STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP
PART 3

DESIGN REQUIREMENTS

Table of Contents

1 INTRODUCTION
2 DESIGN PLANS AND SPECIFICATIONS
3 ENGINEERING SOFTWARE
4 ADDITIONAL INFORMATION
5 DESIGN CODES AND MANUALS
6 PERFORMANCE SPECIFICATIONS

1 INTRODUCTION

This Part 3 – Design Requirements and Performance Specifications establishes basic design and performance requirements to be used in the design and construction of the Project.

2 DESIGN PLANS AND SPECIFICATIONS

The Design-Builder shall prepare Design Plans and Project Specifications for the Project to the Department's standards for general content and format.

CADD formatting for Design Plans and Record (as-built) Drawings shall conform to the Department's CADD drafting standards and CADD design standards as defined in the Plan Development Guidelines available from the Department's Project Development Resource Center. Resource Center information can be found at *http://www.deldot.gov/information/business/drc/index.shtml*.

3 ENGINEERING SOFTWARE

All computer based engineering calculations, checks and studies shall be performed with fully documented engineering software. Checking shall be performed using independent proprietary software or independent commercially available software other than the software used for original calculations. The Responsible Engineer shall be required to validate all computer software (before use of the application is made by the Design-Builder/Responsible Engineer) and document quality control checks.

4 ADDITIONAL INFORMATION

Available non-contractual reference information is provided, as a courtesy, in Reference Information. Design-Builder shall not rely on such information. Any reference to such information within the Contract shall not constitute ability for Design-Builder to rely on such information.

5 DESIGN CODES AND MANUALS

In addition to the requirements listed the Performance Specifications, the Designer shall comply with applicable law, engineering codes, building codes, and standards, including those of the various federal, state, and local jurisdictions.

Codes, standards, and/or manuals specified herein shall be the edition(s) inclusive of published revisions, addenda or errata in effect on the Proposal due date unless specifically identified otherwise within the Contract. If a code, manual, or standard is subsequently modified, the Design-Builder shall notify the Department of such modification(s), providing potential cost and schedule impacts to the Project, and request the Department's decision regarding application of the modification(s). If the Department directs the Design-Builder to comply with the modifications and any change in the cost or time of performance results, such change shall be considered a Change Order.

6 PERFORMANCE SPECIFICATIONS

The Performance Specifications included in Contract Documents Part 3 - Appendix A establish requirements that the Design-Builder's Work shall achieve for elements of the Project Scope. The Performance Specifications provide clear requirements for how the finished product is to perform while allowing the Design-Builder considerable flexibility in selecting the design, means, materials, components, and construction methods used to achieve the specified performance.

6.1 Project Specific Design Parameters

Where necessary, Project-specific design parameters are included under their appropriate and respective Performance Specifications. Project-specific design parameters may include, but are not limited to, design parameters specific to the Project, such as, bridge loadings, design life, design speed, forecasted traffic volumes, number of lanes and lane widths, stopping sight distance, horizontal curvature, super-elevation,

vertical curves, horizontal and vertical alignments, grades, roadside clear zone width, minimum main span bridge navigational clearances, and aesthetic requirements.

6.2 Standards and References

Each Performance Specification includes a listing of Standards and references to be used in the design and construction of the Project generally, and more specifically for the items of work covered by the Performance Specification.

Standards prescribe a concise set of conditions and requirements that must be satisfied by a material, product, process, procedure, convention, or test method as well as the physical, functional, and performance characteristics. Standards are considered contractual requirements.

References constitute advisory or informational, non-contractual material provided for the Design-Builder's benefit. This advisory information need not be followed, but in some cases provide acceptable solutions already used by the Department.

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RFP PART 3

APPENDIX A
PERFORMANCE SPECIFICATIONS

Table of Contents

APPENDIX A - PERFORMANCE SPECIFICATIONS

ROADWAY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

BRIDGE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

TRAFFIC PERFORMANCE SPECIFICATION

1 INTRODUCTION

2 STANDARDS AND REFERENCES

3 REQUIREMENTS

PAVEMENT PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

ROADWAY DRAINAGE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

EROSION AND SEDIMENT CONTROL PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

STORMWATER MANAGEMENT PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

GEOTECHNICAL PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

PUBLIC OUTREACH PERFORMANCE SPECIFICATION

1 INTRODUCTION

2 REQUIREMENTS

WARRANTY PERFORMANCE SPECIFICATION

1 INTRODUCTION

2 REQUIREMENTS

HYDROLOGY AND HYDRAULICS PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

SURVEY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 SPECIFICATIONS

3.0 REQUIREMENTS

UTILITY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

RIGHT-OF-WAY SERVICES PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

ENVIRONMENTAL COMPLIANCE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

2.0 STANDARDS AND REFERENCES

3.0 REQUIREMENTS

ROADWAY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design-Builder shall provide roadway design for all sites. The Project elements shall be designed to satisfy Department requirements, ADA requirements, and safety requirements. The Design-Builder shall abide by the specifications and standards in this Performance Specification and in other applicable sections as they pertain to traffic operations.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Design

a) Delaware Department of Transportation "Road Design Manual", 2004, including revisions through the date of advertisement
b) Delaware Department of Transportation "Pedestrian Accessibility Standards for Facilities in the Public Right-of-Way", 2015
c) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
d) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
e) AASHTO, "A Policy on Geometric Design of Highways and Streets", 2011
f) Delaware Department of Transportation, Design Guidance Memorandums (DGM)
g) AASHTO, "Roadside Design Guide", 2011

3.0 REQUIREMENTS

The Design-Builder shall design the roadway geometrics to provide safe and operationally efficient movements for motorists, bicyclists, and pedestrians through the project limits in accordance with provisions provided herein.

3.1 DESIGN CRITERIA

3.1.1 Typical Section

a) The Department considers replacement of a site's existing corrugated metal pipe culverts with new pipe culverts a maintenance activity. As such, the Typical Section width of the existing roadway may be used in the design of the replacement pipe culverts. Clear zone shall match the approach roadway clear zone or the clear zone across the existing pipes, whichever is greater.
b) The proposed roadway Typical Section shall be based on applicable DelDOT Road Design Manual and AASHTO standards if site conditions dictate that replacement with a structure type other than pipe culverts is necessary.

3.2 DESIGN REVIEWS

Roadway Plans shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

BRIDGE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum bridge design and loading requirements to be considered and addressed by the Design-Builder during the design development of the project.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Standards

a) Delaware Department of Transportation "Bridge Design Manual," 2015
b) 2014 AASHTO LRFD Bridge Design Specifications, 7th Edition
c) Delaware Department of Transportation "Pedestrian Accessibility Standards for Facilities in the Public Right-of-Way", 2015
d) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
e) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
f) AASHTO Manual for Bridge Evaluation, 2nd Edition with Interims through 2015
g) Delaware Department of Transportation Design Guidance Memorandums (DGM)
h) AASHTO Roadside Design Guide, 2011

3.0 REQUIREMENTS

The Design-Builder shall provide structural design for each site in accordance with the design codes, standards and specifications listed in Section 2.1.

The Design-Builder shall use Service Level I Pipe Installations as defined in DGM 1-20 for any site that replaces existing corrugated metal pipes culverts with a new pipe culvert system. New pipe culverts shall be reinforced concrete pipe (RCP). The Department may consider the use of thermoplastic pipe (HDPE) or steel-reinforced thermoplastic pipe (SRPE) at locations where construction using RCP is not feasible.

Rehabilitation of the existing corrugated metal pipe culverts will only be considered for Bridges 1183 276, 1615 021, and 1616 021. Rehabilitation techniques must provide a structurally sound product assuming 100% loss of corrugated metal pipe culvert.

The Design-Builder shall prioritize site work based on condition as reported in the Bridge Inspection Reports included in RFP – Part 3, Appendix I, except the following sites shall be given the highest priority and shall be designed and constructed first:

a) 2066A 066 (BR 2-066A)

b) 3132 565 (BR 3-132)
c) 3576 064 (BR 3-576)
d) 3681 318 (BR 3-681)

The Department may request reprioritization of one or more sites by the Design-Builder should subsequent inspections show a significant decrease in culvert ratings. The Design-Builder shall perform reprioritization and subsequent site design and construction work at no additional cost to the Department.

3.1 DESIGN REVIEWS

Bridge Plans shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

TRAFFIC PERFORMANCE SPECIFICATION

1 INTRODUCTION

The Design-Builder shall be responsible for designing, installing or constructing the Project signing and pavement markings. The Design-Builder is responsible for coordinating all traffic control devices with all other disciplines involved with the Project. The Design-Builder is also responsible for preparing the appropriate level of Traffic Management Plan for each site.

2 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 Standards

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Design

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
c) Delaware Department of Transportation, "Delaware Manual on Uniform Traffic Control Devices", 2011
d) Delaware Department of Transportation, "Traffic Design Manual", 2015
e) Delaware Department of Transportation Design Resource Center
f) Delaware Department of Transportation, "Lighting Design Guidelines, 2009", Revised 2012.
g) Transportation Research Board, "Highway Capacity Manual"
h) Delaware Department of Transportation, Design Guidance Memorandums (DGM)

2.1.2 References

a) Delaware Department of Transportation, "Work Zone Safety and Mobility – Procedures and Guidelines"

3 REQUIREMENTS

3.1 Coordination with Other Contracts

The Design-Builder shall coordinate the design and construction of all traffic control devices for each site with those required for other Department Projects. Overlapping detour routes will not be permitted.

3.2 Permanent Traffic Controls

3.2.1 Permanent Signing

a) The Design-Builder shall submit a signing plan for each site for Department review prior to finalizing the signing plans. The plan shall include proposed sign locations and messages for all guide,

supplemental, route marker, regulatory, and warning signs. All existing signs to be removed or relocated shall also be shown along with the proposed locations for the relocated signs.

b) Modifications to existing signs if required shall conform to the latest applicable standards. The Design-Builder shall provide signing for roadways where existing access has been modified. The signing modifications due to the access modifications shall be shown on the definitive plan. The definitive plan features shall include, but are not limited to, the existing and proposed roadway alignments, right-of-way, utilities, baseline of construction (including stationing), and existing topography at the tie-in points of the roadway limits of work. The proposed pavement markings shall also be shown on the definitive plan.

c) The Design-Builder shall provide fully-compliant signing within the Project Limits. This may including replacing/upgrading existing signs within the Project Limits that are not impacted by the construction.

d) The Design-Builder may reuse or relocate existing signs within the Project limits, provided that the sign meets all applicable standards (including placement, application, size, color, font, reflectivity, condition, etc.). Existing signs that have been damaged in any way shall be removed and replaced. The Design-Builder shall be prepared to submit photographs of any signs to remain or be relocated within the Project Limits at the request of the Project Manager to verify that the sign is suitable for reuse.

e) The Design-Builder assumes ownership of all removed signs and posts.

f) The Design-Builder shall also provide for the modification or removal of any signing outside the physical construction limits of the Project that is no longer appropriate or pertinent as a result of changes associated with this Project. The signing shall be removed or modified regardless of whether it falls within or outside the limits of construction along the mainline and cross-street approach roadways.

g) All signs greater than 4’ x 8’ shall be manufactured using extruded aluminum sign material.

h) New signs for this Project shall be constructed with non-reflective (black copy and background) or retroflective (all other colors) sheeting background and copy. The retroflective sheeting for sign copy shall comply with the Delaware MUTCD.

i) A single sign totaling more than 9 square feet or with any dimension, length or width, greater than 48 inches shall be mounted on two (2) sign posts. Signs with a length greater than or equal to 78 inches shall be mounted on three (3) sign posts.

3.2.2 Permanent Pavement Markings

a) All permanent pavement markings shall be on the signing plans for review by the Department prior to advancing the design.

b) All permanent pavement markings shall be in accordance with the Delaware MUTCD.

c) All single longitudinal lines shall be 5 inches wide, and all double width lines shall be 10 inches wide.

d) Final pavement markings shall be designated on the final signing plans with the same scale. The pavement marking plans shall indicate color, size, location, and material type for markings within the limits of work. The lanes shall be dimensioned based on the typical sections for the Project. Dimensions shall be included for placement of arrows, stop lines and length of longitudinal left turn lane lines. The plan shall also clearly define locations where pavement markings change color, width, or material. Existing pavement markings that are to remain shall be shown on the plans and locations where proposed pavement markings tie-in to existing pavement markings shall be denoted on the plans.

e) All transverse pavement markings (i.e. yield symbols (shark’s teeth), crosswalks, stop lines), as well as all arrows, symbols, and letters shall be heat applied permanent preformed thermoplastic on bituminous surfaces. Concrete surfaces shall be a preformed patterned marking.

f) Crosswalks shall be provided at all signalized intersections as specified in Section 3.5 Traffic Signals.

3.3 Temporary Traffic Controls

3.3.1 Temporary Signing

a) Temporary signing for this Project shall include the design and installation of temporary traffic control signs consistent with the applicable cases outlined in the Delaware MUTCD.
b) Temporary signing shall be shown on the construction phasing sheets in the plans.

3.3.2 Temporary Pavement Markings

a) All temporary pavement markings shall be shown on the temporary traffic control plan (TTC) and in accordance with the Delaware MUTCD.
b) Temporary pavement marking tape shall be used on all concrete surfaces.
c) Temporary pavement markings on interim hot-mix courses, or prior to final pavement marking installation shall be the same configuration as final pavement markings.

3.3.3 Temporary Traffic Signals

a) The Design–Builder shall provide temporary traffic signals if required.
b) The Design-Builder shall perform all studies and prepare all design requests (DRs), as necessary, for placement of Temporary Traffic signals and present all information to the Department for review and written comment.

3.4 Lighting

a) For existing lighting within any site's Project Limit, the maximum outage time for luminaire shall be 24 hours unless otherwise approved by the Administration.
b) Any impacted existing roadway lighting shall be replaced by the Design-Builder.

3.5 Traffic Management Plan (TMP)

a) The Design-Builder shall prepare a TMP for each site. All sites will require preparation of a Type A TMP with the exception of BR 1-615 and BR 1-616, which will require preparation of a Type B TMP.
b) The work at several locations is subject to seasonal traffic restrictions as noted:

Location	Facility	Work Not Permitted
BR 1-183	McKennan's Church Rd	August 15 thru June 15
BR 1-615	Newport Gap Pike	As Determined By TMP B
BR 1-616	Newport Gap Pike	As Determined By TMP B
BR 2-066A	White Oak Rd	May 1 thru September 30
BR 3-317	SR 24 (Laurel Rd)	May 1 thru September 30
BR 3-913	SR 16 (Beach Hwy)	May 1 thru September 30
BR 3-914A	SR 16 (Beach Hwy)	May 1 thru September 30
BR 3-914	SR 16 (Beach Hwy)	May 1 thru September 30

3.7 Design Reviews

a) Traffic plans (signal, lighting, signing, striping, temporary traffic control, and others included in this Performance Specification) shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

PAVEMENT PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design-Builder may provide a bituminous concrete or Portland cement concrete paving section meeting the requirements of this section.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Standards

a) Contract Documents Part 4 – Special Provisions
b) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
c) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
d) Delaware Department of Transportation "Materials and Research Manual"

2.1.2 References

a) AASHTO, "Standard Specifications for Transportation Materials and Methods of Sampling and Testing"

3.0 REQUIREMENTS

Paved areas that are currently Portland Cement Concrete (PCC) shall remain PCC pavement.

If a new section of either bituminous or PCC pavement is constructed alongside existing pavement, the new pavement section shall provide a drainage layer that is continuous from the existing pavement's drainage layer.

Structural pavement to remain within the limits of construction at each site shall have a minimum thickness at least equal to the required structural thickness of the proposed pavement.

3.1 PCC PAVEMENT DESIGN CRITERIA

PCC pavement shall conform to the Department's Standard Construction Details.

3.1.1 Joints

The Design-Builder shall submit their intended joint layouts, dowel bar placement and any reinforcing steel details for all new concrete pavement and tie-ins to existing concrete pavement to the Project Manager prior to any concrete placement.

Tolerances for the placement of the steel shall be as outlined in the most recent Standard Construction Details, Section P-1, Concrete Pavement.

If the data shows the above tolerances are not met, the Design-Builder shall submit to the Department their proposed action to remedy the non-conforming joint for review and approval.

3.1.2 Smoothness

PCC Pavement may not have any deviations (high or low) greater than 0.25” in 10’.

3.2 BITUMINOUS CONCRETE PAVEMENT DESIGN CRITERIA

New and/or reconstructed bituminous pavement shall use materials meeting the Special Provision requirements contained in RFP Section 4, Special Provisions.

Graded aggregate shall be used for sub-base material and shall meet the requirements listed in Standard Specification 302007, GABC, Type B.

There shall be a minimum of 5” of bituminous concrete included in the final pavement section for all sites.

The minimum thickness of Bituminous Concrete Type C at each location is 1.5”

Bituminous concrete may not have any deviations (high or low) greater than 0.25” in 10’.

The Design-Builder shall provide the structural and mix designs as specified for each site in RFP Section 3, Appendix C. Calculate the thickness of each pavement layer using the information below. Locations added after bid award will have the structural value calculated by DelDOT.

Structural value calculated by: $SN < A_1T_1 + A_2T_2 + A_3T_3 + A_4T_4.....A_NT_N$

- $T_1, T_2, T_3, T_4 \ldots T_N$ = Thickness in inches of each layer of material
- $A_1, A_2, A_3, A_4 \ldots A_N$ = Structural Value of each material

- Acceptable materials for use and structural values per inch:

Material	**Structural Value per inch (A_i)**	**Min Lift Thickness**	**Max Lift Thickness**
Type C (9.5 mm)	0.4	1.25	2
Type B*	0.4	2.25	4
BCBC	0.32	3	6
GABC	0.14	--	8

* If Design-Builder chooses to substitute Type B mix for BCBC the material may be placed in the same thicknesses as BCBC. The Design-Builder is still required to meet all compaction requirements.

3.4 DESIGN REVIEWS

Pavement designs shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

ROADWAY DRAINAGE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design-Builder shall provide a roadway drainage system designed to safely handle storm runoff consistent with the Design-Builder's design and to satisfy all environmental commitments and other Department requirements. The design and construction of all drainage and other drainage facilities shall adequately address runoff control, safety, functionality, erosion mitigation, durability, ease of maintenance and repair, and maintenance access.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Standards

a) Delaware Department of Transportation "Road Design Manual", 2004, including revisions through the date of advertisement
b) AASHTO, "A Policy on Geometric Design of Highways and Streets", 2011
c) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction", 2016
d) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
e) Delaware Department of Transportation, Design Guidance Memorandums (DGM)
f) Delaware Department of Transportation "Functional Classification Maps"
g) AASHTO, "Roadside Design Guide", 2011

3.0 REQUIREMENTS

The Design-Builder shall provide roadway drainage satisfying the requirements of the specified Standards including but not limited to Chapter 6 of the Department's "Road Design Manual" along with its supplemental figures, DGM 1-20 regarding pipe materials, DGM 1-15 regarding safety grates, and other permit requirements. In no case shall roadway drainage pipe material be less than specified for Service Level II.

3.1 DESIGN REQUIREMENTS

Within the proposed limits of disturbance at each bridge site in the contract the Design-Builder shall verify the size, condition and capacity of existing roadway drainage facilities. The Design-Builder shall perform any necessary repairs, replacement, or maintenance of these existing drainage facilities to ensure they are compliant with the standards noted above. Any replacement of existing closed drainage conveyances shall be for the complete conveyance, i.e. no partial replacement of closed conveyances shall be permitted. Conversion of existing closed drainage to open drainage will not be permitted.

3.2 DESIGN REVIEWS

In addition to the Reviews required by Contract Documents Part 2 - Section DB 111-8, the Design Builder shall complete and submit to the Department the applicable activities outlined in the Drainage Plan Submission Checklist found in the Department's Design Resource Center: http://deldot.gov/information/business/drc/hydrology.shtml

Preliminary submission is not required. The checklist and necessary documentation shall be submitted with the semi-final and final plan submissions. DelDOT or its designee shall review each submission and return comments within the timeframe specified in Contract Documents Part 2 – Section DB 111-4. DelDOT or its designee reserves the right to reject any submissions that are incomplete.

EROSION AND SEDIMENT CONTROL PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum erosion and sediment control requirements to be considered and addressed by the Design-Builder during the design development and construction of the project. The provisions of this section shall apply to all locations, including those that disturb less than 5,000 square feet.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Standards

a) Delaware Sediment and Stormwater Regulations, 2014
b) Delaware Department of Transportation, Approved Product List for Rolled Erosion Control Products, 2015
c) Delaware Sediment and Stormwater Program Technical Document, 2014

2.1.2 Specifications

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement

2.1.3 References

a) Delaware Department of Transportation "Sediment & Stormwater Management Project Design & Review Checklist"

3.0 REQUIREMENTS

The Design-Builder shall address how the design and construction meets or exceeds the requirements of the National Pollution Discharge Elimination System permit, the Delaware Sediment and Stormwater Regulations, and the other specifications outlined in this RFP.

3.1 Design Requirements

a) The Design-Builder shall design erosion and sediment control devices in accordance with applicable federal and state regulations and this Performance Specification.

b) The Design-Builder shall prepare an erosion and sediment control plan that includes all applicable elements of the Erosion and Sediment Control Plan checklist found in Contract Documents Part 3 – Appendix D, Stormwater Documents.

d) The Design-Builder shall prepare a Maintenance of Stream Flow Plan for each site. Maintenance of Stream Flow Plans shall be incorporated into the erosion and sediment control plan and sequence of construction and submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

e) All locations shall be designated as having "major" erosion and sediment control significance. The Design-Builders Erosion and Sediment Control Supervisor shall be a certified construction reviewer (CCR) as defined in Section 6.3 of the Delaware Sediment and Stormwater regulations.

3.2 Design Reviews

The Plans shall be reviewed for compliance with this erosion and sediment control specification at the Semi-Final submission and Final submission. The Department shall assign an ES2M reviewer who will review each submission and return comments or approval within the timeframe specified in Contract Documents Part 2 – Section DB 111-4. The Department or its designee reserves the right to reject any submissions that are incomplete.

Upon receipt of a plan that meets all requirements for erosion and sediment control design and is satisfactory to the Department, the Department or its designee will approve the plan. No earth disturbing activity shall occur at any location until the erosion and sediment control plan is approved for that location by the Department. Approval of the plan does not relieve the contractor from his or her responsibilities for compliance with the requirements of this specification nor does it relieve the contractor from errors or omissions in the approved plan.

3.3 Construction Requirements

a) The Design-Builder shall attend an Erosion and Sediment Control meeting separate from the Pre-construction meeting prior to the start of any earth disturbing activities. A minimum of one (1) Erosion and Sediment Control meeting will be held, and at the Department's discretion an Erosion and Sediment Control meeting shall be held for each location. Attendees from the Design-Builder shall include, at minimum, the Design-Builder's ESC Supervisor and engineer responsible for erosion and sediment control design.

b) The Design-Builder shall implement and maintain the erosion and sediment control practices shown on the approved plans and as required by this Performance Specification, applicable permits, and Section 900- Erosion, Sediment and Stormwater Management of DelDOT's Standard Specifications.

c) The Department or its designee will identify an ES2M CCR to perform erosion and sediment control inspections on a weekly (at a minimum) basis for the duration of construction. The inspections will include verification that all erosion and sediment control measures shown on the approved plans are in the locations designated, are functioning, and being properly maintained. These inspections will continue until satisfactory stabilization, as determined by the Department, is established. The Design-Builder's ESC Supervisor shall accompany the Department's inspector during these inspections. The Department or its designee will issue a report with its findings, including a timeline to address any deficiencies, utilizing the ES2M Inspection Rating Form. A report will be issued for each location. When failing reports result the Department will utilize methods in Section 901.06 of the Standard Specifications to bring the site within compliance. The

methods in Section 901.06 will apply to all locations within the contract and will not be limited to locations that are receiving failing scores.

d) The Design-Builder shall be responsible for maintaining an accurate and up-to-date erosion and sediment control plan. Maintenance of the erosion and sediment control plan shall include field redlines or design revisions as appropriate and as directed in the Plan Change flowchart included in Contract Documents Part 3 – Appendix D, Stormwater Documents. Failure to maintain an up-to-date and accurate erosion and sediment control plan will result in deficiencies and point deductions on the ES2M Inspection Rating Form.

e) The Design-Builder shall utilize streambank seed mix per Section 908.02 C, Table E of the Standard Specifications, for permanent stabilization of all sites. This seed mix shall be applied to all disturbed areas.

STORMWATER MANAGEMENT PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum stormwater management requirements to be considered and addressed by the Design-Builder during the design development and construction of the project.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1.1 Standards

a) Delaware Sediment and Stormwater Regulations, 2014
b) Delaware Sediment and Stormwater Program Technical Document, 2014

2.1.2 Specifications

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement

3.0 REQUIREMENTS

The Design-Builder shall provide Stormwater Management (SWM) meeting the requirements of the Delaware Sediment and Stormwater Regulations, the National Pollution Discharge Elimination System permit, and these Contract Documents. The Department expects that all projects will fall under the 2014 Delaware Sediment and Stormwater Regulations and the 2014 Technical Guidance Document, including the interim emergency version of these regulations and documents.

3.1 Design Requirements

The Department expects that all sites will comply with the Standard Plan criteria for stormwater management presented in Delaware Sediment and Stormwater Program Technical Document Section 3.01.1.9 – Minor Bridge and Culvert Construction, of the "Delaware Sediment and Stormwater Regulations - Technical Document". For all sites the Design-Builder shall submit a "Stormwater Compliance Plan" graphically showing the site Limits of Disturbance, Limits of Construction, area of new impervious cover, existing site topography and proposed construction. The plan shall include a table containing the Limits of Disturbance and Limits of Construction in acres and the area of new impervious in square feet.

If the Design-Builder identifies a location that does not comply with the standard plan referenced above the Design-Builder shall immediately notify the Department. The Department will review the location and determine, at its discretion, whether to reduce the scope of work to bring the site into compliance with the standard plan requirements or remove the location from the contract. The

Design-Builder shall make every effort to determine if a site may not comply with the standard plan prior to initiating any other work on that site, including, but not limited to, hydraulic analysis, utility coordination/location, geotechnical testing, or engineering design.

3.2 Design Reviews

The "Stormwater Compliance Plan" shall be submitted with the semi-final and final plan submissions. DelDOT or its designee shall review each submission and return comments within the timeframe specified in Contract Documents Part 2 – Section DB 111-4. The Department or its designee reserves the right to reject any submissions that are incomplete.

GEOTECHNICAL PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Department has provided in Contract Documents Part 3 - Appendix E, soil boring logs, soil classification analysis, and Geotechnical Data Report summary for all sites except Bridge 3-914A, which was added to the contract late in the development of the RFP. The Design-Builder shall perform additional Geotechnical Work as s/he deems appropriate to provide necessary design parameters including investigations, analyses, design, construction, and monitoring in accordance with all applicable standards and codes and in accordance with this Performance Specification. The Design-Builder's geotechnical investigations and analyses should be sufficient to adequately characterize the subsurface conditions and provide all the necessary information for a suitable design including soil improvements and erosion control techniques. The Design-Builder must make his own interpretation of any information provided by the Department.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Standards

a) Standards AASHTO, "Manual on Subsurface Investigations"
b) AASHTO Classification of Soil and Soil-Aggregate M-145-91
c) ASTM D 2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)"
d) FHWA, "Geosynthetic Design and Construction Guidelines," FHWA HI-95-038
e) FHWA, "Geotechnical Instrumentation," FHWA HI-98-034
f) FHWA, "Ground Improvement Methods – Reference Manual," FHWA NHI-04-001
g) FHWA, Geotechnical Engineering Circular No. 5: "Evaluation of Soil and Rock Properties," FHWA-IF-02-034, April 2002
h) FHWA, "Soils and Foundations Workshop Manual," FHWA NHI-00-045

2.1.2 Specifications

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement
c) Delaware Department of Transportation, "Construction Manual"
d) Delaware Department of Transportation "Materials Manual"

3.0 REQUIREMENTS

The Department has performed limited subsurface investigation at each project site. Information generated from these completed investigations is included in Contract Documents Part 3 – Appendix E.

The Design-Builder may conduct additional post-award investigations in accordance with the minimum requirements specified herein and any additional subsurface investigations or rock studies the Design-Builder deems necessary to establish the geotechnical conditions and to perform all geotechnical and foundation design and analyses.

3.1 Design Criteria

Except as specified herein, the Department and AASHTO standards shall be followed with respect to planning and performing subsurface exploration programs.

The Design Builder's investigations and testing shall be conducted in accordance with the items identified in Section 2.1 of this Specification and shall include proper coordinates, stations, offsets, and elevations based off of the horizontal and vertical survey control systems established for the Project.

The Design-Builder shall form its own interpretation of the existing geotechnical data and satisfy itself as to the nature of the ground and sub-soil, the form and nature of the site, and nature of the Work that may affect its detailed design, construction methods, and tools.

The Design-Builder shall determine the number and location of additional borings required in accordance with the requirements presented in Table 3.1. Existing investigation borings may be combined with the additional investigations to comply with the requirements presented in Table 3. 1. For borings, split spoon soil samples with standard penetration testing shall be taken at two- foot intervals for the first twenty feet and every five feet, thereafter as a minimum, and a minimum of one (1) undisturbed soil sample shall be taken in each unique cohesive soil deposits. Cone Penetration Test soundings may be considered as an alternative to borings where the Design-Builder considers it appropriate provided that a sufficient number of borings are performed at Cone Penetration Test sounding locations to develop reliable correlation between the boring and Cone Penetration Test results and that the Cone Penetration Testing reaches a suitable depth for design of the foundation elements.

Table 3.1 Minimum Requirements for Additional Investigations

Geotechnical Feature	Minimum Investigation Locations
Roadways	As required by the Design-Builder's Geotechnical Engineer.
Embankments and Cuts	As required by the Design-Builder's Geotechnical Engineer to define the existing geological conditions for stability analysis and to properly design for settlement.
Stormwater Management	As required by DNREC's Stormwater Regulations, infiltration tests in the areas of proposed stormwater management facilities.

The Design-Builder shall classify soils in accordance with Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System) ASTM D 2487 and, Standard Practice for Description and Identification of Soils (DOH-19).

3.2 Cut and Fill

Erosion control and drainage measures shall be evaluated, considered and designed for all new and existing cut and fill slopes within the Project Limits. Each cut and fill slope that requires erosion control and drainage measures shall be evaluated for the following:

a) Reduction of Water Flow across Slope;

b) Slope Revegetation;

c) Slope Armor; and

d) Subsurface Water Control.

3.3 Miscellaneous Considerations

The Design-Builder shall evaluate existing and develop designs for new temporary excavation support required for construction. Such design shall consider short-term loading due to earth pressures, groundwater pressures, surcharge pressures, and construction equipment loading. Design Builder shall provide Working Plans signed and sealed by a Delaware-licensed Professional Engineer.

The Design-Builder shall include surcharge pressures due to structures, point, line and area loads in lateral earth pressure diagrams. Appropriate construction materials and equipment loads shall be determined by the Design-Builder's Geotechnical Engineer and shall be consistent with the methods actually used.

3.4 Design Reviews

In addition to the Reviews required by Contract Documents Part 2 – Section DB 111-8, the Design-Builder shall provide the results of subsurface investigations, if undertaken, to the Department in a memo as follows:

a) The logs of borings, cone penetration test sounding, and related field records of any site investigations or testing; and

b) Laboratory test results and classifications for all samples.

For the Reviews required by Contract Documents Part 2 – Section DB 111-8, the Design-Builder shall prepare a Geotechnical Report. The Geotechnical Report shall define the engineering and design approach that will be followed in order to develop technically and environmentally acceptable and durable foundations, cut and fill slopes, retaining structures, and geotechnical designs for the Project. The Geotechnical Report shall discuss all aspects of the required geotechnical effort and design and analysis, including the following:

a) Plan view showing the location of borings;
b) Boring logs;
c) Available laboratory test results;
d) An evaluation of the encountered subsurface conditions including:
    1. Depth, thickness and variability of soil strata;
    2. Depth to groundwater;
    3. Identification and classification of soils;
    4. Shear strength, compressibility, stiffness, permeability, frost susceptibility, and expansion potential of encountered soils;
    5. Depth to rock, identification and classification of rock, rock quality (i.e., soundness, hardness, jointing, resistance to weathering and solutioning), compressive strength, and expansion potential;
    6. Preliminary soil and rock parameters to be used in design (these parameters are limited to the laboratory test results). The Geotechnical Designer will develop additional parameters.
e) Erosion control measures including design and analysis;
f) Ground improvement or treatment of in-situ soils;
g) Expected serviceability and durability of proposed solutions;
h) Other items related to soil structure interaction or site conditions that may affect design or construction.
i) Support of excavation and groundwater control considerations; and
j) The Final Geotechnical Report shall be prepared and signed and sealed by the Responsible Geotechnical Engineer licensed in Delaware as a Professional Engineer.

PUBLIC OUTREACH PERFORMANCE SPECIFICATION

1 INTRODUCTION

The Department will require assistance from the Design-Builder related to public outreach. This performance specification outlines the responsibilities of the Design-Builder with respect to public outreach, communication, and notification responsibilities and establishes communication protocols for the implementation.

2 REQUIREMENTS

The Department will develop and lead the effort for public outreach on this Project, which will be intended to keep the public and media informed of major activities, decisions, and Project changes through design and construction. Public Workshops will be held for each site through the use of "virtual workshops", which are posted on the Department's website.

2.1 DEPARTMENT RESPONSIBILITIES

The Department's will have primary responsibility for the following public outreach activities:

a) QA/QC of any approved Design-Builder communication efforts;

b) Secure facilities for meetings;

c) Review and distribute meeting minutes, when appropriate;

d) Compile information provided by the Design-Builder for use in printed materials;

e) Coordinate all printed materials including, but not limited to, newsletters, informational maps, press releases, public notices, advertising and correspondence;

f) Review, approve, and distribute responses to inquiries and comments;

g) Issue and advertise Public Meeting Notices;

h) Provide official spokespersons for the Project; and

i) Host and maintain the Project Website.

2.2 DESIGN-BUILDER RESPONSIBILITIES

2.2.1 General Responsibilities

The Design-Builder shall coordinate and cooperate with the Department on all public outreach-related activities including, but not limited to, attending meetings, providing responses, drawings, technical information, status updates, and responding to requests for information as request by the Department, elected officials, or the public.

The Design-Builder shall prepare all mailing lists. The lists shall be submitted to Department for approval. The Department will supply necessary workshop notification materials. The Design-Builder shall mail all letters.

2.2.2 Virtual Workshop

A virtual workshop is required for each site. The virtual workshops will be hosted on the Department's website. The Department will develop a home page for the overall project with separate pages posted for each site. The Department will be responsible for reviewing and approving materials, and for posting materials to the website. The Design-Builder shall prepare all necessary materials for the virtual workshops. Materials will generally include a plan sheet showing the proposed site improvements, a construction traffic control plan, an expected construction schedule and, as necessary, a rendering showing finished site conditions. The virtual workshop shall be posted after the site Right of Way Plans have been recommended for approval.

2.2.3 Responses to Public Inquiries and Comments

If a resident, business, or other member of the public has a question or comment on the Project the first and preferred point of contact shall be the Department's Public Relations Office or the Department's Project Manager. The Design-Builder shall take necessary steps to facilitate such contact.

The Design-Builder shall maintain a consistent system for documenting all contact with business owners, residents, media and property owners. The Design-Builder shall provide the Department an electronic copy of all public contact records on a monthly basis.

The Design-Builder shall provide written responses to inquires as requested by the Department.

If Design-Builder receives a complaint regarding Design-Builder's conduct of Work on the Project, the Design-Builder shall notify the Department's Project Manager within 24 hours. The Design-Builder shall provide necessary information, staff support, and representation to assist in resolving the issue.

The Design-Builder shall provide Key Staff to serve as a spokesperson for the Project, at the Department's request, for technical or any other Project issues.

2.2.4 Media Relations

Neither the Design-Builder nor any Subcontractor nor their employees shall conduct or participate in media events or radio or television broadcasts without the written consent of the Department. In emergencies, the Design-Builder shall immediately notify the Department's Project Manager and Office of Public Relations to coordinate responses.

The Design-Builder shall assist in giving timely information to the Department regarding construction activities and situations that may have the potential for unplanned public focus or media coverage.

2.2.5 Public Notices

The Design-Builder's planned construction activities may periodically result in temporary impacts to utility services, driveway entrances, and vehicular, pedestrian, and bicycle traffic. In such cases, the Design-Builder shall immediately notify the Department. The Design-Builder and the Department will coordinate contacting the affected parties or general public of anticipated impacts or disruptions of services. Utility shut-off/diversion announcements shall be made in the form of a personal contact by the Design-Builder that shall include a written notice to the affected parties. Copies of the notice shall be provided to the Department. At a minimum, the Design-Builder shall provide the specific notifications listed in Table 2.2.5.1

Table 2.2.5.1 – Required Notifications

Notice	Requirement
Closure	Written notices posted at least 14 calendar days in advance of planned traffic lane or pedestrian walkway closures. Notice provided to the Department's Traffic Management Center (TMC) and Public Relations Office 14 calendar days in advance. Lane closures to be signed using Portable Changeable Message Signs (PCMS) in addition to standard signage. PCMS shall be installed at least 10 days in advance of the closure.
Critical Utility Shut-off/Diversion	Written notice at least 72 hours in advance of, but not more than 96 hours before, shut-off and/or diversions. Copy of notice to Department's Project Manager and Public Relations Office.
72-hour Business/Commercial Utility Shutdown	Written notification of Utility shutdown or diversion for businesses and commercial property. Copy of notice to Department's Project Manager and Public Relations Office.
48-hour Residential Utility Shutdown	Written notification of Utility shutdown or diversion for residential property. Copy of notice to Department's Project Manager and Public Relations Office.
Weekly Construction Updates	A construction update will be provided to the Department.
Emergency Unforeseen Utility Disruptions, Hazardous Conditions, Traffic Emergencies, Security, and Loss of Access	See Section 2.2.6.
Road and Driveway Closures	Written notice and personal contact at least 72-hours in advance of, but no sooner than seven calendar days prior to, closure. Copy of notice to Department's Project Manager and Public Relations Office.

2.2.6 Emergency, Unforeseen Utility Disruptions, Hazardous Conditions, Traffic Emergencies, Security, and Loss of Access Notifications

The Design-Builder shall provide immediate response to emergencies by trained personnel from an incident response team within 30 minutes of receiving notification from the Department, law enforcement or fire suppression agencies, federal land management agencies, Utility Owners, and/or affected businesses and/or residents. The Design-Builder shall notify the Department immediately of such occurrences.

The Design-Builder shall establish and manage an emergency response telephone tree. All appropriate emergency response agencies, including regulatory agencies, shall be included on this telephone tree for immediate response in the event of an emergency. The telephone tree shall be divided into areas of expertise so the proper people are called for specific emergency situations.

All emergency and/or unforeseen disruptions shall be explained to affected residents or businesses immediately. The person making the contact shall provide to the affected parties the following information:

a) Cause of disruption (i.e., whether it is construction oriented or not);

b) Actions being taken to alleviate the problem

c) Responsible party for the actions; and

d) Anticipated duration of the disruption.

2.2.7 Changes to Access

Any proposed changes in access shall be submitted to the Department for Approval, along with an access map, at least five Working Days prior to start of construction.

WARRANTY PERFORMANCE SPECIFICATION

1 INTRODUCTION

The Design-Builder shall be required to meet minimum warranty requirements associated with the Contract Work. This Performance Specification identifies items and systems to be warranted by the Design-Builder and the minimum terms associated with those items.

2 REQUIREMENTS

The Design-Builder shall unconditionally warrant to the Department all items specified within this Performance Specification, for the minimum period specified, to be free of defects and deficiencies in the design, manufacture or workmanship that would result in the loss of an essential quality or function. The minimum warranty periods specified shall be from the date of Final Acceptance by the Department.

With respect to any portion of the Work that is repaired or replaced, the remaining warranty period shall be the longer of one year from repair or replacement of the Work or the remainder of the original warranty period.

Nothing in these warranty requirements is intended to limit neither any manufacturer's warranty nor any warranty implied by Delaware law. The Design-Builder will provide the Department with all manufacturers' warranties prior to Final Acceptance of the Work.

See Contract Documents Part 2 –Section DB 104-6 of the Contract Documents for additional requirements.

2.1 CONCRETE

The Design-Builder shall guarantee the performance of all concrete items (structures, pavement and sidewalk) for one year from the date of Final Acceptance. If any portion of the Work fails to perform properly for any reason, including but not limited to cracking or delamination for any cause, then the Design-Builder shall replace the failed portion at no cost to the Department.

2.2 EXTENDED WARRANTY PERIOD

Any extended warranty period beyond the minimum requirements specified in this Performance Specification shall be in accordance with the terms of the Design-Builder's warranty proposal included in the Contract Documents.

HYDROLOGY AND HYDRAULICS PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum hydrology and hydraulic requirements to be considered and addressed by the Design-Builder during the design development of the project.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Design

a) Delaware Department of Transportation "Bridge Design Manual,"2015;
b) AASHTO LRFD Bridge Design Specifications, 7th Edition
c) AASHTO Manual for Bridge Evaluation, 2nd Edition with interims through 2015.
d) Delaware Department of Transportation Design Guidance Memorandums

2.1.2 Specifications

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement

2.1.3 References

a) FHWA, 2006, HEC-14, "Hydraulic Design of Energy Dissipators for Culverts and Channels", Third Edition, FHWA-NHI-06-086
b) FHWA, 2012a, HDS-5, "Hydraulic Design of Highway Culverts", Third Addition, FHWA-12-026 April
c) USACE, 2001, "River Analysis System, HEC-RAS, User's Manual", Version 3.0, Hydrologic Engineering Center, Davis, CA.
d) USACE, 2010, "HEC-RAS River Analysis System Hydraulic Reference Manual"
e) USGS, 2006, "Magnitude and Frequency of Floods on Nontidal Streams in Delaware", Scientific Investigations Report 2006-5146

3.0 REQUIREMENTS

The Design-Builder shall provide hydrologic analysis and hydraulic design for each site in accordance with the design codes, standards and specifications listed in Section 2.1.

The Design-Builder shall prepare a Hydrologic and Hydraulic Report for each site.

The Design-Builder shall perform a hydrologic analysis at each site using the "Delaware Regression

Method" (SIR 2006-5146) and the USGS online StreamStats application.

The Design-Builder shall perform hydraulic analysis at each site using "Culvert Hydraulic Analysis Program" (FHWA, HY-8) or "River Analysis System" (USACE, HEC-RAS).

The Design-Builder shall perform hydraulic design at each site in conformance with "Hydraulic Design of Highway Culverts" (FHWA, HDS-5).

3.1 DESIGN REVIEWS

Design Reports and Plans shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

SURVEY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum topographic survey requirements to be considered and addressed by the Design-Builder during the design development of the project.

2.0 SPECIFICATIONS

a) Delaware Department of Transportation Engineering Instructions.

3.0 REQUIREMENTS

The Design-Builder shall perform topographic survey for each site. Topographic survey and locating right of way mapping features shall conform to the requirements of Engineering Instruction PM-16-001. EI PM-16-001 can be found at: http://deldot.gov/information/business/drc/projectmanagement.shtml.

As part of the topographic survey, the Design-Builder shall shoot elevations of the outside top of both ends of the crossroad corrugated metal pipes. These elevations will be used by DelDOT's Environmental Section for determining proper streambed elevations. In addition, the Design-Builder shall survey the Ordinary High Water (OHW) elevations on both the upstream and downstream sides of the pipes. Details of identifying the OHW can be obtained from the Environmental Studies Office after the contract has been awarded.

UTILITY PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum utility requirements to be considered and addressed by the Design-Builder during the design development of the project.

2.0 STANDARDS AND REFERENCES

The design and construction of the Project elements in this section shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Standards and Specifications utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Design

a) Delaware Department of Transportation "Bridge Design Manual," 2015;
b) AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 Interims
c) AASHTO Manual for Bridge Evaluation, 2nd Edition with interims through 2015.
d) Delaware Department of Transportation "Utilities Manual", 2007 Edition
e) Delaware Department of Transportation "Road Design Manual"
f) AASHTO, "A Policy on Geometric Design of Highways and Streets"
g) Delaware Department of Transportation, Design Guidance Memorandums
h) AASHTO, "Roadside Design Guide"

2.1.2 Specifications

a) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" 2016
b) Delaware Department of Transportation "Standard Construction Details" including revisions through the date of advertisement

3.0 REQUIREMENTS

3.1 Department's Responsibilities

The Department will be responsible for the following utility coordination and relocation activities:

a) providing the Design-Build team with Utility company representative contact information;
b) reviewing and approving real property interest packages; Utility reimbursement requests and associated cost estimates from Utilities for reimbursable work;
c) preparing and executing Utility agreements for reimbursement and cost sharing;
d) issuing the final, executed utility statement which has been prepared and signed by the Design-Builder;
e) securing funding, and issuing necessary NTP's to the Utility companies;

f) assisting in conflict resolution between the Utility and Design-Build Designer with respect to any utility relocation activities;
g) meeting with Design-Build team and the Utilities to discuss and resolve matters relating to the utility relocation work; and
h) processing invoices and/or payments from Utilities for utility relocation work;
i) assisting the Design-Builder with sending construction plan submittals to the utility companies via the Utility Permit Application (UPA).

The Department will be responsible for all costs associated with the utility relocation coordination activities that it is responsible for pursuant to Chapter 5 of the DelDOT Utility Manual and per Delaware Code, except that the Design-Build team will be responsible for all costs associated with carrying out Incorporated Work and all items identified in Section 3.2 – Design-Build Team's Responsibilities.

3.2 Design-Build Team's Responsibilities

The Design-Build team will be responsible for all utility coordination and relocation activities, except for the Department obligations mentioned above.

The requirements of DelDOT Utility Manual and Delaware Code will govern the utility relocations unless modified in this section. The Design-Build team is responsible for the coordination of all utility relocations required for construction of the Project. The Design-Build team's action plan for each site must be to design to avoid or minimize impacts to Utilities' facilities to the extent practicable. Betterments, as defined in the Utility Manual, are not included within the Design-Build team's work. This Section applies to existing and proposed underground and overhead Utilities. The following are not considered Utilities: traffic signals, storms drains, street lighting, variable message signs, video and video detection systems and the Department-owned fiber optics.

The Design-Build team must identify all Utilities located within the Construction Limits of each proposed site. If utility relocations are necessary, the Design-Build team shall coordinate utility relocations consistent with the requirements of the DelDOT Utility Manual.

The Design Build team's responsibilities include:

a) obtaining minimum 60-year title searches on all parcels within the project limits and potential areas of relocation needed by Utilities. Documents to be supplied to the Department and shared with Utilities if property interested are identified;
b) identifying and verifying all existing Utilities located within the project limits;
c) notifying and coordinating project designs with Utilities (see Chapter 5 of the DelDOT Utility Manual for more details on the coordination process);
d) if a Utility claims to be compensable, requesting and obtaining the applicable real property interest (RPI) documentation from the Utility. Prior to submitting the RPI documents to the Department the Design Build team shall show any and all easements or RPI's in the construction and right-of-way plan set;
e) forwarding cost sharing requests and justification received from a Utility to the Department for consideration;
f) ensuring proposed utility relocations are accurately accounted for in the project designs;

g) having the appropriate level of Subsurface Utility Engineering (SUE) performed to confirm and or accommodate Utility conflicts. All information obtained from the use of SUE shall be provided to the Department and the applicable Utility in format acceptable to each respective party. At a minimum, obtaining SUE designation of all underground Utility facilities within the project limits;
h) providing all affected Utilities and the Department a matrix of confirmed conflicts requiring the relocation of a Utility facility. The Utility Conflict Matrix (UCM) shall identify Utility conflicts and outline the proposed, agreed upon resolutions for each location (UCM included in Contract Documents Part 3 - Appendix F);
i) for each review submission, providing Utility Coordinator with electronic copy of plan (dgn, dwg and/or PDF) which meet or exceed the minimum plan requirements set forth in the DelDOT Utility Manual as requested to distribute to Utility Companies through the Department's electronic Utility Permit Application (UPA);
j) providing any Utilities within the limits of the Project one (1) set of hard copy plans, unless additional copies are requested, which meet or exceed the minimum plan requirements set forth in the DelDOT Utility Manual if needs are not met through the UPA;
k) providing adequate right-of-way to and ensuring the proposed limits of construction (LOC) incorporate any necessary Utility relocations;
l) requesting and receiving estimates from Utilities for any reimbursable work and providing to the Department;
m) completion of the Utility Relocation Checklists for each Utility within the project limits, submitting checklists to DelDOT Utility Coordinator assigned to the project for review, and executing checklists (checklist provided in Contract Documents Part 3 - Appendix F);
n) obtaining Buy America submissions from companies if warranted and submitting to DelDOT Utility Coordinator for review and approval (form provided in Contract Documents Part 3 - Appendix F);
o) developing a utility statement outlining existing utility facilities and proposed relocations along with responsibilities, timing, duration and overall schedule signed by Design Build designer and submitted to DelDOT Utility Coordinator for review, approval to form, and final signature (example statement provided in Contract Documents Part 3 - Appendix F);
p) providing in writing to all Utilities within the limits of the project a detailed schedule of design milestones;
q) providing mutually beneficial information to assist Utilities in securing permits (including environmental), licenses and authorizations for the relocation of their facilities;
r) providing survey stake out services at the request of the Utilities to assist and facilitate the design and construction of the Utility Relocations;
s) scheduling of the Utility Relocation Work proposed by the utilities;
t) completing construction specific operations for coordinated work;
u) performing construction of Utility incorporated Work;
v) following "Miss Utility" law (Title 26, Chapter 8 of DE Code);
w) coordinating with Utility companies to determine maintenance of traffic (MOT) needs and supplying MOT to cover any necessary Utility relocation work required within all project limits;
x) providing a primary contact person for Utility Relocations and coordination; and
y) obtaining and maintaining As-Built Plans of Utility relocations and providing to the Department;

3.3 Meetings and Documentation

The Design-Build team shall be available to meet when requested by the Utilities to discuss and resolve matters relating to the Utility Work. If needed, or at its discretion, the Department will attend the meetings. If the Department is requested to attend, the Design-Build team shall provide the Department with not less than fourteen (14) days prior notice of such meetings.

The Design-Build team shall produce minutes of all meetings with Utilities and/or the Department and shall distribute copies of the minutes to the Utility, the Department and other attendees no later than seven (7) days after each meeting date.

The Design-Build team shall also provide the Department copies of all correspondence between Design-Build team and any Utility and any other documentation no later than seven (7) days after receipt or sending.

The documentation to the Department should be in Portable Document Format (PDF) file format.

3.4 Cost

The Department shall be responsible for the reimbursable utility relocation costs associated with the utility relocation work completed for the Project (See Chapter 5 of the DelDOT Utility Manual and DE Code).

Utilities are responsible for all other costs not outlined in Chapter 5 of the DelDOT Utilities Manual and DE Code. This should also include the cost of removing any lines attached to the bridges or within the project limits that contain asbestos, unless the utilities are eligible for cost sharing. Utility companies are responsible to request reimbursement and supply supporting documentation including but not limited to easement documents, prior rights documents, and relocation costs estimates.

The Design-Build team shall be responsible for the Utility costs of incorporated Utility Work, provide the Department the actual and indirect related costs for that work and the Department will bill the Utility for their share of the incorporated Work, if any.

3.5 Utility Infrastructure and Utility Relocations

3.5.1 Utility Infrastructure and Utility Relocations Interfering with Contract Operations

Before submitting a bid for the project, examine the project site and any waste or borrow sites designated in the proposal to determine the location of all utility infrastructure and the need for any utility relocations. The Department is not responsible for waste and borrow areas not designated in the Project Documents. Accept the responsibility and risk relating to the conditions to be encountered regarding utility infrastructure and utility relocations that are indicated in the Project Documents or that can be ascertained from a careful pre-bid.

Subject to the Department's obligations in respect of the same set forth in this document (above), inform all public service companies, individuals, and others owning or controlling any facilities or structures within the Construction Limits, which may have to be relocated, adjusted, protected, or reconstructed, of the plan of construction work. Give due notice to the responsible party in sufficient time for that party to organize

and perform such work in conjunction with or in advance of construction work.

Subject to the Department's obligations in respect of the same set forth in this document (above), cooperate with the utility infrastructure owners and the owners of all waste and borrow areas not on the project site. Make arrangements for utility relocations necessary to perform the work as indicated in the Project Documents. Arrange and perform work in and around such utility infrastructure in accordance with recognized and accepted engineering and construction practices and in a manner that assists the utility infrastructure owners in their required utility relocations.

3.5.2 Utility Relocations by Others

The Design-Build team shall follow the Miss Utility requirements as outlined in Title 26, Chapter 8 of Delaware Code, cited as the "Underground Utility Damage and Safety Act".

The Design-Build team shall be responsible for any and all damage caused by their Subcontractors, employees or agents to the property, facilities, structures or persons of the Utility. Design-Build team shall immediately notify the affected Utilities of any damage to their facilities caused by their Subcontractors, employees or agents.

The Design-Build team shall be responsible for all costs and/or schedule impacts associated with said damage. This does not include underground facilities that are incorrectly marked by the Utility. The Miss Utility Law places the responsibility on the Utility when said Utility incorrectly marks underground facilities that are subsequently hit by excavation activities.

Should Design-Build team equipment come in contact with or damage a Utility in any way, even though there may be no apparent evidence of breakage or harm, the Design-Build team must promptly notify the proper authorities and cooperate with those authorities in determining damage and restoring interrupted services as may be needed. **(Note: Damage to gas and or oil facilities must be reported immediately to authorities via 911. The affected Utility should also be contacted immediately.)**

Promptly after Design-Build team's discovery of such damage or the Design-Build team's receipt of notice of any such damage from the Utility or from any other source, at the Utility's election, the Utility may make such repairs at Design-Build team's expense or the Design-Build team shall repair the damage to the Utility's s reasonable satisfaction.

3.6 DESIGN REVIEWS

Design Reports and Plans shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

RIGHT-OF-WAY SERVICES PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the minimum right-of-way (ROW) services requirements to be considered and addressed by the Design-Builder during the design development and right-of-way acquisition phase of the project.

1.1 Definitions

a) Appraisal Manager - DelDOT staff member identified as the Head of the Appraisal Section.
b) Appraisal Waiver - DelDOT waiver valuation, limited to a maximum of $15,000.
c) Chief of ROW - Lead DelDOT staff member responsible for the Right-of-Way Section.
d) Consultant - A prequalified firm that provides right-of-way services.
e) DelDOT/Department – Delaware Department of Transportation (including Right-of-Way Section)
f) Department's Designated Representative (DDR) – ROW Agent, Manager or other employee formally assigned by the Department as the ROW Project Manager
g) Right-of-Way Acquisition Manual (ROW Manual) - DelDOT Manual controlling right-of-way related activities

2.0 STANDARDS AND REFERENCES

Right-of-Way services shall be in accordance with this Performance Specification and relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in this Performance Specification establish requirements that have precedence over all others. All Standards and Specifications used by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Codes and Regulations

a) Code of Federal Regulations, Title 23
b) Code of Federal Regulations, Title 49
c) Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act)
d) Delaware Code, Title 29

2.1.2 Manuals

a) Delaware Department of Transportation "Right-of-Way Acquisition Manual"
b) Uniform Standards of Professional Appraisal Practice (USAP)

2.1.3 References

a) Delaware Department of Transportation Design Resource Center

3.0 REQUIREMENTS

The Design-Builder shall provide Right-of-Way design and acquisition services in accordance with provisions provided herein.

3.1 General Requirements (for all Right-of-Way Tasks)

a) Attend project related meetings as required.
b) Develop memoranda for all project related meetings and provide them to the DDR within 10 working days of the meeting.
c) Use Department approved forms contained in Contract Documents Part 3 - Appendix G.
d) Unless otherwise directed, the Design-Builder will be the primary contact for all correspondence (verbal and written) and document preparation with the property owners/agents/relocates from the initial notification through closing or the filing of a condemnation complaint.
e) The DDR must sign any correspondence that appears on DelDOT letterhead and commits the Department to expend funds, such as offer letters and administrative settlement approvals. The determination of when to use DelDOT letterhead shall be the Department's decision.
f) In the event that the Department determines that a deficiency exists concerning any tasks (negotiation, appraisal, relocation assistance, property management, etc.) performed by the Design-Builder, the Department shall notify the Design-Builder who shall then provide such information, and take such action as is necessary to resolve the deficiency.
g) The Design-Builder shall identify all personnel who will be performing the work. Design-Builder personnel shall be qualified personnel experienced in performing their function in accordance with state and federally funded projects. The Department reserves the right to approve all of Design-Builder's personnel employed to perform work under this contract.
h) The Design-Builder must identify the need for interpreters as soon as possible and is responsible for obtaining the necessary interpreters.
i) Request from the Department all brochures, forms, maps, and other documents required by the ROW Manual for acquisition, relocation or property management activities.
j) Promptly report problems and complaints of residents and local officials to the DDR.
k) All work by the Design-Builder shall be performed in accordance with the applicable provisions of the ROW Manual, with Delaware's Eminent Domain or other pertinent Statutes and the Uniform Act.
l) Revisions may be caused by a variety of factors beyond the control of the Design-Builder, such as errors and incomplete documents or maps, revisions stemming from design changes, additional parcels or easements. New appraisals may be needed due to unforeseen delays, changes in ownership, occupants to be relocated, legal settlements and eminent domain proceedings.

3.1.1 Correspondence

In all correspondence with the Department relating to acquisition of real property, include the following information (at a minimum) in a heading:

A. Project Name.
B. Project Number.
C. P3 Identification Number.
D. Project Site Information (road number, road name and feature intersected).
E. DelDOT Parcel Number(s).
F. Assessor's Parcel Number(s).
G. Name-of-record owner(s).

3.2 Department's Responsibilities

The Department shall be responsible for the following right of way acquisition activities:

a) Review and approve Right of Way Plans
b) Prepare Right of Way Certification Statement
c) Review and approve the Design-Builder's written acquisition procedures and schedule prior to

commencing right-of-way activities

d) Review and approve estimates of just compensation
e) Review and approve all requests for administrative settlement offers
f) Provide property settlement services
g) Provide property condemnation services
h) Provide a Designated Department Representative to serve as a point of contact for all right of way acquisition activities

3.3 Right-of-Way Schedule

3.3.1 Submittal

Within twenty Working Days after issuance of NTP, submit a schedule for the acquisition and delivery of ROW to the Department for review and written approval. Include in the schedule the following:

A. The beginning date and anticipated completion date of ROW acquisition.
B. Priorities for parcels whose acquisition will significantly impact the Project Schedule and/or affect its Critical Path.
C. Restriction of Department reviews to a maximum of twenty appraisal or acquisition files at any given time.

3.3.2 Implementation

After Department approval, implement the approved schedule as the ROW schedule and integrate it into the Project Schedule.

3.3.3 Additional Properties

Notify, in advance, the Department of all Design-Builder Additional Properties and temporary rights or interests in real property to be acquired by the Design-Builder and obtain prior approval for the acquisition of any additional ROW required due to a design change. Comply with all NEPA and permit requirements.

3.3.4 Review Period

A. Assume that the Department reviews will require ten Working Days per twenty appraisals or acquisition files within any given ten Working Days.

B. Right-of-way design packages shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

3.3.5 Acquisition

A. Incorporate 35 days into the schedule for negotiations. Include a minimum of one personal contact per ownership during the 35 day negotiation period with at least two follow up contacts unless or until the agent is successful in reaching a settlement agreement with the owners after the first or second contact.

B. The Design-Builder shall incorporate 90 calendar days into the schedule for eminent domain procedures. The 90 calendar days begins on the day the case is received by the court which is at least 30 calendar days after all required documentation is submitted to the Department's legal representative. (Please note: the 30 day period allows for in state service of the summons to in

state grantors or parties of interest. If there are parties of interest who reside out of state and who are temporarily out of the area, this time line may need to be extended.)

C. Providing that the Design-Builder has provided the appropriate documents with the request for condemnation (including but not limited to the title report, an error free legal description and error free map of the parcels) the Department will submit the completed Condemnation Resolution to the Department's legal representative within 15 working days after the request for condemnation has been approved.

3.4 Public Involvement

The Design-Builder shall provide all necessary handouts/graphics and conduct informational presentations regarding right-of-way procedures, at formal public hearings, or at one (or more) separate public meetings.

3.5 Title Services

The Design-Builder shall select and contract with one or more title companies from a list of Department approved title companies included in Contract Documents Part 3 - Appendix G. The Design-Builder shall provide a 60 Year Title Report for each property acquisition.

3.6 Appraisal Services

Among the services that may be required to be performed are:

a) Review the project site and right-of-way plan with the DDR.
b) Identify the valuation problems, determine the number and type of appraisal reports needed for each parcel (aka "case" or "claim"), identify items pertinent to the valuation of each case, and note any specific or unusual appraisal problems (e.g., the need for septic and well relocations, parking studies, special engineering reports, architects reports, unity of use situations, larger parcels, etc.).
c) Prepare or have prepared studies and special reports that are not appraisals, which are usually incorporated into the final appraisal to provide a complete valuation of the property. Examples of these include, but are not limited to M&E reports, cost to cure studies, planning studies, architects reports, septic system replacements.
d) Utilize appraisers, appraisal reviewers, and specialists from the Department's lists of pre-qualified fee appraisers, reviewers and specialists.
e) Prepare a comprehensive appraisal plan detailing the fee appraisers to be contacted. This plan must be approved by the DDR.
f) Any fee in excess of $15,000 must be approved by the DDR.

If the estimated appraisal fee is less than $15,000.00, the assigned Design-Builder shall:

a) Contact a DelDOT approved fee appraiser qualified to perform the appraisal service required.
b) Prepare Appraisal Waiver forms by analyzing the acquisition, and applying unit rates obtained by the consultant through comparable sale research. The Department will sign such forms to authorize the Waiver as an offer.

All appraisal reports will be reviewed by a pre-qualified appraiser, independent of the individual who issued the report. The review appraiser will recommend the fair market value for a particular parcel based on the results of the review process. The DDR will make the final acceptances of the appraisal(s) received and will select one of the appraisal(s) as the approved appraisal for the purpose of determining the amount to be offered to the owner as the Department's estimate of just compensation. The acceptance and

approval of appraisal waiver, appraisal and review reports, and the determination of the Department's estimate of just compensation shall only be made by the Project Manager after consideration of the review analysis and reviewer's recommendation or the information set forth in the appraisal waiver.

3.7 Negotiations

a) The Design-Builder may conduct preliminary acquisition interviews with affected property owners prior to the initiation of negotiations. Such preliminary contacts may be made on an individual basis or in a public meeting of property owners.
b) Prior to negotiations, the Design-Builder may prepare property descriptions and individual plat maps per the ROW manual. All descriptions and individual plat maps shall be approved by the DDR prior to any commencement of negotiations.
c) The Design-Builder may negotiate acquisitions in accordance with the ROW Manual, the Uniform Act, and the laws of the State of Delaware. This includes describing the taking, ROW plats, construction plans, and need for the project. It also includes discussing and explaining the appraisal and engineering reports, detailing how the offer was developed, and other valuation questions. The Design-Builder shall prepare all necessary documents for review and signature by the DDR. The only offer allowed is that approved by the Department. The Design-Builder may not present any counter offer or agree to any engineering plans revisions or changes without express permission by DelDOT. The Design-Builder is to relay all concerns, counter offers, or issues to the DDR for review and consideration.
d) If the DDR approves the offering of an administrative settlement to the owner, prior to any presentation of the settlement to the owner, the Design-Builder shall prepare an administrative settlement request for review and written approval by the Chief of ROW. This will include justification for the recommended settlement. Only upon written approval by the Chief of ROW may any offer beyond the Fair Market Value be presented by the Design-Builder.
e) When negotiations result in an agreement or a DelDOT approved administrative settlement, the Design-Builder shall prepare the necessary documents and secure signatures from the owner or their representatives for processing the case for settlement. When negotiations result in condemnation, the consultant shall submit completed case file documents to the DDR.
f) At a minimum the Design-Builder must take the following acquisition actions on each right-of-way case being acquired on the project: Deliver owner's notification letters, acquisition brochures, plans, offer letters, and unsigned agreements by means of personal contact or certified mail. Offers by mail must have written approval by the DDR. Maintain diary of negotiator's contacts with property owners to document bona fide negotiations, efforts to achieve amicable settlements, responsiveness to owners' counter proposals, and suggestions for changes in plans.
g) Complete negotiations on all parcels (cases) on the project to settlement stage or condemnation (letter of intent) prior to the scheduled project right-of-way certification date.

3.8 Legal Processing

The Design-Builder shall cooperate and assist when necessary with the legal representatives of DelDOT to assist in the processing of all cases for legal action. The Design-Builder will make available staff and information as may be required by DelDOT legal representatives.

3.9 Relocation and Property Management Services

It is anticipated that no relocations of personal property as defined by the Uniform Act or property management services will be required under this contract.

ENVIRONMENTAL COMPLIANCE PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design-Builder shall provide environmental compliance for all sites. Environmental compliance shall include development of National Environmental Policy Act (NEPA) documents for each site and the acquisition of all applicable environmental permits.

2.0 STANDARDS AND REFERENCES

Environmental compliance shall be in accordance with this Performance Specification and the relevant requirements provided in the following codes, unless otherwise stipulated in this Performance Specification. Codes specifically cited in the body of the Performance Specification establish requirements that have precedence over all others. All Codes utilized by the Design-Builder shall be the most recent version available at the time of advertisement of the RFP, unless otherwise noted.

2.1 STANDARDS

Specific codes include, but are not limited to, the following:

2.1.1 Codes

a) 23 CFR 771.117
b) Section 404 of the Clean Water Act
c) Delaware Code, Title 7, Section 66
d) Delaware Code, Title 7, Section 72
e) New Castle County Uniform Development Code, Chapter 40, Section 10
f) Endangered Species Act, Section 7

2.1.2 References

a) FHWA-DelDOT Categorical Exclusion Programmatic Agreement (see Appendix H)

3.0 REQUIREMENTS

3.1 NEPA DOCUMENT

The Department anticipates that each site will require processing a Categorical Exclusion in accordance with the Programmatic Agreement executed between DelDOT and the FHWA. Each site must meet the following specific conditions to be considered under the Categorical Exclusion Evaluation Programmatic Agreement:

a) Right-of-Way or Permanent Easement acquisition of less than 1.0 Acre.
b) No property relocations.
c) No Adverse Effect to historic properties.
d) No Section 4(f) properties impacted, unless they qualify for a *de minimus* finding or a FHWA Section 4(f) Nationwide Programmatic Evaluation.
e) No Section 6(f) properties impacted.
f) Permanent wetland impacts of less than 0.1 Acres.
g) No rare, threatened or endangered (RTE) species are present within the limits of construction.

The Design-Builder shall complete a "Programmatic Categorical Exclusion Evaluation Project Checklist and Project Level Determination Form" for each site. This form is included in Contract Documents Part 3 - Appendix H. Sites that do meet the above criteria must be evaluated for project level determination in accordance with 23 CFR 771.117.

3.2 PERMITS

The Design-Builder shall obtain all municipal, county, state and federal permits from the appropriate regulatory agencies. The Design-Builder shall take into account that existing USACE Section 404 permits will expire March 18, 2017 when preparing his bid. Anticipated permits include, but are not limited to:

a) USACE Section 404 (Note: Existing USACE Section 404 nationwide permits will expire March 18, 2017)
b) DNREC Wetlands and Subaqueous Lands
c) New Castle County Floodplain

3.3 CONSULTATION

The Design-Builder shall consult with and obtain clearance from the DNREC and U.S. Fish and Wildlife Service on rare, threatened and endangered species. An example query is included in Contract Documents Part 3 - Appendix C.

3.4 SUBMISSIONS

The Design-Builder shall submit the following materials by site at the noted submission milestones to meet environmental compliance requirements:

a) Preliminary Plans (50%) - DRAFT NEPA, permit and consultation documents for review
b) Semi-Final Plans (85%) – FINAL NEPA, permit and consultation documents for review
c) Final Plans (100%) – permit submittals

3.5 INFORMATION PROVIDED BY THE DEPARTMENT

The Department will provide the following to the Design-Builder:

a) Cultural resources coordination and clearance under Section 106 of the National Historic Preservation Act and its implementing regulations (36 CFR 800).
b) Any coordination required under Section 4(f) of the US Department of Transportation Act of 1966.
c) Any coordination required under Section 6(f) of the Land and Water Conservation Fund Act.
d) Wetlands delineation.
e) “Streamstats” – stream channel requirements including any proposed modifications and the need for a low-flow channel.

3.6 ENVIRONMENTAL COMPLIANCE REVIEWS

NEPA and Permit Application documents shall be submitted for Review in accordance with Contract Documents Part 2 – Section DB 111-8.

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX B

TRAFFIC DOCUMENTS

TRAFFIC REQUIREMENTS AND RESTRICTIONS							
Bridge ID	Road Facility	Bridge Map	Functional Classification	TMP Type	Seasonal Restriction (Work Not Allowed)	Vehicle Detour	Ped Detour
1178 282	MILL CREEK RD.	11	Urban Collector	A	N/A	Y	N
1183 276	MCKENNAN'S CHURCH	12	Urban Minor Arterial	A	8/15 thru 6/15	Y	N
1420 461	MARYLAND LINE RD.	16	Rural Local	A	N/A	Y	N
1449 456	UNION CHURCH RD	17	Rural Local	A	N/A	Y	N
1454 465	EAGLES NEST LNDG R	17	Rural Local	A	N/A	Y	N
1455 466	DEER RUN RD	17	Rural Local	A	N/A	Y	N
1615 021	NEWPORT GAP PIKE	12	Urban Principal Arterial	B	TBD	Y	N
1616 021	NEWPORT GAP PIKE	12	Urban Principal Arterial	B	TBD	Y	N
2066A 066	WHITE OAK RD	21	Urban Local	A	5/1 thru 9/30	Y	Y
2113B 113	CATTAIL BRANCH RD.	27	Rural Local	A	N/A	Y	N
2303A 303	HIGH STUMP RD.	27	Rural Local	A	N/A	Y	N
2371B 371	BARRATTS CHAPEL RD	25	Urban Collector	A	N/A	Y	N
2384C 384	KILLENS POND RD	25	Rural Local	A	N/A	Y	N
2442A 442	ABBOTTS POND RD	29	Rural Local	A	N/A	Y	N
3132 565	SUNNYSIDE RD.	34	Rural Local	A	N/A	Y	N
3139 597	TUCKERS RD.	35	Rural Local	A	N/A	Y	N
3236 046	ELKS RD.	34	Rural Local	A	N/A	Y	N
3317 024	SR 24 / LAUREL RD	41	Rural Major Collector	A	5/1 thru 9/30	Y	N
3323 447	JOHNSON RD.	41	Rural Local	A	N/A	Y	N
3335 515	BACONS RD	40	Rural Local	A	N/A	Y	N
3441 382	ARMORY RD.	43	Rural Major Collector	A	N/A	Y	N
3564 413	FIREMANS RD	42	Rural Local	A	N/A	Y	N
3576 064	WHITESVILLE RD.	41	Rural Major Collector	A	N/A	Y	N
3626 608	ELLENDALE FOREST R	29	Rural Local	A	N/A	Y	N
3627 606	SAMMONS RD.	35	Rural Local	A	N/A	Y	N
3630 593	MAPLE BRANCH RD.	35	Rural Local	A	N/A	Y	N
3681 318	CEDAR LANE	36	Rural Local	A	N/A	Y	N
3913 016	BEACH HGWY / SR16	29	Rural Major Collector	A	5/1 thru 9/30	Y	N
3914 016	BEACH HGWY / SR16	29	Rural Major Collector	A	5/1 thru 9/30	Y	N
3914A 016	BEACH HGWY / SR16	29	Rural Major Collector	A	5/1 thru 9/30	Y	N
3923 224	FLEATOWN ROAD	30	Rural Local	A	N/A	Y	N

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

DESIGN-BUILD STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX C

PAVEMENT DESIGN DOCUMENTS

bridge_id	Bridge #	facility	funcclass	ADT	manual trucks	% Trucks	DD	Tf	Gr	LDF	R	SN Req	Type C Stone	gyrations of mix (C,B,BCBC)	Binder Grade (C,B)	Binder Grade BCBC
1178 282	1-178	MILL CREEK RD.	Urban Collector	4332		7.51	60.2	0.6	1.07	100	85	3.75	carb	160	64-22	64-22
1183 276	1-183	MCKENNAN'S CHURCH	Urban Minor Arterial	3865	6984	7.69	56.86	0.6	1	100	90	4.2	carb	160	64-22	64-22
1420 461	1-420	MARYLAND LINE RD.	Rural Local	215		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
1449 456	1-449	UNION CHURCH RD	Rural Local	263		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
1453 045	1-453	WALKER SCHOOL RD.	Rural Minor Collector	623		7.8	60.27	0.6	1.03	100	80	2.75	carb	160	64-22	64-22
1454 465	1-454	EAGLES NEST LNDG R	Rural Local	346		7.8	60.27	0.6	1.03	100	70	2.36	carb	160	64-22	64-22
1455 466	1-455	DEER RUN RD	Rural Local	110		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
1615 021	1-615	NEWPORT GAP PIKE	Urban Principal Arterial	13170		7.69	56.86	1.6	1	100	90	5.5	non-carb	160	70-22	64-22
1616 021	1-616	NEWPORT GAP PIKE	Urban Principal Arterial	13170		7.69	56.86	1.6	1	100	90	5.5	non-carb	160	70-22	64-22
2066A066	2-066a	WHITE OAK RD	Urban Local	1175		7.85	61.45	0.6	1.07	100	70	3	carb	160	64-22	64-22
2098 098	2-098	FORDS CORNER RD.	Rural Minor Collector	530		7.8	60.27	0.6	1.03	100	80	2.75	carb	160	64-22	64-22
2113B113	2-113b	CATTAIL BRANCH RD.	Rural Local	222		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
2303A303	2-303a	HIGH STUMP RD.	Rural Local	42		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
2371B371	2-371b	BARRATTS CHAPEL RD	Urban Collector	1479		7.8	60.27	0.6	1.03	100	85	3	carb	160	64-22	64-22
2371C371	2-371c	BARRATTS CHAPEL RD	Urban Collector	1479		7.8	60.27	0.6	1.03	100	85	3	carb	160	64-22	64-22
2384C384	2-384c	KILLENS POND RD	Rural Local	908	1244	7.8	60.27	0.6	1.03	100	70	2.9	carb	160	64-22	64-22
2442A442	2-442a	ABBOTTS POND RD	Rural Local	1163		7.8	60.27	0.6	1.03	100	70	2.9	carb	160	64-22	64-22
2443A443	2-443a	WILLIAMSVILLE RD.	Rural Minor Collector	1585		7.8	60.27	0.6	1.03	100	80	3.3	carb	160	64-22	64-22
2443B443	2-443b	WILLIAMSVILLE RD.	Rural Minor Collector	1585		7.8	60.27	0.6	1.03	100	80	3.3	carb	160	64-22	64-22
3132 565	3-132	SUNNYSIDE RD.	Rural Local	328		7.8	60.27	0.6	1.03	100	70	2.36	carb	160	64-22	64-22
3139 597	3-139	TUCKERS RD.	Rural Local	121		6.32	69.93					2.25	carb	160	64-22	64-22
3236 046	3-236	ELKS RD.	Rural Local	1798		7.8	60.27					3.25	carb	160	64-22	64-22
3317 024	3-317	SR 24 / LAUREL RD	Rural Major Collector	2624	3657	8.03	56.17	0.6	1.01	100	85	3.6	carb	160	64-22	64-22
3323 447	3-323	JOHNSON RD.	Rural Local	310		6.32	69.93					2.4	carb	160	64-22	64-22
3335 515	3-335	BACONS RD	Rural Local	788		6.32	69.93					2.67	carb	160	64-22	64-22
3441 382	3-441	ARMORY RD.	Rural Major Collector	5978		8.03	56.17	0.6	1.01	100	85	4	carb	160	64-22	64-22
3564 413	3-564	FIREMANS RD	Rural Local	262		6.32	69.93					2.45	carb	160	64-22	64-22
3576 064	3-576	WHITESVILLE RD.	Rural Major Collector	2032		8.03	56.17					3.5	carb	160	64-22	64-22
3626 608	3-626	ELLENDALE FOREST R	Rural Local	69		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
3627 606	3-627	SAMMONS RD.	Rural Local	203		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
3630 593	3-630	MAPLE BRANCH RD.	Rural Local	102		7.8	60.27	0.6	1.03	100	70	2.3	carb	160	64-22	64-22
3681 318	3-681	CEDAR LANE	Rural Local	2306		6.32	69.93					3.25	carb	160	64-22	64-22
3913 016	3-913	BEACH HGWY / SR16	Rural Major Collector	5556	7928	8.03	56.17	0.6	1.01	100	85	4.4	carb	160	64-22	64-22
3914 016	3-914	BEACH HGWY / SR16	Rural Major Collector	5556	7928	8.03	56.17	0.6	1.01	100	85	4.4	carb	160	64-22	64-22
3923 224	3-923	FLEATOWN ROAD	Rural Local	2257		8.03	56.17	0.6	1.01	100	70	3.5	carb	160	64-22	64-22

Pavement Design and Material Requirements

bridge_id	Bridge #	facility	Map	featint	funcclass	SN Req	Type C Stone	gyrations of mix (C,B,BCBC)	Binder Grade (C,B)	Binder Grade BCBC
1178 282	1-178	MILL CREEK RD.	11	TRIB. OF MILL CREEK	Urban Collector	3.75	carb	160	64-22	64-22
1183 276	1-183	MCKENNAN'S CHURCH	12	HYDE RUN	Urban Minor Arterial	4.2	carb	160	64-22	64-22
1420 461	1-420	MARYLAND LINE RD.	16	TRIB OF SASSAFRAS RIVER	Rural Local	2.3	carb	160	64-22	64-22
1449 456	1-449	UNION CHURCH RD	17	TRIB. TO BLACKBIRD CREEK	Rural Local	2.3	carb	160	64-22	64-22
1454 465	1-454	EAGLES NEST LNDG R	17	SAW MILL BRANCH	Rural Local	2.36	carb	160	64-22	64-22
1455 466	1-455	DEER RUN RD	17	SAW MILL BRANCH	Rural Local	2.3	carb	160	64-22	64-22
1615 021	1-615	NEWPORT GAP PIKE	12	HYDE RUN	Urban Principal Arterial	5.5	non-carb	160	70-22	64-22
1616 021	1-616	NEWPORT GAP PIKE	12	HYDE RUN	Urban Principal Arterial	5.5	non-carb	160	70-22	64-22
2066A066	2-066a	WHITE OAK RD	21	LITTLE RIVER	Urban Local	3	carb	160	64-22	64-22
2113B113	2-113b	CATTAIL BRANCH RD.	27	SAULSBURY CREEK	Rural Local	2.3	carb	160	64-22	64-22
2303A303	2-303a	HIGH STUMP RD.	27	CATTAIL BRANCH	Rural Local	2.3	carb	160	64-22	64-22
2371B371	2-371b	BARRATTS CHAPEL RD	25	TRIB. TO MCGINNIS POND	Urban Collector	3	carb	160	64-22	64-22
2384C384	2-384c	KILLENS POND RD	25	BROWNS BRANCH	Rural Local	2.9	carb	160	64-22	64-22
2442A442	2-442a	ABBOTTS POND RD		TANTROUGH BRANCH	Rural Local	2.9	carb	160	64-22	64-22
3132 565	3-132	SUNNYSIDE RD.	34	GUM BRANCH	Rural Local	2.36	carb	160	64-22	64-22
3139 597	3-139	TUCKERS RD.	35	WEST BRANCH	Rural Local	2.25	carb	160	64-22	64-22
3236 046	3-236	ELKS RD.	34	TRIB. TO HEARNS POND	Rural Local	3.25	carb	160	64-22	64-22
3317 024	3-317	SR 24 / LAUREL RD	41	TRIB. TO TRAP POND	Rural Major Collector	3.6	carb	160	64-22	64-22
3323 447	3-323	JOHNSON RD.	41	WILEYS POND	Rural Local	2.4	carb	160	64-22	64-22
3335 515	3-335	BACONS RD	40	MEADOW BRANCH	Rural Local	2.67	carb	160	64-22	64-22
3441 382	3-441	ARMORY RD.	43	HERRING BRANCH	Rural Major Collector	4	carb	160	64-22	64-22
3564 413	3-564	FIREMANS RD	42	GUM BRANCH	Rural Local	2.45	carb	160	64-22	64-22
3576 064	3-576	WHITESVILLE RD.	41	NORTH FORK GREEN RUN	Rural Major Collector	3.5	carb	160	64-22	64-22
3626 608	3-626	ELLENDALE FOREST R	29	MAPLE MARSH/BEAVER DAM B	Rural Local	2.3	carb	160	64-22	64-22
3627 606	3-627	SAMMONS RD.	35	MAPLE MARSH&BEAVER DAM B	Rural Local	2.3	carb	160	64-22	64-22
3630 593	3-630	MAPLE BRANCH RD.	35	MAPLE MARSH & BEAVER DAM	Rural Local	2.3	carb	160	64-22	64-22
3681 318	3-681	CEDAR LANE	36	ELI WALLS DITCH	Rural Local	3.25	carb	160	64-22	64-22
3913 016	3-913	BEACH HGWY / SR16	29	WEST BRANCH	Rural Major Collector	4.4	carb	160	64-22	64-22
3914 016	3-914	BEACH HGWY / SR16	29	STALLION HEAD BRANCH	Rural Major Collector	4.4	carb	160	64-22	64-22
3914A 016	3-914A	BEACH HGWY / SR16	29	STALLION HEAD BRANCH	Rural Major Collector	4.4	carb	160	64-22	64-22
3923 224	3-923	FLEATOWN ROAD	30	SWIGGETS POND	Rural Local	3.5	carb	160	64-22	64-22

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX D

STORMWATER MANAGEMENT DOCUMENTS

Delaware Department of Transportation

Drainage Plan Submission Checklist for Division of Transportation Solutions Projects

Directions for Completing the Checklist

- This checklist indicates what content should be included with each required submission to the Department.
- The Checkboxes ☐ indicate that information is required and must be included in the submission.
- For each submission, indicate that the required information has been included in the plan submission by placing an "X" in the appropriate checkbox.
- Items may need to be added for some projects and may not be required for others. Please discuss with the DelDOT Drainage Reviewers to determine if an item is not required. If the item is not required place a strikethrough line through the item that is not required.
- The DelDOT project manager shall review this checklist with the Designer/Consultant at each required submission to verify that all necessary information has been included in the report and shall sign below for each submission to attest to the completeness of the plan submission.
- The Preliminary Drainage Report Submission will occur with internal Preliminary Plan submission and will include all items in this checklist. Final Drainage Report Submission will occur with internal Semi-Final Plan Submission and include all items in this checklist.
- This checklist shall be completed, signed and submitted with each submission.

Project Information			
Contract #:		Project ID:	
Contract Name:			
Designer:		Project Manager:	

Verification of Submission Completeness		
Submission	Designer Approval	Project Manager Approval
Survey Plans		
Preliminary Plans		
Semi-Final Plans		
Final Plans		

Cover Sheet			
	Prelim	Semi	Final
Project title	☐	☐	☐
Project contract number	☐	☐	☐
P3E number	☐	☐	☐
Date submitted for review	☐	☐	☐
Name of designer(s) that the report was prepared by	☐	☐	☐
Phone number of designer(s)	☐	☐	☐
E-mail address of the designer(s)	☐	☐	☐

Table of Contents			
	Prelim	Semi	Final
Table of contents showing the order of the report. The report order shall follow the order presented in the checklist	☐	☐	☐

Narrative			
	Prelim	Semi	Final
Project summary included providing a brief history of the project	☐	☐	☐
Design methodology describing the following items:			
• Inlet spacing	☐	☐	☐
• Roadside ditches	☐	☐	☐
• Storm drain system	☐	☐	☐
• Inlet box sizing	☐	☐	☐
• EGL and HGL Calculations	☐	☐	☐

Support Calculations/ Appendices			
	Prelim	Semi	Final
Drainage area Maps in PDF or CADD format which include the following:			
• North arrow	☐	☐	☐
• Proposed drainage area's boundaries	☐	☐	☐
• Label each drainage area based on DI number on construction plans	☐	☐	☐
• Roadway names labeled	☐	☐	☐
• Ariel Photo in background	☐	☐	☐
• Proposed contours in project limits	☐	☐	☐
• Existing contours in project limits (shown in different color than proposed and on line a lighter line weight)	☐	☐	☐
• Proposed Impervious limits	☐	☐	☐
• The Tc path shown for each drainage area in a different color than the contours and drainage boundaries	☐	☐	☐

Support Calculations/ Appendices Cont.			
	Prelim	Semi	Final
Provide tables in PDF format which show each drainage area specifics including:			
• Each land type present listed with its associated area and “C” value	☐	☐	☐
• Weighted “C” value listed for entire drainage area	☐	☐	☐
• Total area of each drainage area in acres	☐	☐	☐
• Calculated overland sheet flow time, shallow concentrated flow time and concentrated flow time summed into total Tc time	☐	☐	☐
• “I” values corresponding to chapter 6 of the Road Design Manual	☐	☐	☐
• Total “Q” to the drainage area	☐	☐	☐
Inlet spacing calculations performed and submitted in PDF format including:			
• List design storm event	☐	☐	☐
• Associated inlet number identified	☐	☐	☐
• Longitudinal slope listed	☐	☐	☐
• Cross slope of shoulder/ travel Lane listed	☐	☐	☐
• Total gutter flow including previous bypass flow	☐	☐	☐
• Gutter depth	☐	☐	☐
• Actual Gutter spread	☐	☐	☐
• Allowable spread	☐	☐	☐
• Efficiency factor listed	☐	☐	☐
• Bypass flow calculated	☐	☐	☐
• Perform flanking inlet calculations for sags	☐	☐	☐
Ditch sizing calculations performed and submitted in PDF format including:			
• List design storm event	☐	☐	☐
• List the drainage areas (which were calculated in previous steps) contributing to the ditch flow	☐	☐	☐
• Each land type present listed with its associated area and “C” value	☐	☐	☐
• Weighted “C” value listed for combined drainage area to each ditch run	☐	☐	☐
• Total area of each combined drainage area in acres	☐	☐	☐
• Calculated overland sheet flow time, shallow concentrated flow time, and concentrated flow time summed into total Tc time	☐	☐	☐
• “I” Values corresponding to chapter 6 of the Road Design Manual	☐	☐	☐
• Total Q to the ditch	☐	☐	☐
• Ditch bottom width listed	☐	☐	☐
• Composite longitudinal slope of the ditch section	☐	☐	☐
• Ditch side slopes listed (for both sides)	☐	☐	☐
• Calculated depth of water in the ditch	☐	☐	☐
• Calculated water velocity in the ditch	☐	☐	☐
• Calculated shear stress in the ditch	☐	☐	☐
• Permissible shear stress for the ditch lining	☐	☐	☐

Support Calculations/ Appendices Cont.			
	Prelim	Semi	Final
Pipe Sizing Calculations submitted in table format			
• List design storm event		☐	☐
• Identify the pipe number associated with calculation		☐	☐
• Identify the length of the pipe		☐	☐
• Use previously created drainage area maps and inlet spacing calculations to identify the associated drainage area of both the individual pipe and total system		☐	☐
• Identify individual “C” value as well as aggregate total “C” value for each pipe		☐	☐
• Use previously created drainage area maps and inlet spacing calculations to identify the associated Tc of the of both the individual pipe and the total system		☐	☐
• Calculate associated “I” using Chapter 6 of the Road Design Manual		☐	☐
• Determine Runoff “Q” to the pipe being designed		☐	☐
• Identify the slope of each pipe		☐	☐
• Perform Manning’s calculation to determine the design and full flow velocity		☐	☐
• Identify invert and discharge elevations for each pipe		☐	☐
• Calculate crown drop for each pipe		☐	☐
HGL and EGL calculations submitted in table format		☐	☐
• Provide summary of HGL and EGL calculation results		☐	☐
• Include sample HGL and EGL calculations for the project		☐	☐
Culvert Analysis (which do not classify as a bridge)			
• Design flow		☐	☐
• Maximum flow		☐	☐
• Headwater elevation		☐	☐
• Tailwater elevation		☐	☐
• Outlet velocity		☐	☐
• Tailwater velocity		☐	☐
Energy Dissipater Design			
• Perform appropriate energy dissipater calculations		☐	☐
• Determine outlet velocity with proposed energy dissipater		☐	☐
Inlet Box Sizing calculations are not included at preliminary			
• List structure number of associated structure		☐	☐
• List pipe numbers, sizes and angles coming into associated structure		☐	☐
• List box size required based on Maximum Angle of Deflection for Pipes Entering and Exiting Inlet Boxes found on the Delaware DRC		☐	☐

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX E

GEOTECHNICAL DOCUMENTS

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-23-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-178 on Millcreek – Hockessin DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-22-2016. Walton Corporation-Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 67 feet below the existing ground surface elevation, In addition 6 feet of coring rock was collected from this site . Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

2.1 The geological background of this area was found using the Geologic Map of New castle county, Delaware Series No. 13 by Ramsey, K.W 2005. According to Geologic Map the area is situated in Wissahickon Formation: Interlayered psammitic and pelitic gneiss with amphibolite. Psammitic gneiss is a medium- to fine-grained biotite-plagioclase-quartz gneiss with or without small garnets. Contacts with pelitic gneiss are gradational. Pelitic gneiss is medium- to coarse-grained garnet-sillimanite-biotite-plagioclase-quartz gneiss.

