |                                        |
| 10           |         |          | Test Pit Completed at 8'-0"                                                                             |                                        |
| 11           |         |          |                                                                                                         |                                        |
| 12           |         |          |                                                                                                         |                                        |
| 13           |         |          |                                                                                                         |                                        |
| 14           |         |          |                                                                                                         |                                        |
| 15           |         |          |                                                                                                         |                                        |
| 16           |         |          |                                                                                                         |                                        |
| 17           |         |          |                                                                                                         |                                        |
| 18           |         |          |                                                                                                         |                                        |
| 19           |         |          |                                                                                                         |                                        |
| 20           |         |          |                                                                                                         |                                        |

EXCAVATOR : D. Willis Excavating  
EQUIPMENT : Backhoe  
STL REPRESENTATIVE : T. Maravegias

|                                           |                     |                           |
|-------------------------------------------|---------------------|---------------------------|
| <b>SOR CONSULTING<br/>ENGINEERS, INC.</b> | <b>TEST PIT LOG</b> | <b>TEST PIT NO. TP-47</b> |
|-------------------------------------------|---------------------|---------------------------|

|                   |                                          |                    |           |
|-------------------|------------------------------------------|--------------------|-----------|
| <b>CLIENT :</b>   | Garden Homes/ West Essex Highlands, Inc. | <b>GSE</b>         | +578'     |
| <b>PROJECT :</b>  | Stormwater Management System             | <b>WATER LEVEL</b> | NE        |
| <b>LOCATION :</b> | West Orange, New Jersey                  | <b>DATE</b>        | 3/28/2024 |
|                   |                                          | <b>JOB NO.</b>     | 24-C-02   |
|                   |                                          | <b>REPORT NO.</b>  | 24-C-11   |

| DEPTH<br>FT. | DENSITY | MOISTURE | GROUND SURFACE                                                                                                   | REMARKS                                |
|--------------|---------|----------|------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1            | Firm    | Moist    | Topsoil/Vegetation<br>1'-3"                                                                                      | Permeability @ 3'<br>K=0.11 in/hr (K0) |
| 2            |         |          | Gray to Reddish Brown Clayey Silt, little coarse to fine Sand, little coarse to fine Gravel (Clay Loam)<br>2'-0" |                                        |
| 3            | Dense   |          | Light Brown Clayey Silt, little coarse to fine Sand, I (Silt Loam)<br>4'-0"                                      |                                        |
| 4            |         |          | Reddish Brown coarse to fine Sand, some Silt, and coarse to fine Gravel (Loam)<br>Bedrock at 5'-0"               |                                        |
| 5            |         |          |                                                                                                                  |                                        |
| 6            |         |          | Test Pit completed at 5'-0"                                                                                      |                                        |
| 7            |         |          |                                                                                                                  |                                        |
| 8            |         |          |                                                                                                                  |                                        |
| 9            |         |          |                                                                                                                  |                                        |
| 10           |         |          |                                                                                                                  |                                        |
| 11           |         |          |                                                                                                                  |                                        |
| 12           |         |          |                                                                                                                  |                                        |
| 13           |         |          |                                                                                                                  |                                        |
| 14           |         |          |                                                                                                                  |                                        |
| 15           |         |          |                                                                                                                  |                                        |
| 16           |         |          |                                                                                                                  |                                        |
| 17           |         |          |                                                                                                                  |                                        |
| 18           |         |          |                                                                                                                  |                                        |
| 19           |         |          |                                                                                                                  |                                        |
| 20           |         |          |                                                                                                                  |                                        |

**EXCAVATOR :** D. Willis Excavating  
**EQUIPMENT :** Backhoe  
**STL REPRESENTATIVE :** T. Maravegias

## VISUAL IDENTIFICATION OF SAMPLES

The samples were identified in accordance with the American Society for Engineering Education System of Definition described by Professor Donald M. Burmeister in ASTM Special Technical Publication 479, 5th Edition, 1970.

### I. Definition of Soil Components and Fractions

| MATERIAL | SYMBOL | FRACTION                             | SIEVE SIZE                                             | DEFINITION                                                                                                             |
|----------|--------|--------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Boulders | Bldr   | --                                   | 9" +                                                   | Material retained on 9" sieve.                                                                                         |
| Cobbles  | Cbl    | --                                   | 3" to 9"                                               | Material passing the 9" sieve and retained on the 3" sieve.                                                            |
| Gravel   | G      | Coarse (c)<br>Medium (m)<br>Fine (f) | 1" to 3"<br>3/8" to 1"<br>No. 10 to 3/8"               | Material passing the 3" sieve and retained on the No. 10 sieve.                                                        |
| Sand     | S      | Coarse (c)<br>Medium (m)<br>Fine (f) | No.30 to No. 10<br>No.60 to No. 30<br>No.200 to No. 60 | Material passing the No. 10 sieve and retained on the No. 200 sieve.                                                   |
| Silt     | \$     | --                                   | Passing No. 200<br>(0.074 mm)                          | Material passing the No. 200 sieve that is non-plastic in character and exhibits little or no strength when air dried. |

#### Organic Silt (O\$)

Material passing the No. 200 sieve which exhibits plastic properties within a certain range of moisture content, and exhibits fine granular and organic characteristics.

|             |      | PLASTICITY     | PLASTICITY INDEX | CLAY-SOIL                                                                                                                                                                                          |
|-------------|------|----------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clayey SILT | Cy\$ | Slight (sl)    | 1 to 5           | Material passing the No. 200 sieve which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried. |
| SILT & CLAY | \$&C | Low (l)        | 5 to 10          |                                                                                                                                                                                                    |
| CLAY & SILT | C&\$ | Medium (m)     | 10 to 20         |                                                                                                                                                                                                    |
| Silty CLAY  | \$yC | High (h)       | 20 t 40          |                                                                                                                                                                                                    |
| CLAY        | C    | Very High (vh) | 40 plus          |                                                                                                                                                                                                    |

## II. Definition of Component Proportions

| COMPONENT | WRITTEN    | PROPORTIONS                    | SYMBOL | PERCENTAGE RANGE BY WEIGHT* |
|-----------|------------|--------------------------------|--------|-----------------------------|
| Principal | CAPITALS   | --                             |        | 50 or more                  |
| Minor     | Lower Case | and<br>some<br>little<br>trace | a.     | 35 to 50                    |
|           |            |                                | s.     | 20 to 35                    |
|           |            |                                | l.     | 10 to 20                    |
|           |            |                                | t.     | 1 to 10                     |

\*Minus sign (-) lower limit, plus sign (+) upper limit, no sign middle range.