3. Ground Water Background

3.1 The Water-Table and Surface-Drainage were not encountered for this site.
3.2 The Delaware Geologic Information Resource (DGIR) was not encountered for this site.

4. Hydrologic Background

The Delaware Geological Survey Geohydrology was not encountered for this site.

5. Ground Cover

The ground cover for this site is 10 inches of asphalt. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 8.2 and 12 feet, 8 feet after complete the drilling and caved at 8 and 26 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 9 to 48.3 percent. The Atterberg limit is 50 percent, Liquid limits is 22.1 to 52.8 percent and Plasticity Index is 6 and 6.3 percent. Organic matter is 3 % percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition, a layer of 4 feet in thickness of fine and coarse sand was appeared at 8 feet from the surface elevation at the borings was drilled at south of the bridge. In addition the entire sample from the depth of 2 to 10 feet from the surface had not enough of all borrow type material to reuse according to Del-DOT standard specification except borrow type ”F”. The Rock coring where collected appeared recovery is 23 to 45 % percent and the Rock Quality Designation RQD is range of 8 to 20 % percent this is very poor condition more detail at Appendix D.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only

to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (9- sheets)

APPENDIX C

- Grain Size Distribution Result (6- sheets)

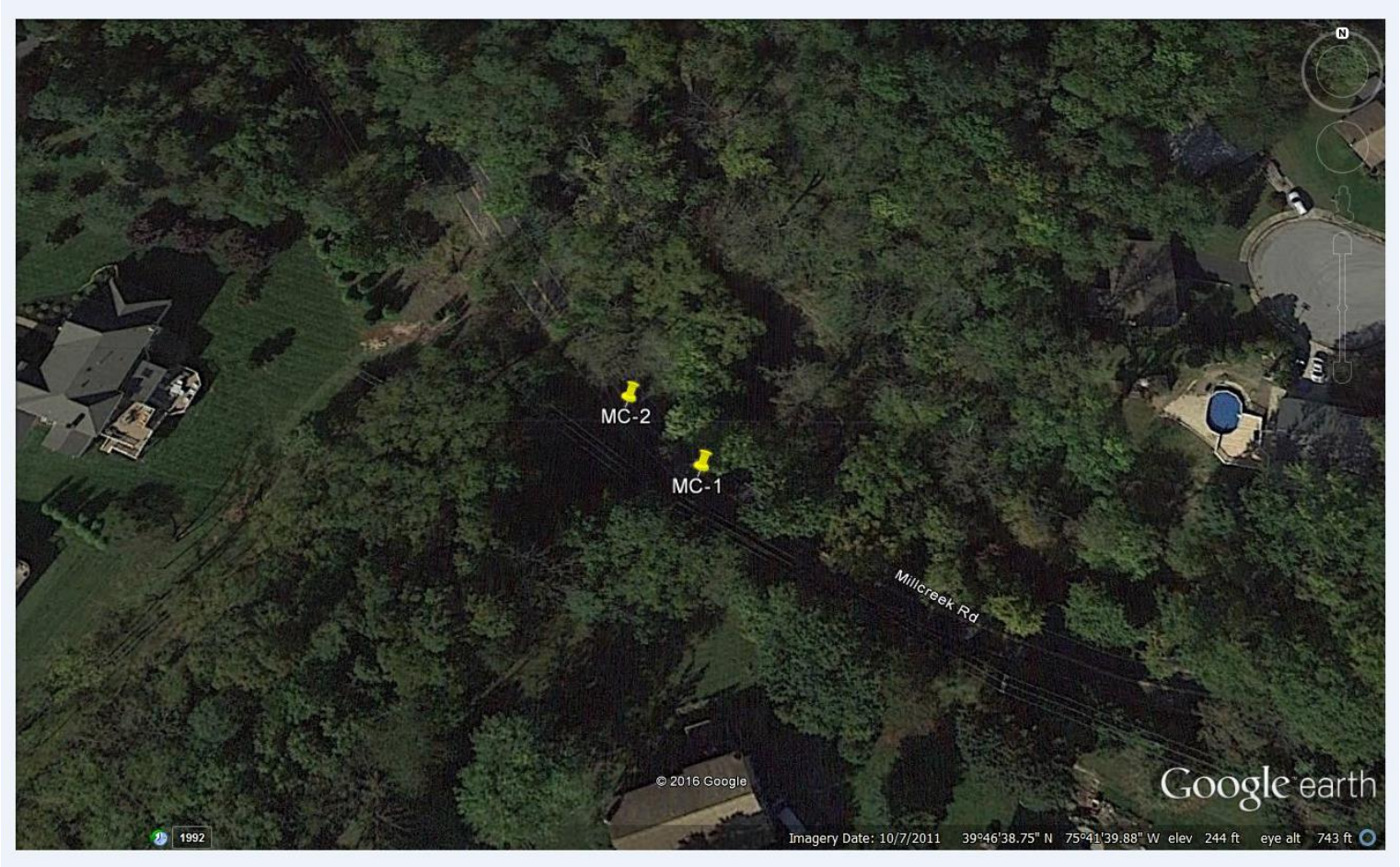
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 5-23-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-178 on Millcreek – Hockessin DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
MC-1	647463.901	578098.819	39.7773667	-75.6944194
MC-2	647501.447	578064.582	39.7774694	-75.6945417

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MC-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 647463.901
Easting: 578098.819
Boring Surface Elev.:
Reference:
Date Started: 3/22/16
Date Completed: 3/22/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 67.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/22/16	8.2	
3/22/16	6.7	26.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'		Moist gray silty coarse to fine sand and fine gravel. 14" RECOVERY	A-1-b	Hot-mix 10"
2.53		2	2.0' 4.0'	9 7 7 7	Moist stiff gray fine to coarse sandy silt w/ trace fine gravel. 17" RECOVERY	A-4(0)	
5.06		3	4.0' 6.0'	2 3 2 3	Wet firm gray silt w/some fine sand, trace of coarse sand and fine gravel. 21" RECOVERY	A-4(0)	
7.59		4	6.0' 8.0'	2 4 4 9	Saturated firm gray organic fine sandy silt w/ some coarse sand, trace of fine gravel. 20" RECOVERY	A-4(0)	
10.12		5	8.0' 10.0'	6 17 15 10	Saturated dense brown coarse sand and fine gravel w/some fine sand and silt. 7" RECOVERY	A-1-b	
		6	10.0' 12.0'	6 6 8 8	Saturated medium dense brown fine gravelly coarse sand w/some fine sand and silt. 8" RECOVERY	A-1-b	
12.65		7	12.0' 14.0'	10 10 12 15	Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt. 8" RECOVERY	A-1-b	
		8	14.0'	5 8	Saturated medium dense brown silty coarse	A-1-b	

Remarks: Auger refusal @ 67'

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	11 11	to fine sand w/some fine gravel. 12" RECOVERY		
17.71		9	16.0' 18.0'	7 11 11 15	Saturated medium dense brown silty coarse to fine sand w/trace fine gravel. 13" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	7 8 9 9	Saturated medium dense gray silty coarse to fine sand w/trace fine gravel. 7" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' 26.0'	2 3 11 11	Saturated stiff gray fine to coarse sandy silt w/trace fine gravel. 20" RECOVERY	A-4(0)	
27.83							
30.36		12	29.0' 31.0'	6 6 12 50	Saturated very stiff gray fine sandy silt w/ some coarse sand, trace of fine gravel. 19" RECOVERY	A-4(0)	
32.89							
35.42		13	34.0' 36.0'	50	Saturated very dense gray fine sandy fine gravel w/some coarse sand and silt. 6" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	50	Saturated very dense gray fine to coarse sandy fine gravel w/some silt. 4" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	50	Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt. 1" RECOVERY	A-1-b	
48.07							
50.6		16	49.0' 51.0'	50	Saturated very dense gray coarse sand w/ some fine gravel and fine sand, trace of silt. 1" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	50	Saturated very dense gray fine gravelly coarse to fine sand w/some silt. 3" RECOVERY	A-1-b	
58.19							
		18	59.0'	50	Saturated very dense gray silty fine sand and fine gravel w/some coarse sand.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72			61.0'		1" RECOVERY		
63.25							
		19	64.0'	50	Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt.	A-1-b	
65.78			66.0'		2" RECOVERY		
		20	66.0'	50	Saturated very dense gray fine gravel w/some coarse to fine sand and silt.	A-1-b	
			68.0'		3" RECOVERY		
68.31					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MC-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 647501.447
Easting: 578064.582
Boring Surface Elev.:
Reference:
Date Started: 3/22/16
Date Completed: 3/22/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 49.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/22/16	12.0	
3/22/16	8.0	14.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	2 2 3 3	Wet firm gray clayey silt w/some fine to coarse sand, trace of fine gravel. 15" RECOVERY	A-4(3)	Hot-mix 10"
5.06		2	4.0' – 6.0'	2 3 4 8	No Recovery NR" RECOVERY		
7.59	▽	3	6.0' – 8.0'	2 5 7 8	Wet stiff gray fine to coarse sandy silt w/ some fine gravel. 16" RECOVERY	A-4(0)	
10.12		4	8.0' – 10.0'	1 1 1 1	No sieve analysis - Indication of wet stiff gray fine to coarse sandy silt w some fine gravel. 1" RECOVERY		
		5	10.0' – 12.0'	1 2 1 2	No sieve analysis - Indication of wet stiff gray fine to coarse sandy silt w some fine gravel. 2" RECOVERY		
12.65	■	6	12.0' – 14.0'	2 7 9 11	Wet medium dense gray silty coarse to fine sandy w/some fine gravel. 21" RECOVERY	A-2-4(0)	
15.18		7	14.0'	5 7 9 10	Wet medium dense gray silty coarse to fine sand w/some fine gravel.	A-2-4(0)	

Remarks: Auger refusal @ 39.0'

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MC-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		19" RECOVERY		
		8	16.0'	7 8 8 9	Wet stiff gray coarse to fine sandy silt w/ trace fine gravel.	A-4(0)	
17.71			18.0'		20" RECOVERY		
		9	18.0'	11 30 50	Wet very dense gray silty coarse to fine sand and fine gravel.	A-1-b	
20.24			20.0'		16" RECOVERY		
22.77							
		10	24.0'	9 11 28 32	Wet dense gray silty fine to coarse sand w/ some fine gravel.	A-2-4(0)	
25.3			26.0'		20" RECOVERY		
27.83							
		11	28.0'	7 8 8 8	Saturated stiff gray fine to coarse sandy silt.	A-5(0)	
30.36			30.0'		21" RECOVERY		
32.89							
		12	34.0'	50	Saturated very dense gray fine to coarse sand w/some fine gravel and silt.	A-2-4(0)	
35.42			36.0'		6" RECOVERY		
37.95							
		13	38.0'	50	Saturated very dense gray coarse to fine sand	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MC-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
					w/some fine gravel and silt.		
		R-1	39.0'		Schist - Recovery 23% RQD 8%		
			40.0'		2" RECOVERY		
40.48							
43.01							
			44.0'		14" RECOVERY		
		R-2	44.0'		Schist - Recovery 45% RQD 20%		
45.54							
48.07							
			49.0'		27" RECOVERY		
					End Boring		
50.6							
53.13							
55.66							
58.19							
60.72							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Elastic Silts
Misc. Symbols	
	Description not given for: "WATER2"

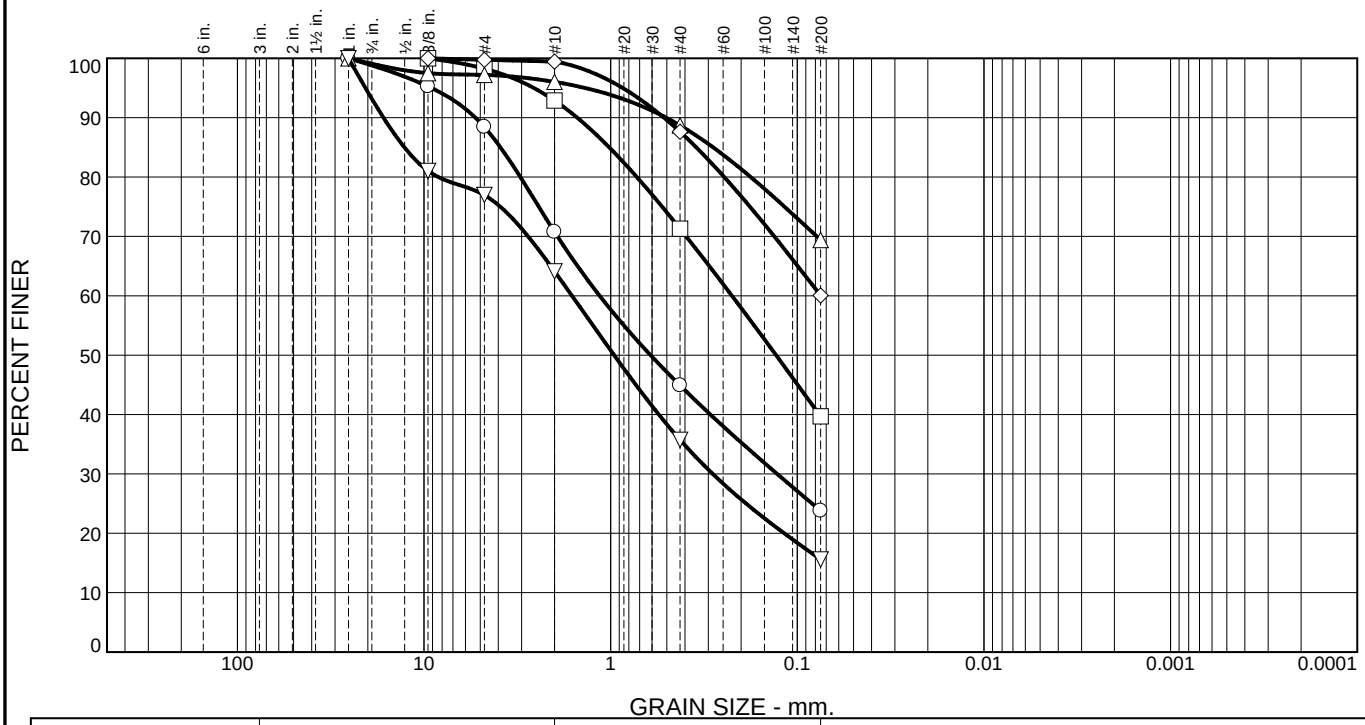
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	29.2	25.9	21.1	23.8	
□	0.0	7.1	21.6	31.6	39.7	
△	0.0	4.0	7.3	19.3	69.4	
◇	0.0	0.6	11.8	27.5	60.1	
▽	0.0	35.9	28.4	20.1	15.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22.1	NP	3.8929	1.1459	0.6115	0.1283				
□	25.5	NP	1.0176	0.2239	0.1300					
△	32.4	NP	0.2823							
◇	38.8	NP	0.3478							
▽	NV	NP	12.7408	1.6113	0.9580	0.2838				

Material Description	USCS	AASHTO
○ Moist gray silty coarse to fine sand and fine gravel.	SM	A-1-b
□ Moist stiff gray fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
△ Wet firm gray silt w/some fine sand, trace of coarse sand and fine gravel.	ML	A-4(0)
◇ Saturated firm gray organic fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
▽ Saturated dense brown coarse sand and fine gravel w/some fine sand and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-1 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** MC-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** MC-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** MC-1 **Depth:** 6.0 **Sample Number:** 4

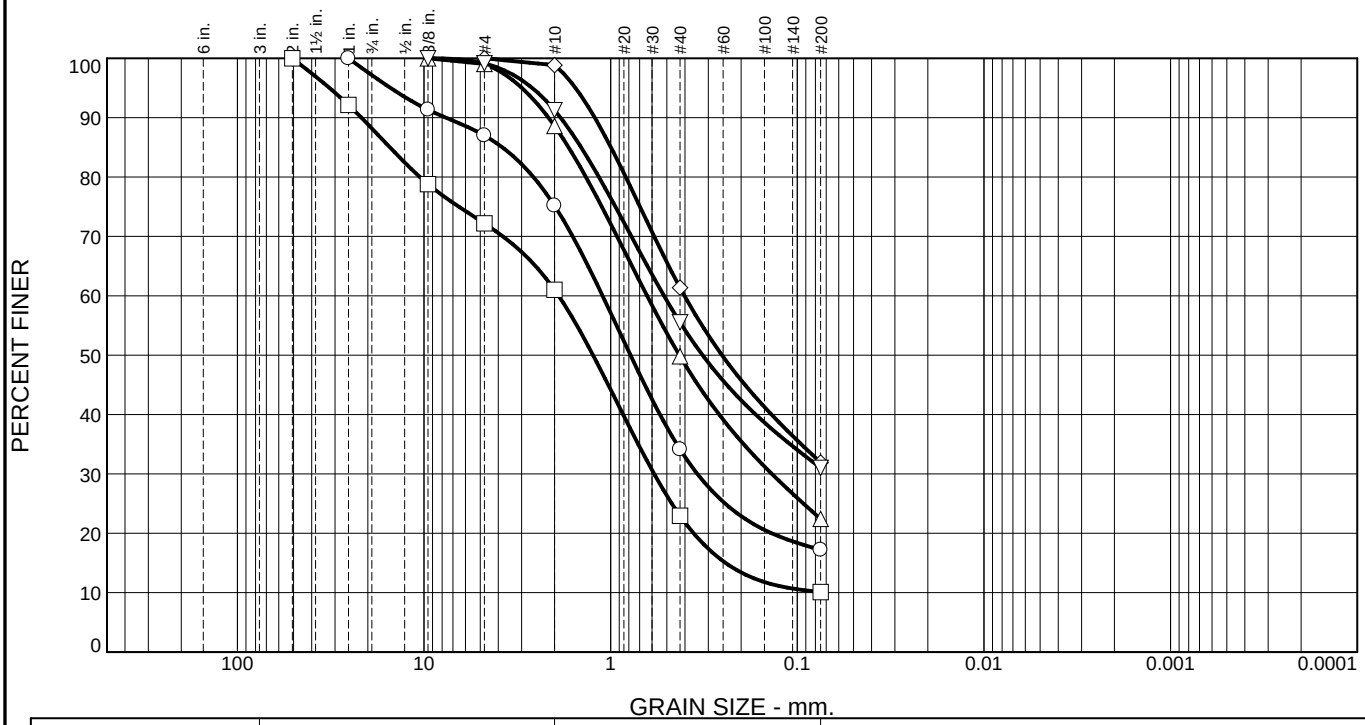
▽ **Source of Sample:** MC-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	24.8	41.1	16.9	17.2	
□	0.0	39.0	38.1	12.8	10.1	
△	0.0	11.4	38.8	27.4	22.4	
◇	0.0	1.2	37.4	29.5	31.9	
▽	0.0	8.7	35.8	24.5	31.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.8017	1.1056	0.7832	0.3432				
□	NV	NP	15.2355	1.8998	1.2431	0.5847	0.2421			
△	NV	NP	1.6807	0.6382	0.4285	0.1369				
◇	32.0	NP	0.9968	0.4023	0.2532					
▽	NV	NP	1.4399	0.5177	0.3218					

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine gravelly coarse sand w/some fine sand and silt.	SM	A-1-b
□ Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	SP-SM	A-1-b
△ Saturated medium dense brown silty coarse to fine sand w/some fine gravel.	SM	A-1-b
◇ Saturated medium dense brown silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)
▽ Saturated medium dense gray silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** MC-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** MC-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** MC-1 **Depth:** 16.0 **Sample Number:** 9

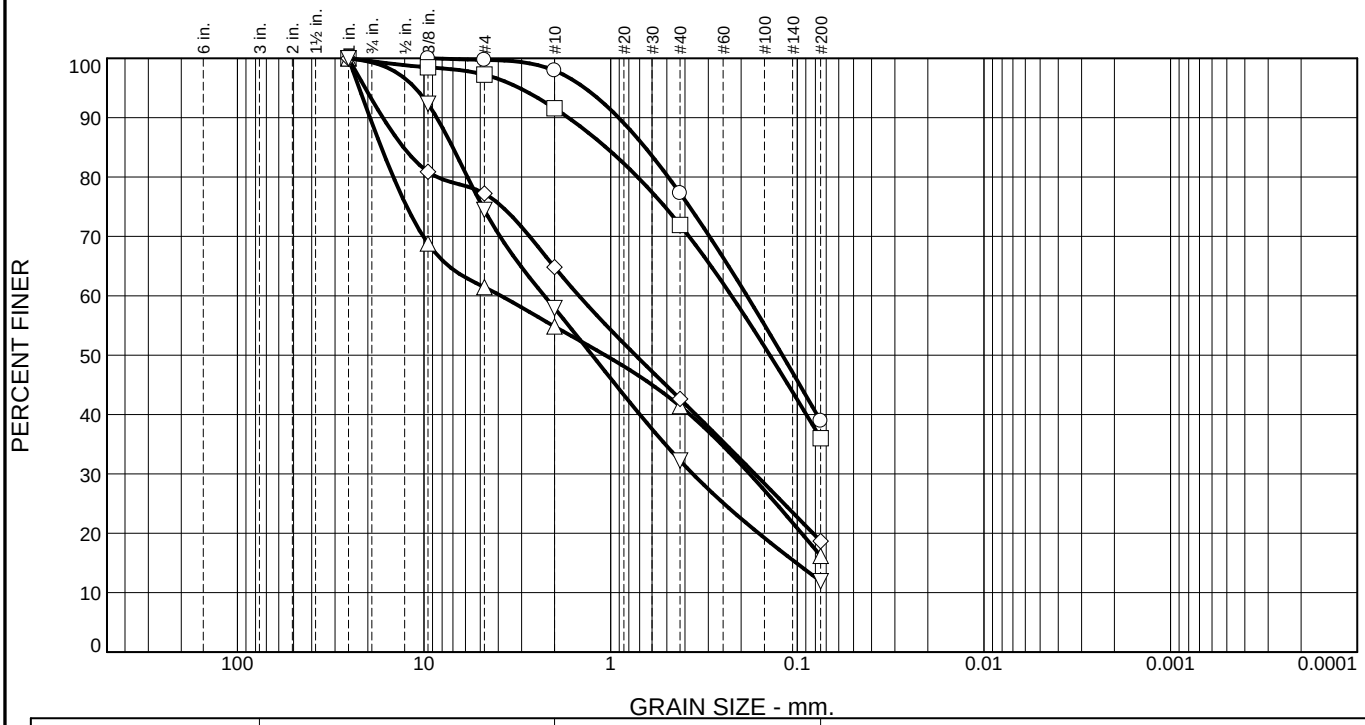
▽ **Source of Sample:** MC-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.1	20.6	38.4	38.9	
□	0.0	8.4	19.7	35.9	36.0	
△	0.0	45.2	13.4	25.2	16.2	
◇	0.0	35.2	22.2	23.9	18.7	
▽	0.0	42.1	25.7	20.3	11.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40.5	NP	0.6537	0.1861	0.1202					
□	37.6	NP	1.0585	0.2252	0.1404					
△	NV	NP	16.9431	3.8765	1.0698	0.1801				
◇	NV	NP	12.8879	1.4789	0.7360	0.1687				
▽	NV	NP	7.0168	2.2660	1.2562	0.3628	0.1011			

Material Description	USCS	AASHTO
○ Saturated stiff gray fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
□ Saturated very stiff gray fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)
△ Saturated very dense gray fine sandy fine gravel w/some coarse sand and silt.	SM	A-1-b
◇ Saturated very dense gray fine to coarse sandy fine gravel w/some silt.	SM	A-1-b
▽ Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** MC-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** MC-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** MC-1 **Depth:** 39.0 **Sample Number:** 14

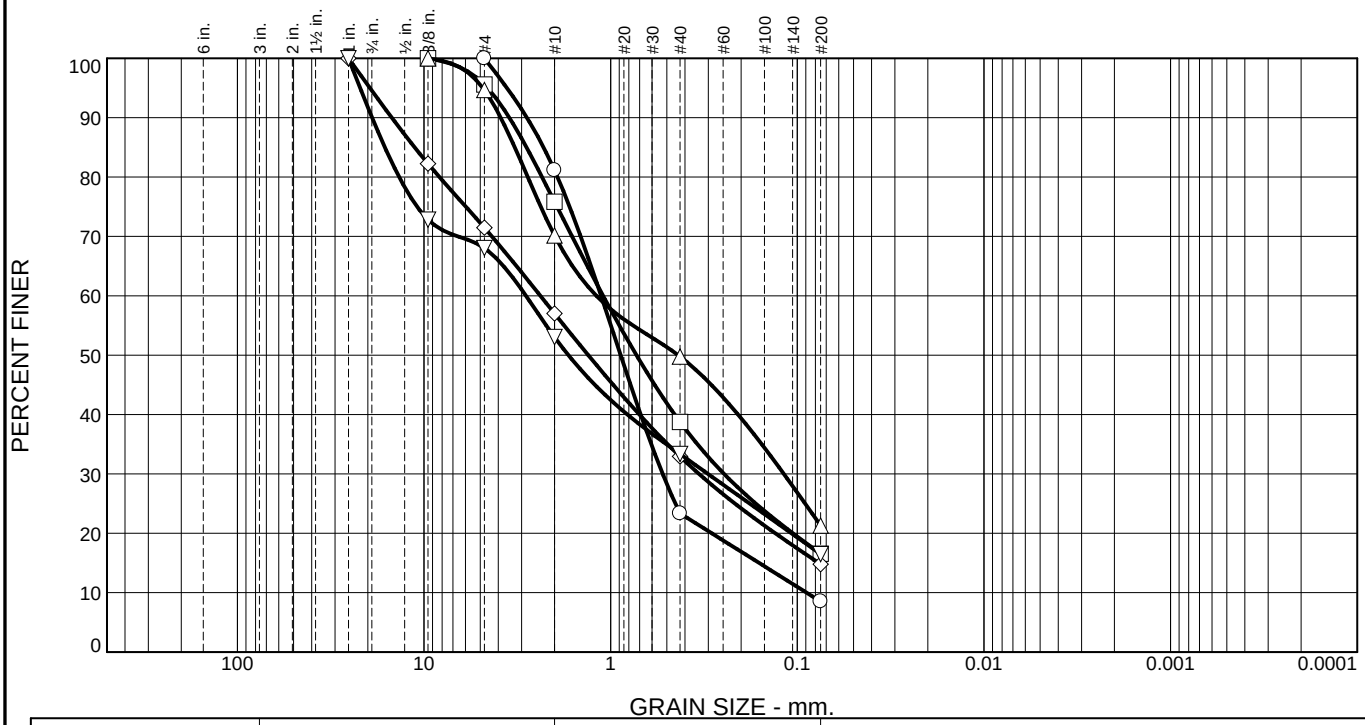
▽ **Source of Sample:** MC-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	18.9	57.7	14.9	8.5	
□	0.0	24.2	37.0	22.2	16.6	
△	0.0	29.9	20.3	28.5	21.3	
◇	0.0	43.0	24.1	18.1	14.8	
▽	0.0	47.0	19.6	16.9	16.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.2894	1.1260	0.8839	0.5263	0.1601	0.0892	2.76	12.62
□	NV	NP	2.8249	1.0980	0.7274	0.2468				
△	NV	NP	3.2642	1.1931	0.4347	0.1181				
◇	NV	NP	11.2224	2.3811	1.3183	0.3361	0.0767			
▽	NV	NP	16.2085	2.8448	1.6849	0.3009				

Material Description	USCS	AASHTO
○ Saturated very dense gray coarse sand w/some fine gravel and fine sand, trace of silt.	SW-SM	A-1-b
□ Saturated very dense gray fine gravelly coarse to fine sand w/some silt.	SM	A-1-b
△ Saturated very dense gray silty fine sand and fine gravel w/some coarse sand.	SM	A-1-b
◇ Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt.	SM	A-1-b
▽ Saturated very dense gray fine gravel w/some coarse to fine sand and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** MC-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** MC-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** MC-1 **Depth:** 64.0 **Sample Number:** 19

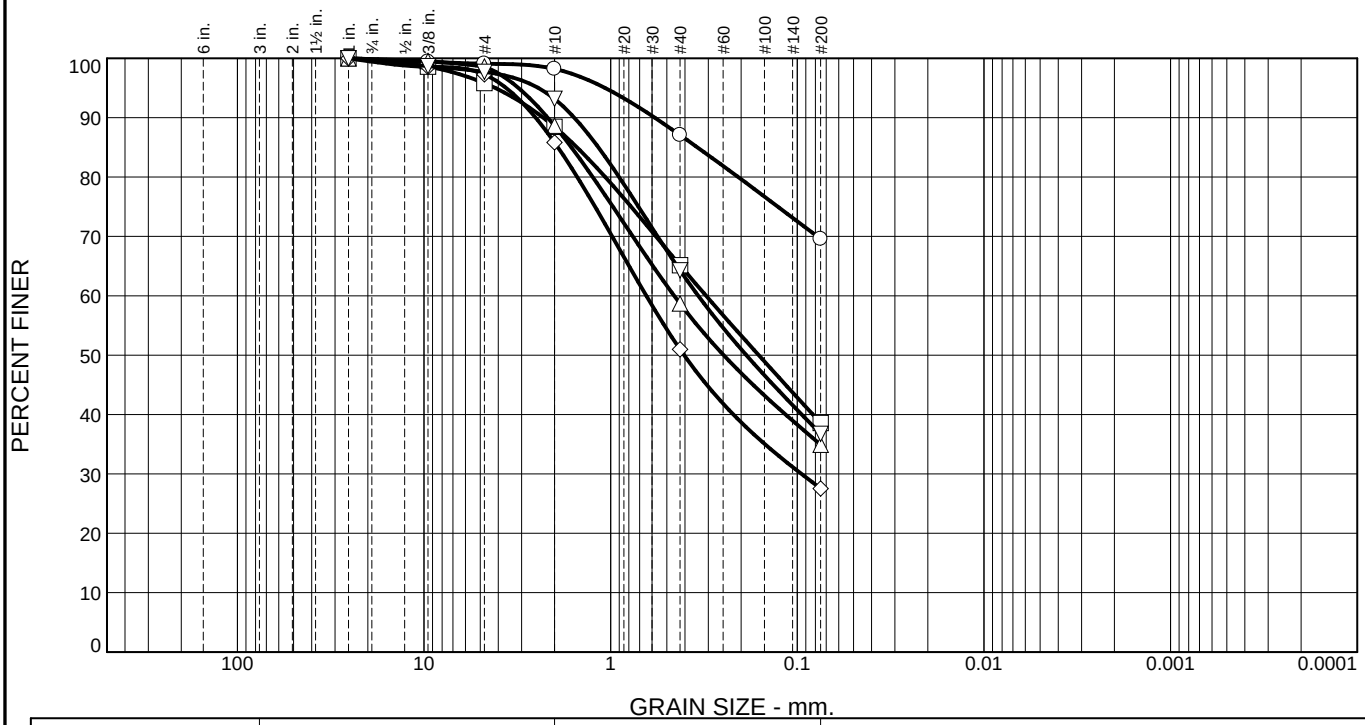
▽ **Source of Sample:** MC-1 **Depth:** 66.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.8	11.1	17.5	69.6	
□	0.0	11.5	23.4	26.5	38.6	
△	0.0	11.4	29.9	23.8	34.9	
◇	0.0	14.2	34.8	23.5	27.5	
▽	0.0	6.8	28.9	27.5	36.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30.4	24.4	0.3431							
□	23.5	NP	1.5156	0.3080	0.1610					
△	31.6	NP	1.6239	0.4568	0.2480					
◇	29.9	NP	1.9170	0.6441	0.4041	0.0950				
▽	30.7	NP	1.1637	0.3395	0.1877					

Material Description	USCS	AASHTO
○ Wet firm gray clayey silt w/some fine to coarse sand, trace of fine gravel.	ML	A-4(3)
□ Wet stiff gray fine to coarse sandy silt w/some fine gravel.	SM	A-4(0)
△ Wet medium dense gray silty coarse to fine sandy w/some fine gravel.	SM	A-2-4(0)
◇ Wet medium dense gray silty coarse to fine sand w/some fine gravel.	SM	A-2-4(0)
▽ Wet stiff gray coarse to fine sandy silt w/trace fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-2 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** MC-2 **Depth:** 6.0 **Sample Number:** 3

△ **Source of Sample:** MC-2 **Depth:** 12.0 **Sample Number:** 6

◇ **Source of Sample:** MC-2 **Depth:** 14.0 **Sample Number:** 7

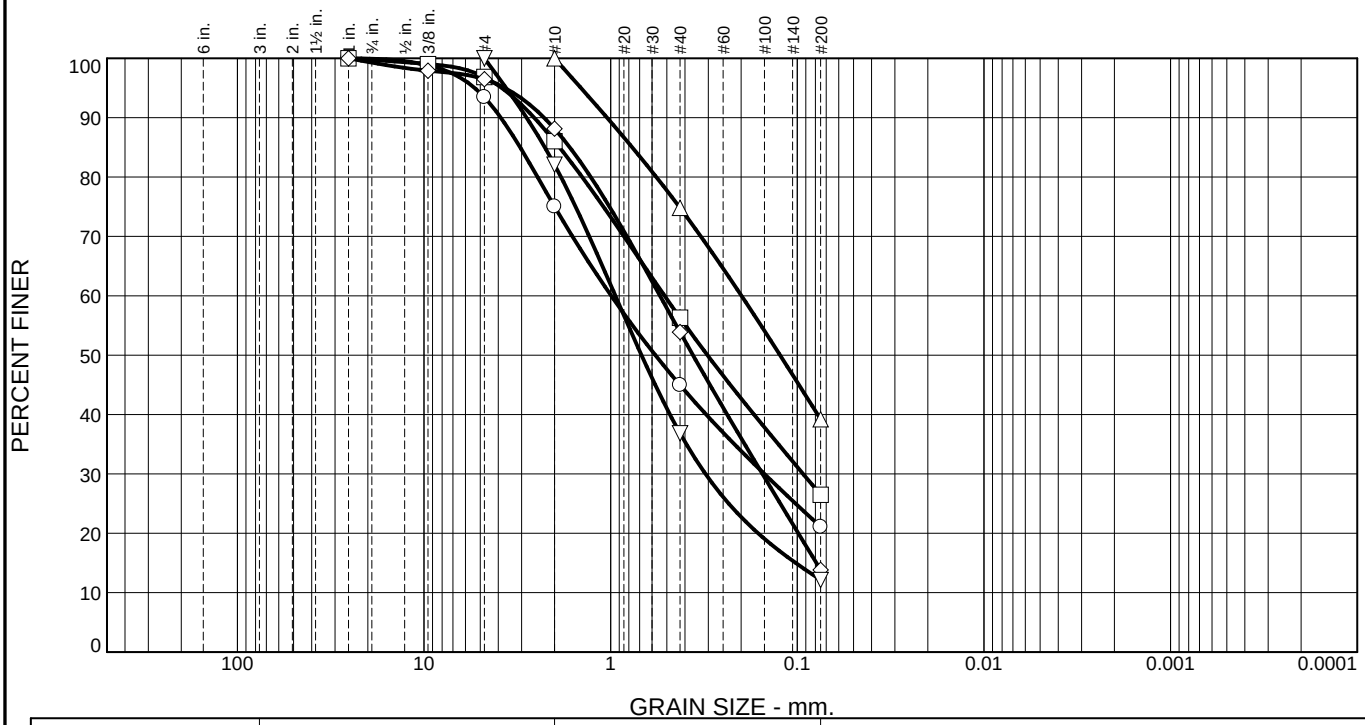
▽ **Source of Sample:** MC-2 **Depth:** 16.0 **Sample Number:** 8

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	25.0	30.0	23.9	21.1	
□	0.0	14.0	29.7	29.8	26.5	
△	0.0	0.0	25.2	35.6	39.2	
◇	0.0	11.9	34.2	40.1	13.8	
▽	0.0	17.9	45.3	24.7	12.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.0550	0.9928	0.5761	0.1502				
□	30.8	NP	1.8807	0.5140	0.3028	0.0931				
△	52.8	NP	0.7665	0.1991	0.1237					
◇	NV	NP	1.6561	0.5441	0.3622	0.1538	0.0790			
▽	NV	NP	2.2536	0.9438	0.6834	0.3103	0.1019			

Material Description	USCS	AASHTO
○ Wet very dense gray silty coarse to fine sand and fine gravel.	SM	A-1-b
□ Wet dense gray silty fine to coarse sand w/some fine gravel.	SM	A-2-4(0)
△ Saturated stiff gray fine to coarse sandy silt.	SM	A-5(0)
◇ Saturated very dense gray fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
▽ Saturated very dense gray coarse to fine sand w/some fine gravel and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MC-2 **Depth:** 18.0 **Sample Number:** 9

□ **Source of Sample:** MC-2 **Depth:** 24.0 **Sample Number:** 10

△ **Source of Sample:** MC-2 **Depth:** 28.0 **Sample Number:** 11

◇ **Source of Sample:** MC-2 **Depth:** 34.0 **Sample Number:** 12

▽ **Source of Sample:** MC-2 **Depth:** 38.0 **Sample Number:** 13

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

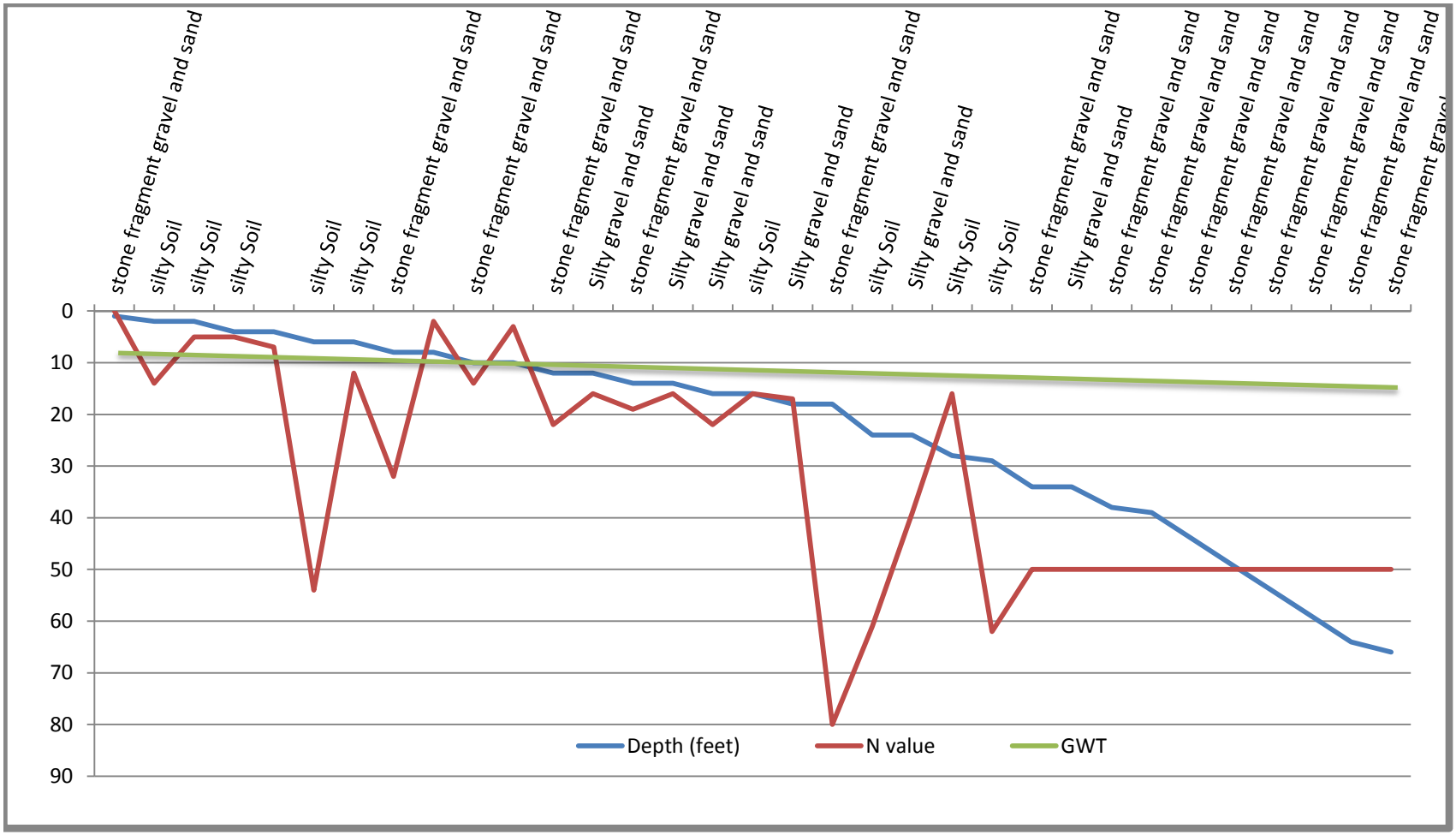
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
MC-1														
	1	1	Moist gray silty coarse to fine sand and fine gravel.	22.1	NP	9	SM	A-1-b	70.8	23.8				
	2	2	Moist stiff gray fine to coarse sandy silt w/trace fine gravel.	25.5	NP	14.2	SM	A-4(0)	92.9	39.7	9	7	7	7
	3	4	Wet firm gray silt w/some fine sand, trace of coarse sand and fine gravel.	32.4	NP	29.8	ML	A-4(0)	96	69.4	2	3	2	3
	4	6	Saturated firm gray organic fine sandy silt w/some coarse sand, trace of fine gravel.	38.8	NP	48.3	ML	A-4(0)	99.4	60.1	2	4	4	9
	5	8	Saturated dense brown coarse sand and fine gravel w/some fine sand and silt.	NV	NP	14.4	SM	A-1-b	64.1	15.6	6	17	15	10
	6	10	Saturated medium dense brown fine gravelly coarse sand w/some fine sand and silt.	NV	NP	16.2	SM	A-1-b	75.2	17.2	6	6	8	8
	7	12	Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	NV	NP	13.8	SP-SM	A-1-b	61	10.1	10	10	12	15
	8	14	Saturated medium dense brown silty coarse to fine sand w/some fine gravel.	NV	NP	16.6	SM	A-1-b	88.6	22.4	5	8	11	11
	9	16	Saturated medium dense brown silty coarse to fine sand w/trace fine gravel.	32	NP	18.1	SM	A-2-4(0)	98.8	31.9	7	11	11	15
	10	18	Saturated medium dense gray silty coarse to fine sand w/trace fine gravel.	NV	NP	18.6	SM	A-2-4(0)	91.3	31	7	8	9	9
	11	24	Saturated stiff gray fine to coarse sandy silt w/trace fine gravel.	40.5	NP	30.6	SM	A-4(0)	97.9	38.9	2	3	11	11
	12	29	Saturated very stiff gray fine sandy silt w/some coarse sand, trace of fine gravel.	37.6	NP	31.7	SM	A-4(0)	91.6	36	6	6	12	50
	13	34	Saturated very dense gray fine sandy fine gravel w/some coarse sand and silt.	NV	NP	20.3	SM	A-1-b	54.8	16.2	50			
	14	39	Saturated very dense gray fine to coarse sandy fine gravel w/some silt.	NV	NP	15.5	SM	A-1-b	64.8	18.7	50			
	15	44	Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt.	NV	NP	13.2	SP-SM	A-1-b	57.9	11.9	50			
	16	49	Saturated very dense gray coarse sand w/some fine gravel and fine sand, trace of silt.	NV	NP	21.6	SW-SM	A-1-b	81.1	8.5	50			
	17	54	Saturated very dense gray fine gravelly coarse to fine sand w/some silt.	NV	NP	20.4	SM	A-1-b	75.8	16.6	50			
	18	59	Saturated very dense gray silty fine sand and fine gravel w/some coarse sand.	NV	NP	18.2	SM	A-1-b	70.1	21.3	50			
	19	64	Saturated very dense gray coarse sandy fine gravel w/some fine sand and silt.	NV	NP	14.7	SM	A-1-b	57	14.8	50			
	20	66	Saturated very dense gray fine gravel w/some coarse to fine sand and silt.	NV	NP	12.8	SM	A-1-b	53	16.5	50			
		68	End Boring											
	1	2	Wet firm gray clayey silt w/some fine to coarse sand, trace of fine gravel.	30.4	6	25.2	ML	A-4(3)	98.2	69.6	2	2	3	3
	2	4	No Recovery								2	3	4	8
	3	6	Wet stiff gray fine to coarse sandy silt w/some fine gravel.	23.5	NP	23.7	SM	A-4(0)	88.5	38.6	2	5	7	8
	4	8	No sieve analysis - Indication of wet stiff gray fine to coarse sandy silt w some fine gravel.	27	NP	23.6					1	1	1	1
	5	10	No sieve analysis - Indication of wet stiff gray fine to coarse sandy silt w some fine gravel.	27.1	6.3	23					1	2	1	2
	6	12	Wet medium dense gray silty coarse to fine sandy w/some fine gravel.	31.6	NP	16.8	SM	A-2-4(0)	88.6	34.9	2	7	9	11
	7	14	Wet medium dense gray silty coarse to fine sand w/some fine gravel.	29.9	NP	14.5	SM	A-2-4(0)	85.8	27.5	5	7	9	10
	8	16	Wet stiff gray coarse to fine sandy silt w/trace fine gravel.	30.7	NP	20	SM	A-4(0)	93.2	36.8	7	8	8	9
	9	18	Wet very dense gray silty coarse to fine sand and fine gravel.	NV	NP	15.4	SM	A-1-b	75	21.1	11	30	50	
	10	24	Wet dense gray silty fine to coarse sand w/some fine gravel.	30.8	NP	19.1	SM	A-2-4(0)	86	26.5	9	11	28	32
	11	28	Saturated stiff gray fine to coarse sandy silt.	52.8	NP	40.8	SM	A-5(0)	100	39.2	7	8	8	8
	12	34	Saturated very dense gray fine to coarse sand w/some fine gravel and silt.	NV	NP	18.1	SM	A-2-4(0)	88.1	13.8	50			
	13	38	Saturated very dense gray coarse to fine sand w/some fine gravel and silt.	NV	NP	20.9	SM	A-1-b	82.1	12.1	50			
	R-1	39	Schist - Recovery 23% RQD 8%											
	R-2	44	Schist - Recovery 45% RQD 20%											
		49	End Boring											

DATE : **5-23-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR1-178 on Millcreek – Hockessin DE**



DATE : **5-23-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR1-178 on Millcreek – Hockessin DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-23-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-183 on McKennans church road over Hude Run – Wilmington, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-16-2016. Walton Corporation-Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 47 feet below the existing ground surface elevation, In addition 15 feet of coring rock was collected from this site . Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map of New castle county, Delaware Series No. 13 by Ramsey, K.W 2005. According to Geologic Map the area is situated in Mill Creek Metagabbro as an Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary minerals are hornblende and plagioclase.

3. Ground Water Background

3.1 The Water-Table and Surface-Drainage were not encountered for this site.
3.2 The Delaware Geologic Information Resource (DGIR) was not encountered for this site.

4. Hydrologic Background

The Delaware Geological Survey Geohydrology was not encountered for this site.

5. Ground Cover

The ground cover for this site is 6 inches of asphalt top of 5 inches of stone. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 4 feet and caved at 3.5 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 4.2 to 44.2 percent. The Atterberg limit is 50 percent, Liquid limits is 23.1 to 56 percent. The Plasticity Index and the Organic matter is not encountered for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is not in good condition, a layer of 8 feet in thickness of fine and coarse sand was appeared at 6 feet from the surface elevation this layer may need to be considering in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had very good amount of all borrow type material to reuse according to Del-DOT standard specification. The Rock coring where collected appeared recovery is 80 to 100 % percent and the Rock Quality Designation RQD is range of 80 to 95 % percent this is excellent condition more detail at Appendix D.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only

to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (9- sheets)

APPENDIX C

- Grain Size Distribution Result (6- sheets)

APPENDIX D

- Summary of the Borings and the Rock (2- sheets)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **5-23-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR1-183 on McKennans church road over Hude Run – Wilmington, DE**

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
MK-1	641263.000	587159.674	39.7604167	-75.6621222
MK-2	641222.500	587168.935	39.7603056	-75.6620889

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MK-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 641263.000
Easting: 587159.674
Boring Surface Elev.:
Reference:
Date Started: 3/16/16
Date Completed: 3/16/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 47.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/16/16	3.5	
3/16/16	Dry	3.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'		Moist brown coarse to fine sandy fine gravel w/some silt. 12" RECOVERY	A-1-b	Hot-mix 5" Stone 5"
2.53		2	2.0' 4.0'	6 12 14 8	Moist medium dense brown coarse to fine sandy fine gravel w/trace silt. 15" RECOVERY	A-1-b	
5.06		3	4.0' 6.0'	3 4 8 14	Wet stiff brown fine gravelly silt w/some coarse to fine sand. 14" RECOVERY	A-4(0)	
7.59		4	6.0' 8.0'	35 9 8 5	Wet medium dense brown fine gravel w/ some coarse sand, trace of fine sand and silt. 2" RECOVERY	A-1-a	
10.12		5	8.0' 10.0'	2 2 3 4	Saturated loose brown silty fine sand w/some coarse sand. 20" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	2 2 3 4	No sieve analysis - Indication of saturated loose brown silty fine sand w/some coarse sand. 20" RECOVERY		
12.65		7	12.0' 14.0'	4 5 5 6	Saturated stiff brown fine sandy silt w/some coarse sand. 20" RECOVERY	A-4(0)	
		8	14.0'	1 1	Saturated soft brown fine sandy silt w trace	A-4(0)	

Remarks: Auger Refusal @ 42.0'

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MK-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	2 1	coarse sand. 17" RECOVERY		
17.71		9	16.0' 18.0'	4 5 5 7	Saturated stiff brown fine sandy silt w/trace coarse sand. 24" RECOVERY	A-4(0)	
20.24		10	18.0' 20.0'	4 5 12 13	Saturated very stiff brown fine sandy silt w/ trace coarse sand. 24" RECOVERY	A-4(0)	
22.77							
25.3		11	24.0' 26.0'	3 6 6 10	Saturated medium dense brown silty fine sand w/some coarse sand. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	29.0' 31.0'	5 10 25 50	Saturated dense brown silty fine sand w/some coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	34.0' 36.0'	5 10 15 20	Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel. 16" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MK-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	50	No Recovery		
			40.0'		NR" RECOVERY		
40.48							
		R-1	42.0'		Schist - Recovery 100% RQD 95%		
43.01							
45.54							
			47.0'		60" RECOVERY		
					End Boring		
48.07							
50.6							
53.13							
55.66							
58.19							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Poorly graded, silty or clayey sands and gravel

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MK-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 641222.500
Easting: 587168.935
Boring Surface Elev.:
Reference:
Date Started: 3/16/16
Date Completed: 3/16/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 46.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/16/16	4.0	
3/16/16	Dry	3.5

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'	14 21	Moist dense brown coarse sand and fine gravel w/some fine sand, trace of silt. 9" RECOVERY	A-1-b	Hot-mix 6" stone 2"
2.53		2	2.0' 4.0'	9 8 2 2	Moist loose brown fine gravelly coarse to fine sand w/trace silt. 14" RECOVERY	A-1-b	
5.06	■	3	4.0' 6.0'	7 8 9 6	Moist medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt. 4" RECOVERY	A-1-b	
7.59		4	6.0' 8.0'	6 4 4 2	Wet loose brown silty coarse to fine sand w/ some fine gravel. 18" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	2 2 3 2	Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel. 18" RECOVERY	A-2-5(0)	
		6	10.0' 12.0'	4 4 5 6	Saturated stiff brown fine sandy silt w/some coarse sand, trace of fine gravel. 22" RECOVERY	A-5(0)	
12.65		7	12.0' 14.0'	WR WR 1 2	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel. 23" RECOVERY	A-5(0)	
		8	14.0'	1 2	Saturated soft brown fine sandy silt w some	A-5(0)	

Remarks: Auger Refusal @ 36.0'

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MK-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	2 4	coarse sand, trace of fine gravel. 23" RECOVERY		
17.71		9	16.0' 18.0'	3 4 5 7	Saturated loose brown silty fine to coarse sand w/trace fine gravel. 23" RECOVERY	A-2-5(0)	
20.24		10	18.0' 20.0'	8 12 14 19	Saturated medium dense brown fine to coarse sand w/some silt. 16" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' 26.0'	8 9 9 11	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 17" RECOVERY	A-2-4(0)	
27.83							
30.36		12	29.0' 31.0'	50	Saturated very dense brown fine sand w some coarse sand and silt, trace of fine gravel. 3" RECOVERY	A-2-4(0)	
32.89							
35.42		13	34.0' 36.0'	30 50	Saturated very dense brown silty fine sand w/ some coarse sand, trace of fine gravel. 11" RECOVERY	A-2-4(0)	
		R-1	36.0'		Schist - Recovery 80% RQD 80%		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MK-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48							
43.01							
45.54			46.0'		95" RECOVERY		
					End Boring		
48.07							
50.6							
53.13							
55.66							
58.19							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Elastic Silts

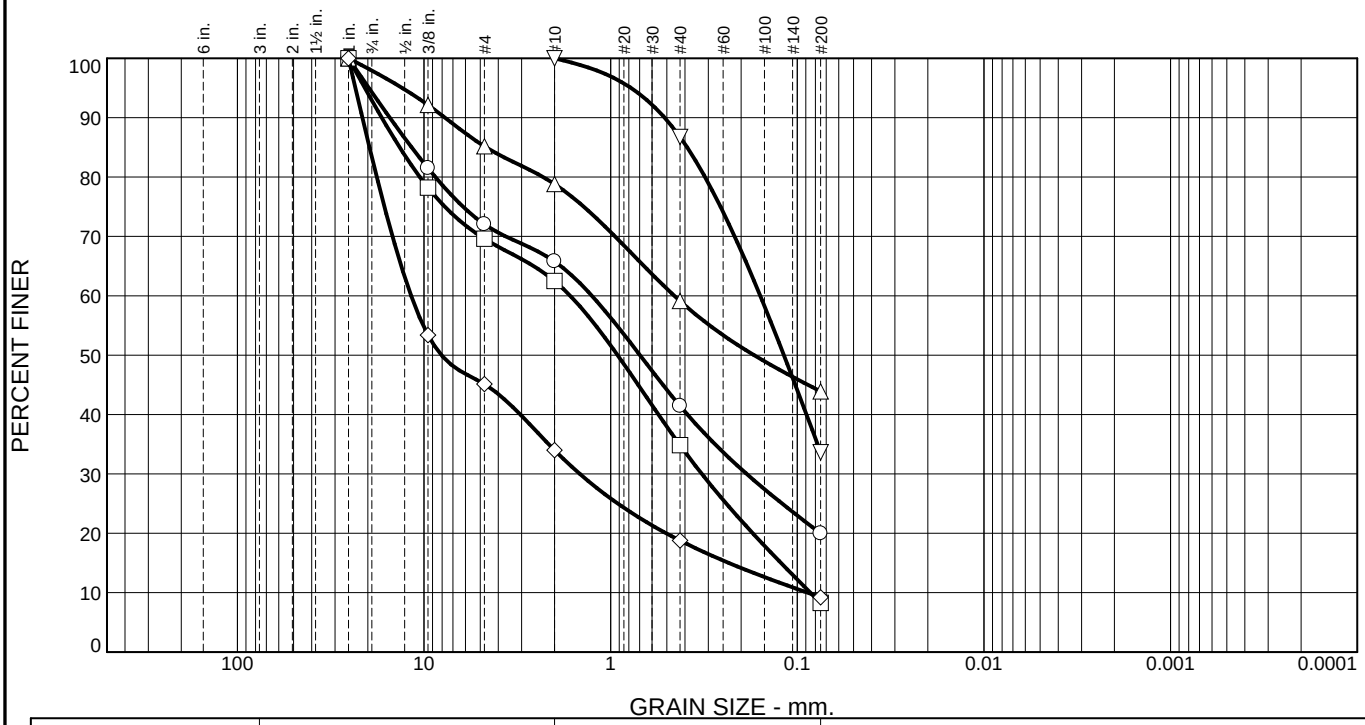
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	34.2	24.3	21.5	20.0	
□	0.0	37.5	27.7	26.5	8.3	
△	0.0	21.2	19.7	15.2	43.9	
◇	0.0	66.0	15.2	9.6	9.2	
▽	0.0	0.0	13.3	53.1	33.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	11.6503	1.2606	0.6965	0.1868				
□	NV	NP	13.4983	1.6473	0.9179	0.3247	0.1223	0.0851	0.75	19.36
△	23.1	NP	4.6494	0.4561	0.1706					
◇	NV	NP	19.5963	11.7195	8.0637	1.4628	0.2325	0.0882	2.07	132.83
▽	38.2	NP	0.3892	0.1580	0.1181					

Material Description	USCS	AASHTO
○ Moist brown coarse to fine sandy fine gravel w/some silt.	SM	A-1-b
□ Moist medium dense brown coarse to fine sandy fine gravel w/trace silt.	SP-SM	A-1-b
△ Wet stiff brown fine gravelly silt w/some coarse to fine sand.	SM	A-4(0)
◇ Wet medium dense brown fine gravel w/some coarse sand, trace of fine sand and silt.	GW-GM	A-1-a
▽ Saturated loose brown silty fine sand w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-1 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** MK-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** MK-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** MK-1 **Depth:** 6.0 **Sample Number:** 4

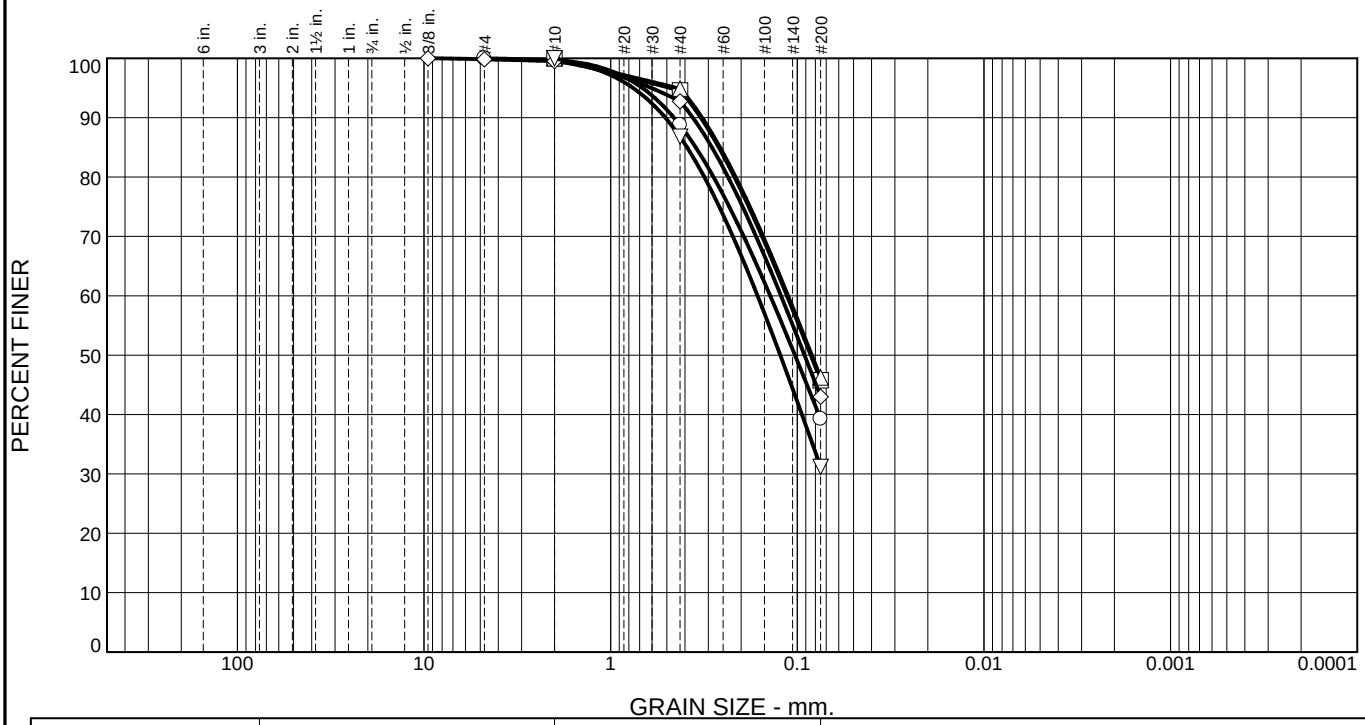
▽ **Source of Sample:** MK-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	11.0	49.4	39.3	
□	0.0	0.0	5.4	48.8	45.8	
△	0.0	0.0	5.1	48.7	46.2	
◇	0.0	0.5	6.7	49.8	43.0	
▽	0.0	0.0	13.2	55.6	31.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37.3	NP	0.3499	0.1397	0.1030					
□	39.1	NP	0.2633	0.1136	0.0847					
△	37.2	NP	0.2594	0.1121	0.0836					
◇	36.2	NP	0.2865	0.1223	0.0915					
▽	39.9	NP	0.3894	0.1633	0.1234					

Material Description	USCS	AASHTO
○ Saturated stiff brown fine sandy silt w/some coarse sand.	SM	A-4(0)
□ Saturated soft brown fine sandy silt w trace coarse sand.	SM	A-4(0)
△ Saturated stiff brown fine sandy silt w/trace coarse sand.	SM	A-4(0)
◇ Saturated very stiff brown fine sandy silt w/trace coarse sand.	SM	A-4(0)
▽ Saturated medium dense brown silty fine sand w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-1 **Depth:** 12.0 **Sample Number:** 7

□ **Source of Sample:** MK-1 **Depth:** 14.0 **Sample Number:** 8

△ **Source of Sample:** MK-1 **Depth:** 16.0 **Sample Number:** 9

◇ **Source of Sample:** MK-1 **Depth:** 18.0 **Sample Number:** 10

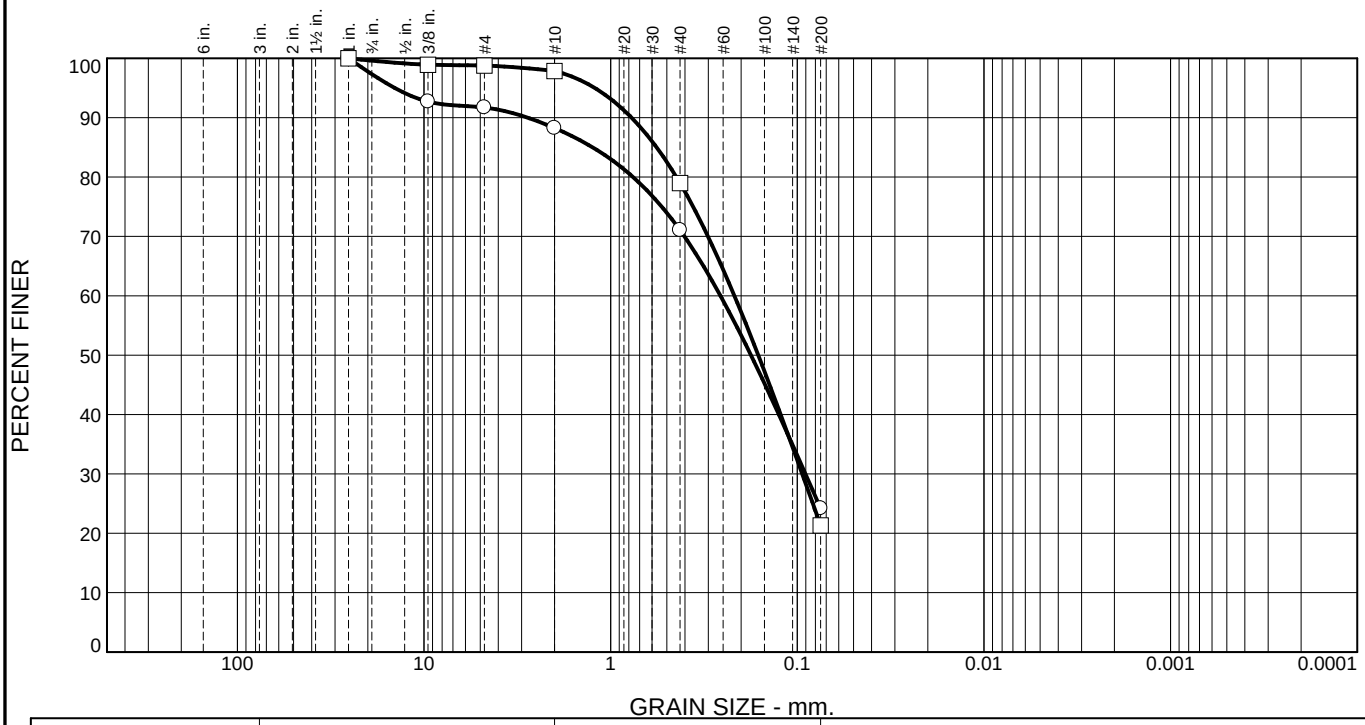
▽ **Source of Sample:** MK-1 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.8	17.1	46.9	24.2	
□	0.0	2.1	18.9	57.7	21.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2490	0.2580	0.1772	0.0905				
□	NV	NP	0.5673	0.2173	0.1619	0.0941				

Material Description	USCS	AASHTO
○ Saturated dense brown silty fine sand w/some coarse sand and fine gravel.	SM	A-2-4(0)
□ Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-1 **Depth:** 29.0 **Sample Number:** 12

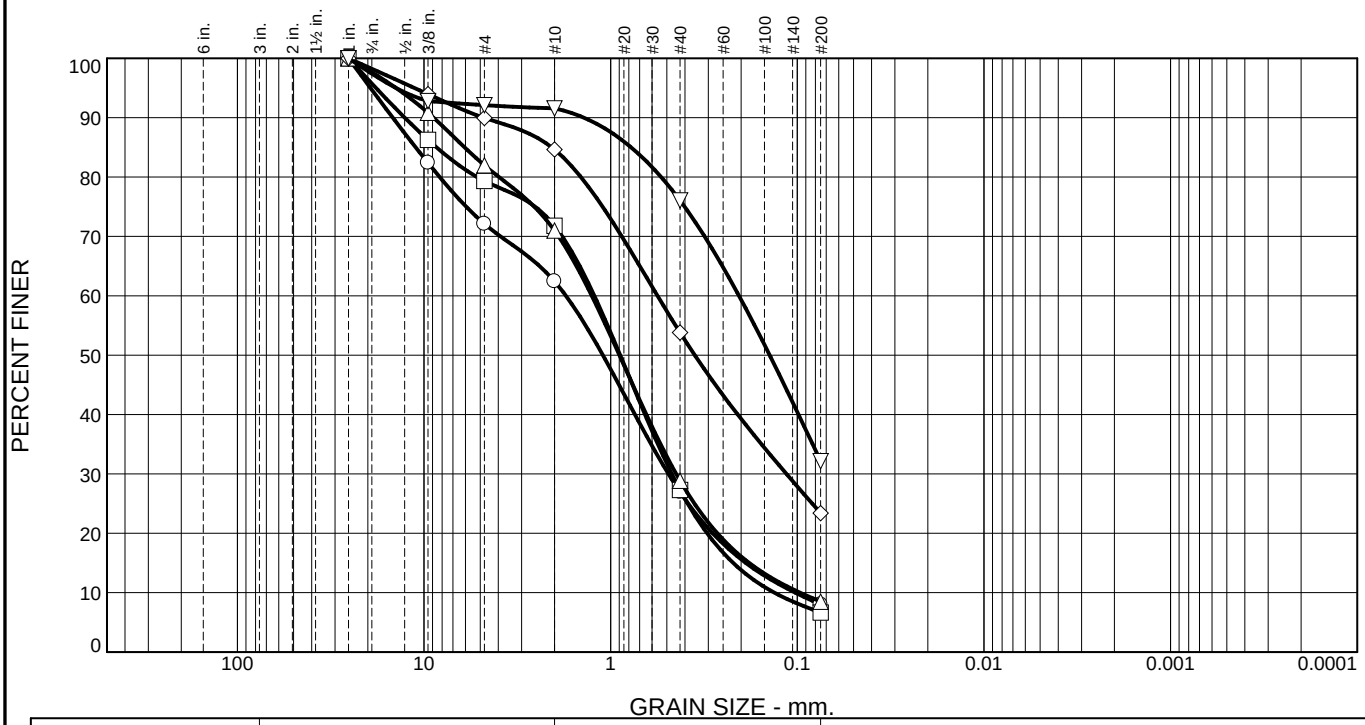
□ **Source of Sample:** MK-1 **Depth:** 34.0 **Sample Number:** 13

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	37.6	35.4	19.0	8.0	
□	0.0	28.2	44.5	20.7	6.6	
△	0.0	29.0	42.1	20.4	8.5	
◇	0.0	15.4	30.8	30.4	23.4	
▽	0.0	8.4	15.5	43.9	32.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	11.0826	1.7365	1.1012	0.4903	0.1887	0.1025	1.35	16.95
□	NV	NP	8.5748	1.2233	0.8892	0.4704	0.2205	0.1329	1.36	9.20
△	NV	NP	6.0606	1.2625	0.8978	0.4459	0.1812	0.0966	1.63	13.07
◇	NV	NP	2.0678	0.5610	0.3542	0.1144				
▽	43.0	NP	0.7770	0.2054	0.1407					

Material Description	USCS	AASHTO
○ Moist dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	SW-SM	A-1-b
□ Moist loose brown fine gravelly coarse to fine sand w/trace silt.	SW-SM	A-1-b
△ Moist medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SW-SM	A-1-b
◇ Wet loose brown silty coarse to fine sand w/some fine gravel.	SM	A-2-4(0)
▽ Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-5(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-2 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** MK-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** MK-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** MK-2 **Depth:** 6.0 **Sample Number:** 4

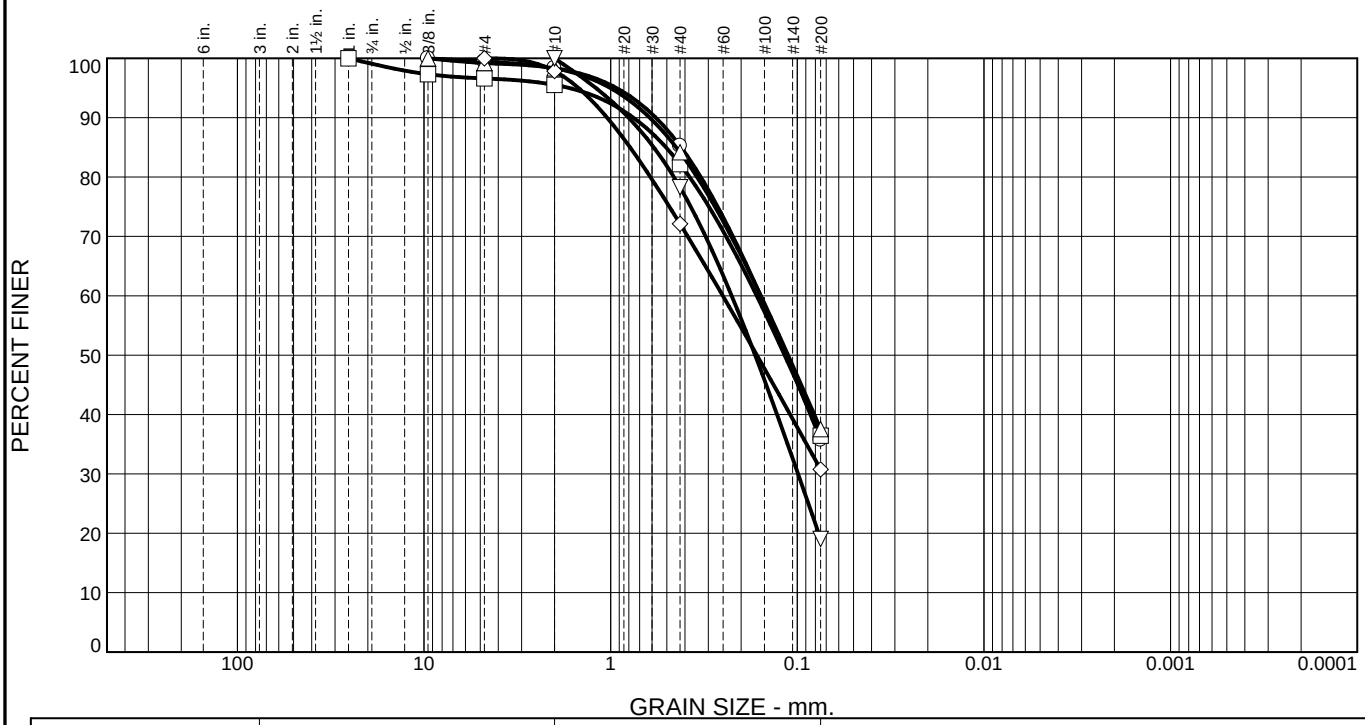
▽ **Source of Sample:** MK-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.6	13.1	49.5	35.8	
□	0.0	4.5	13.3	45.8	36.4	
△	0.0	1.7	14.1	46.7	37.5	
◇	0.0	2.1	25.8	41.3	30.8	
▽	0.0	0.0	21.7	59.3	19.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	48.8	NP	0.4192	0.1575	0.1150					
□	43.8	NP	0.5051	0.1651	0.1170					
△	56.0	NP	0.4451	0.1570	0.1122					
◇	51.9	NP	0.7871	0.2506	0.1648					
▽	NV	NP	0.5876	0.2246	0.1683	0.0991				

Material Description	USCS	AASHTO
○ Saturated stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-5(0)
□ Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	SM	A-5(0)
△ Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	SM	A-5(0)
◇ Saturated loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-5(0)
▽ Saturated medium dense brown fine to coarse sand w/some silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** MK-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** MK-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** MK-2 **Depth:** 16.0 **Sample Number:** 9

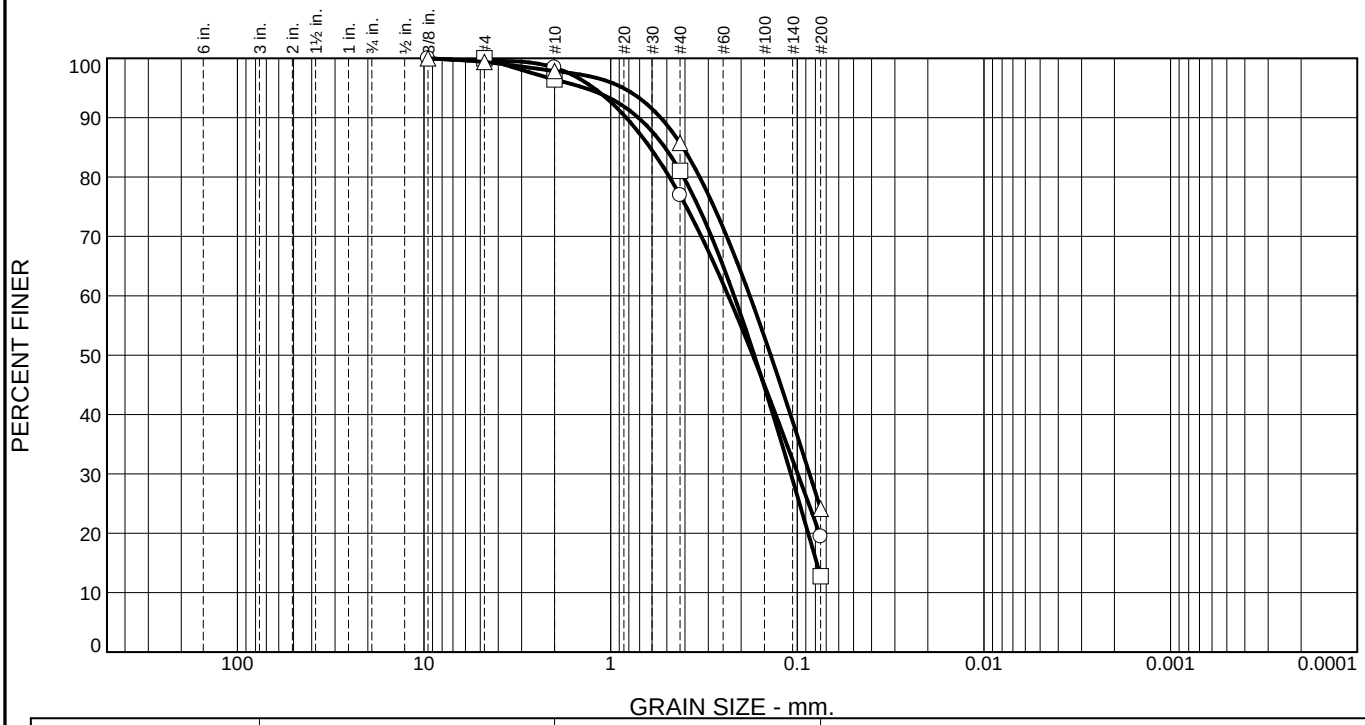
▽ **Source of Sample:** MK-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.6	21.5	57.4	19.5	
□	0.0	3.6	15.4	68.2	12.8	
△	0.0	2.1	12.2	61.6	24.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6157	0.2342	0.1733	0.0995				
□	NV	NP	0.5123	0.2181	0.1701	0.1083	0.0786			
△	NV	NP	0.4103	0.1798	0.1389	0.0860				

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated very dense brown fine sand w some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated very dense brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MK-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** MK-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** MK-2 **Depth:** 34.0 **Sample Number:** 13

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

ENGINEERING & TESTING SERVICES, INC.

April 27, 2016

To: Walton Corporation
P.O.Box 1097
Newark, Delaware 19715

Attn: Mr. Randy Ferguson

Re: Reports of Uniaxial Compressive Strength of Intact Rock Core Specimen
Delaware Department of Transportation
ETS Report No.: ETS-16T167-1
Task 64, T201407003, Bridge 1-183 on McKennans Church Road

Dear Mr. Ferguson:

The purpose of this report is to submit the results of the compression tests conducted on two intact rock core specimens, designated as MK-1 & MK-2, at Engineering & Testing Services, Inc. (ETS) AASHTO accredited laboratory in Virginia Beach, Virginia. The rock cores were delivered to our laboratory by Walton Corporation personnel on April 12, 2016. The rock cores were prepared, measured, and tested in general accordance with ASTM Standard D7012, Method "C". All laboratory services performed by our personnel were supervised by a Professional Engineer from ETS. The reader is referred to the attached reports of Uniaxial Compressive Strength of Intact Rock Core Specimen for further details.

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this letter, do not hesitate to contact our office at 757-306-1040.

Respectfully Submitted,
Engineering & Testing Services, Inc.

Charlie T. Nabhan, P.E.
Principal Geotechnical Engineer
VA License No.: 25133

Sidni Hoxha, E.I.T.
Staff Engineer

5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040* • *fax 757.306.1042*

REPORT OF UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

CLIENT: Walton Corporation

PROJECT NAME: AGR 1693, Task 64, T201407003, Bridge 1-183 on McKennans Church Road

ETS Job NO.: ETS-16T167-2

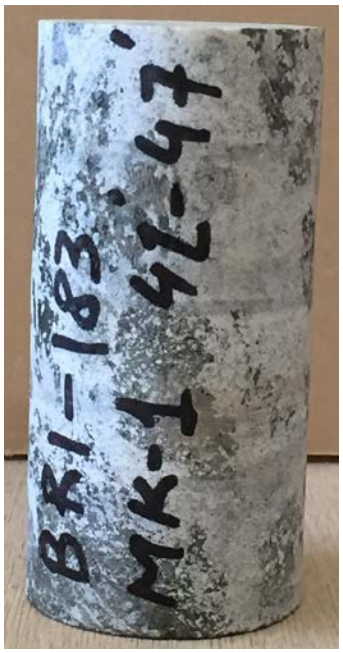
MATERIAL DESCRIPTION: Grey and White, Gneiss

LOAD DIRECTION: Uniaxial

This Specimen was not prepared in accordance with ASTM D4543

Engineer: Sidni Hoxha

COMPRESSION TEST RESULTS (ASTM D7012) - Method "C"											
LABORATORY NUMBER	SPECIMEN IDENTIFICATION OR SET NO.	DEPTH (FT.)	DATE OF TEST	SPECIMEN DIAMETER (IN.)	SPECIMEN HEIGHT (IN.)	SPECIMEN AREA (SQ. IN.)	TOTAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)	AMBIENT TEMPERATURE AT TEST (F°)	BREAK TYPE	TIME TO FAILURE (MIN.)
BR1-183	MK-1	42-47	4/18/2016	2.0	4.0	3.1416	42,360	13,482	70	3	3.0



Respectfully Submitted,
Charlie T. Nabhan, PE
Principal Geotechnical Engineer

Respectfully Submitted,
Sidni Hoxha E.I.T.
Staff Engineer

5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040* • *fax 757.306.1042*
www.etsva.com

REPORT OF UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

CLIENT: Walton Corporation

PROJECT NAME: AGR 1693, Task 64, T201407003, Bridge 1-183 on McKennans Church Road

ETS Job NO.: ETS-16T167-3

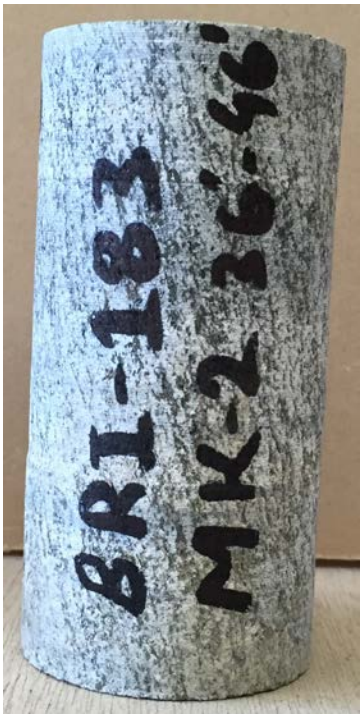
MATERIAL DESCRIPTION: Grey and White, Gneiss

LOAD DIRECTION: Uniaxial

This Specimen was not prepared in accordance with ASTM D4543

Engineer: Sidni Hoxha

COMPRESSION TEST RESULTS (ASTM D7012) - Method "C"											
LABORATORY NUMBER	SPECIMEN IDENTIFICATION OR SET NO.	DEPTH (FT.)	DATE OF TEST	SPECIMEN DIAMETER (IN.)	SPECIMEN HEIGHT (IN.)	SPECIMEN AREA (SQ. IN.)	TOTAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)	AMBIENT TEMPERATURE AT TEST (F°)	BREAK TYPE	TIME TO FAILURE (MIN.)
BR1-183	MK-2	36-46	4/18/2016	2.0	4.0	3.1416	53,900	17,156	70	3	3.0



Respectfully Submitted,
Charlie T. Nabhan, PE
Principal Geotechnical Engineer

Respectfully Submitted,
Sidni Hoxha E.I.T.
Staff Engineer

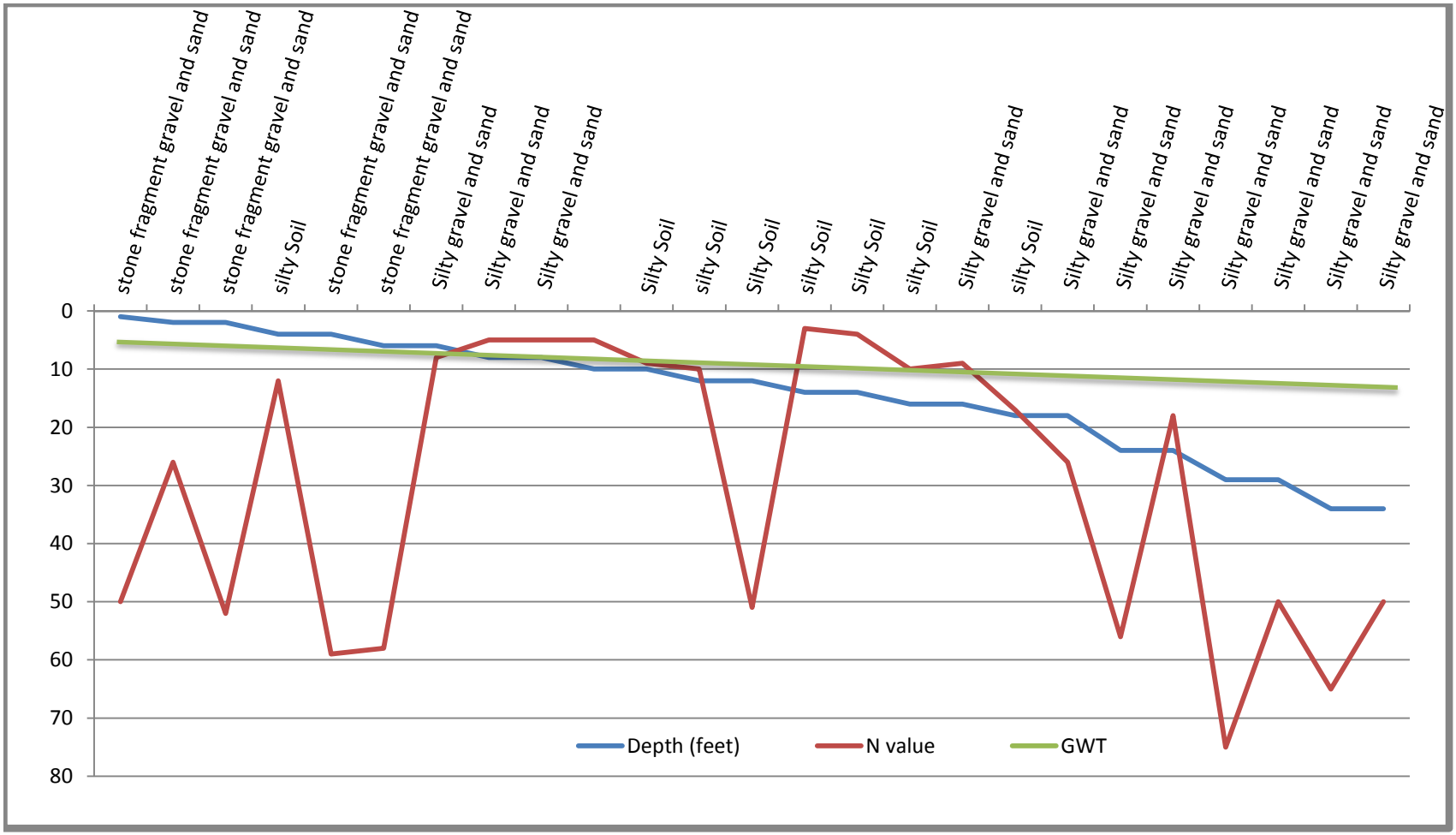
5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040 • fax 757.306.1042*
www.etsva.com

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
MK-1														
	1	1	Moist brown coarse to fine sandy fine gravel w/some silt.	NV	NP	7.5	SM	A-1-b	65.8	20				
	2	2	Moist medium dense brown coarse to fine sandy fine gravel w/trace silt.	NV	NP	4.2	SP-SM	A-1-b	62.5	8.3	6	12	14	8
	3	4	Wet stiff brown fine gravelly silt w/some coarse to fine sand.	23.1	NP	15.7	SM	A-4(0)	78.8	43.9	3	4	8	14
	4	6	Wet medium dense brown fine gravel w/some coarse sand, trace of fine sand and silt.	NV	NP	9.8	GW-GM	A-1-a	34	9.2	35	9	8	5
	5	8	Saturated loose brown silty fine sand w/some coarse sand.	38.2	NP	36	SM	A-2-4(0)	100	33.6	2	2	3	4
	6	10	No sieve analysis - Indication of saturated loose brown silty fine sand w/some coarse sand.	40.8	NP	43.8					2	2	3	4
	7	12	Saturated stiff brown fine sandy silt w/some coarse sand.	37.3	NP	41.6	SM	A-4(0)	99.7	39.3	4	5	5	6
	8	14	Saturated soft brown fine sandy silt w trace coarse sand.	39.1	NP	41.8	SM	A-4(0)	100	45.8	1	1	2	1
	9	16	Saturated stiff brown fine sandy silt w/trace coarse sand.	37.2	NP	41.6	SM	A-4(0)	100	46.2	4	5	5	7
	10	18	Saturated very stiff brown fine sandy silt w/trace coarse sand.	36.2	NP	40.8	SM	A-4(0)	99.5	43	4	5	12	13
	11	24	Saturated medium dense brown silty fine sand w/some coarse sand.	39.9	NP	38.2	SM	A-2-4(0)	100	31.2	3	6	6	10
	12	29	Saturated dense brown silty fine sand w/some coarse sand and fine gravel.	NV	NP	25.3	SM	A-2-4(0)	88.2	24.2	5	10	25	50
	13	34	Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	22.2	SM	A-2-4(0)	97.9	21.3	5	10	15	20
	14	38	No Recovery								50			
	R-1	42	Schist - Recovery 100% RQD 95%											
		47	End Boring											
MK-2														
	1	1	Moist dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	NV	NP	4.2	SW-SM	A-1-b	62.4	8	14	21		
	2	2	Moist loose brown fine gravelly coarse to fine sand w/trace silt.	NV	NP	8.7	SW-SM	A-1-b	71.8	6.6	9	8	2	2
	3	4	Moist medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	13.5	SW-SM	A-1-b	71	8.5	7	8	9	6
	4	6	Wet loose brown silty coarse to fine sand w/some fine gravel.	NV	NP	25.6	SM	A-2-4(0)	84.6	23.4	6	4	4	2
	5	8	Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel.	43	NP	33.1	SM	A-2-5(0)	91.6	32.2	2	2	3	2
	6	10	Saturated stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	48.8	NP	41.7	SM	A-5(0)	98.4	35.8	4	4	5	6
	7	12	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	43.8	NP	37	SM	A-5(0)	95.5	36.4	WR	WR	1	2
	8	14	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	56	NP	44.1	SM	A-5(0)	98.3	37.5	1	2	2	4
	9	16	Saturated loose brown silty fine to coarse sand w/trace fine gravel.	51.9	NP	44.2	SM	A-2-5(0)	97.9	30.8	3	4	5	7
	10	18	Saturated medium dense brown fine to coarse sand w/some silt.	NV	NP	31.1	SM	A-2-4(0)	100	19	8	12	14	19
	11	24	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	34.9	SM	A-2-4(0)	98.4	19.5	8	9	9	11
	12	29	Saturated very dense brown fine sand w some coarse sand and silt, trace of fine gravel.	NV	NP	35.6	SM	A-2-4(0)	96.4	12.8	50			
	13	34	Saturated very dense brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	29.3	SM	A-2-4(0)	97.9	24.1	30	50		
	R-1	36	Schist - Recovery 80% RQD 80%											
		46	End Boring											

DATE : **5-23-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME **BR1-183 on McKennans church road over Hude Run – Wilmington, DE**



DATE : 5-23-2016

PROJECT NUMBER : T201407003

PROJECT NAME BR1-183 on McKennans church road over Hude Run – Wilmington, DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO: **Jason Hasting**
Design Engineer
Bridge Section

FROM: **Hany Fekry, P.E.**
Geotechnical Engineer
Material & Research

DATE **: 3-24-2016**
PROJECT NUMBER **: T201407003**
PROJECT NAME **: BR1-420 on Maryland line Rd over Sassafras River- Townsend, DE**
SUBJECT **: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-02-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CME 55 and CME 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Middletown-Odessa Area Geologic Map Series No. 2 by Pickett, T.E., Spoljaric, N. July, 1971 this site is situated in Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Middletown Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA- 82. The nearest well to this site the groundwater historically had been measured as 53

feet on September 1958 and between the years of 1950 to 1962 appeared from 50 to 57 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 36 feet down is Silty soils (A-4) and from 36 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter less of 9 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 20 to 30 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Hydrologic map of the Middletown-Odessa Area, Delaware; Map Series, No. 8, by Woodruff, K.D., 1992 this site is situated in Sediments of the Beaverdam Formation this is usually support high yielding well.

5. Ground Cover

The ground cover for site is 3 and 4 inches of asphalt a top of 4 and 8 inches of stone. More detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 6 and 7.8 feet and caved at 8 and 19.7 feet below the ground surface elevation more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 7.4 to 75.5 percent. The Atterberg limit is 10 percent, Liquid limits is 25.2 to 30.1 percent and Plasticity Index was 4.4 and 8.8 for the entire sample. The organic matter is 21 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition. In addition all the sample from the depth of 2 to 12 feet from the surface had been met all the

borrow material according to Del-DOT standard specification with good amount to reuse except borrow type "B".

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 3-24-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-420 on Maryland line Rd over Sassafras River- Townsend, DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
ML-1	501891.953	557285.906	39.3775333	-75.7664528
ML-2	501933.455	557281.356	39.3776472	-75.7664694

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING ML-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 501891.953
Easting: 557285.906
Boring Surface Elev.:
Reference:
Date Started: 2/2/16
Date Completed: 2/2/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/2/16	7.8	
2/2/16	4.8	19.7

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'		Moist brown coarse sand and fine gravel w/ some fine sand and silt. 12" RECOVERY	A-1-b	Hot-mix 4" stone 8"
2.53		2	2.0' 4.0'	10 12 50	Moist very dense brown silty coarse to fine sand and fine gravel. 10" RECOVERY	A-1-b	
5.06	▽	3	4.0' 6.0'	1 2 2 3	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel. 10" RECOVERY	A-4(0)	
7.59	■	4	6.0' 8.0'	2 2 2 2	Saturated soft brown clayey fine to coarse sandy silt w/trace fine gravel. 9" RECOVERY	A-4(0)	
10.12		5	8.0' 10.0'	14 16 17 20	Saturated dense brown fine to coarse sand w/ trace silt. 20" RECOVERY	A-3	
		6	10.0' 12.0'	8 23 25 30	Saturated dense brown fine sand w/some coarse sand, trace of silt. 18" RECOVERY	A-3	
12.65		7	12.0' 14.0'	8 12 15 18	Saturated medium dense brown fine sand w/ some coarse sand and silt. 18" RECOVERY	A-2-4(0)	
		8	14.0'	8 22	Saturated very dense brown fine sand w some	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	30 57	coarse sand, trace of silt. 18" RECOVERY		
17.71		9	16.0' 18.0'	23 30 35 37	Saturated very dense brown fine sand w some coarse sand, trace of silt. 22" RECOVERY	A-3	
20.24		10	18.0' 20.0'	20 22 22 28	Saturated dense brown fine sand w/some coarse sand and silt. 18" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' 26.0'	5 8 10 11	Saturated medium dense brown fine sand w/ trace coarse sand and silt. 18" RECOVERY	A-3	
27.83							
30.36		12	29.0' 31.0'	8 10 10 13	Saturated medium dense brown fine sand w/ trace coarse sand and silt. 17" RECOVERY	A-3	
32.89							
35.42		13	34.0' 36.0'	13 23 16 14	Saturated dense brown fine sand w/trace coarse sand and silt. 18" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	35 50	Saturated very dense gray fine sand w/some silt. 10" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	9 15 12 17	Saturated medium dense gray fine sand w/ some coarse sand, trace of silt. 18" RECOVERY	A-3	
48.07							
50.6		16	49.0' 51.0'	30 42 50	Saturated very dense gray fine sand w/some coarse sand, trace of silt. 12" RECOVERY	A-3	
53.13							
55.66		17	54.0' 56.0'	16 25 34 41	Saturated very dense gray fine sand w/some coarse sand, trace of silt and organic matter. 15" RECOVERY	A-3	
58.19							
		18	59.0'	41 43 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72			61.0'		15" RECOVERY		
63.25							
		19	64.0'	16 37 50	Saturated very dense gray fine to coarse sand w/trace silt, fine gravel and organic matter.	A-3	
65.78			66.0'		17" RECOVERY		
68.31		20	68.0'	13 28 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	A-2-4(0)	
			70.0'		14" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Clean sand & gravelly sand
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING ML-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 501933.455
Easting: 557281.356
Boring Surface Elev.:
Reference:
Date Started: 2/2/16
Date Completed: 2/2/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/2/16	6.0	
2/2/16	7.0	8.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		No Sample NR" RECOVERY		Hot-mix 3" stone 4"
2.53		2	2.0' 4.0'	2 2 1 2	Wet soft brown clayey fine sandy silt w/some coarse sand, trace of fine gravel. 10" RECOVERY	A-4(2)	
5.06		3	4.0' 6.0'	2 1 3 2	Wet very loose brown silty fine to coarse sand w/trace fine gravel. 18" RECOVERY	A-2-4(0)	
7.59	■ ▽	4	6.0' 8.0'	2 3 2 8	Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	11 19 14 46	Wet dense brown fine sand w/some coarse sand and silt. 16" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	11 16 18 17	Wet dense brown fine to coarse sand w/trace silt. 14" RECOVERY	A-3	
12.65		7	12.0'	8 11 24 32	Wet dense brown fine to coarse sand w/trace silt.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		20" RECOVERY		
15.18		8	14.0' 16.0'	11 36 44 48	Wet very dense brown fine sand w/some coarse sand, trace of silt. 18" RECOVERY	A-3	
17.71		9	16.0' 18.0'	10 24 25 36	Wet dense brown fine sand w/some coarse sand, trace of silt. 20" RECOVERY	A-3	
20.24		10	18.0' 20.0'	23 33 50	Wet very dense brown fine sand w/some coarse sand, trace of silt. 24" RECOVERY	A-3	
22.77							
25.3		11	24.0' 26.0'	5 3 5 7	Wet loose gray fine sand w/trace coarse sand and silt. 12" RECOVERY	A-3	
27.83							
30.36		12	29.0' 31.0'	11 12 15 19	Wet medium dense gray fine sand w/trace coarse sand and silt. 18" RECOVERY	A-3	
32.89							
35.42		13	34.0' 36.0'	18 28 30 32	Wet very dense gray fine sand w/trace coarse sand and silt. 18" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	21 30 50	Wet very dense gray fine sand w/some silt, trace of coarse sand. 16" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	10 11 13 18	Wet medium dense gray fine sand w/some silt, trace of coarse sand. 20" RECOVERY	A-2-4(0)	
48.07							
50.6		16	49.0' 51.0'	11 50	Wet very dense gray fine sand w/some silt, trace of coarse sand. 8" RECOVERY	A-2-4(0)	
53.13							
55.66		17	54.0' 56.0'	11 19 32 41	Wet dense gray fine sand w/some silt, trace of coarse sand, fine gravel and organic matter. 18" RECOVERY	A-2-4(0)	
58.19							
				36			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ML-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72		18	59.0' 61.0'	50	Wet very dense gray fine sand w/some coarse sand, trace of fine gravel, silt and organic matter. 10" RECOVERY	A-3	
63.25							
65.78		19	64.0' 66.0'	23 39 50	Wet very dense gray fine sand w/some coarse sand and silt, trace of fine gravel and organic matter. 20" RECOVERY	A-2-4(0)	
68.31		20	68.0' 70.0'	20 50	Wet very dense gray silty fine sand w/some coarse sand and clay, trace of fine gravel and organic matter. 14" RECOVERY	A-2-4(0)	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

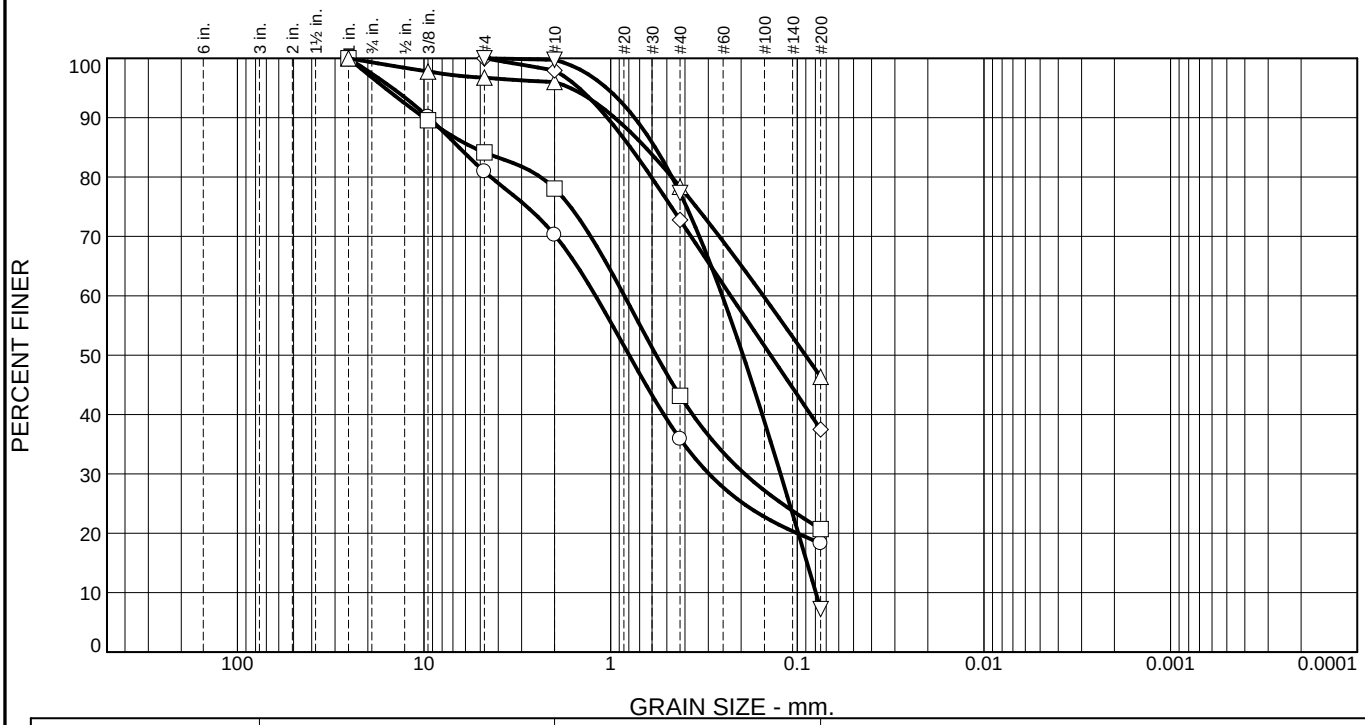
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	29.7	34.4	17.6	18.3	
□	0.0	21.9	34.9	22.5	20.7	
△	0.0	4.0	17.6	32.0	46.4	
◇	0.0	2.0	25.2	35.3	37.5	
▽	0.0	0.3	22.4	70.1	7.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	6.4885	1.2058	0.7962	0.2970				
□	NV	NP	5.4610	0.8450	0.5702	0.1913				
△	28.5	NP	0.6514	0.1523	0.0905					
◇	30.1	24.2	0.7839	0.2275	0.1391					
▽	NV	NP	0.5776	0.2521	0.1955	0.1230	0.0886	0.0796	0.75	3.17

Material Description	USCS	AASHTO
○ Moist brown coarse sand and fine gravel w/some fine sand and silt.	SM	A-1-b
□ Moist very dense brown silty coarse to fine sand and fine gravel.	SM	A-1-b
△ Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	SM	A-4(0)
◇ Saturated soft brown clayey fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
▽ Saturated dense brown fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-1 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** ML-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** ML-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** ML-1 **Depth:** 6.0 **Sample Number:** 4

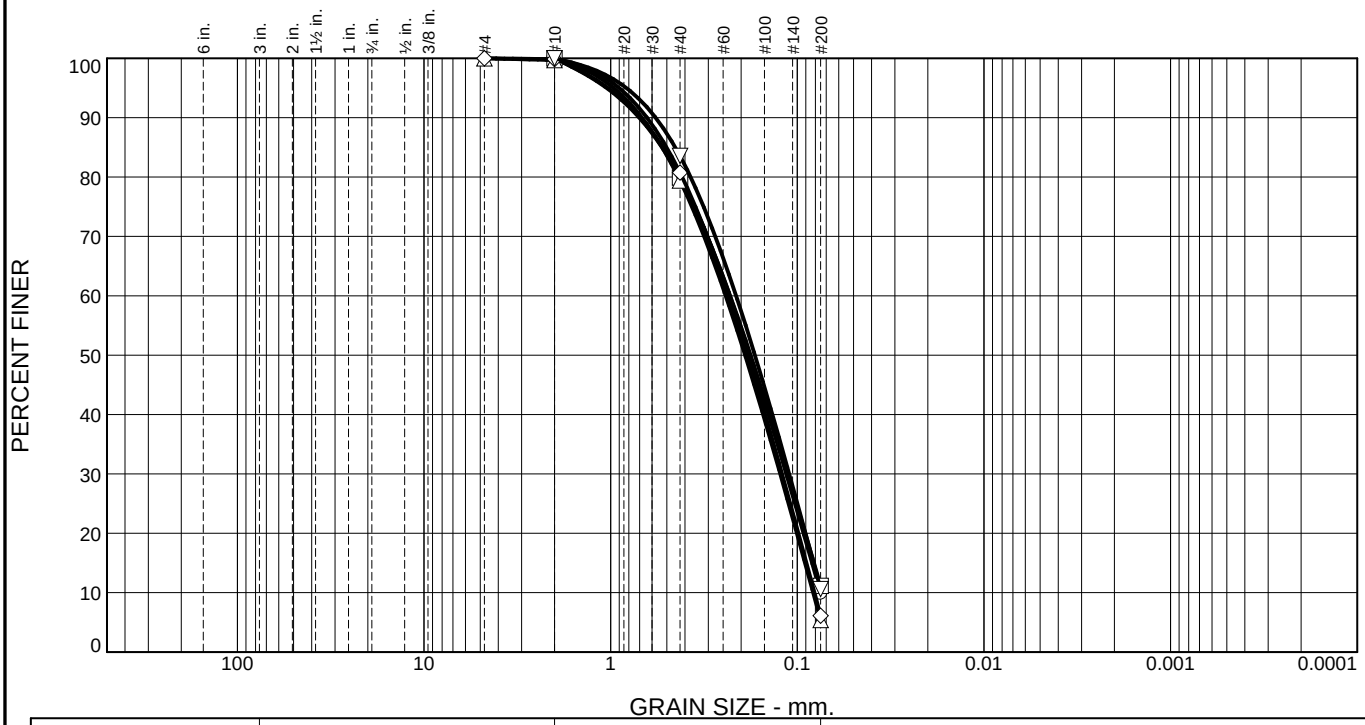
▽ **Source of Sample:** ML-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	19.9	70.1	10.0	
□	0.0	0.0	20.1	68.8	11.1	
△	0.0	0.3	20.3	74.0	5.4	
◇	0.0	0.1	19.2	74.6	6.1	
▽	0.0	0.0	16.4	73.0	10.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.5250	0.2300	0.1796	0.1146	0.0834	0.0751	0.76	3.06
□	NV	NP	0.5302	0.2289	0.1780	0.1127	0.0815			
△	NV	NP	0.5297	0.2419	0.1905	0.1235	0.0909	0.0822	0.77	2.94
◇	NV	NP	0.5018	0.2338	0.1850	0.1208	0.0894	0.0810	0.77	2.89
▽	NV	NP	0.4506	0.2128	0.1688	0.1106	0.0818			

	Material Description	USCS	AASHTO
○	Saturated dense brown fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
□	Saturated medium dense brown fine sand w/some coarse sand and silt.	SP-SM	A-2-4(0)
△	Saturated very dense brown fine sand w some coarse sand, trace of silt.	SP-SM	A-3
◇	Saturated very dense brown fine sand w some coarse sand, trace of silt.	SP-SM	A-3
▽	Saturated dense brown fine sand w/some coarse sand and silt.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** ML-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** ML-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** ML-1 **Depth:** 16.0 **Sample Number:** 9

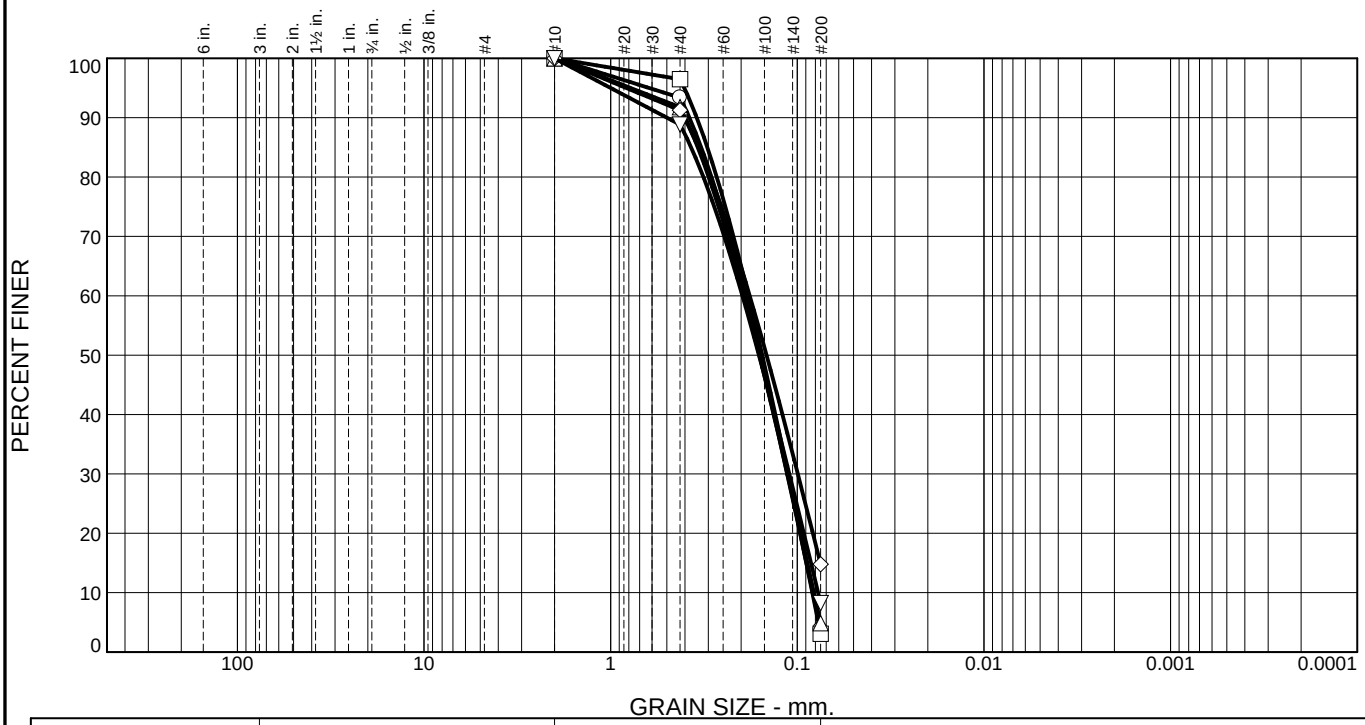
▽ **Source of Sample:** ML-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	6.6	89.6	3.8	
□	0.0	0.0	3.5	93.4	3.1	
△	0.0	0.0	8.2	86.9	4.9	
◇	0.0	0.0	8.7	76.5	14.8	
▽	0.0	0.0	11.2	80.6	8.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.3272	0.1897	0.1584	0.1134	0.0894	0.0826	0.82	2.30
□	NV	NP	0.3033	0.1829	0.1542	0.1123	0.0895	0.0831	0.83	2.20
△	NV	NP	0.3411	0.1927	0.1598	0.1130	0.0884	0.0815	0.81	2.37
◇	NV	NP	0.3386	0.1799	0.1462	0.0994	0.0753			
▽	NV	NP	0.3708	0.1969	0.1606	0.1104	0.0845	0.0774	0.80	2.55

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine sand w/trace coarse sand and silt.	SP	A-3
□ Saturated medium dense brown fine sand w/trace coarse sand and silt.	SP	A-3
△ Saturated dense brown fine sand w/trace coarse sand and silt.	SP	A-3
◇ Saturated very dense gray fine sand w/some silt.	SM	A-2-4(0)
▽ Saturated medium dense gray fine sand w/some coarse sand, trace of silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** ML-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** ML-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** ML-1 **Depth:** 39.0 **Sample Number:** 14

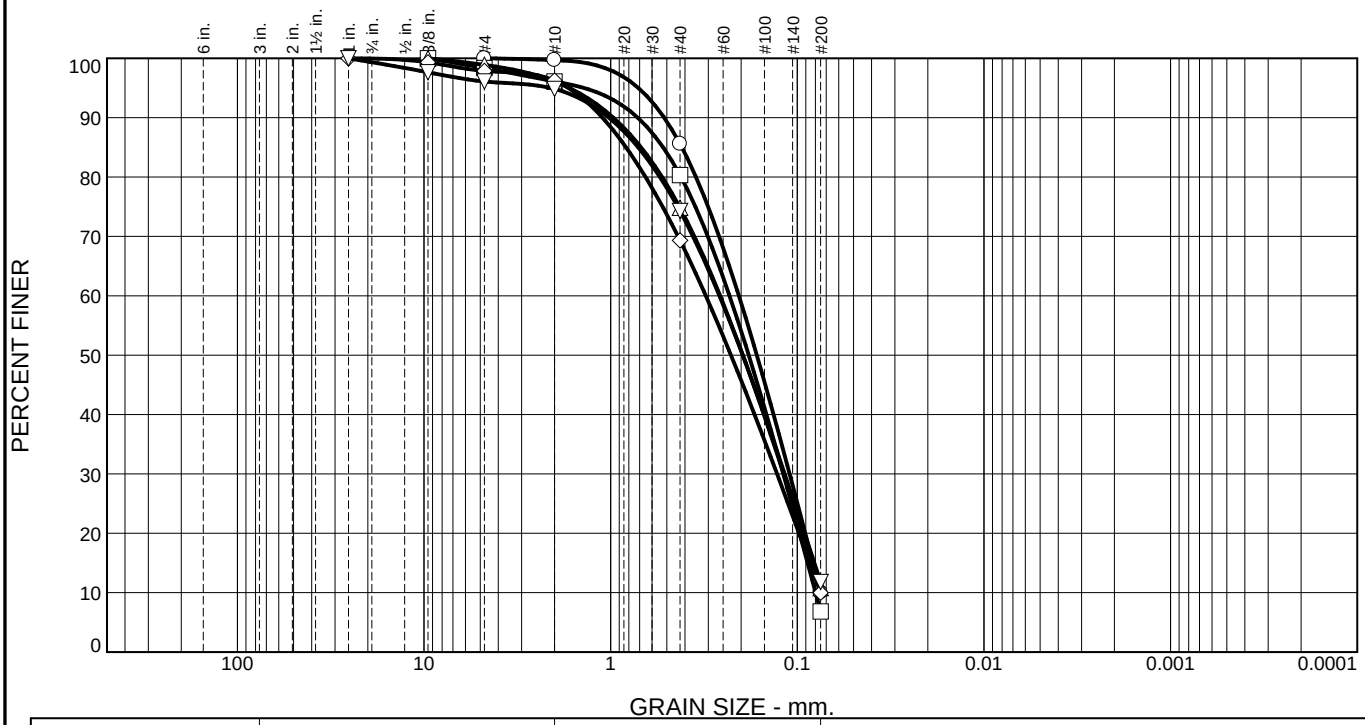
▽ **Source of Sample:** ML-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	14.1	75.6	10.0	
□	0.0	3.9	15.8	73.5	6.8	
△	0.0	3.9	21.3	64.0	10.8	
◇	0.0	3.7	27.0	59.3	10.0	
▽	0.0	5.2	20.5	62.5	11.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4153	0.2056	0.1649	0.1100	0.0824			
□	NV	NP	0.5235	0.2308	0.1821	0.1189	0.0881	0.0798	0.77	2.89
△	NV	NP	0.6872	0.2591	0.1958	0.1183	0.0828			
◇	NV	NP	0.8268	0.3091	0.2267	0.1284	0.0857	0.0750	0.71	4.12
▽	NV	NP	0.7116	0.2614	0.1961	0.1169	0.0810			

Material Description	USCS	AASHTO
○ Saturated very dense gray fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
□ Saturated very dense gray fine sand w/some coarse sand, trace of silt and organic matter.	SP-SM	A-3
△ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SP-SM	A-2-4(0)
◇ Saturated very dense gray fine to coarse sand w/trace silt, fine gravel and organic matter.	SP-SM	A-3
▽ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** ML-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** ML-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** ML-1 **Depth:** 64.0 **Sample Number:** 19

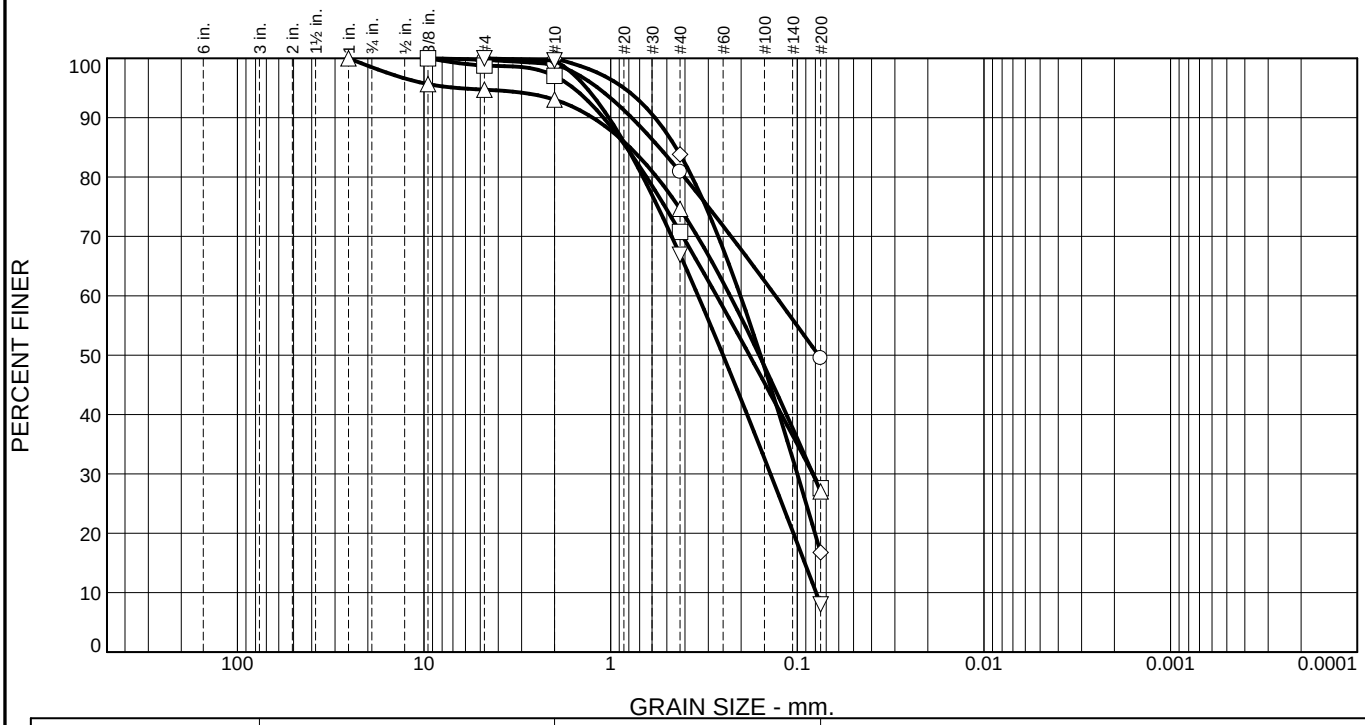
▽ **Source of Sample:** ML-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.0	18.1	31.4	49.5	
□	0.0	3.0	26.2	43.2	27.6	
△	0.0	7.0	18.4	47.6	27.0	
◇	0.0	0.0	16.2	67.0	16.8	
▽	0.0	0.4	32.7	58.9	8.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25.7	16.9	0.5492	0.1311	0.0770					
□	NV	NP	0.8228	0.2705	0.1805	0.0824				
△	NV	NP	0.7886	0.2291	0.1600	0.0825				
◇	NV	NP	0.4474	0.2018	0.1576	0.1000				
▽	NV	NP	0.8182	0.3401	0.2499	0.1393	0.0912	0.0792	0.72	4.29

Material Description	USCS	AASHTO
○ Wet soft brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	SC	A-4(2)
□ Wet very loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
◇ Wet dense brown fine sand w/some coarse sand and silt.	SM	A-2-4(0)
▽ Wet dense brown fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-2 **Depth:** 2.0 **Sample Number:** 2

□ **Source of Sample:** ML-2 **Depth:** 4.0 **Sample Number:** 3

△ **Source of Sample:** ML-2 **Depth:** 6.0 **Sample Number:** 4

◇ **Source of Sample:** ML-2 **Depth:** 8.0 **Sample Number:** 5

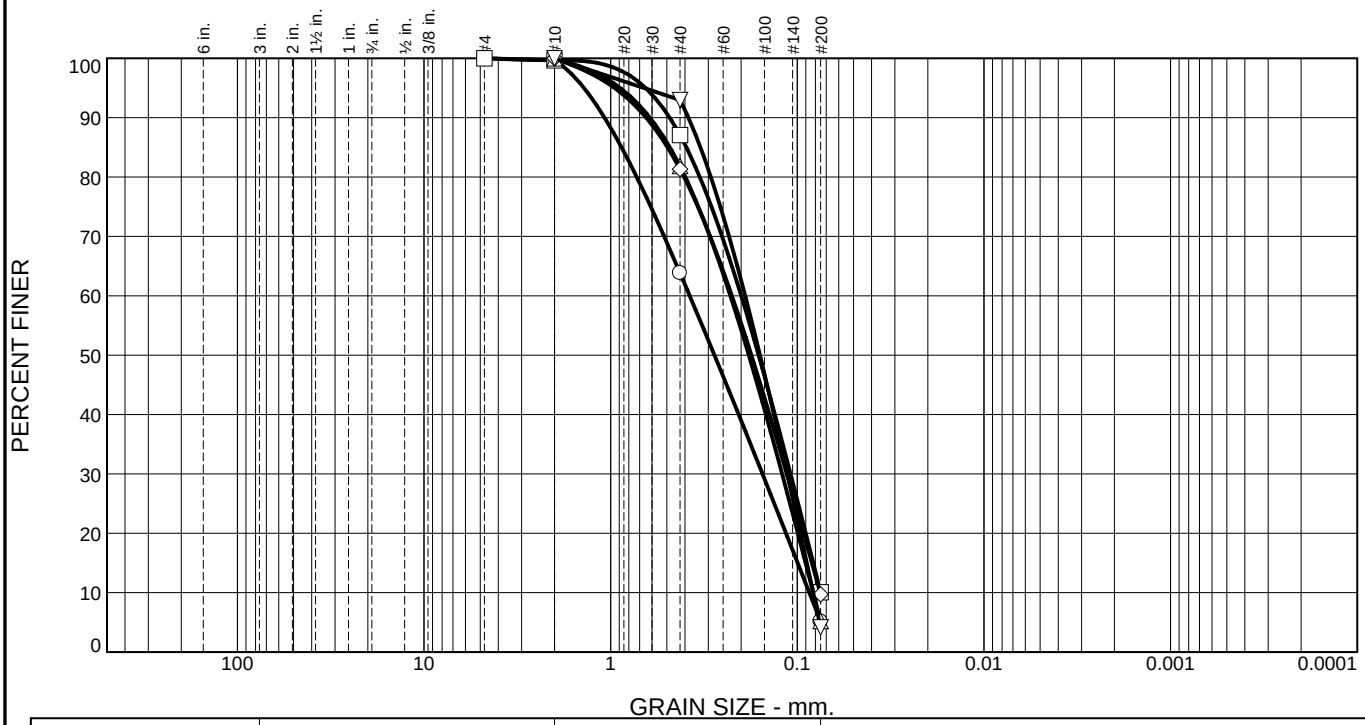
▽ **Source of Sample:** ML-2 **Depth:** 10.0 **Sample Number:** 6

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	35.9	58.7	5.1	
□	0.0	0.3	12.6	77.0	10.1	
△	0.0	0.0	18.1	76.7	5.2	
◇	0.0	0.0	18.7	71.6	9.7	
▽	0.0	0.0	7.0	88.8	4.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8742	0.3772	0.2779	0.1537	0.0996	0.0862	0.73	4.37
□	NV	NP	0.3929	0.1998	0.1612	0.1088	0.0822			
△	NV	NP	0.4815	0.2282	0.1820	0.1207	0.0903	0.0821	0.78	2.78
◇	NV	NP	0.4954	0.2241	0.1763	0.1139	0.0835	0.0754	0.77	2.97
▽	NV	NP	0.3303	0.1903	0.1586	0.1132	0.0890	0.0822	0.82	2.31

Material Description	USCS	AASHTO
○ Wet dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
□ Wet very dense brown fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
△ Wet dense brown fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
◇ Wet very dense brown fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
▽ Wet loose gray fine sand w/trace coarse sand and silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-2 **Depth:** 12.0 **Sample Number:** 7

□ **Source of Sample:** ML-2 **Depth:** 14.0 **Sample Number:** 8

△ **Source of Sample:** ML-2 **Depth:** 16.0 **Sample Number:** 9

◇ **Source of Sample:** ML-2 **Depth:** 18.0 **Sample Number:** 10

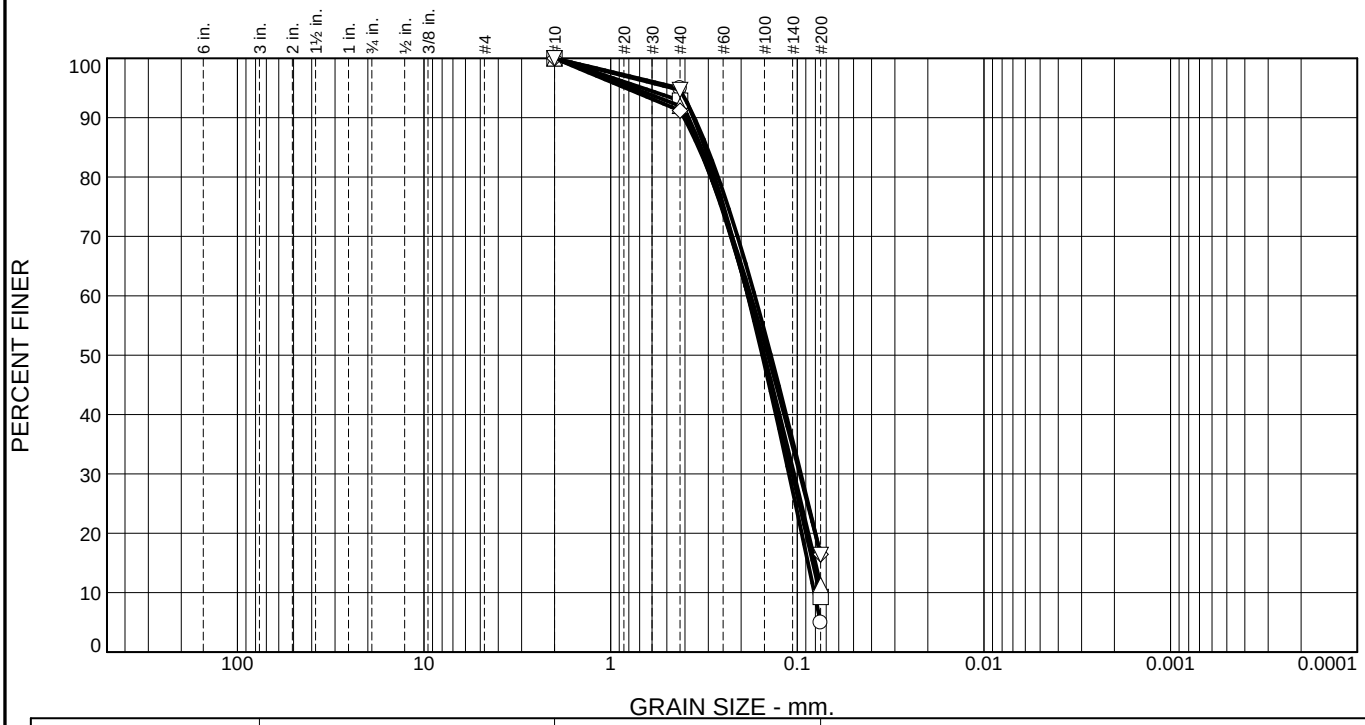
▽ **Source of Sample:** ML-2 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	5.0	90.0	5.0	
□	0.0	0.0	7.1	83.6	9.3	
△	0.0	0.0	8.0	80.7	11.3	
◇	0.0	0.0	8.8	74.7	16.5	
▽	0.0	0.0	5.3	78.3	16.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.3131	0.1841	0.1542	0.1109	0.0876	0.0811	0.82	2.27
□	NV	NP	0.3272	0.1836	0.1517	0.1064	0.0825	0.0759	0.81	2.42
△	NV	NP	0.3340	0.1832	0.1503	0.1041	0.0800			
◇	NV	NP	0.3382	0.1776	0.1437	0.0970				
▽	NV	NP	0.3046	0.1689	0.1386	0.0957				

Material Description	USCS	AASHTO
○ Wet medium dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
□ Wet very dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
△ Wet very dense gray fine sand w/some silt, trace of coarse sand.	SP-SM	A-2-4(0)
◇ Wet medium dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
▽ Wet very dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-2 **Depth:** 29.0 **Sample Number:** 12

□ **Source of Sample:** ML-2 **Depth:** 34.0 **Sample Number:** 13

△ **Source of Sample:** ML-2 **Depth:** 39.0 **Sample Number:** 14

◇ **Source of Sample:** ML-2 **Depth:** 44.0 **Sample Number:** 15

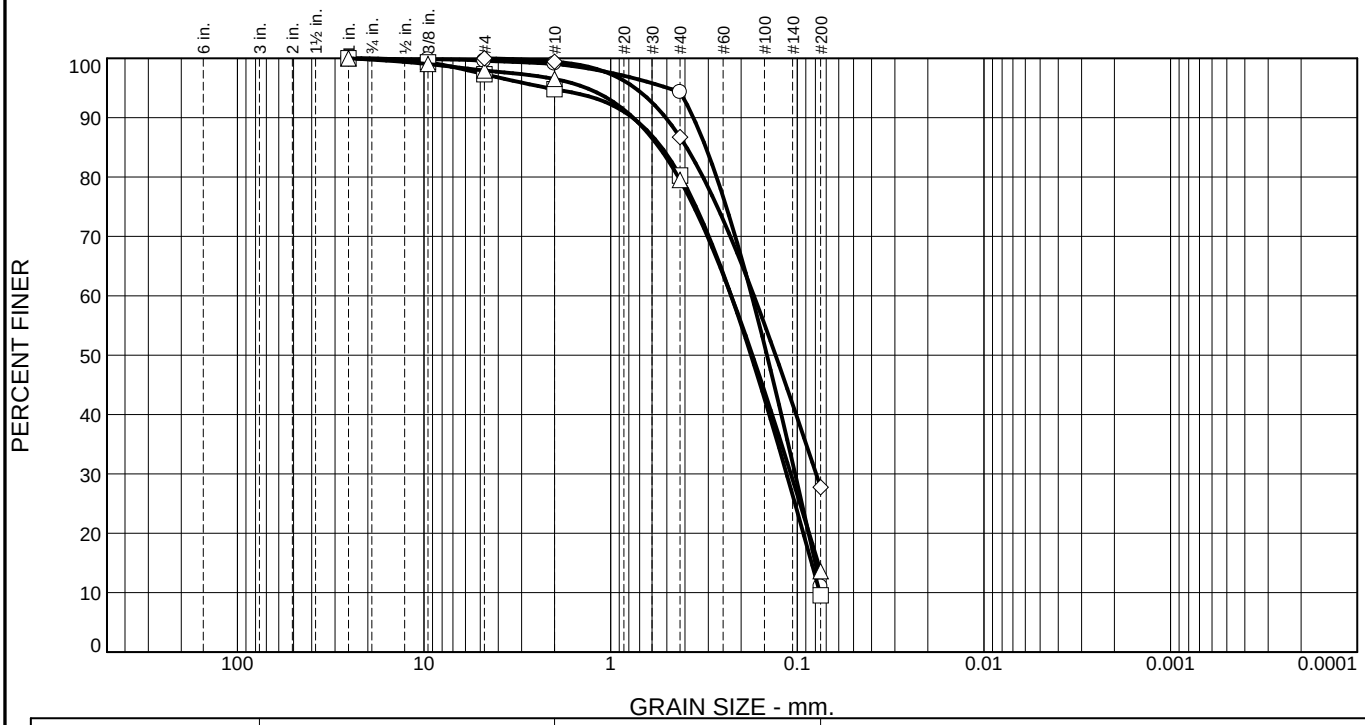
▽ **Source of Sample:** ML-2 **Depth:** 49.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.9	4.8	83.3	11.0	
□	0.0	5.2	14.5	70.8	9.5	
△	0.0	3.5	17.0	65.9	13.6	
◇	0.0	0.6	12.7	58.9	27.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.3091	0.1754	0.1455	0.1027	0.0801			
□	NV	NP	0.5333	0.2260	0.1771	0.1142	0.0838	0.0757	0.76	2.99
△	NV	NP	0.5493	0.2259	0.1740	0.1083	0.0773			
◇	25.2	20.8	0.3923	0.1708	0.1308	0.0793				

Material Description	USCS	AASHTO
○ Wet dense gray fine sand w/some silt, trace of coarse sand, fine gravel and organic matter.	SP-SM	A-2-4(0)
□ Wet very dense gray fine sand w/some coarse sand, trace of fine gravel, silt and organic matter.	SP-SM	A-3
△ Wet very dense gray fine sand w/some coarse sand and silt, trace of fine gravel and organic matter.	SM	A-2-4(0)
◇ Wet very dense gray silty fine sand w/some coarse sand and clay, trace of fine gravel and organic matter.	SC-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ML-2 **Depth:** 54.0 **Sample Number:** 17

□ **Source of Sample:** ML-2 **Depth:** 59.0 **Sample Number:** 18

△ **Source of Sample:** ML-2 **Depth:** 64.0 **Sample Number:** 19

◇ **Source of Sample:** ML-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

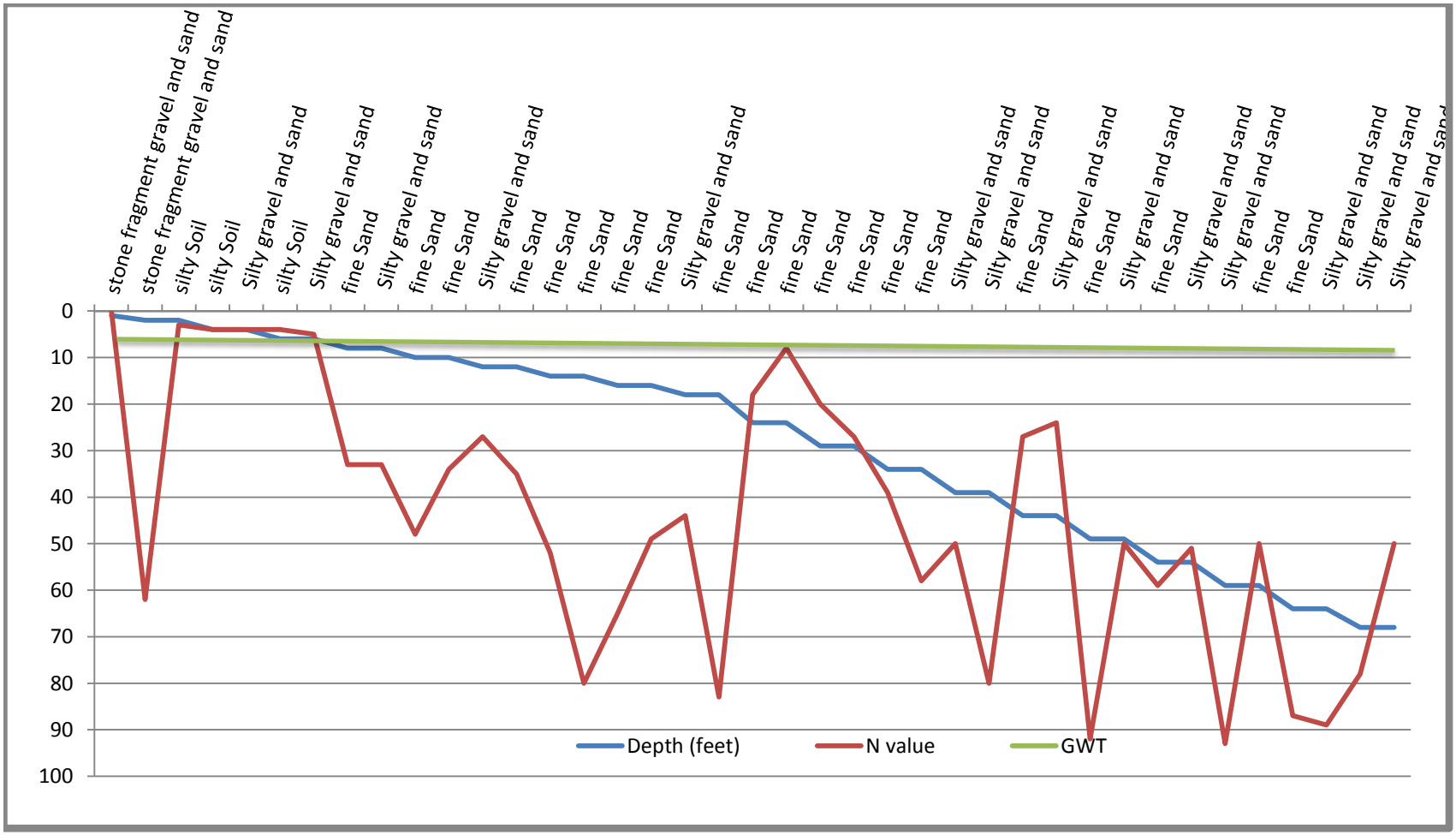
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
ML-1	1	1	Moist brown coarse sand and fine gravel w/some fine sand and silt.	NV	NP	7.4	SM	A-1-b	70.3	18.3				
	2	2	Moist very dense brown silty coarse to fine sand and fine gravel.	NV	NP	8.1	SM	A-1-b	78.1	20.7	10	12	50	
	3	4	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel.	28.5	NP	49.8	SM	A-4(0)	96	46.4	1	2	2	3
	4	6	Saturated soft brown clayey fine to coarse sandy silt w/trace fine gravel.	30.1	5.9	75.5	SM	A-4(0)	98	37.5	2	2	2	2
	5	8	Saturated dense brown fine to coarse sand w/trace silt.	NV	NP	26.3	SP-SM	A-3	99.7	7.2	14	16	17	20
	6	10	Saturated dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	24.2	SP-SM	A-3	100	10	8	23	25	30
	7	12	Saturated medium dense brown fine sand w/some coarse sand and silt.	NV	NP	25.6	SP-SM	A-2-4(0)	100	11.1	8	12	15	18
	8	14	Saturated very dense brown fine sand w some coarse sand, trace of silt.	NV	NP	28.2	SP-SM	A-3	99.7	5.4	8	22	30	57
	9	16	Saturated very dense brown fine sand w some coarse sand, trace of silt.	NV	NP	26.3	SP-SM	A-3	99.9	6.1	23	30	35	37
	10	18	Saturated dense brown fine sand w/some coarse sand and silt.	NV	NP	23.1	SP-SM	A-2-4(0)	100	10.6	20	22	22	28
	11	24	Saturated medium dense brown fine sand w/trace coarse sand and silt.	NV	NP	29.3	SP	A-3	100	3.8	5	8	10	11
	12	29	Saturated medium dense brown fine sand w/trace coarse sand and silt.	NV	NP	30.1	SP	A-3	100	3.1	8	10	10	13
	13	34	Saturated dense brown fine sand w/trace coarse sand and silt.	NV	NP	27.2	SP	A-3	100	4.9	13	23	16	14
	14	39	Saturated very dense gray fine sand w/some silt.	NV	NP	24.7	SM	A-2-4(0)	100	14.8	35	50		
	15	44	Saturated medium dense gray fine sand w/some coarse sand, trace of silt.	NV	NP	27.5	SP-SM	A-3	100	8.2	9	15	12	17
	16	49	Saturated very dense gray fine sand w/some coarse sand, trace of silt.	NV	NP	24.6	SP-SM	A-3	99.7	10	30	42	50	
	17	54	Saturated very dense gray fine sand w/some coarse sand, trace of silt and organic matter.	NV	NP	24.8	SP-SM	A-3	96.1	6.8	16	25	34	41
	18	59	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	21.6	SP-SM	A-2-4(0)	96.1	10.8	41	43	50	
	19	64	Saturated very dense gray fine to coarse sand w/trace silt, fine gravel and organic matter.	NV	NP	21.3	SP-SM	A-3	96.3	10	16	37	50	
	20	68	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	24.6	SP-SM	A-2-4(0)	94.8	11.8	13	28	50	
		70	End Boring											
ML-2	1		No Sample											
	2	2	Wet soft brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	25.7	8.8	20.3	SC	A-4(2)	99	49.5	2	2	1	2
	3	4	Wet very loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	28.6	SM	A-2-4(0)	97	27.6	2	1	3	2
	4	6	Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	44.3	SM	A-2-4(0)	93	27	2	3	2	8
	5	8	Wet dense brown fine sand w/some coarse sand and silt.	NV	NP	25	SM	A-2-4(0)	100	16.8	11	19	14	46
	6	10	Wet dense brown fine to coarse sand w/trace silt.	NV	NP	26.5	SP-SM	A-3	99.6	8	11	16	18	17
	7	12	Wet dense brown fine to coarse sand w/trace silt.	NV	NP	27.2	SP-SM	A-3	99.7	5.1	8	11	24	32
	8	14	Wet very dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	26.5	SP-SM	A-3	99.7	10.1	11	36	44	48
	9	16	Wet dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	27.5	SP-SM	A-3	100	5.2	10	24	25	36
	10	18	Wet very dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	19.1	SP-SM	A-3	100	9.7	23	33	50	
	11	24	Wet loose gray fine sand w/trace coarse sand and silt.	NV	NP	29	SP	A-3	100	4.2	5	3	5	7
	12	29	Wet medium dense gray fine sand w/trace coarse sand and silt.	NV	NP	28.4	SP-SM	A-3	100	5	11	12	15	19
	13	34	Wet very dense gray fine sand w/trace coarse sand and silt.	NV	NP	27.1	SP-SM	A-3	100	9.3	18	28	30	32
	14	39	Wet very dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	27.8	SP-SM	A-2-4(0)	100	11.3	21	30	50	
	15	44	Wet medium dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	32.3	SM	A-2-4(0)	100	16.5	10	11	13	18
	16	49	Wet very dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	32.2	SM	A-2-4(0)	100	16.4	11	50		
	17	54	Wet dense gray fine sand w/some silt, trace of coarse sand, fine gravel and organic matter.	NV	NP	28.4	SP-SM	A-2-4(0)	99.1	11	11	19	32	41
	18	59	Wet very dense gray fine sand w/some coarse sand, trace of fine gravel, silt and organic matter.	NV	NP	24.7	SP-SM	A-3	94.8	9.5	36	50		
	19	64	Wet very dense gray fine sand w/some coarse sand and silt, trace of fine gravel and organic matter.	NV	NP	24.3	SM	A-2-4(0)	96.5	13.6	23	39	50	
	20	68	Wet very dense gray silty fine sand w/some coarse sand and clay, trace of fine gravel and organic matter.	25.2	4.4	26	SC-SM	A-2-4(0)	99.4	27.8	20	50		
		70	End Boring											

DATE : 3-24-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR1-420 on Maryland line Rd over Sassafras River- Townsend, DE



DATE : **3-24-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR1-420 on Maryland line Rd over Sassafras River- Townsend, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 4-13-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-449 on Union church Rd over Herring Run - Townsend, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-3-2016. Walton Corporation-Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation and two Shelby tube was collected. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Middletown-Odessa Area Geologic Map Series No. 2 by Pickett, T.E., Spoljaric, N. July, 1971 this site is situated in TERTIARY Chesapeake Group and the general description of the soil it is Predominantly Sandy Silt or Sand , bluish gray to light olive gray; diatomaceous, particularly in the lower Miocene, Subordinate sands are quartzose, medium- to course- grained, may be Shelly; where well- developed used as aquifers, Cheswold(chs) and Frederica (fred) aquifers.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Middletown Area , Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA- 82. The nearest well to this site the groundwater historically had been measured as 51 feet on September 1958 and between the years of 1950 to 1962 appeared from 47 to 53 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is less of 3 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters less of 10 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Hydrologic map of the Middletown-Odessa Area, Delaware; Map Series, No. 8, by Woodruff, K.D., 1992 this site is situated in Calvert Formation may provide enough water for domestic well.

5. Ground Cover

The ground cover for this site is 4 and 8 inches of asphalt top of 6 and 8 inches of stone. More detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 5 and 5.7 feet and caved at 5.1 and 16 feet all the measurements is below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

7.1 The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 10.6 to 73.6 percent. The Atterberg limit is 35 percent, Liquid limits is the range of 21.1 to 67.7 percent and Plasticity Index is the range of 5 to 25.2 percent. The Organic matter is 11 percent more detail show in Appendix- E.

7.2 Undisturbed soil sample was tested on the samples obtained from the Shelby tube all the test result in Appendix "D". Direct Shear AASHTO T236 had been test from the sample UC-1 at depth 20 feet below the existing elevation the sample indicated that the friction angle (ϕ) was approximately 23.3^{o} and a corresponding cohesion values is 2.6 PSI

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition and 6 feet in thickness of loose sand material appeared at 10 feet down from the surface elevation this layer need to be consider in the design. In addition the entire sample from the depth of 2 to 12 feet from the surface had been met all borrow type material according to Del-DOT standard specification with good amount to reuse except borrow type "B".

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations. This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of Direct Shear AASHTO T236 test (12- sheets)

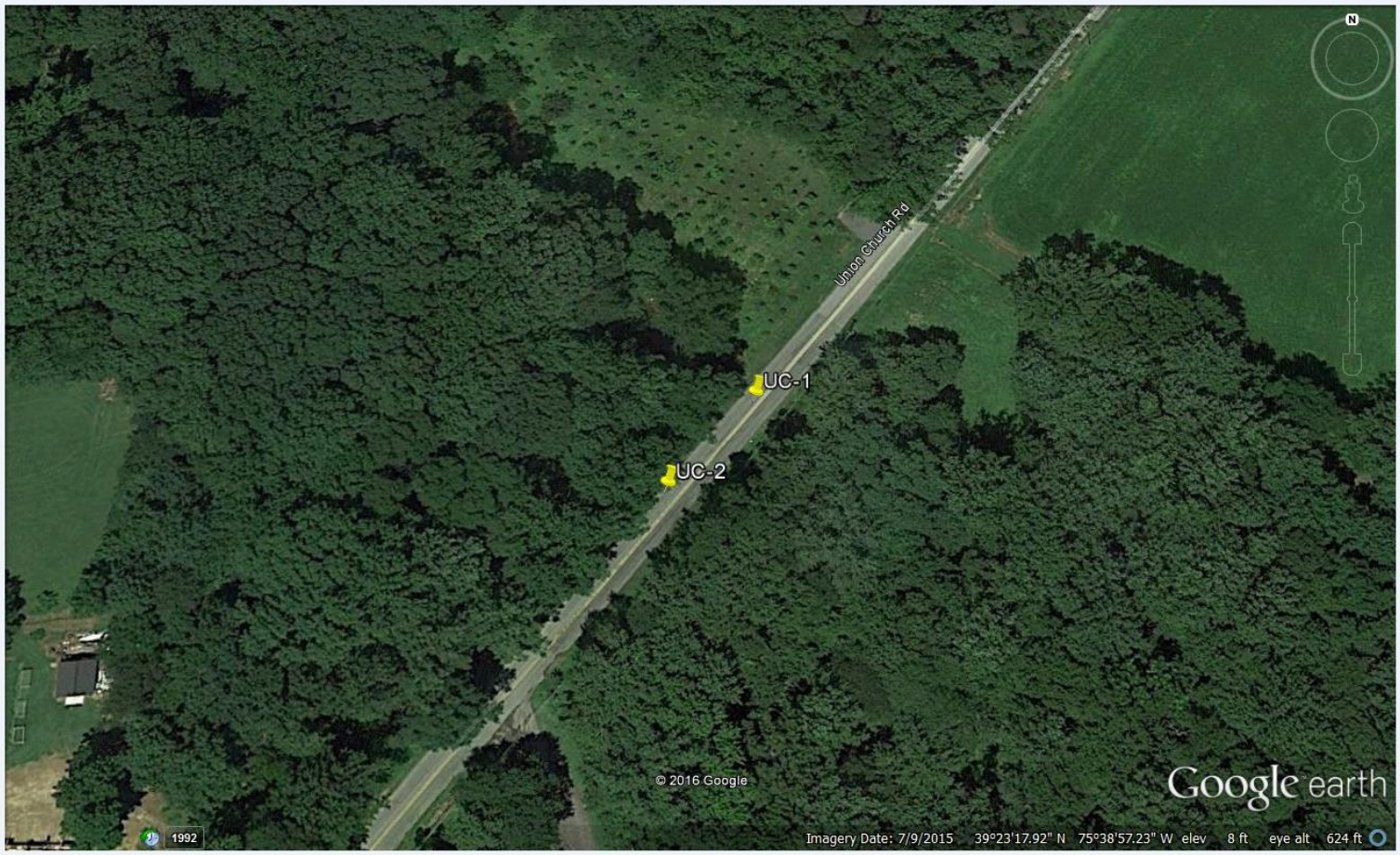
APPENDIX E

- Summary of the Borings (1- sheet)

APPENDIX F

- Chat N- Value Vs. Depth (1- sheet)

DATE : 4-13-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-449 on Union church Rd over Herring Run - Townsend, DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
UC-1	505725.980	590461.823	39.3883528	-75.6491306
UC-2	505672.480	590413.007	39.3882056	-75.6493028

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING UC-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 505725.980
Easting: 590461.823
Boring Surface Elev.:
Reference:
Date Started: 2/3/16
Date Completed: 2/3/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/3/16	5.0	
2/3/16	4.0	16.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		No Recovery NR" RECOVERY		Hot-mix 4", stone 6" and fill 14"
2.53		2	2.0' 4.0'	4 3 3 2	Moist loose brown silty fine to coarse sand w/trace fine gravel. 17" RECOVERY	A-2-4(0)	
5.06	▼ ■	3	4.0' 6.0'	13 32 39 49	Wet very dense brown fine gravelly fine to coarse sand w/trace silt. 11" RECOVERY	A-1-b	
7.59		4	6.0' 8.0'	50	Wet very dense brown fine gravelly coarse to fine sand w/some silt. 5" RECOVERY	A-1-b	
10.12		5	8.0' 10.0'	5 2 9 10	Wet medium dense brown silty fine gravelly coarse sand w/some fine sand and clay. 8" RECOVERY	A-1-b	
		6	10.0' 12.0'	8 5 2 2	Wet loose brown coarse sandy fine gravel w/ some fine sand and silt. 11" RECOVERY	A-1-b	
12.65		7	12.0'	3 2 2 2	Wet very loose brown silty coarse sand and fine gravel w/some fine sand.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	3 2 2 3	Saturated soft brown silty clay w/some fine sand, trace of coarse sand. 24" RECOVERY	A-7-5(21)	
17.71		9	16.0' 18.0'	7 9 11 11	Saturated very stiff brown fine sandy clay w/ some silt and coarse sand. 24" RECOVERY	A-7-5(7)	
20.24		U-1	18.0' 20.0'		24" RECOVERY		Shelby Tube - Press Sample
25.3		11	24.0' 26.0'	8 9 5 4	Saturated medium dense brown silty fine to coarse sand w/trace organic matter. 12" RECOVERY	A-2-4(0)	
30.36		12	29.0' 31.0'	18 20 50	Saturated very dense gray silty fine to coarse sand. 18" RECOVERY	A-2-4(0)	
35.42		13	34.0' 36.0'	38 50	Saturated very dense gray fine to coarse sand w/some silt. 7" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	34 50	Saturated very dense gray fine to coarse sand w/some silt. 9" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	50	Saturated very dense gray fine to coarse sand w/some silt. 5" RECOVERY	A-2-4(0)	
48.07							
50.6		16	49.0' 51.0'	32 50	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt. 2" RECOVERY		
53.13							
55.66		17	54.0' 56.0'	24 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel. 8" RECOVERY	A-2-4(0)	
58.19							
				25			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	50	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
60.72			61.0'		9" RECOVERY		
63.25							
		19	64.0'	16 23 47 49	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
65.78			66.0'		16" RECOVERY		
68.31		20	68.0'		No Recovery		
			70.0'		NR" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Expansive plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING UC-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 505672.480
Easting: 590413.007
Boring Surface Elev.:
Reference:
Date Started: 2/3/16
Date Completed: 2/3/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/3/16	5.7	
2/3/16	5.7	5.10

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 0.7'		Wet brown gravelly fine gravel w/some coarse to fine sand and silt. 8" RECOVERY	A-2-4(0)	Hot-mix 8", stone 8"
2.53		2	2.0' 4.0'	2 2 2 2	Wet soft brown clayey silt w/some fine sand, trace of coarse sand and fine gravel. 18" RECOVERY	A-4(2)	
5.06		3	4.0' 6.0'	3 3 3 4	Wet firm brown silty clay w/some fine to coarse sand, trace of fine gravel. 12" RECOVERY	A-6(6)	
7.59		4	6.0' 8.0'	3 3 4 3	Wet firm brown clay w/some silt, fine to coarse sand and fine gravel. 10" RECOVERY	A-6(3)	
10.12		5	8.0' 10.0'	WH WH 7 8	Wet firm brown clayey fine sandy silt w/ some coarse sand and fine gravel. 10" RECOVERY	A-4(1)	
		6	10.0' 12.0'	15 20 7 8	Wet medium dense brown clayey fine gravel w/some fine to coarse sand, trace of silt. 10" RECOVERY	A-2-4(0)	
12.65		7	12.0'	9 7 6 2	Saturated stiff brown clay w/some fine to coarse sand, fine gravel and silt.	A-7-6(8)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		6" RECOVERY		
15.18		8	14.0' 16.0'	4 5 5 7	Saturated stiff brown organic silty clay w/ trace coarse to fine sand and fine gravel. 24" RECOVERY	A-7-5(29)	
17.71		9	16.0' 18.0'	7 7 8 9	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand and fine gravel. 21" RECOVERY	A-7-5(18)	
20.24		10	18.0' 20.0'	7 9 10 9	Saturated very stiff gray organic silty clay w/ some fine sand and fine gravel, trace of coarse sand. 24" RECOVERY	A-7-5(15)	
22.77							
25.3		U-1	24.0' 26.0'		No Recovery NR" RECOVERY		Shelby Tube - Press Sample
27.83		11	26.0' 28.0'	15 22 25 28	Saturated dense gray silty coarse to fine sand. 18" RECOVERY	A-2-4(0)	
30.36		12	29.0' 31.0'	13 17 30 32	Saturated dense gray coarse to fine sand w/ some silt. 10" RECOVERY	A-1-b	
32.89							
35.42		13	34.0' 36.0'	32 50	Saturated very dense gray fine to coarse sand w/some silt. 8" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	30 50	Saturated very dense gray coarse to fine sand w/some silt. 8" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	41 50	No sieve analysis - Indication of saturated very dense gray coarse to fine sand w/some silt. 6" RECOVERY		
48.07							
50.6		16	49.0' 51.0'	50	No sieve analysis - Indication of saturated very dense gray coarse to fine sand w/some silt. 4" RECOVERY		
53.13							
55.66		17	54.0' 56.0'	25 32 50	Saturated very dense gray fine to coarse sand w/some silt. 9" RECOVERY	A-2-4(0)	
58.19							
				37			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** UC-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	50	Saturated very dense gray coarse to fine sand w/trace silt.	A-3	
60.72			61.0'		7" RECOVERY		
63.25							
		19	64.0'	25 36 50	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
65.78			66.0'		9" RECOVERY		
68.31		20	68.0'	21 39 50	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
			70.0'		11" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Plastic clays
	Expansive plastic clays
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

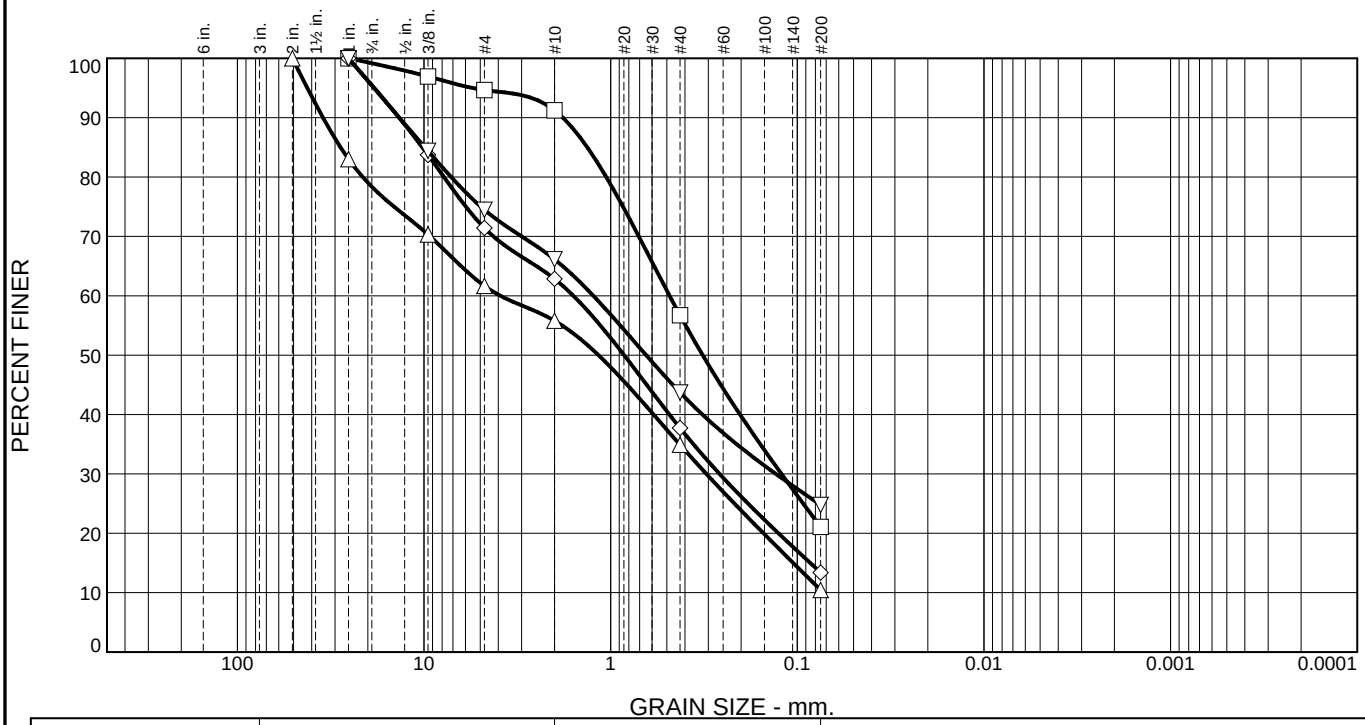
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○						
□	0.0	8.8	34.5	35.6	21.1	
△	0.0	44.2	20.9	24.5	10.4	
◇	0.0	37.2	25.1	24.3	13.4	
▽	0.0	33.9	22.4	18.9	24.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										
□	NV	NP	1.3341	0.4833	0.3214	0.1217				
△	NV	NP	28.0219	3.8913	1.1621	0.3069	0.1052			
◇	NV	NP	10.2071	1.5839	0.8469	0.2607	0.0852			
▽	21.1	16.1	9.8881	1.2379	0.6456	0.1303				

Material Description	USCS	AASHTO
○ No Recovery		
□ Moist loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Wet very dense brown fine gravelly fine to coarse sand w/trace silt.	SP-SM	A-1-b
◇ Wet very dense brown fine gravelly coarse to fine sand w/some silt.	SM	A-1-b
▽ Wet medium dense brown silty fine gravelly coarse sand w/some fine sand and clay.	SC-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** UC-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** UC-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** UC-1 **Depth:** 6.0 **Sample Number:** 4

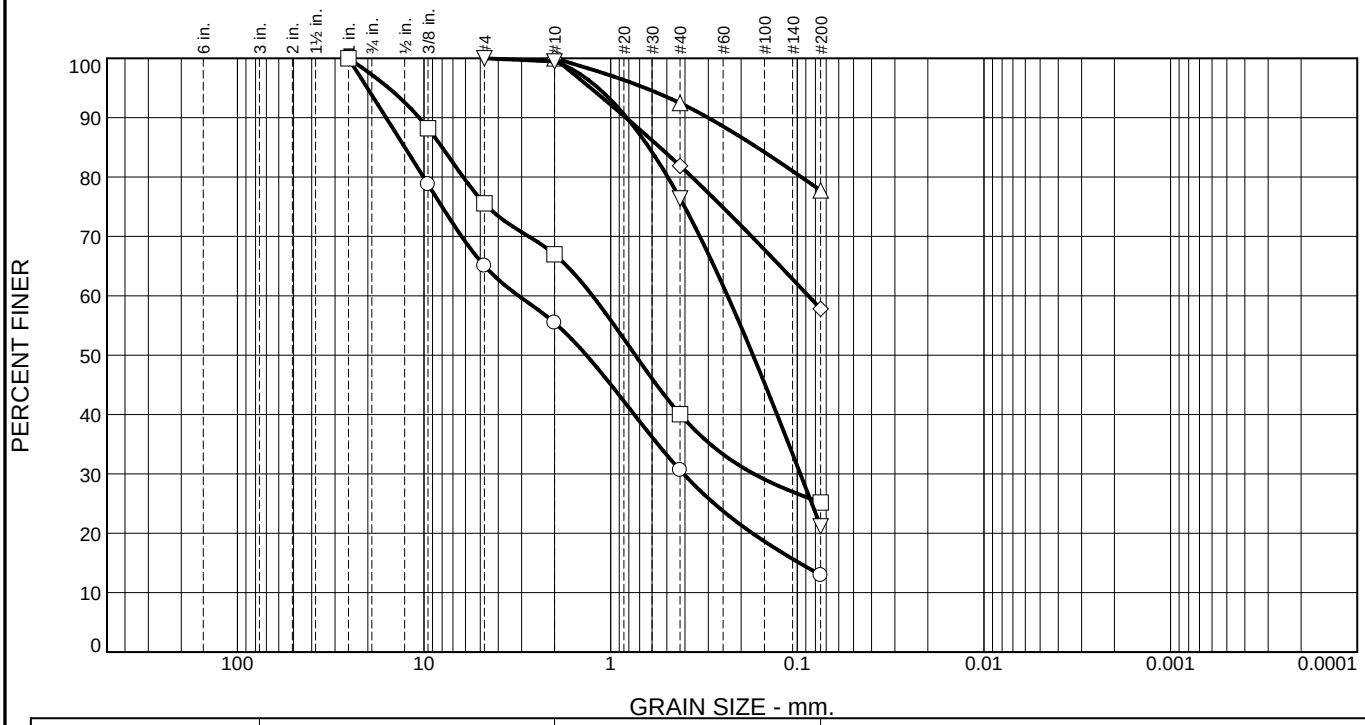
▽ **Source of Sample:** UC-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	44.5	24.9	17.7	12.9	
□	0.0	33.0	26.9	14.9	25.2	
△	0.0	0.0	7.5	14.7	77.8	
◇	0.0	0.0	18.1	24.1	57.8	
▽	0.0	0.5	23.1	55.2	21.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	12.6680	3.1148	1.3485	0.4069	0.0973			
□	NV	NP	7.9947	1.2511	0.7382	0.1709				
△	62.2	39.9	0.1644							
◇	49.6	36.9	0.5452	0.0873						
▽	NV	NP	0.6239	0.2364	0.1728	0.0963				

Material Description	USCS	AASHTO
○ Wet loose brown coarse sandy fine gravel w/some fine sand and silt.	SM	A-1-b
□ Wet very loose brown silty coarse sand and fine gravel w/some fine sand.	SM	A-1-b
△ Saturated soft brown silty clay w/some fine sand, trace of coarse sand.	MH	A-7-5(21)
◇ Saturated very stiff brown fine sandy clay w/some silt and coarse sand.	MH	A-7-5(7)
▽ Saturated medium dense brown silty fine to coarse sand w/trace organic matter.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** UC-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** UC-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** UC-1 **Depth:** 16.0 **Sample Number:** 9

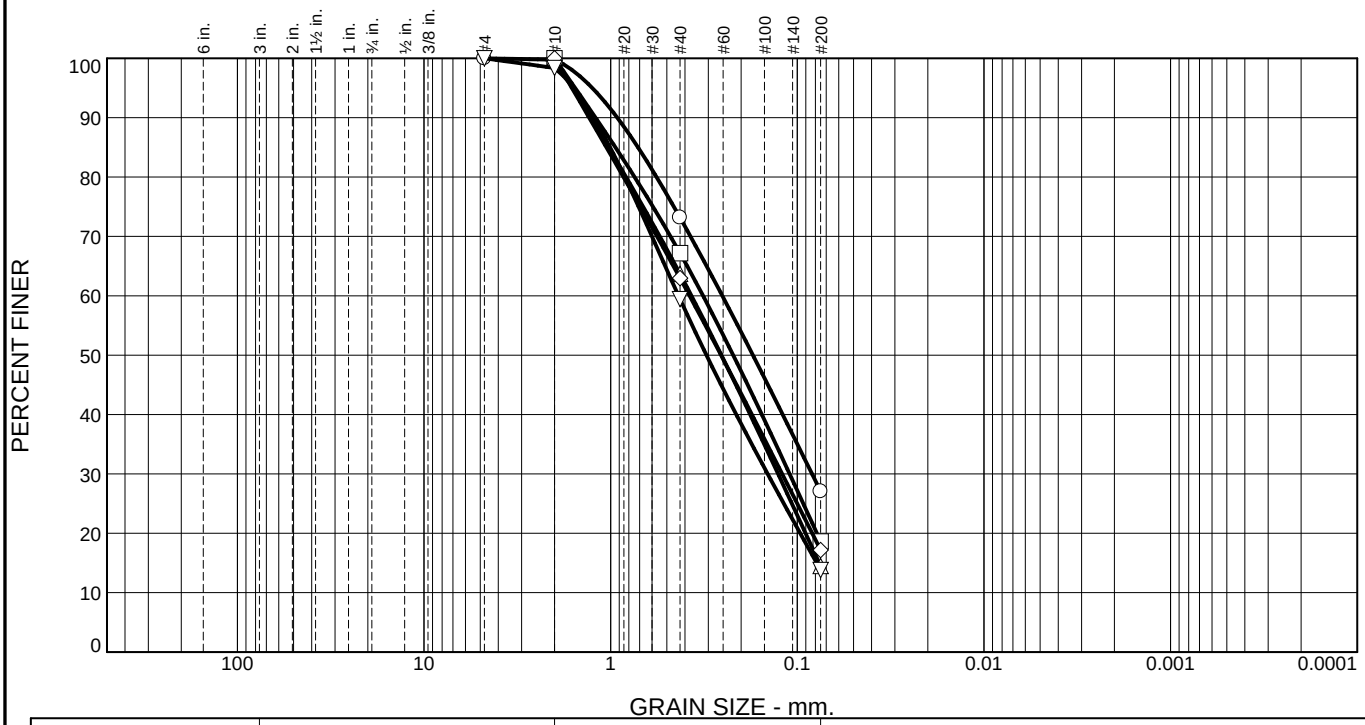
▽ **Source of Sample:** UC-1 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.2	26.6	46.1	27.1	
□	0.0	0.0	32.8	48.6	18.6	
△	0.0	0.0	36.3	49.2	14.5	
◇	0.0	0.0	37.0	45.8	17.2	
▽	0.0	1.6	39.0	45.6	13.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7137	0.2522	0.1730	0.0834				
□	NV	NP	0.9435	0.3198	0.2205	0.1100				
△	NV	NP	1.0268	0.3690	0.2550	0.1268	0.0763			
◇	NV	NP	1.0539	0.3777	0.2560	0.1206				
▽	NV	NP	1.0074	0.4329	0.3067	0.1442	0.0787			

Material Description	USCS	AASHTO
○ Saturated very dense gray silty fine to coarse sand.	SM	A-2-4(0)
□ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
▽ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-1 **Depth:** 29.0 **Sample Number:** 12

□ **Source of Sample:** UC-1 **Depth:** 34.0 **Sample Number:** 13

△ **Source of Sample:** UC-1 **Depth:** 39.0 **Sample Number:** 14

◇ **Source of Sample:** UC-1 **Depth:** 44.0 **Sample Number:** 15

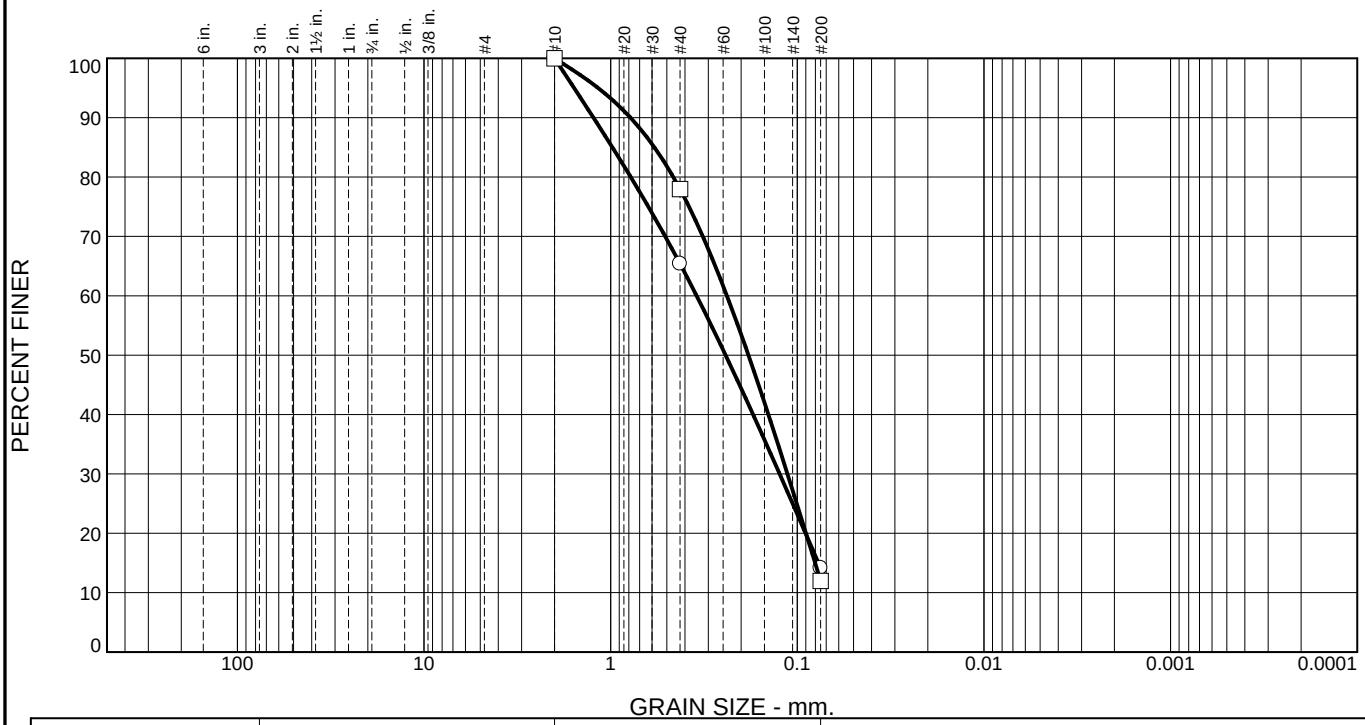
▽ **Source of Sample:** UC-1 **Depth:** 54.0 **Sample Number:** 17

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	34.6	51.2	14.2	
□	0.0	0.0	22.0	66.0	12.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9791	0.3463	0.2422	0.1245	0.0770			
□	NV	NP	0.5828	0.2383	0.1828	0.1130	0.0803			

Material Description	USCS	AASHTO
○ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
□ Saturated very dense gray fine to coarse sand w/some silt.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-1 **Depth:** 59.0 **Sample Number:** 18

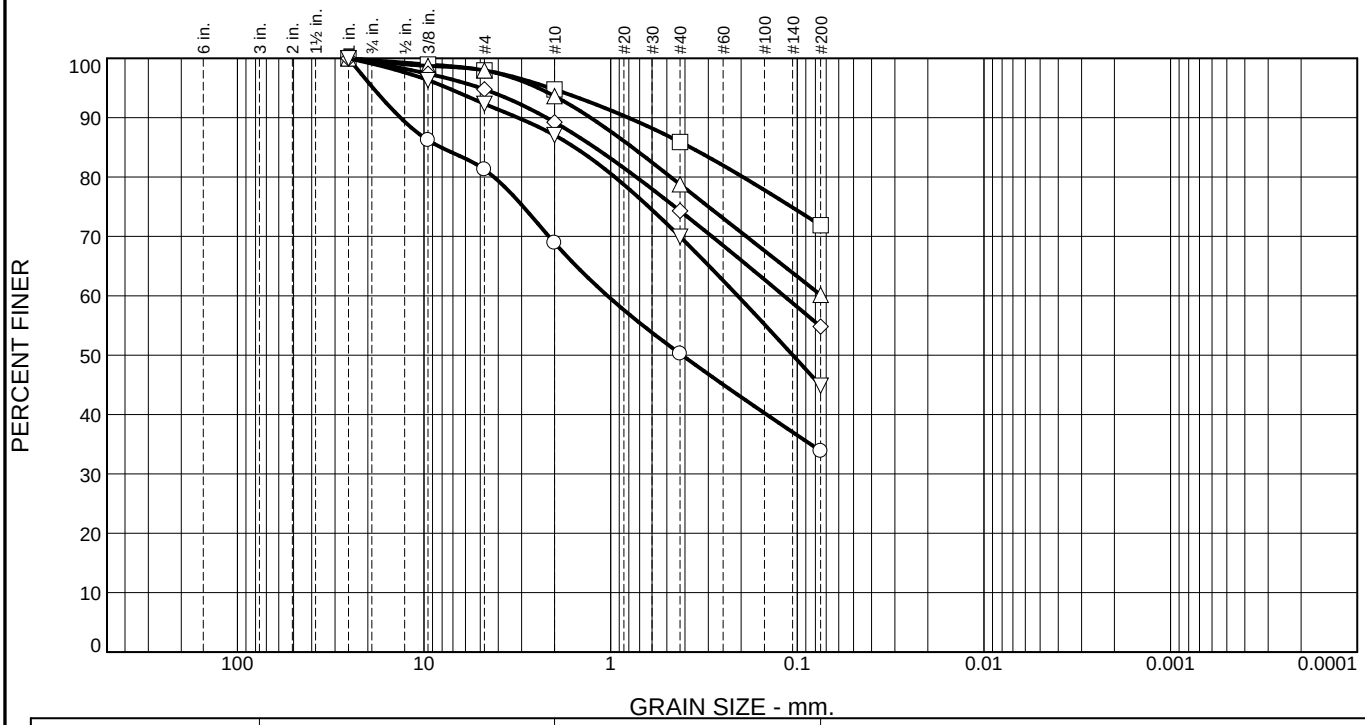
□ **Source of Sample:** UC-1 **Depth:** 64.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	31.1	18.6	16.4	33.9	
□	0.0	5.2	8.9	14.0	71.9	
△	0.0	6.4	14.8	18.6	60.2	
◇	0.0	10.8	14.9	19.5	54.8	
▽	0.0	12.9	17.1	25.1	44.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24.6	17.6	8.1223	1.0398	0.4142					
□	24.5	17.8	0.3742							
△	30.7	16.6	0.7653							
◇	27.8	16.9	1.2198	0.1180						
▽	25.6	15.5	1.5578	0.2087	0.1058					

Material Description	USCS	AASHTO
○ Wet brown gravelly fine gravel w/some coarse to fine sand and silt.	SC-SM	A-2-4(0)
□ Wet soft brown clayey silt w/some fine sand, trace of coarse sand and fine gravel.	CL-ML	A-4(2)
△ Wet firm brown silty clay w/some fine to coarse sand, trace of fine gravel.	CL	A-6(6)
◇ Wet firm brown clay w/some silt, fine to coarse sand and fine gravel.	CL	A-6(3)
▽ Wet firm brown clayey fine sandy silt w/some coarse sand and fine gravel.	SC	A-4(1)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** UC-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** UC-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** UC-2 **Depth:** 6.0 **Sample Number:** 4

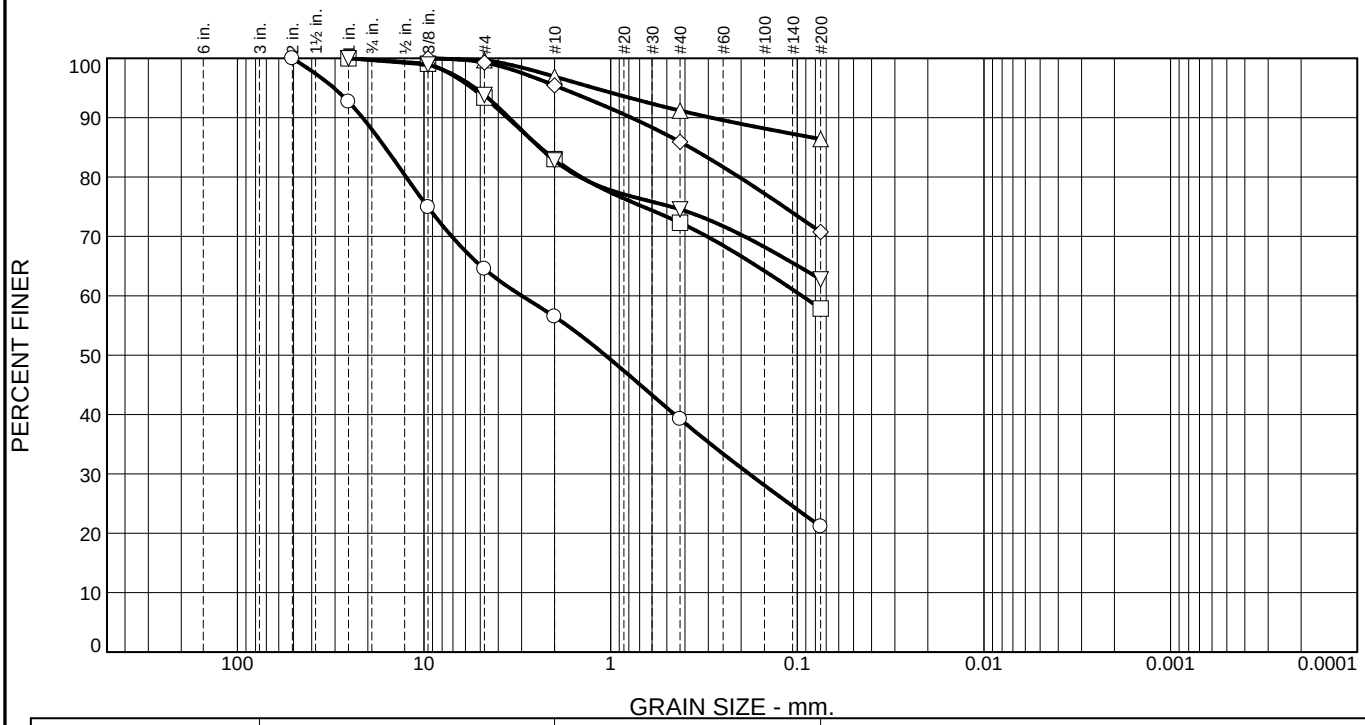
▽ **Source of Sample:** UC-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	43.5	17.3	18.1	21.1	
□	0.0	17.0	10.7	14.4	57.9	
△	0.0	3.1	5.7	4.8	86.4	
◇	0.0	4.6	9.5	15.1	70.8	
▽	0.0	17.2	8.2	11.8	62.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22.2	14.9	16.1564	2.9955	1.0680	0.1810				
□	40.6	24.3	2.3847	0.0945						
△	67.7	42.5								
◇	62.0	40.5	0.3758							
▽	61.8	39.4	2.4111							

Material Description	USCS	AASHTO
○ Wet medium dense brown clayey fine gravel w/some fine to coarse sand, trace of silt.	SC-SM	A-2-4(0)
□ Saturated stiff brown clay w/some fine to coarse sand, fine gravel and silt.	CL	A-7-6(8)
△ Saturated stiff brown organic silty clay w/trace coarse to fine sand and fine gravel.	MH	A-7-5(29)
◇ Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand and fine gravel.	MH	A-7-5(18)
▽ Saturated very stiff gray organic silty clay w/some fine sand and fine gravel, trace of coarse sand.	MH	A-7-5(15)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** UC-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** UC-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** UC-2 **Depth:** 16.0 **Sample Number:** 9

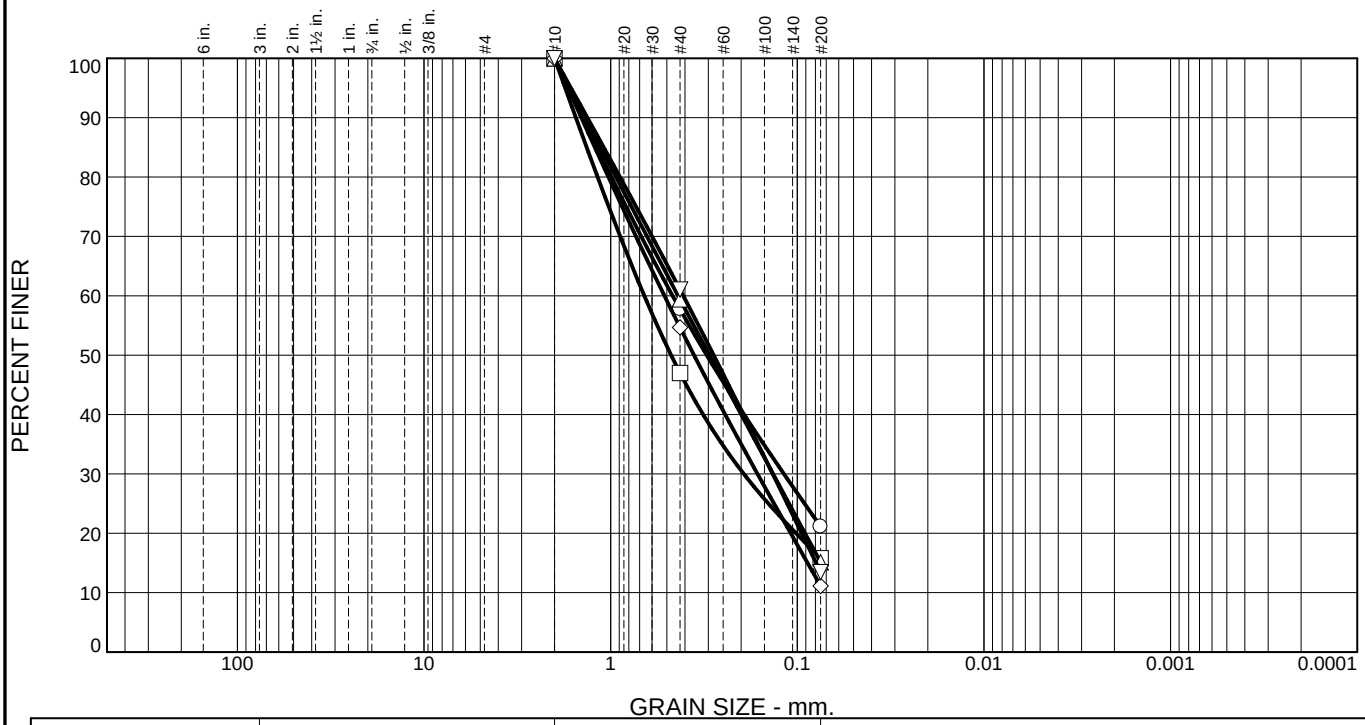
▽ **Source of Sample:** UC-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	42.3	36.6	21.1	
□	0.0	0.0	53.0	31.2	15.8	
△	0.0	0.0	40.6	44.3	15.1	
◇	0.0	0.0	45.3	43.6	11.1	
▽	0.0	0.0	38.9	47.7	13.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1831	0.4657	0.3057	0.1180				
□	NV	NP	1.3449	0.6602	0.4743	0.1936				
△	NV	NP	1.1320	0.4350	0.2952	0.1349				
◇	NV	NP	1.2160	0.5153	0.3574	0.1634	0.0881			
▽	NV	NP	1.0893	0.4083	0.2806	0.1355	0.0793			

Material Description	USCS	AASHTO
○ Saturated dense gray silty coarse to fine sand.	SM	A-2-4(0)
□ Saturated dense gray coarse to fine sand w/some silt.	SM	A-1-b
△ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Saturated very dense gray coarse to fine sand w/some silt.	SP-SM	A-2-4(0)
▽ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-2 **Depth:** 26.0 **Sample Number:** 11

□ **Source of Sample:** UC-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** UC-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** UC-2 **Depth:** 39.0 **Sample Number:** 14

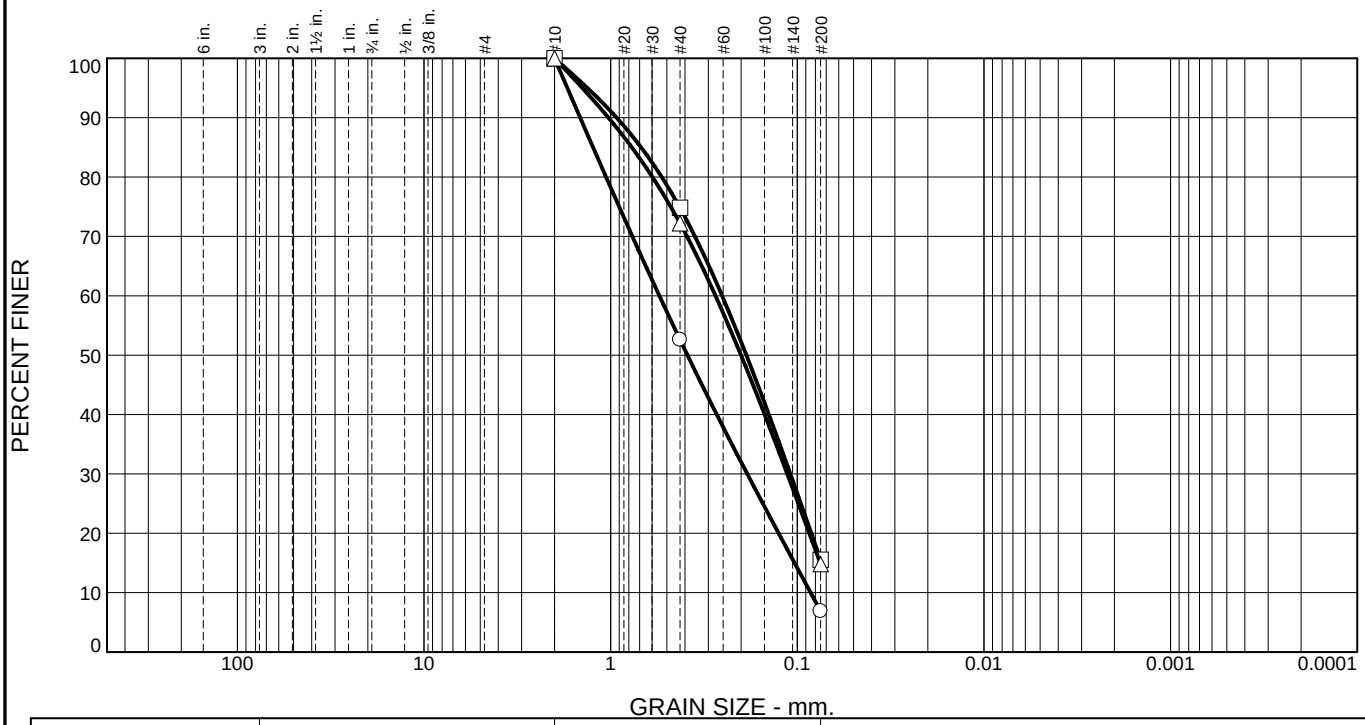
▽ **Source of Sample:** UC-2 **Depth:** 54.0 **Sample Number:** 17

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	47.4	45.7	6.9	
□	0.0	0.0	25.2	59.3	15.5	
△	0.0	0.0	27.8	57.4	14.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2425	0.5482	0.3878	0.1855	0.1034	0.0849	0.74	6.46
□	NV	NP	0.6868	0.2527	0.1876	0.1090				
△	NV	NP	0.7704	0.2742	0.2004	0.1132	0.0754			

Material Description	USCS	AASHTO
○ Saturated very dense gray coarse to fine sand w/trace silt.	SP-SM	A-3
□ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** UC-2 **Depth:** 59.0 **Sample Number:** 18

□ **Source of Sample:** UC-2 **Depth:** 64.0 **Sample Number:** 19

△ **Source of Sample:** UC-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

ENGINEERING & TESTING SERVICES, INC.