## III. Glossary of Modifying Abbreviations

| CATEGORY                   | SYMBOL                                                                                     | TERM                                                                                                                                   | SYMBOL                                                                                                                                                                                                                                                                                                                             | TERM                                                                                        | SYMBOL                            | TERM                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------|
| A. Borings                 | U/D                                                                                        | Undisturbed                                                                                                                            | B                                                                                                                                                                                                                                                                                                                                  | Exploratory                                                                                 | A                                 | Auger                                                                       |
| B. Samples                 | C<br>D<br>O.E.                                                                             | Casing<br>Denison<br>Open End                                                                                                          | L<br>S                                                                                                                                                                                                                                                                                                                             | Lost<br>Spoon                                                                               | U<br>W                            | Undisturbed<br>Wash                                                         |
| C. Colors                  | bk<br>bl<br>br<br>gr                                                                       | black<br>blue<br>brown<br>gray                                                                                                         | gn<br>or<br>rd<br>tn                                                                                                                                                                                                                                                                                                               | green<br>orange<br>red<br>tan                                                               | wh<br>yw<br>dk<br>lt              | white<br>yellow<br>dark<br>light                                            |
| D. Organic Soils           | dec<br>dec'g<br>lig                                                                        | decayed<br>decaying<br>lignite                                                                                                         | o<br>rts<br>ts                                                                                                                                                                                                                                                                                                                     | organic<br>roots<br>topsoil                                                                 | veg<br>pt                         | Vegetation<br>peat                                                          |
| E. Rocks                   | LS<br>Gns                                                                                  | Limestone<br>Gneiss                                                                                                                    | rk<br>SS                                                                                                                                                                                                                                                                                                                           | rock<br>Sandstone                                                                           | Shst<br>Sh                        | Schist<br>Shale                                                             |
| F. Fill and Misc. Material | bldr(s)<br>brk(s)<br>cndr(s)                                                               | boulder(s)<br>brick(s)<br>cinder(s)                                                                                                    | cbl (s)<br>wd<br>dbr                                                                                                                                                                                                                                                                                                               | cobble (s)<br>wood<br>debris                                                                | gls<br>misc<br>rbl                | glass<br>miscellaneo<br>us<br>rubble                                        |
| G. Misc. Terms             | do<br>el, El<br>fgmt (s)<br>frqt<br>lrg<br>mtld<br>no rec<br>pen                           | ditto<br>elevation<br>fragment(s)<br>frequent<br>large<br>mottled<br>no recovery<br>penetration                                        | pp<br><br>P.I.<br><br>P<br><br>pc(s)<br>rec or R                                                                                                                                                                                                                                                                                   | pocket<br>penetrometer<br>Plasticity<br>Index<br>pushed<br>pressed<br>piece(s)<br>recovered | ref<br>sm<br>W.L.<br>W.H.<br>W.R. | refusal<br>small<br>water level<br>weight of<br>hammer<br>weight of<br>rods |
| H. Stratified Soils        | alt<br>thk<br>thn<br>w<br>prt<br>seam<br>lyr<br>stra<br>vvd c<br>pkt<br>Ins<br>occ<br>freq | alternating<br>thick<br>thin<br>with<br>parting<br>seam<br>layer<br>stratum<br>varved Clay<br>pocket<br>lens<br>occasional<br>frequent | - ) to 1/16" thickness<br>- 1/16 to 1/2" thickness<br>- 1/2 to 12" thickness<br>- greater than 12" thickness<br>- alternating seams or layers of sand, silt and clay<br>- small, erratic deposit, usually less than 1 foot<br>- lenticular deposit<br>- one or less per foot of thickness<br>- more than one per foot of thickness |                                                                                             |                                   |                                                                             |

IV. Other Descriptive Criteria

A. Relative density of coarse-grained soils and non-plastic silts.

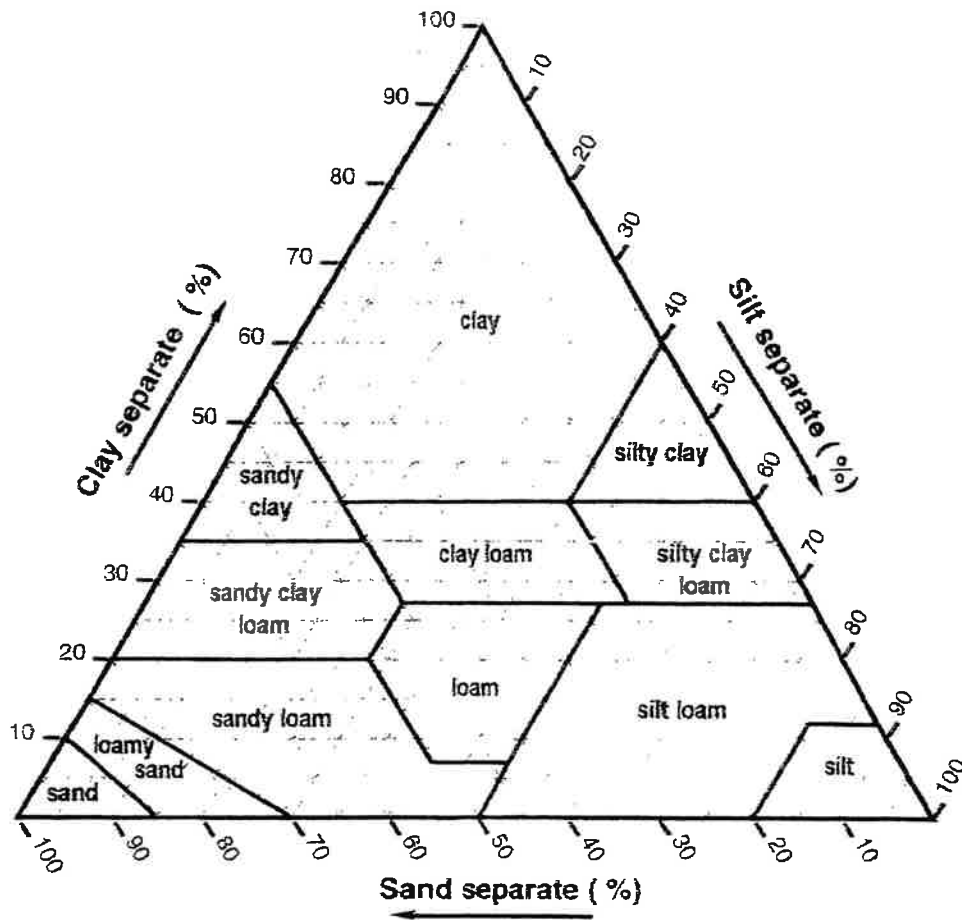
| N-VALUE | DESCRIPTIVE TERM | RELATIVE DENSITY (%) |
|---------|------------------|----------------------|
| 0-4     | Very Loose       | 0-15                 |
| 4-10    | Loose            | 15-45                |
| 10-30   | Medium Dense     | 45-70                |
| 30-50   | Dense            | 70-85                |
| 50+     | Very Dense       | 85-100               |

B. Consistency of fine-grained soils with some plasticity.

| N-VALUE | DESCRIPTIVE TERM | UNCONFINED<br>COMPRESSIVE STRENGTH<br>(tsf) |
|---------|------------------|---------------------------------------------|
| 0-2     | Very Soft        | Less than 0.25                              |
| 2-4     | Soft             | 0.25-0.50                                   |
| 4-8     | Medium           | 0.50-1.00                                   |
| 8-16    | Stiff            | 1.00-2.00                                   |
| 16-32   | Very Stiff       | 2.00-4.00                                   |
| 32+     | Hard             | 4.00+                                       |

## Texture Triangle:

Fine Earth Texture Classes ( — )