March 4, 2016

To: Walton Corporation
P.O.Box 1097
Newark, Delaware 19715

Attn: Mr. Randy Ferguson

Re: **Direct Shear Test Results**
ETS Report No.: ETS-16T133-1
Task 48, T201407003, Bridge 1-449 on Union Church Road

Dear Mr. Ferguson:

Engineering & Testing Services, Inc. (ETS) is pleased to submit the completed Direct Shear Test results performed at our AASHTO accredited soils laboratory in Virginia Beach, Virginia. On February 9, 2016, Walton Corporation delivered a Shelby tube soil sample to our laboratory. The Shelby tube was labeled as UC-1, depth 18 to 20 feet, Task 48, T 201407003. The following describes the procedures, methodologies, and apparatuses used to complete the test.

1. Test Specimen Extrusion and Preparation

The undisturbed soil sample was carefully extruded from the Shelby tube to ensure minimal disturbance. The undisturbed soil specimens were trimmed from the soil sample per ASTM standards, and immediately transferred into the direct shear machine for testing. A Geotechnical Engineer from our office performed the direct shear test in accordance with ASTM Standard (ASTM D3080-11) Standard Test Method for Direct Shear Test of Soils under Consolidated Drained Conditions). The test was conducted by using the most modern direct shear test machine available in the market produced by **HUMBOLDT** as illustrated in Figure 1.

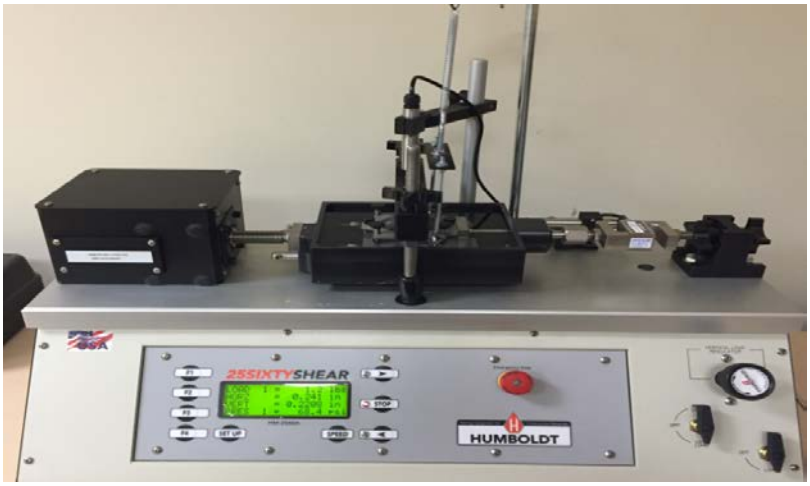


Figure 1: Direct Sheart Test Machine

The extruded soil sample was preserved in temperature controlled room to minimize the loss of water content. Three soil specimens were prepared to perform the direct shear test at three different normal loads. The soil specimens were designated as Specimens A through C. The normal loads applied on each specimen during testing are listed in Table 1.

Table 1: Applied Normal Stress on the Soil Specimens	
Soil Designation	Shear Stress (Tsf)
A	0.5
B	1
C	2

2. Consolidation Stage

Before applying the respective normal stresses on the specimens, the shear box container was filled with water to achieve saturation, and kept full for the duration of the test. To initiate the consolidation stage, the specified normal stresses as shown in Table 1 were applied to each soil specimen. The normal stresses were maintained until the primary consolidation was achieved based on either of the following: interpretation of time versus normal vertical deformation or a waiting period of at least 24 hours. The total estimated elapsed time to failure was calculated based on the time required to achieve 90 percent consolidation as illustrated in Figure 2. Following, the displacement/strain rate was calculated and used during testing for shearing the specimen under drained condition according with ASTM D-3080-11.

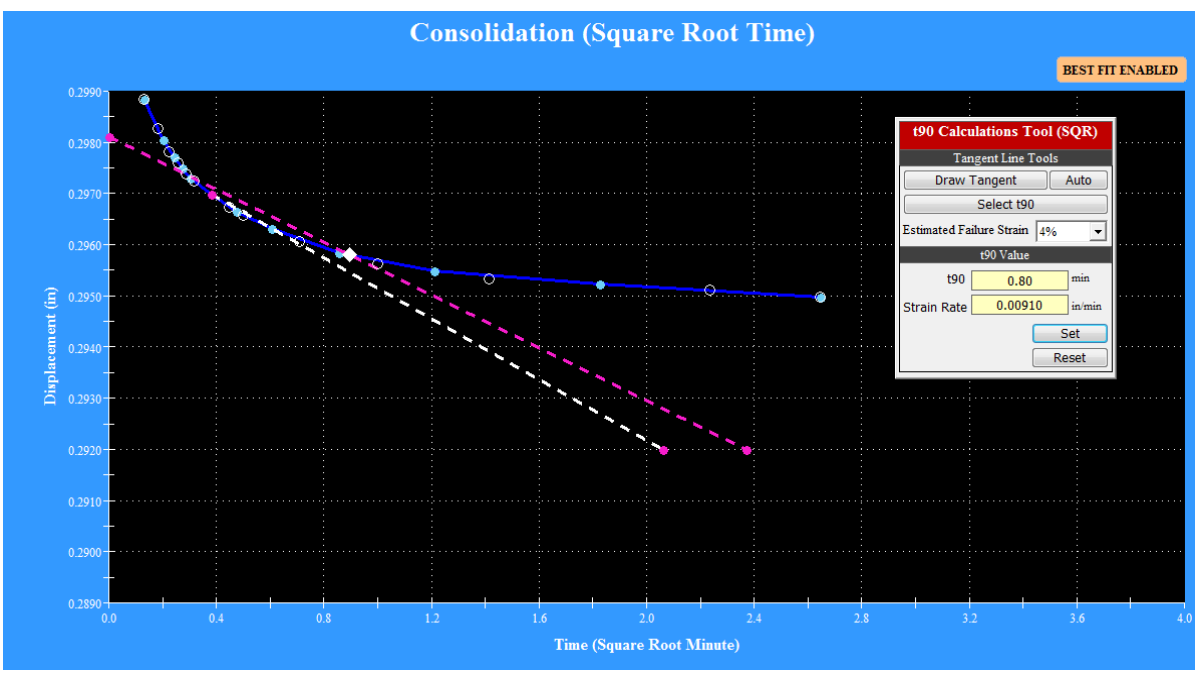


Figure 2: Determination of Time Required to Achieve 90% Consolidation

3. Shear Stage

Prior to applying the shear force on the soil specimens, the ETS geotechnical engineer computed the displacement rate based on the time required to achieve 90% consolidation. The shear force was applied to the soil specimen using the displacement rate. According to ASTM-D3080, the soil specimen should be sheared within the range from 10 to 15 percent relative lateral displacement. Therefore, it was specified that the threshold value of the shear failure should be at 0.375 inch horizontal displacement and/or the shear force decreases while the horizontal displacement increases. When the sample reached failure due to the applied shear force, the test was terminated. The test results should be used conservatively by the designers and are included in Appendix I of this report.

4. Laboratory Tests

At the time of testing, the soils specimens consisted of gray, organic silt (OH) classified as A-7-5(91). The samples were subjected to natural moisture content testing (ASTM D2216), Particle-Size Analysis (ASTM D422), Atterberg Limits (ASTM D4318) testing, Specific Gravity testing (ASTM D854) and visual classification (ASTM D2487, D2488) by the ETS engineering staff. All laboratory test procedures were conducted in accordance with applicable ASTM standards, under the supervision of a Professional Engineer licensed in the Commonwealth of Virginia and in strict adherence to the Quality Assurance program established and documented in the ETS Quality Manual and Quality test procedures. The classification laboratory test results are included in Appendix II of this report.

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report, do not hesitate to call our office at 757-306-1040.

Respectfully Submitted,
Engineering & Testing Services, Inc.

Charlie T. Nabhan, PE
Principal Geotechnical Engineer
VA License No.: 25133

Raju Acharya, Ph.D.
Geotechnical Staff Engineer

APPENDICES

APPENDIX I – DIRECT SHEAR TEST RESULTS

APPENDIX II – CLASSIFICATION LABORATORY TEST RESULTS

APPENDIX I – DIRECT SHEAR TEST RESULTS

Engineering & Testing Services, Inc

Direct Shear Test (ASTM D3080)

Date 3/4/2016

C.T.N.

Checked By

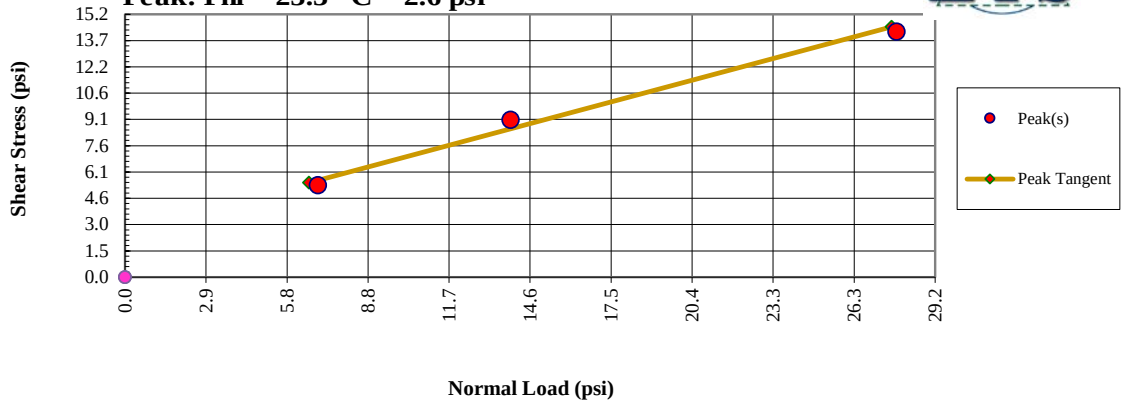
2/29/2016

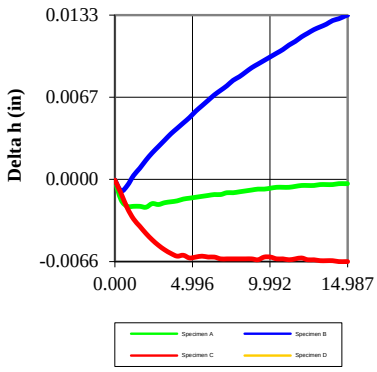
Date

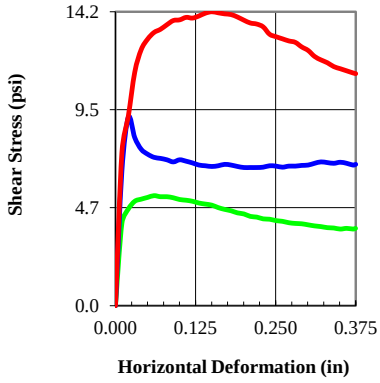
R. Acharya

Tested By

Peak: Phi = 23.3 C = 2.6 psi







Initial	Specimen A	B	C	D
Moisture (%)	64.63	64.63	64.63	
Density (pcf)	61.57	62.76	61.24	
Void Ratio	1.696	1.645	1.710	
Saturation (%)	100.00	100.00	100.00	
Diameter (in)	2.500	2.500	2.500	
Height (in)	1.049	0.994	1.005	
Specific Gravity	2.659	2.659	2.659	

Final	A	B	C	D
Moisture (%)	69.50	67.35	65.36	
Density (pcf)	59.19	60.67	59.10	
Void Ratio	1.805	1.736	1.809	
Saturation (%)	100.00	100.00	97.42	
Diameter (in)	2.500	2.500	2.500	
Height (in)	1.035	0.984	0.996	
Normal Stress (psi)	6.9	13.9	27.8	
Peak Stress (psi)	5.3	9.1	14.2	
Residual Stress (psi)				
Strain (%)	14.976	14.987	14.987	
Rate (in/min)	0.0058	0.0046	0.0052	

Project Date
Date

Project:	Bridge 1-449 on Union Church Road
Location:	
Project Number:	ETS-16T133
Boring Number	UC-1
Sample Number:	
Depth:	18-20'
Sample Type:	Undisturbed
Description:	Gray, Organic Silt (OH)
Test Type:	Direct Shear
Remarks:	

A	B	C	N/A
Failure Photographs			

Engineering & Testing Services, Inc

Direct Shear Test (ASTM D3080)

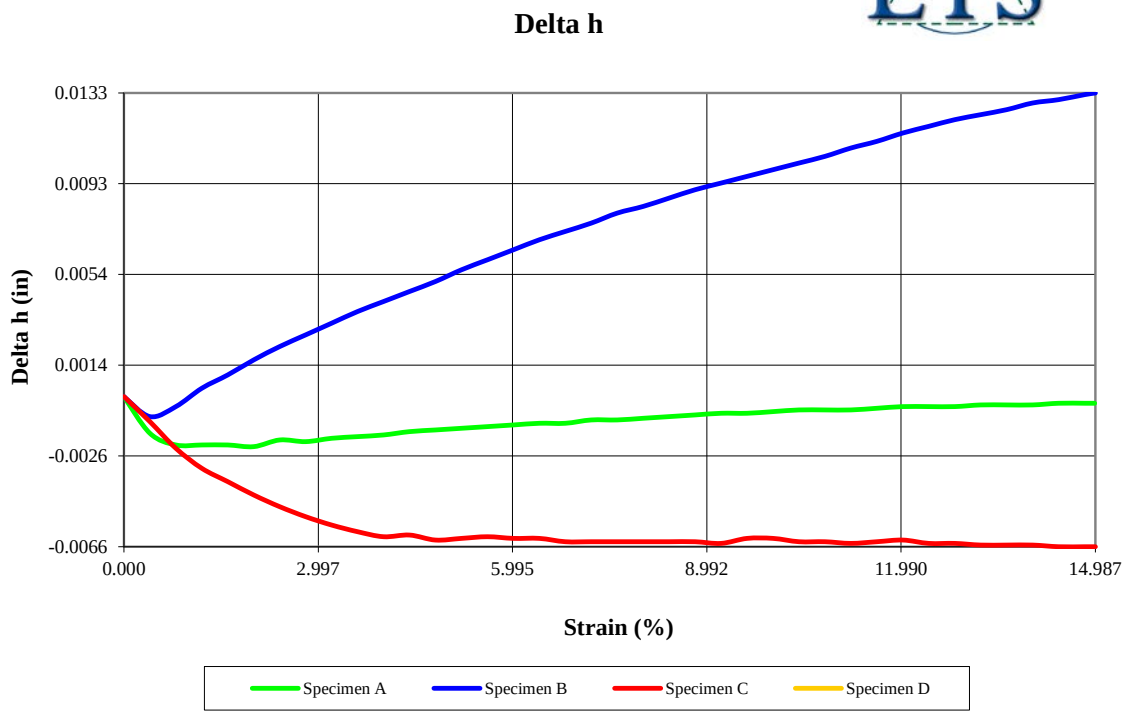
Date 3/4/2016

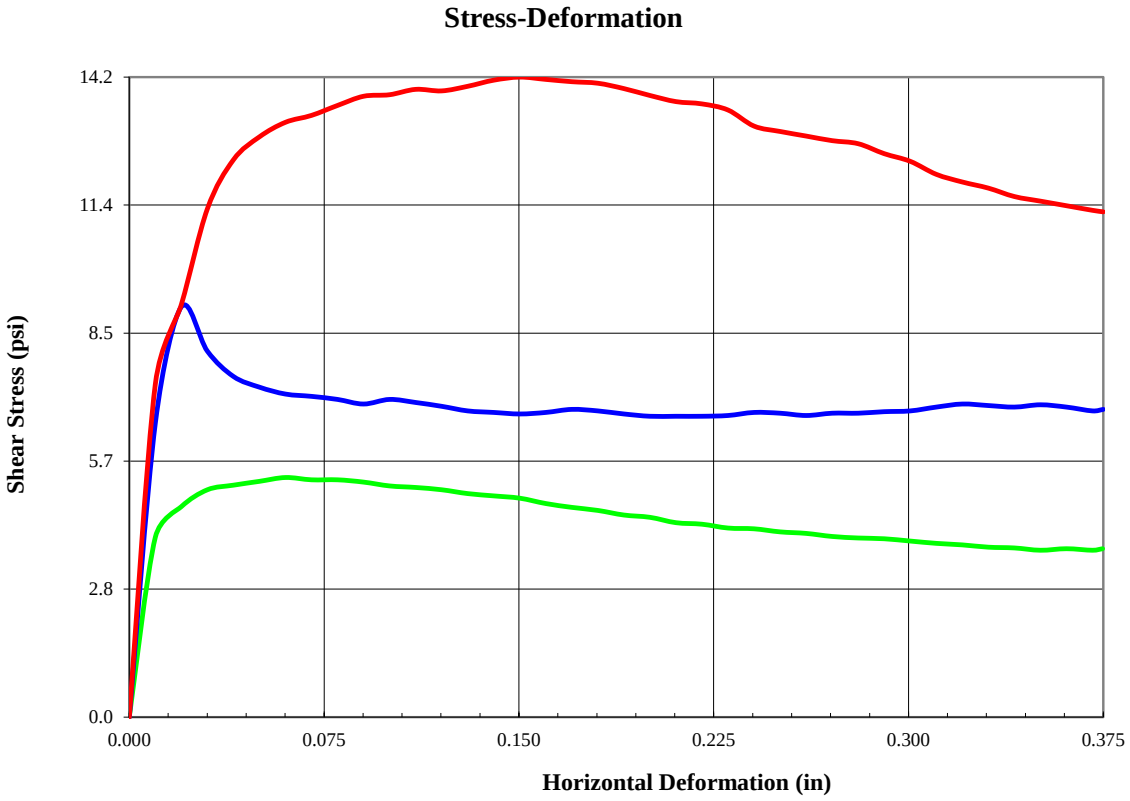
Checked By C.T.N.

2/29/2016

Date

Tested By R. Acharya





Engineering & Testing Services, Inc

Direct Shear Test

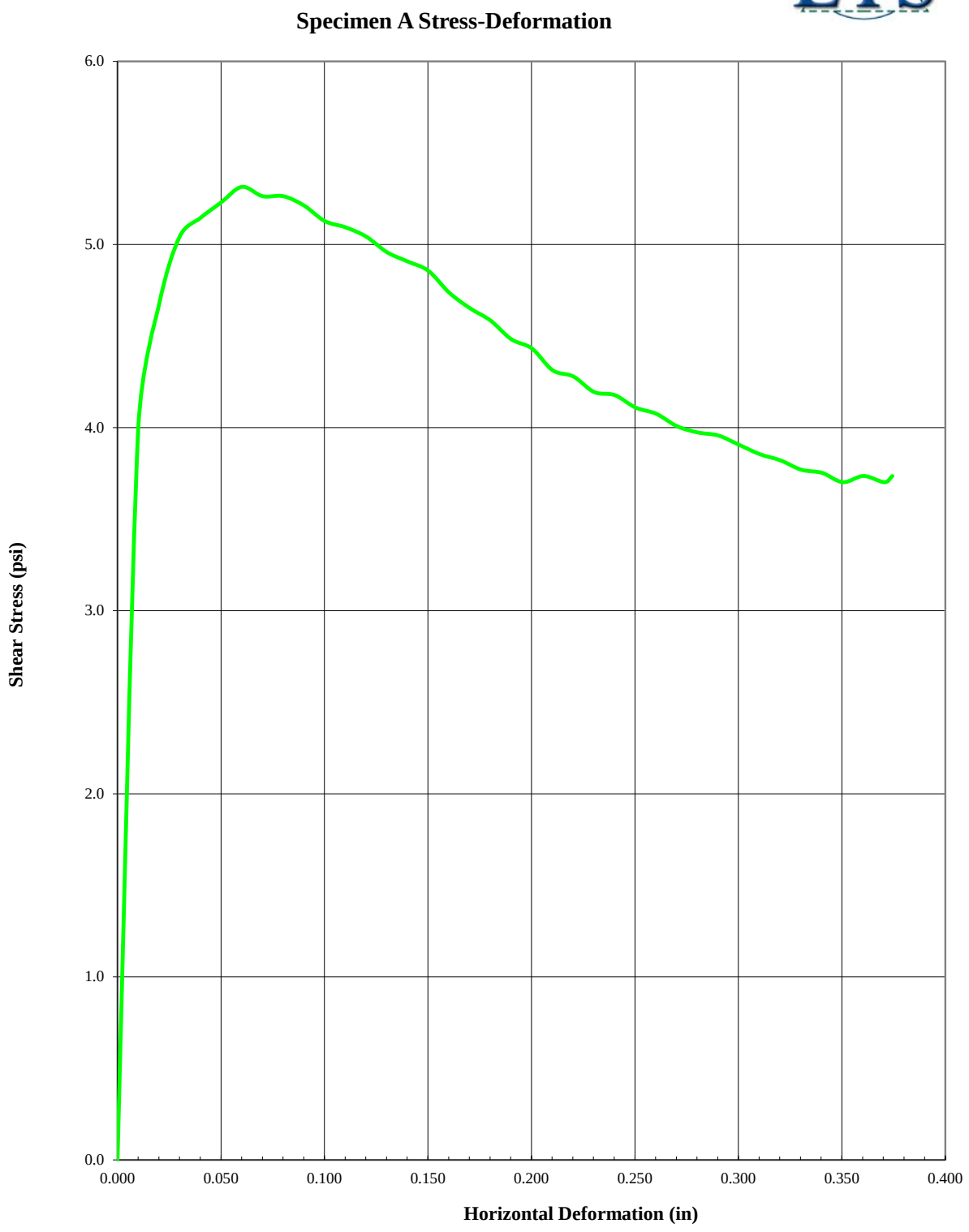
Date 3/4/2016

Checked By C.T.N.

2/29/2016

Date

Tested By R. Acharya



UC-1.HSD

Engineering & Testing Services, Inc

Direct Shear Test

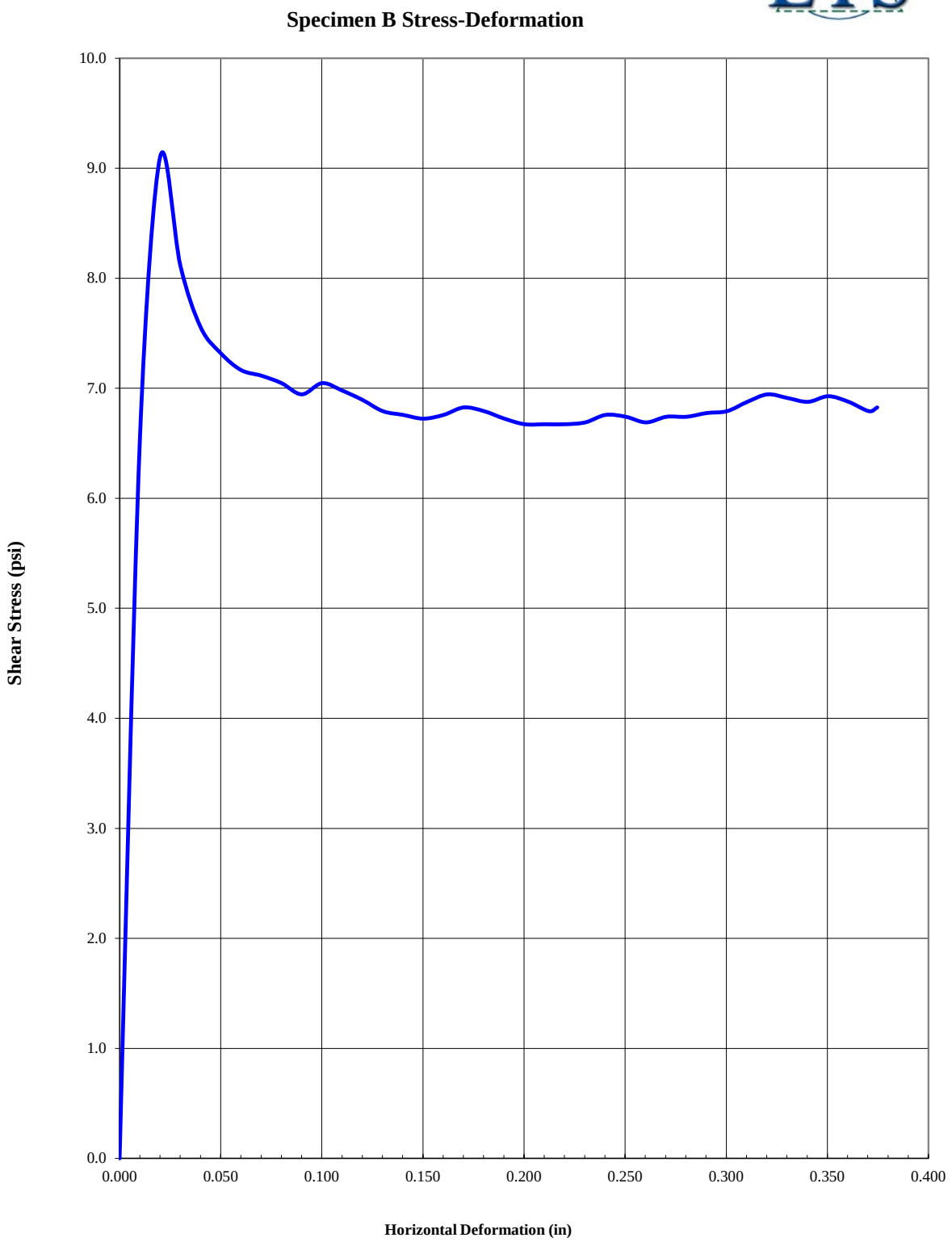
Date 3/4/2016

Checked By C.T.N.

2/29/2016

Date

Tested By R. Acharya



UC-1.HSD

Engineering & Testing Services, Inc

Direct Shear Test

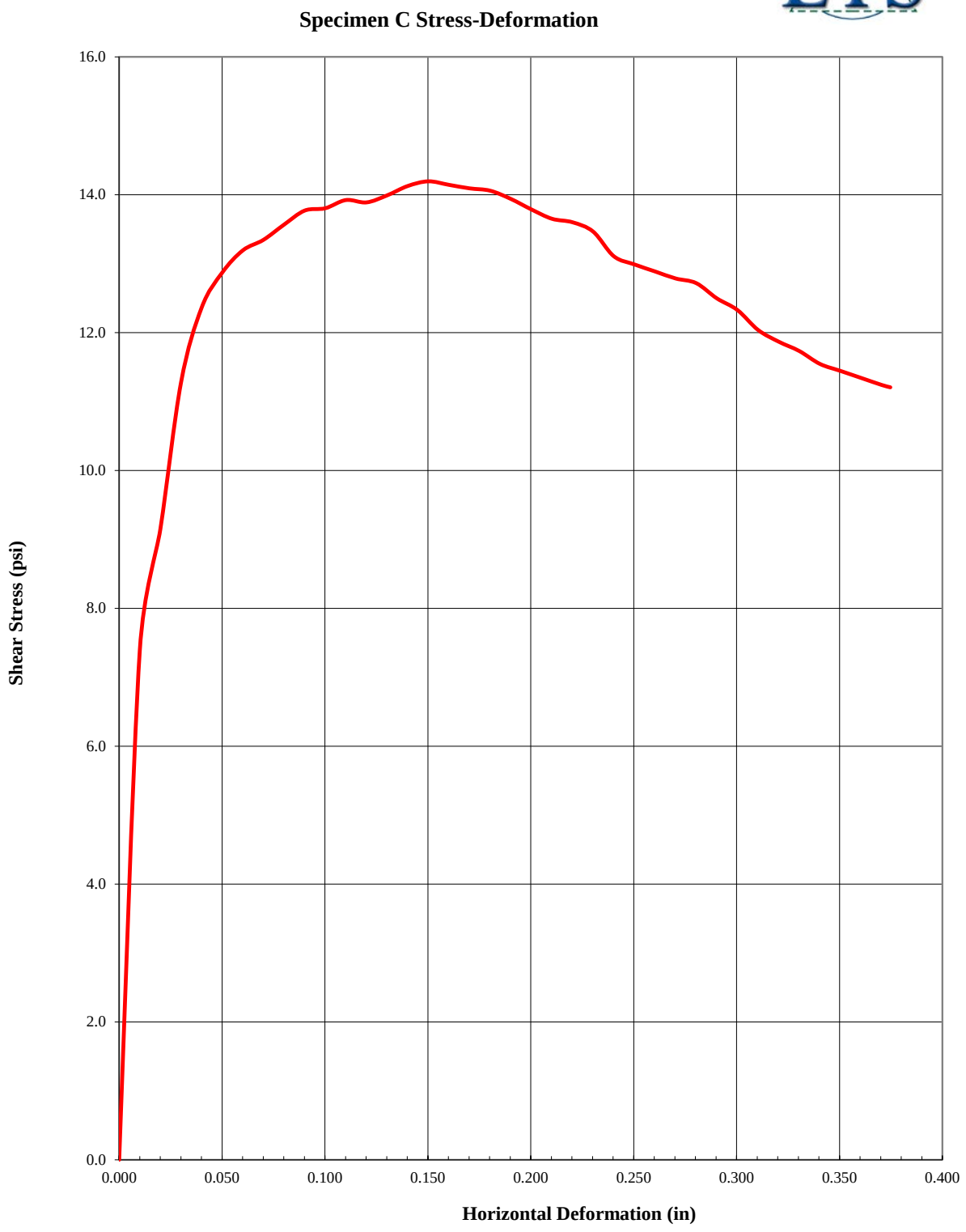
Date 3/4/2016

Checked By C.T.N.

2/29/2016

Date

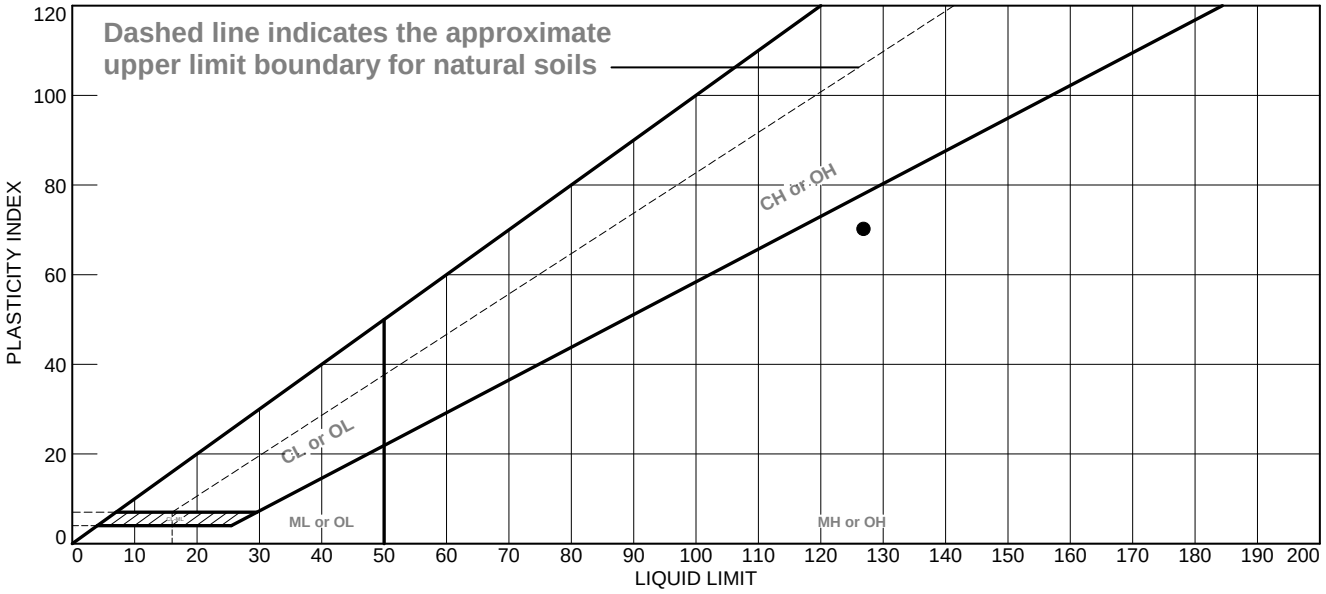
Tested By R. Acharya

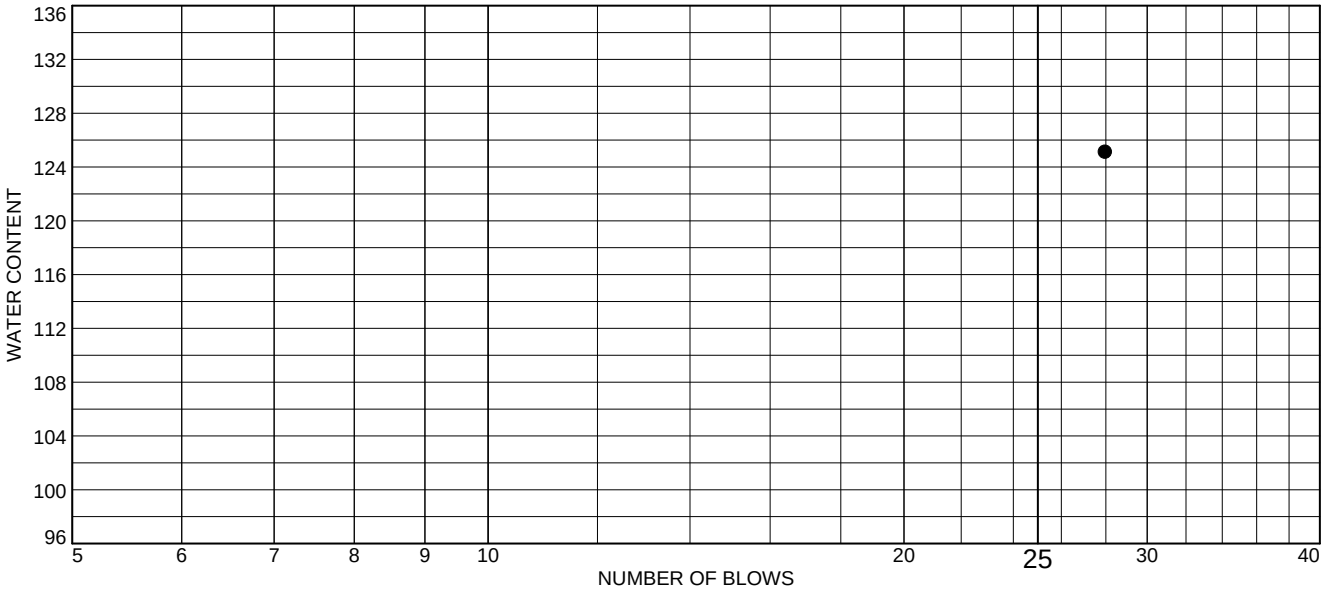


UC-1.HSD

APPENDIX II – CLASSIFICATION LABORATORY TEST RESULTS

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY, ORGANIC SILT (OH)	127	57	70	99.3	99.2	OH

Project No. ETS-16T133 **Client:** Walton Corporation

Project: Bridge 1-449 on Union Church Road

Sample Number: UC-1 **Depth:** 18-20

Remarks:

ENGINEERING AND TESTING SERVICES, INC.

Virginia Beach, VA

Figure

Tested By: MM **Checked By:** R. ACHARYA, PhD

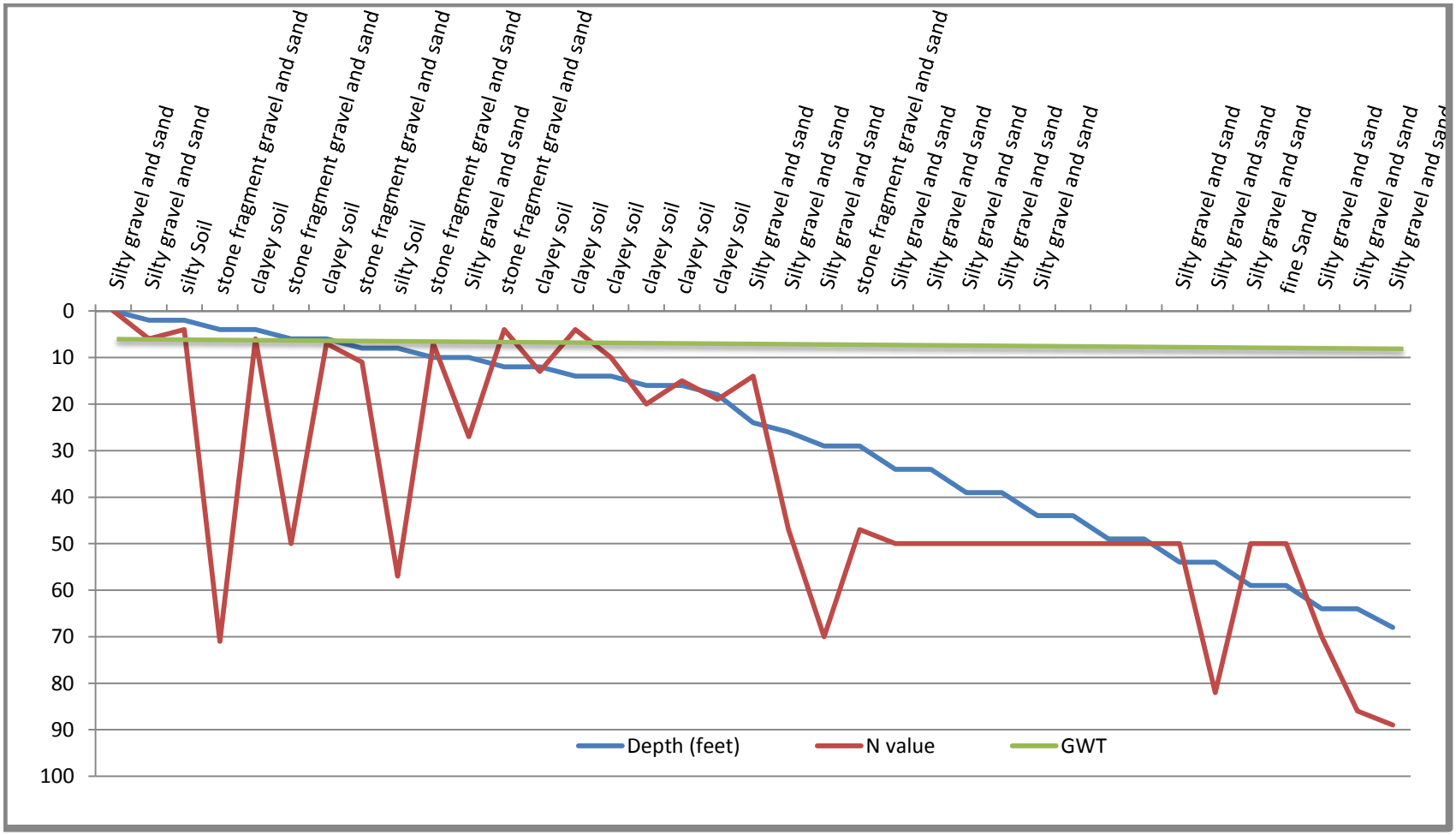
Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
UC-1														
	1		No Recovery											
	2	2	Moist loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	10.6	SM	A-2-4(0)	91.2	21.1	4	3	3	2
	3	4	Wet very dense brown fine gravelly fine to coarse sand w/trace silt.	NV	NP	16.1	SP-SM	A-1-b	55.8	10.4	13	32	39	49
	4	6	Wet very dense brown fine gravelly coarse to fine sand w/some silt.	NV	NP	17.1	SM	A-1-b	62.8	13.4	50			
	5	8	Wet medium dense brown silty fine gravelly coarse sand w/some fine sand and clay.	21.1	5	11.5	SC-SM	A-1-b	66.1	24.8	5	2	9	10
	6	10	Wet loose brown coarse sandy fine gravel w/some fine sand and silt.	NV	NP	18.2	SM	A-1-b	55.5	12.9	8	5	2	2
	7	12	Wet very loose brown silty coarse sand and fine gravel w/some fine sand.	NV	NP	26.5	SM	A-1-b	67	25.2	3	2	2	2
	8	14	Saturated soft brown silty clay w/some fine sand, trace of coarse sand.	62.2	22.3	73.6	MH	A-7-5(21)	100	77.8	3	2	2	3
	9	16	Saturated very stiff brown fine sandy clay w/some silt and coarse sand.	49.6	12.7	55.3	MH	A-7-5(7)	100	57.8	7	9	11	11
	U-1	18												
	11	24	Saturated medium dense brown silty fine to coarse sand w/trace organic matter.	NV	NP	35	SM	A-2-4(0)	99.5	21.2	8	9	5	4
	12	29	Saturated very dense gray silty fine to coarse sand.	NV	NP	29.2	SM	A-2-4(0)	99.8	27.1	18	20	50	
	13	34	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	25.3	SM	A-2-4(0)	100	18.6	38	50		
	14	39	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	22.6	SM	A-2-4(0)	100	14.5	34	50		
	15	44	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	22.7	SM	A-2-4(0)	100	17.2	50			
	16	49	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt.	NV	NP	24.5					32	50		
	17	54	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	22	SM	A-2-4(0)	98.4	13.8	24	50		
	18	59	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	26.4	SM	A-2-4(0)	100	14.2	25	50		
	19	64	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	28	SP-SM	A-2-4(0)	100	12	16	23	47	49
	20	68	No Recovery											
		70	End Boring											
	1		Wet brown gravelly fine gravel w/some coarse to fine sand and silt.	24.6	7	16.7	SC-SM	A-2-4(0)	68.9	33.9				
	2	2	Wet soft brown clayey silt w/some fine sand, trace of coarse sand and fine gravel.	24.5	6.7	21.8	CL-ML	A-4(2)	94.8	71.9	2	2	2	2
	3	4	Wet firm brown silty clay w/some fine to coarse sand, trace of fine gravel.	30.7	14.1	20.6	CL	A-6(6)	93.6	60.2	3	3	3	4
	4	6	Wet firm brown clay w/some silt, fine to coarse sand and fine gravel.	27.8	10.9	19.8	CL	A-6(3)	89.2	54.8	3	3	4	3
	5	8	Wet firm brown clayey fine sandy silt w/some coarse sand and fine gravel.	25.6	10.1	19.9	SC	A-4(1)	87.1	44.9	WH	WH	7	8
	6	10	Wet medium dense brown clayey fine gravel w/some fine to coarse sand, trace of silt.	22.2	7.3	13.7	SC-SM	A-2-4(0)	56.5	21.1	15	20	7	8
	7	12	Saturated stiff brown clay w/some fine to coarse sand, fine gravel and silt.	40.6	16.3	51.2	CL	A-7-6(8)	83	57.9	9	7	6	2
	8	14	Saturated stiff brown organic silty clay w/trace coarse to fine sand and fine gravel.	67.7	25.2	67	MH	A-7-5(29)	96.9	86.4	4	5	5	7
	9	16	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand and fine gravel.	62	21.5	48.9	MH	A-7-5(18)	95.4	70.8	7	7	8	9
	10	18	Saturated very stiff gray organic silty clay w/some fine sand and fine gravel, trace of coarse sand.	61.8	22.4	45.9	MH	A-7-5(15)	82.8	62.8	7	9	10	9
	U-1	24	No Recovery											
	11	26	Saturated dense gray silty coarse to fine sand.	NV	NP	24.5	SM	A-2-4(0)	100	21.1	15	22	25	28
	12	29	Saturated dense gray coarse to fine sand w/some silt.	NV	NP	23	SM	A-1-b	100	15.8	13	17	30	32
	13	34	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	22	SM	A-2-4(0)	100	15.1	32	50		
	14	39	Saturated very dense gray coarse to fine sand w/some silt.	NV	NP	19.9	SP-SM	A-2-4(0)	100	11.1	30	50		
	15	44	No sieve analysis - Indication of saturated very dense gray coarse to fine sand w/some silt.								41	50		
	16	49	No sieve analysis - Indication of saturated very dense gray coarse to fine sand w/some silt.								50			
	17	54	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	21.3	SM	A-2-4(0)	100	13.4	25	32	50	
	18	59	Saturated very dense gray coarse to fine sand w/trace silt.	NV	NP	21.1	SP-SM	A-3	100	6.9	37	50		
	19	64	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	24.8	SM	A-2-4(0)	100	15.5	25	36	50	
	20	68	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	25.3	SM	A-2-4(0)	100	14.8	21	39	50	
		70	End Boring											

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4

DATE : 4-13-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR1-449 on Union church Rd over Herring Run - Townsend, DE



DATE : 4-13-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR1-449 on Union church Rd over Herring Run - Townsend, DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-10-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-454 on Eagles Nest Landing Rd over Sawmill Branch- Townsend, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-4-2016 and 1-5-2016. Walton Corporation- Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation and two Shelby tube was collected. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix-A.

2. Area Geology Background

The geological background of this area was found using Smyrna- Clayton Area, Delaware According to Geologic Map Series No. 5 by Thomas Pickett and Richard Benson 1977 this site is situated in TERTIARY Chesapeake Group and the general description of the soil it is Predominantly Sandy Silt or Sand , bluish gray to light olive gray; diatomaceous, particularly in the lower Miocene, Subordinate sands are quartzose, medium- to course- grained, may be Shelly; where well- developed used as aquifers, Cheswold(chs) and Frederica (fred) aquifers.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John K. Adams, Durward H. Boggess, and O.J Coskery (1964) Atlas HA- 83. The nearest well to this site the groundwater historically had been measured as 30 feet on September 1958 and between the years of 1950 to 1962 appeared from 28 to 34 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 28 feet down is Silty or Clayey gravel and sand (A-2-4) and from 28 to 72 feet down is fine sand (A-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Smyrna- Clayton Delaware; Map Series, No. 10, by A. Scott Andres June 2001. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 3 to 8 inches of asphalt top of 2 inches of stone.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 3 and 8 feet and caved at 7 and 12 feet all the measurements is below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 5.9 to 79.6 percent. The Atterberg limit is 83 percent, Liquid limits is the range of 17.2 to 93.6 percent and Plasticity Index is the range of 2.3 to 39.6 percent. The Organic matter is 47 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is not in a good condition and 10 feet in thickness of firm to stiff of organic silty clay appeared at 14 feet down from the surface elevation this layer need to be consider in the design. In addition the entire sample from the depth of 2 to 12 feet from the surface had been met borrow type material "A, and "F" only according to Del-DOT standard specification with fair amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

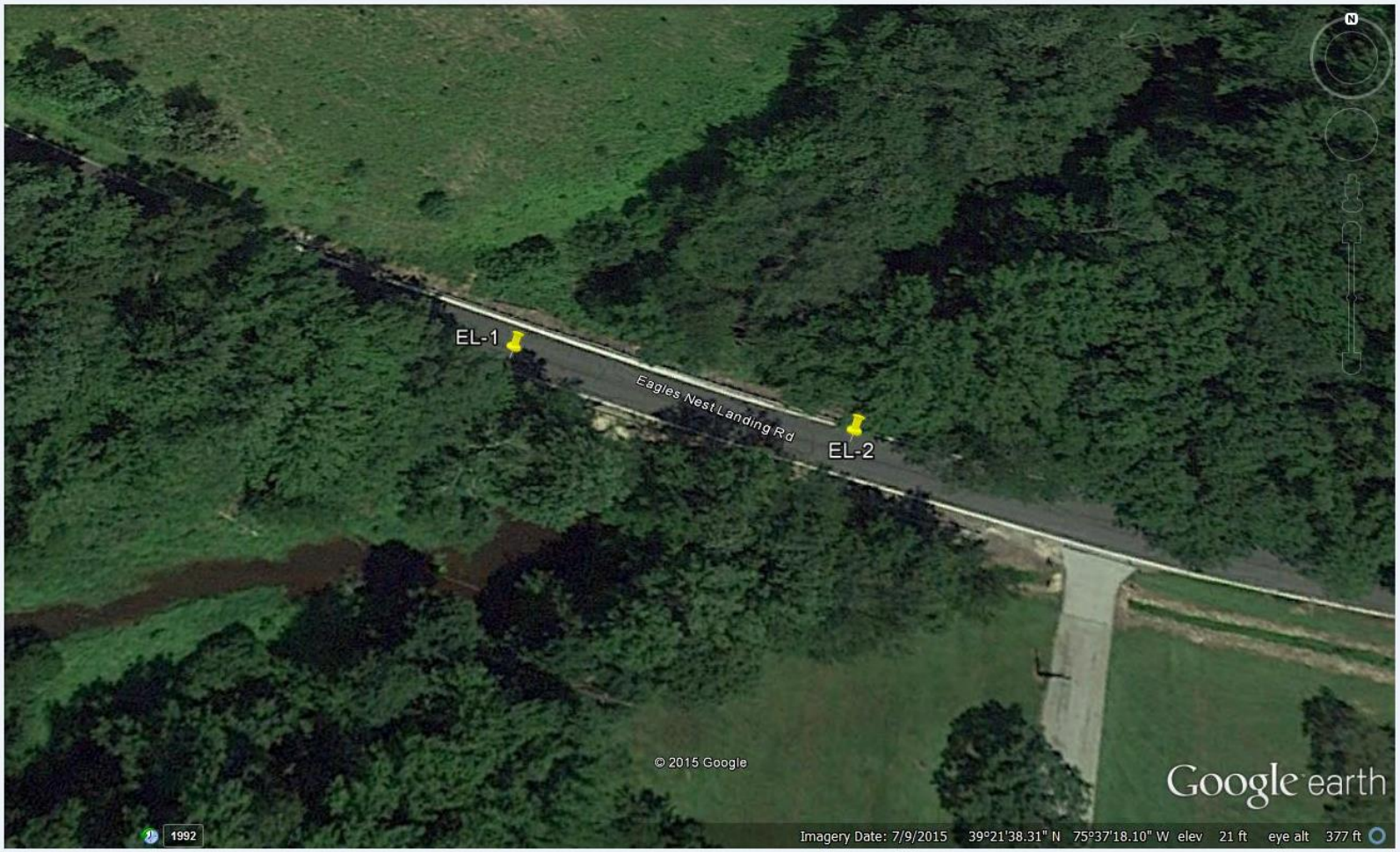
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 3-10-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-454 on Eagles Nest Landing Rd over Sawmill Branch- Townsend, DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
EL-1	495641.019	598126.121	39.3607167	-75.6219333
EL-2	495607.362	598243.861	39.3606250	-75.6215167

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING EL-1

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 495641.019
Easting: 598126.121
Boring Surface Elev.:
Reference:
Date Started: 1/4/16
Date Completed: 1/4/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/4/16	16.0	
1/4/16	Dry	12.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 ATV
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	14 12 10 16	Moist very stiff gray silt w/some coarse to fine sand and fine gravel. 19" RECOVERY	A-4(0)	Hot-mix 3" stone 2"
5.06		2	4.0' – 6.0'	6 6 11 12	Moist very stiff gray fine to coarse sandy silt w/trace fine gravel. 17" RECOVERY	A-4(0)	
7.59		3	6.0' – 8.0'	5 5 4 3	Wet stiff gray fine sandy silt w/some coarse sand, trace of fine gravel. 19" RECOVERY	A-4(0)	
10.12		4	8.0' – 10.0'	2 3 3 2	Wet firm gray fine sandy silt w/some clay and coarse sand. 15" RECOVERY	A-4(0)	
12.65		5	10.0' – 12.0'	4 6 6 8	Wet medium dense gray silty fine to coarse sand w/trace fine gravel. 15" RECOVERY	A-2-4(0)	
15.18		6	12.0' – 14.0'	4 6 9 7	Wet medium dense brown silty fine to coarse sand w/trace fine gravel and clay. 12" RECOVERY	A-2-4(0)	
		7	14.0'	2 2 4 5	Wet firm brown clay w/some fine to coarse sand and clay, trace of fine gravel.	A-6(6)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: EL-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		12" RECOVERY		
17.71	■	8	16.0' 18.0'	2 2 6 9	Wet loose brown silty coarse to fine sand w/ trace fine gravel. 21" RECOVERY	A-2-4(0)	
20.24		9	18.0' 20.0'	2 3 3 3	Saturated firm brown fine to coarse sandy clay w/some silt, trace of fine gravel. 17" RECOVERY	A-6(6)	
25.3		10	24.0' 26.0'	3 3 5 6	Saturated firm gray silty clay w/some fine to coarse sand and clay. 20" RECOVERY	A-7-5(17)	
30.36		11	28.0' 30.0'	3 3 5 7	Saturated firm gray silty clay w/some fine sand, trace of coarse sand. 22" RECOVERY	A-7-5(14)	
35.42		12	34.0' 36.0'	3 4 5 5	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand. 22" RECOVERY	A-7-5(22)	
37.95		13	38.0'	2	Saturated firm gray organic silty fine sandy	A-7-6(19)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: EL-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				2 3 4	clay w/trace coarse sand.		
			40.0'		21" RECOVERY		
40.48							
43.01							
		14	44.0'	3 2 3 3	Saturated firm gray organic silty fine sandy clay w/trace coarse sand.	A-7-5(29)	
45.54			46.0'		19" RECOVERY		
48.07							
		15	48.0'	3 4 6 6	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	A-7-5(33)	
			50.0'		20" RECOVERY		
50.6							
53.13							
		16	54.0'	3 3 9 12	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	A-7-5(26)	
55.66			56.0'		21" RECOVERY		
58.19		17	58.0'	7 12 13 18	Saturated very stiff gray organic silty fine sandy clay w/trace coarse sand.	A-7-5(23)	
			60.0'		22" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003

Boring No.: EL-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	17 35 50	Saturated very dense brown organic silty coarse to fine sand w/trace fine gravel. 22" RECOVERY	A-2-4(0)	
68.31		19	68.0' 70.0'	50	No Recovery NR" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Plastic clays
	Expansive plastic clays

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING EL-2

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 495607.362
Easting: 598243.861
Boring Surface Elev.:
Reference:
Date Started: 1/5/16
Date Completed: 1/5/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/5/16	11.0	
1/5/16	Dry	7.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 ATV
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	24 16 15 17	Moist dense gray fine gravelly coarse sand w/ some fine sand and silt. 13" RECOVERY	A-1-b	Hot-mix 8"
5.06		2	4.0' – 6.0'	5 7 9 6	Moist stiff gray fine to coarse sandy silt w/ trace fine gravel. 11" RECOVERY	A-4(0)	
7.59		3	6.0' – 8.0'	3 4 4 5	Wet firm gray clayey silt w/some fine sand, trace of coarse sand and fine gravel. 17" RECOVERY	A-4(2)	
10.12		4	8.0' – 10.0'	19 17 36 38	No sieve analysis - Indication of wet very dense gray coarse sand w/some fine gravel and silt, trace of fine sand. 2" RECOVERY		
	■	5	10.0' – 12.0'	9 9 11 13	Wet medium dense gray coarse sand w/some fine gravel, trace of fine sand and silt. 17" RECOVERY	A-1-b	
12.65		6	12.0' – 14.0'	9 5 5 6	Saturated stiff gray coarse to fine sandy clay w/some silt, trace of fine gravel. 10" RECOVERY	A-6(3)	
15.18		U-1	14.0'				Shelby Tube - Press Sample

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: EL-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		24" RECOVERY		
		7	16.0'	1 3 3 5	Saturated firm gray silty clay w/some fine to coarse sand, trace of fine gravel.	A-7-6(14)	
17.71			18.0'		14" RECOVERY		
		U-2	18.0'				Shelby Tube - Press Sample
20.24			20.0'		24" RECOVERY		
22.77		8	22.0'	5 5 6 5	Saturated stiff gray coarse to fine sandy clay w/some silt, trace of organic matter.	A-7-5(8)	
			24.0'		23" RECOVERY		
25.3		9	24.0'	5 6 6 7	Saturated stiff gray fine sandy clay w some coarse sand, silt and organic matter.	A-7-5(14)	
			26.0'		23" RECOVERY		
27.83							
		10	28.0'	5 5 6 5	Saturated stiff gray silty clay w/some fine sand, trace of coarse sand.	A-7-5(23)	
30.36			30.0'		22" RECOVERY		
32.89							
		11	34.0'	5 5 7 5	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	A-7-5(29)	
35.42			36.0'		23" RECOVERY		
37.95							
		12	38.0'	4	Saturated stiff gray organic silty clay w/some	A-7-5(34)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road **Boring No.:** EL-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				5 5 5	fine sand, trace of coarse sand.		
			40.0'		22" RECOVERY		
40.48							
43.01							
		13	44.0'	5 5 6 6	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	A-7-5(33)	
45.54			46.0'		21" RECOVERY		
48.07							
		14	48.0'	4 4 6 5	Saturated stiff gray organic fine sandy clay w/some silt and coarse sand.	A-7-5(18)	
			50.0'		21" RECOVERY		
50.6							
53.13							
		15	54.0'	5 6 11 10	Saturated very stiff gray organic silty fine sandy clay w/some coarse sand.	A-7-5(19)	
55.66			56.0'		20" RECOVERY		
58.19							
		16	58.0'	11 16 15 28	Saturated hard gray organic fine to coarse sandy clay w/some silt.	A-7-5(3)	
			60.0'		23" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: EL-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		17	64.0' 66.0'	38 50	Saturated very dense gray silty coarse to fine sand w/trace organic matter. 11" RECOVERY	A-2-4(0)	
68.31		18	68.0' 70.0'	50	Saturated dense gray silty fine to coarse sand w/some organic matter. 6" RECOVERY	A-2-6(0)	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Plastic clays
	Expansive plastic clays
	Poorly graded, silty or clayey sands and gravel

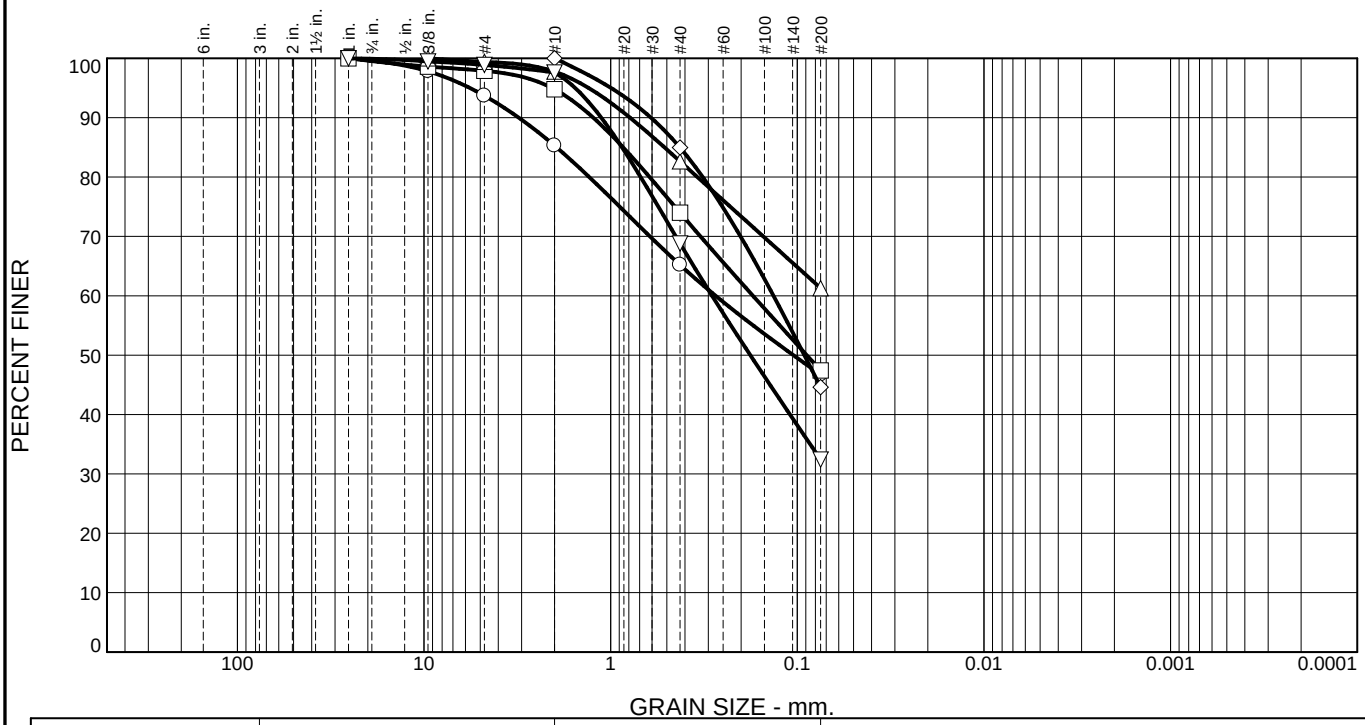
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	14.7	20.1	18.5	46.7	
□	0.0	5.2	20.8	26.6	47.4	
△	0.0	2.2	15.2	21.3	61.3	
◇	0.0	0.0	15.0	40.4	44.6	
▽	0.0	2.4	28.8	36.4	32.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18.2	NP	1.9496	0.2739	0.1051					
□	18.1	NP	0.8573	0.1728	0.0890					
△	19.9	NP	0.5150							
◇	19.1	14.3	0.4257	0.1342	0.0917					
▽	17.7	15.4	0.8692	0.2862	0.1786					

Material Description	USCS	AASHTO
○ Moist very stiff gray silt w/some coarse to fine sand and fine gravel.	SM	A-4(0)
□ Moist very stiff gray fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
△ Wet stiff gray fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
◇ Wet firm gray fine sandy silt w/some clay and coarse sand.	SC-SM	A-4(0)
▽ Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-1 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** EL-1 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** EL-1 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** EL-1 **Depth:** 8.0 **Sample Number:** 4

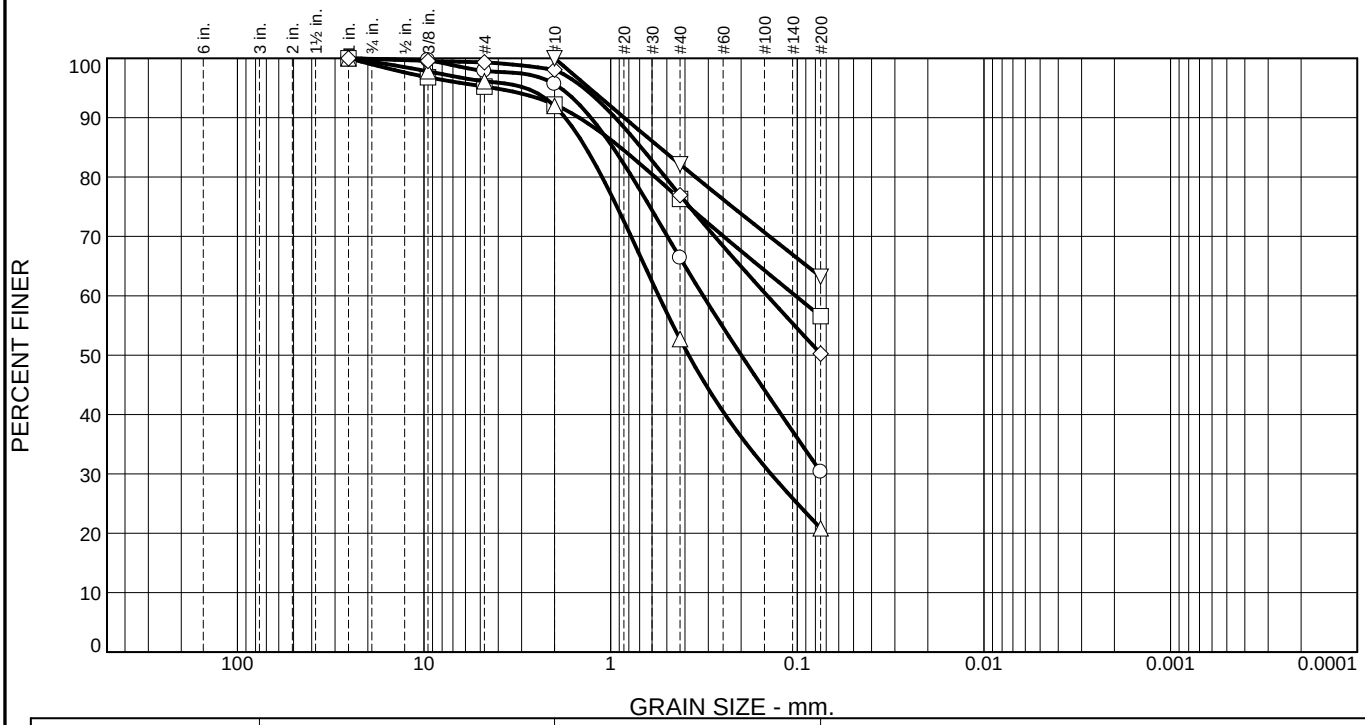
▽ **Source of Sample:** EL-1 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.3	29.3	36.1	30.3	
□	0.0	7.8	15.9	19.7	56.6	
△	0.0	8.0	39.3	31.9	20.8	
◇	0.0	1.9	21.2	26.7	50.2	
▽	0.0	0.0	17.9	18.9	63.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	17.2	14.8	0.9730	0.3194	0.1997					
□	33.4	16.6	0.8888	0.1022						
△	NV	NP	1.3634	0.5529	0.3822	0.1385				
◇	35.9	18.0	0.6870	0.1447						
▽	61.9	35.0	0.5472							

Material Description	USCS	AASHTO
○ Wet medium dense brown silty fine to coarse sand w/trace fine gravel and clay.	SM	A-2-4(0)
□ Wet firm brown clay w/some fine to coarse sand and clay, trace of fine gravel.	CL	A-6(6)
△ Wet loose brown silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)
◇ Saturated firm brown fine to coarse sandy clay w/some silt, trace of fine gravel.	CL	A-6(6)
▽ Saturated firm gray silty clay w/some fine to coarse sand and clay.	MH	A-7-5(17)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-1 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** EL-1 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** EL-1 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** EL-1 **Depth:** 18.0 **Sample Number:** 9

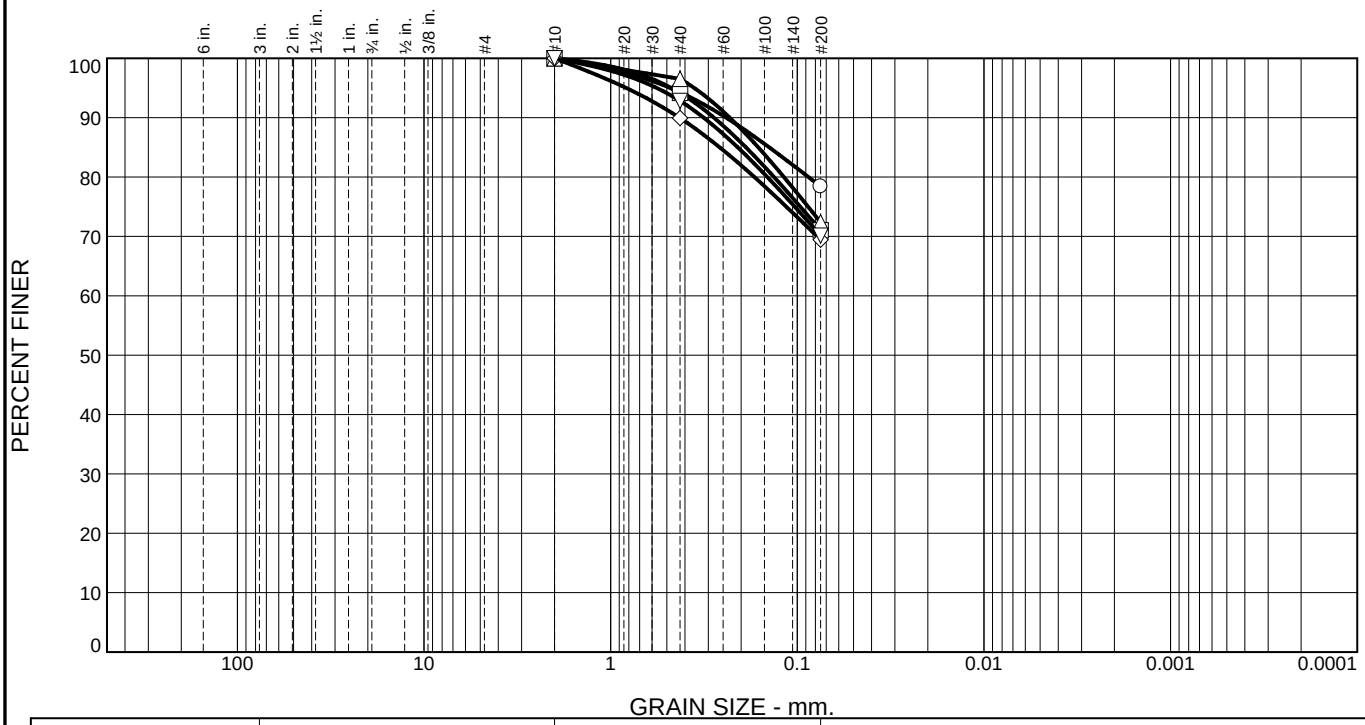
▽ **Source of Sample:** EL-1 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	5.7	15.9	78.4	
□	0.0	0.0	5.8	23.2	71.0	
△	0.0	0.0	3.5	24.1	72.4	
◇	0.0	0.0	10.1	20.5	69.4	
▽	0.0	0.0	7.2	22.7	70.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	46.2	29.8	0.1414							
□	60.1	30.1	0.1885							
△	53.5	28.6	0.1619							
◇	81.6	44.6	0.2604							
▽	93.6	54.0	0.2085							

Material Description	USCS	AASHTO
○ Saturated firm gray silty clay w/some fine sand, trace of coarse sand.	ML	A-7-5(14)
□ Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	CH	A-7-5(22)
△ Saturated firm gray organic silty fine sandy clay w/trace coarse sand.	CH	A-7-6(19)
◇ Saturated firm gray organic silty fine sandy clay w/trace coarse sand.	MH	A-7-5(29)
▽ Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	MH	A-7-5(33)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-1 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** EL-1 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** EL-1 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** EL-1 **Depth:** 44.0 **Sample Number:** 14

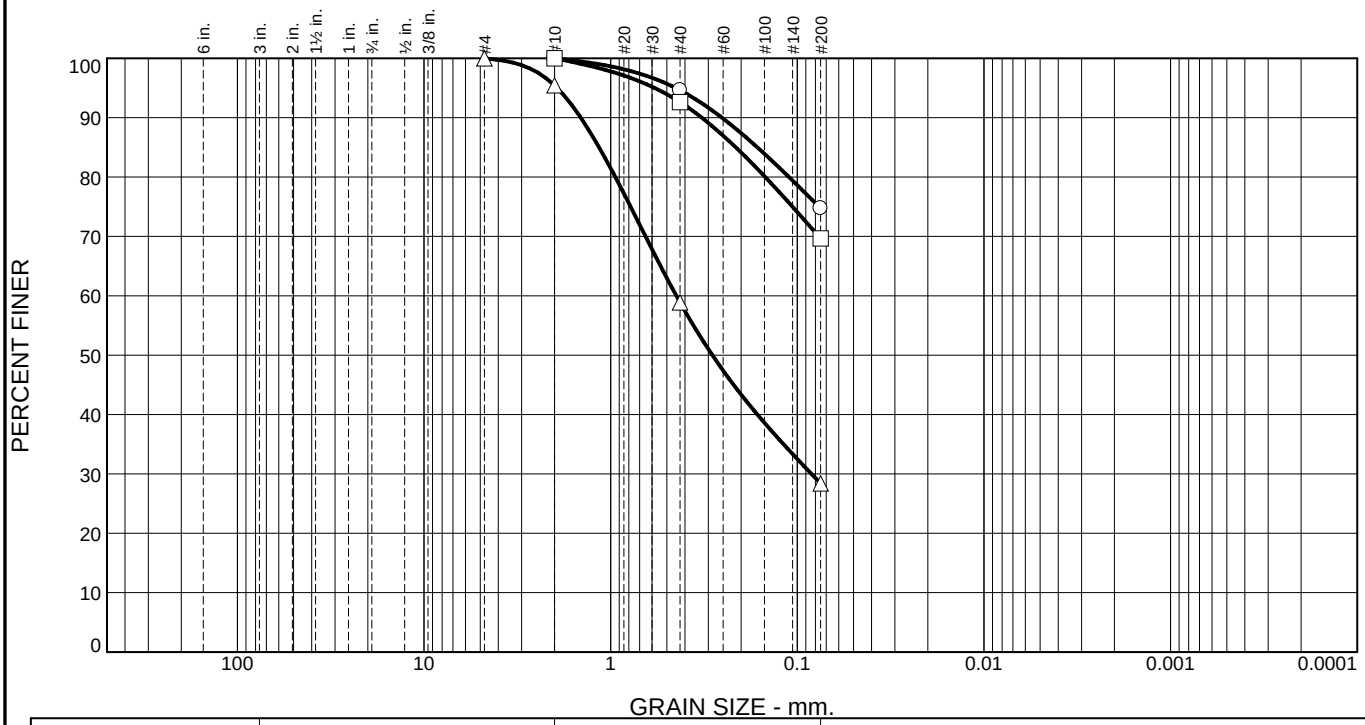
▽ **Source of Sample:** EL-1 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	5.4	19.9	74.7	
□	0.0	0.0	7.4	22.9	69.7	
△	0.0	4.6	36.5	30.5	28.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	69.1	38.0	0.1637							
□	72.1	43.3	0.2136							
△	NV	NP	1.1539	0.4448	0.2849	0.0840				

Material Description	USCS	AASHTO
○ Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	MH	A-7-5(26)
□ Saturated very stiff gray organic silty fine sandy clay w/trace coarse sand.	MH	A-7-5(23)
△ Saturated very dense brown organic silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-1 **Depth:** 54.0 **Sample Number:** 16

□ **Source of Sample:** EL-1 **Depth:** 58.0 **Sample Number:** 17

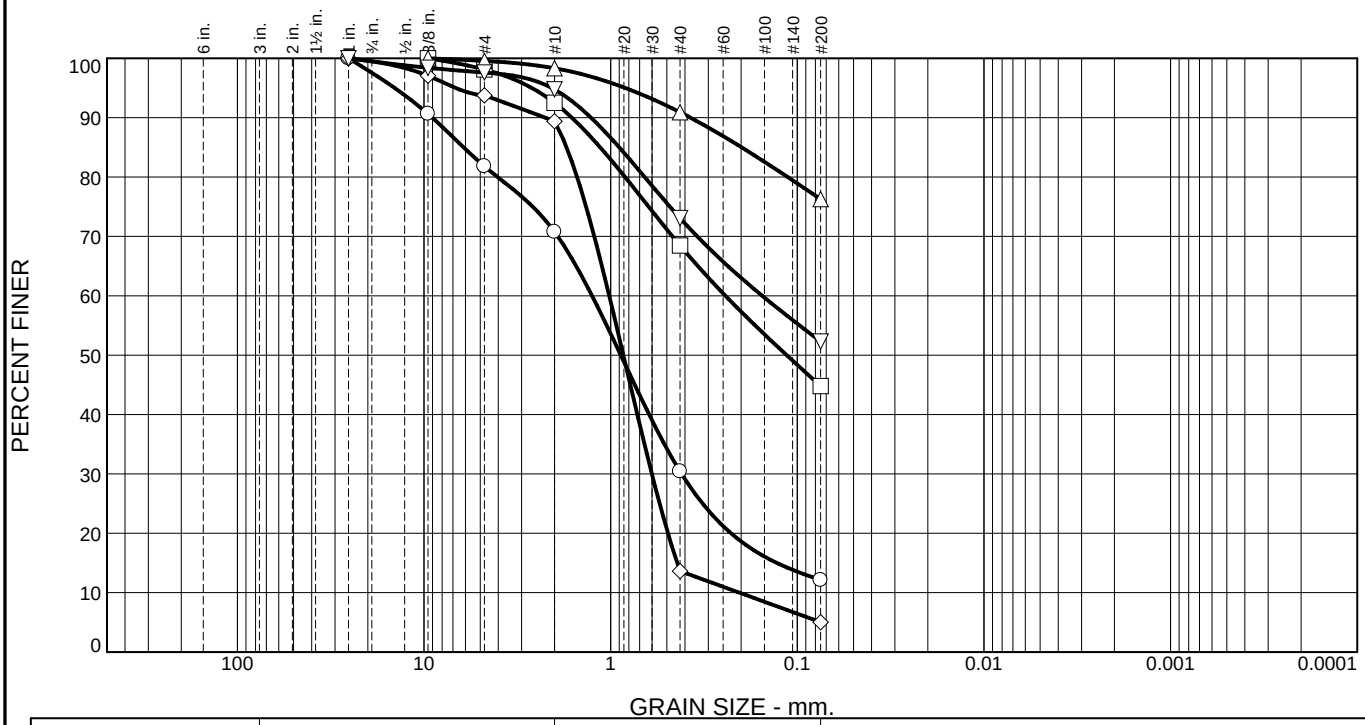
△ **Source of Sample:** EL-1 **Depth:** 64.0 **Sample Number:** 18

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	29.2	40.4	18.3	12.1	
□	0.0	7.5	24.0	23.7	44.8	
△	0.0	1.7	7.4	14.6	76.3	
◇	0.0	10.6	75.8	8.6	5.0	
▽	0.0	5.2	21.7	20.8	52.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	6.1373	1.2581	0.8826	0.4170	0.1286			
□	18.2	NP	1.1381	0.2427	0.1140					
△	24.3	18.6	0.1988							
◇	NV	NP	1.7229	1.0178	0.8552	0.6015	0.4398	0.2043	1.74	4.98
▽	27.6	16.1	0.8998	0.1541						

Material Description	USCS	AASHTO
○ Moist dense gray fine gravelly coarse sand w/some fine sand and silt.	SM	A-1-b
□ Moist stiff gray fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
△ Wet firm gray clayey silt w/some fine sand, trace of coarse sand and fine gravel.	CL-ML	A-4(2)
◇ Wet medium dense gray coarse sand w/some fine gravel, trace of fine sand and silt.	SP-SM	A-1-b
▽ Saturated stiff gray coarse to fine sandy clay w/some silt, trace of fine gravel.	CL	A-6(3)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-2 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** EL-2 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** EL-2 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** EL-2 **Depth:** 10.0 **Sample Number:** 5

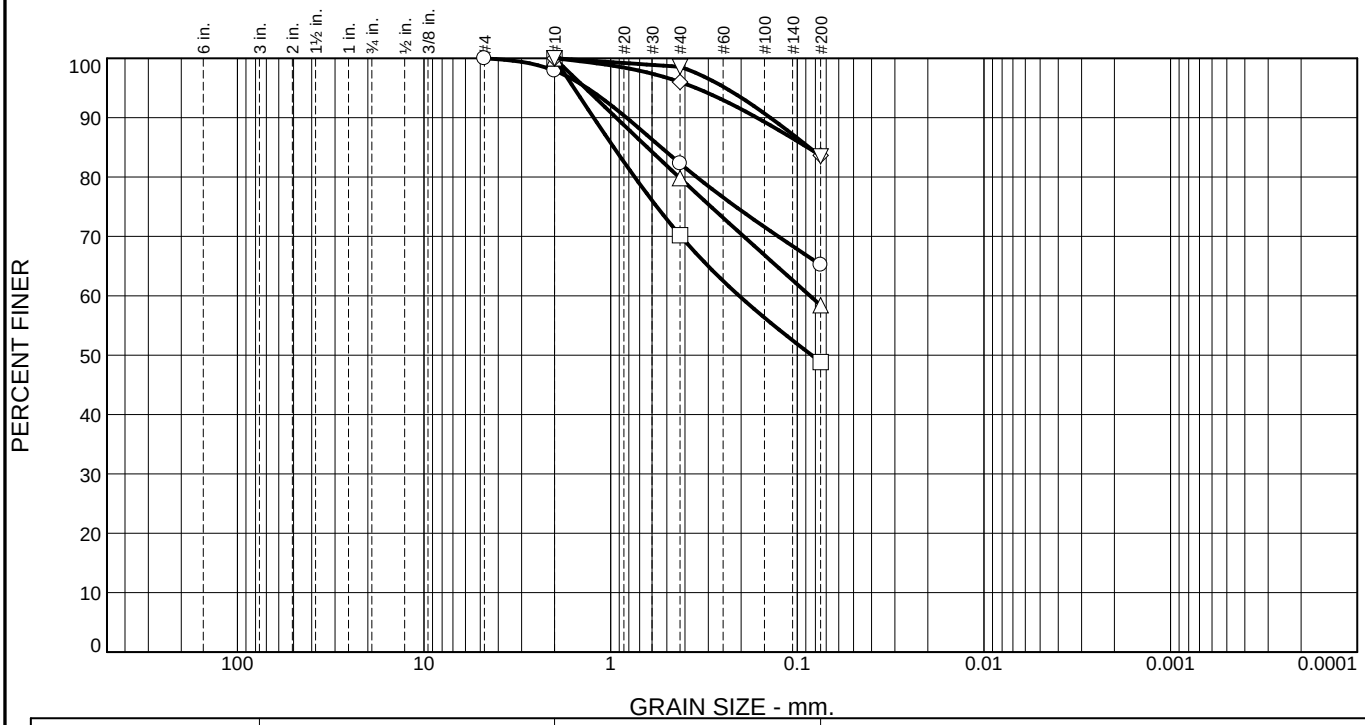
▽ **Source of Sample:** EL-2 **Depth:** 12.0 **Sample Number:** 6

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.1	15.6	17.1	65.2	
□	0.0	0.0	29.8	21.4	48.8	
△	0.0	0.0	20.2	21.4	58.4	
◇	0.0	0.0	4.0	12.3	83.7	
▽	0.0	0.0	1.4	15.1	83.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	50.5	25.7	0.5364							
□	53.6	32.9	0.9626	0.2050	0.0838					
△	59.4	33.4	0.6364	0.0855						
◇	54.4	29.7	0.0882							
▽	60.8	29.5	0.0864							

Material Description	USCS	AASHTO
○ Saturated firm gray silty clay w/some fine to coarse sand, trace of fine gravel.	CH	A-7-6(14)
□ Saturated stiff gray coarse to fine sandy clay w/some silt, trace of organic matter.	SM	A-7-5(8)
△ Saturated stiff gray fine sandy clay w some coarse sand, silt and organic matter.	MH	A-7-5(14)
◇ Saturated stiff gray silty clay w/some fine sand, trace of coarse sand.	MH	A-7-5(23)
▽ Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	CH	A-7-5(29)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-2 **Depth:** 16.0 **Sample Number:** 7

□ **Source of Sample:** EL-2 **Depth:** 22.0 **Sample Number:** 8

△ **Source of Sample:** EL-2 **Depth:** 24.0 **Sample Number:** 9

◇ **Source of Sample:** EL-2 **Depth:** 28.0 **Sample Number:** 10

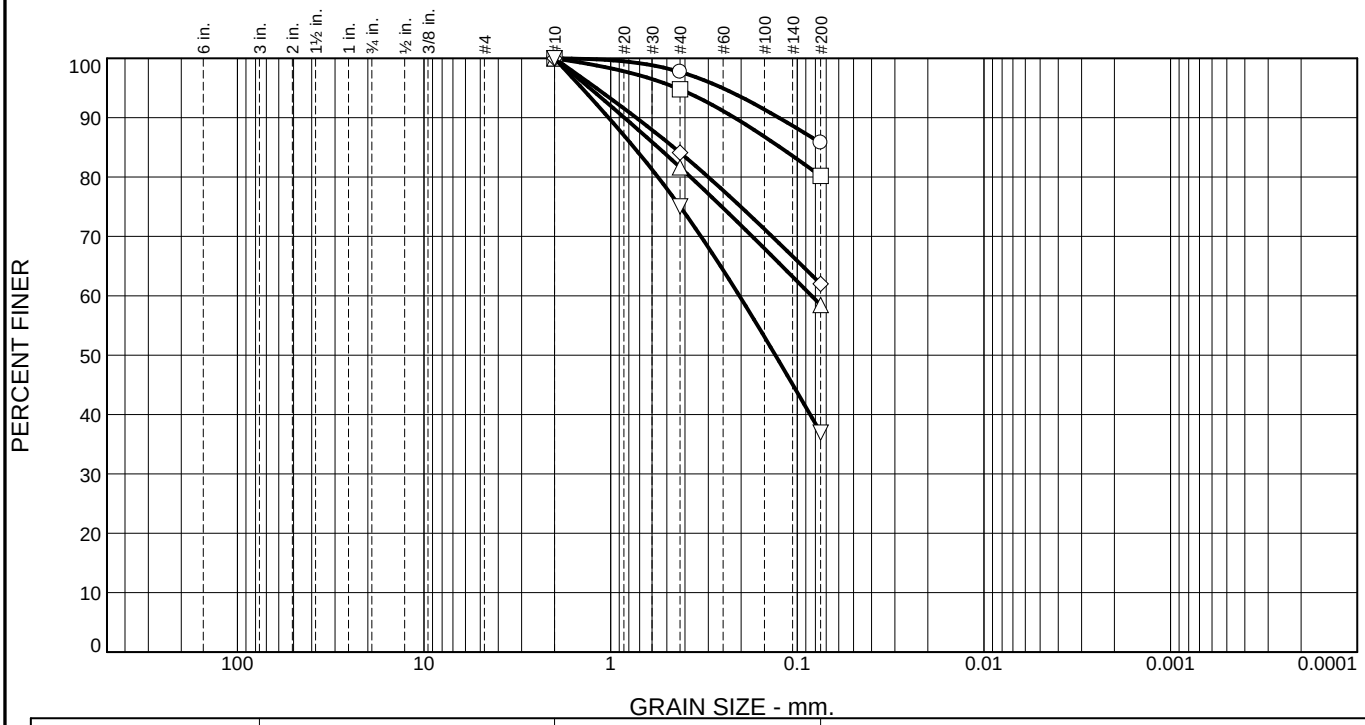
▽ **Source of Sample:** EL-2 **Depth:** 34.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	2.3	11.9	85.8	
□	0.0	0.0	5.2	14.6	80.2	
△	0.0	0.0	18.4	23.1	58.5	
◇	0.0	0.0	15.9	22.1	62.0	
▽	0.0	0.0	25.0	38.0	37.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	66.1	32.1								
□	81.9	50.0	0.1235							
△	83.4	53.8	0.5573	0.0839						
◇	71.3	42.5	0.4595							
▽	52.8	33.5	0.7496	0.2044	0.1311					

Material Description	USCS	AASHTO
○ Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	CH	A-7-5(34)
□ Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	MH	A-7-5(33)
△ Saturated stiff gray organic fine sandy clay w/some silt and coarse sand.	MH	A-7-5(18)
◇ Saturated very stiff gray organic silty fine sandy clay w/some coarse sand.	MH	A-7-5(19)
▽ Saturated hard gray organic fine to coarse sandy clay w/some silt.	SM	A-7-5(3)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-2 **Depth:** 38.0 **Sample Number:** 12

□ **Source of Sample:** EL-2 **Depth:** 44.0 **Sample Number:** 13

△ **Source of Sample:** EL-2 **Depth:** 48.0 **Sample Number:** 14

◇ **Source of Sample:** EL-2 **Depth:** 54.0 **Sample Number:** 15

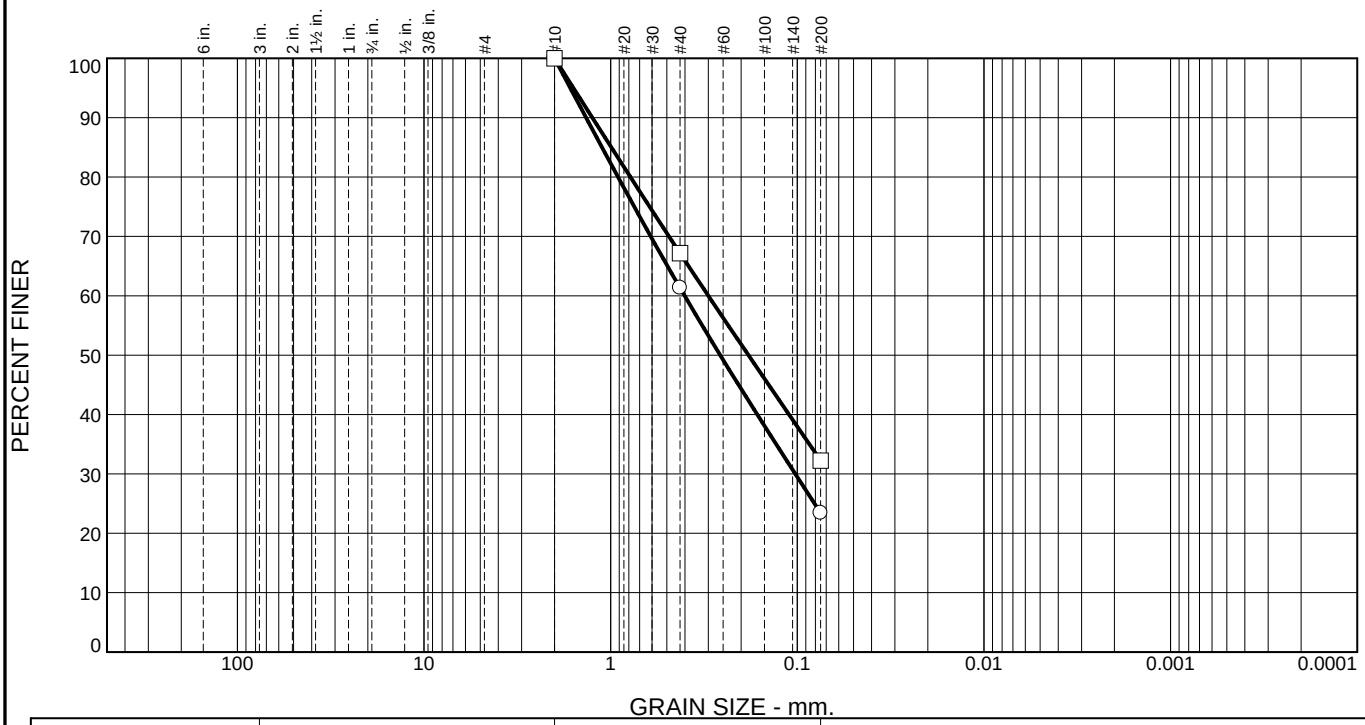
▽ **Source of Sample:** EL-2 **Depth:** 58.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	38.7	37.9	23.4	
□	0.0	0.0	32.8	35.0	32.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1129	0.4014	0.2588	0.1025				
□	36.2	23.6	0.9919	0.2996	0.1828					

Material Description	USCS	AASHTO
○ Saturated very dense gray silty coarse to fine sand w/trace organic matter.	SM	A-2-4(0)
□ Saturated dense gray silty fine to coarse sand w/some organic matter.	SC	A-2-6(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** EL-2 **Depth:** 64.0 **Sample Number:** 17

□ **Source of Sample:** EL-2 **Depth:** 68.0 **Sample Number:** 18

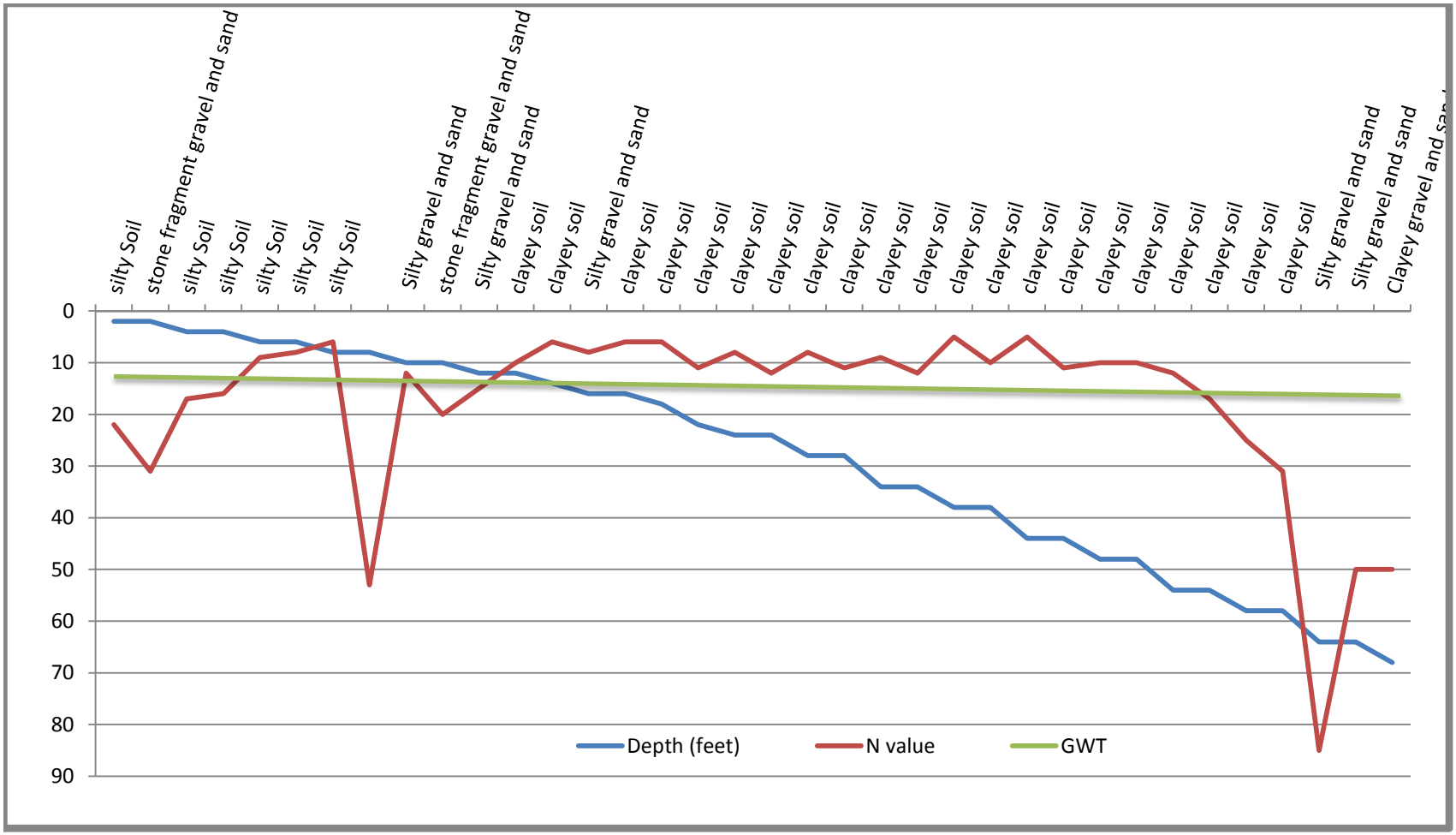
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
EL-1														
	1	2	Moist very stiff gray silt w/some coarse to fine sand and fine gravel.	18.2	NP	10.2	SM	A-4(0)	85.3	46.7	14	12	10	16
	2	4	Moist very stiff gray fine to coarse sandy silt w/trace fine gravel.	18.1	NP	10.8	SM	A-4(0)	94.8	47.4	6	6	11	12
	3	6	Wet stiff gray fine sandy silt w/some coarse sand, trace of fine gravel.	19.9	NP	16.2	ML	A-4(0)	97.8	61.3	5	5	4	3
	4	8	Wet firm gray fine sandy silt w/some clay and coarse sand.	19.1	4.8	15.9	SC-SM	A-4(0)	100	44.6	2	3	3	2
	5	10	Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	17.7	2.3	17.5	SM	A-2-4(0)	97.6	32.4	4	6	6	8
	6	12	Wet medium dense brown silty fine to coarse sand w/trace fine gravel and clay.	17.2	2.4	19.7	SM	A-2-4(0)	95.7	30.3	4	6	9	7
	7	14	Wet firm brown clay w/some fine to coarse sand and clay, trace of fine gravel.	33.4	16.8	28.3	CL	A-6(6)	92.2	56.6	2	2	4	5
	8	16	Wet loose brown silty coarse to fine sand w/trace fine gravel.	NV	NP	23.1	SM	A-2-4(0)	92	20.8	2	2	6	9
	9	18	Saturated firm brown fine to coarse sandy clay w/some silt, trace of fine gravel.	35.9	17.9	35.2	CL	A-6(6)	98.1	50.2	2	3	3	3
	10	24	Saturated firm gray silty clay w/some fine to coarse sand and clay.	61.9	26.9	52.6	MH	A-7-5(17)	100	63.2	3	3	5	6
	11	28	Saturated firm gray silty clay w/some fine sand, trace of coarse sand.	46.2	16.4	50.2	ML	A-7-5(14)	100	78.4	3	3	5	7
	12	34	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	60.1	30	72.5	CH	A-7-5(22)	100	71	3	4	5	5
	13	38	Saturated firm gray organic silty fine sandy clay w/trace coarse sand.	53.5	24.9	60	CH	A-7-6(19)	100	72.4	2	2	3	4
	14	44	Saturated firm gray organic silty fine sandy clay w/trace coarse sand.	81.6	37	79.6	MH	A-7-5(29)	100	69.4	3	2	3	3
	15	48	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	93.6	39.6	67.6	MH	A-7-5(33)	100	70.1	3	4	6	6
	16	54	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	69.1	31.1	54.1	MH	A-7-5(26)	100	74.7	3	3	9	12
	17	58	Saturated very stiff gray organic silty fine sandy clay w/trace coarse sand.	72.1	28.8	44.6	MH	A-7-5(23)	100	69.7	7	12	13	18
	18	64	Saturated very dense brown organic silty coarse to fine sand w/trace fine gravel.	NV	NP	32.5	SM	A-2-4(0)	95.4	28.4	17	35	50	
	19	68	No Recovery								50			
		70	End Boring											
EL-2														
	1	2	Moist dense gray fine gravelly coarse sand w/some fine sand and silt.	NV	NP	5.9	SM	A-1-b	70.8	12.1	24	16	15	17
	2	4	Moist stiff gray fine to coarse sandy silt w/trace fine gravel.	18.2	NP	11	SM	A-4(0)	92.5	44.8	5	7	9	6
	3	6	Wet firm gray clayey silt w/some fine sand, trace of coarse sand and fine gravel.	24.3	5.7	21.6	CL-ML	A-4(2)	98.3	76.3	3	4	4	5
	4	8	No sieve analysis - Indication of wet very dense gray coarse sand w/some fine gravel and silt, trace of fine s	NV	NP	15.5					19	17	36	38
	5	10	Wet medium dense gray coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	19.8	SP-SM	A-1-b	89.4	5	9	9	11	13
	6	12	Saturated stiff gray coarse to fine sandy clay w/some silt, trace of fine gravel.	27.6	11.5	30.5	CL	A-6(3)	94.8	52.3	9	5	5	6
	U-1	14												
	7	16	Saturated firm gray silty clay w/some fine to coarse sand, trace of fine gravel.	50.5	24.8	44.8	CH	A-7-6(14)	97.9	65.2	1	3	3	5
	U-2	18												
	8	22	Saturated stiff gray coarse to fine sandy clay w/some silt, trace of organic matter.	53.6	20.7	56.9	SM	A-7-5(8)	100	48.8	5	5	6	5
	9	24	Saturated stiff gray fine sandy clay w some coarse sand, silt and organic matter.	59.4	26	53.5	MH	A-7-5(14)	100	58.4	5	6	6	7
	10	28	Saturated stiff gray silty clay w/some fine sand, trace of coarse sand.	54.4	24.7	58.7	MH	A-7-5(23)	100	83.7	5	5	6	5
	11	34	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	60.8	31.3	66.1	CH	A-7-5(29)	100	83.5	5	5	7	5
	12	38	Saturated stiff gray organic silty clay w/some fine sand, trace of coarse sand.	66.1	34	67.1	CH	A-7-5(34)	100	85.8	4	5	5	5

DATE : **3-10-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR1-454 on Eagles Nest Landing Rd over Sawmill Branch- Townsend, DE**



DATE : **3-10-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR1-454 on Eagles Nest Landing Rd over Sawmill Branch- Townsend, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-14-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-455 on Deer Run Rd over Sawmill Branch- Townsend, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-6-2016. Walton Corporation-Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation and two Shelby tube was collected. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Smyrna- Clayton Area, Delaware According to Geologic Map Series No. 5 by Thomas Pickett and Richard Benson 1977 this site is situated in TERTIARY Chesapeake Group and the general description of the soil it is Predominantly Sandy Silt or Sand , bluish gray to light olive gray; diatomaceous, particularly in the lower Miocene, Subordinate sands are quartzose, medium- to course- grained, may be Shelly; where well- developed used as aquifers, Cheswold(chs) and Frederica (fred) aquifers.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John K. Adams, Durward H. Boggess, and O.J Coskery (1964) Atlas HA- 83. The nearest well to this site the groundwater historically had been measured as 30 feet on September 1958 and between the years of 1950 to 1962 appeared from 28 to 34 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 28 feet down is Silty or Clayey gravel and sand (A-2-4) and from 28 to 72 feet down is fine sand (A-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Smyrna- Clayton Delaware; Map Series, No. 10, by A. Scott Andres June 2001. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 4 to 5 inches of asphalt top of 2 inches of stone.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 10 and 11.5 feet and caved at 5.2 and 8 feet all the measurements is below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 5.4 to 104.2 percent. The Atterberg limit is 80 percent, Liquid limits is the range of 18.8 to 84.4 percent and Plasticity Index is the range of 3.5 to 27.7 percent. The Organic matter is 43 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is not in a good condition and 6 feet in thickness of firm to stiff of organic silty clay appeared at 10 feet down from the surface elevation this layer need to be consider in the design. In addition the entire sample from the depth of 2 to 12 feet from the surface had been met borrow type material "A" only according to Del-DOT standard specification with little amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

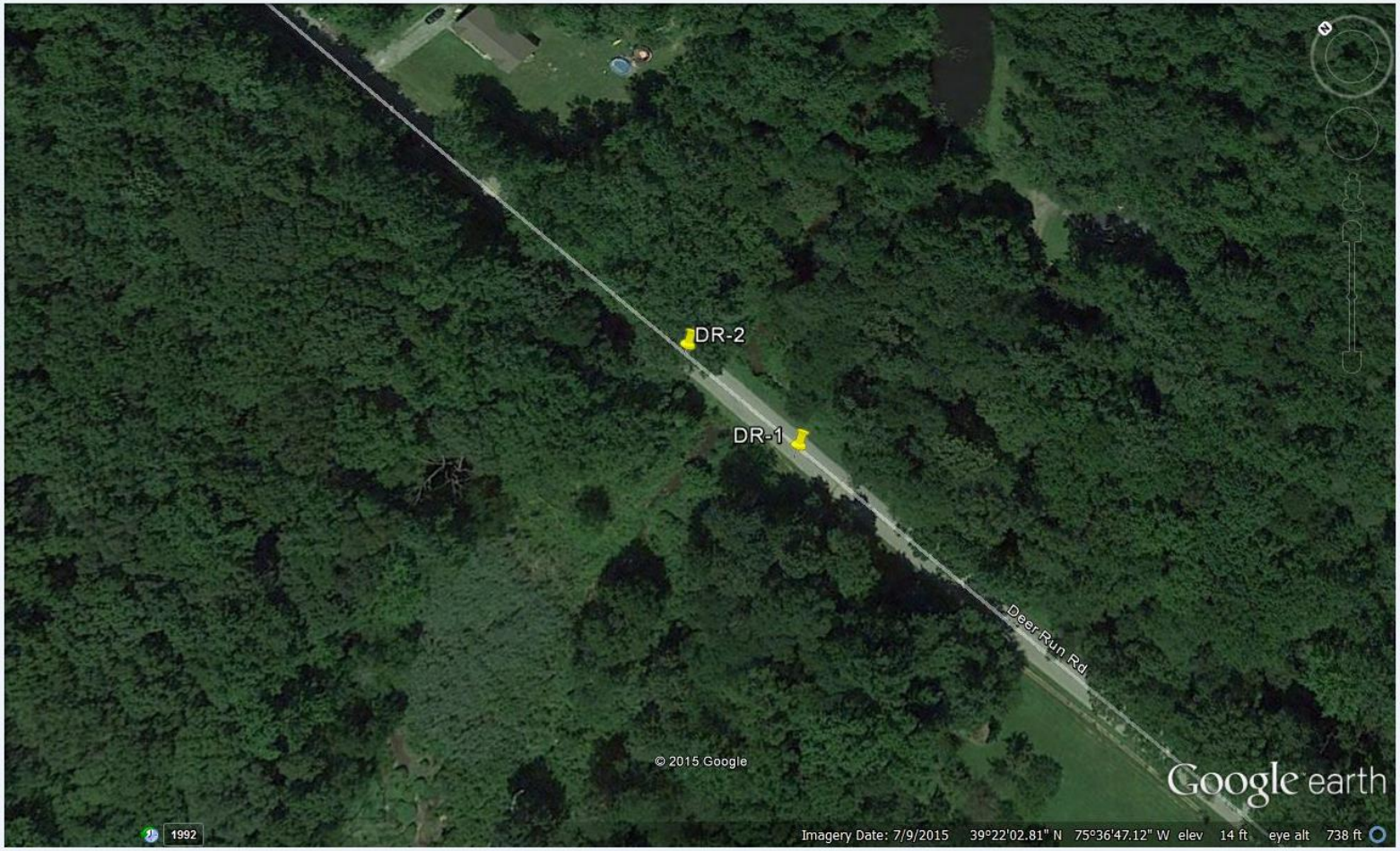
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 3-14-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-455 on Deer Run Rd over Sawmill Branch- Townsend, DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
DR-1	498029.290	600662.784	39.3672889	-75.6129806
DR-2	498129.466	600659.075	39.3675639	-75.6129944

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING DR-1

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 498029.290
Easting: 600662.784
Boring Surface Elev.:
Reference:
Date Started: 1/6/16
Date Completed: 1/6/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/6/16	10.0	
1/6/16	Dry	5.2

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 ATV
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	9 11 31 28	Moist dense brown silty coarse to fine sand w/some fine gravel. 16" RECOVERY	A-1-b	Hot-mix 5"
5.06		2	4.0' – 6.0'	4 4 5 5	Moist stiff brown fine to coarse sandy silt w/ some fine gravel and clay. 9" RECOVERY	A-4(0)	
7.59		3	6.0' – 8.0'	5 4 4 3	Wet firm brown fine sandy silt w/some coarse sand and clay, trace of fine gravel. 6" RECOVERY	A-4(0)	
10.12	■	4	8.0' – 10.0'	4 21 21 16	No sieve analysis - Indication of wet very dense gray silty fine to coarse sand and fine gravel. 3" RECOVERY		
		5	10.0' – 12.0'	7 11 5 6	Wet medium dense gray silty fine to coarse sand and fine gravel w/some clay. 16" RECOVERY	A-2-4(0)	
12.65		6	12.0' – 14.0'	3 3 4 3	Wet firm gray fine sandy clay w/some silt, coarse sand and fine gravel. 17" RECOVERY	A-6(2)	
15.18		7	14.0'	3 3 4 3	Saturated firm gray clayey fine to coarse sandy silt w/trace fine gravel.	A-4(2)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: DR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		21" RECOVERY		
17.71		8	16.0' 18.0'	4 4 4 4	Saturated firm gray fine sandy clay w/some silt, coarse sand and organic matter, trace of fine gravel. 23" RECOVERY	A-6(4)	
20.24		9	18.0' 20.0'	5 6 7 7	Saturated stiff gray organic fine to coarse sandy clay w/some silt. 23" RECOVERY	A-7-5(12)	
22.77							
25.3		10	24.0' 26.0'	5 5 4 5	Saturated stiff gray organic silty fine sandy clay w/some coarse sand. 22" RECOVERY	A-7-5(12)	
27.83							
30.36		11	28.0' 30.0'	3 4 5 4	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand. 22" RECOVERY	A-7-5(13)	
32.89							
35.42		12	34.0' 36.0'	5 5 5 5	Saturated stiff gray organic fine to coarse sandy clay w/some silt. 21" RECOVERY	A-7-5(12)	
37.95							
		13	38.0'	4	Saturated stiff gray organic coarse sandy clay	A-7-5(6)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: DR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				6 5 4	w/some silt, trace of fine sand.		
			40.0'		16" RECOVERY		
40.48							
43.01							
		14	44.0'	4 4 5 4	Saturated stiff gray organic coarse to fine sandy clay w/some silt.	A-7-5(9)	
45.54			46.0'		18" RECOVERY		
48.07							
		15	48.0'	12 13 15 16	Saturated medium dense gray organic silty coarse to fine sand.	A-2-4(0)	
			50.0'		20" RECOVERY		
50.6							
53.13							
		16	54.0'	38 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
55.66			56.0'		15" RECOVERY		
58.19		17	58.0'	50	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.		
			60.0'		2" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road **Boring No.:** DR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	50	Saturated very dense gray silty fine to coarse sand. 1" RECOVERY	A-2-4(0)	
68.31		19	68.0' 70.0'	50	No Recovery NR" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Plastic clays
	Expansive plastic clays

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING DR-2

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 498129.466
Easting: 600659.075
Boring Surface Elev.:
Reference:
Date Started: 1/6/16
Date Completed: 1/6/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/6/16	11.5	
1/6/16	7.8	8.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' 4.0'	23 14 12 6	Wet hard brown fine sandy silt w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-4(0)	Hot-mix 4", stone 2" and fill 18"
5.06		2	4.0' 6.0'	4 3 4 3	Wet firm brown clayey fine sandy silt w/ some coarse sand, trace of fine gravel. 14" RECOVERY	A-4(2)	
7.59	▽	3	6.0' 8.0'	4 9 10 8	Wet medium dense brown clayey coarse sand and fine gravel w/some fine sand and silt. 20" RECOVERY	A-2-4(0)	
10.12		4	8.0' 10.0'	5 6 12 24	Wet medium dense brown clayey fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
	■	5	10.0' 12.0'	6 12 13 5	Wet medium dense brown clayey fine gravel w/some coarse to fine sand, trace of silt. 20" RECOVERY	A-2-4(0)	
12.65		6	12.0' 14.0'	3 4 5 5	Wet loose brown clayey coarse sand and fine gravel w/some fine sand, trace of silt. 18" RECOVERY	A-2-4(0)	
15.18		7	14.0'	2 3 4 5	Saturated firm brown coarse sandy clay w/ some fine sand and silt, trace of fine gravel.	A-7-5(9)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: DR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		20" RECOVERY		
		8	16.0'	5 5 6 5	Saturated stiff brown coarse sandy clay w/ some fine sand and silt.	A-7-5(10)	
17.71			18.0'		20" RECOVERY		
		9	18.0'	5 4 5 5	Saturated stiff gray coarse sandy clay w/some fine sand, organic matter and silt, trace of fine gravel.	A-7-5(9)	
20.24			20.0'		22" RECOVERY		
		U-1	22.0'				Shelby Tube - Press Sample
22.77			24.0'		24" RECOVERY		
		11	24.0'	2 3 4 5	Saturated stiff gray organic coarse sandy clay w/some fine sand and silt.	A-7-5(9)	
25.3			26.0'		20" RECOVERY		
27.83							
		12	29.0'	3 3 4 5	Saturated stiff gray organic coarse to fine sandy clay w/some silt.	A-7-5(11)	
30.36			31.0'		20" RECOVERY		
32.89							
		13	34.0'	2 2 3 4	Saturated firm gray organic coarse to fine sandy clay w/some silt.	A-7-5(10)	
35.42			36.0'		23" RECOVERY		
37.95							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: DR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		14	39.0'	3 4 5 6	Saturated stiff gray organic fine to coarse sandy clay w/trace silt.	A-7-5(5)	
40.48			41.0'		20" RECOVERY		
43.01							
		15	44.0'	11 10 12 14	Saturated very stiff gray organic coarse to fine sandy clay w/some silt.	A-7-5(3)	
45.54			46.0'		23" RECOVERY		
48.07							
		16	49.0'	9 16 12 14	Saturated very stiff gray organic fine to coarse sandy clay w/some silt.	A-7-5(2)	
50.6			51.0'		24" RECOVERY		
53.13							
		17	54.0'	23 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
55.66			56.0'		12" RECOVERY		
58.19							
		18	59.0'	50	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.		
60.72			61.0'		3" RECOVERY		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: DR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
		19	64.0'	50	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.		
65.78			66.0'		3" RECOVERY		
68.31		20	68.0'		No Recovery		
			70.0'		NR" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Expansive plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

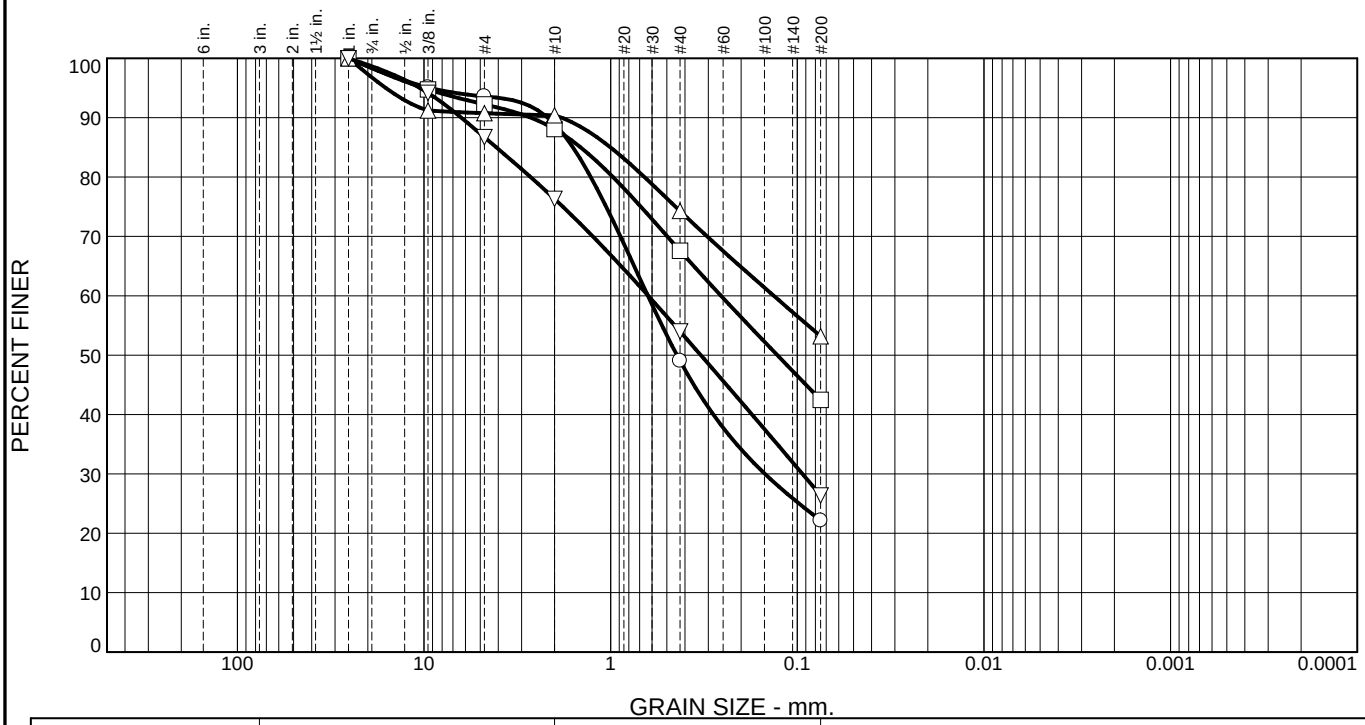
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.1	39.9	26.9	22.1	
□	0.0	11.9	20.5	25.1	42.5	
△	0.0	9.6	16.1	21.1	53.2	
◇						
▽	0.0	23.7	22.3	27.6	26.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5934	0.6317	0.4413	0.1491				
□	20.6	17.1	1.4489	0.2562	0.1280					
△	20.9	17.4	1.0021	0.1337						
◇	18.8	NP								
▽	21.2	16.3	4.0973	0.6287	0.3290	0.0939				

Material Description	USCS	AASHTO
○ Moist dense brown silty coarse to fine sand w/some fine gravel.	SM	A-1-b
□ Moist stiff brown fine to coarse sandy silt w/some fine gravel and clay.	SC-SM	A-4(0)
△ Wet firm brown fine sandy silt w/some coarse sand and clay, trace of fine gravel.	CL-ML	A-4(0)
◇ No sieve analysis - Indication of wet very dense gray silty fine to coarse sand and fine gravel.		
▽ Wet medium dense gray silty fine to coarse sand and fine gravel w/some clay.	SC-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-1 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** DR-1 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** DR-1 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** DR-1 **Depth:** 8.0 **Sample Number:** 4

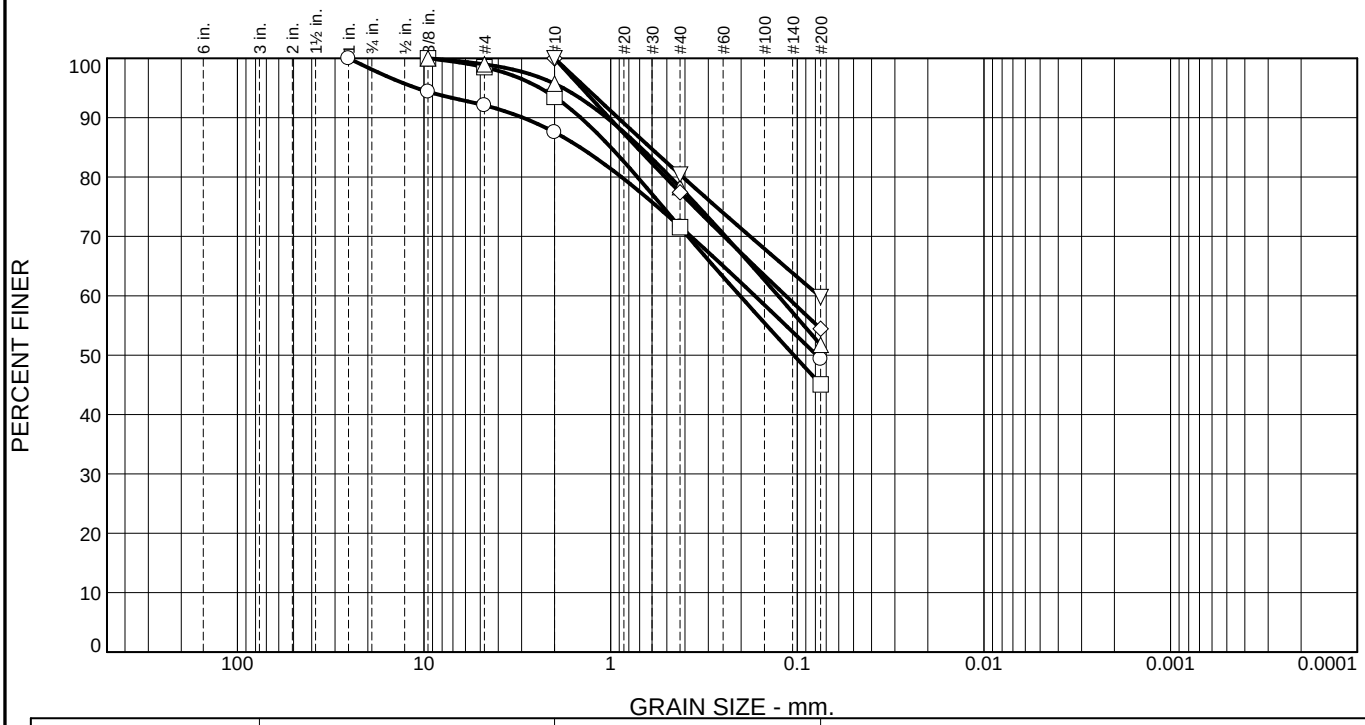
▽ **Source of Sample:** DR-1 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.5	15.9	22.2	49.4	
□	0.0	6.5	21.9	26.5	45.1	
△	0.0	4.3	17.4	26.6	51.7	
◇	0.0	0.0	22.6	23.0	54.4	
▽	0.0	0.0	19.6	20.6	59.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30.3	19.3	1.4586	0.1689	0.0787					
□	35.5	25.6	0.9981	0.2028	0.1044					
△	37.3	24.9	0.6927	0.1267						
◇	61.7	36.3	0.7237	0.1153						
▽	60.2	39.2	0.6147	0.0764						

Material Description	USCS	AASHTO
○ Wet firm gray fine sandy clay w/some silt, coarse sand and fine gravel.	SC	A-6(2)
□ Saturated firm gray clayey fine to coarse sandy silt w/trace fine gravel.	SM	A-4(2)
△ Saturated firm gray fine sandy clay w/some silt, coarse sand and organic matter, trace of fine gravel.	CL	A-6(4)
◇ Saturated stiff gray organic fine to coarse sandy clay w/some silt.	MH	A-7-5(12)
▽ Saturated stiff gray organic silty fine sandy clay w/some coarse sand.	MH	A-7-5(12)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-1 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** DR-1 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** DR-1 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** DR-1 **Depth:** 18.0 **Sample Number:** 9

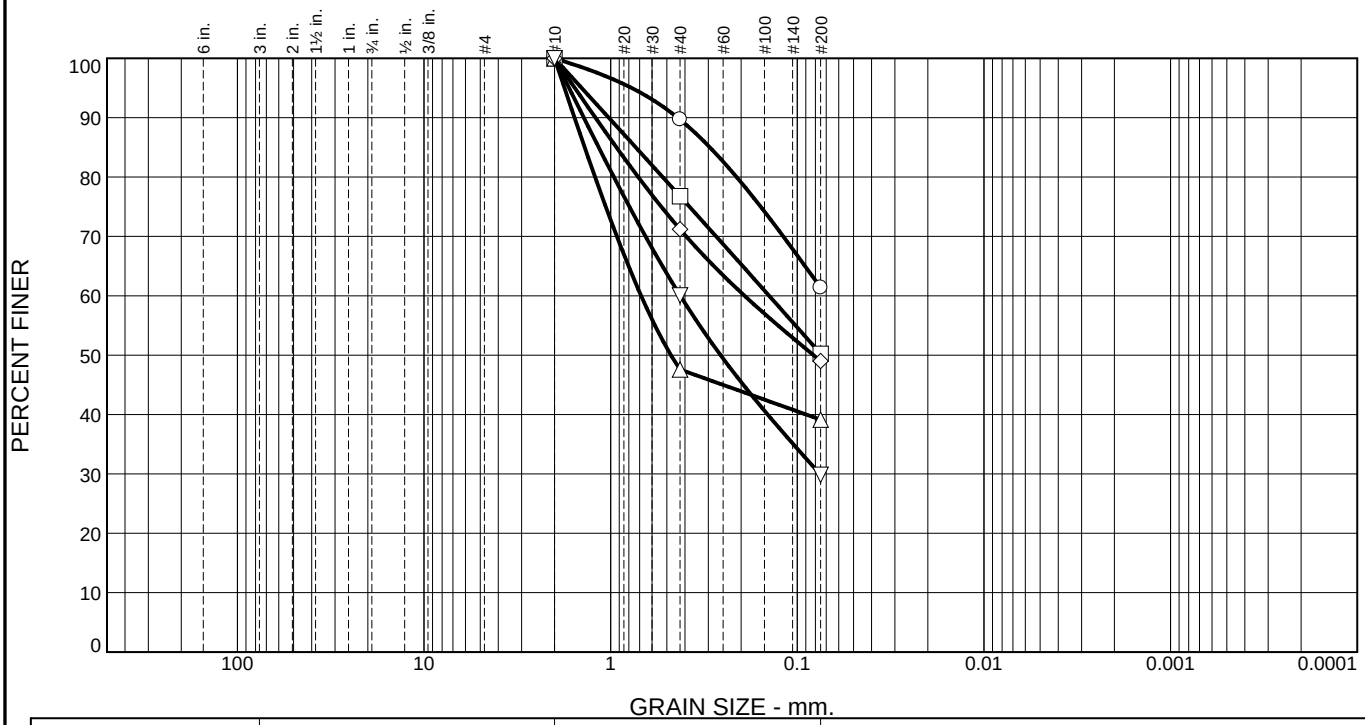
▽ **Source of Sample:** DR-1 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	10.3	28.3	61.4	
□	0.0	0.0	23.2	26.6	50.2	
△	0.0	0.0	52.4	8.5	39.1	
◇	0.0	0.0	28.8	22.2	49.0	
▽	0.0	0.0	39.9	30.3	29.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	54.9	33.3	0.2940							
□	78.5	51.1	0.7337	0.1416						
△	84.4	56.7	1.3782	0.6868	0.4753					
◇	64.5	42.4	0.9314	0.1917	0.0819					
▽	NV	NP	1.1592	0.4235	0.2575	0.0758				

Material Description	USCS	AASHTO
○ Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	MH	A-7-5(13)
□ Saturated stiff gray organic fine to coarse sandy clay w/some silt.	MH	A-7-5(12)
△ Saturated stiff gray organic coarse sandy clay w/some silt, trace of fine sand.	SM	A-7-5(6)
◇ Saturated stiff gray organic coarse to fine sandy clay w/some silt.	SM	A-7-5(9)
▽ Saturated medium dense gray organic silty coarse to fine sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-1 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** DR-1 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** DR-1 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** DR-1 **Depth:** 44.0 **Sample Number:** 14

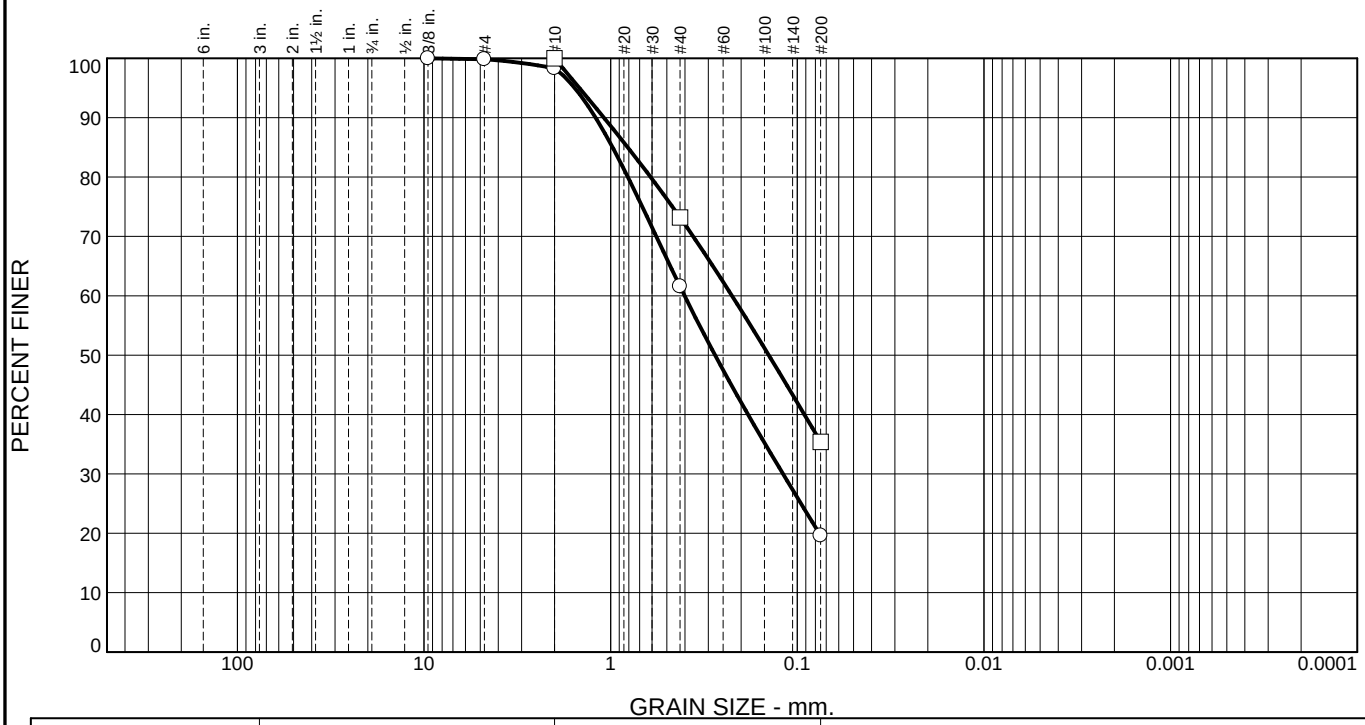
▽ **Source of Sample:** DR-1 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.7	36.7	42.0	19.6	
□	0.0	0.0	26.8	37.8	35.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9768	0.4016	0.2757	0.1193				
□	NV	NP	0.8106	0.2238	0.1423					

Material Description	USCS	AASHTO
○ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated very dense gray silty fine to coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-1 **Depth:** 54.0 **Sample Number:** 16

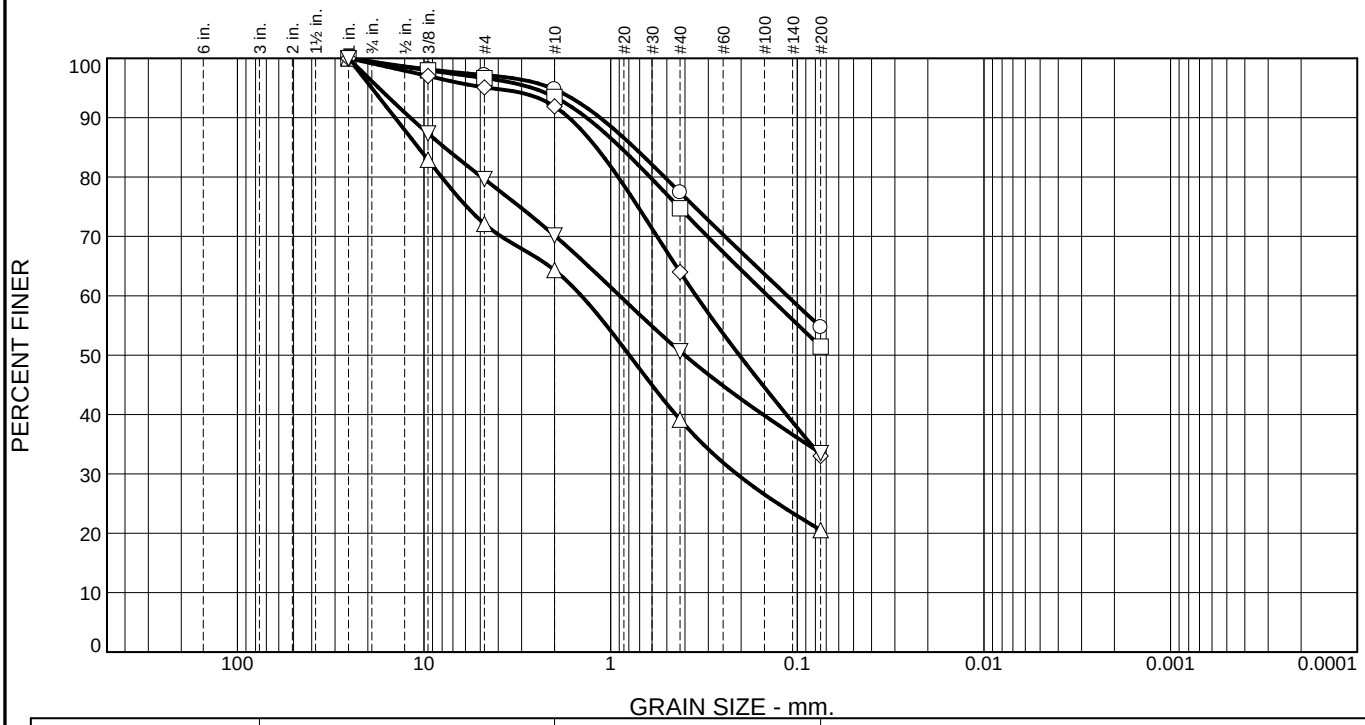
□ **Source of Sample:** DR-1 **Depth:** 64.0 **Sample Number:** 18

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.2	17.4	22.7	54.7	
□	0.0	6.5	18.8	23.3	51.4	
△	0.0	35.7	25.2	18.6	20.5	
◇	0.0	8.1	27.9	31.0	33.0	
▽	0.0	29.8	19.5	17.2	33.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19.1	NP	0.7486	0.1132						
□	27.1	16.7	0.8854	0.1441						
△	25.1	16.5	10.7382	1.4344	0.7946	0.2113				
◇	22.0	15.7	1.1941	0.3485	0.2044					
▽	24.5	19.0	7.7714	0.8942	0.4014					

Material Description	USCS	AASHTO
○ Wet hard brown fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
□ Wet firm brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	CL	A-4(2)
△ Wet medium dense brown clayey coarse sand and fine gravel w/some fine sand and silt.	SC	A-2-4(0)
◇ Wet medium dense brown clayey fine to coarse sand w/some silt, trace of fine gravel.	SC-SM	A-2-4(0)
▽ Wet medium dense brown clayey fine gravel w/some coarse to fine sand, trace of silt.	SC-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-2 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** DR-2 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** DR-2 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** DR-2 **Depth:** 8.0 **Sample Number:** 4

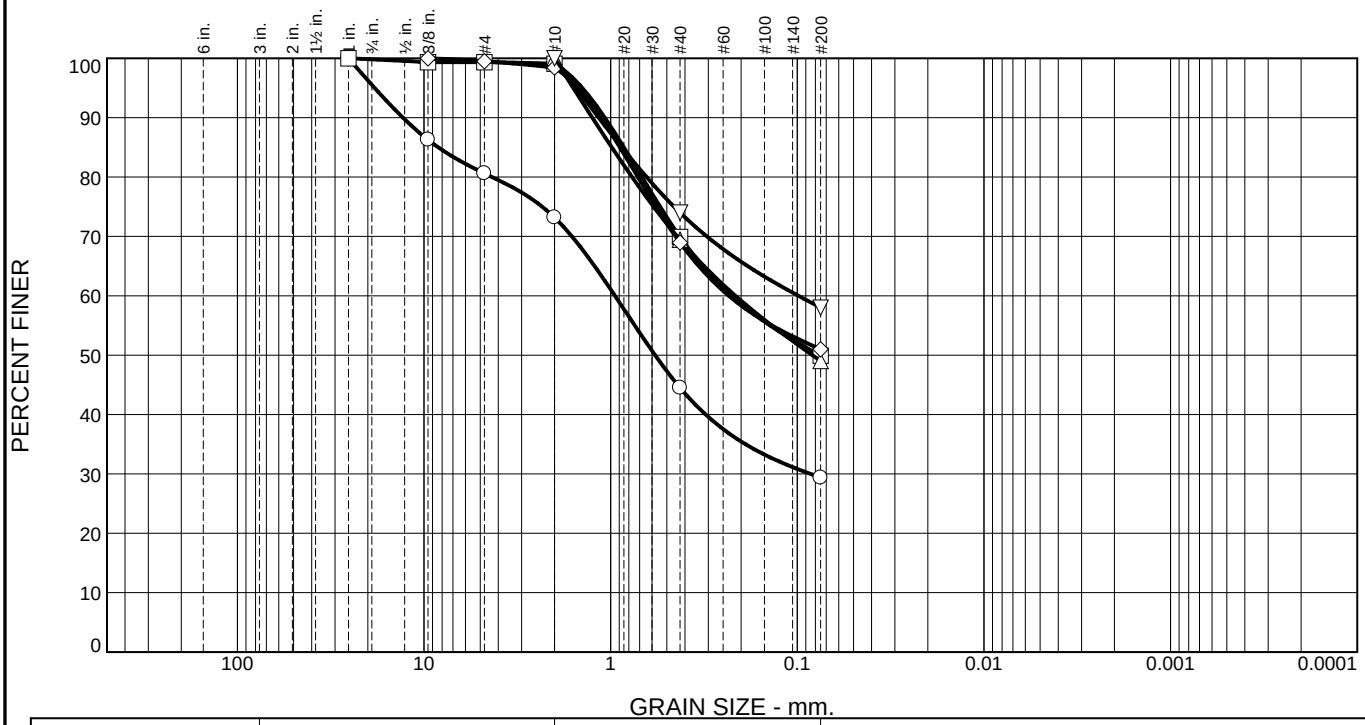
▽ **Source of Sample:** DR-2 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	26.8	28.7	15.1	29.4	
□	0.0	0.9	29.2	20.0	49.9	
△	0.0	0.0	30.6	20.4	49.0	
◇	0.0	1.6	29.4	18.0	51.0	
▽	0.0	0.0	26.0	16.0	58.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	29.1	20.7	8.3925	0.9481	0.5779	0.0850				
□	57.9	34.7	0.8494	0.2245	0.0758					
△	61.2	33.9	0.9863	0.2147	0.0831					
◇	54.2	31.8	0.8924	0.2329						
▽	52.3	35.6	0.8711	0.0986						

Material Description	USCS	AASHTO
○ Wet loose brown clayey coarse sand and fine gravel w/some fine sand, trace of silt.	SC	A-2-4(0)
□ Saturated firm brown coarse sandy clay w/some fine sand and silt, trace of fine gravel.	SM	A-7-5(9)
△ Saturated stiff brown coarse sandy clay w/some fine sand and silt.	SM	A-7-5(10)
◇ Saturated stiff gray coarse sandy clay w/some fine sand, organic matter and silt, trace of fine gravel.	MH	A-7-5(9)
▽ Saturated stiff gray organic coarse sandy clay w/some fine sand and silt.	MH	A-7-5(9)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-2 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** DR-2 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** DR-2 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** DR-2 **Depth:** 18.0 **Sample Number:** 9

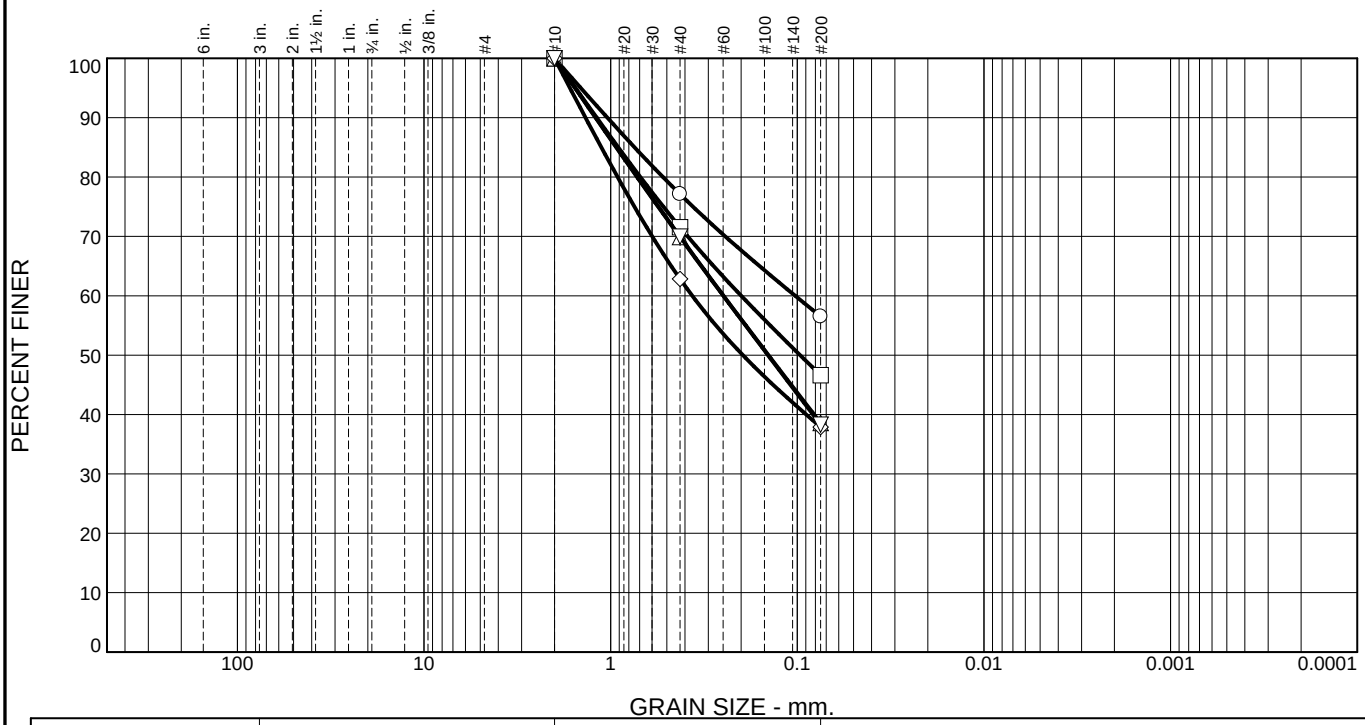
▽ **Source of Sample:** DR-2 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	22.9	20.6	56.5	
□	0.0	0.0	28.4	25.0	46.6	
△	0.0	0.0	30.1	31.3	38.6	
◇	0.0	0.0	37.2	24.9	37.9	
▽	0.0	0.0	30.0	31.7	38.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	62.1	40.1	0.7444	0.1026						
□	79.3	54.3	0.9106	0.1997	0.0966					
△	80.0	57.3	0.9339	0.2490	0.1428					
◇	64.2	45.4	1.1218	0.3654	0.1958					
▽	58.3	42.3	0.9300	0.2487	0.1436					

Material Description	USCS	AASHTO
○ Saturated stiff gray organic coarse to fine sandy clay w/some silt.	MH	A-7-5(11)
□ Saturated firm gray organic coarse to fine sandy clay w/some silt.	SM	A-7-5(10)
△ Saturated stiff gray organic fine to coarse sandy clay w/trace silt.	SM	A-7-5(5)
◇ Saturated very stiff gray organic coarse to fine sandy clay w/some silt.	SM	A-7-5(3)
▽ Saturated very stiff gray organic fine to coarse sandy clay w/some silt.	SM	A-7-5(2)

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-2 **Depth:** 29.0 **Sample Number:** 12

□ **Source of Sample:** DR-2 **Depth:** 34.0 **Sample Number:** 13

△ **Source of Sample:** DR-2 **Depth:** 39.0 **Sample Number:** 14

◇ **Source of Sample:** DR-2 **Depth:** 44.0 **Sample Number:** 15

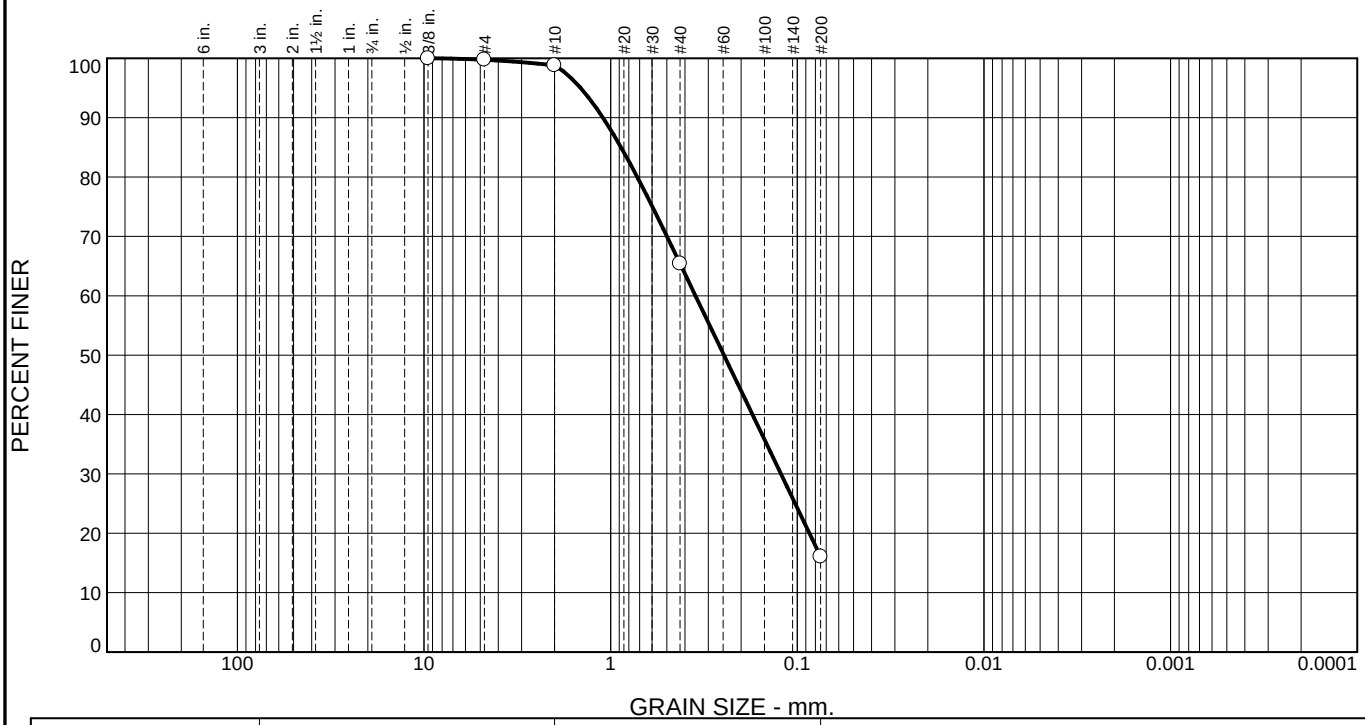
▽ **Source of Sample:** DR-2 **Depth:** 49.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.2	33.4	49.3	16.1	
□						

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8799	0.3512	0.2471	0.1224				
□	NV	NP								

Material Description	USCS	AASHTO
○ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt, trace of fine		

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** DR-2 **Depth:** 54.0 **Sample Number:** 17

□ **Source of Sample:** DR-2 **Depth:** 59.0 **Sample Number:** 18

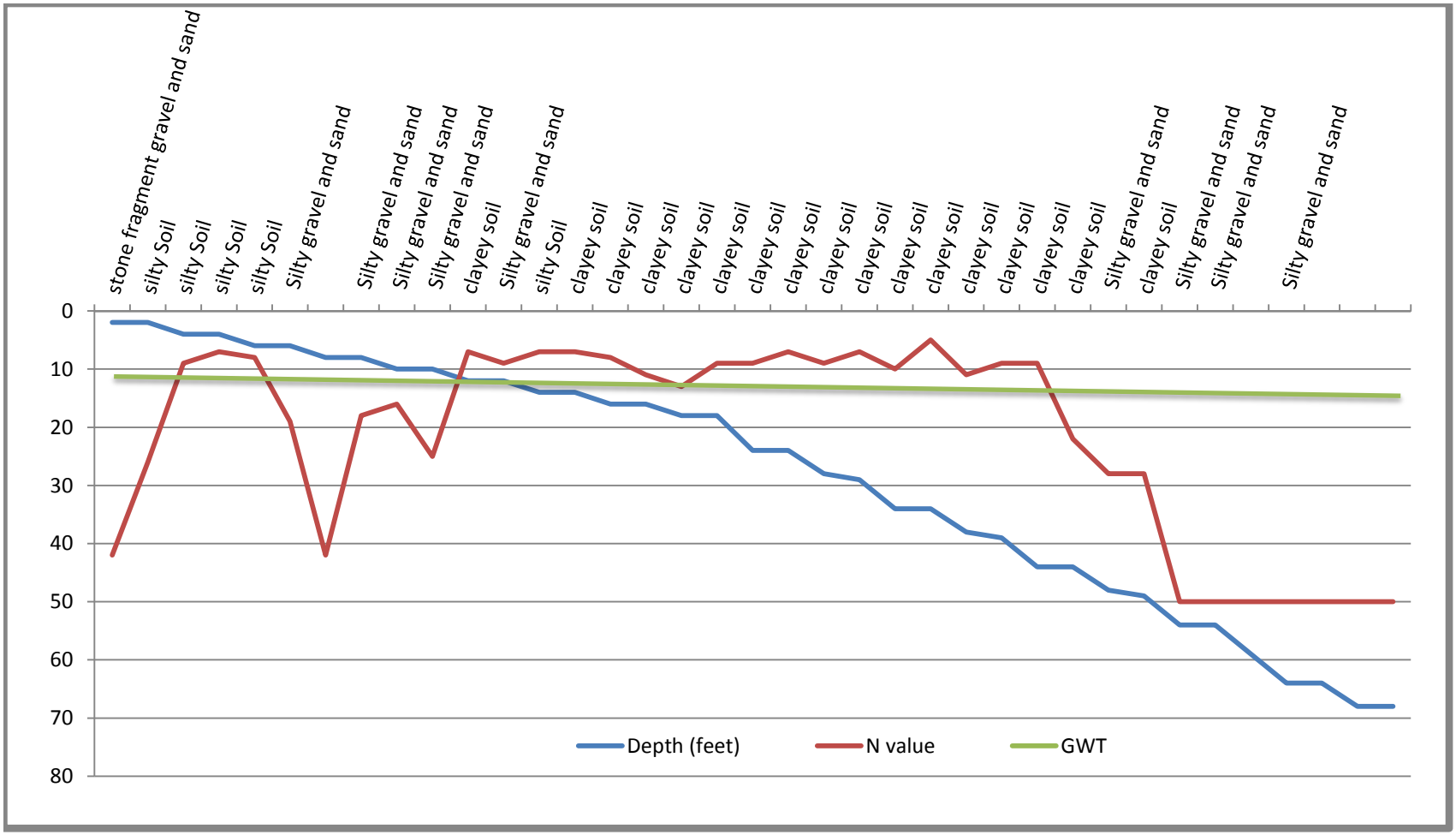
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
DR-1														
	1	2	Moist dense brown silty coarse to fine sand w/some fine gravel.	NV	NP	9.3	SM	A-1-b	88.9	22.1	9	11	31	28
	2	4	Moist stiff brown fine to coarse sandy silt w/some fine gravel and clay.	20.6	3.5	12.2	SC-SM	A-4(0)	88.1	42.5	4	4	5	5
	3	6	Wet firm brown fine sandy silt w/some coarse sand and clay, trace of fine gravel.	20.9	3.5	16.1	CL-ML	A-4(0)	90.4	53.2	5	4	4	3
	4	8	No sieve analysis - Indication of wet very dense gray silty fine to coarse sand and fine gravel.	18.8	NP	15.7					4	21	21	16
	5	10	Wet medium dense gray silty fine to coarse sand and fine gravel w/some clay.	21.2	4.9	19.5	SC-SM	A-2-4(0)	76.3	26.4	7	11	5	6
	6	12	Wet firm gray fine sandy clay w/some silt, coarse sand and fine gravel.	30.3	11	24.5	SC	A-6(2)	87.5	49.4	3	3	4	3
	7	14	Saturated firm gray clayey fine to coarse sandy silt w/trace fine gravel.	35.5	9.9	36.9	SM	A-4(2)	93.5	45.1	3	3	4	3
	8	16	Saturated firm gray fine sandy clay w/some silt, coarse sand and organic matter, trace of fine gravel.	37.3	12.4	42.9	CL	A-6(4)	95.7	51.7	4	4	4	4
	9	18	Saturated stiff gray organic fine to coarse sandy clay w/some silt.	61.7	25.4	56.4	MH	A-7-5(12)	100	54.4	5	6	7	7
	10	24	Saturated stiff gray organic silty fine sandy clay w/some coarse sand.	60.2	21	69.5	MH	A-7-5(12)	100	59.8	5	5	4	5
	11	28	Saturated stiff gray organic silty fine sandy clay w/trace coarse sand.	54.9	21.6	71.1	MH	A-7-5(13)	100	61.4	3	4	5	4
	12	34	Saturated stiff gray organic fine to coarse sandy clay w/some silt.	78.5	27.4	96.5	MH	A-7-5(12)	100	50.2	5	5	5	5
	13	38	Saturated stiff gray organic coarse sandy clay w/some silt, trace of fine sand.	84.4	27.7	101.6	SM	A-7-5(6)	100	39.1	4	6	5	4
	14	44	Saturated stiff gray organic coarse to fine sandy clay w/some silt.	64.5	22.1	64.4	SM	A-7-5(9)	100	49	4	4	5	4
	15	48	Saturated medium dense gray organic silty coarse to fine sand.	NV	NP	63.4	SM	A-2-4(0)	100	29.8	12	13	15	16
	16	54	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	32.9	SM	A-2-4(0)	98.3	19.6	38	50		
	17	58	No sieve analysis - Indication of saturated very dense gray fine to coarse sand w/some silt, trace of fine grav			39.6					50			
	18	64	Saturated very dense gray silty fine to coarse sand.	NV	NP	37.9	SM	A-2-4(0)	100	35.4	50			
	19	68	No Recovery								50			
		70	End Boring											
DR-2														
	1	2	Wet hard brown fine sandy silt w/some coarse sand, trace of fine gravel.	19.1	NP	11.3	ML	A-4(0)	94.8	54.7	23	14	12	6
	2	4	Wet firm brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	27.1	10.4	15.9	CL	A-4(2)	93.5	51.4	4	3	4	3
	3	6	Wet medium dense brown clayey coarse sand and fine gravel w/some fine sand and silt.	25.1	8.6	12	SC	A-2-4(0)	64.3	20.5	4	9	10	8
	4	8	Wet medium dense brown clayey fine to coarse sand w/some silt, trace of fine gravel.	22	6.3	15.1	SC-SM	A-2-4(0)	91.9	33	5	6	12	24
	5	10	Wet medium dense brown clayey fine gravel w/some coarse to fine sand, trace of silt.	24.5	5.5	22.2	SC-SM	A-2-4(0)	70.2	33.5	6	12	13	5
	6	12	Wet loose brown clayey coarse sand and fine gravel w/some fine sand, trace of silt.	29.1	8.4	26.2	SC	A-2-4(0)	73.2	29.4	3	4	5	5
	7	14	Saturated firm brown coarse sandy clay w/some fine sand and silt, trace of fine gravel.	57.9	23.2	52.2	SM	A-7-5(9)	99.1	49.9	2	3	4	5
	8	16	Saturated stiff brown coarse sandy clay w/some fine sand and silt.	61.2	27.3	59.6	SM	A-7-5(10)	100	49	5	5	6	5
	9	18	Saturated stiff gray coarse sandy clay w/some fine sand, organic matter and silt, trace of fine gravel.	54.2	22.4	60.1	MH	A-7-5(9)	98.4	51	5	4	5	5
	U-1	22												
	11	24	Saturated stiff gray organic coarse sandy clay w/some fine sand and silt.	52.3	16.7	73	MH	A-7-5(9)	100	58	2	3	4	5
	12	29	Saturated stiff gray organic coarse to fine sandy clay w/some silt.	62.1	22	80.4	MH	A-7-5(11)	100	56.5	3	3	4	5
	13	34	Saturated firm gray organic coarse to fine sandy clay w/some silt.	79.3	25	104.2	SM	A-7-5(10)	100	46.6	2	2	3	4
	14	39	Saturated stiff gray organic fine to coarse sandy clay w/trace silt.	80	22.7	97.2	SM	A-7-5(5)	100	38.6	3	4	5	6

DATE : **3-14-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR1-455 on Deer Run Rd over Sawmill Branch- Townsend, DE**



DATE : **3-14-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR1-455 on Deer Run Rd over Sawmill Branch- Townsend, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-17-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-615 on Newport Gap Pike over Waterway - Wilmington DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-21-2016. Walton Corporation-Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 51 feet below the existing ground surface elevation, In addition 10 feet of coring rock was collected from this site . Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 10 by Ramsey, K.W 2001. The area is situated in Mill Creek Metagabbro as an Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary minerals are hornblende and plagioclase.

3. Ground Water Background

3.1 The Water-Table and Surface-Drainage were not encountered for this site.
3.2 The Delaware Geologic Information Resource (DGIR) was not encountered for this site.

4. Hydrologic Background

The Delaware Geological Survey Geohydrology was not encountered for this site.