USDA SOIL CLASSIFICATION SYSTEM

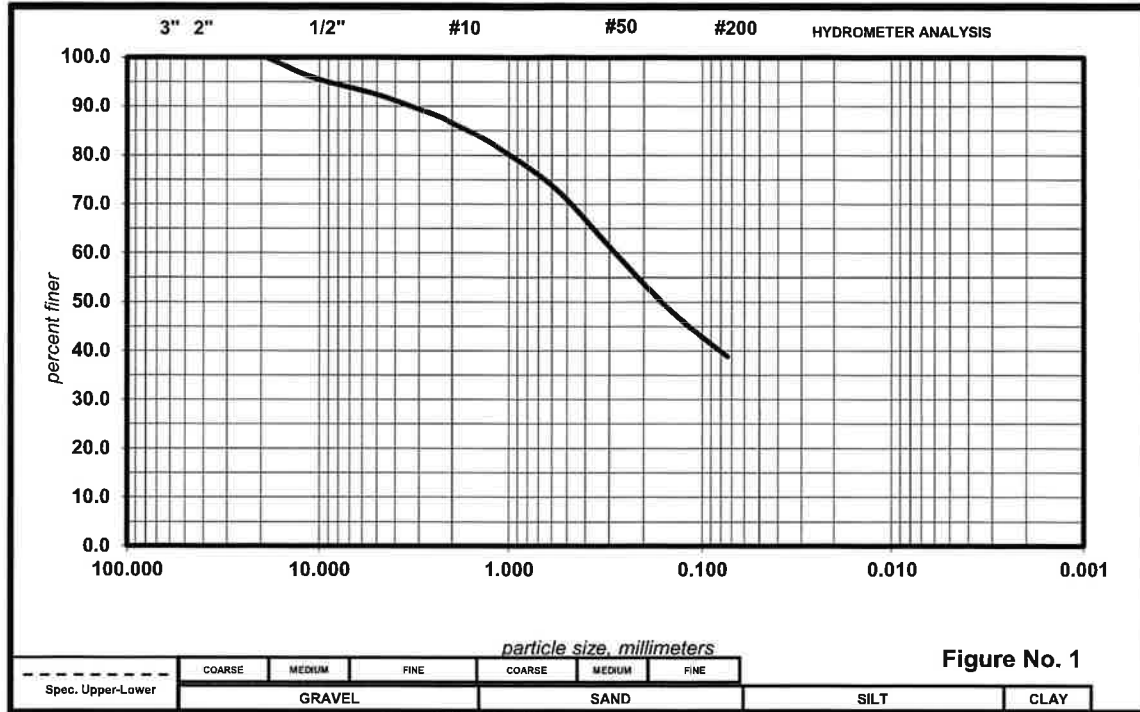
**APPENDIX III**

**LABORATORY SOIL TEST RESULTS**

# SOR TESTING LABORATORIES, INC.

98 Sand Park Road - Cedar Grove, NJ 07009  
Tel.: (973) 239-6001 Fax: (973) 239-8380 <http://www.sorlabs.com>

## PARTICLE SIZE DISTRIBUTION TEST REPORT



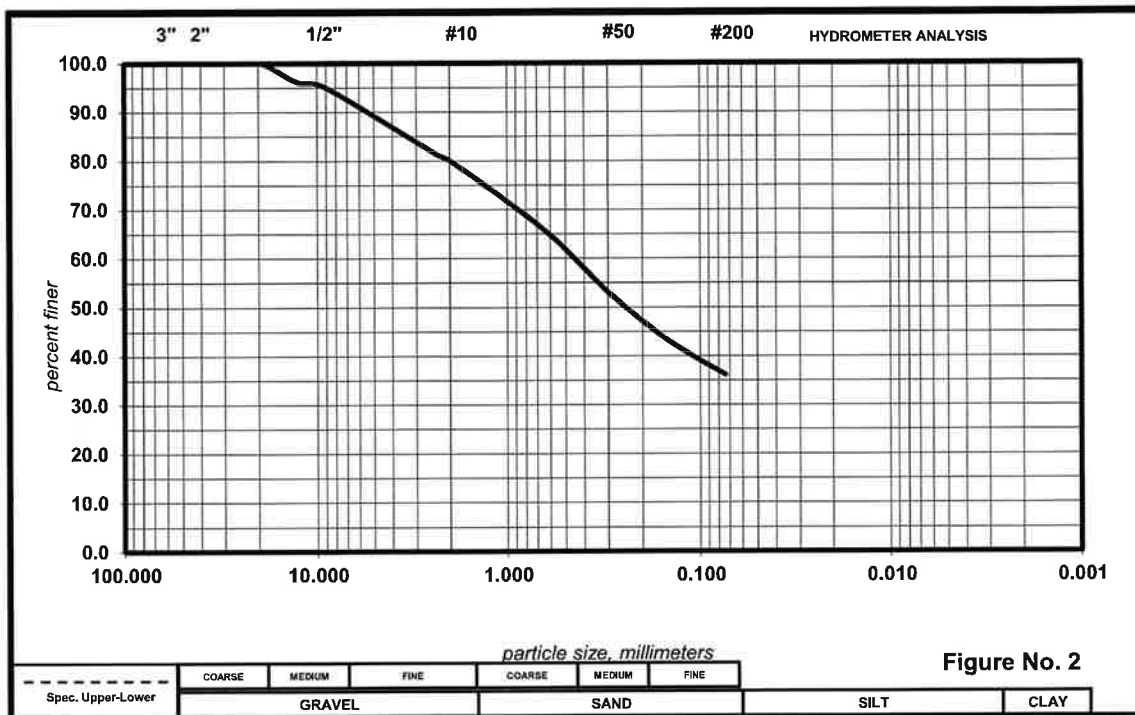
### Specification\*

| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample Identification                                  |                                           |      |
|------------------|---------|---------|---------|--------------------------------------------------------|-------------------------------------------|------|
| 3" (75 mm)       |         |         |         | Sample No.:                                            | TP-40                                     |      |
| 2 1/2" (63 mm)   |         |         |         | Lab No.:                                               | A24-41-01                                 |      |
| 2" (50 mm)       |         |         |         | Source/Location:                                       | 2'                                        |      |
| 1 1/2" (38.1 mm) |         |         |         | Description:                                           | Brown of Sand, and Silt, little mf Gravel |      |
| 1" (25 mm)       |         |         |         |                                                        |                                           |      |
| 3/4" (19 mm)     | 100.0   |         |         |                                                        |                                           |      |
| 5/8" (16 mm)     |         |         |         |                                                        |                                           |      |
| 1/2" (12.5 mm)   | 96.8    |         |         |                                                        |                                           |      |
| 3/8" (9.5 mm)    | 95.2    |         |         | sample description in accordance with Burmister System |                                           |      |
| 5/16" (8 mm)     |         |         |         | LL :                                                   | PL :                                      | PI : |
| 1/4" (6.3 mm)    |         |         |         | As received Moisture Content: 22.1 %                   |                                           |      |
| #4 (4.75 mm)     | 92.1    |         |         | Classification:                                        |                                           |      |
| #6 (3.35 mm)     |         |         |         | USCS: [SM]                                             |                                           |      |
| #8 (2.36 mm)     | 87.9    |         |         | AASHTO:                                                |                                           |      |
| #10 (2 mm)       |         |         |         | Remarks:                                               |                                           |      |
| #14 (1.4 mm)     |         |         |         | Sample received in lab on March 29, 2024               |                                           |      |
| #16 (1.18 mm)    | 82.0    |         |         | Permeability, k: 3.9 x 10-4 cm/s (0.56 in/hr) K1       |                                           |      |
| #20 (850 µm)     |         |         |         | Permeability, k: 3.7 x 10-4 cm/s (0.53 in/hr) K1       |                                           |      |
| #30 (600 µm)     | 73.6    |         |         | Client: Garden Homes                                   |                                           |      |
| #40 (425 µm)     |         |         |         | Project: West Essex Highlands                          |                                           |      |
| #50 (300 µm)     | 61.1    |         |         | Stormwater Management System                           |                                           |      |
| #60 (250 µm)     |         |         |         | Location: West Orange, New Jersey                      |                                           |      |
| #100 (150 µm)    | 48.5    |         |         | Date: 3-Apr-24                                         |                                           |      |
| #200 (75 µm)     | 38.8    |         |         | Job No.: 24-C-02 Report No.: 24-C-11                   |                                           |      |
| -                |         |         |         |                                                        |                                           |      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT

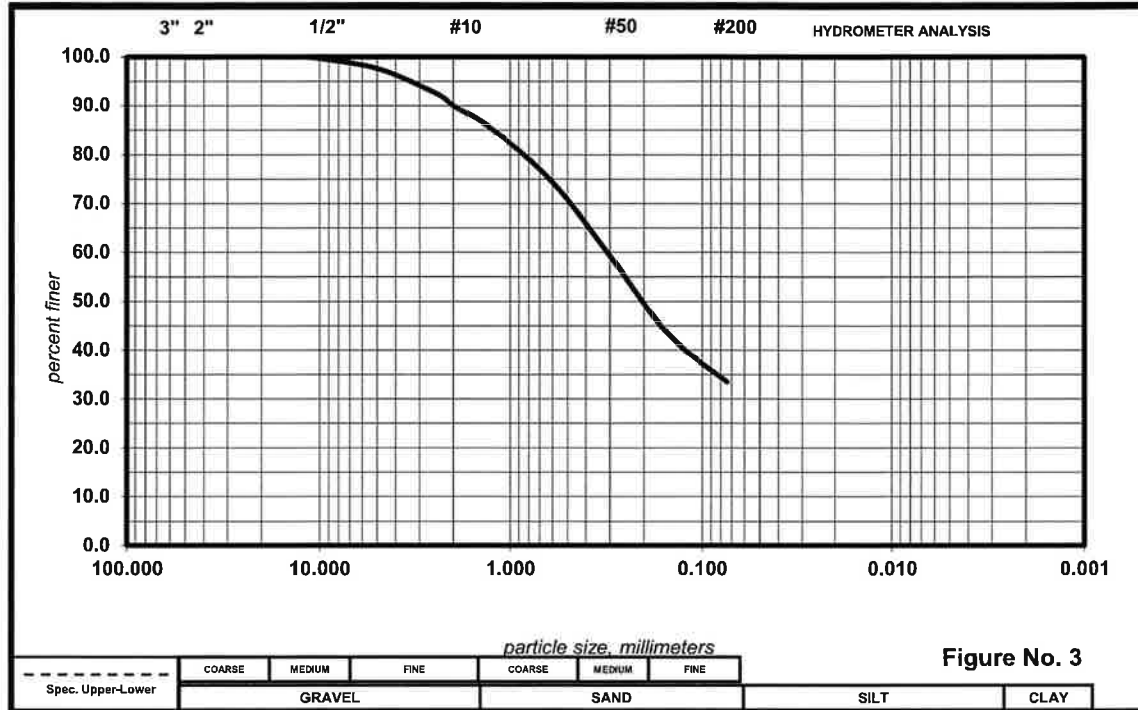


| Specification*   |         |         |         | Sample Identification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
|------------------|---------|---------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | <div>Sample No.: TP-41</div> <div>Lab No.: A24-41-02</div> <div>Source/Location: 2'</div> <div>Description: Brown of Sand, and Silt, little mf Gravel</div> <div>sample description in accordance with Burmister System</div> <div>LL :      PL :      PI :</div> <div>As received Moisture Content: 20.8 %</div> <div>Classification:</div> <div>USCS: [SM]</div> <div>AASHTO:</div> <div>Remarks:</div> <div>Sample received in lab on March 29, 2024</div> <div>Permeability, k: 4.9 x 10-4 cm/s (0.71 in/hr) K2</div> <div>Permeability, k: 4.7 x 10-4 cm/s (0.68 in/hr) K2</div> <div>Client: Garden Homes</div> <div>Project: West Essex Highlands</div> <div>Stormwater Management System</div> <div>Location: West Orange, New Jersey</div> <div>Date: 3-Apr-24</div> <div>Job No.: 24-C-02      Report No.: 24-C-11</div> |  |  |
| 3" (75 mm)       |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 2 1/2" (63 mm)   |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 2" (50 mm)       |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 1 1/2" (38.1 mm) |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 1" (25 mm)       |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 3/4" (19 mm)     | 100.0   |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 5/8" (16 mm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 1/2" (12.5 mm)   | 96.1    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 3/8" (9.5 mm)    | 95.4    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 5/16" (8 mm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 1/4" (6.3 mm)    |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #4 (4.75 mm)     | 88.7    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #6 (3.35 mm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #8 (2.36 mm)     | 81.4    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #10 (2 mm)       |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #14 (1.4 mm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #16 (1.18 mm)    | 73.9    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #20 (850 μm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #30 (600 μm)     | 64.5    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #40 (425 μm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #50 (300 μm)     | 52.9    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #60 (250 μm)     |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #100 (150 μm)    | 43.3    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| #200 (75 μm)     | 36.2    |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| -                |         |         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT



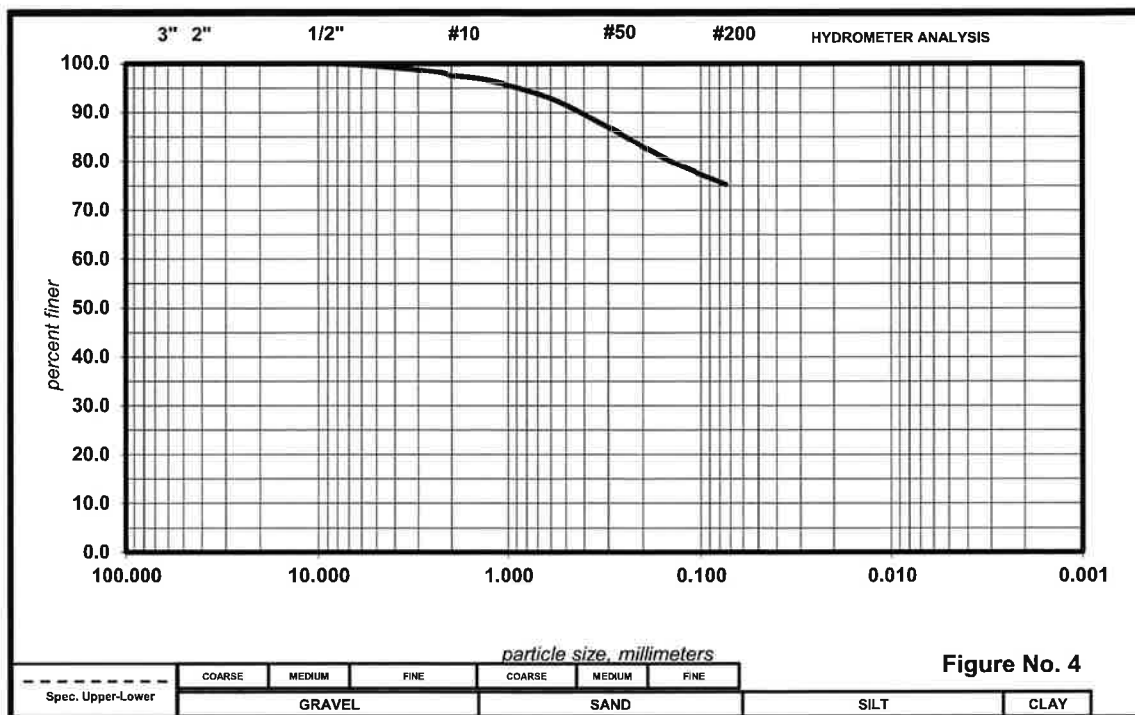
### Specification\*

| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample Identification                                  |                                           |      |
|------------------|---------|---------|---------|--------------------------------------------------------|-------------------------------------------|------|
| 3" (75 mm)       |         |         |         | Sample No.:                                            | TP-42                                     |      |
| 2 1/2" (63 mm)   |         |         |         | Lab No.:                                               | A24-41-03                                 |      |
| 2" (50 mm)       |         |         |         | Source/Location:                                       | 2'                                        |      |
| 1 1/2" (38.1 mm) |         |         |         | Description:                                           | Brown of SAND, some Silt, trace mf Gravel |      |
| 1" (25 mm)       |         |         |         |                                                        |                                           |      |
| 3/4" (19 mm)     |         |         |         |                                                        |                                           |      |
| 5/8" (16 mm)     |         |         |         |                                                        |                                           |      |
| 1/2" (12.5 mm)   | 100.0   |         |         |                                                        |                                           |      |
| 3/8" (9.5 mm)    | 99.5    |         |         | sample description in accordance with Burmister System |                                           |      |
| 5/16" (8 mm)     |         |         |         | LL :                                                   | PL :                                      | PI : |
| 1/4" (6.3 mm)    |         |         |         | As received Moisture Content: 19.4 %                   |                                           |      |
| #4 (4.75 mm)     | 97.3    |         |         | Classification:                                        |                                           |      |
| #6 (3.35 mm)     |         |         |         | USCS: [SM]                                             |                                           |      |
| #8 (2.36 mm)     | 92.2    |         |         | AASHTO:                                                |                                           |      |
| #10 (2 mm)       |         |         |         | Remarks:                                               |                                           |      |
| #14 (1.4 mm)     |         |         |         | Sample received in lab on March 29, 2024               |                                           |      |
| #16 (1.18 mm)    | 84.6    |         |         | Permeability, k: 6.6 x 10-4 cm/s (0.95 in/hr) K2       |                                           |      |
| #20 (850 µm)     |         |         |         | Permeability, k: 6.3 x 10-4 cm/s (0.91 in/hr) K2       |                                           |      |
| #30 (600 µm)     | 74.0    |         |         | Client: Garden Homes                                   |                                           |      |
| #40 (425 µm)     |         |         |         | Project: West Essex Highlands                          |                                           |      |
| #50 (300 µm)     | 59.0    |         |         | Stormwater Management System                           |                                           |      |
| #60 (250 µm)     |         |         |         | Location: West Orange, New Jersey                      |                                           |      |
| #100 (150 µm)    | 43.1    |         |         | Date: 3-Apr-24                                         |                                           |      |
| #200 (75 µm)     | 33.5    |         |         | Job No.: 24-C-02 Report No.: 24-C-11                   |                                           |      |
| -                |         |         |         |                                                        |                                           |      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT



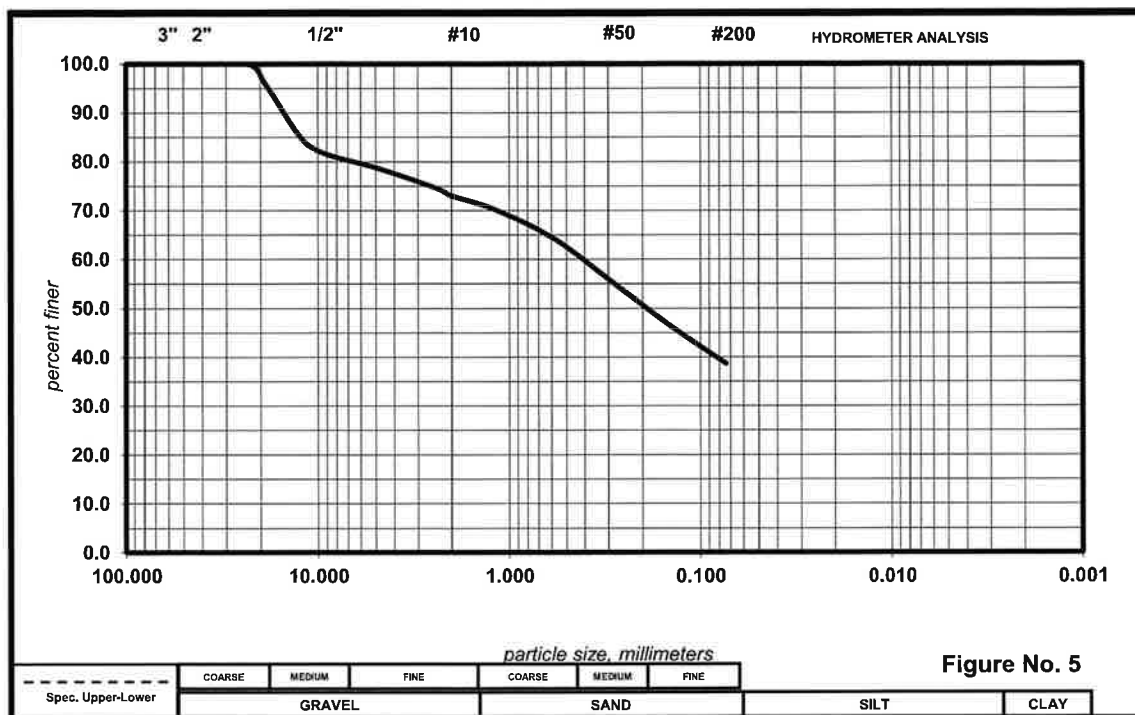
### Specification\*

| Specification    |         |         |         | Sample Identification                                  |                                                   |  |      |      |
|------------------|---------|---------|---------|--------------------------------------------------------|---------------------------------------------------|--|------|------|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample No.:                                            | TP-43                                             |  |      |      |
| 3" (75 mm)       |         |         |         | Lab No.:                                               | A24-41-04                                         |  |      |      |
| 2 1/2" (63 mm)   |         |         |         | Source/Location:                                       | 3'                                                |  |      |      |
| 2" (50 mm)       |         |         |         | Description:                                           | Brown Clayey SILT and, cf Sand, trace fine Gravel |  |      |      |
| 1 1/2" (38.1 mm) |         |         |         | sample description in accordance with Burmister System |                                                   |  |      |      |
| 1" (25 mm)       |         |         |         | LL :                                                   |                                                   |  | PL : | PI : |
| 3/4" (19 mm)     |         |         |         | As received Moisture Content: 22.9 %                   |                                                   |  |      |      |
| 5/8" (16 mm)     |         |         |         | Classification:                                        |                                                   |  |      |      |
| 1/2" (12.5 mm)   |         |         |         | USCS: [ML]                                             |                                                   |  |      |      |
| 3/8" (9.5 mm)    | 100.0   |         |         | AASHTO:                                                |                                                   |  |      |      |
| 5/16" (8 mm)     |         |         |         | Remarks:                                               |                                                   |  |      |      |
| 1/4" (6.3 mm)    |         |         |         | Sample received in lab on March 29, 2024               |                                                   |  |      |      |
| #4 (4.75 mm)     | 99.4    |         |         | Permeability, k: 3.5 x 10-5 cm/s (0.05 in/hr) K0       |                                                   |  |      |      |
| #6 (3.35 mm)     |         |         |         | Permeability, k: 3.3 x 10-5 cm/s (0.05 in/hr) K0       |                                                   |  |      |      |
| #8 (2.36 mm)     | 98.2    |         |         | Client: Garden Homes                                   |                                                   |  |      |      |
| #10 (2 mm)       |         |         |         | Project: West Essex Highlands                          |                                                   |  |      |      |
| #14 (1.4 mm)     |         |         |         | Stormwater Management System                           |                                                   |  |      |      |
| #16 (1.18 mm)    | 96.3    |         |         | Location: West Orange, New Jersey                      |                                                   |  |      |      |
| #20 (850 µm)     |         |         |         | Date: 3-Apr-24                                         |                                                   |  |      |      |
| #30 (600 µm)     | 92.7    |         |         | Job No.: 24-C-02                                       |                                                   |  |      |      |
| #40 (425 µm)     |         |         |         | Report No.: 24-C-11                                    |                                                   |  |      |      |
| #50 (300 µm)     | 86.8    |         |         |                                                        |                                                   |  |      |      |
| #60 (250 µm)     |         |         |         |                                                        |                                                   |  |      |      |
| #100 (150 µm)    | 80.3    |         |         |                                                        |                                                   |  |      |      |
| #200 (75 µm)     | 75.3    |         |         |                                                        |                                                   |  |      |      |
|                  |         |         |         |                                                        |                                                   |  |      |      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT



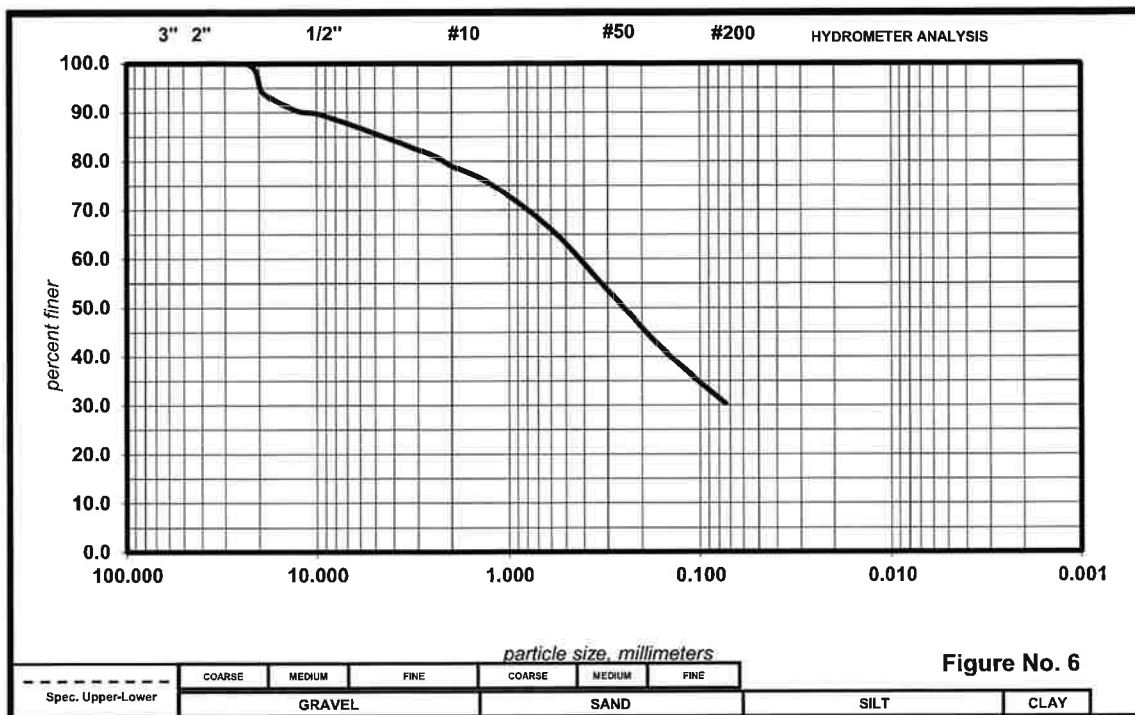
### Specification\*

| Specimen:        |         |         |         | Sample Identification                                  |                                                |      |
|------------------|---------|---------|---------|--------------------------------------------------------|------------------------------------------------|------|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample No.:                                            | TP-44                                          |      |
| 3" (75 mm)       |         |         |         | Lab No.:                                               | A24-41-05                                      |      |
| 2 1/2" (63 mm)   |         |         |         | Source/Location:                                       | 1'                                             |      |
| 2" (50 mm)       |         |         |         | Description:                                           | Brown of Sand, and Clayey Silt, some mf Gravel |      |
| 1 1/2" (38.1 mm) |         |         |         |                                                        |                                                |      |
| 1" (25 mm)       | 100.0   |         |         |                                                        |                                                |      |
| 3/4" (19 mm)     | 96.2    |         |         |                                                        |                                                |      |
| 5/8" (16 mm)     |         |         |         |                                                        |                                                |      |
| 1/2" (12.5 mm)   | 85.6    |         |         | sample description in accordance with Burmister System |                                                |      |
| 3/8" (9.5 mm)    | 81.9    |         |         | LL :                                                   | PL :                                           | PI : |
| 5/16" (8 mm)     |         |         |         | As received Moisture Content: 17.3 %                   |                                                |      |
| 1/4" (6.3 mm)    |         |         |         | Classification:                                        |                                                |      |
| #4 (4.75 mm)     | 78.5    |         |         | USCS: [SM]                                             |                                                |      |
| #6 (3.35 mm)     |         |         |         | AASHTO:                                                |                                                |      |
| #8 (2.36 mm)     | 74.5    |         |         | Remarks:                                               |                                                |      |
| #10 (2 mm)       |         |         |         | Sample received in lab on March 29, 2024               |                                                |      |
| #14 (1.4 mm)     |         |         |         | Permeability, k: 1.0 x 10-4 cm/s (0.14 in/hr) K0       |                                                |      |
| #16 (1.18 mm)    | 70.2    |         |         | Permeability, k: 9.0 x 10-5 cm/s (0.13 in/hr) K0       |                                                |      |
| #20 (850 µm)     |         |         |         | Client: Garden Homes                                   |                                                |      |
| #30 (600 µm)     | 64.4    |         |         | Project: West Essex Highlands                          |                                                |      |
| #40 (425 µm)     |         |         |         | Stormwater Management System                           |                                                |      |
| #50 (300 µm)     | 55.8    |         |         | Location: West Orange, New Jersey                      |                                                |      |
| #60 (250 µm)     |         |         |         | Date: 3-Apr-24                                         |                                                |      |
| #100 (150 µm)    | 46.9    |         |         | Job No.: 24-C-02                                       |                                                |      |
| #200 (75 µm)     | 38.7    |         |         | Report No.: 24-C-11                                    |                                                |      |
| -                |         |         |         |                                                        |                                                |      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT



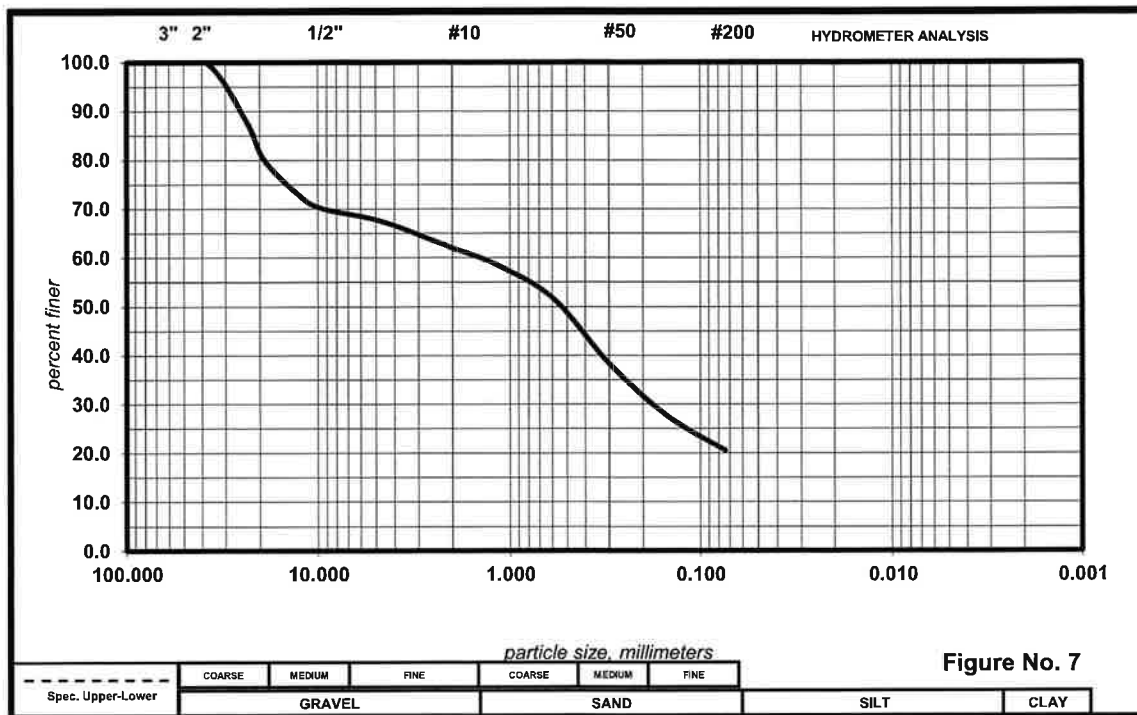
### Specification\*

| Specification    |         |         |         | Sample Identification                            |                                                  |                                          |
|------------------|---------|---------|---------|--------------------------------------------------|--------------------------------------------------|------------------------------------------|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample No.:                                      | TP-45                                            |                                          |
| 3" (75 mm)       |         |         |         |                                                  | Lab No.:                                         | A24-41-06                                |
| 2 1/2" (63 mm)   |         |         |         | Source/Location:                                 |                                                  | 6'                                       |
| 2" (50 mm)       |         |         |         |                                                  | Description:                                     | Brown of Sand, some Silt, some mf Gravel |
| 1 1/2" (38.1 mm) |         |         |         |                                                  |                                                  |                                          |
| 1" (25 mm)       | 100.0   |         |         |                                                  |                                                  |                                          |
| 3/4" (19 mm)     | 94.0    |         |         |                                                  |                                                  |                                          |
| 5/8" (16 mm)     |         |         |         |                                                  |                                                  |                                          |
| 1/2" (12.5 mm)   | 90.3    |         |         |                                                  |                                                  |                                          |
| 3/8" (9.5 mm)    | 89.5    |         |         |                                                  |                                                  |                                          |
| 5/16" (8 mm)     |         |         |         |                                                  |                                                  |                                          |
| 1/4" (6.3 mm)    |         |         |         |                                                  |                                                  |                                          |
| #4 (4.75 mm)     | 85.3    |         |         |                                                  |                                                  |                                          |
| #6 (3.35 mm)     |         |         |         | Classification:                                  | USCS: [SM]<br>AASHTO:                            |                                          |
| #8 (2.36 mm)     | 80.7    |         |         |                                                  |                                                  |                                          |
| #10 (2 mm)       |         |         |         | Remarks:                                         | Sample received in lab on March 29, 2024         |                                          |
| #14 (1.4 mm)     |         |         |         |                                                  |                                                  |                                          |
| #16 (1.18 mm)    | 74.8    |         |         |                                                  |                                                  |                                          |
| #20 (850 μm)     |         |         |         |                                                  |                                                  |                                          |
| #30 (600 μm)     | 65.8    |         |         |                                                  |                                                  |                                          |
| #40 (425 μm)     |         |         |         |                                                  |                                                  |                                          |
| #50 (300 μm)     | 53.3    |         |         |                                                  |                                                  |                                          |
| #60 (250 μm)     |         |         |         |                                                  |                                                  |                                          |
| #100 (150 μm)    | 40.7    |         |         |                                                  |                                                  |                                          |
| #200 (75 μm)     | 30.3    |         |         |                                                  |                                                  |                                          |
|                  |         |         |         | Permeability, k: 6.6 x 10-4 cm/s (0.95 in/hr) K2 | Permeability, k: 6.2 x 10-4 cm/s (0.89 in/hr) K2 |                                          |
|                  |         |         |         | Client:                                          | Garden Homes                                     |                                          |
|                  |         |         |         | Project:                                         | West Essex Highlands                             |                                          |
|                  |         |         |         |                                                  | Stormwater Management System                     |                                          |
|                  |         |         |         | Location:                                        | West Orange, New Jersey                          |                                          |
|                  |         |         |         | Date:                                            | 3-Apr-24                                         |                                          |
|                  |         |         |         | Job No.:                                         | 24-C-02                                          | Report No.: 24-C-11                      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT

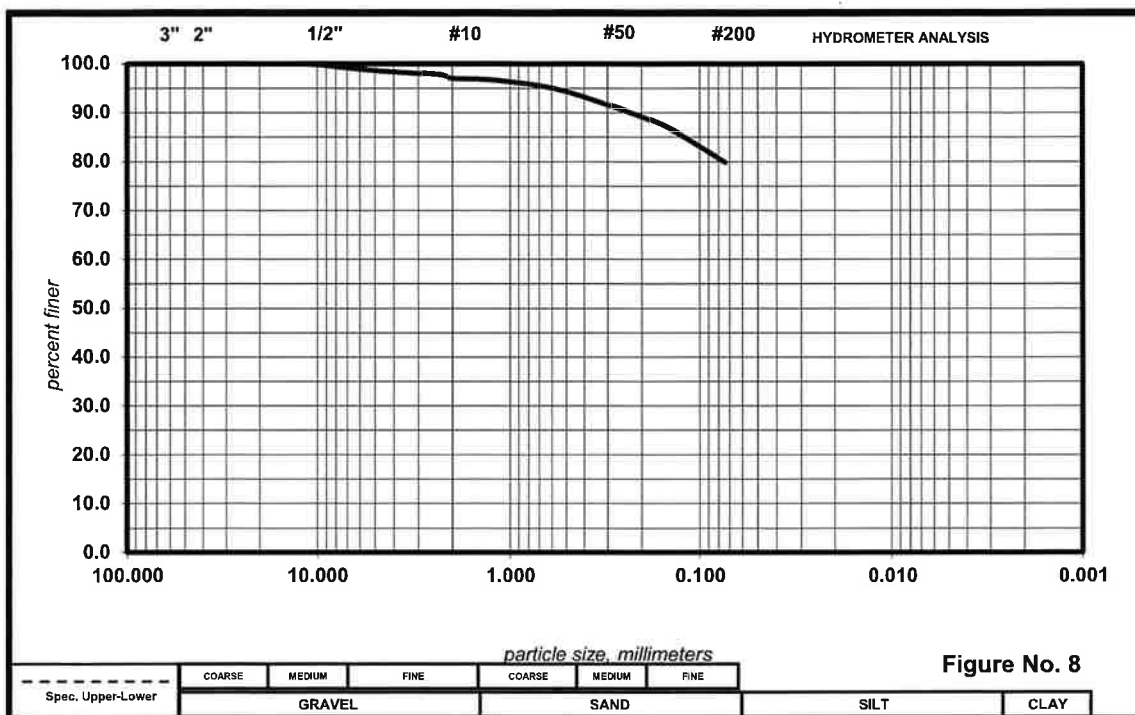


| Specification*   |         |         |         | Sample Identification                                  |      |      |
|------------------|---------|---------|---------|--------------------------------------------------------|------|------|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample No.: TP-46                                      |      |      |
| 3" (75 mm)       |         |         |         | Lab No.: A24-41-07                                     |      |      |
| 2 1/2" (63 mm)   |         |         |         | Source/Location: 6'                                    |      |      |
| 2" (50 mm)       |         |         |         | Description:                                           |      |      |
| 1 1/2" (38.1 mm) | 100.0   |         |         | Brown of Sand, some Silt, and of Gravel                |      |      |
| 1" (25 mm)       | 88.1    |         |         | sample description in accordance with Burmister System |      |      |
| 3/4" (19 mm)     | 80.2    |         |         | LL :                                                   | PL : | PI : |
| 5/8" (16 mm)     |         |         |         | As received Moisture Content: 12.6 %                   |      |      |
| 1/2" (12.5 mm)   | 73.0    |         |         | Classification:                                        |      |      |
| 3/8" (9.5 mm)    | 70.1    |         |         | USCS: [SM]                                             |      |      |
| 5/16" (8 mm)     |         |         |         | AASHTO:                                                |      |      |
| 1/4" (6.3 mm)    |         |         |         | Remarks:                                               |      |      |
| #4 (4.75 mm)     | 67.6    |         |         | Sample received in lab on March 29, 2024               |      |      |
| #6 (3.35 mm)     |         |         |         | Permeability, k: 6.9 x 10-4 cm/s (0.99 in/hr) K2       |      |      |
| #8 (2.36 mm)     | 63.2    |         |         | Permeability, k: 6.7 x 10-4 cm/s (0.97 in/hr) K2       |      |      |
| #10 (2 mm)       |         |         |         | Client: Garden Homes                                   |      |      |
| #14 (1.4 mm)     |         |         |         | Project: West Essex Highlands                          |      |      |
| #16 (1.18 mm)    | 58.7    |         |         | Stormwater Management System                           |      |      |
| #20 (850 µm)     |         |         |         | Location: West Orange, New Jersey                      |      |      |
| #30 (600 µm)     | 51.6    |         |         | Date: 3-Apr-24                                         |      |      |
| #40 (425 µm)     |         |         |         | Job No.: 24-C-02                                       |      |      |
| #50 (300 µm)     | 38.1    |         |         | Report No.: 24-C-11                                    |      |      |
| #60 (250 µm)     |         |         |         |                                                        |      |      |
| #100 (150 µm)    | 27.6    |         |         |                                                        |      |      |
| #200 (75 µm)     | 20.5    |         |         |                                                        |      |      |
| -                |         |         |         |                                                        |      |      |

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## PARTICLE SIZE DISTRIBUTION TEST REPORT



### Specification\*

| Specification    |         |         |         | Sample Identification                                  |                                                 |      |
|------------------|---------|---------|---------|--------------------------------------------------------|-------------------------------------------------|------|
| Sieve Size       | % Finer | Min.(%) | Max.(%) | Sample No.:                                            | TP-47                                           |      |
| 3" (75 mm)       |         |         |         | Lab No.:                                               | A24-41-08                                       |      |
| 2 1/2" (63 mm)   |         |         |         | Source/Location:                                       | 3'                                              |      |
| 2" (50 mm)       |         |         |         | Description:                                           | Brown CLAYEY SILT and, cf Sand, trace mf Gravel |      |
| 1 1/2" (38.1 mm) |         |         |         | sample description in accordance with Burmister System |                                                 |      |
| 1" (25 mm)       |         |         |         | LL :                                                   | PL :                                            | PI : |
| 3/4" (19 mm)     |         |         |         | As received Moisture Content: 22.7 %                   |                                                 |      |
| 5/8" (16 mm)     |         |         |         | Classification:                                        |                                                 |      |
| 1/2" (12.5 mm)   | 100.0   |         |         | USCS: [ML]                                             |                                                 |      |
| 3/8" (9.5 mm)    | 99.7    |         |         | AASHTO:                                                |                                                 |      |
| 5/16" (8 mm)     |         |         |         | Remarks:                                               |                                                 |      |
| 1/4" (6.3 mm)    |         |         |         | Sample received in lab on March 29, 2024               |                                                 |      |
| #4 (4.75 mm)     | 98.5    |         |         | Permeability, k: 7.7 x 10-5 cm/s (0.11 in/hr) K0       |                                                 |      |
| #6 (3.35 mm)     |         |         |         | Permeability, k: 7.3 x 10-5 cm/s (0.11 in/hr) K0       |                                                 |      |
| #8 (2.36 mm)     | 97.7    |         |         | Client: Garden Homes                                   |                                                 |      |
| #10 (2 mm)       |         |         |         | Project: West Essex Highlands                          |                                                 |      |
| #14 (1.4 mm)     |         |         |         | Stormwater Management System                           |                                                 |      |
| #16 (1.18 mm)    | 96.6    |         |         | Location: West Orange, New Jersey                      |                                                 |      |
| #20 (850 µm)     |         |         |         | Date: 3-Apr-24                                         |                                                 |      |
| #30 (600 µm)     | 95.0    |         |         | Job No.: 24-C-02 Report No.: 24-C-11                   |                                                 |      |
| #40 (425 µm)     |         |         |         |                                                        |                                                 |      |
| #50 (300 µm)     | 91.5    |         |         |                                                        |                                                 |      |
| #60 (250 µm)     |         |         |         |                                                        |                                                 |      |
| #100 (150 µm)    | 87.0    |         |         |                                                        |                                                 |      |
| #200 (75 µm)     | 79.9    |         |         |                                                        |                                                 |      |
| -                |         |         |         |                                                        |                                                 |      |

**APPENDIX IV**  
**LIMITATIONS**

# SOR CONSULTING ENGINEERS, INC

## LIMITATIONS

The conclusions and recommendations contained in this supplementary geotechnical report no. 24-C-11 are based upon the applicable standards of our profession at the time this report was prepared.

The analyses and recommendations submitted in this report are based in part upon the data obtained from eight (8) test pits performed for this study. The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types. However, the transition between soil types may be gradual.

In our opinion, the number of explorations performed for this study is adequate for a general understanding of the site's subsurface conditions. However, the nature and extent of variations between the explorations may not become evident until construction. If, during construction, variations become evident, it will be necessary to re-evaluate the recommendations of this report.

In the event that any changes in the nature, design, or location of the stormwater systems are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of this report modified or verified in writing.

This report may be referred to or included in the project specifications for general information purposes only but should not be solely used as the technical specifications for the work.

This geotechnical engineering report was prepared for the project by Sor Consulting Engineers, Inc. for design purposes only, and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope is limited to design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

This report has been prepared in accordance with generally accepted geotechnical engineering practices for the exclusive use of Garden Homes/West Essex Highlands, Inc. and/or their authorized representatives for specific application to the design of the proposed stormwater management system to be constructed on Lot 32, Block 179 in West Orange, New Jersey. No other warranty, expressed or implied, is made.