5. Ground Cover

The ground cover for this site is 7 inches of asphalt top of 8 inches of concrete. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 9 and 16 feet and caved at 9 and 24.6 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 11.3 to 41.9 percent. The Atterberg limit is 55 percent, Liquid limits is 21.8 to 40.1 percent and Plasticity Index is 4 to 6 percent. Organic matter is 9 % percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition. If the design is shallow foundation the first 8 feet of loose fine sand from the surface elevation need to be considering in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had enough of all borrow type material to reuse according to Del-DOT standard specification except borrow type ”B”. The Rock coring where collected appeared recovery is 75 to 100 % percent and the Rock Quality Designation RQD is range of 31 to 50 % percent this is poor condition more detail at Appendix D.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (8- sheets)

APPENDIX C

- Grain Size Distribution Result (5- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 5-17-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-615 on Newport Gap Pike over Waterway - Wilmington DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
NG-1	640954.069	588017.099	39.7595750	-75.6590694
NG-2	640873.963	588079.359	39.7593556	-75.6588472

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING NG-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 640954.069
Easting: 588017.099
Boring Surface Elev.:
Reference:
Date Started: 3/21/16
Date Completed: 3/21/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 51.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/21/16	16.0	
3/21/16	14.2	24.6

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	5 3 2 2	Moist loose brown coarse to fine sand w/ some fine gravel and silt. 5" RECOVERY	A-2-4(0)	
5.06		2	4.0' – 6.0'	2 2 2 2	Wet very loose brown fine to coarse sand w/ some fine gravel and silt. 9" RECOVERY	A-2-4(0)	
7.59		3	6.0' – 8.0'	1 1 1 1	Wet very loose brown coarse to fine sand w/ some fine gravel and silt. 4" RECOVERY	A-1-b	
10.12		4	8.0' – 10.0'	3 3 3 4	Wet firm brown coarse to fine sandy silt w/ some fine gravel, trace of organic matter. 8" RECOVERY	A-4(0)	
12.65		5	10.0' – 12.0'	7 8 5 5	Wet medium dense brown silty fine to coarse sand and fine gravel. 20" RECOVERY	A-2-4(0)	
		6	12.0' – 14.0'	6 5 8 7	No Recovery NR" RECOVERY		
15.18	▼	7	14.0'	7 8 9 9	Saturated medium dense brown silty fine sand w/some coarse sand.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		15" RECOVERY		
	■	8	16.0'	7 7 9 11	Saturated medium dense brown silty fine to coarse sand w/some fine gravel.	A-2-4(0)	
17.71			18.0'		22" RECOVERY		
		9	18.0'	9 9 10 11	Saturated medium dense brown silty fine sand w/some coarse sand.	A-2-4(0)	
20.24			20.0'		14" RECOVERY		
22.77							
		10	24.0'	32 50	Saturated very dense gray silty fine to coarse sand.	A-2-4(0)	
25.3			26.0'		13" RECOVERY		
27.83							
		11	28.0'	50	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
30.36			30.0'		4" RECOVERY		
32.89							
		12	34.0'	50	Saturated very dense gray silty fine to coarse sand.	A-2-4(0)	
35.42			36.0'		4" RECOVERY		
37.95							
		13	38.0'	18	Saturated very dense gray silty fine to coarse	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				50	sand.		
			40.0'		6" RECOVERY		
40.48							
43.01							
		14	44.0'	50	Saturated hard gray fine to coarse sandy silt w/some clay.	A-4(0)	
45.54							
			46.0'		5" RECOVERY		
		R-1	46.0'		Schist - Recovery 94% RQD 85%		
48.07							
50.6							
			51.0'		56.5" RECOVERY		
					End Boring		
53.13							
55.66							
58.19							
60.72							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Silty soils
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING NG-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 640954.069
Easting: 588017.099
Boring Surface Elev.:
Reference:
Date Started: 3/21/16
Date Completed: 3/21/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 21.5
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/21/16	9.0	
3/21/16	3.0	9.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'		Wet brown clayey fine sandy silt w/some coarse sand, trace of fine gravel. 9" RECOVERY	A-4(1)	Hot-mix 7" Concrete 8"
2.53		2	2.0' 4.0'	4 4 4 5	Wet firm brown clayey silt w/some fine sand, trace of coarse sand, fine gravel and organic matter. 13" RECOVERY	A-4(2)	
5.06		3	4.0' 6.0'	1 3 4 15	Wet firm brown silt w/some fine sand and clay, trace of coarse sand and fine gravel. 13" RECOVERY	A-4(1)	
7.59		4	6.0' 8.0'	16 15 10 10	Wet medium dense brown silty fine sand and fine gravel w/some coarse sand. 5" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	7 5 4 3	Wet stiff gray fine sandy silt w/some coarse sand and fine gravel. 17" RECOVERY	A-4(0)	
		6	10.0' 12.0'	5 8 8 12	Saturated stiff gray fine sandy silt w trace coarse sand and fine gravel. 19" RECOVERY	A-4(0)	
12.65		7	12.0' 14.0'	5 6 10 12	Saturated medium dense gray silty fine sand w/some coarse sand, trace of fine gravel. 17" RECOVERY	A-2-4(0)	
		8	14.0'	2 2	Saturated firm gray fine sandy silt w/some	A-4(0)	

Remarks: Hit obstruction @ 16.5'. Moved 5'

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	4 15	coarse sand, trace of fine gravel. 18" RECOVERY		
		9	16.0'	40 50	Saturated very dense gray silty fine sand and fine gravel w/some coarse sand. 6" RECOVERY	A-2-4(0)	
		R1	16.5' 16.5'		Schist - Recovery 100% RQD 100%		
17.71							
20.24			21.5'		60" RECOVERY		
					End Boring		
22.77							
25.3							
27.83							
30.36							
32.89							
35.42							

KEY TO SYMBOLS

Symbol Description

Strata symbols

Silty soils

Poorly graded, silty or clayey sands and gravel

Misc. Symbols

Description not given for: "WATER2"

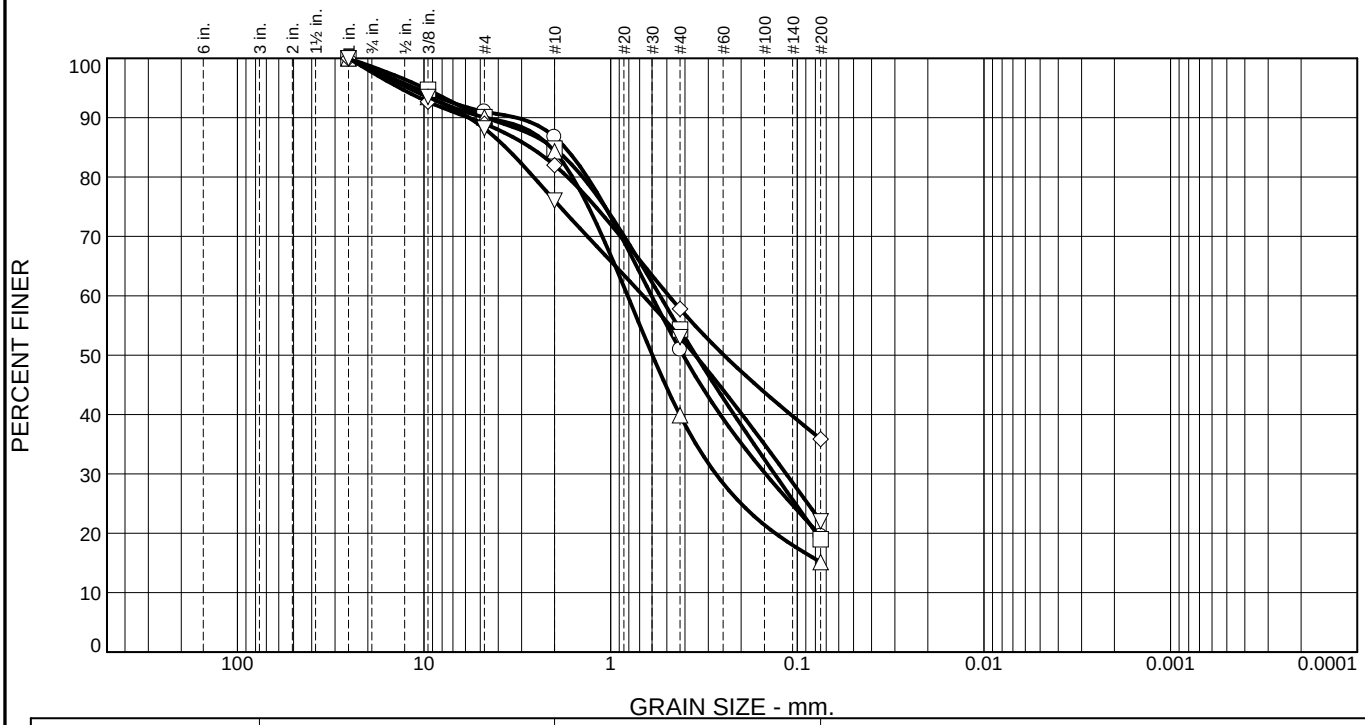
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	13.2	35.9	31.3	19.6	
□	0.0	15.2	30.5	35.3	19.0	
△	0.0	15.7	44.4	24.8	15.1	
◇	0.0	18.0	24.2	21.9	35.9	
▽	0.0	24.0	23.0	31.0	22.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.7578	0.6034	0.4091	0.1479				
□	NV	NP	2.0401	0.5443	0.3501	0.1325				
△	NV	NP	2.0897	0.8109	0.5975	0.2732				
◇	23.1	NP	2.6896	0.4879	0.2472					
▽	NV	NP	3.6508	0.6695	0.3525	0.1147				

Material Description	USCS	AASHTO
○ Moist loose brown coarse to fine sand w/some fine gravel and silt.	SM	A-2-4(0)
□ Wet very loose brown fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
△ Wet very loose brown coarse to fine sand w/some fine gravel and silt.	SM	A-1-b
◇ Wet firm brown coarse to fine sandy silt w/some fine gravel, trace of organic matter.	SM	A-4(0)
▽ Wet medium dense brown silty fine to coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-1 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** NG-1 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** NG-1 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** NG-1 **Depth:** 8.0 **Sample Number:** 4

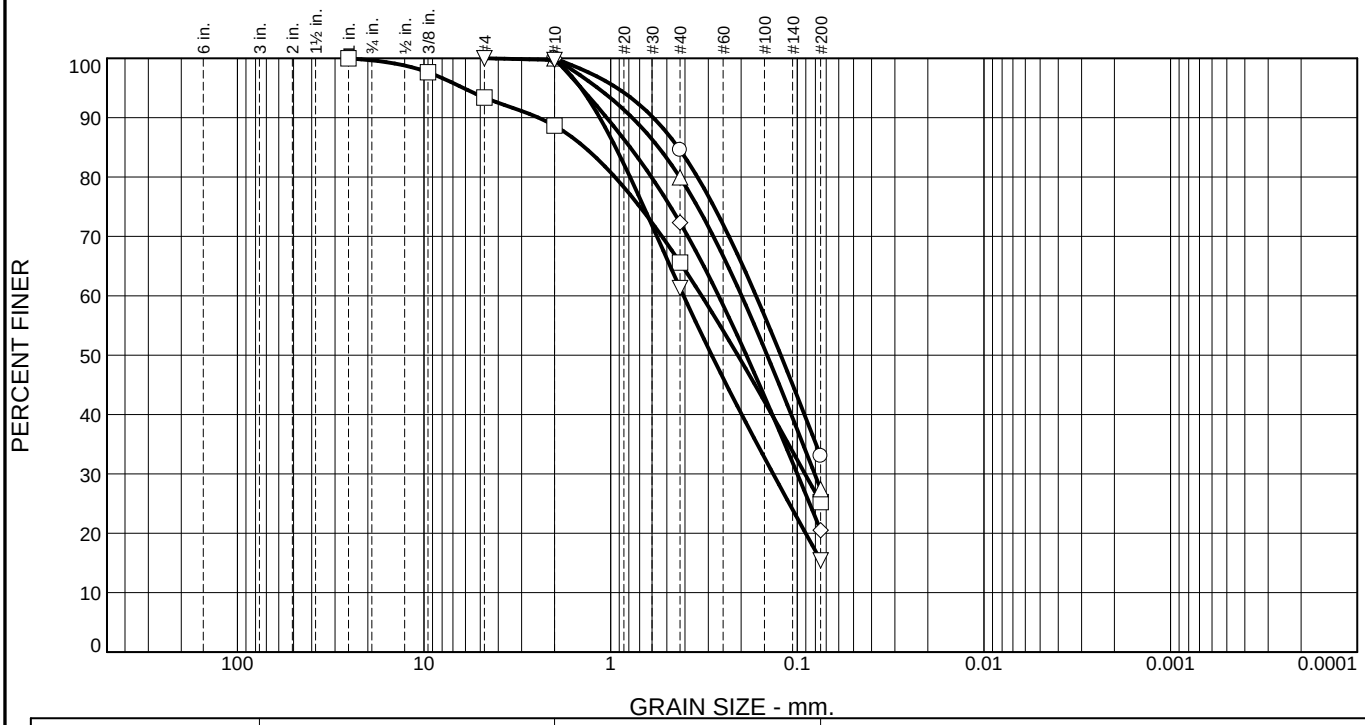
▽ **Source of Sample:** NG-1 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	15.4	51.6	33.0	
□	0.0	11.3	23.1	40.4	25.2	
△	0.0	0.0	20.1	52.5	27.4	
◇	0.0	0.0	27.7	51.8	20.5	
▽	0.0	0.3	38.4	45.9	15.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	31.7	NP	0.4351	0.1665	0.1227					
□	NV	NP	1.3777	0.3256	0.2085	0.0909				
△	NV	NP	0.5535	0.1988	0.1451	0.0807				
◇	NV	NP	0.7862	0.2640	0.1876	0.1000				
▽	NV	NP	0.9407	0.4068	0.2873	0.1347				

Material Description	USCS	AASHTO
○ Saturated medium dense brown silty fine sand w/some coarse sand.	SM	A-2-4(0)
□ Saturated medium dense brown silty fine to coarse sand w/some fine gravel.	SM	A-2-4(0)
△ Saturated medium dense brown silty fine sand w/some coarse sand.	SM	A-2-4(0)
◇ Saturated very dense gray silty fine to coarse sand.	SM	A-2-4(0)
▽ Saturated very dense gray fine to coarse sand w/some silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-1 **Depth:** 14.0 **Sample Number:** 7

□ **Source of Sample:** NG-1 **Depth:** 16.0 **Sample Number:** 8

△ **Source of Sample:** NG-1 **Depth:** 18.0 **Sample Number:** 9

◇ **Source of Sample:** NG-1 **Depth:** 24.0 **Sample Number:** 10

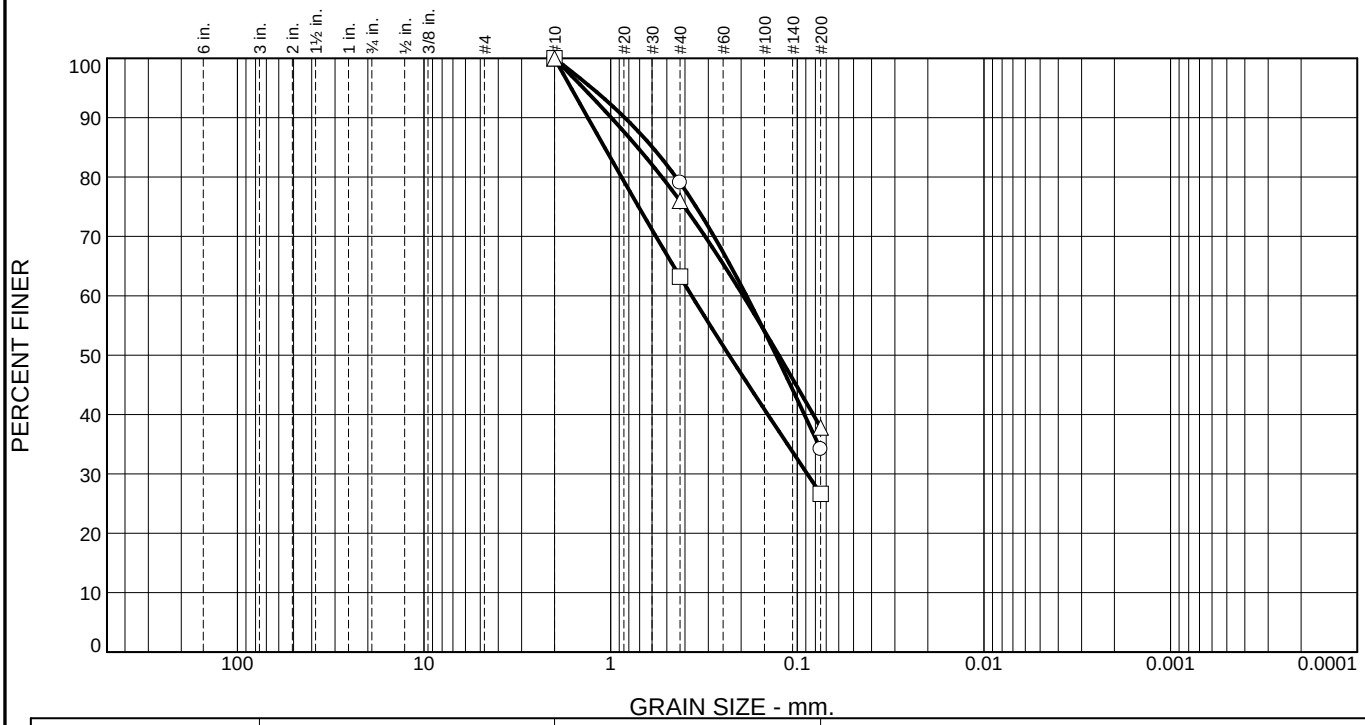
▽ **Source of Sample:** NG-1 **Depth:** 28.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	21.0	44.8	34.2	
□	0.0	0.0	36.8	36.6	26.6	
△	0.0	0.0	24.0	38.2	37.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22.8	NP	0.5963	0.1873	0.1300					
□	NV	NP	1.0780	0.3678	0.2320	0.0884				
△	25.2	21.2	0.7175	0.1950	0.1257					

Material Description	USCS	AASHTO
○ Saturated very dense gray silty fine to coarse sand.	SM	A-2-4(0)
□ Saturated very dense gray silty fine to coarse sand.	SM	A-2-4(0)
△ Saturated hard gray fine to coarse sandy silt w/some clay.	SC-SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-1 **Depth:** 34.0 **Sample Number:** 12

□ **Source of Sample:** NG-1 **Depth:** 38.0 **Sample Number:** 13

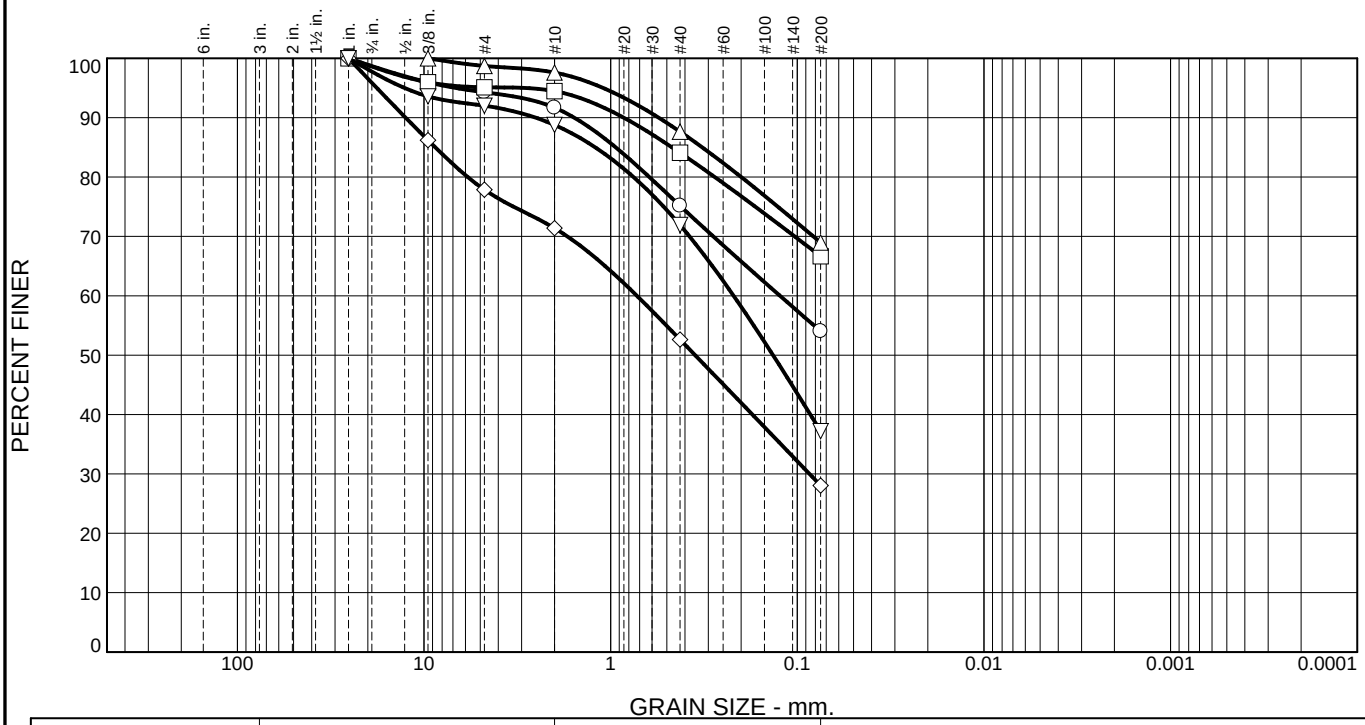
△ **Source of Sample:** NG-1 **Depth:** 44.0 **Sample Number:** 14

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.3	16.5	21.2	54.0	
□	0.0	5.5	10.4	17.4	66.7	
△	0.0	2.4	10.0	18.6	69.0	
◇	0.0	28.6	18.8	24.6	28.0	
▽	0.0	11.2	16.9	34.7	37.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	23.9	18.3	0.9400	0.1238						
□	25.3	19.3	0.4690							
△	26.2	21.6	0.3230							
◇	21.8	NP	8.7049	0.7230	0.3528	0.0861				
▽	35.7	NP	1.2092	0.2193	0.1350					

Material Description	USCS	AASHTO
○ Wet brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	CL-ML	A-4(1)
□ Wet firm brown clayey silt w/some fine sand, trace of coarse sand, fine gravel and organic matter.	CL-ML	A-4(2)
△ Wet firm brown silt w/some fine sand and clay, trace of coarse sand and fine gravel.	CL-ML	A-4(1)
◇ Wet medium dense brown silty fine sand and fine gravel w/some coarse sand.	SM	A-2-4(0)
▽ Wet stiff gray fine sandy silt w/some coarse sand and fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-2 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** NG-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** NG-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** NG-2 **Depth:** 6.0 **Sample Number:** 4

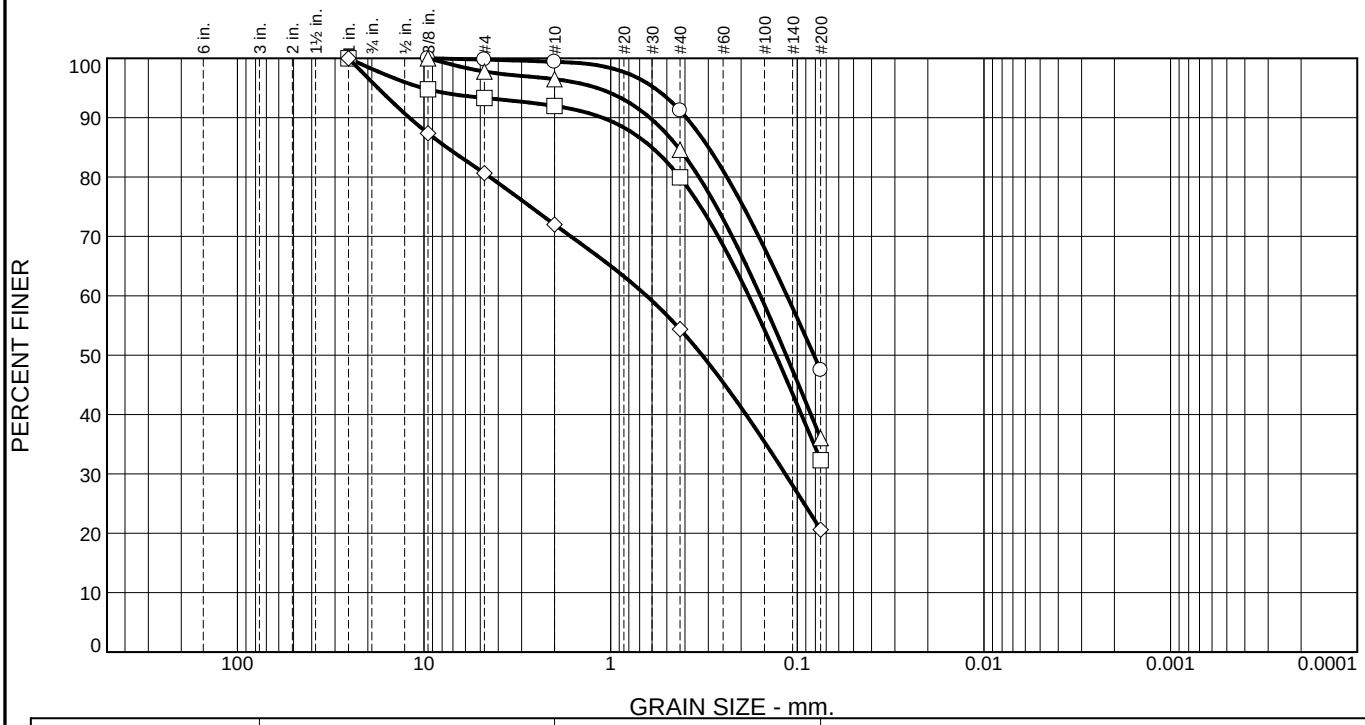
▽ **Source of Sample:** NG-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.6	8.2	43.7	47.5	
□	0.0	8.0	12.0	47.7	32.3	
△	0.0	3.5	11.9	48.6	36.0	
◇	0.0	28.0	17.6	33.8	20.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40.0	NP	0.2991	0.1136	0.0814					
□	37.8	NP	0.6017	0.1822	0.1303					
△	40.1	NP	0.4349	0.1578	0.1147					
◇	NV	NP	7.5581	0.6423	0.3235	0.1160				

Material Description	USCS	AASHTO
○ Saturated stiff gray fine sandy silt w trace coarse sand and fine gravel.	SM	A-4(0)
□ Saturated medium dense gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
△ Saturated firm gray fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)
◇ Saturated very dense gray silty fine sand and fine gravel w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** NG-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** NG-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** NG-2 **Depth:** 16.0 **Sample Number:** 9

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
NG-1														
	1	2	Moist loose brown coarse to fine sand w/some fine gravel and silt.	NV	NP	11.3	SM	A-2-4(0)	86.8	19.6	5	3	2	2
	2	4	Wet very loose brown fine to coarse sand w/some fine gravel and silt.	NV	NP	15.5	SM	A-2-4(0)	84.8	19	2	2	2	2
	3	6	Wet very loose brown coarse to fine sand w/some fine gravel and silt.	NV	NP	18.6	SM	A-1-b	84.3	15.1	1	1	1	1
	4	8	Wet firm brown coarse to fine sandy silt w/some fine gravel, trace of organic matter.	23.1	NP	22.5	SM	A-4(0)	82	35.9	3	3	3	4
	5	10	Wet medium dense brown silty fine to coarse sand and fine gravel.	NV	NP	23.4	SM	A-2-4(0)	76	22	7	8	5	5
	6	12	No Recovery								6	5	8	7
	7	14	Saturated medium dense brown silty fine sand w/some coarse sand.	31.7	NP	31.2	SM	A-2-4(0)	100	33	7	8	9	9
	8	16	Saturated medium dense brown silty fine to coarse sand w/some fine gravel.	NV	NP	28.5	SM	A-2-4(0)	88.7	25.2	7	7	9	11
	9	18	Saturated medium dense brown silty fine sand w/some coarse sand.	NV	NP	25.5	SM	A-2-4(0)	100	27.4	9	9	10	11
	10	24	Saturated very dense gray silty fine to coarse sand.	NV	NP	23	SM	A-2-4(0)	100	20.5	32	50		
	11	28	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	25	SM	A-2-4(0)	99.7	15.4	50			
	12	34	Saturated very dense gray silty fine to coarse sand.	22.8	NP	17.9	SM	A-2-4(0)	100	34.2	50			
	13	38	Saturated very dense gray silty fine to coarse sand.	NV	NP	19.1	SM	A-2-4(0)	100	26.6	18	50		
	14	44	Saturated hard gray fine to coarse sandy silt w/some clay.	25.2	4	13.7	SC-SM	A-4(0)	100	37.8	50			
	R-1	46	Schist - Recovery 94% RQD 85%											
		51	End Boring											
NG-2														
	1	1	Wet brown clayey fine sandy silt w/some coarse sand, trace of fine gravel.	23.9	5.6	15.2	CL-ML	A-4(1)	91.7	54				
	2	2	Wet firm brown clayey silt w/some fine sand, trace of coarse sand, fine gravel and organic matter.	25.3	6	17.8	CL-ML	A-4(2)	94.5	66.7	4	4	4	5
	3	4	Wet firm brown silt w/some fine sand and clay, trace of coarse sand and fine gravel.	26.2	4.6	24.3	CL-ML	A-4(1)	97.6	69	1	3	4	15
	4	6	Wet medium dense brown silty fine sand and fine gravel w/some coarse sand.	21.8	NP	16.3	SM	A-2-4(0)	71.4	28	16	15	10	10
	5	8	Wet stiff gray fine sandy silt w/some coarse sand and fine gravel.	35.7	NP	26.3	SM	A-4(0)	88.8	37.2	7	5	4	3
	6	10	Saturated stiff gray fine sandy silt w trace coarse sand and fine gravel.	40	NP	41.9	SM	A-4(0)	99.4	47.5	5	8	8	12
	7	12	Saturated medium dense gray silty fine sand w/some coarse sand, trace of fine gravel.	37.8	NP	34.4	SM	A-2-4(0)	92	32.3	5	6	10	12
	8	14	Saturated firm gray fine sandy silt w/some coarse sand, trace of fine gravel.	40.1	NP	41.2	SM	A-4(0)	96.5	36	2	2	4	15
	9	16	Saturated very dense gray silty fine sand and fine gravel w/some coarse sand.	NV	NP	16.3	SM	A-2-4(0)	72	20.6	40	50		
	R1	16.5	Schist - Recovery 100% RQD 100%											
		21.5	End Boring											

DATE **: 5-17-2016**

PROJECT NUMBER **: T201407003**

PROJECT NAME **:BR1-615 on Newport Gap Pike over Waterway - Wilmington DE**

51.0

NG-1
46.0

NG-1

Depth	Run	Rec	RQD
46-51	#1	~~95%~~ 75%	~~85%~~ 50%

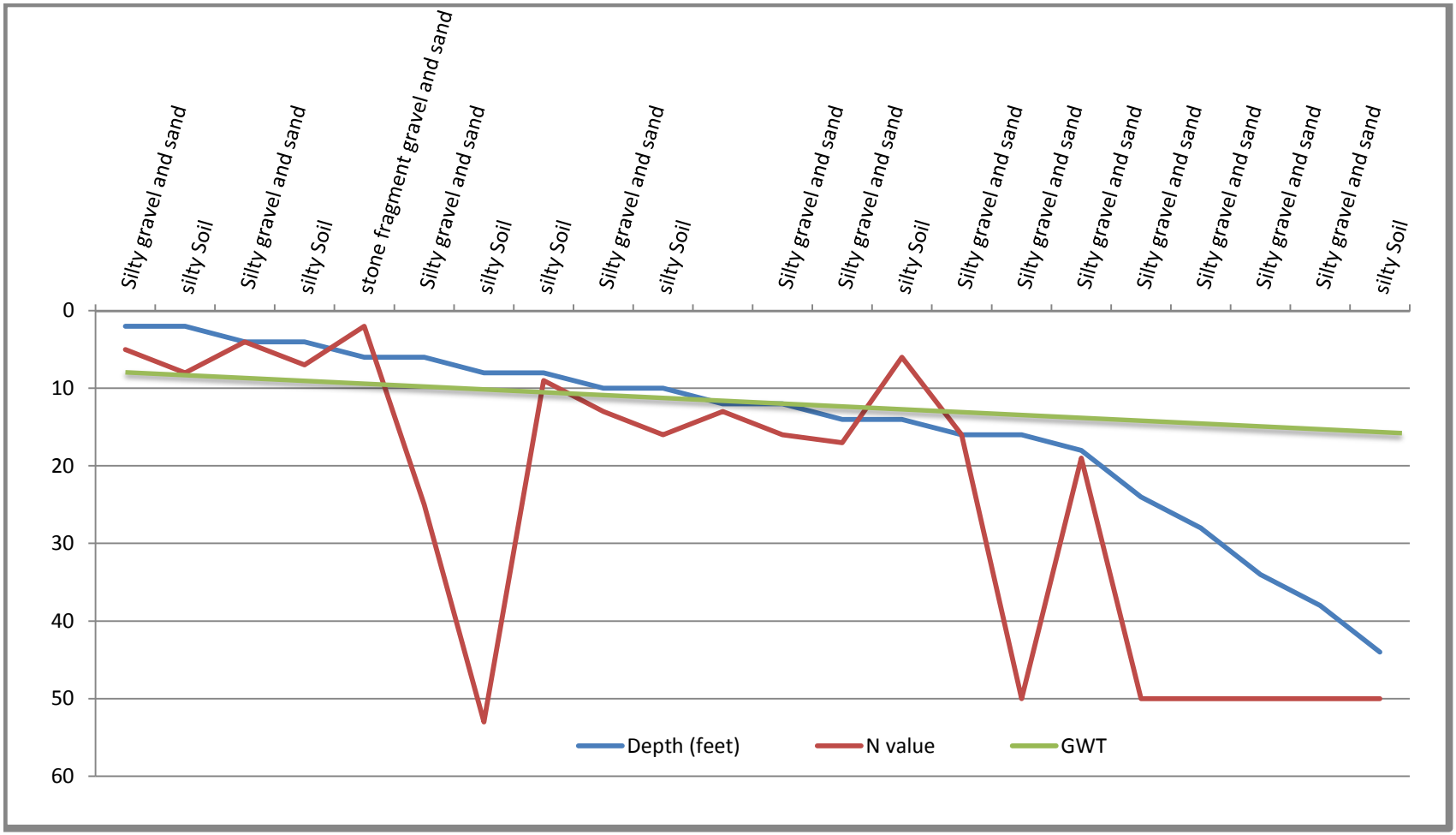
NG-2

60" Recovery = 100 %

~~39"~~ RQD = ~~65~~ %

18.5" 31 %

BR 1-615
NEWPORT GAP PIKE
T201407003



DATE : 5-17-2016

PROJECT NUMBER : T201407003

PROJECT NAME :BR1-615 on Newport Gap Pike over Waterway - Wilmington DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-16-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR1-616 on Newport Gap Pike over Waterway - Wilmington DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-17-2016 and 3-18-2016. Walton Corporation- Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation, In addition 10 feet of coring rock was collected from this site . Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 10 by Ramsey, K.W 2001. The area is situated in Wissahickon Formation Interlayered psammitic and pelitic gneiss with amphibolite. Psammitic gneiss is a medium- to fine-grained biotite-plagioclase-quartz gneiss with or without small garnets. Contacts with pelitic gneiss are gradational. Pelitic gneiss is medium- to coarse-grained garnet-sillimanite-biotite-plagioclase-quartz gneiss.

3. Ground Water Background

3.1 The Water-Table and Surface-Drainage were not encountered for this site.

3.2 The Delaware Geologic Information Resource (DGIR) was not encountered for this site.

4. Hydrologic Background

The Delaware Geological Survey Geohydrology was not encountered for this site.

5. Ground Cover

The ground cover for this site is 7 inches of asphalt top of 8 inches of concrete. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 12 and 18 feet and caved at 20 and 22.5 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 4.8 to 43 percent. The Atterberg limit is 37 percent, Liquid limits is 20.1 to 41.6 percent and Plasticity Index is 6.3 to 13.2 percent. Organic matter was not encountered for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition. In addition the entire sample from the depth of 2 to 10 feet from the surface had not enough borrow type material to reuse according to Del-DOT standard specification except borrow type ”F”.
The Rock coring where collected appeared recovery is 95 % percent and the Rock Quality Designation RQD is 66 % percent this is fair condition more detail at Appendix D.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (15- sheets)

APPENDIX C

- Grain Size Distribution Result (11- sheets)

APPENDIX D

- Summary of the Borings (2- sheets)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 5-16-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR1-616 on Ellendale Forest road over Waterway - Wilmington DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
NG-3	642363.660	586883.123	39.7634361	-75.6631167
NG-4	642430.613	586821.616	39.7636194	-75.6633361
NG-5	642502.404	586840.555	39.7638167	-75.6632694

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING NG-3

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 642363.660
Easting: 586883.123
Boring Surface Elev.:
Reference:
Date Started: 3/17/16
Date Completed: 3/17/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 59.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/17/16	18.0	
3/17/16	12.0	22.5

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	5 6 7 6	Moist stiff gray clayey coarse sandy silt w/ some fine sand and fine gravel. 18" RECOVERY	A-4(0)	Hot-mix 7.5" Concrete 8"
5.06		2	4.0' – 6.0'	5 6 7 9	Moist stiff brown clayey fine sandy silt w/ some coarse sand and fine gravel. 17" RECOVERY	A-4(0)	
7.59		3	6.0' – 8.0'	7 5 6 4	Moist medium dense brown silty fine sand w/ some fine gravel, trace of coarse sand. 19" RECOVERY	A-1-b	
10.12		4	8.0' – 10.0'	2 3 5 7	Moist loose brown coarse sandy fine gravel w/some fine sand and silt. 4" RECOVERY	A-1-b	
		5	10.0' – 12.0'	10 7 10 9	No sieve analysis - Indication of moist medium dense brown coarse sandy fine sand w/some fine sand and silt. 2" RECOVERY		
12.65	▽	6	12.0' – 14.0'	7 9 6 8	Wet medium dense gray silty fine to coarse sand w/trace fine gravel. 17" RECOVERY	A-2-4(0)	
15.18		7	14.0'	4 5 5 7	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-3
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		19" RECOVERY		
		8	16.0'	4 5 6 9	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	
17.71			18.0'		19" RECOVERY		
	■	9	18.0'	2 3 3 5	Saturated loose gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	
20.24			20.0'		17" RECOVERY		
22.77							
		10	24.0'	7 7 9 10	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	
25.3			26.0'		19" RECOVERY		
27.83							
		11	28.0'	15 21 18 27	Saturated dense gray fine to coarse sand w/ some silt, trace of fine gravel.	A-2-4(0)	
30.36			30.0'		20" RECOVERY		
32.89							
		12	34.0'	28 50	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
35.42			36.0'		6" RECOVERY		
37.95							
		13	38.0'	50	Saturated very dense gray fine to coarse sand	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-3
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
					w/some silt, trace of fine gravel.		
			40.0'		5" RECOVERY		
40.48							
43.01							
		14	44.0'	50	Saturated very dense gray coarse to fine sand w/some silt, trace of fine gravel.	A-2-4(0)	
45.54			46.0'		2" RECOVERY		
48.07							
		15	48.0'	50	Saturated very dense gray coarse to fine sand w/some fine gravel and silt.	A-1-b	
			50.0'		4" RECOVERY		
50.6							
53.13							
		R-1	54.0'		Rock Schist - Recovery 95%, RQD 92%		
55.66							
58.19							
			59.0'		57" RECOVERY		
60.72							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING NG-4

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 642430.613
Easting: 586821.616
Boring Surface Elev.:
Reference:
Date Started: 3/17/16
Date Completed: 3/17/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/17/16	19.0	
3/17/16	13.0	20.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'		Moist gray fine gravel w/some coarse to fine sand and silt. 11" RECOVERY	A-1-a	Hot-mix 7" concrete 6"
2.53		2	2.0' 4.0'	2 3 4 5	Moist loose brown silty coarse to fine sand w/some fine gravel. 17" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	4 6 12 15	Moist medium dense brown fine gravelly coarse to fine sand w/some silt. 12" RECOVERY	A-1-b	
7.59		4	6.0' 8.0'	2 3 5	Wet firm brown clayey silt w/some fine sand, trace of coarse sand and fine gravel. 17" RECOVERY	A-4(4)	
10.12		5	8.0' 10.0'	6 3 3 4	Wet firm brown fine to coarse sandy silt w/ trace fine gravel. 20" RECOVERY	A-4(0)	
		6	10.0' 12.0'	4 5 4 7	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-4(0)	
12.65	▽	7	12.0' 14.0'	4 4 5 5	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel. 19" RECOVERY	A-4(0)	
		8	14.0'	4 4	Saturated stiff brown silty fine sand w/some	A-2-4(0)	

Remarks: 0'-6' hit obstruction, moved hole 5' and continued drilling.

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-4
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	5 5	coarse sand, trace of fine gravel. 24" RECOVERY		
17.71		9	16.0' 18.0'	3 4 5 9	Saturated loose brown silty fine to coarse sand w/trace fine gravel. 20" RECOVERY	A-2-4(0)	
20.24	■	10	18.0' 20.0'	7 8 9 12	Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' 26.0'	5 5 6 8	Saturated medium dense brown silty coarse to fine sand w/trace fine gravel. 20" RECOVERY	A-2-4(0)	
27.83							
30.36		12	29.0' 31.0'	3 5 10 12	Saturated medium dense brown silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	34.0' 36.0'	2 7 15 17	Saturated medium dense brown silty fine to coarse sand w/trace fine gravel. 17" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-4
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	17 50	Saturated very dense gray fine sandy silt w/ some coarse sand and fine gravel. 7" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	5 45 50	Saturated very dense gray silty fine sand w/ some coarse sand, fine gravel. 10" RECOVERY	A-2-4(0)	
48.07							
50.6		16	49.0' 51.0'	3 19 50	Saturated very dense gray silty fine to coarse sand w/trace fine gravel. 10" RECOVERY	A-2-4(0)	
53.13							
55.66		17	54.0' 56.0'	22 27 50	Saturated very dense gray silty fine to coarse sand w/some fine gravel. 9" RECOVERY	A-2-4(0)	
58.19							
		18	59.0'	5 50	Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-4
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72			61.0'		7" RECOVERY		
63.25							
		19	64.0'	25 32 50	Saturated hard gray fine sandy silt w/some coarse sand, fine gravel.	A-4(0)	
65.78			66.0'		12" RECOVERY		
68.31		20	68.0'		No Sample		Auger Refusal @ 67.0'
			70.0'		0" RECOVERY		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Silty soils
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING NG-5

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 642502.404
Easting: 586840.555
Boring Surface Elev.:
Reference:
Date Started: 3/18/16
Date Completed: 3/18/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/18/16	12.0	
3/18/16	Dry	4.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	4 5 5 6	Wet stiff gray clayey silt w/some fine to coarse sand and fine gravel. 12" RECOVERY	A-4(3)	Hot-mix 7" concrete 6"
5.06		2	4.0' – 6.0'	10 5 4 3	Wet loose gray silty fine to coarse sand w/ some fine gravel. 10" RECOVERY	A-2-4(0)	
7.59		3	6.0' – 8.0'	5 5 5 5	Wet loose gray silty fine to coarse sand and fine gravel. 6" RECOVERY	A-2-4(0)	
10.12		4	8.0' – 10.0'	2 3 3 5	No sieve analysis - Indication of wet loose gray silty fine to coarse sand w some fine gravel. 4" RECOVERY		
12.65	■	5	10.0' – 12.0'	6 7 9 8	Saturated stiff brown fine sandy silt w/trace coarse sand and fine gravel. 18" RECOVERY	A-4(0)	
15.18		6	12.0' – 14.0'	2 3 3 6	Saturated loose brown fine sandy silt w/some coarse sand, trace of fine gravel. 16" RECOVERY	A-4(0)	
		7	14.0'	7 8 9 9	Saturated very stiff brown fine sandy silt w/ some coarse sand, trace of fine gravel.	A-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-5
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		20" RECOVERY		
		8	16.0'	10 13 13 11	Saturated very stiff brown fine sandy clay w/ some coarse sand and silt, trace of fine gravel.	A-7-6(3)	
17.71			18.0'		24" RECOVERY		
		9	18.0'	9 33 50	Saturated hard gray fine to coarse sandy silt w/trace fine gravel.	A-4(0)	
20.24			20.0'		14" RECOVERY		
22.77							
		10	24.0'	50	Saturated very dense gray silty fine sand w/ some coarse sand.	A-2-4(0)	
25.3			26.0'		4" RECOVERY		
27.83							
		11	28.0'	28 50	Saturated very dense gray silty fine sand w/ some coarse sand.	A-2-4(0)	
30.36			30.0'		4" RECOVERY		
32.89							
		12	34.0'	13 28 31 29	Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	A-4(0)	
35.42			36.0'		16" RECOVERY		
37.95							
		13	38.0'	19	Saturated hard gray fine sandy silt w/some	A-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** NG-5
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				29 50	coarse sand.		
			40.0'		4" RECOVERY		
40.48							
43.01							
		14	44.0'	50	Saturated very dense gray silty fine sand w/ some coarse sand, trace of fine gravel.	A-2-4(0)	
45.54			46.0'		4" RECOVERY		
48.07							
		15	48.0'	50	Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	
			50.0'		4" RECOVERY		
50.6							
53.13							
		16	54.0'	50	Saturated very stiff gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
55.66			56.0'		8" RECOVERY		
58.19							
		17	58.0'	50	Saturated very dense gray silty fine to coarse sand w/some fine gravel.	A-2-4(0)	
			60.0'		3" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: NG-5

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
		18	64.0'		No Recovery		
65.78			66.0'		NR" RECOVERY		
68.31		19	68.0'	50	Saturated very dense gray silty coarse to fine sand w/some fine gravel.	A-1-b	
			70.0'		2" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Expansive plastic clays
	Well graded gravels and sands

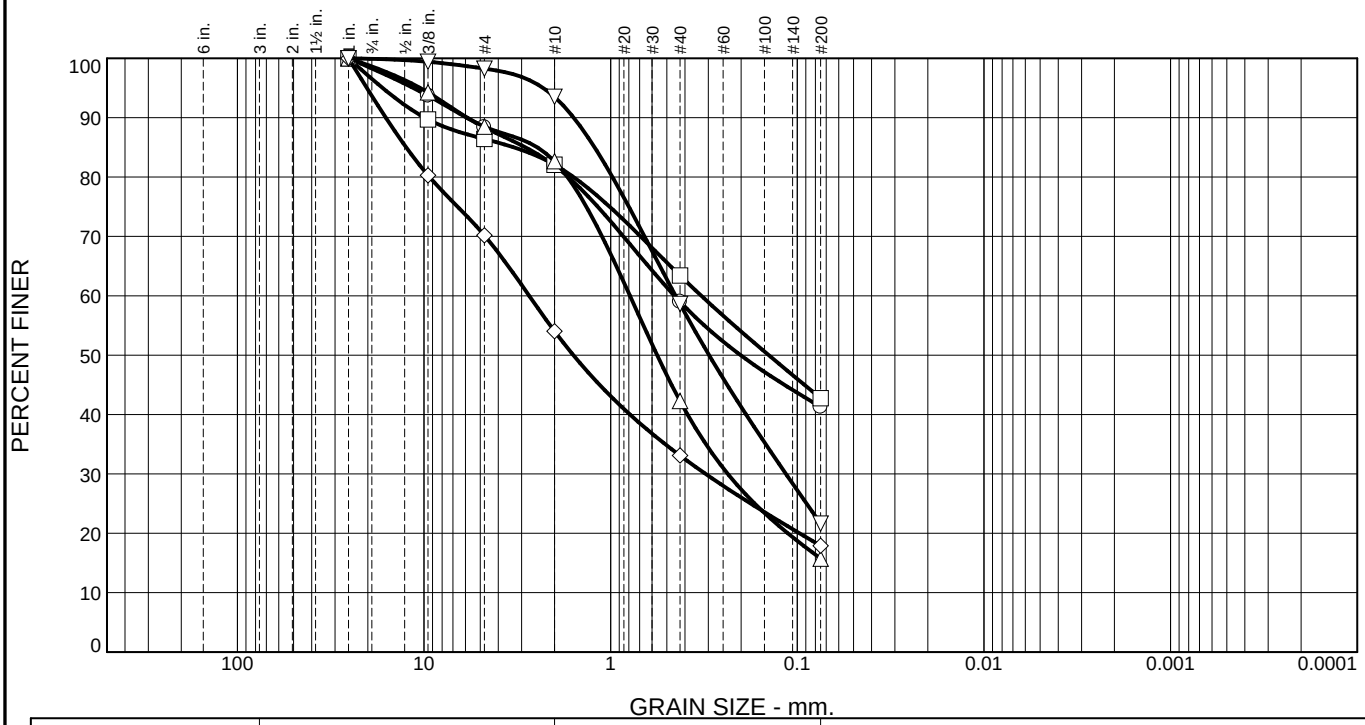
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	18.1	22.9	17.7	41.3	
□	0.0	17.9	18.7	20.6	42.8	
△	0.0	17.3	40.4	26.6	15.7	
◇	0.0	46.0	20.9	15.2	17.9	
▽	0.0	6.5	34.9	37.0	21.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30.3	24.0	2.8629	0.4553	0.2012					
□	28.4	21.8	3.2949	0.3267	0.1422					
△	NV	NP	2.4725	0.7880	0.5634	0.2356				
◇	21.6	NP	12.4646	2.7335	1.5856	0.3098				
▽	NV	NP	1.2194	0.4488	0.2969	0.1151				

Material Description	USCS	AASHTO
○ Moist stiff gray clayey coarse sandy silt w/some fine sand and fine gravel.	SM	A-4(0)
□ Moist stiff brown clayey fine sandy silt w/some coarse sand and fine gravel.	SC-SM	A-4(0)
△ Moist medium dense brown silty fine sand w/some fine gravel, trace of coarse sand.	SM	A-1-b
◇ Moist loose brown coarse sandy fine gravel w/some fine sand and silt.	SM	A-1-b
▽ Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-3 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** NG-3 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** NG-3 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** NG-3 **Depth:** 8.0 **Sample Number:** 4

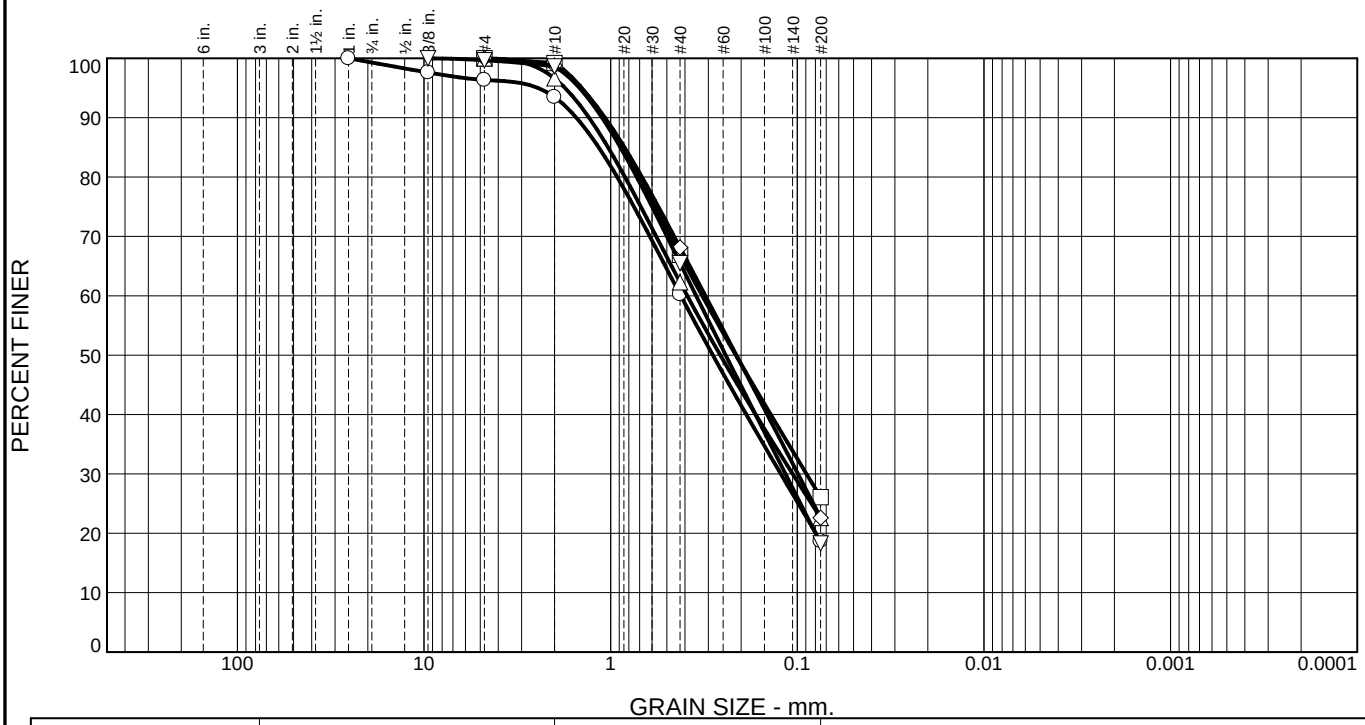
▽ **Source of Sample:** NG-3 **Depth:** 12.0 **Sample Number:** 6

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	6.5	33.2	41.6	18.7	
□	0.0	0.8	32.3	40.8	26.1	
△	0.0	3.4	34.3	39.7	22.6	
◇	0.0	1.2	30.7	45.5	22.6	
▽	0.0	1.4	33.1	47.2	18.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1594	0.4208	0.2834	0.1226				
□	NV	NP	0.8678	0.3230	0.2135	0.0893				
△	NV	NP	1.0325	0.3889	0.2585	0.1059				
◇	NV	NP	0.8431	0.3108	0.2120	0.0992				
▽	NV	NP	0.8869	0.3482	0.2419	0.1158				

Material Description	USCS	AASHTO
○ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Saturated loose gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
▽ Saturated dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-3 **Depth:** 14.0 **Sample Number:** 7

□ **Source of Sample:** NG-3 **Depth:** 16.0 **Sample Number:** 8

△ **Source of Sample:** NG-3 **Depth:** 18.0 **Sample Number:** 9

◇ **Source of Sample:** NG-3 **Depth:** 24.0 **Sample Number:** 10

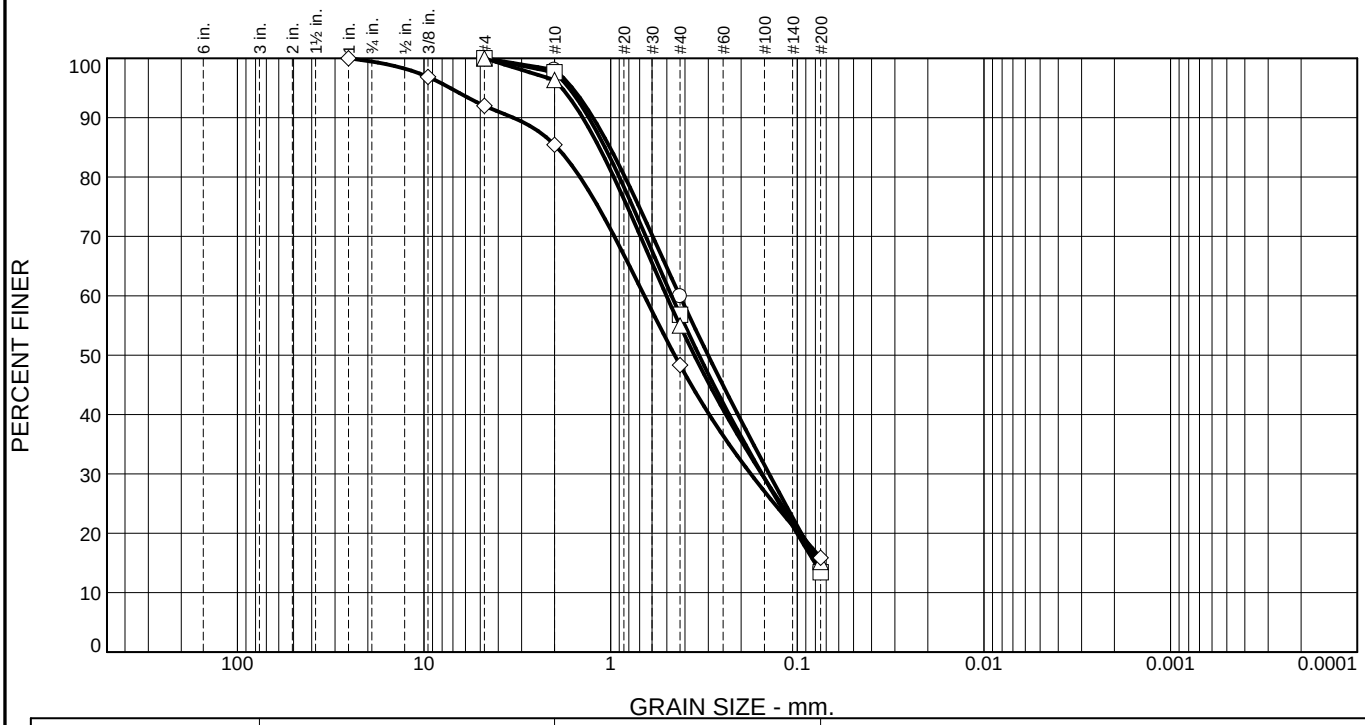
▽ **Source of Sample:** NG-3 **Depth:** 28.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.0	38.1	45.9	14.0	
□	0.0	2.3	40.9	43.4	13.4	
△	0.0	3.7	41.3	39.8	15.2	
◇	0.0	14.6	37.1	32.4	15.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0097	0.4262	0.3007	0.1416	0.0780			
□	NV	NP	1.0732	0.4717	0.3363	0.1546	0.0804			
△	NV	NP	1.1520	0.5023	0.3563	0.1553				
◇	NV	NP	1.9388	0.6598	0.4541	0.1777				

Material Description	USCS	AASHTO
○ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated very dense gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Saturated very dense gray coarse to fine sand w/some fine gravel and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-3 **Depth:** 34.0 **Sample Number:** 12

□ **Source of Sample:** NG-3 **Depth:** 38.0 **Sample Number:** 13

△ **Source of Sample:** NG-3 **Depth:** 44.0 **Sample Number:** 14

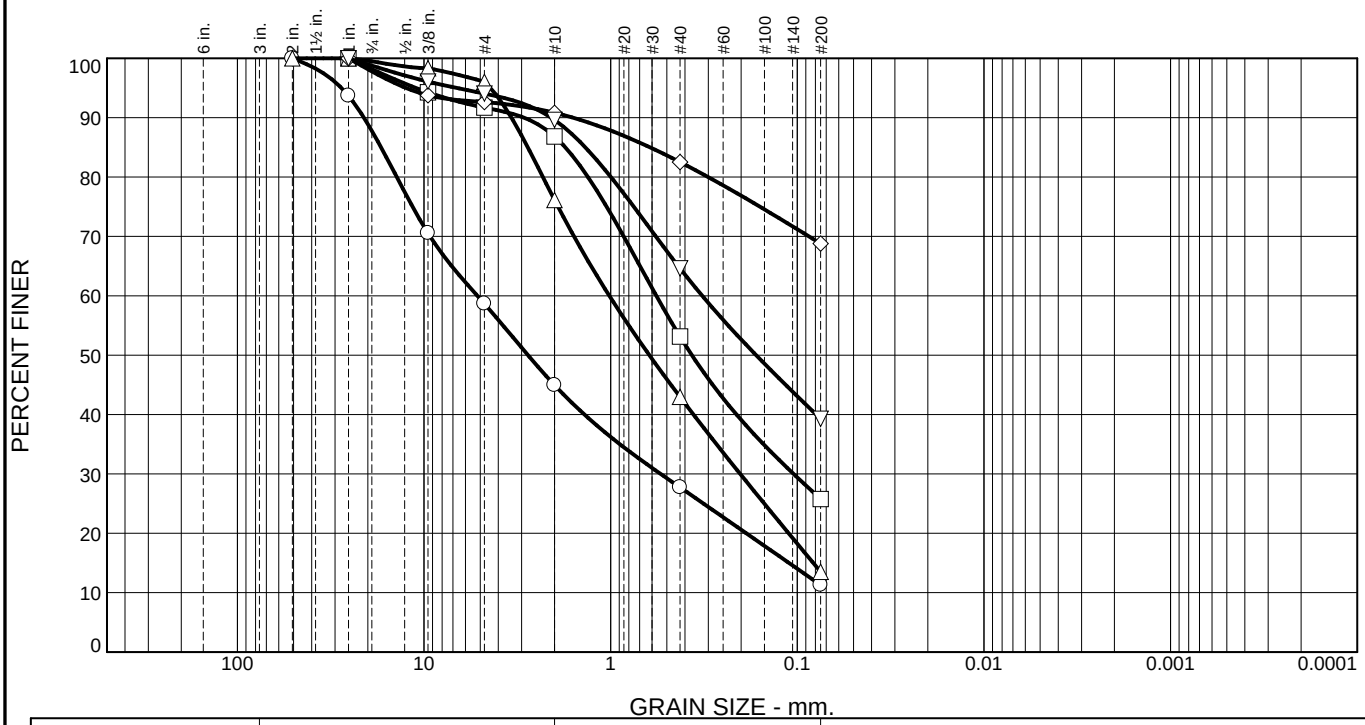
◇ **Source of Sample:** NG-3 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	55.0	17.3	16.4	11.3	
□	0.0	13.2	33.7	27.3	25.8	
△	0.0	23.9	33.1	29.5	13.5	
◇	0.0	9.2	8.3	13.7	68.8	
▽	0.0	10.4	25.0	25.3	39.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	16.9927	5.1767	2.7735	0.5401	0.1108			
□	NV	NP	1.7503	0.5690	0.3671	0.1047				
△	NV	NP	2.7808	1.0166	0.6203	0.2024	0.0821			
◇	32.0	24.2	0.6154							
▽	35.9	NP	1.3676	0.3231	0.1662					

Material Description	USCS	AASHTO
○ Moist gray fine gravel w/some coarse to fine sand and silt.	SP-SM	A-1-a
□ Moist loose brown silty coarse to fine sand w/some fine gravel.	SM	A-2-4(0)
△ Moist medium dense brown fine gravelly coarse to fine sand w/some silt.	SM	A-1-b
◇ Wet firm brown clayey silt w/some fine sand, trace of coarse sand and fine gravel.	ML	A-4(4)
▽ Wet firm brown fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-4 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** NG-4 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** NG-4 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** NG-4 **Depth:** 6.0 **Sample Number:** 4

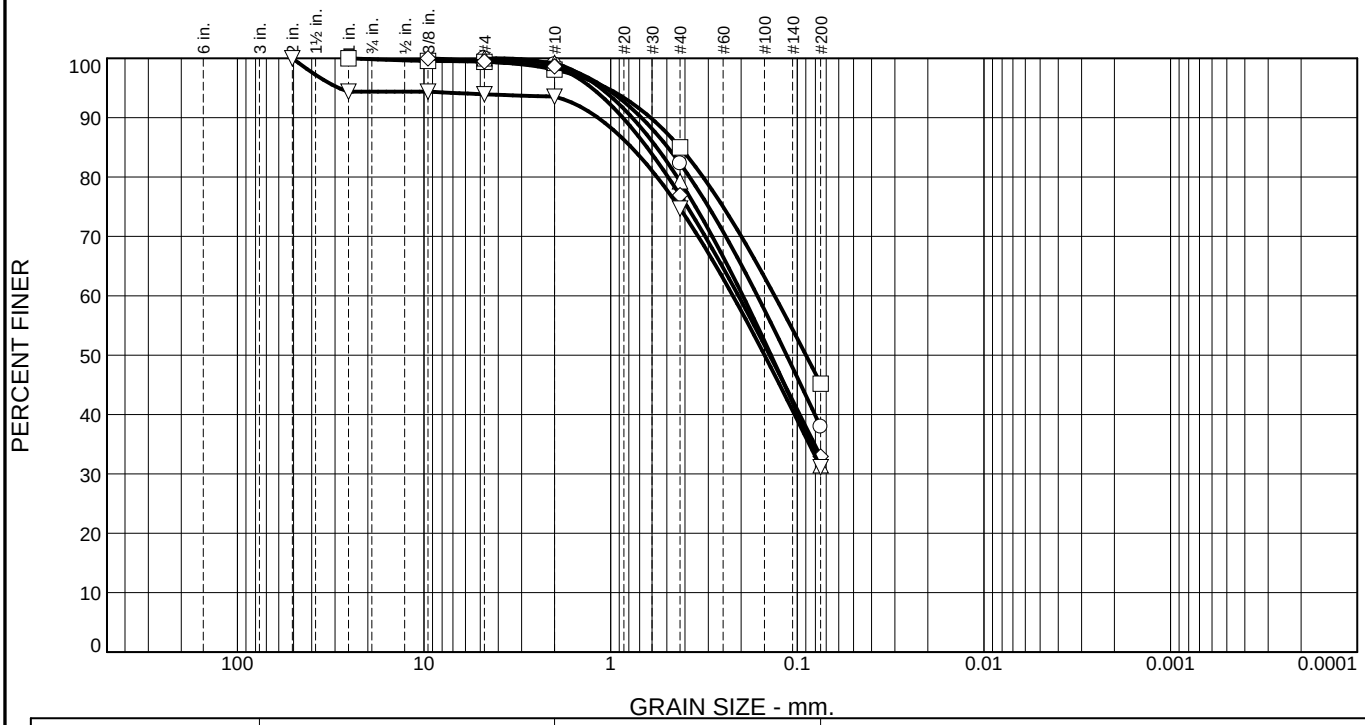
▽ **Source of Sample:** NG-4 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.0	16.7	44.4	37.9	
□	0.0	1.9	13.1	39.8	45.2	
△	0.0	0.8	19.9	47.9	31.4	
◇	0.0	1.4	21.7	44.0	32.9	
▽	0.0	6.5	18.8	43.6	31.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4939	0.1637	0.1141					
□	NV	NP	0.4252	0.1323	0.0899					
△	NV	NP	0.5670	0.1959	0.1383					
◇	NV	NP	0.6382	0.2067	0.1407					
▽	NV	NP	0.7729	0.2213	0.1499					

Material Description	USCS	AASHTO
○ Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)
□ Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)
△ Saturated stiff brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
◇ Saturated loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
▽ Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-4 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** NG-4 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** NG-4 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** NG-4 **Depth:** 16.0 **Sample Number:** 9

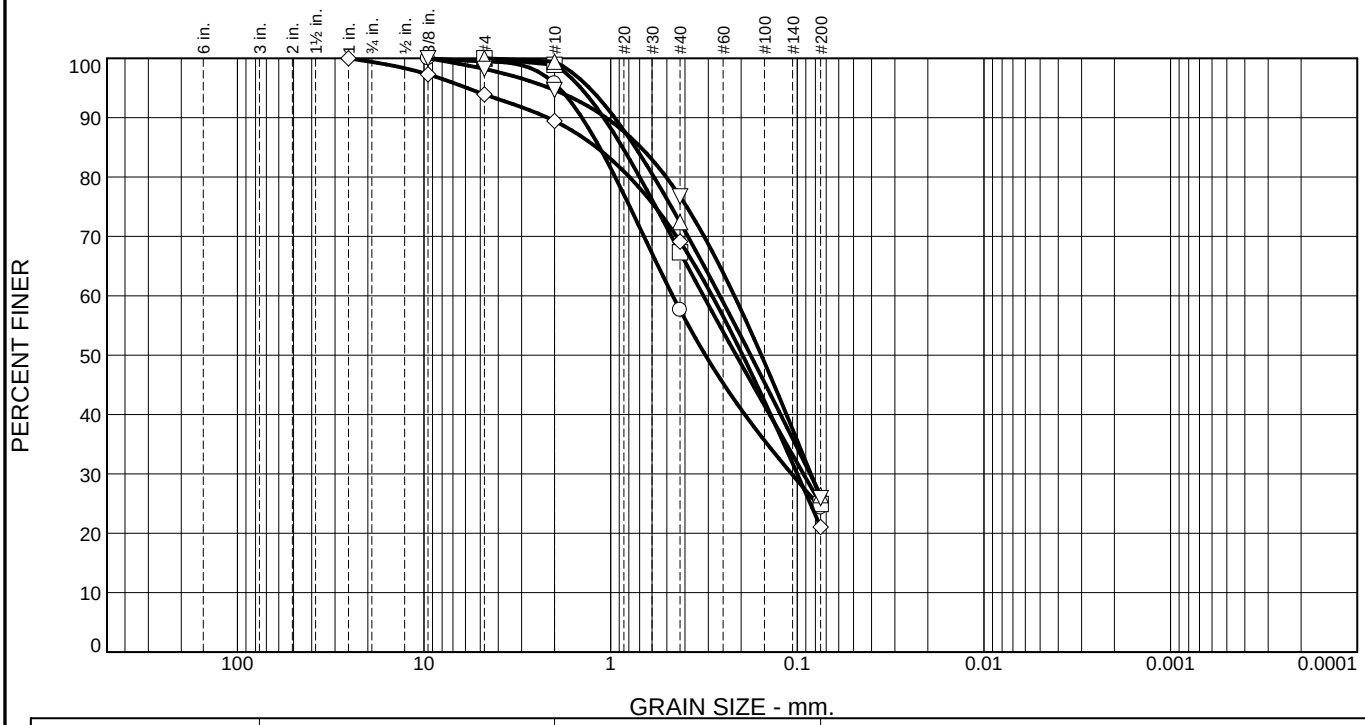
▽ **Source of Sample:** NG-4 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.2	38.2	33.3	24.3	
□	0.0	1.1	31.6	42.4	24.9	
△	0.0	0.6	27.0	46.0	26.4	
◇	0.0	10.6	20.3	48.0	21.1	
▽	0.0	5.3	18.0	50.8	25.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1466	0.4648	0.3107	0.1073				
□	NV	NP	0.8637	0.3184	0.2126	0.0927				
△	NV	NP	0.7371	0.2600	0.1779	0.0854				
◇	NV	NP	1.1897	0.2859	0.1963	0.1001				
▽	NV	NP	0.6897	0.2173	0.1559	0.0846				

Material Description	USCS	AASHTO
○ Saturated medium dense brown silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)
□ Saturated medium dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Saturated medium dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Saturated very dense gray fine sandy silt w/some coarse sand and fine gravel.	SM	A-2-4(0)
▽ Saturated very dense gray silty fine sand w/some coarse sand, fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-4 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** NG-4 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** NG-4 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** NG-4 **Depth:** 39.0 **Sample Number:** 14

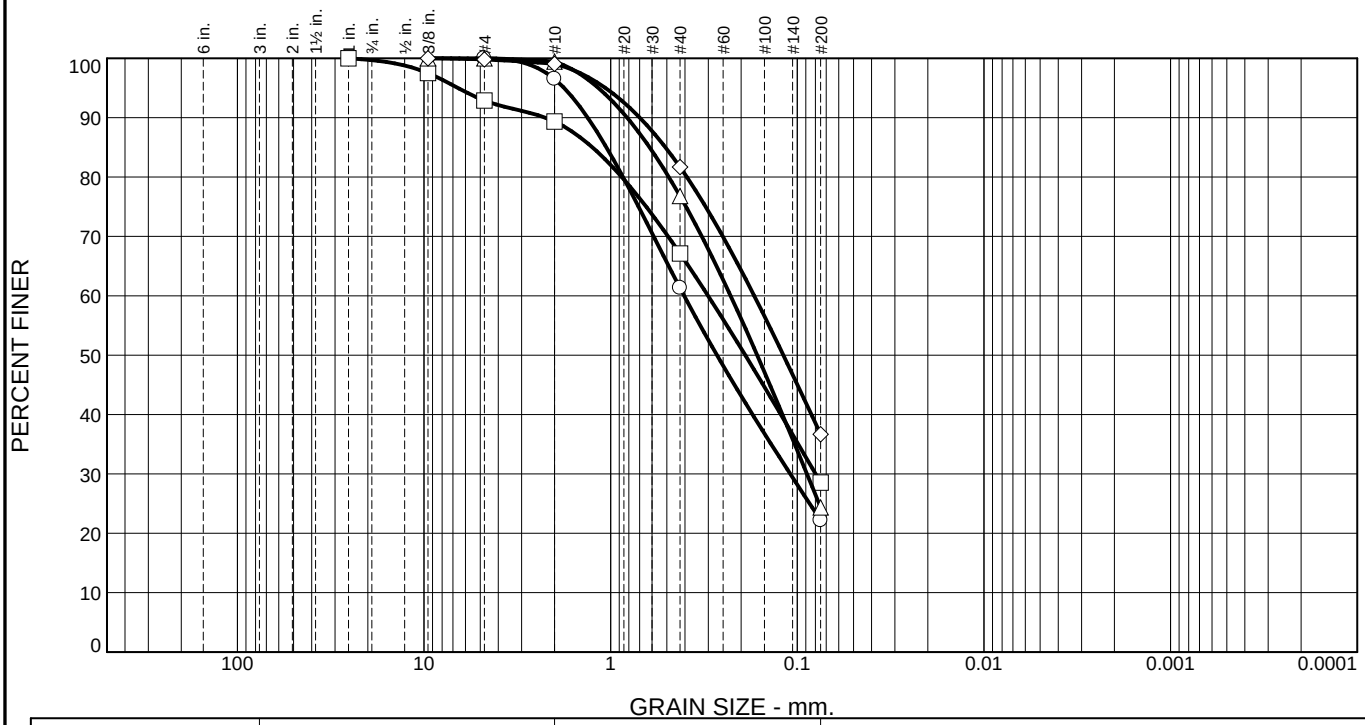
▽ **Source of Sample:** NG-4 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.5	35.2	39.1	22.2	
□	0.0	10.7	22.2	38.6	28.5	
△	0.0	0.6	22.6	52.4	24.4	
◇	0.0	0.9	17.4	45.0	36.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0541	0.4039	0.2693	0.1091				
□	NV	NP	1.2531	0.3006	0.1901	0.0798				
△	NV	NP	0.6186	0.2277	0.1641	0.0888				
◇	NV	NP	0.5086	0.1702	0.1188					

Material Description	USCS	AASHTO
○ Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Saturated very dense gray silty fine to coarse sand w/some fine gravel.	SM	A-2-4(0)
△ Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Saturated hard gray fine sandy silt w/some coarse sand, fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-4 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** NG-4 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** NG-4 **Depth:** 59.0 **Sample Number:** 18

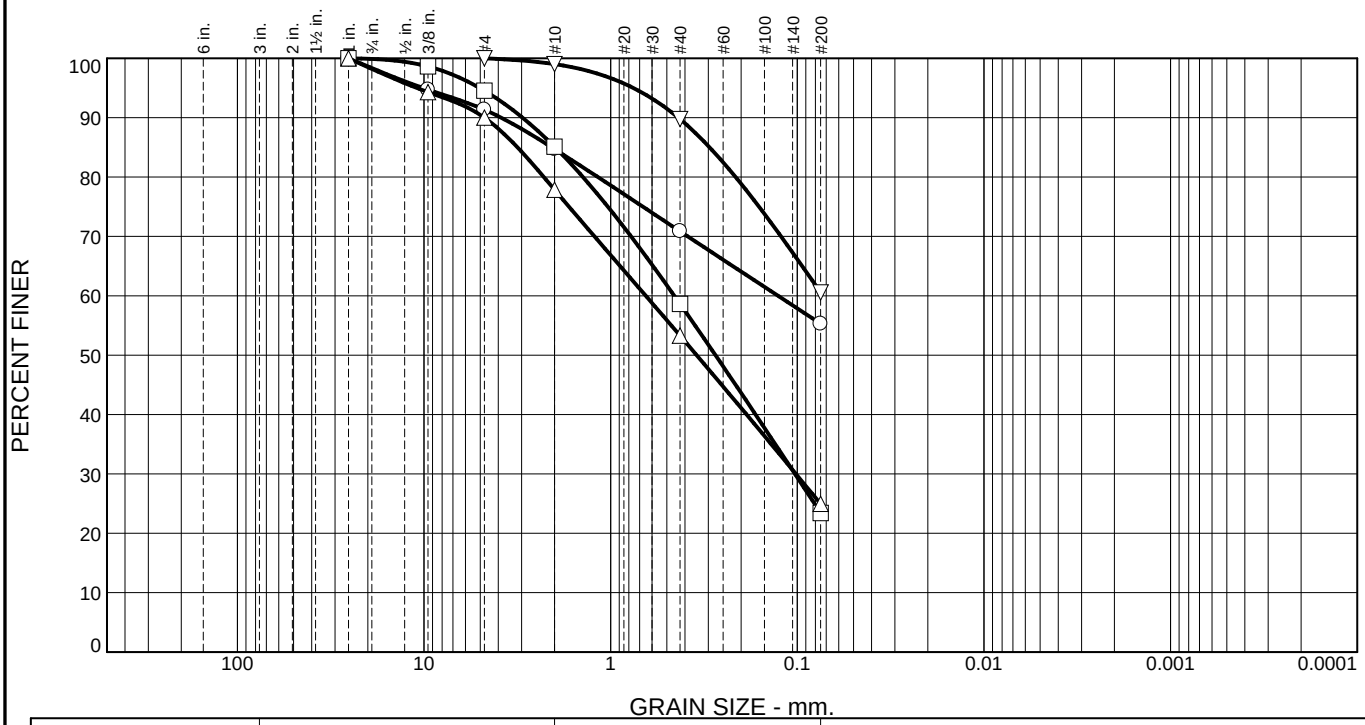
◇ **Source of Sample:** NG-4 **Depth:** 64.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	15.3	13.8	15.6	55.3	
□	0.0	14.9	26.5	35.2	23.4	
△	0.0	22.1	24.6	28.3	25.0	
◇						
▽	0.0	1.0	9.2	29.2	60.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32.1	22.5	2.0689	0.1269						
□	NV	NP	1.9837	0.4560	0.2743	0.1030				
△	32.9	NP	3.1579	0.6483	0.3461	0.1018				
◇	NV	NP								
▽	31.8	NP	0.2951							

Material Description	USCS	AASHTO
○ Wet stiff gray clayey silt w/some fine to coarse sand and fine gravel.	CL	A-4(3)
□ Wet loose gray silty fine to coarse sand w/some fine gravel.	SM	A-2-4(0)
△ Wet loose gray silty fine to coarse sand and fine gravel.	SM	A-2-4(0)
◇ No sieve analysis - Indication of wet loose gray silty fine to coarse sand w some fine gravel.		
▽ Saturated stiff brown fine sandy silt w/trace coarse sand and fine gravel.	ML	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-5 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** NG-5 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** NG-5 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** NG-5 **Depth:** 8.0 **Sample Number:** 4

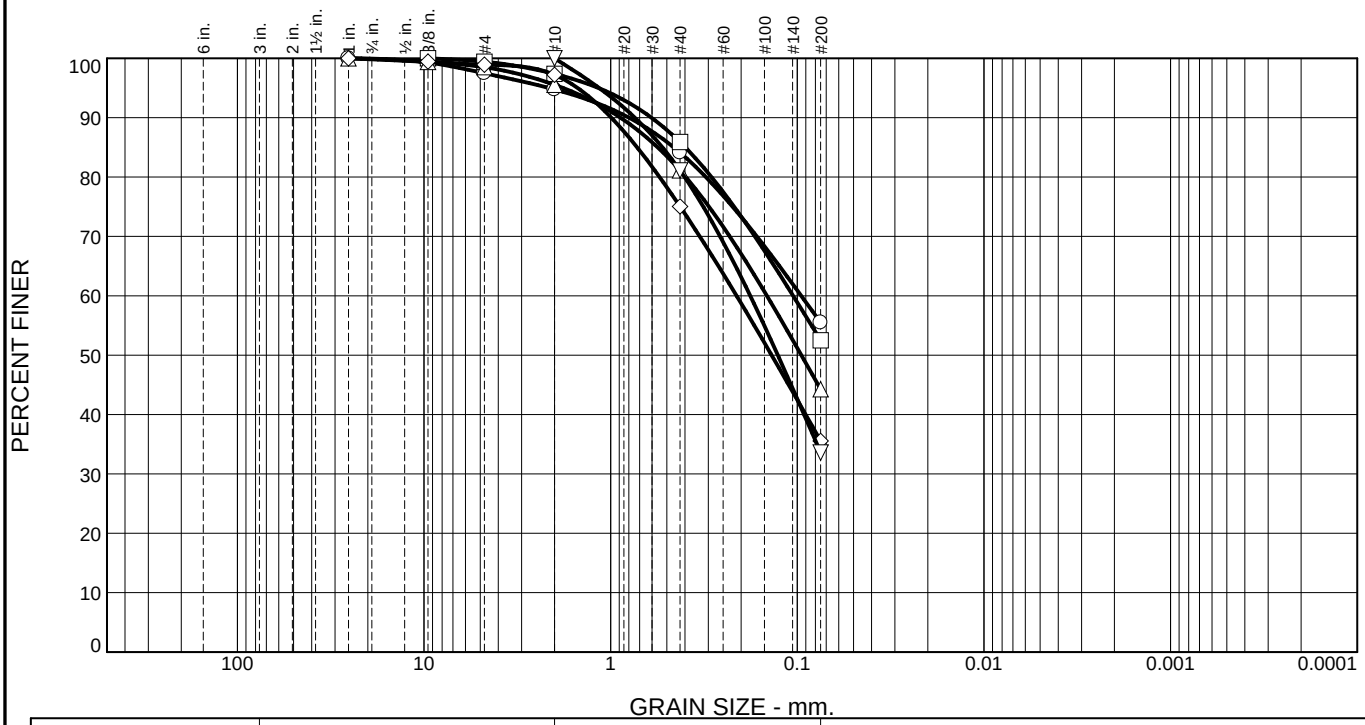
▽ **Source of Sample:** NG-5 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.2	10.7	28.6	55.5	
□	0.0	2.6	11.5	33.4	52.5	
△	0.0	4.5	14.4	36.8	44.3	
◇	0.0	2.8	22.2	39.4	35.6	
▽	0.0	0.0	18.9	47.5	33.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32.4	NP	0.4587	0.0953						
□	38.8	NP	0.3981	0.1053						
△	41.6	28.4	0.5597	0.1456	0.0952					
◇	26.0	NP	0.7215	0.2115	0.1373					
▽	24.4	NP	0.5279	0.1787	0.1272					

Material Description	USCS	AASHTO
○ Saturated loose brown fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
□ Saturated very stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
△ Saturated very stiff brown fine sandy clay w/some coarse sand and silt, trace of fine gravel.	SM	A-7-6(3)
◇ Saturated hard gray fine to coarse sandy silt w/trace fine gravel.	SM	A-4(0)
▽ Saturated very dense gray silty fine sand w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-5 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** NG-5 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** NG-5 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** NG-5 **Depth:** 18.0 **Sample Number:** 9

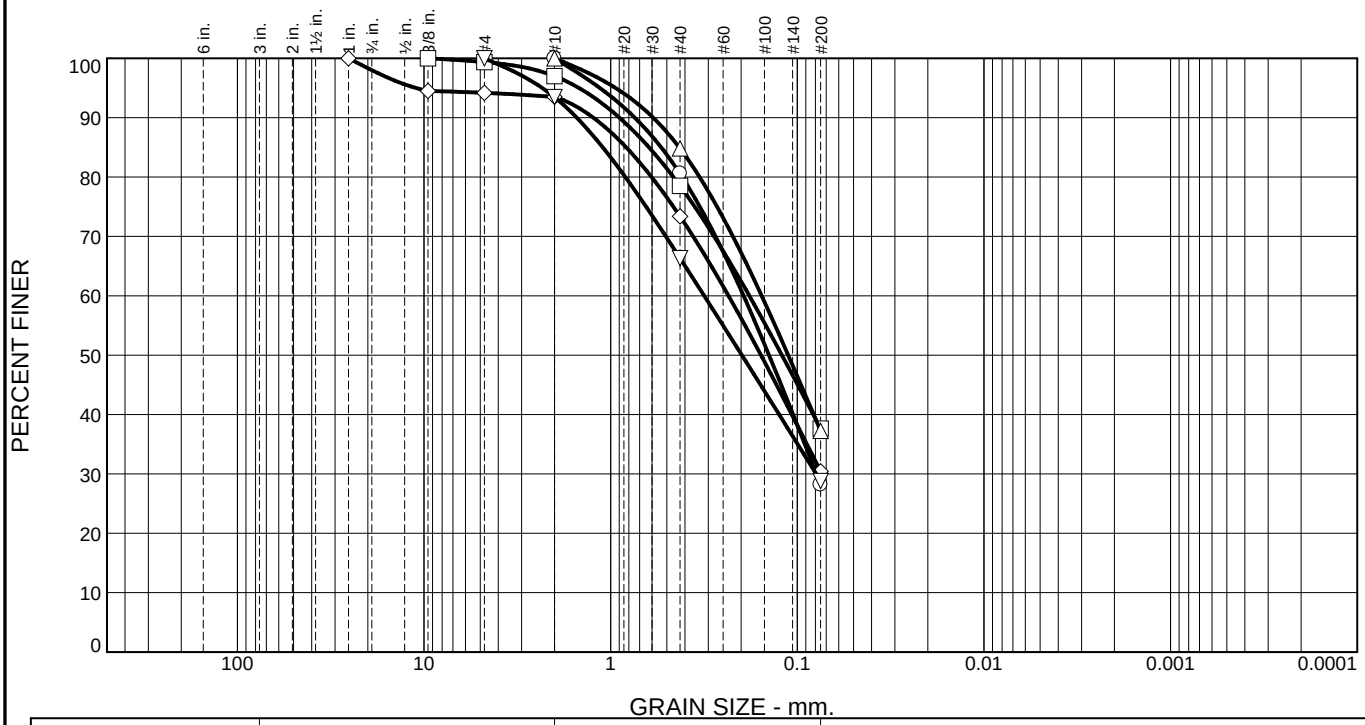
▽ **Source of Sample:** NG-5 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	19.4	52.4	28.2	
□	0.0	3.0	18.5	40.9	37.6	
△	0.0	0.0	15.2	47.6	37.2	
◇	0.0	6.5	20.1	43.0	30.4	
▽	0.0	6.5	27.2	37.5	28.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.5361	0.1940	0.1418	0.0790				
□	37.6	NP	0.6232	0.1808	0.1210					
△	26.2	NP	0.4291	0.1553	0.1120					
◇	20.6	NP	0.8257	0.2335	0.1566					
▽	21.9	NP	1.1025	0.3154	0.1981	0.0792				

Material Description	USCS	AASHTO
○ Saturated very dense gray silty fine sand w/some coarse sand.	SM	A-2-4(0)
□ Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)
△ Saturated hard gray fine sandy silt w/some coarse sand.	SM	A-4(0)
◇ Saturated very dense gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-5 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** NG-5 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** NG-5 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** NG-5 **Depth:** 44.0 **Sample Number:** 14

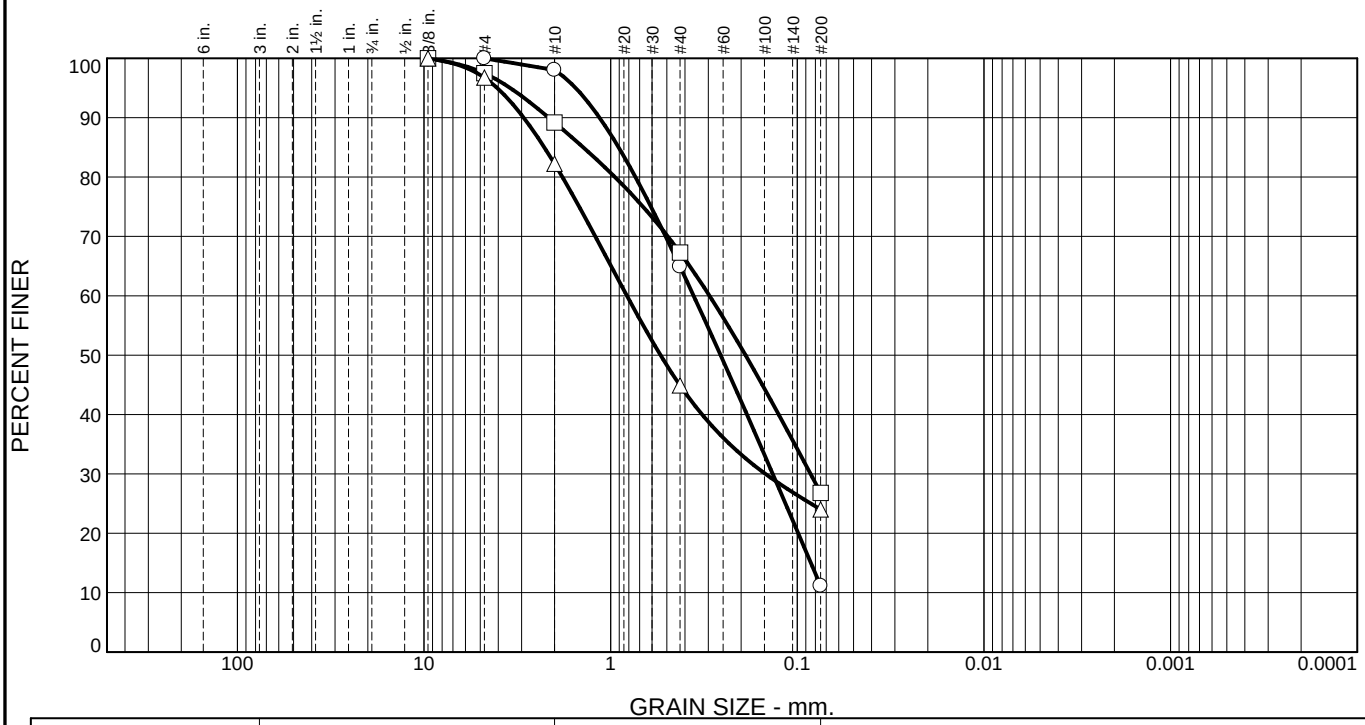
▽ **Source of Sample:** NG-5 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.0	33.1	53.8	11.1	
□	0.0	10.8	21.9	40.5	26.8	
△	0.0	17.8	37.3	20.9	24.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9064	0.3593	0.2576	0.1355	0.0846			
□	20.1	NP	1.4029	0.2953	0.1895	0.0849				
△	NV	NP	2.2683	0.8183	0.5405	0.1482				

Material Description	USCS	AASHTO
○ Saturated very stiff gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
□ Saturated very dense gray silty fine to coarse sand w/some fine gravel.	SM	A-2-4(0)
△ Saturated very dense gray silty coarse to fine sand w/some fine gravel.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** NG-5 **Depth:** 54.0 **Sample Number:** 16

□ **Source of Sample:** NG-5 **Depth:** 58.0 **Sample Number:** 17

△ **Source of Sample:** NG-5 **Depth:** 68.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
NG-3														
	1	2	Moist stiff gray clayey coarse sandy silt w/some fine sand and fine gravel.	30.3	6.3	13.3	SM	A-4(0)	81.9	41.3	5	6	7	6
	2	4	Moist stiff brown clayey fine sandy silt w/some coarse sand and fine gravel.	28.4	6.6	14.2	SC-SM	A-4(0)	82.1	42.8	5	6	7	9
	3	6	Moist medium dense brown silty fine sand w/some fine gravel, trace of coarse sand.	NV	NP	11.8	SM	A-1-b	82.7	15.7	7	5	6	4
	4	8	Moist loose brown coarse sandy fine gravel w/some fine sand and silt.	21.6	NP	9.9	SM	A-1-b	54	17.9	2	3	5	7
	5	10	No sieve analysis - Indication of moist medium dense brown coarse sandy fine sand w/some fine sand and s	25.8	NP	22.5					10	7	10	9
	6	12	Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	25.2	SM	A-2-4(0)	93.5	21.6	7	9	6	8
	7	14	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	22.5	SM	A-2-4(0)	93.5	18.7	4	5	5	7
	8	16	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	31.7	SM	A-2-4(0)	99.2	26.1	4	5	6	9
	9	18	Saturated loose gray silty fine to coarse sand w/trace fine gravel.	NV	NP	31	SM	A-2-4(0)	96.6	22.6	2	3	3	5
	10	24	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	22.1	SM	A-2-4(0)	98.8	22.6	7	7	9	10
	11	28	Saturated dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	19.4	SM	A-2-4(0)	98.6	18.3	15	21	18	27
	12	34	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.6	SM	A-2-4(0)	98	14	28	50		
	13	38	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	12.8	SM	A-2-4(0)	97.7	13.4	50			
	14	44	Saturated very dense gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	19.3	SM	A-2-4(0)	96.3	15.2	50			
	15	48	Saturated very dense gray coarse to fine sand w/some fine gravel and silt.	NV	NP	15.5	SM	A-1-b	85.4	15.9	50			
	R-1	54	Rock Schist - Recovery 95%, RQD 92%											
NG-4														
	1	1	Moist gray fine gravel w/some coarse to fine sand and silt.	NV	NP	10.4	SP-SM	A-1-a	45	11.3				
	2	2	Moist loose brown silty coarse to fine sand w/some fine gravel.	NV	NP	12.1	SM	A-2-4(0)	86.8	25.8	2	3	4	5
	3	4	Moist medium dense brown fine gravelly coarse to fine sand w/some silt.	NV	NP	7.1	SM	A-1-b	76.1	13.5	4	6	12	15
	4	6	Wet firm brown clayey silt w/some fine sand, trace of coarse sand and fine gravel.	32	7.8	24	ML	A-4(4)	90.8	68.8	2	3	5	
	5	8	Wet firm brown fine to coarse sandy silt w/trace fine gravel.	35.9	NP	22.8	SM	A-4(0)	89.6	39.3	6	3	3	4
	6	10	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	NV	NP	37.2	SM	A-4(0)	99	37.9	4	5	4	7
	7	12	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	NV	NP	43	SM	A-4(0)	98.1	45.2	4	4	5	5
	8	14	Saturated stiff brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	32.9	SM	A-2-4(0)	99.2	31.4	4	4	5	5
	9	16	Saturated loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	37.3	SM	A-2-4(0)	98.6	32.9	3	4	5	9
	10	18	Saturated medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	36.6	SM	A-2-4(0)	93.5	31.1	7	8	9	12
	11	24	Saturated medium dense brown silty coarse to fine sand w/trace fine gravel.	NV	NP	31.5	SM	A-2-4(0)	95.8	24.3	5	5	6	8
	12	29	Saturated medium dense brown silty fine to coarse sand w/trace fine gravel.	NV	NP	29	SM	A-2-4(0)	98.9	24.9	3	5	10	12
	13	34	Saturated medium dense brown silty fine to coarse sand w/trace fine gravel.	NV	NP	27.4	SM	A-2-4(0)	99.4	26.4	2	7	15	17
	14	39	Saturated very dense gray fine sandy silt w/some coarse sand and fine gravel.	NV	NP	14.5	SM	A-2-4(0)	89.4	21.1	17	50		
	15	44	Saturated very dense gray silty fine sand w/some coarse sand, fine gravel.	NV	NP	17.4	SM	A-2-4(0)	94.7	25.9	5	45	50	
	16	49	Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	28.7	SM	A-2-4(0)	96.5	22.2	3	19	50	
	17	54	Saturated very dense gray silty fine to coarse sand w/some fine gravel.	NV	NP	20.1	SM	A-2-4(0)	89.3	28.5	22	27	50	
	18	59	Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	24.6	SM	A-2-4(0)	99.4	24.4	5	50		
	19	64	Saturated hard gray fine sandy silt w/some coarse sand, fine gravel.	NV	NP	20.8	SM	A-4(0)	99.1	36.7	25	32	50	
	20	68	No Sample											
NG-5														
	1	2	Wet stiff gray clayey silt w/some fine to coarse sand and fine gravel.	32.1	9.6	17.1	CL	A-4(3)	84.7	55.3	4	5	5	6
	2	4	Wet loose gray silty fine to coarse sand w/some fine gravel.	NV	NP	15	SM	A-2-4(0)	85.1	23.4	10	5	4	3
	3	6	Wet loose gray silty fine to coarse sand and fine gravel.	32.9	NP	16.2	SM	A-2-4(0)	77.9	25	5	5	5	5
	4	8	No sieve analysis - Indication of wet loose gray silty fine to coarse sand w some fine gravel.	NV	NP	4.8					2	3	3	5
	5	10	Saturated stiff brown fine sandy silt w/trace coarse sand and fine gravel.	31.8	NP	31.8	ML	A-4(0)	99	60.6	6	7	9	8

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
	6	12	Saturated loose brown fine sandy silt w/some coarse sand, trace of fine gravel.	32.4	NP	27.6	ML	A-4(0)	94.8	55.5	2	3	3	6
	7	14	Saturated very stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	38.8	NP	28.7	ML	A-4(0)	97.4	52.5	7	8	9	9
	8	16	Saturated very stiff brown fine sandy clay w/some coarse sand and silt, trace of fine gravel.	41.6	13.2	29.8	SM	A-7-6(3)	95.5	44.3	10	13	13	11
	9	18	Saturated hard gray fine to coarse sandy silt w/trace fine gravel.	26	NP	18.7	SM	A-4(0)	97.2	35.6	9	33	50	
	10	24	Saturated very dense gray silty fine sand w/some coarse sand.	24.4	NP	20.2	SM	A-2-4(0)	100	33.6	50			
	11	28	Saturated very dense gray silty fine sand w/some coarse sand.	NV	NP	19.2	SM	A-2-4(0)	100	28.2	28	50		
	12	34	Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	37.6	NP	29.3	SM	A-4(0)	97	37.6	13	28	31	29
	13	38	Saturated hard gray fine sandy silt w/some coarse sand.	26.2	NP	20.9	SM	A-4(0)	100	37.2	19	29	50	
	14	44	Saturated very dense gray silty fine sand w/some coarse sand, trace of fine gravel.	20.6	NP	13.9	SM	A-2-4(0)	93.5	30.4	50			
	15	48	Saturated very dense gray silty fine to coarse sand w/trace fine gravel.	21.9	NP	15.3	SM	A-2-4(0)	93.5	28.8	50			
	16	54	Saturated very stiff gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	24.6	SP-SM	A-2-4(0)	98	11.1	50			
	17	58	Saturated very dense gray silty fine to coarse sand w/some fine gravel.	20.1	NP	17.5	SM	A-2-4(0)	89.2	26.8	50			
	18	64	No Recovery											
	19	68	Saturated very dense gray silty coarse to fine sand w/some fine gravel.	NV	NP	16.9	SM	A-1-b	82.2	24	50			
		70	End Boring											

DATE **: 5-16-2016**

PROJECT NUMBER **: T201407003**

PROJECT NAME **:BR1-616 on Newport Gap Pike over Waterway - Wilmington DE**

54.0'

54.0

RUN 1

54.0'-59.0'

57" RECOVERY = 95%

~~55" RQD = 92%~~

295" RQD = 50 %

Br. 1-Lelle
Newport Cordike
T2 [illegible]

ENGINEERING & TESTING SERVICES, INC.

April 27, 2016

To: Walton Corporation
P.O.Box 1097
Newark, Delaware 19715

Attn: Mr. Randy Ferguson

Re: Reports of Uniaxial Compressive Strength of Intact Rock Core Specimen
Delaware Department of Transportation
ETS Report No.: ETS-16T176-1
AGR 1693, Task 69, T201407003, Bridge 1-616 on Newport Gap Pike/Loveville Road

Dear Mr. Ferguson:

The purpose of this report is to submit the result of the compression test conducted on an intact rock core specimen, designated as NG-3, at Engineering & Testing Services, Inc. (ETS) AASHTO accredited laboratory in Virginia Beach, Virginia. The rock core was delivered to our laboratory by Walton Corporation personnel on April 12, 2016. The rock core was prepared, measured, and tested in general accordance with ASTM Standard D7012, Method "C". All laboratory services performed by our personnel were supervised by a Professional Engineer from ETS. The reader is referred to the attached report of Uniaxial Compressive Strength of Intact Rock Core Specimen for further details.

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this letter, do not hesitate to contact our office at 757-306-1040.

Respectfully Submitted,
Engineering & Testing Services, Inc.

Charlie T. Nabhan, P.E.
Principal Geotechnical Engineer
VA License No.: 25133

Sidni Hoxha, E.I.T.
Staff Engineer

5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040* • *fax 757.306.1042*

REPORT OF UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMEN

CLIENT: Walton Corporation

PROJECT NAME: AGR 1693, Task 69, T201407003, Bridge 1-616 on Newport Gap Pike/Loveville Road

ETS Job NO.: ETS-16T176-2

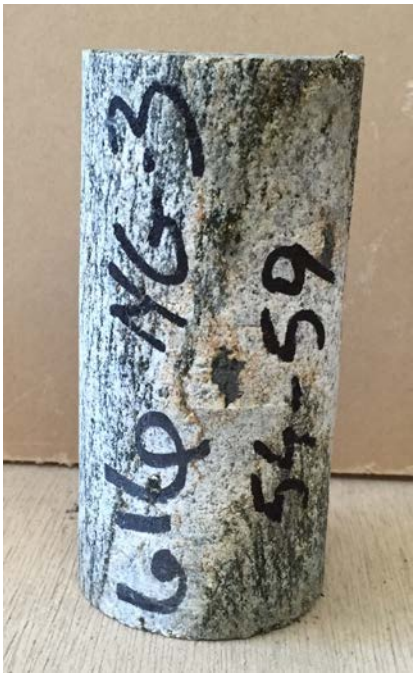
MATERIAL DESCRIPTION: Grey and White, Schist

LOAD DIRECTION: Uniaxial

This Specimen was not prepared in accordance with ASTM D4543

Engineer: Sidni Hoxha

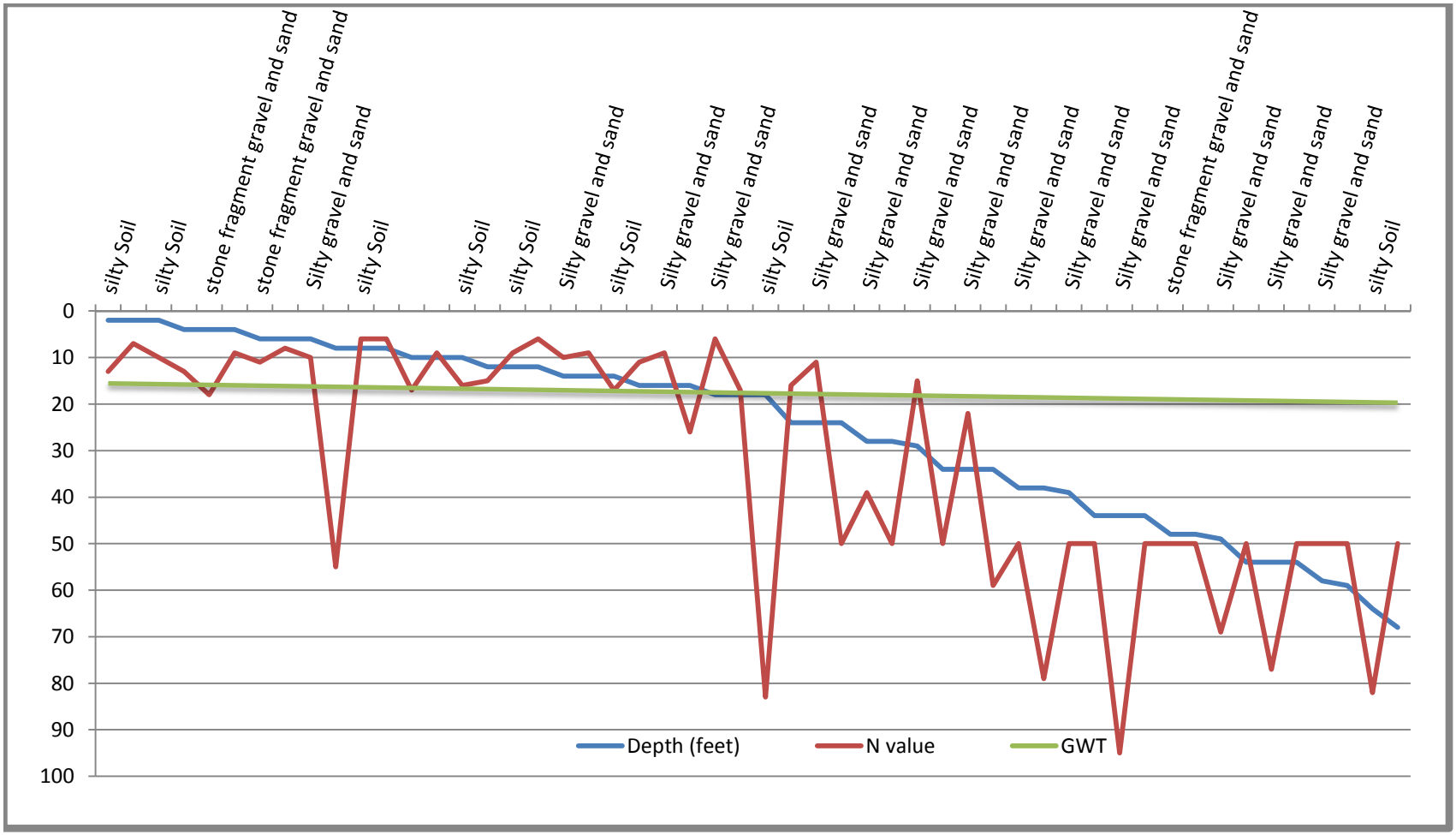
COMPRESSION TEST RESULTS (ASTM D7012) - Method "C"											
LABORATORY NUMBER	SPECIMEN IDENTIFICATION OR SET NO.	DEPTH (FT.)	DATE OF TEST	SPECIMEN DIAMETER (IN.)	SPECIMEN HEIGHT (IN.)	SPECIMEN AREA (SQ. IN.)	TOTAL LOAD (LBS.)	COMPRESSIVE STRENGTH (PSI)	AMBIENT TEMPERATURE AT TEST (F°)	BREAK TYPE	TIME TO FAILURE (MIN.)
BR1-616	NG-3	54-59	4/18/2016	2.0	4.0	3.1416	19,360	6,163	70	3	3.0



Respectfully Submitted,
Charlie T. Nabhan, PE
Principal Geotechnical Engineer

Respectfully Submitted,
Sidni Hoxha E.I.T.
Staff Engineer

5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040* • *fax 757.306.1042*
www.etsva.com



DATE : 5-16-2016

PROJECT NUMBER : T201407003

PROJECT NAME :BR1-616 on Newport Gap Pike over Waterway - Wilmington DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 4-14-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-066A on White Oak Rd over Little River - Dover, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-4-2016. Walton Corporation-Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation and two Shelby tube was collected. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Dover Area Geologic Map Series No. 6 by Pickett, T.E., Benson, R.N. September, 1983 this site is situated in TERTIARY Chesapeake Group and the general description of the soil it is Predominantly Sandy Silt or Sand , bluish gray to light olive gray; diatomaceous, particularly in the lower Miocene, Subordinate sands are quartzose, medium- to course- grained, may be Shelly; where well- developed used as aquifers, Cheswold(chs) and Frederica (fred) aquifers.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Dover Area , Delaware by John K. Adams and Durward H. Boggess (1965) Atlas HA- 134. The nearest well to this site the groundwater historically had been measured as 12 feet on October 1959 and between the years of 1950 to 1962 appeared from 12 to 17 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 45 down is Silty soils (A-4) and from 45 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters is 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Hydrologic map of the Kent County Area, Delaware, Map Series, No. 11 by Scott Andres 2003 this site is situated in good category for the Recharge potential.

5. Ground Cover

The ground cover for this site is 6 and 5 inches of asphalt. More detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 8 feet and caved at 4 and 6.8 feet all the measurements is below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 4.6 to 64.6 percent. The Atterberg limit is 41 percent, Liquid limits is the range of 17.8 to 56.3 percent and Plasticity Index is the range of 3.2 to 13.9 percent. The Organic matter is not encounter for the entire samples more detail show in Appendix- E.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition. In addition the entire sample from the depth of 2 to 12 feet from the surface had not enough borrow type materials according to Del-DOT standard specification to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations. This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (2- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 4-14-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR2-066A on White Oak Rd over Little River - Dover, DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
WO-1	429196.741	633296.889	39.1784500	0.0000000
WO-2	429155.323	633224.404	39.1783361	-75.4975944

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING WO-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 429196.741
Easting: 633296.889
Boring Surface Elev.:
Reference:
Date Started: 2/4/16
Date Completed: 2/4/16

Wt. of Sample Hammer: Lbs.
Type of: D-Sampler: Split Barrel O.D.
S-Sampler: O.D.
U-Sampler: O.D.
Core Bit: O.D.

Average Fall: IN.
O.D. of Sampler: 2 IN.
O.D. of Samp. Tube: IN.
O.D. of Samp. Tube: IN.
O.D. of Rock Core: IN.

Hollow Stem Auger Diameter: 3 1/4" Inches
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/4/16	7.8	
2/4/16	Dry	4.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		No Sample NR" RECOVERY		Hot-mix 6", stone 18"
2.53		2	2.0' 4.0'	5 5 5 5	Wet gray silt w/trace fine to coarse sand and fine gravel. 18" RECOVERY	A-4(0)	
5.06		3	4.0' 6.0'	5 2 2 3	Wet soft gray silt w/trace fine to coarse sand and fine gravel. 14" RECOVERY	A-4(0)	
7.59	■	4	6.0' 8.0'	2 2 3 4	Wet firm gray silt w/some fine to coarse sand and organic matter, trace of fine gravel. 20" RECOVERY	A-4(0)	
10.12		5	8.0' 10.0'	8 12 14 18	Wet medium dense gray coarse sandy fine gravel w/some fine sand and silt, trace of clay. 10" RECOVERY	A-1-b	
		6	10.0' 12.0'	7 7 7 5	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt. 16" RECOVERY	A-1-b	
12.65		7	12.0'	1 3 5 6	Wet loose gray fine gravelly coarse sand w/ trace fine sand and silt.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		14" RECOVERY		
15.18		8	14.0' 16.0'	3 4 5 4	Wet loose gray coarse sand and fine gravel w/trace fine sand and silt. 10" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	7 7 13 11	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt. 24" RECOVERY	A-1-b	
20.24 22.77		10	18.0' 20.0'	13 5 3 4	Wet loose gray fine to coarse sand w/some fine gravel and silt. 17" RECOVERY	A-2-4(0)	
25.3 27.83		11	24.0' 26.0'	9 9 12 11	Wet medium dense gray fine to coarse sand w/some fine gravel, trace of silt. 14" RECOVERY	A-3	
30.36 32.89		12	29.0' 31.0'	12 25 35 32	Wet very dense gray fine to coarse sand w/ trace fine gravel and silt. 16" RECOVERY	A-3	
35.42		13	34.0' 36.0'	25 50	Wet very dense gray coarse to fine sand w/ trace fine gravel and silt. 9" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	50	Wet very dense gray fine sand w/trace coarse sand and silt. 4" RECOVERY	A-3	
43.01							
45.54		15	44.0' 46.0'	9 11 9 13	Wet very stiff gray organic fine sandy silt w/ trace coarse sand. 24" RECOVERY	A-4(0)	
48.07							
50.6		16	49.0' 51.0'	6 8 13 17	Wet very stiff gray organic fine sandy silt w/ trace coarse sand. 24" RECOVERY	A-5(1)	
53.13							
55.66		17	54.0' 56.0'	7 9 15 18	Wet very stiff gray organic fine sandy silt w/ trace coarse sand. 24" RECOVERY	A-4(0)	
58.19							
				14			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72		18	59.0' 61.0'	11 11 12	Wet medium dense gray silty fine to coarse sand w/trace fine gravel and organic matter. 18" RECOVERY	A-2-4(0)	
65.78		19	64.0' 66.0'	10 16 36 31	Wet hard gray fine sandy silt w/trace coarse sand. 24" RECOVERY	A-5(0)	
68.31		20	68.0' 70.0'	8 23 20 19	Wet very dense gray silty fine sand w/some coarse sand, trace of fine. 24" RECOVERY	A-2-4(0)	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Elastic Silts

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING WO-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 429155.323
Easting: 633224.404
Boring Surface Elev.:
Reference:
Date Started: 2/4/16
Date Completed: 2/4/16

Wt. of Sample Hammer: Lbs.
Type of: D-Sampler: Split Barrel O.D.
S-Sampler: O.D.
U-Sampler: O.D.
Core Bit: O.D.

Average Fall: IN.
O.D. of Sampler: 2 IN.
O.D. of Samp. Tube: IN.
O.D. of Samp. Tube: IN.
O.D. of Rock Core: IN.

Hollow Stem Auger Diameter: 3 1/4" Inches
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/4/16	8.0	
2/4/16	Dry	6.3

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' – 2.0'		Moist brown fine gravel w/some coarse sand, trace of fine sand and silt. 18" RECOVERY	A-1-a	Hot-mix 5"
2.53		2	2.0' – 4.0'	5 4 3 4	Wet firm brown silt w/trace fine to coarse sand and fine gravel. 18" RECOVERY	A-4(0)	
5.06		3	4.0' – 6.0'	2 2 3 4	Wet firm brown clayey silt w/trace fine to coarse sand and fine gravel. 14" RECOVERY	A-4(4)	
7.59		4	6.0' – 8.0'	5 6 8 10	Wet stiff brown silt w/some fine sand, trace of coarse sand. 18" RECOVERY	A-4(0)	
10.12	■	5	8.0' – 10.0'	7 11 17 14	Wet dense gray coarse sandy fine gravel w/ trace fine sand and silt. 10" RECOVERY	A-1-a	
		6	10.0' – 12.0'	14 14 8 7	Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt. 16" RECOVERY	A-1-a	
12.65		7	12.0' – 14.0'	6 7 4 5	Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt. 16" RECOVERY	A-1-a	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	6 7 6 5	Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt. 10" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	8 8 9 12	Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	10 11 13 17	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt. 19" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	20 8 9 10	Wet medium dense brown fine to coarse sand w/some fine gravel, trace of silt. 12" RECOVERY	A-1-b	
30.36		12	29.0' 31.0'	21 50	Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt. 15" RECOVERY	A-3	
35.42		13	34.0' 36.0'	18 50	Wet very dense brown fine sand w/some coarse sand, trace of silt and fine gravel. 10" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	34 50	Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt. 7" RECOVERY	A-3	
43.01							
45.54		15	44.0' 46.0'	32 50	Wet very dense brown fine sand w/trace coarse sand and silt. 7" RECOVERY	A-3	
48.07							
50.6		16	49.0' 51.0'	10 11 9 17	Saturated very stiff gray organic fine sandy silt w/some coarse sand. 24" RECOVERY	A-4(0)	
53.13							
55.66		17	54.0' 56.0'	7 8 16 27	Saturated very stiff gray organic fine sandy silt w/trace coarse sand. 14" RECOVERY	A-4(0)	
58.19							
		18	59.0'	9 11 13	Saturated very stiff gray organic clayey fine	A-4(3)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WO-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72			61.0'	19	sandy silt w/trace coarse sand. 12" RECOVERY		
63.25							
65.78		19	64.0' 66.0'	8 10 20 32	Saturated hard gray fine sandy silt w/some organic matter, trace of coarse sand.	A-4(0)	
68.31		20	68.0' 70.0'	12 17 22 40	Saturated very stiff gray organic fine sandy clay w/some silt, trace of coarse sand.	A-7-5(8)	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Clean sand & gravelly sand
	Expansive plastic clays

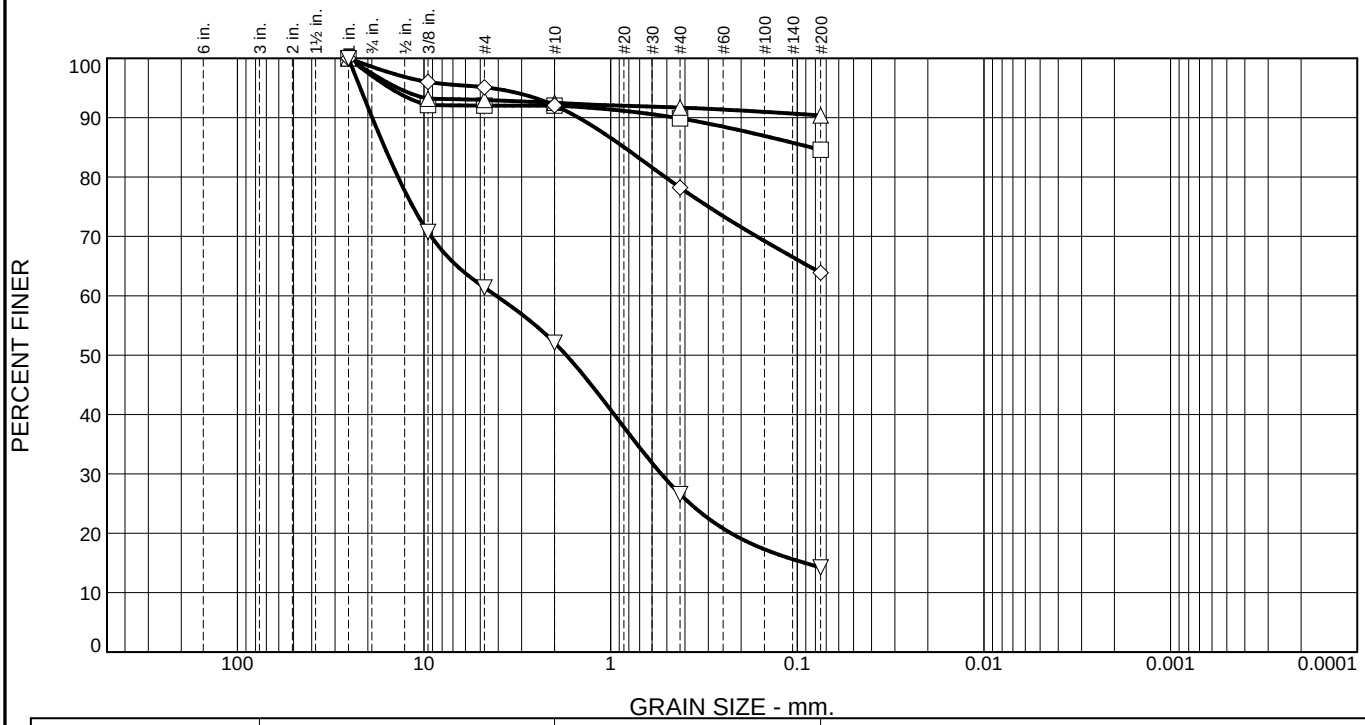
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○						
□	0.0	8.0	2.1	5.3	84.6	
△	0.0	7.5	0.8	1.3	90.4	
◇	0.0	7.9	13.9	14.3	63.9	
▽	0.0	47.9	25.5	12.4	14.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										
□	22.1	NP	0.0845							
△	27.1	NP								
◇	30.3	NP	0.8457							
▽	17.8	14.6	16.2458	4.1069	1.7287	0.5353	0.0909			

Material Description	USCS	AASHTO
○ No Sample		
□ Wet gray silt w/trace fine to coarse sand and fine gravel.	ML	A-4(0)
△ Wet soft gray silt w/trace fine to coarse sand and fine gravel.	ML	A-4(0)
◇ Wet firm gray silt w/some fine to coarse sand and organic matter, trace of fine gravel.	ML	A-4(0)
▽ Wet medium dense gray coarse sandy fine gravel w/some fine sand and silt, trace of clay.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** WO-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** WO-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** WO-1 **Depth:** 6.0 **Sample Number:** 4

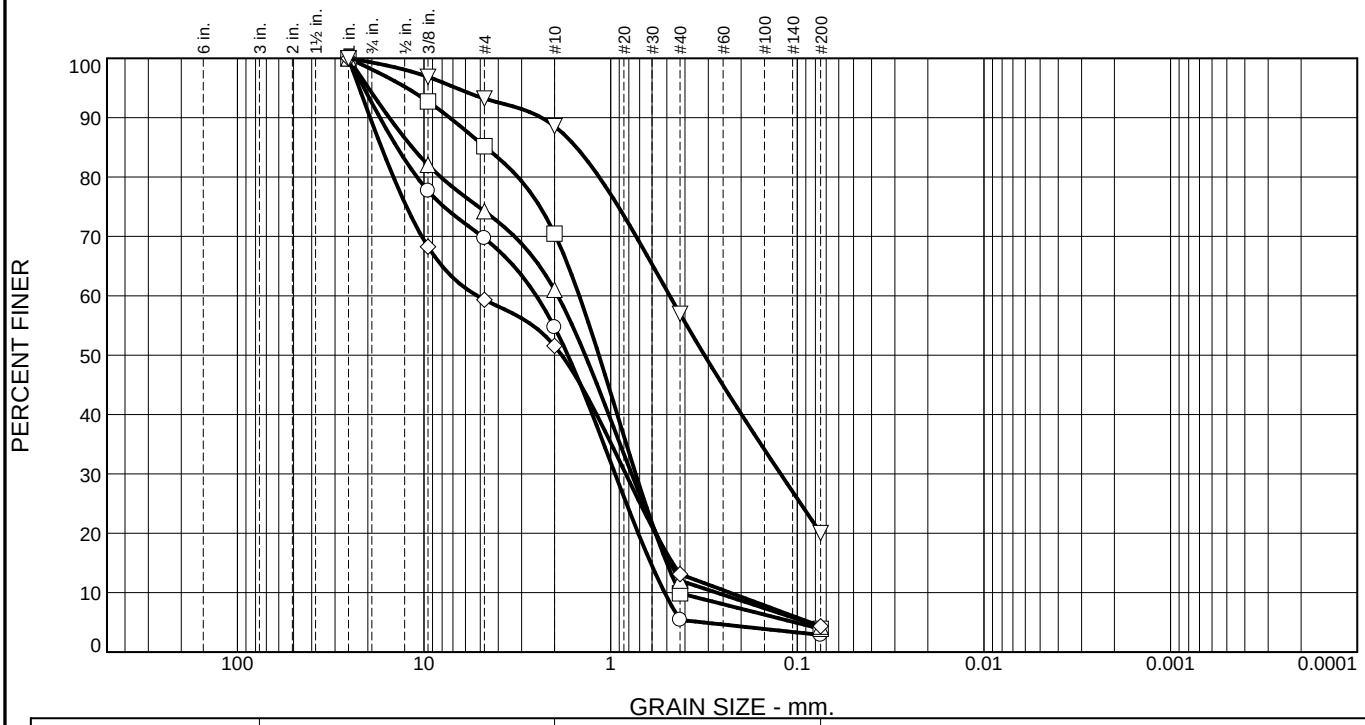
▽ **Source of Sample:** WO-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	45.3	49.3	2.5	2.9	
□	0.0	29.5	60.6	6.0	3.9	
△	0.0	39.0	49.0	7.7	4.3	
◇	0.0	48.4	38.5	8.8	4.3	
▽	0.0	11.4	31.6	37.0	20.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	13.9376	2.5032	1.6962	0.9469	0.6098	0.5136	0.70	4.87
□	NV	NP	4.6686	1.4731	1.1564	0.7342	0.5008	0.4267	0.86	3.45
△	NV	NP	11.5610	1.9203	1.3693	0.7725	0.4791	0.2697	1.15	7.12
◇	NV	NP	16.9075	5.1888	1.8287	0.8302	0.4657	0.2295	0.58	22.61
▽	NV	NP	1.5265	0.4824	0.3144	0.1229				

Material Description	USCS	AASHTO
○ Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	SP	A-1-b
□ Wet loose gray fine gravelly coarse sand w/trace fine sand and silt.	SP	A-1-b
△ Wet loose gray coarse sand and fine gravel w/trace fine sand and silt.	SW	A-1-b
◇ Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	SP	A-1-b
▽ Wet loose gray fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** WO-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** WO-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** WO-1 **Depth:** 16.0 **Sample Number:** 9

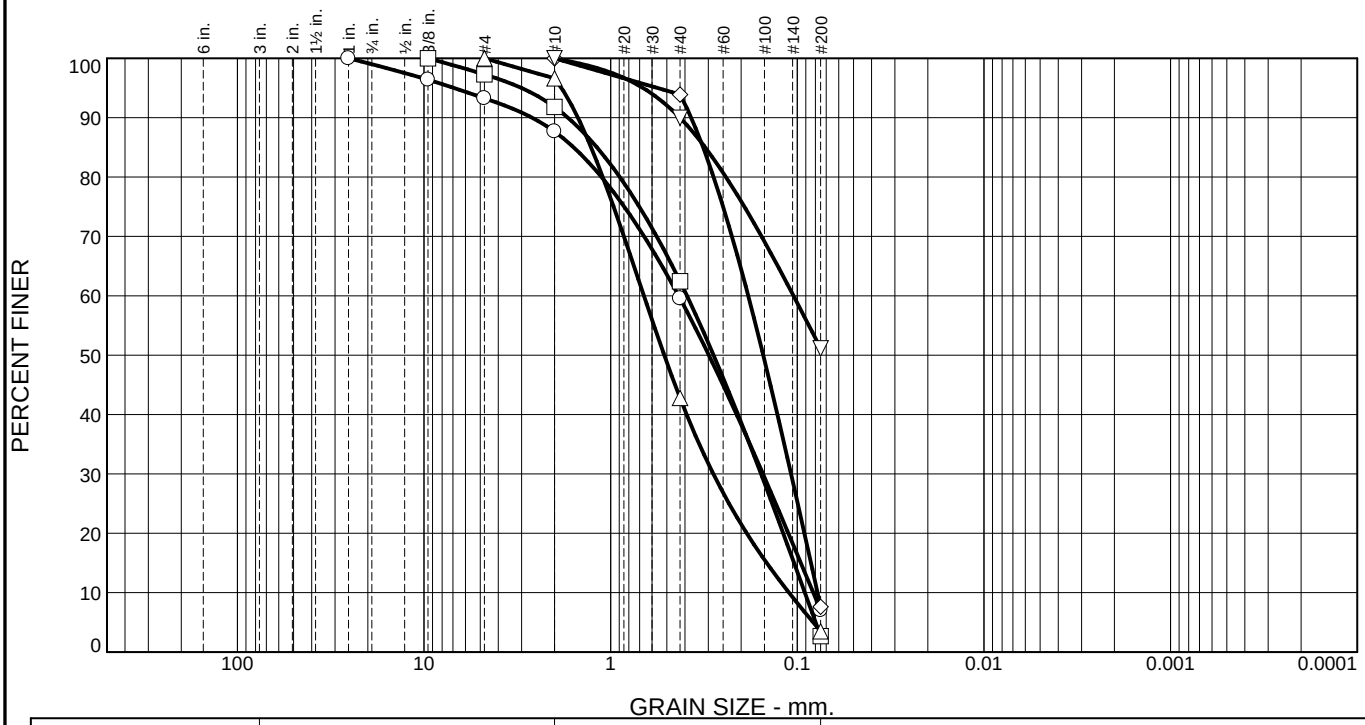
▽ **Source of Sample:** WO-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.3	28.1	52.6	7.0	
□	0.0	8.2	29.4	59.7	2.7	
△	0.0	3.4	53.8	39.3	3.5	
◇	0.0	0.0	6.1	86.3	7.6	
▽	0.0	0.0	10.0	38.9	51.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5795	0.4324	0.2977	0.1528	0.0958	0.0821	0.66	5.26
□	NV	NP	1.1853	0.3900	0.2809	0.1565	0.1041	0.0911	0.69	4.28
△	NV	NP	1.2731	0.6634	0.5162	0.2817	0.1459	0.1108	1.08	5.99
◇	NV	NP	0.3195	0.1833	0.1523	0.1080	0.0845	0.0779	0.82	2.35
▽	30.6	NP	0.3117	0.1048						

Material Description	USCS	AASHTO
○ Wet medium dense gray fine to coarse sand w/some fine gravel, trace of silt.	SP-SM	A-3
□ Wet very dense gray fine to coarse sand w/trace fine gravel and silt.	SP	A-3
△ Wet very dense gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Wet very dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
▽ Wet very stiff gray organic fine sandy silt w/trace coarse sand.	ML	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** WO-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** WO-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** WO-1 **Depth:** 39.0 **Sample Number:** 14

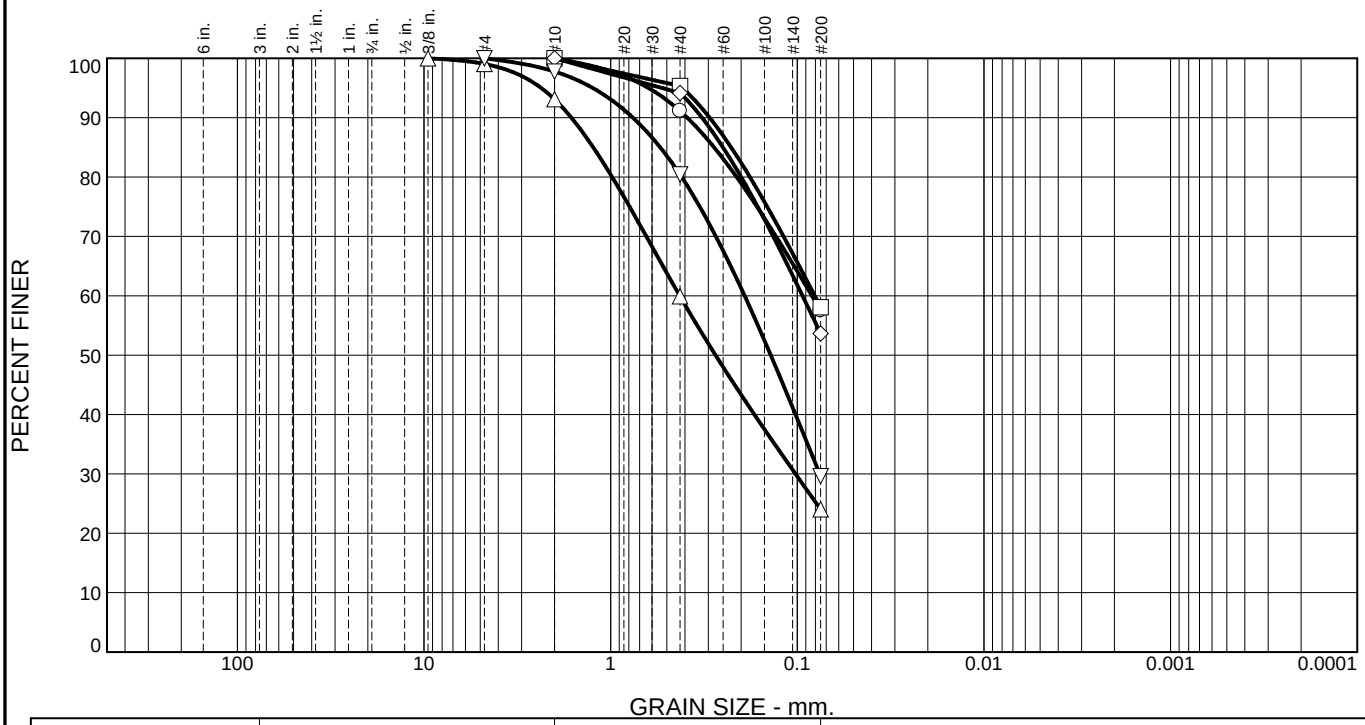
▽ **Source of Sample:** WO-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	8.9	33.6	57.5	
□	0.0	0.0	4.7	37.2	58.1	
△	0.0	6.9	33.2	35.9	24.0	
◇	0.0	0.0	5.8	40.5	53.7	
▽	0.0	2.2	17.4	50.8	29.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	45.6	NP	0.2790	0.0835						
□	35.5	NP	0.2262	0.0807						
△	NV	NP	1.2399	0.4265	0.2741	0.1022				
◇	43.7	NP	0.2501	0.0938						
▽	NV	NP	0.5421	0.1916	0.1388	0.0759				

Material Description	USCS	AASHTO
○ Wet very stiff gray organic fine sandy silt w/trace coarse sand.	ML	A-5(1)
□ Wet very stiff gray organic fine sandy silt w/trace coarse sand.	ML	A-4(0)
△ Wet medium dense gray silty fine to coarse sand w/trace fine gravel and organic matter.	SM	A-2-4(0)
◇ Wet hard gray fine sandy silt w/trace coarse sand.	ML	A-5(0)
▽ Wet very dense gray silty fine sand w/some coarse sand, trace of fine.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** WO-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** WO-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** WO-1 **Depth:** 64.0 **Sample Number:** 19

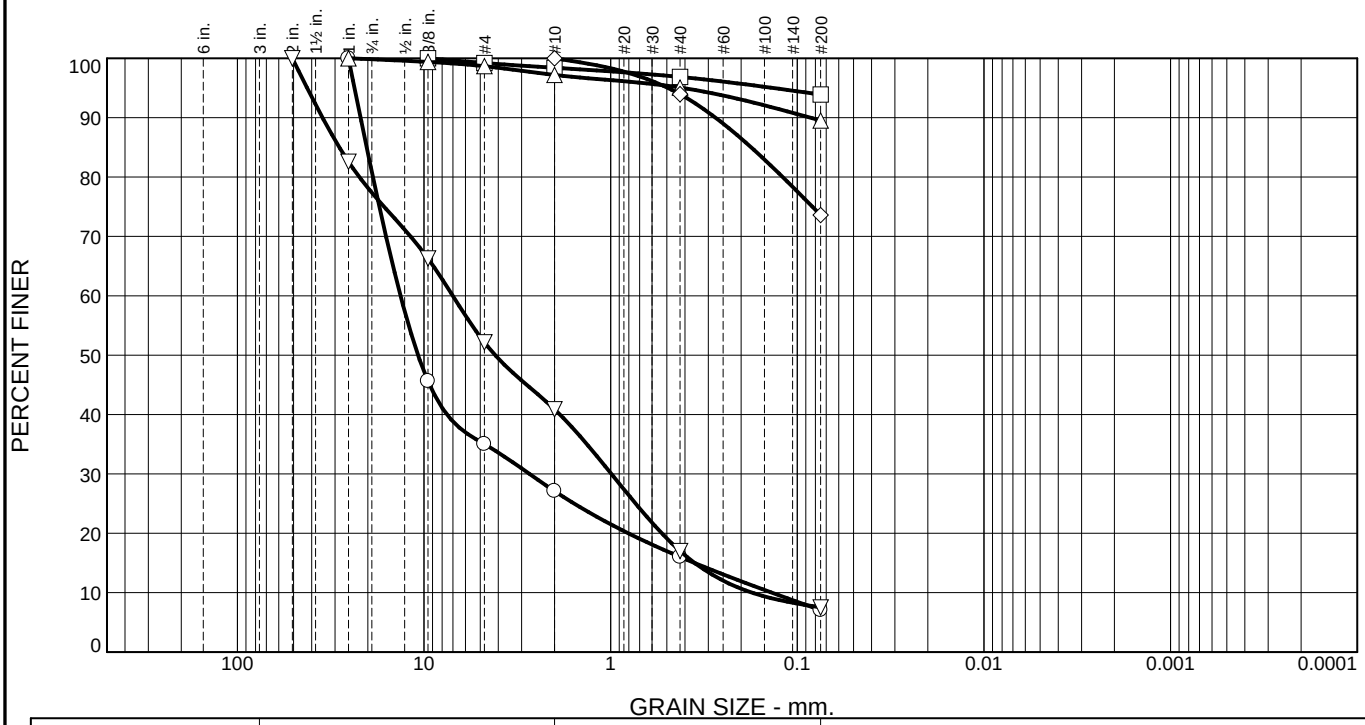
▽ **Source of Sample:** WO-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	72.9	11.1	8.9	7.1	
□	0.0	1.6	1.5	3.0	93.9	
△	0.0	2.8	2.1	5.6	89.5	
◇	0.0	0.0	6.0	20.4	73.6	
▽	0.0	59.1	23.9	9.5	7.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	20.2894	13.3617	10.7642	2.7221	0.3551	0.1369	4.05	97.63
□	24.0	NP								
△	27.0	20.6								
◇	25.5	NP	0.1767							
▽	NV	NP	28.4173	7.0124	4.1565	0.9912	0.3546	0.1748	0.80	40.12

Material Description	USCS	AASHTO
○ Moist brown fine gravel w/some coarse sand, trace of fine sand and silt.	GP-GM	A-1-a
□ Wet firm brown silt w/trace fine to coarse sand and fine gravel.	ML	A-4(0)
△ Wet firm brown clayey silt w/trace fine to coarse sand and fine gravel.	CL-ML	A-4(4)
◇ Wet stiff brown silt w/some fine sand, trace of coarse sand.	ML	A-4(0)
▽ Wet dense gray coarse sandy fine gravel w/trace fine sand and silt.	GP-GM	A-1-a

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-2 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** WO-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** WO-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** WO-2 **Depth:** 6.0 **Sample Number:** 4

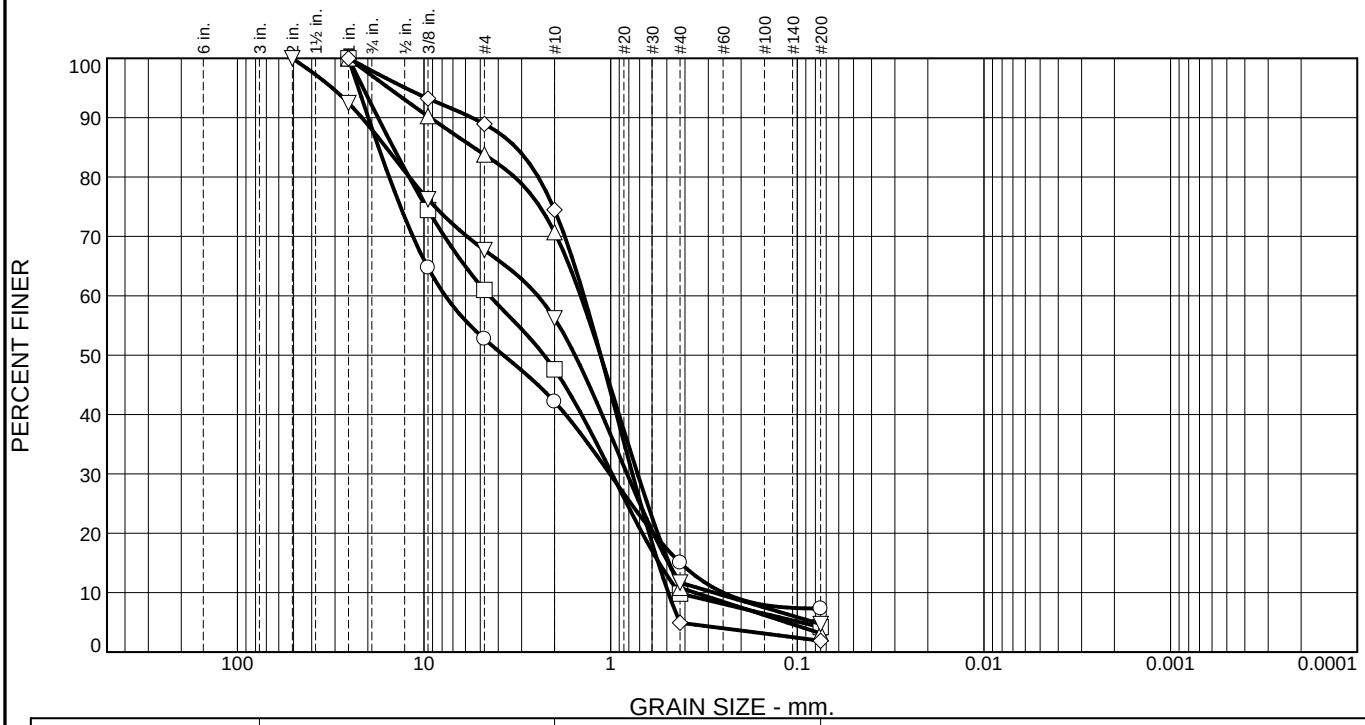
▽ **Source of Sample:** WO-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	57.8	27.1	7.8	7.3	
□	0.0	52.4	37.8	5.6	4.2	
△	0.0	29.3	59.9	7.7	3.1	
◇	0.0	25.5	69.6	3.0	1.9	
▽	0.0	43.8	44.5	7.0	4.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	17.5320	7.6966	3.7532	1.0100	0.4231	0.2494	0.53	30.87
□	NV	NP	14.6168	4.4543	2.2733	0.9840	0.5497	0.4290	0.51	10.38
△	NV	NP	5.4266	1.4490	1.1340	0.7170	0.4864	0.3530	1.00	4.10
◇	NV	NP	3.2156	1.3912	1.1315	0.7646	0.5559	0.4915	0.86	2.83
▽	NV	NP	15.9846	2.4565	1.5528	0.8169	0.4905	0.2789	0.97	8.81

Material Description	USCS	AASHTO
○ Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt.	GP-GM	A-1-a
□ Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt.	SP	A-1-a
△ Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt.	SP	A-1-b
◇ Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt.	SP	A-1-b
▽ Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** WO-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** WO-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** WO-2 **Depth:** 16.0 **Sample Number:** 9

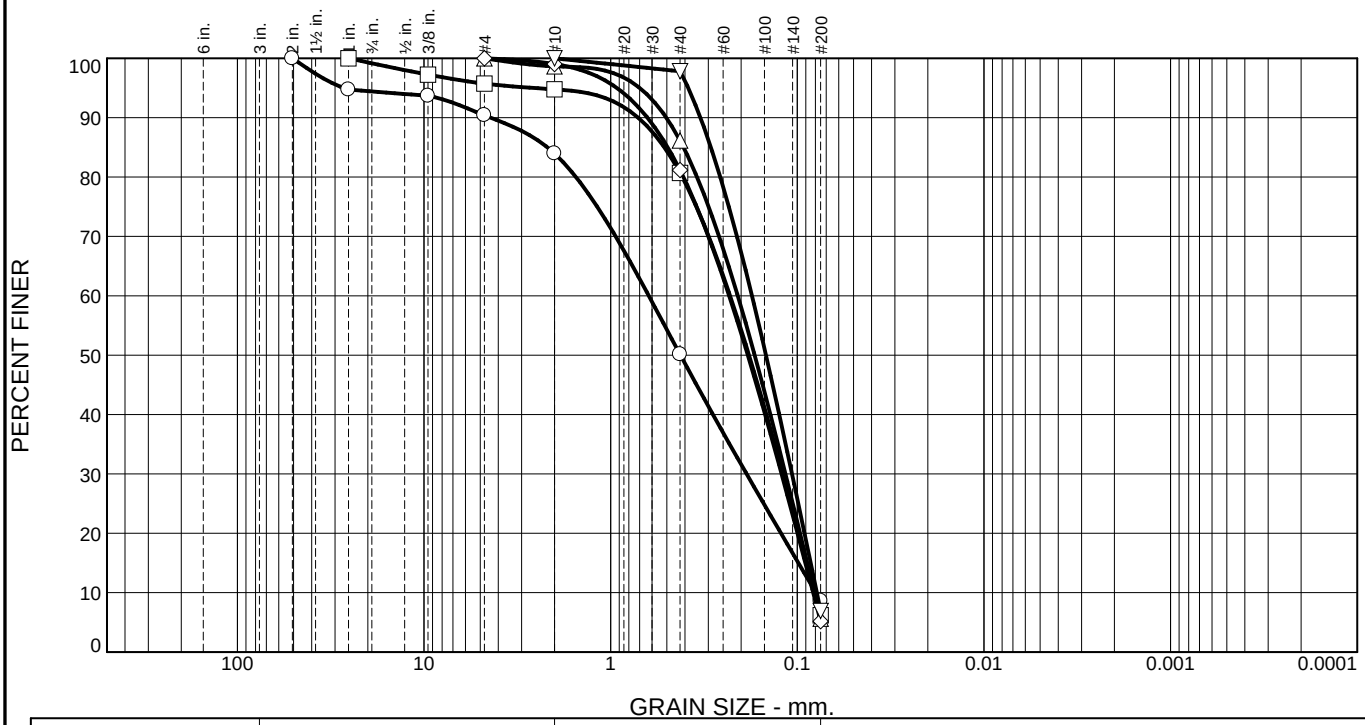
▽ **Source of Sample:** WO-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	16.0	33.9	41.5	8.6	
□	0.0	5.2	14.1	74.5	6.2	
△	0.0	1.4	12.5	80.5	5.6	
◇	0.0	1.0	17.8	76.0	5.2	
▽	0.0	0.0	2.2	90.9	6.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.1840	0.6247	0.4227	0.1870	0.0987	0.0796	0.70	7.85
□	NV	NP	0.5158	0.2292	0.1815	0.1194	0.0889	0.0807	0.77	2.84
△	NV	NP	0.4070	0.2085	0.1693	0.1158	0.0885	0.0810	0.79	2.57
◇	NV	NP	0.4946	0.2318	0.1842	0.1215	0.0906	0.0823	0.77	2.82
▽	NV	NP	0.2905	0.1750	0.1473	0.1068	0.0848	0.0786	0.83	2.23

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
□ Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
△ Wet very dense brown fine sand w/some coarse sand, trace of silt and fine gravel.	SP-SM	A-3
◇ Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
▽ Wet very dense brown fine sand w/trace coarse sand and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** WO-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** WO-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** WO-2 **Depth:** 39.0 **Sample Number:** 14

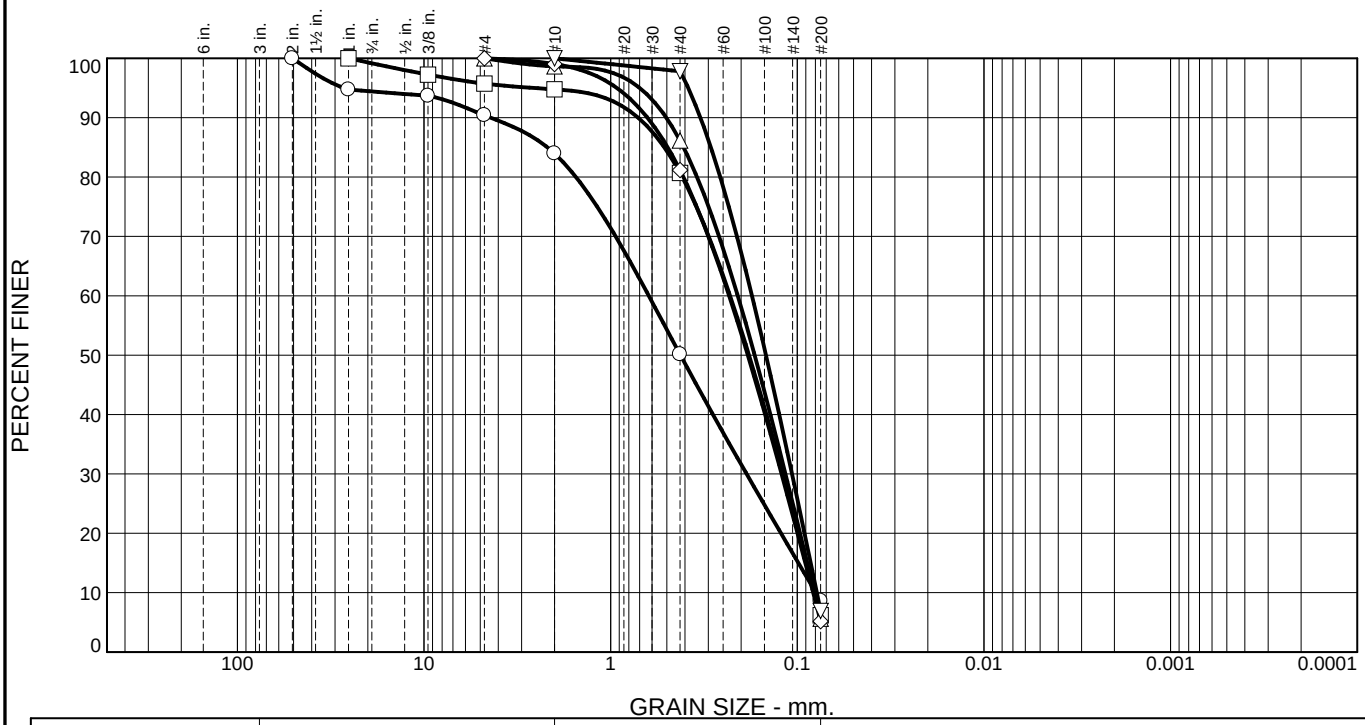
▽ **Source of Sample:** WO-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	16.0	33.9	41.5	8.6	
□	0.0	5.2	14.1	74.5	6.2	
△	0.0	1.4	12.5	80.5	5.6	
◇	0.0	1.0	17.8	76.0	5.2	
▽	0.0	0.0	2.2	90.9	6.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.1840	0.6247	0.4227	0.1870	0.0987	0.0796	0.70	7.85
□	NV	NP	0.5158	0.2292	0.1815	0.1194	0.0889	0.0807	0.77	2.84
△	NV	NP	0.4070	0.2085	0.1693	0.1158	0.0885	0.0810	0.79	2.57
◇	NV	NP	0.4946	0.2318	0.1842	0.1215	0.0906	0.0823	0.77	2.82
▽	NV	NP	0.2905	0.1750	0.1473	0.1068	0.0848	0.0786	0.83	2.23

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
□ Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
△ Wet very dense brown fine sand w/some coarse sand, trace of silt and fine gravel.	SP-SM	A-3
◇ Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
▽ Wet very dense brown fine sand w/trace coarse sand and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WO-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** WO-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** WO-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** WO-2 **Depth:** 39.0 **Sample Number:** 14

▽ **Source of Sample:** WO-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

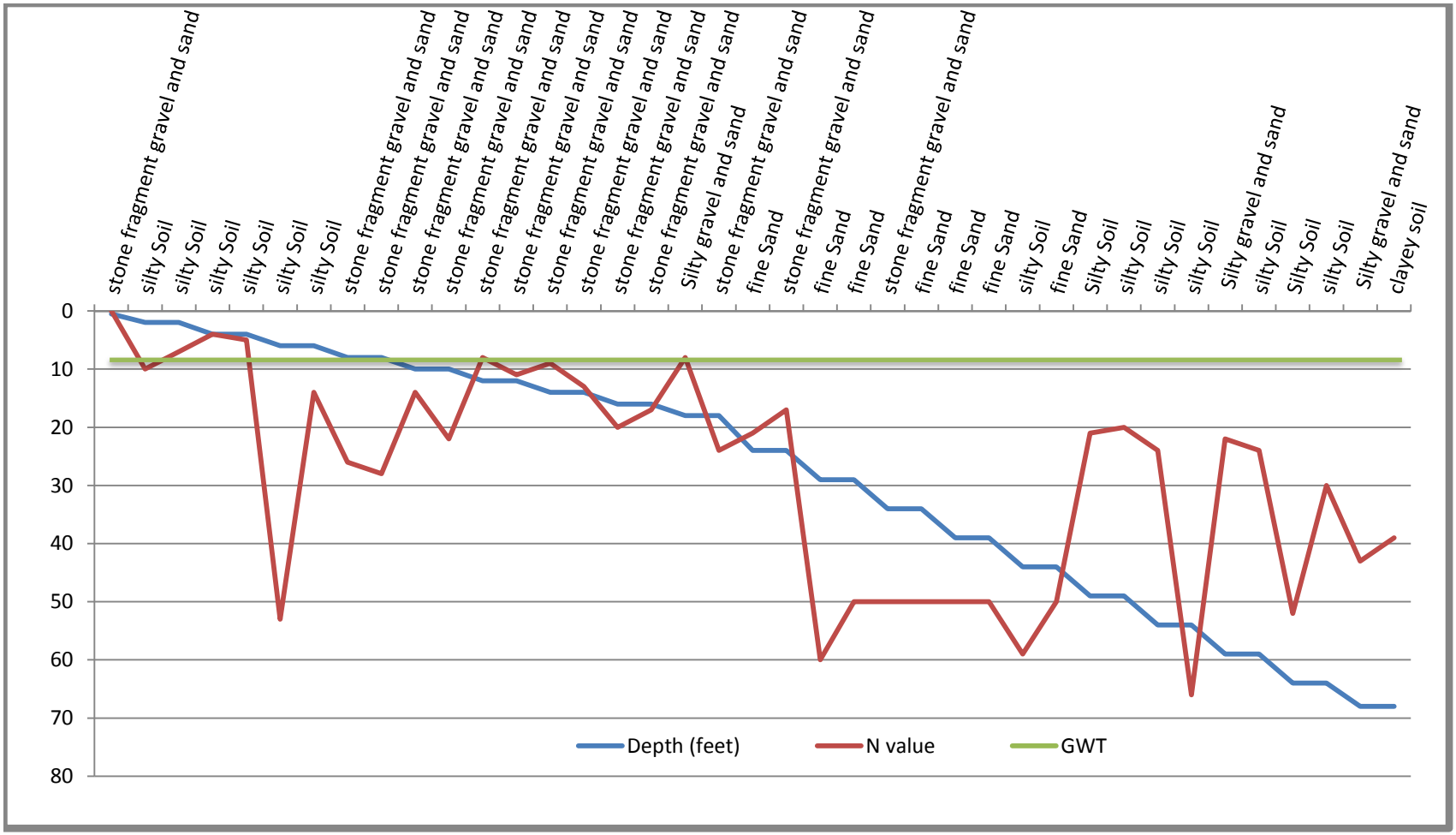
Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
WO-1														
	1		No Sample											
	2	2	Wet gray silt w/trace fine to coarse sand and fine gravel.	22.1	NP	21	ML	A-4(0)	92	84.6	5	5	5	5
	3	4	Wet soft gray silt w/trace fine to coarse sand and fine gravel.	27.1	NP	27.7	ML	A-4(0)	92.5	90.4	5	2	2	3
	4	6	Wet firm gray silt w/some fine to coarse sand and organic matter, trace of fine gravel.	30.3	NP	34.1	ML	A-4(0)	92.1	63.9	2	2	3	4
	5	8	Wet medium dense gray coarse sandy fine gravel w/some fine sand and silt, trace of clay.	17.8	3.2	11.8	SM	A-1-b	52.1	14.2	8	12	14	18
	6	10	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	NV	NP	12.1	SP	A-1-b	54.7	2.9	7	7	7	5
	7	12	Wet loose gray fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	14.6	SP	A-1-b	70.5	3.9	1	3	5	6
	8	14	Wet loose gray coarse sand and fine gravel w/trace fine sand and silt.	NV	NP	11.2	SW	A-1-b	61	4.3	3	4	5	4
	9	16	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	NV	NP	9.4	SP	A-1-b	51.6	4.3	7	7	13	11
	10	18	Wet loose gray fine to coarse sand w/some fine gravel and silt.	NV	NP	20.2	SM	A-2-4(0)	88.6	20	13	5	3	4
	11	24	Wet medium dense gray fine to coarse sand w/some fine gravel, trace of silt.	NV	NP	19.7	SP-SM	A-3	87.7	7	9	9	12	11
	12	29	Wet very dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	19	SP	A-3	91.8	2.7	12	25	35	32
	13	34	Wet very dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.6	SP	A-1-b	96.6	3.5	25	50		
	14	39	Wet very dense gray fine sand w/trace coarse sand and silt.	NV	NP	23.5	SP-SM	A-3	100	7.6	50	50		
	15	44	Wet very stiff gray organic fine sandy silt w/trace coarse sand.	30.6	NP	49.9	ML	A-4(0)	100	51.1	9	11	9	13
	16	49	Wet very stiff gray organic fine sandy silt w/trace coarse sand.	45.6	NP	64.6	ML	A-5(1)	100	57.5	6	8	13	17
	17	54	Wet very stiff gray organic fine sandy silt w/trace coarse sand.	35.5	NP	54.8	ML	A-4(0)	100	58.1	7	9	15	18
	18	59	Wet medium dense gray silty fine to coarse sand w/trace fine gravel and organic matter.	NV	NP	35.5	SM	A-2-4(0)	93.1	24	14	11	11	12
	19	64	Wet hard gray fine sandy silt w/trace coarse sand.	43.7	NP	58.5	ML	A-5(0)	100	53.7	10	16	36	31
	20	68	Wet very dense gray silty fine sand w/some coarse sand, trace of fine.	NV	NP	37.4	SM	A-2-4(0)	97.8	29.6	8	23	20	19
		70	End Boring											
WO-2														
	1	0.5	Moist brown fine gravel w/some coarse sand, trace of fine sand and silt.	NV	NP	4.6	GP-GM	A-1-a	27.1	7.1				
	2	2	Wet firm brown silt w/trace fine to coarse sand and fine gravel.	24	NP	22.5	ML	A-4(0)	98.4	93.9	5	4	3	4
	3	4	Wet firm brown clayey silt w/trace fine to coarse sand and fine gravel.	27	6.4	24.5	CL-ML	A-4(4)	97.2	89.5	2	2	3	4
	4	6	Wet stiff brown silt w/some fine sand, trace of coarse sand.	25.5	NP	28.4	ML	A-4(0)	100	73.6	5	6	8	10
	5	8	Wet dense gray coarse sandy fine gravel w/trace fine sand and silt.	NV	NP	8.5	GP-GM	A-1-a	40.9	7.5	7	11	17	14
	6	10	Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt.	NV	NP	9.4	GP-GM	A-1-a	42.2	7.3	14	14	8	7
	7	12	Wet medium dense gray coarse sandy fine gravel w/trace fine sand and silt.	NV	NP	9.5	SP	A-1-a	47.6	4.2	6	7	4	5
	8	14	Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt.	NV	NP	13.3	SP	A-1-b	70.7	3.1	6	7	6	5
	9	16	Wet medium dense gray fine gravel coarse sand w/trace fine sand and silt.	NV	NP	12.4	SP	A-1-b	74.5	1.9	8	8	9	12
	10	18	Wet medium dense gray coarse sand and fine gravel w/trace fine sand and silt.	NV	NP	9.9	SP	A-1-b	56.2	4.7	10	11	13	17
	11	24	Wet medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	NV	NP	17	SP-SM	A-1-b	84	8.6	20	8	9	10
	12	29	Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	NV	NP	21	SP-SM	A-3	94.8	6.2	21	50		
	13	34	Wet very dense brown fine sand w/some coarse sand, trace of silt and fine gravel.	NV	NP	22.7	SP-SM	A-3	98.6	5.6	18	50		
	14	39	Wet very dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	NV	NP	23.8	SP-SM	A-3	99	5.2	34	50		
	15	44	Wet very dense brown fine sand w/trace coarse sand and silt.	NV	NP	23.6	SP-SM	A-3	100	6.9	32	50		
	16	49	Saturated very stiff gray organic fine sandy silt w/some coarse sand.	30.7	NP	64.4	SM	A-4(0)	100	45.1	10	11	9	17
	17	54	Saturated very stiff gray organic fine sandy silt w/trace coarse sand.	30.4	NP	47.1	SM	A-4(0)	100	47.8	7	8	16	27
	18	59	Saturated very stiff gray organic clayey fine sandy silt w/trace coarse sand.	35.2	8	62.7	ML	A-4(3)	100	55.6	9	11	13	19
	19	64	Saturated hard gray fine sandy silt w/some organic matter, trace of coarse sand.	36.3	NP	49.9	ML	A-4(0)	100	53.7	8	10	20	32
	20	68	Saturated very stiff gray organic fine sandy clay w/some silt, trace of coarse sand.	56.3	13.9	61.1	MH	A-7-5(8)	100	59.4	12	17	22	40
		70	End Boring											

DATE : 4-13-2016

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4

PROJECT NUMBER : T201407003

PROJECT NAME : BR2-066A on White Oak Rd over Little River - Dover, DE



DATE : 4-14-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR2-066A on White Oak Rd over Little River - Dover, DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-24-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-113B along on Cattail Branch Rd, on Saulsbury Creek- Farmington, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-28-2016. Walton Corporation-Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation and one Shelby tube was collected. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Kent County, Delaware According to Geologic Map Series No. 14 by Ramsey, K.W. October 2007 this site is situated in Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Hickman Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-100. The nearest well to this site the groundwater historically had been measured as 44 feet

on November 1959 and between the years of 1950 to 1962 appeared from 48 to 49 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 6 to 9 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Kent County Area, Map Series, No. 11 by Scott Andres 2003. The Recharge potential is a Good to Fair category.

5. Ground Cover

The ground cover for this site is 2 and 3 inches of asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 9.5 and 13.0 feet, noted at the completion of the drilling is 7.8 and 8 feet and caved at 8.3 and 9 feet all the measurements is below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

7.1 The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 7.0 to 48.0 percent. The Atterberg limit is 28 percent, Liquid limits is the range of 13.7 to 50.8 percent and Plasticity Index is the range of 4.2 to 21.9 percent. The Organic matter is 36 percent more detail show in Appendix- E.

7.2 Undisturbed soil sample was tested on the samples obtained from the Shelby tube all the test result in Appendix “D”. Direct Shear AASHTO T236 had been test from the sample CT-2 at depth 32 feet below the existing elevation the sample indicated that the friction angle (ϕ) was approximately 19.3^{o} and a corresponding cohesion values is 1.7 PSI.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition. For the boring at southwest side of the bridge "CT-2" has an 20 feet in thickness of firm of organic silty clay appeared at 29 feet down from the surface elevation this layer need to be consider in the design. In addition the entire sample from the depth of 2 to 12 feet from the surface had been met borrow type material "A", "C" and "F" according to Del-DOT standard specification with good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations. This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of Direct Shear AASHTO T236 test (12- sheets)

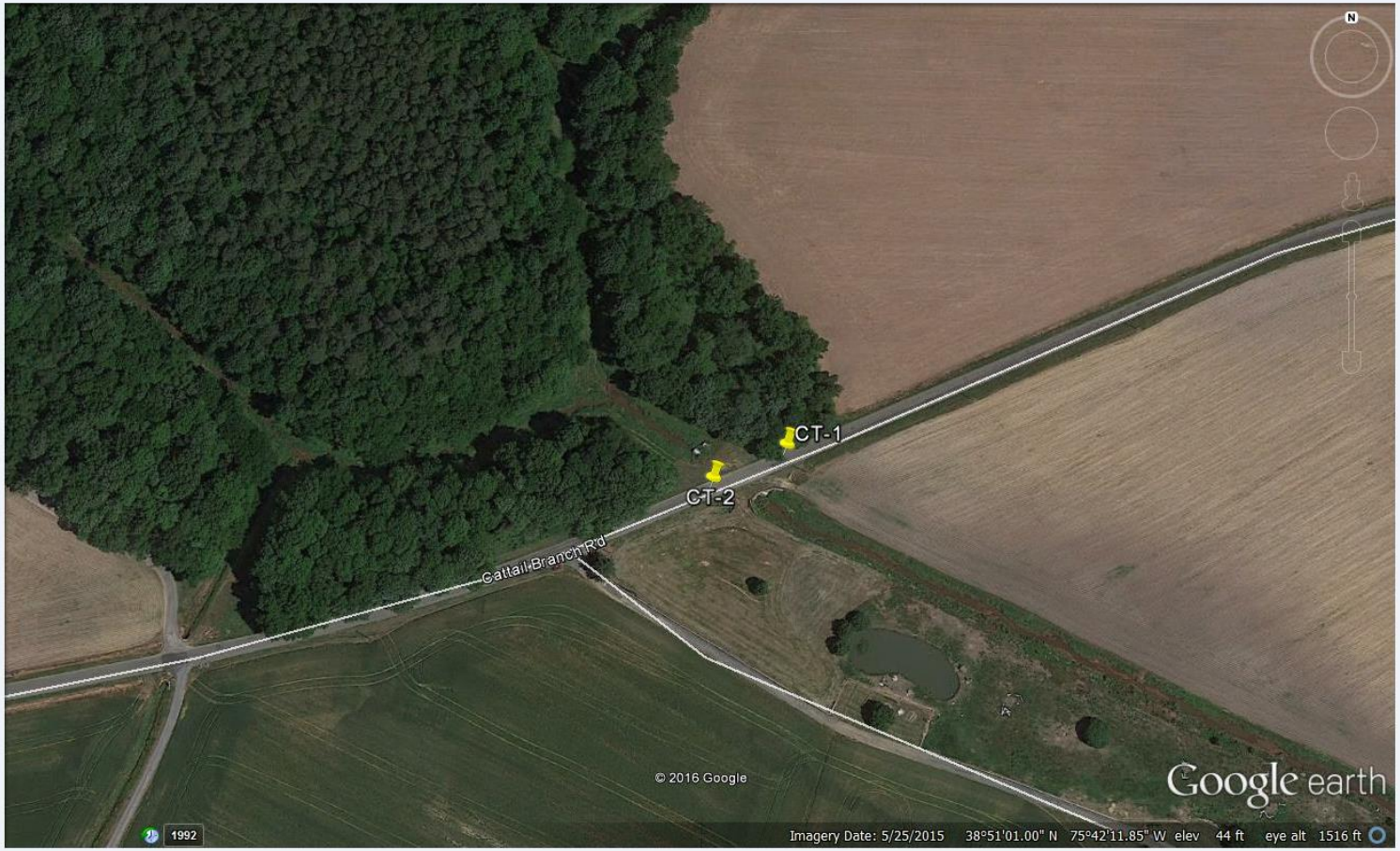
APPENDIX E

- Summary of the Borings (1- sheet)

APPENDIX F

- Chat N- Value Vs. Depth (1- sheet)

DATE : 3-24-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR2-113B along on Cattail Branch Rd, on Saulsbury Creek- Farmington, DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
CT-1	309747.209	574637.552	38.8501694	-75.7029306
CT-2	309705.007	574544.857	38.8500528	-75.7032556

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING CT-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 309747.209
Easting: 574637.552
Boring Surface Elev.:
Reference: BR2-113 B
Date Started: 1/28/16
Date Completed: 1/28/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/28/16	13.0	
1/28/16	7.8	8.3

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' 2.0'		Moist brown fine to coarse sand w/some silt and fine gravel. 18" RECOVERY	A-2-4(0)	Hot-mix 2" stone 5"
2.53		2	2.0' 4.0'	8 5 4 3	Moist loose brown fine to coarse sand w/ some fine gravel and silt. 20" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	3 3 5 4	Moist loose brown fine to coarse sand w/ some fine gravel and silt. 8" RECOVERY	A-2-4(0)	
7.59	▼	4	6.0' 8.0'	3 2 2 2	Moist very loose brown silty fine sand w/ some coarse sand, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	3 4 3 5	Wet loose brown fine sand w/some silt, trace of coarse sand and fine gravel. 10" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	2 3 5 5	Wet loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
12.65	■	7	12.0' 14.0'	3 3 6 6	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	5 8 8 7	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 22" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	8 9 13 13	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	8 12 14 14	Wet medium dense brown coarse sand w/ some fine gravel and fine sand, trace of silt. 18" RECOVERY	A-1-b	
22.77							
25.3		11	24.0' 26.0'	9 12 13 13	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 13" RECOVERY	A-1-b	
27.83							
30.36		12	29.0' 31.0'	4 5 5 9	Wet loose brown coarse to fine sand w/some fine gravel, trace of silt. 10" RECOVERY	A-1-b	
32.89							
35.42		13	34.0' 36.0'	9 11 9 17	Wet medium dense brown silty fine sand w/ trace coarse sand. 9" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	9 9 10 12	Saturated very stiff gray fine to coarse sandy clay w/some silt, trace of organic matter. 24" RECOVERY	A-7-6(9)	
43.01							
45.54		15	44.0' 46.0'	8 11 10 13	Saturated very stiff gray coarse sandy clay w/ some fine sand, silt and organic matter. 15" RECOVERY	A-7-6(10)	
48.07							
50.6		16	49.0' 51.0'	6 10 10 15	Saturated very stiff gray coarse sandy clay w/ some fine sand, silt and organic matter. 12" RECOVERY	A-7-6(8)	
53.13							
55.66		17	54.0' 56.0'	9 11 15 17	Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter. 16" RECOVERY	A-2-4(0)	
58.19							
		18	59.0'	7 11 15	Saturated medium dense gray silty fine sand	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				25	w/trace coarse sand and organic matter.		
60.72			61.0'		17" RECOVERY		
63.25							
		19	64.0'	15 17 18 29	Saturated dense gray silty fine sand w/ trace coarse sand and organic matter.	A-2-4(0)	
65.78			66.0'		15" RECOVERY		
68.31		20	68.0'	17 28 30 35	Saturated very dense gray fine sand w/ some silt and coarse sand.	A-2-4(0)	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
	Expansive plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING CT-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 309705.007
Easting: 574544.857
Boring Surface Elev.:
Reference: BR2-113B
Date Started: 1/28/16
Date Completed: 1/28/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/28/16	9.5	
1/28/16	8.0	9.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		No Recovery NR" RECOVERY		Hot-mix 3", stone 3"
2.53		2	2.0' 4.0'	4 4 2 2	Moist firm gray fine sandy silt w/some coarse sand. 18" RECOVERY	A-4(0)	
5.06		3	4.0' 6.0'	4 2 1 1	Saturated soft gray fine to coarse sandy silt. 17" RECOVERY	A-4(0)	
7.59		4	6.0' 8.0'	5 3 2 2	Saturated loose gray silty fine sand w some coarse sand and organic matter./ 20" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	4 7 3 5	Saturated loose gray fine to coarse sand w/ some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	5 7 11 13	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt. 20" RECOVERY	A-1-b	
12.65		7	12.0'	11 13 18 17	Saturated dense gray coarse to fine sand w/ some fine gravel, trace of silt.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		23" RECOVERY		
15.18		8	14.0' 16.0'	2 4 5 3	Saturated loose gray coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	3 5 5 5	Saturated loose brown coarse to fine sand w/ some fine gravel, trace of silt. 22" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	5 7 11 18	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	24.0' 26.0'	7 7 9 10	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 17" RECOVERY	A-1-b	
27.83							
30.36		12	29.0' 31.0'	13 2 4 3	Saturated loose brown silty fine to coarse sand. 24" RECOVERY	A-2-4(0)	
32.89		U-1	32.0' 34.0'		24" RECOVERY		Shelby Tube - Press Sample
35.42		13	34.0' 36.0'	3 3 3 5	Saturated loose gray silty fine sand w/ some coarse sand and clay, trace of organic matter. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	2 2 3 3	Saturated firm gray fine to coarse sandy clay w/some silt, trace of organic matter. 24" RECOVERY	A-7-6(6)	
43.01							
45.54		15	44.0' 46.0'	3 3 3 9	Saturated firm gray fine sandy clay w/some coarse sand, silt and organic matter. 24" RECOVERY	A-7-6(6)	
48.07							
50.6		16	49.0' 51.0'	5 7 7 10	Saturated stiff gray fine sandy clay w/ some silt and coarse sand, trace of fine gravel and organic matter. 24" RECOVERY	A-6(1)	
53.13							
55.66		17	54.0' 56.0'	6 9 13 18	Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter. 24" RECOVERY	A-2-4(0)	
58.19							
				7			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** CT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	8 10 13	Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter.	A-2-4(0)	
60.72			61.0'		24" RECOVERY		
63.25							
		19	64.0'	10 23 50	Saturated very dense gray fine sand w/some coarse sand and silt, trace of organic matter.	A-2-4(0)	
65.78			66.0'		24" RECOVERY		
68.31		20	68.0'	10 11 13 20	Saturated medium dense gray silty fine sand w/trace coarse sand and clay.	A-2-4(0)	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Expansive plastic clays
	Plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

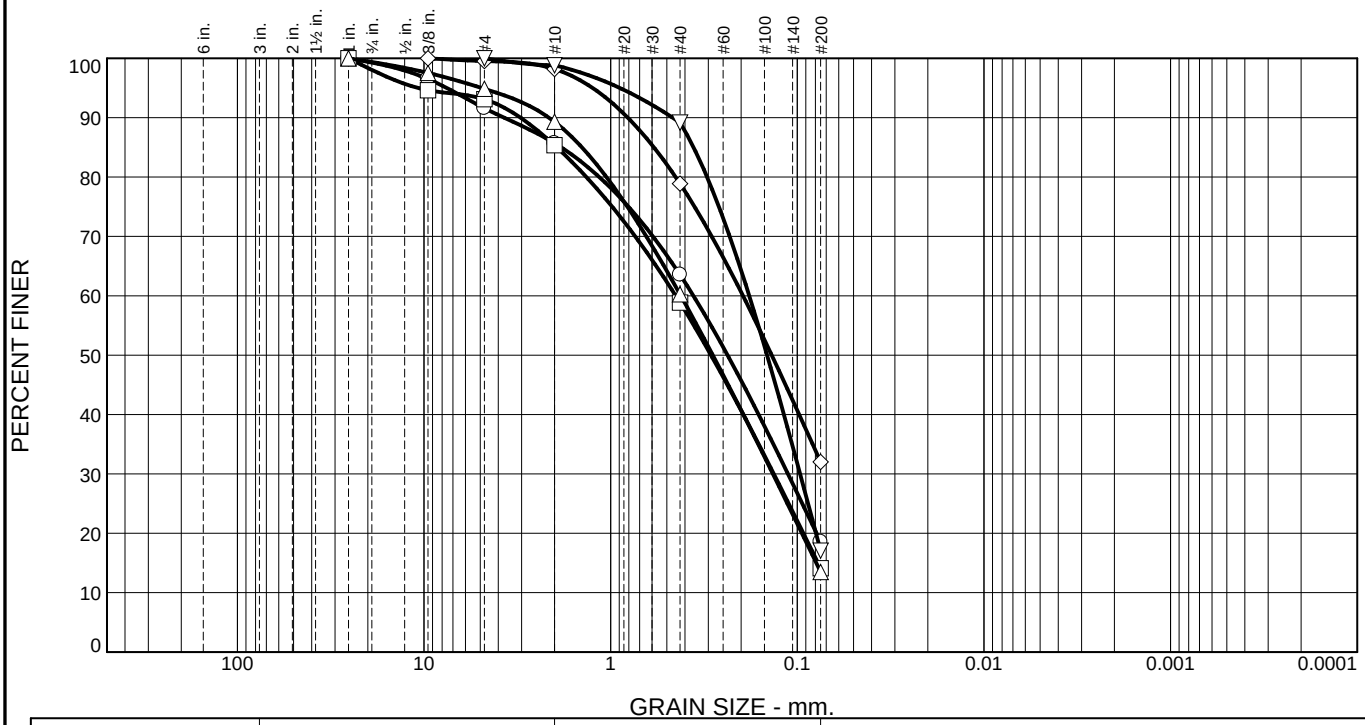
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	14.3	22.2	44.9	18.6	
□	0.0	14.6	26.5	44.8	14.1	
△	0.0	10.7	29.1	46.7	13.5	
◇	0.0	1.8	19.3	46.9	32.0	
▽	0.0	1.2	9.6	72.1	17.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8414	0.3603	0.2364	0.1123				
□	NV	NP	1.9432	0.4479	0.2899	0.1337	0.0775			
△	NV	NP	1.4255	0.4208	0.2836	0.1352	0.0791			
◇	13.7	NP	0.5863	0.1955	0.1372					
▽	NV	NP	0.3596	0.1810	0.1453	0.0966				

Material Description	USCS	AASHTO
○ Moist brown fine to coarse sand w/some silt and fine gravel.	SM	A-2-4(0)
□ Moist loose brown fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
△ Moist loose brown fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
◇ Moist very loose brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
▽ Wet loose brown fine sand w/some silt, trace of coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** CT-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** CT-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** CT-1 **Depth:** 6.0 **Sample Number:** 4

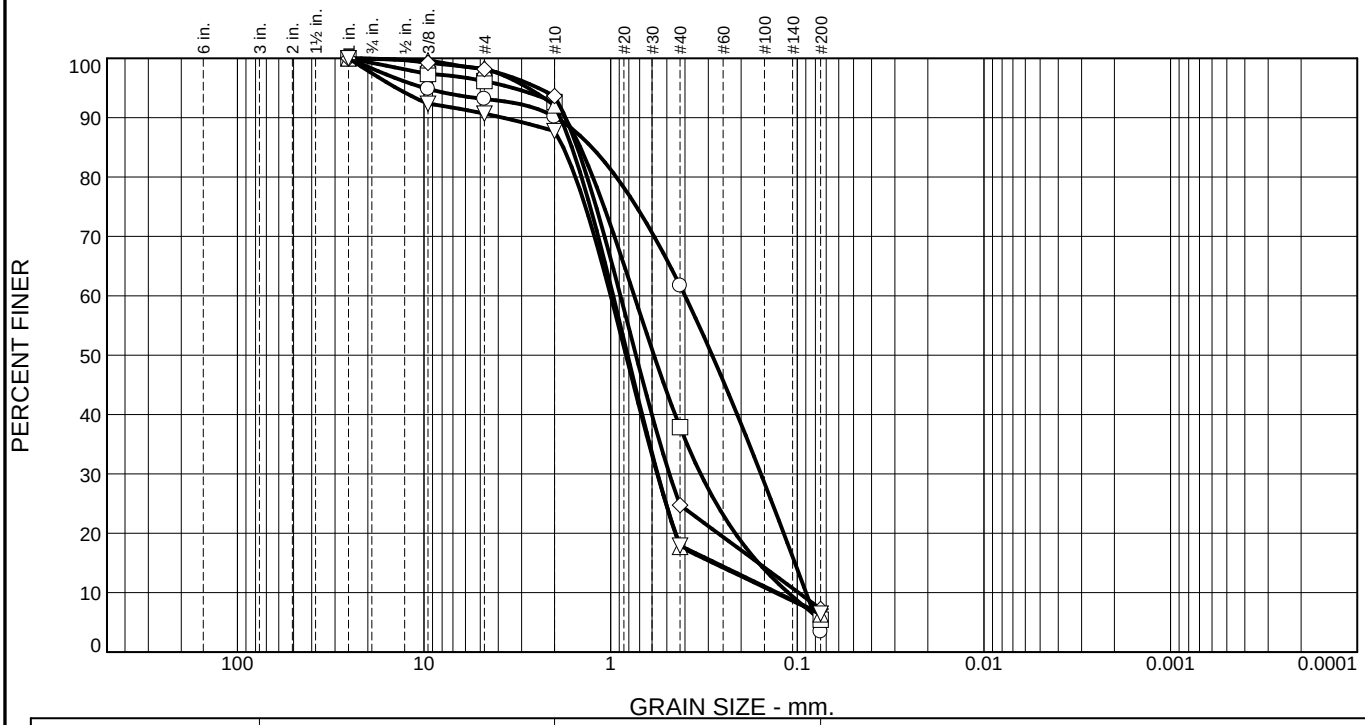
▽ **Source of Sample:** CT-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.8	28.5	58.3	3.4	
□	0.0	7.4	54.7	32.5	5.4	
△	0.0	7.9	74.4	11.4	6.3	
◇	0.0	6.4	68.9	17.4	7.3	
▽	0.0	12.3	69.8	11.4	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2614	0.3997	0.2858	0.1568	0.1030	0.0898	0.68	4.45
□	NV	NP	1.4536	0.7477	0.5864	0.3295	0.1614	0.1119	1.30	6.68
△	NV	NP	1.6132	0.9692	0.8112	0.5604	0.2815	0.1311	2.47	7.39
◇	NV	NP	1.5109	0.8864	0.7321	0.4845	0.1617	0.0985	2.69	9.00
▽	NV	NP	1.7952	0.9997	0.8279	0.5630	0.2729	0.1281	2.48	7.81

Material Description	USCS	AASHTO
○ Wet loose brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
□ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense brown coarse sand w/some fine gravel and fine sand, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** CT-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** CT-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** CT-1 **Depth:** 16.0 **Sample Number:** 9

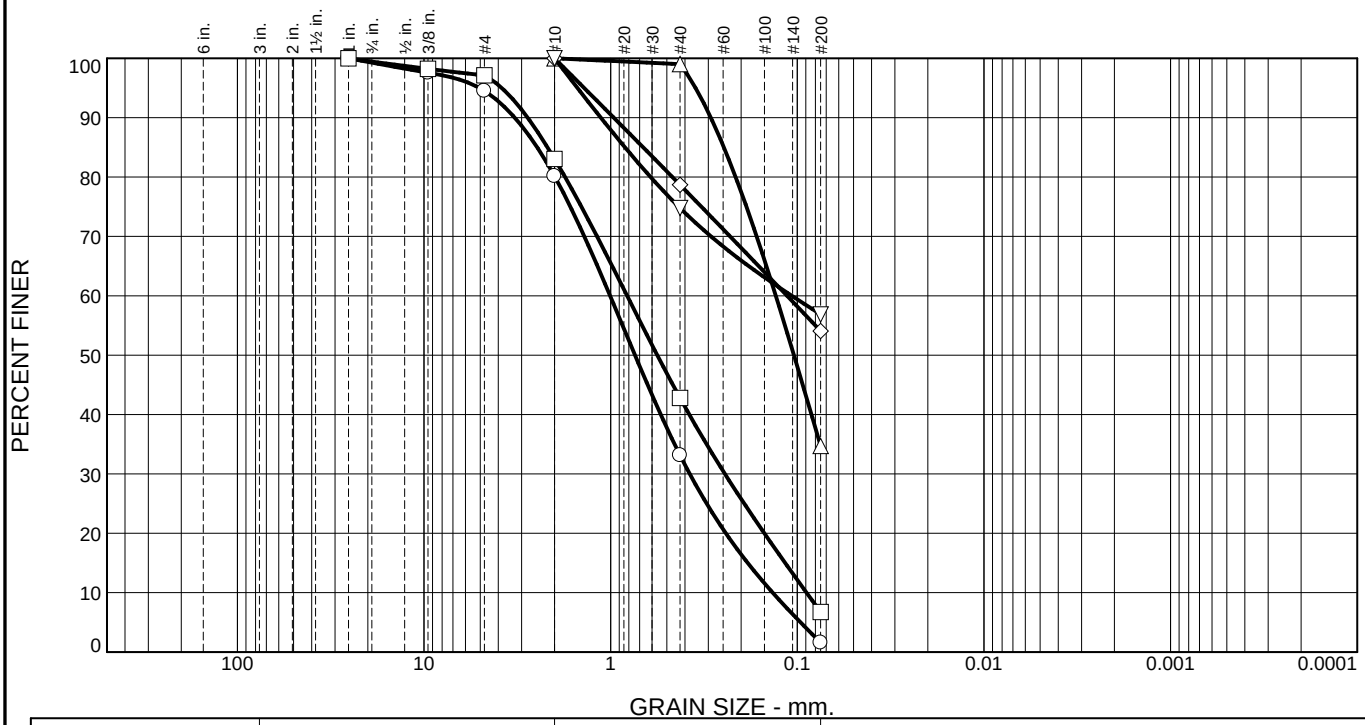
▽ **Source of Sample:** CT-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	19.8	47.1	31.5	1.6	
□	0.0	16.9	40.3	36.1	6.7	
△	0.0	0.0	1.0	64.3	34.7	
◇	0.0	0.0	21.3	24.6	54.1	
▽	0.0	0.0	25.2	17.9	56.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.4771	1.0069	0.7405	0.3770	0.1844	0.1356	1.04	7.43
□	NV	NP	2.1809	0.8162	0.5626	0.2442	0.1161	0.0892	0.82	9.15
△	14.9	NP	0.2474	0.1304	0.1043					
◇	45.1	23.6	0.6694	0.1135						
▽	48.7	28.4	0.8380	0.1070						

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW	A-1-b
□ Wet loose brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
△ Wet medium dense brown silty fine sand w/trace coarse sand.	SM	A-2-4(0)
◇ Saturated very stiff gray fine to coarse sandy clay w/some silt, trace of organic matter.	CL	A-7-6(9)
▽ Saturated very stiff gray coarse sandy clay w/some fine sand, silt and organic matter.	CL	A-7-6(10)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** CT-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** CT-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** CT-1 **Depth:** 39.0 **Sample Number:** 14

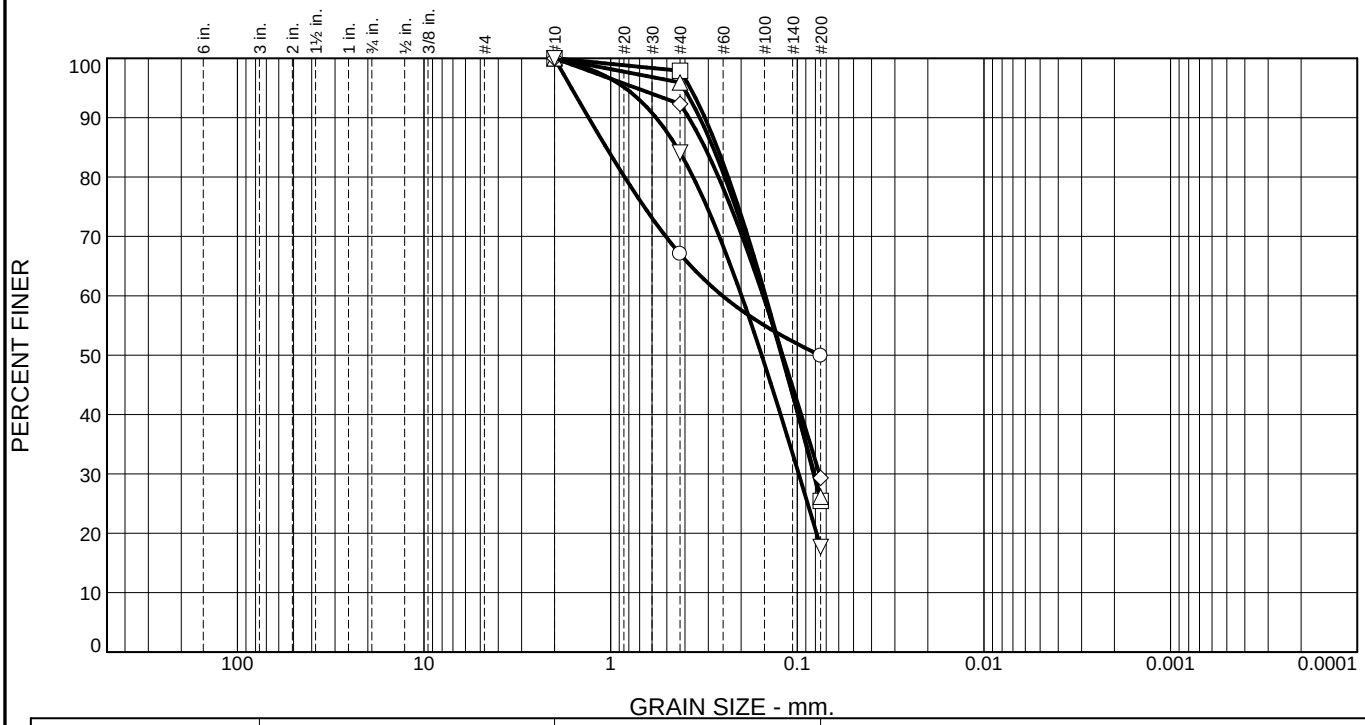
▽ **Source of Sample:** CT-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	33.0	17.1	49.9	
□	0.0	0.0	2.1	72.4	25.5	
△	0.0	0.0	4.1	69.7	26.2	
◇	0.0	0.0	7.7	63.0	29.3	
▽	0.0	0.0	15.9	66.4	17.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	50.8	28.9	1.0566	0.2517	0.0760					
□	NV	NP	0.2687	0.1481	0.1206	0.0818				
△	NV	NP	0.2828	0.1506	0.1216	0.0810				
◇	NV	NP	0.3129	0.1525	0.1200	0.0761				
▽	NV	NP	0.4417	0.1990	0.1553	0.0983				

Material Description	USCS	AASHTO
○ Saturated very stiff gray coarse sandy clay w/some fine sand, silt and organic matter.	SM	A-7-6(8)
□ Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	SM	A-2-4(0)
△ Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	SM	A-2-4(0)
◇ Saturated dense gray silty fine sand w/ trace coarse sand and organic matter.	SM	A-2-4(0)
▽ Saturated very dense gray fine sand w/ some silt and coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** CT-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** CT-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** CT-1 **Depth:** 64.0 **Sample Number:** 19

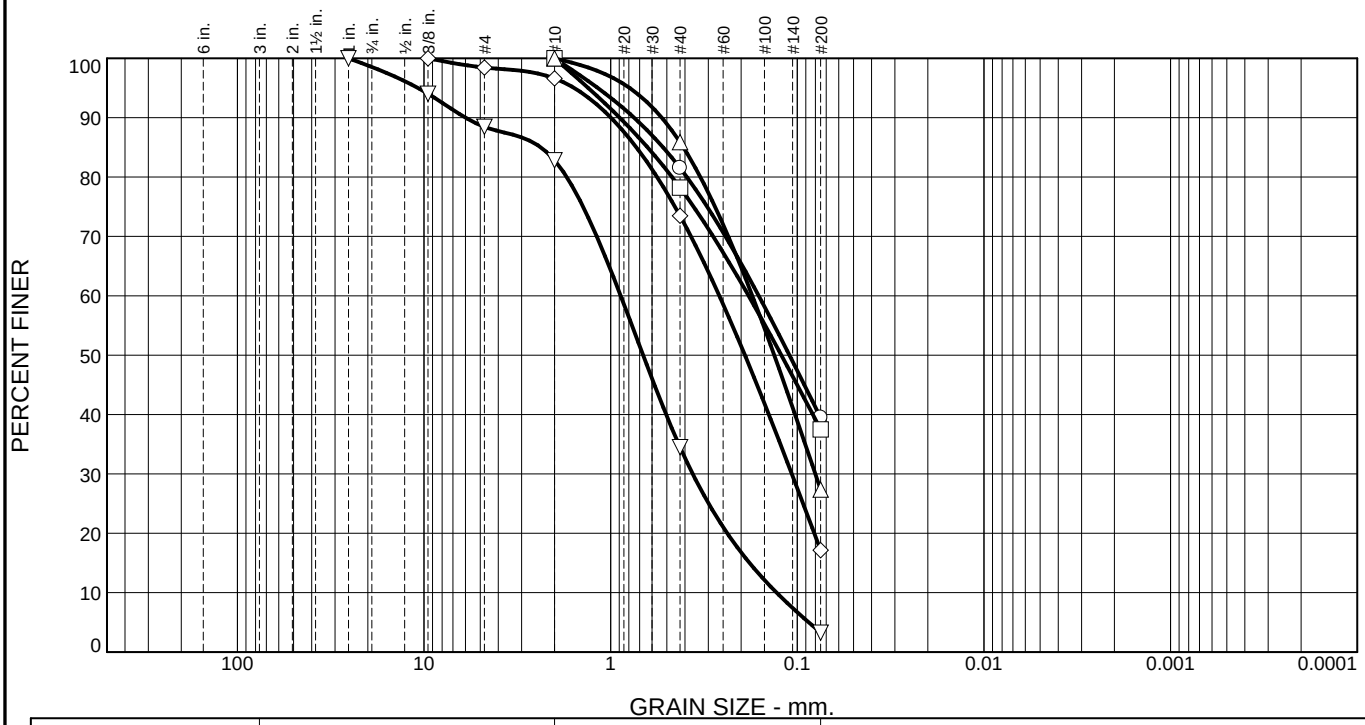
▽ **Source of Sample:** CT-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	18.5	42.0	39.5	
□	0.0	0.0	21.8	40.7	37.5	
△	0.0	0.0	14.1	58.5	27.4	
◇	0.0	3.4	23.1	56.3	17.2	
▽	0.0	17.2	48.3	31.2	3.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	16.1	NP	0.5237	0.1610	0.1103					
□	19.5	NP	0.6342	0.1824	0.1218					
△	NV	NP	0.4077	0.1743	0.1330	0.0801				
◇	NV	NP	0.7281	0.2616	0.1909	0.1071				
▽	NV	NP	2.3693	0.8838	0.6701	0.3635	0.1804	0.1292	1.16	6.84

Material Description	USCS	AASHTO
○ Moist firm gray fine sandy silt w/some coarse sand.	SM	A-4(0)
□ Saturated soft gray fine to coarse sandy silt.	SM	A-4(0)
△ Saturated loose gray silty fine sand w some coarse sand and organic matter./	SM	A-2-4(0)
◇ Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-2 **Depth:** 2.0 **Sample Number:** 2

□ **Source of Sample:** CT-2 **Depth:** 4.0 **Sample Number:** 3

△ **Source of Sample:** CT-2 **Depth:** 6.0 **Sample Number:** 4

◇ **Source of Sample:** CT-2 **Depth:** 8.0 **Sample Number:** 5

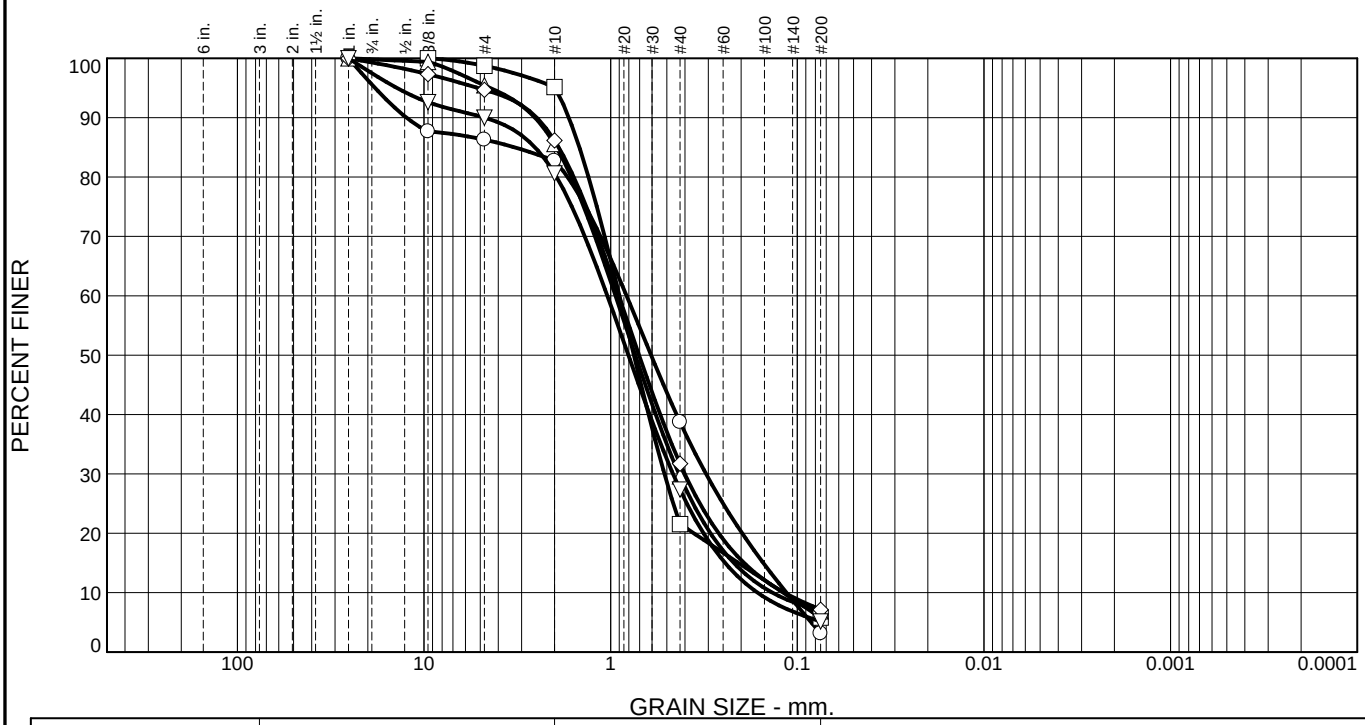
▽ **Source of Sample:** CT-2 **Depth:** 10.0 **Sample Number:** 6

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	17.3	44.0	35.6	3.1	
□	0.0	4.8	73.7	15.7	5.8	
△	0.0	14.4	56.0	22.7	6.9	
◇	0.0	13.8	54.5	24.6	7.1	
▽	0.0	19.4	53.2	22.3	5.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.2680	0.8218	0.6073	0.3083	0.1522	0.1143	1.01	7.19
□	NV	NP	1.4712	0.8972	0.7510	0.5151	0.2066	0.1191	2.48	7.54
△	NV	NP	1.9518	0.9420	0.7379	0.4307	0.2188	0.1361	1.45	6.92
◇	NV	NP	1.8993	0.9050	0.7045	0.4013	0.1930	0.1174	1.52	7.71
▽	NV	NP	2.5443	1.0418	0.8037	0.4633	0.2435	0.1635	1.26	6.37

Material Description	USCS	AASHTO
○ Saturated dense gray coarse to fine sand w/some fine gravel, trace of silt.	SW	A-1-b
□ Saturated loose gray coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
△ Saturated loose brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
◇ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-2 **Depth:** 12.0 **Sample Number:** 7

□ **Source of Sample:** CT-2 **Depth:** 14.0 **Sample Number:** 8

△ **Source of Sample:** CT-2 **Depth:** 16.0 **Sample Number:** 9

◇ **Source of Sample:** CT-2 **Depth:** 18.0 **Sample Number:** 10

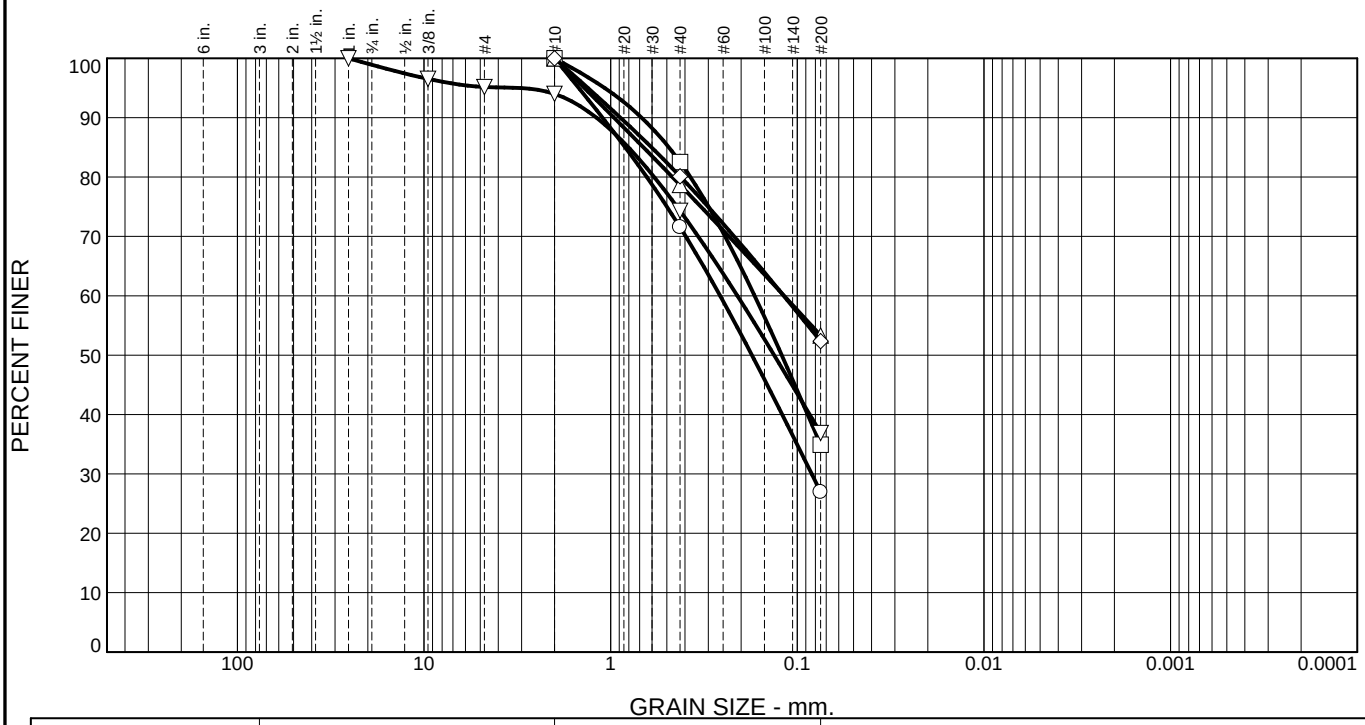
▽ **Source of Sample:** CT-2 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	28.4	44.7	26.9	
□	0.0	0.0	17.5	47.6	34.9	
△	0.0	0.0	21.3	25.4	53.3	
◇	0.0	0.0	19.9	27.7	52.4	
▽	0.0	6.0	19.7	37.4	36.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8354	0.2590	0.1751	0.0838				
□	21.2	17.0	0.4875	0.1694	0.1212					
△	41.0	24.6	0.6675	0.1177						
◇	41.3	22.7	0.6041	0.1182						
▽	29.9	18.0	0.8035	0.2095	0.1331					

Material Description	USCS	AASHTO
○ Saturated loose brown silty fine to coarse sand.	SM	A-2-4(0)
□ Saturated loose gray silty fine sand w/ some coarse sand and clay, trace of organic matter.	SC-SM	A-2-4(0)
△ Saturated firm gray fine to coarse sandy clay w/some silt, trace of organic matter.	CL	A-7-6(6)
◇ Saturated firm gray fine sandy clay w/some coarse sand, silt and organic matter.	CL	A-7-6(6)
▽ Saturated stiff gray fine sandy clay w/ some silt and coarse sand, trace of fine gravel and organic matter.	SC	A-6(1)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-2 **Depth:** 29.0 **Sample Number:** 12

□ **Source of Sample:** CT-2 **Depth:** 34.0 **Sample Number:** 13

△ **Source of Sample:** CT-2 **Depth:** 39.0 **Sample Number:** 14

◇ **Source of Sample:** CT-2 **Depth:** 44.0 **Sample Number:** 15

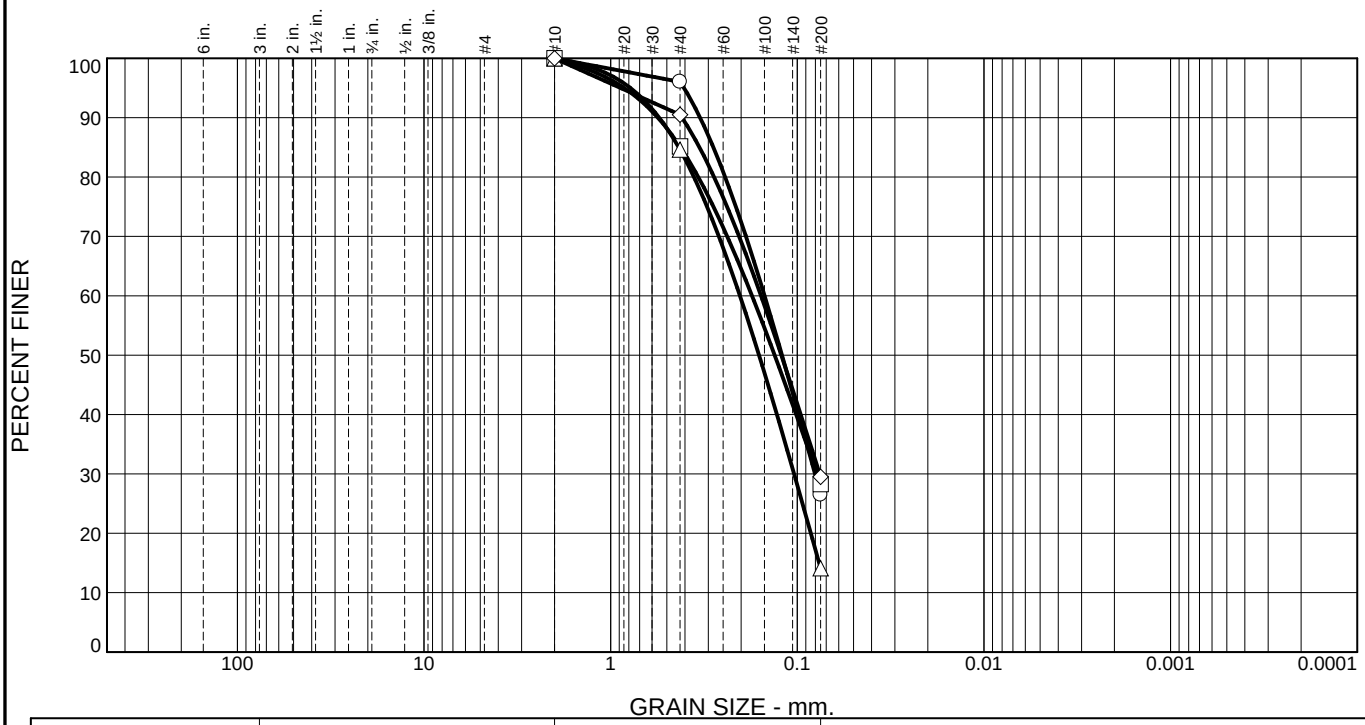
▽ **Source of Sample:** CT-2 **Depth:** 49.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	4.0	69.5	26.5	
□	0.0	0.0	14.9	56.8	28.3	
△	0.0	0.0	15.4	70.5	14.1	
◇	0.0	0.0	9.5	61.0	29.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.2815	0.1498	0.1209	0.0804				
□	NV	NP	0.4219	0.1749	0.1323	0.0784				
△	NV	NP	0.4317	0.2030	0.1604	0.1041	0.0764			
◇	NV	NP	0.3342	0.1565	0.1219	0.0759				

Material Description	USCS	AASHTO
○ Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	SM	A-2-4(0)
□ Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter.	SM	A-2-4(0)
△ Saturated very dense gray fine sand w/some coarse sand and silt, trace of organic matter.	SM	A-2-4(0)
◇ Saturated medium dense gray silty fine sand w/trace coarse sand and clay.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** CT-2 **Depth:** 54.0 **Sample Number:** 17

□ **Source of Sample:** CT-2 **Depth:** 59.0 **Sample Number:** 18

△ **Source of Sample:** CT-2 **Depth:** 64.0 **Sample Number:** 19

◇ **Source of Sample:** CT-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

ENGINEERING & TESTING SERVICES, INC.

March 9, 2016

To: Walton Corporation
P.O.Box 1097
Newark, Delaware 19715

Attn: Mr. Randy Ferguson

Re: **Direct Shear Test Results**
ETS Report No.: ETS-16T134-1
Task 56, T201407003, Bridge 2-113B

Dear Mr. Ferguson:

Engineering & Testing Services, Inc. (ETS) is pleased to submit the completed Direct Shear Test results performed at our AASHTO accredited soils laboratory in Virginia Beach, Virginia. On February 9, 2016, Walton Corporation delivered a Shelby tube soil sample to our laboratory. The Shelby tube was labeled as CT-2/ST-1, depth 32 to 34 feet, Task 56, T 201407003. The following describes the procedures, methodologies, and apparatuses used to complete the test.

1. Test Specimen Extrusion and Preparation

The undisturbed soil sample was carefully extruded from the Shelby tube to ensure minimal disturbance. The undisturbed soil specimens were trimmed from the soil sample per ASTM standards, and immediately transferred into the direct shear machine for testing. A Geotechnical Engineer from our office performed the direct shear test in accordance with ASTM Standard (ASTM D3080-11) Standard Test Method for Direct Shear Test of Soils under Consolidated Drained Conditions). The test was conducted by using the most modern direct shear test machine available in the market produced by **HUMBOLDT** as illustrated in Figure 1.

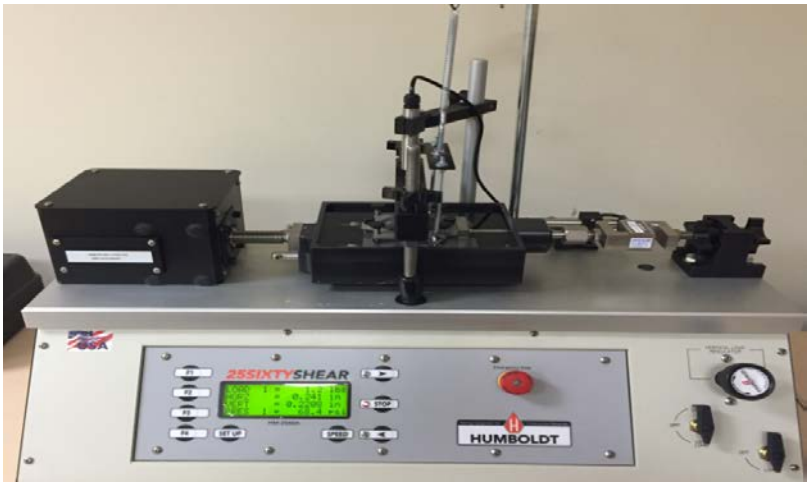


Figure 1: Direct Sheart Test Machine

5226 Indian River Road • Suite 103 • Virginia Beach, VA 23464 • *phone 757.306.1040* • *fax 757.306.1042*

The extruded soil sample was preserved in temperature controlled room to minimize the loss of water content. Three soil specimens were prepared to perform the direct shear test at three different normal loads. The soil specimens were designated as Specimens A through C. The normal loads applied on each specimen during testing are listed in Table 1.

Table 1: Applied Normal Stress on the Soil Specimens	
Soil Designation	Shear Stress (Tsf)
A	0.5
B	1
C	2

2. Consolidation Stage

Before applying the respective normal stresses on the specimens, the shear box container was filled with water to achieve saturation, and kept full for the duration of the test. To initiate the consolidation stage, the specified normal stresses as shown in Table 1 were applied to each soil specimen. The normal stresses were maintained until the primary consolidation was achieved based on either of the following: interpretation of time versus normal vertical deformation or a waiting period of at least 24 hours. The total estimated elapsed time to failure was calculated based on the time required to achieve 90 percent consolidation as illustrated in Figure 2. Following, the displacement/strain rate was calculated and used during testing for shearing the specimen under drained condition according with ASTM D-3080-11.

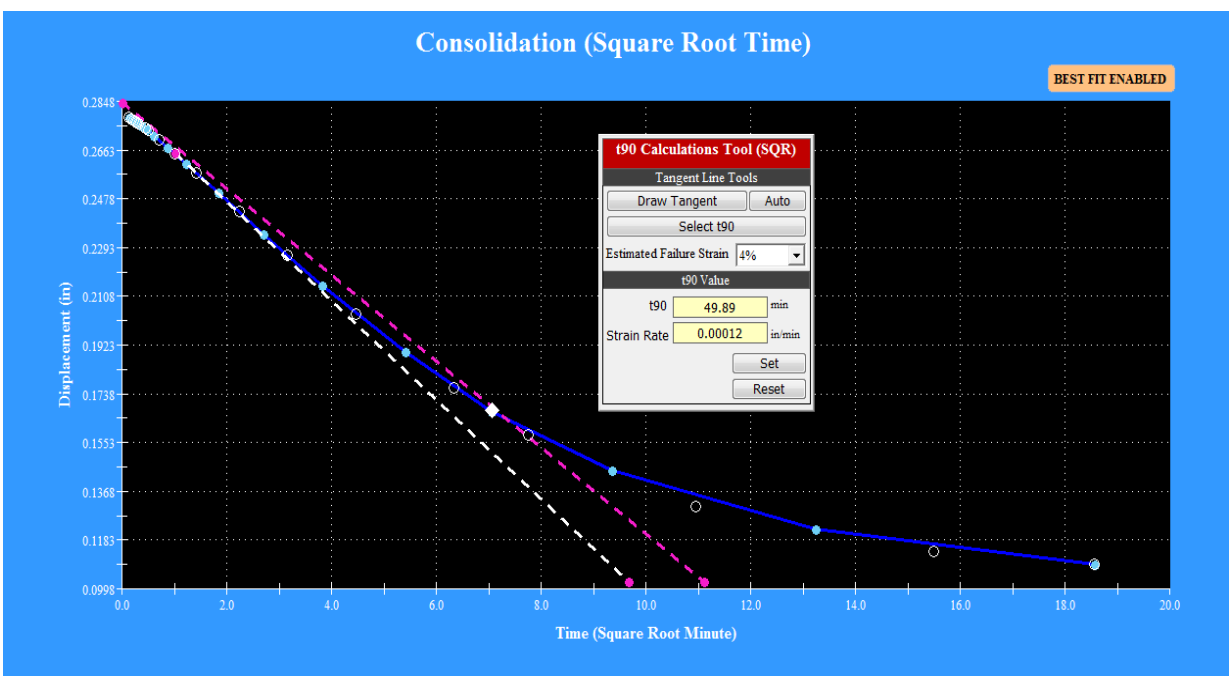


Figure 2: Determination of Time Required to Achieve 90% Consolidation

3. Shear Stage

Prior to applying the shear force on the soil specimens, the ETS geotechnical engineer computed the displacement rate based on the time required to achieve 90% consolidation. The shear force was applied to the soil specimen using the displacement rate. According to ASTM-D3080, the soil specimen should be sheared within the range from 10 to 15 percent relative lateral displacement. Therefore, it was specified that the threshold value of the shear failure should be at 0.375 inch horizontal displacement and/or the shear force decreases while the horizontal displacement increases. When the sample reached failure due to the applied shear force, the test was terminated. The test results should be used conservatively by the designers and are included in Appendix I of this report.

4. Laboratory Tests

At the time of testing, the soils specimens consisted of gray, fat clay (CH) classified as A-7-6(47). The samples were subjected to natural moisture content testing (ASTM D2216), Particle-Size Analysis (ASTM D422), Atterberg Limits (ASTM D4318) testing, Specific Gravity testing (ASTM D854) and visual classification (ASTM D2487, D2488) by the ETS engineering staff. All laboratory test procedures were conducted in accordance with applicable ASTM standards, under the supervision of a Professional Engineer licensed in the Commonwealth of Virginia and in strict adherence to the Quality Assurance program established and documented in the ETS Quality Manual and Quality test procedures. The classification laboratory test results are included in Appendix II of this report.

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report, do not hesitate to call our office at 757-306-1040.

Respectfully Submitted,
Engineering & Testing Services, Inc.

Charlie T. Nabhan, PE
Principal Geotechnical Engineer
VA License No.: 25133

Raju Acharya, Ph.D.
Geotechnical Staff Engineer

APPENDICES

APPENDIX I – DIRECT SHEAR TEST RESULTS

APPENDIX II – CLASSIFICATION LABORATORY TEST RESULTS

APPENDIX I – DIRECT SHEAR TEST RESULTS

Engineering & Testing Services, Inc

Direct Shear Test (ASTM D3080)

Date 3/8/2016

C.T.N.

Checked By

3/7/2016

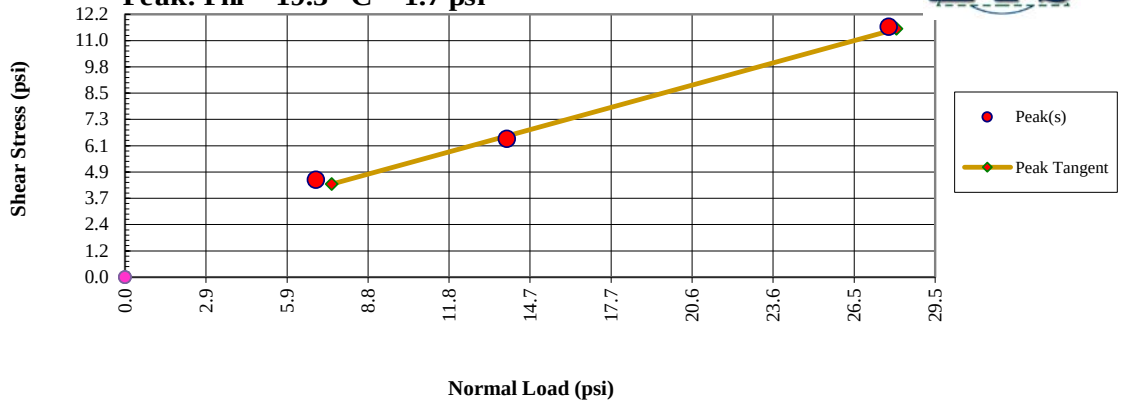
2/29/2016

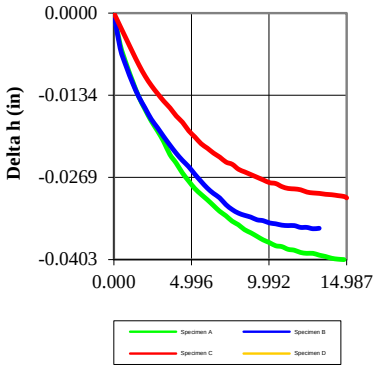
Date

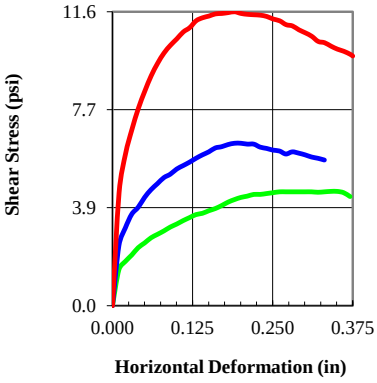
R. Acharya

Tested By

Peak: Phi = 19.3 C = 1.7 psi







Initial	Specimen A	B	C	D
Moisture (%)	59.49	59.49	59.49	
Density (pcf)	64.92	63.64	63.49	
Void Ratio	1.690	1.745	1.751	
Saturation (%)	98.47	95.42	95.04	
Diameter (in)	2.500	2.500	2.500	
Height (in)	1.007	1.035	1.024	
Specific Gravity	2.798	2.798	2.798	

Final	A	B	C	D
Moisture (%)	53.48	47.93	43.67	
Density (pcf)	58.63	57.88	58.66	
Void Ratio	1.979	2.018	1.978	
Saturation (%)	97.72	88.05	88.01	
Diameter (in)	2.500	2.500	2.500	
Height (in)	0.856	0.865	0.821	
Normal Stress (psi)	6.9	13.9	27.8	
Peak Stress (psi)	4.5	6.4	11.6	
Residual Stress (psi)				
Strain (%)	14.019	13.218	14.987	
Rate (in/min)	0.00013	0.00012	0.00015	

Project Date
Date

Project:	Bridge 2-113B
Location:	
Project Number:	ETS-16T134
Boring Number	CT-2
Sample Number:	ST-1
Depth:	32-34'
Sample Type:	Undisturbed
Description:	Gray, Fat Clay (CH)
Test Type:	Direct Shear
Remarks:	

A B C

Failure Photographs

N/A

CT-2.HSD

Engineering & Testing Services, Inc

Direct Shear Test (ASTM D3080)

Date 3/8/2016

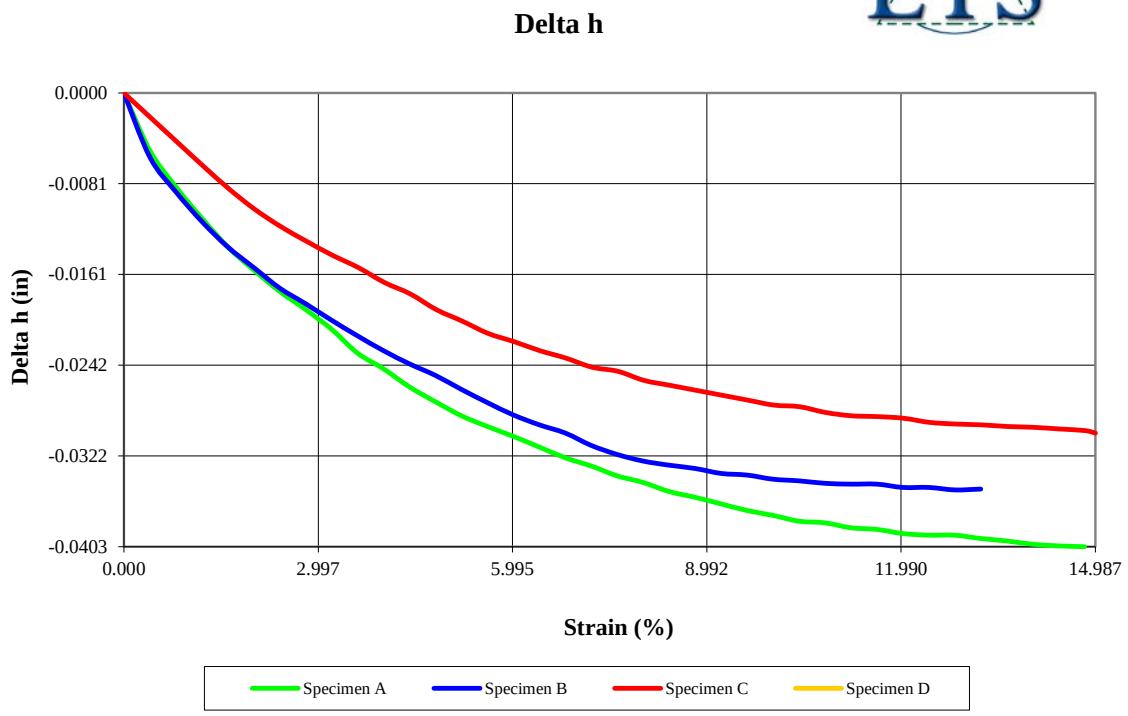
Checked By C.T.N.

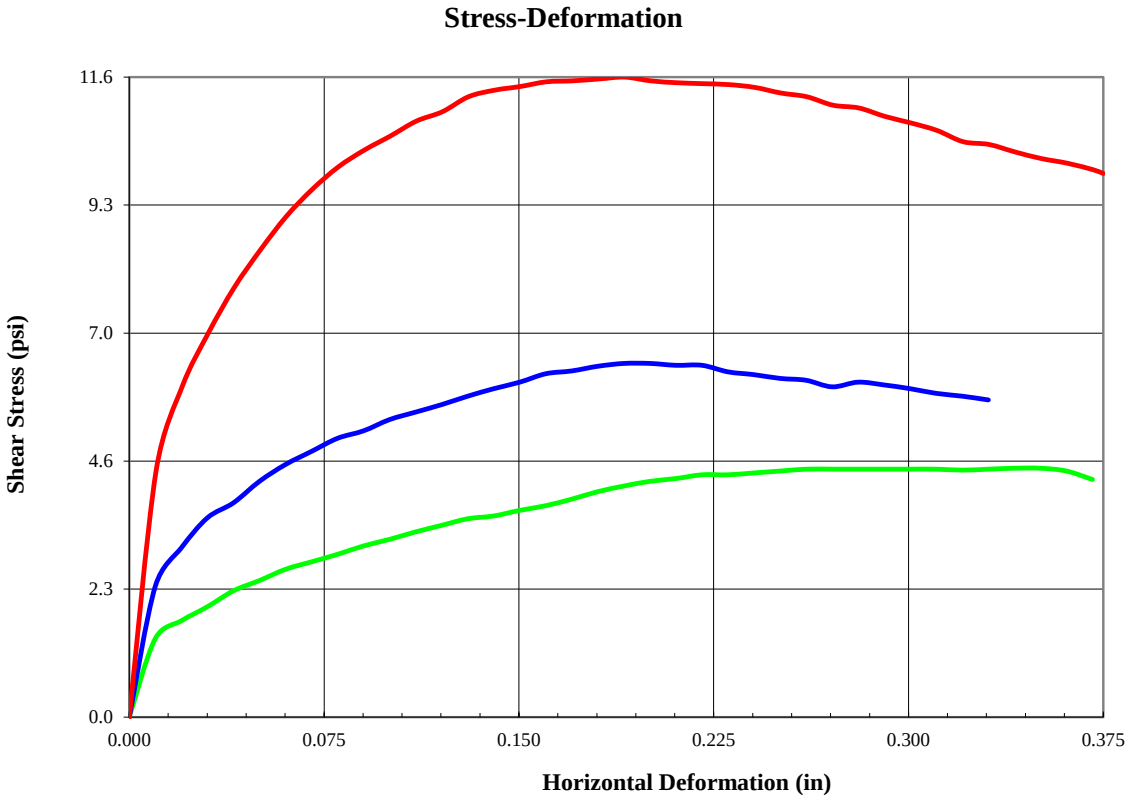
3/7/2016

2/29/2016

Date

Tested By R. Acharya





CT-2.HSD

Engineering & Testing Services, Inc

Direct Shear Test

Date 3/8/2016

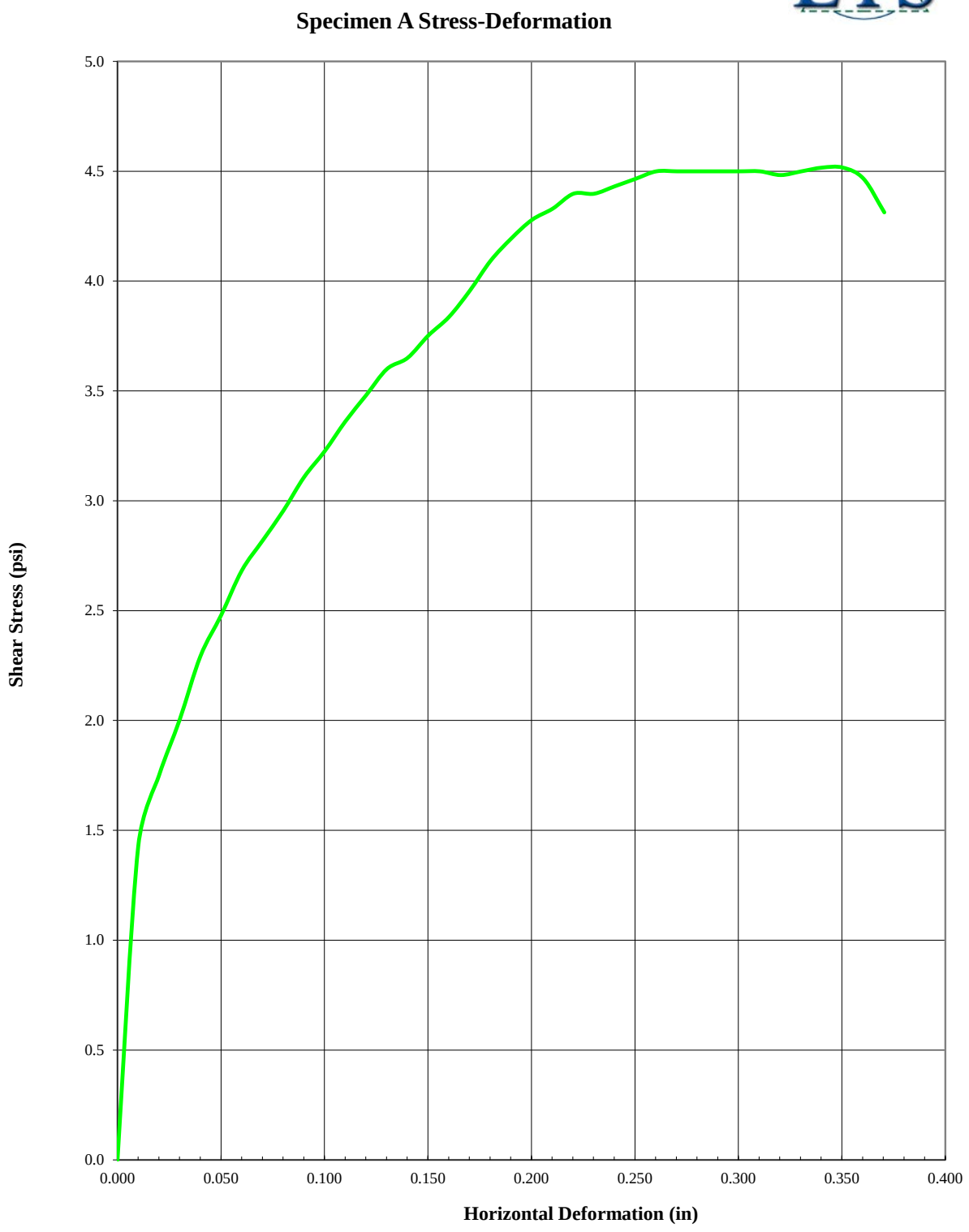
Checked By C.T.N.

3/7/2016

2/29/2016

Date

Tested By R. Acharya



CT-2.HSD

Engineering & Testing Services, Inc

Direct Shear Test

Date 3/8/2016

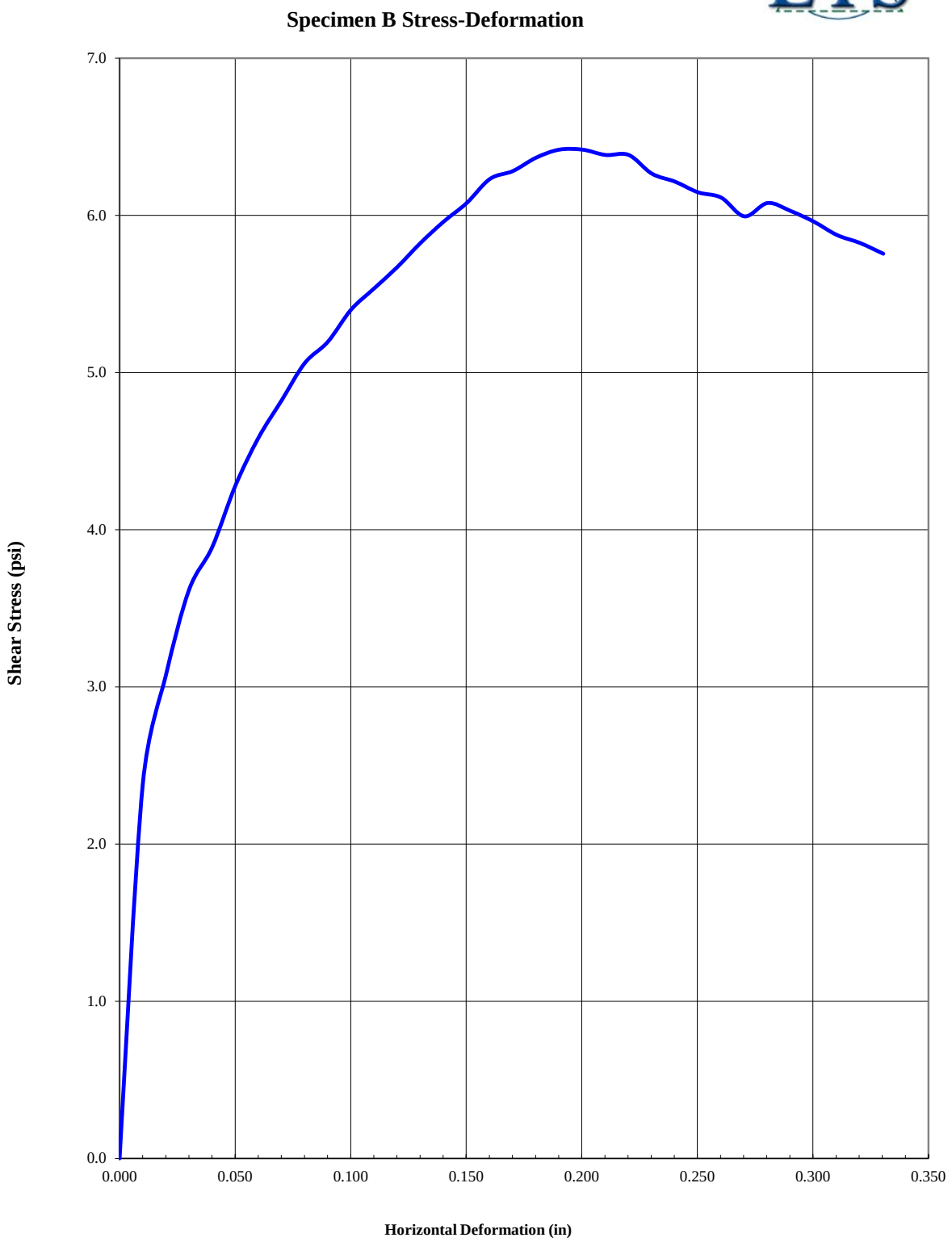
Checked By C.T.N.

3/7/2016

2/29/2016

Date

Tested By R. Acharya



CT-2.HSD

Engineering & Testing Services, Inc

Direct Shear Test

Date 3/8/2016

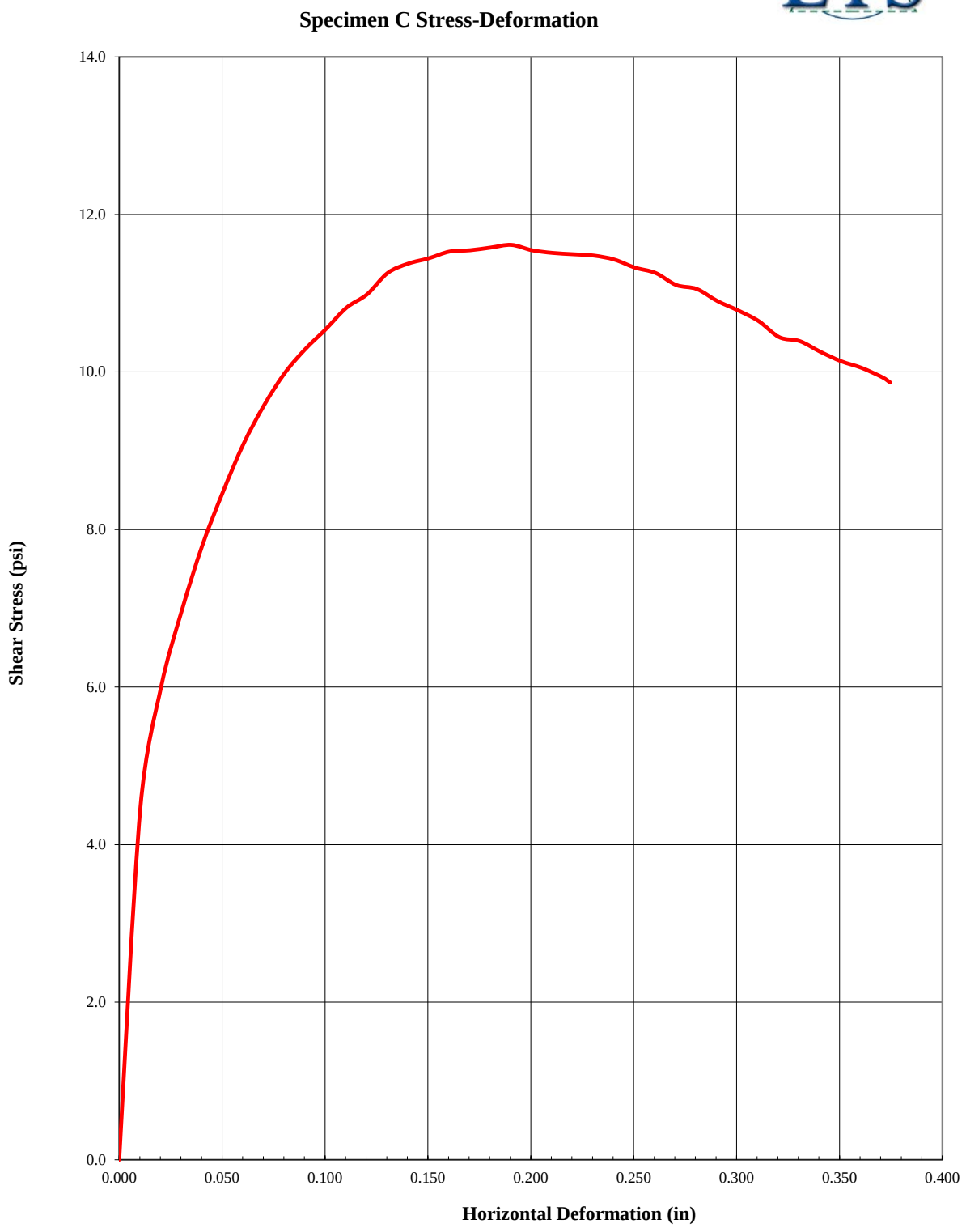
Checked By C.T.N.

3/7/2016

2/29/2016

Date

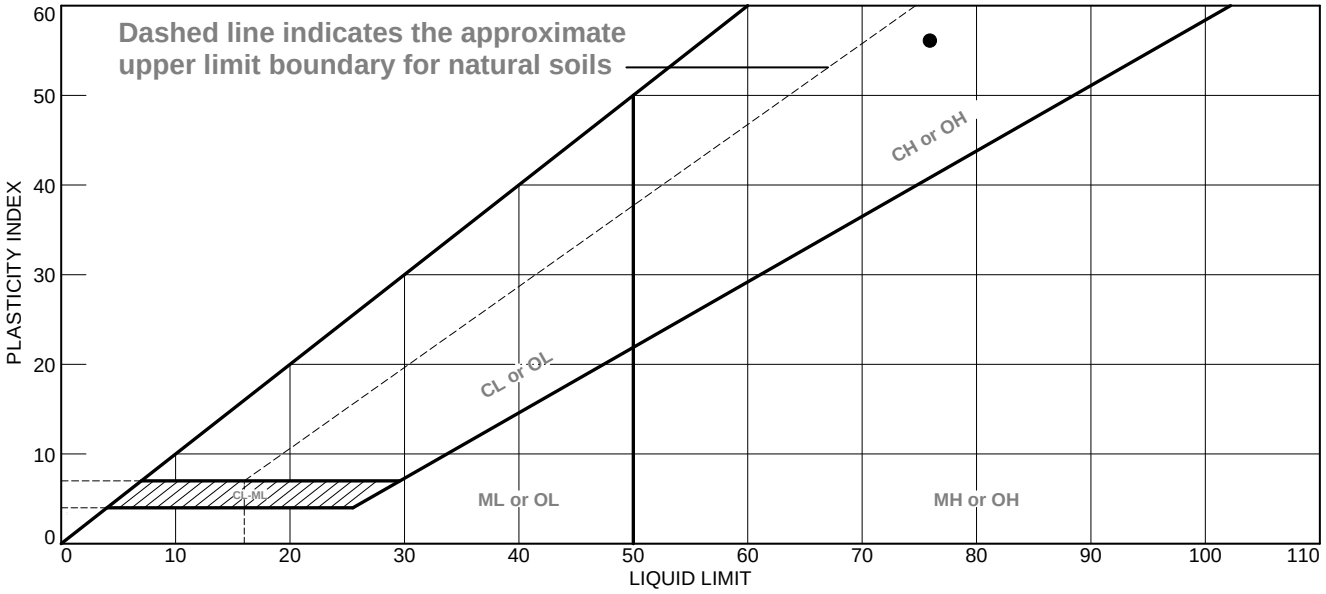
Tested By R. Acharya

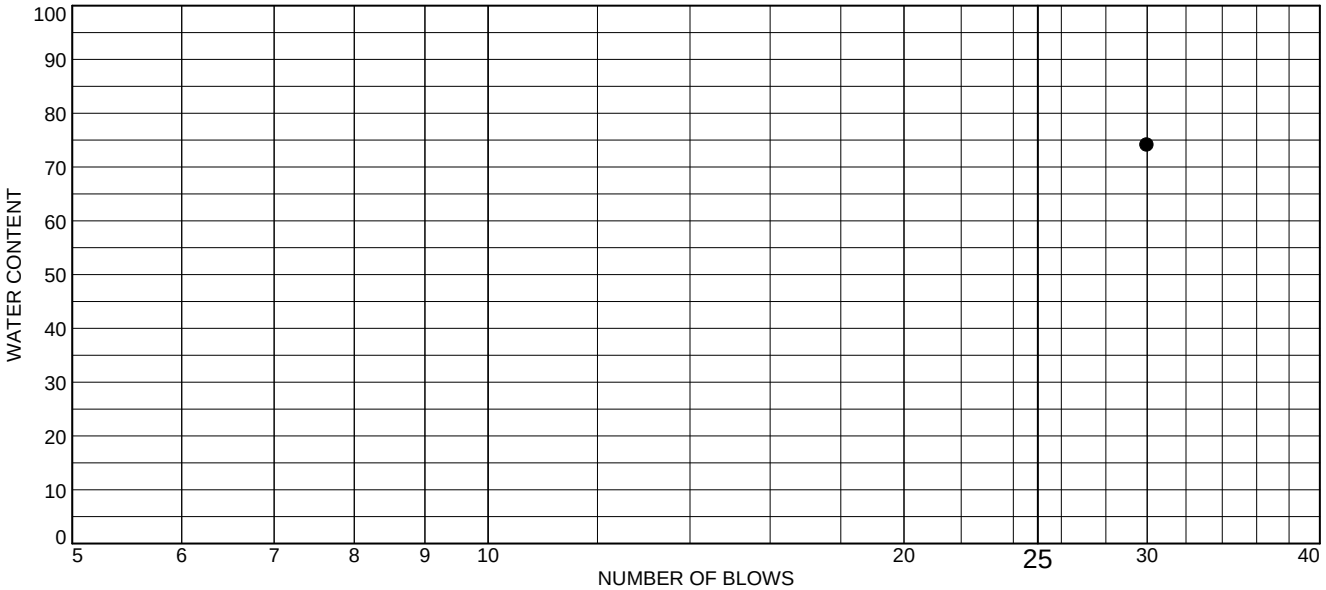


CT-2.HSD

APPENDIX II – CLASSIFICATION LABORATORY TEST RESULTS

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY, FAT CLAY	76	20	56		80.1	CH

Project No. ETS-16T134 **Client:** Walton Corporation

Project: Bridge 2-113B

Sample Number: CT-2 / ST-1 **Depth:** 32-34'

ENGINEERING AND TESTING SERVICES, INC.

Virginia Beach, VA

Remarks:

Figure

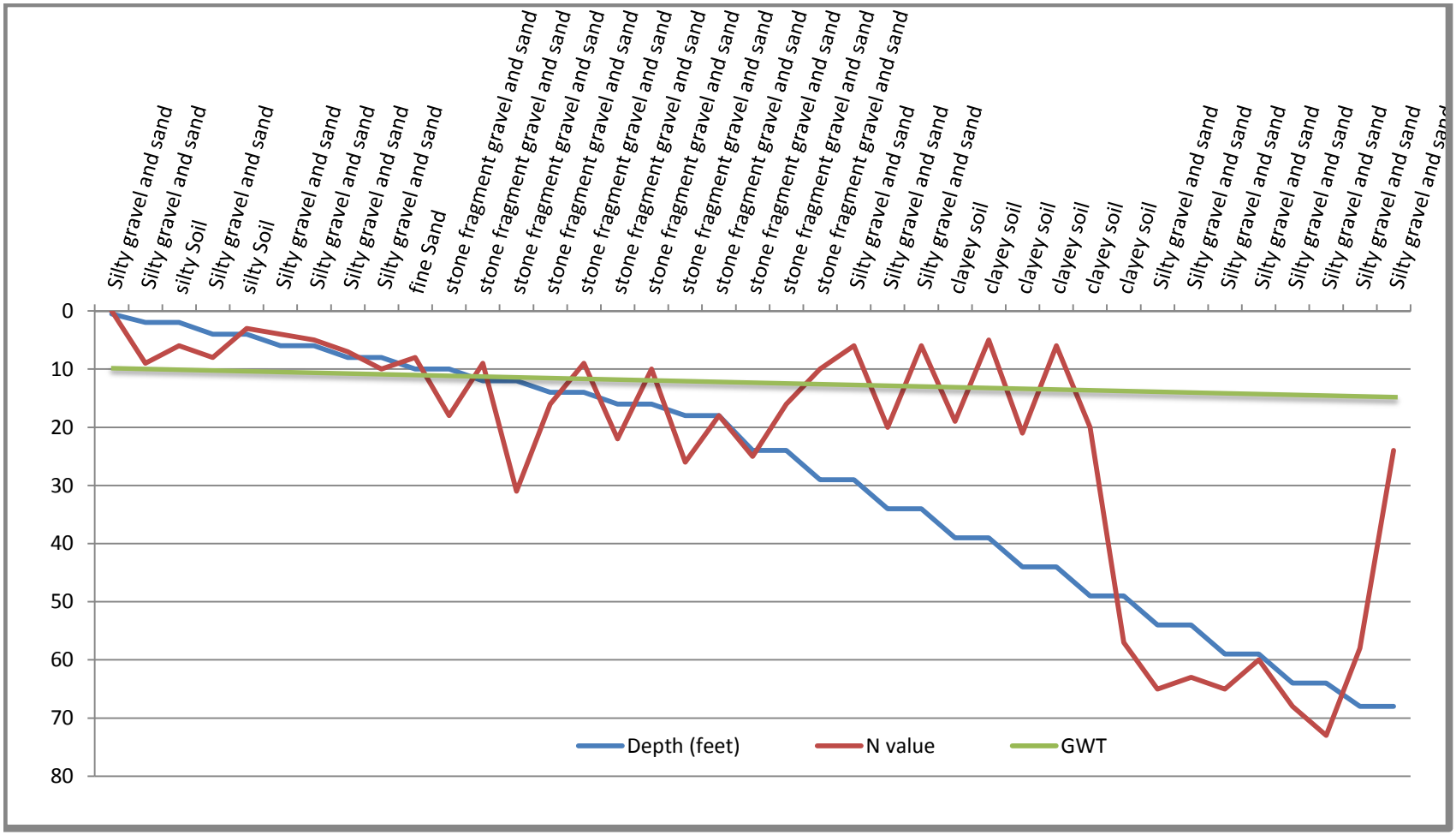
Tested By: MM **Checked By:** R. Acharya

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
CL-1	1	0.5	Moist brown fine to coarse sand w/some silt and fine gravel.	NV	NP	7.7	SM	A-2-4(0)	85.7	18.6				
	2	2	Moist loose brown fine to coarse sand w/some fine gravel and silt.	NV	NP	7.4	SM	A-2-4(0)	85.4	14.1	8	5	4	3
	3	4	Moist loose brown fine to coarse sand w/some fine gravel and silt.	NV	NP	7	SM	A-2-4(0)	89.3	13.5	3	3	5	4
	4	6	Moist very loose brown silty fine sand w/some coarse sand, trace of fine gravel.	13.7	NP	14.4	SM	A-2-4(0)	98.2	32	3	2	2	2
	5	8	Wet loose brown fine sand w/some silt, trace of coarse sand and fine gravel.	NV	NP	19.6	SM	A-2-4(0)	98.8	17.1	3	4	3	5
	6	10	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	19.5	SP	A-3	90.2	3.4	2	3	5	5
	7	12	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.4	SW-SM	A-1-b	92.6	5.4	3	3	6	6
	8	14	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	17.9	SW-SM	A-1-b	92.1	6.3	5	8	8	7
	9	16	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	15.9	SW-SM	A-1-b	93.6	7.3	8	9	13	13
	10	18	Wet medium dense brown coarse sand w/some fine gravel and fine sand, trace of silt.	NV	NP	16	SW-SM	A-1-b	87.7	6.5	8	12	14	14
	11	24	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	19.7	SW	A-1-b	80.2	1.6	9	12	13	13
	12	29	Wet loose brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	16.9	SP-SM	A-1-b	83.1	6.7	4	5	5	9
	13	34	Wet medium dense brown silty fine sand w/trace coarse sand.	14.9	NP	23	SM	A-2-4(0)	100	34.7	9	11	9	17
	14	39	Saturated very stiff gray fine to coarse sandy clay w/some silt, trace of organic matter.	45.1	21.5	44.4	CL	A-7-6(9)	100	54.1	9	9	10	12
	15	44	Saturated very stiff gray coarse sandy clay w/some fine sand, silt and organic matter.	48.7	20.3	46.2	CL	A-7-6(10)	100	56.9	8	11	10	13
	16	49	Saturated very stiff gray coarse sandy clay w/some fine sand, silt and organic matter.	50.8	21.9	44.8	SM	A-7-6(8)	100	49.9	6	10	10	15
	17	54	Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	NV	NP	31.2	SM	A-2-4(0)	100	25.5	9	11	15	17
	18	59	Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	NV	NP	34.9	SM	A-2-4(0)	100	26.2	7	11	15	25
	19	64	Saturated dense gray silty fine sand w/ trace coarse sand and organic matter.	NV	NP	32.6	SM	A-2-4(0)	100	29.3	15	17	18	29
	20	68	Saturated very dense gray fine sand w/ some silt and coarse sand.	NV	NP	34.6	SM	A-2-4(0)	100	17.7	17	28	30	35
		70	End Boring											
CL-2	1		No Recovery						98.8	39				
	2	2	Moist firm gray fine sandy silt w/some coarse sand.	16.1	NP	13.8	SM	A-4(0)	100	39.5	4	4	2	2
	3	4	Saturated soft gray fine to coarse sandy silt.	19.5	NP	29.7	SM	A-4(0)	100	37.5	4	2	1	1
	4	6	Saturated loose gray silty fine sand w some coarse sand and organic matter./	NV	NP	41.4	SM	A-2-4(0)	100	27.4	5	3	2	2
	5	8	Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20	SM	A-2-4(0)	96.6	17.2	4	7	3	5
	6	10	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	15.9	SW	A-1-b	82.8	3.3	5	7	11	13
	7	12	Saturated dense gray coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	14.3	SW	A-1-b	82.7	3.1	11	13	18	17
	8	14	Saturated loose gray coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	20.3	SW-SM	A-1-b	95.2	5.8	2	4	5	3
	9	16	Saturated loose brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	17.9	SW-SM	A-1-b	85.6	6.9	3	5	5	5
	10	18	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	20.1	SW-SM	A-1-b	86.2	7.1	5	7	11	18
	11	24	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	18	SW-SM	A-1-b	80.6	5.1	7	7	9	10
	12	29	Saturated loose brown silty fine to coarse sand.	NV	NP	30.7	SM	A-2-4(0)	100	26.9	13	2	4	3
	U-1	32												
	13	34	Saturated loose gray silty fine sand w/ some coarse sand and clay, trace of organic matter.	21.2	4.2	35.3	SC-SM	A-2-4(0)	100	34.9	3	3	3	5
	14	39	Saturated firm gray fine to coarse sandy clay w/some silt, trace of organic matter.	41	16.4	48	CL	A-7-6(6)	100	53.3	2	2	3	3
	15	44	Saturated firm gray fine sandy clay w/some coarse sand, silt and organic matter.	41.3	18.6	41.9	CL	A-7-6(6)	100	52.4	3	3	3	9
	16	49	Saturated stiff gray fine sandy clay w/ some silt and coarse sand, trace of fine gravel and organic matter.	29.9	11.9	30.9	SC	A-6(1)	94	36.9	5	7	7	10
	17	54	Saturated medium dense gray silty fine sand w/trace coarse sand and organic matter.	NV	NP	35.7	SM	A-2-4(0)	100	26.5	6	9	13	18
	18	59	Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter.	NV	NP	33.8	SM	A-2-4(0)	100	28.3	7	8	10	13
	19	64	Saturated very dense gray fine sand w/some coarse sand and silt, trace of organic matter.	NV	NP	25.6	SM	A-2-4(0)	100	14.1	10	23	50	
	20	68	Saturated medium dense gray silty fine sand w/trace coarse sand and clay.	NV	NP	44.9	SM	A-2-4(0)	100	29.5	10	11	13	20

DATE : 3-24-2016

PROJECT NUMBER : T201407003

PROJECT NAME BR2-113B along on Cattail Branch Rd, on Saulsbury Creek- Farmington, DE



DATE : 3-24-2016

PROJECT NUMBER : T201407003

PROJECT NAME BR2-113B along on Cattail Branch Rd, on Saulsbury Creek- Farmington, DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 6-02-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-303A High Stump road over Cattail Branch Rd- Farmington, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 4-13-2016. Walton Corporation-Newark, Delaware was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CME 55 and 75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Kent County, Delaware According to Geologic Map Series No. 14 by Ramsey, K.W. October 2007 this site is situated in Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Hickman Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-100. The nearest well to this site the groundwater historically had been measured as 44 feet

on November 1959 and between the years of 1950 to 1962 appeared from 48 to 49 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 6 to 9 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 40 to 50 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Kent County Area, Map Series, No. 11 by Scott Andres 2003. The Recharge potential is a Good to Excellent category.

5. Ground Cover

The ground cover for this site is 3 inches of asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 7.9 and 11 feet below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 8.2 to 38.5 percent. The Atterberg limit and Organic matter was not encountered for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition. For the boring at west side of the bridge “HS-2” has an loose fine sandy coarse sand appeared at the surface to 14 feet down this layer need to be consider in the design also is suited in the excellent Recharge potential area. In addition the entire sample from the depth of 2 to 12 feet from the surface had been met all type borrow material according to Del-DOT standard specification with good amount to reuse except Borrow type “B”.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations. This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

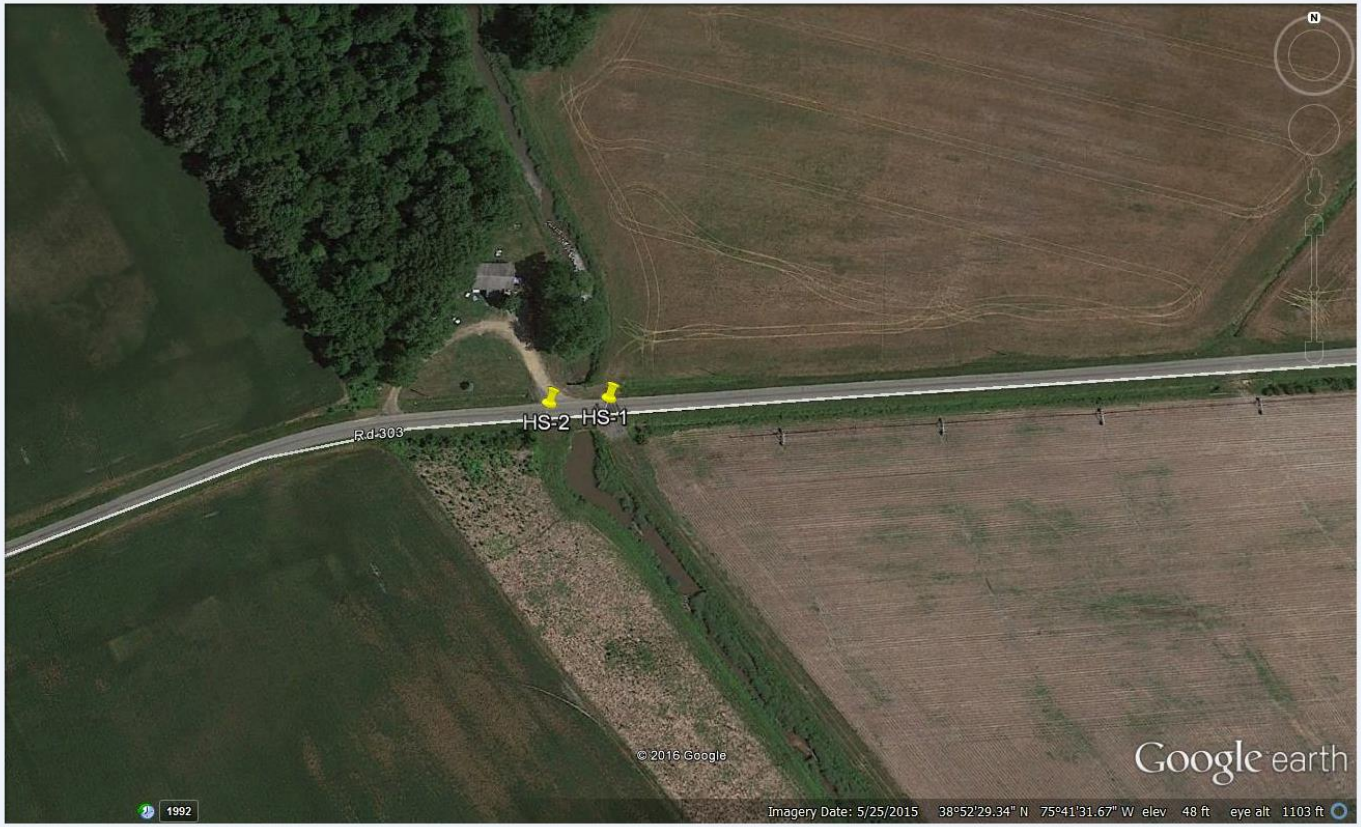
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 6-02-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR2-303A High Stop road over Cattail Branch Rd- Farmington, DE



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
HS-1	318717.870	577665.399	38.8748250	-75.6923944
HS-2	318712.986	577607.652	38.8748111	-75.6925972

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING HS-1

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 318717.87
Easting: 577665.399
Boring Surface Elev.:
Reference:
Date Started: 4/13/2016
Date Completed: 4/13/2016

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 inches **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: **Inches**
Mud Rotary:

From Depth of: **To:**
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
4/13/2016	7.9	
4/13/2016	Dry	4.0

Boring Contractor: Walton INC
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason- Dave
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	NA NA NA NA	Moist borown silty Fine sandy Coarse Sand, trace of Fine gravel 21" RECOVERY	A-2-4(0)	
2.53		2	2.0' 4.0'	5 8 11 11	Moist gray M.dense silty Fine Sand w/ some Coarse sand trace of Fine gravel 22" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	7 9 10 9	Moist brown M.dense silty Fine Sand w/ some Coarse sand,trace of Fine gravel 20" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	9 8 7 11	Wet M.dense gray Fine Sand Coarse Sand w/ some silt, trace of Fine gravel 24" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' 10.0'	6 4 3 3	Sat Loose gray Fine sandy Coarse Sand w/ some silt,trace of Fine gravel 18" RECOVERY	A-1-b	
		6	10.0' 12.0'	3 5 7 9	Wet M.dense gray Coarse Sand w/ some silt and Fine sand, trace of Fine gravel 24" RECOVERY	A-1-b	
12.65		7	12.0'	2 5 6 5	Wet M.dense gray Fine sandy Coarse Sand w/ some silt trace of Fine gravel	A-1-b	

Remarks:

Reviewed By: Aaron Wieczoreck **Soils Supervisor:** Hany Fekry

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** HS-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		18" RECOVERY		
15.18		8	14.0' 16.0'	3 3 3 3	Sat Loose gray Fine sandy Coarse Sand trace of silt and Fine gravel 16" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	2 4 5 5	Sat Loose brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	5 3 2 3	Wet M.dense brown Coarse Sand w/some silt w/ some Fine sand, trace of Fine gravel 22" RECOVERY	A-1-b	
22.77							
25.3		11	24.0' 26.0'	10 8 11 13	Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand, trace of silt 18" RECOVERY	A-1-b	
27.83							
30.36		12	29.0' 31.0'	18 26 34 31	Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand, trace of silt 19" RECOVERY	A-1-b	
32.89							
35.42		13	34.0' 36.0'	3 5 6 9	Sat M.dense gray Fine Sand w/ some silt w/ some Coarse sand, trace of Fine gravel 20" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** HS-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	3 3 5 9	Sat Loose gray silty Fine Sand w/ some Coarse sand 24" RECOVERY	A-2-4(0)	
43.01							
45.54		15	44.0' 46.0'	5 11 13 14	Sat M.dense gray silty Fine Sand w/ some Coarse sand 24" RECOVERY	A-2-4(0)	
48.07							
50.6		16	49.0' 51.0'	8 10 8 9	Sat M.dense gray silty Fine Sand w/ some Coarse sand trace of Fine gravel 24" RECOVERY	A-2-4(0)	
53.13							
55.66		17	54.0' 56.0'	10 15 26 29	Sat Dense gray silty Coarse sandy Fine Sand trace of Fine gravel 24" RECOVERY	A-2-4(0)	
58.19							
				10			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** HS-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	5 6 8	Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel	A-2-4(0)	
60.72			61.0'		18" RECOVERY		
63.25							
		19	64.0'	8 9 11 17	Sat M.dense gray Fine Sand w/ some silt trace of Coarse sand and Fine gravel	A-2-4(0)	
65.78			66.0'		24" RECOVERY		
68.31		20	68.0'	12 19 39 37	Sat V. Dence Fine Sand w/ some silt w/ some Coarse sand	A-2-4(0)	
			70.0'		24" RECOVERY		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING HS-2

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 318712.986
Easting: 577607.652
Boring Surface Elev.:
Reference:
Date Started:
Date Completed:

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 inches **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: **Inches**
Mud Rotary:

From Depth of: **To:**
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
4/13/2016	11	
4/13/2016	Dry	2

Boring Contractor: Walton Inc
Equipment/Rig Type: CME 55 Truck Rig
Driller: Bill
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	2 3 4 5	Moist Loose black silty Coarse sandy Fine Sand trace of Fine gravel 17" RECOVERY	A-2-4(0)	
5.06		2	4.0' – 6.0'	2 2 2 2	Wet V. loose black silty Fine Sand w/ some Coarse sand, trace of Fine gravel 21" RECOVERY	A-2-4(0)	
7.59		3	6.0' – 8.0'	3 4 5 6	Wet Loose gray Coarse sandy Fine Sand w/ some silt, trace of Fine gravel 17" RECOVERY	A-2-4(0)	
10.12		4	8.0' – 10.0'	2 2 2 2	Sat V. loose brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel 18" RECOVERY	A-1-b	
	■	5	10.0' – 12.0'	3 3 4 3	Sat Loose brown Coarse Sand w/ some Fine sand trace of silt and Fine gravel 19" RECOVERY	A-1-b	
12.65		6	12.0' – 14.0'	4 2 2 2	Wet V. loose brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel 17" RECOVERY	A-1-b	
15.18		7	14.0'	4 5 8 5	Moist M.dense brown Fine sandy Coarse Sand trace of silt and Fine gravel	A-1-b	

Remarks:

Reviewed By: Aaron Wieczoreck
Soils Supervisor: Hany Fekry

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** HS-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		20" RECOVERY		
		8	16.0'	4 5 6 5	Wet M.dense brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel	A-1-b	
17.71			18.0'		21" RECOVERY		
		9	18.0'	3 3 4 3	Sat Loose brown Coarse sandy Fine Sand w/ some silt, trace of Fine gravel	A-2-4(0)	
20.24			20.0'		20" RECOVERY		
22.77							
		10	24.0'	6 7 9 9	Sat M.dense brown Fine to Coarse Sand trace of silt and Fine gravel	A-1-b	
25.3			26.0'		15" RECOVERY		
27.83							
		11	28.0'	9 11 13 10	Wet M.dense brown Fine gravelly Coarse Sand w/ some Fine sand, trace of silt	A-1-b	
30.36			30.0'		12" RECOVERY		
32.89							
		12	34.0'	4 5 7 11	Sat M.dense gray Coarse sandy Fine Sand w/ some silt and Fine gravel	A-2-4(0)	
35.42			36.0'		8" RECOVERY		
37.95							
		13	38.0'	8	Sat M.dense gray silty Fine Sand w/ some	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** HS-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			40.0'	8 9 12	Coarse sand, trace of Fine gravel 10" RECOVERY		
40.48							
43.01							
		14	44.0'	11 14 16 21	Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel 16" RECOVERY	A-2-4(0)	
45.54			46.0'				
48.07							
		15	48.0'	11 7 5 9	Sat Stiff gray Fine sandy Silt w/ some Coarse sand, trace of Fine gravel 19" RECOVERY	A-2-4(0)	
50.6			50.0'				
53.13							
		16	54.0'	15 19 17 20	Sat Hard gray Fine sandy Silt w/ some Coarse sand, trace of Fine gravel 4" RECOVERY	A-4(0)	
55.66			56.0'				
58.19							
		17	58.0'	12 15 11 17	Sat V. Stiff gray Fine sandy Coarse sandy Silt, trace of Fine gravel 7" RECOVERY	A-4(0)	
			60.0'				
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: HS-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	9 11 10 9	Sat M.dense gray silty Fine Sand w/ some Coarse sand, trace of Fine gravel 12" RECOVERY	A-2-4(0)	
68.31		19	68.0' 70.0'	7 7 9 8	Sat M.dense gray silty Fine Sand w/ some Coarse sand 16" RECOVERY	A-2-4(0)	
70.84							
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Silty soils

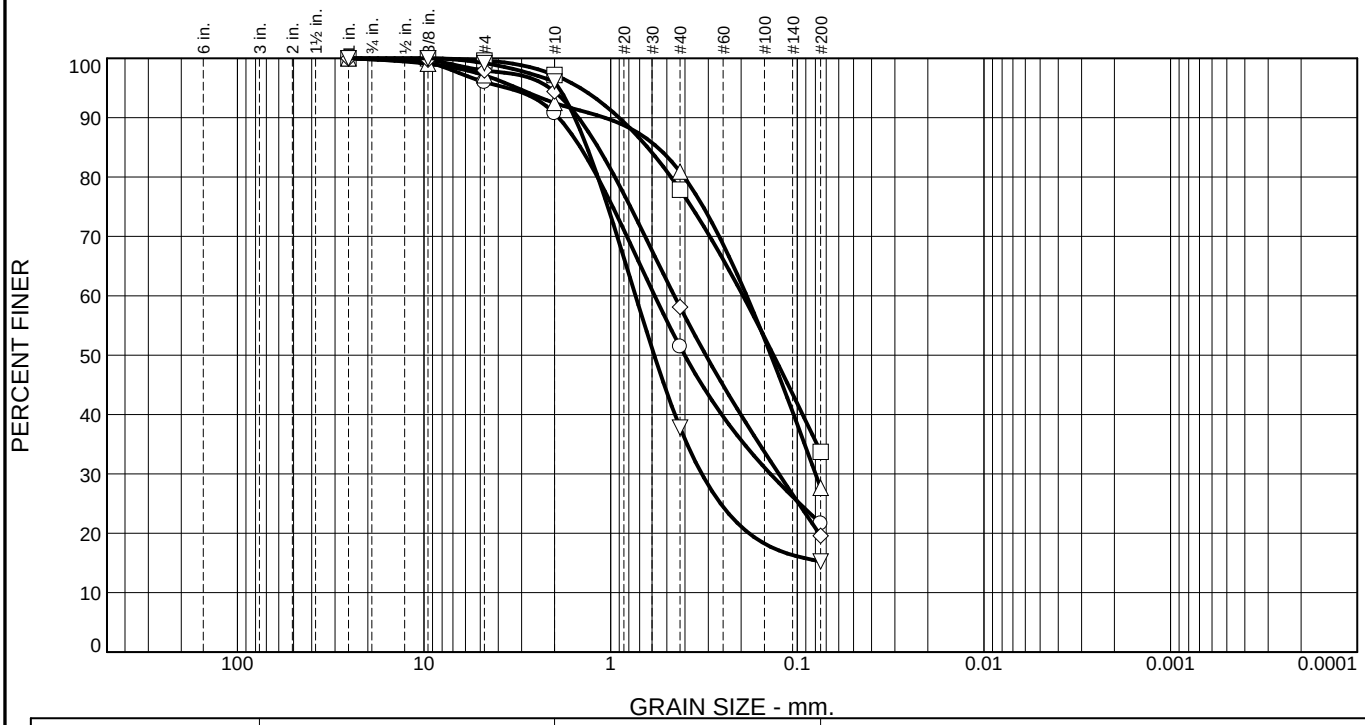
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.3	39.3	29.8	21.6	
□	0.0	2.8	19.3	44.2	33.7	
△	0.0	7.5	11.6	53.2	27.7	
◇	0.0	5.6	36.3	38.5	19.6	
▽	0.0	3.9	58.3	22.5	15.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4526	0.5807	0.4014	0.1394				
□	NV	NP	0.6343	0.1955	0.1342					
△	NV	NP	0.5609	0.1869	0.1385	0.0798				
◇	NV	NP	1.1675	0.4559	0.3091	0.1256				
▽	NV	NP	1.3382	0.7354	0.5841	0.3249				

Material Description	USCS	AASHTO
○ Moist borown silty Fine sandy Coarse Sand, trace of Fine gravel	SM	A-2-4(0)
□ Moist gray M.dense silty Fine Sand w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)
△ Moist brown M.dense silty Fine Sand w/ some Coarse sand,trace of Fine gravel	SM	A-2-4(0)
◇ Wet M.dense gray Fine Sand Coarse Sand w/some silt, trace of Fine gravel	SM	A-2-4(0)
▽ Sat Loose gray Fine sandy Coarse Sand w/ some silt,trace of Fine gravel	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-1 **Depth:** 0 **Sample Number:** 1

□ **Source of Sample:** HS-1 **Depth:** 2 **Sample Number:** 2

△ **Source of Sample:** HS-1 **Depth:** 4 **Sample Number:** 3

◇ **Source of Sample:** HS-1 **Depth:** 6 **Sample Number:** 4

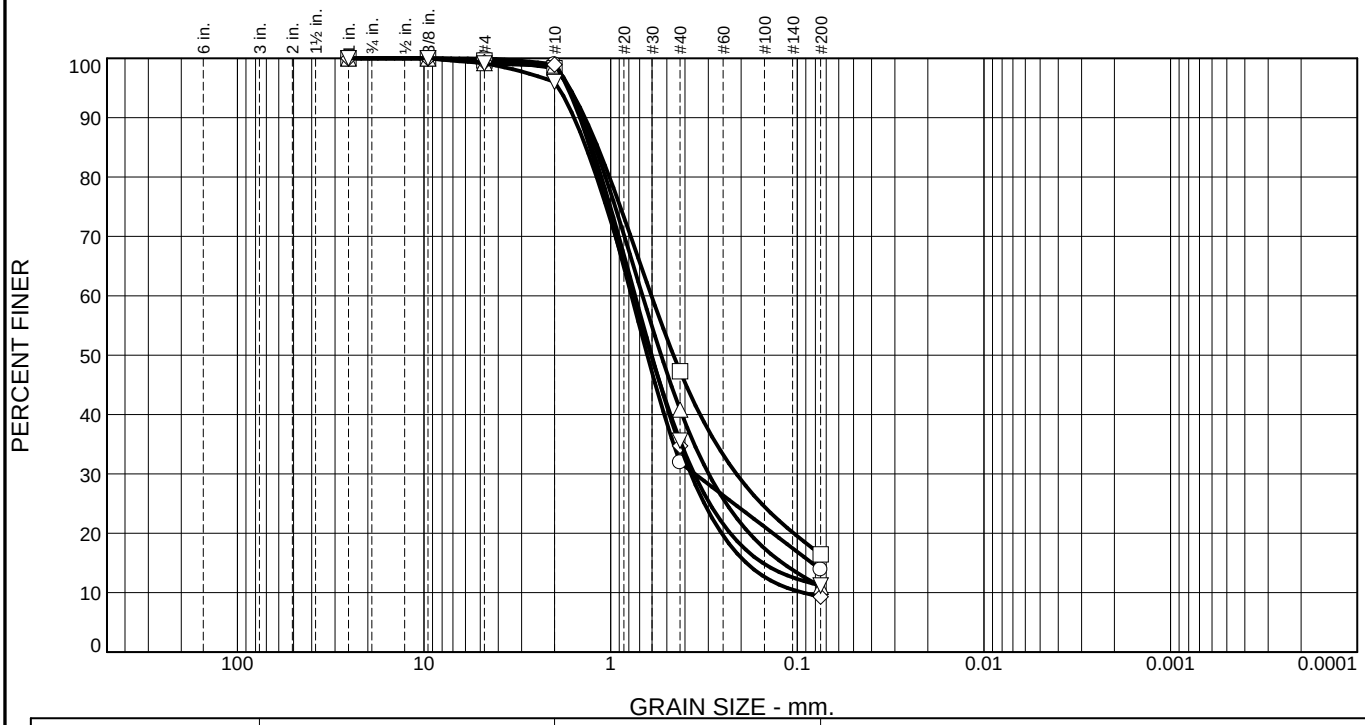
▽ **Source of Sample:** HS-1 **Depth:** 8 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.0	67.1	18.0	13.9	
□	0.0	1.7	51.0	30.9	16.4	
△	0.0	1.2	58.0	29.8	11.0	
◇	0.0	1.1	64.2	25.4	9.3	
▽	0.0	4.0	60.4	24.4	11.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2908	0.7737	0.6364	0.3536	0.0835			
□	NV	NP	1.1714	0.6046	0.4607	0.2119				
△	NV	NP	1.2106	0.6748	0.5366	0.2984	0.1200			
◇	NV	NP	1.2593	0.7392	0.6030	0.3720	0.1874	0.0933	2.01	7.93
▽	NV	NP	1.3542	0.7568	0.6071	0.3568	0.1531			

Material Description	USCS	AASHTO
○ Wet M.dense gray Coarse Sand w/ some silt and Fine sand, trace of Fine gravel	SM	A-1-b
□ Wet M.dense gray Fine sandy Coarse Sand w/ some silt trace of Fine gravel	SM	A-1-b
△ Sat Loose gray Fine sandy Coarse Sand trace of silt trace of Fine gravel	SP-SM	A-1-b
◇ Sat Loose brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel	SW-SM	A-1-b
▽ Wet M.dense brown Coarse Sand w/ some silt w/ some Fine sand trace of Fine gravel	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-1 **Depth:** 10 **Sample Number:** 6

□ **Source of Sample:** HS-1 **Depth:** 12 **Sample Number:** 7

△ **Source of Sample:** HS-1 **Depth:** 14 **Sample Number:** 8

◇ **Source of Sample:** HS-1 **Depth:** 16 **Sample Number:** 9

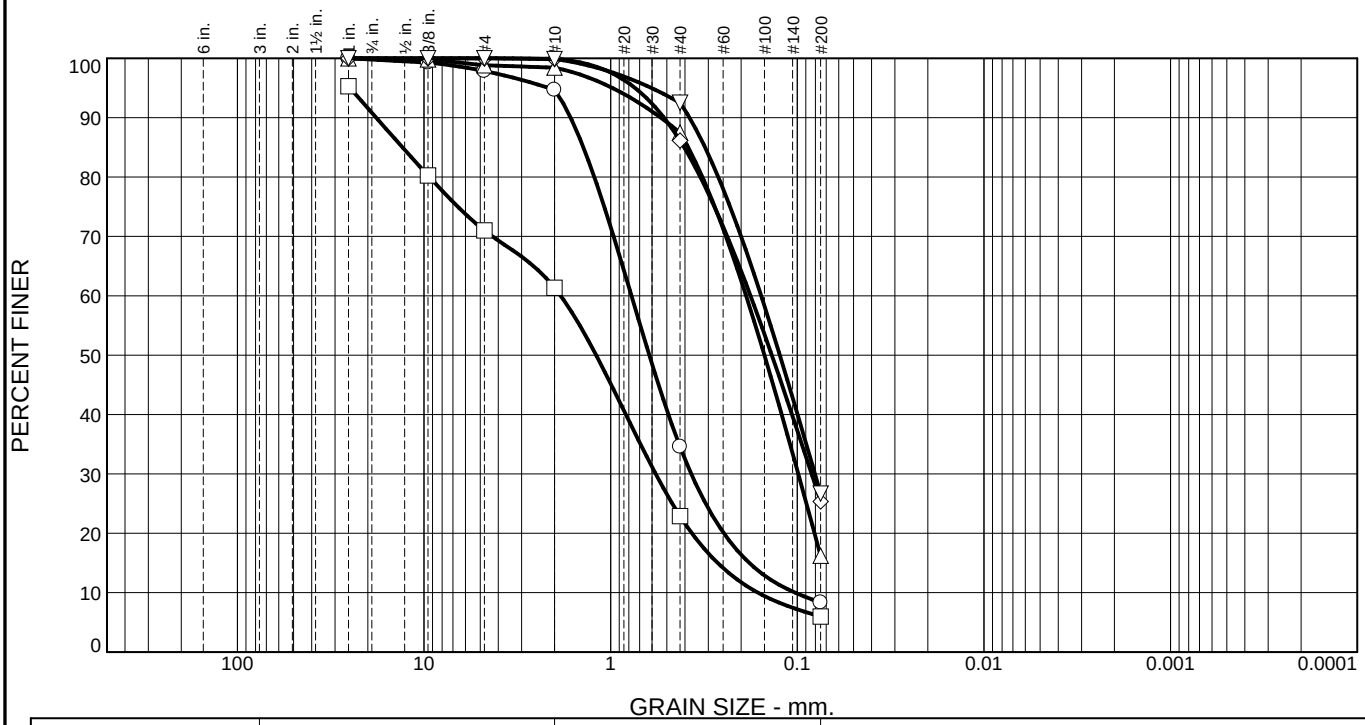
▽ **Source of Sample:** HS-1 **Depth:** 18 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.3	60.1	26.3	8.3	
□			38.5	16.9	6.0	
△	0.0	1.6	10.9	71.3	16.2	
◇	0.0	0.1	13.8	60.7	25.4	
▽	0.0	0.1	7.4	65.8	26.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4003	0.7735	0.6207	0.3701	0.1808	0.1028	1.72	7.53
□	NV	NP	13.0381	1.8533	1.1963	0.5737	0.2670	0.1628	1.09	11.38
△	NV	NP	0.3841	0.1881	0.1501	0.0988				
◇	NV	NP	0.4037	0.1781	0.1370	0.0838				
▽	NV	NP	0.3121	0.1562	0.1241	0.0805				

Material Description	USCS	AASHTO
○ Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand trace of silt	SW-SM	A-1-b
□ Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand trace of silt	SW-SM	A-1-b
△ Sat M.dense gray Fine Sand w/ some silt w/ some Coarse sand, trace of Fine gravel	SM	A-2-4(0)
◇ Sat Loose gray silty Fine Sand w/ some Coarse sand	SM	A-2-4(0)
▽ Sat M.dense gray silty Fine Sand w/ some Coarse sand	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-1 **Depth:** 24 **Sample Number:** 11

□ **Source of Sample:** HS-1 **Depth:** 29 **Sample Number:** 12

△ **Source of Sample:** HS-1 **Depth:** 34 **Sample Number:** 13

◇ **Source of Sample:** HS-1 **Depth:** 39 **Sample Number:** 14

▽ **Source of Sample:** HS-1 **Depth:** 44 **Sample Number:** 15

Remarks:

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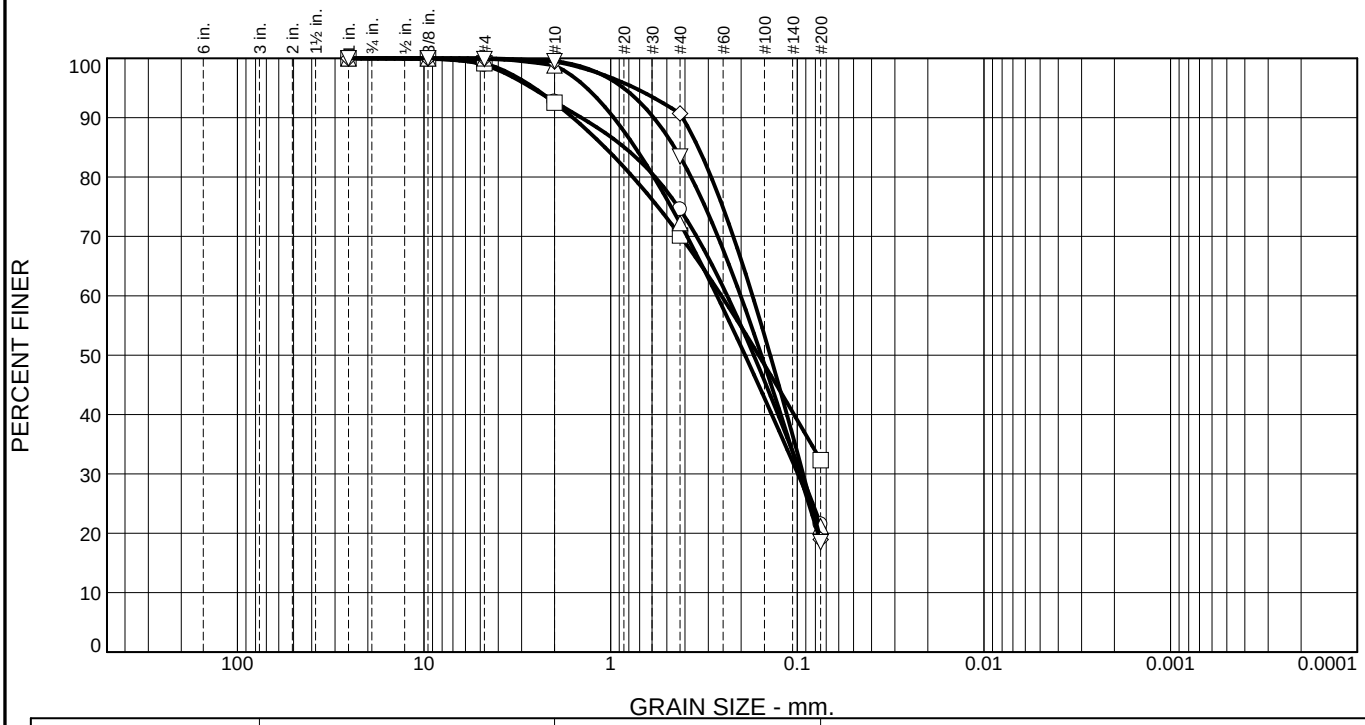
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.3	18.2	53.0	21.5	
□	0.0	7.5	22.4	37.8	32.3	
△	0.0	1.2	26.6	51.0	21.2	
◇	0.0	0.5	8.8	71.7	19.0	
▽	0.0	0.5	16.1	64.9	18.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8441	0.2372	0.1712	0.0952				
□	NV	NP	1.0730	0.2549	0.1611					
△	NV	NP	0.7391	0.2693	0.1907	0.0993				
◇	NV	NP	0.3396	0.1738	0.1397	0.0931				
▽	NV	NP	0.4546	0.2012	0.1559	0.0973				

Material Description	USCS	AASHTO
○ Sat M.dense gray silty Fine Sand w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)
□ Sat Dense gray silty Coarse sandy Fine Sand trace of Fine gravel	SM	A-2-4(0)
△ Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel	SM	A-2-4(0)
◇ Sat M.dense gray Fine Sand w/ some silt trace of Coarse sand and Fine gravel	SM	A-2-4(0)
▽ Sat V. Dence Fine Sand w/ some silt w/ some Coarse sand	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-1 **Depth:** 49 **Sample Number:** 16

□ **Source of Sample:** HS-1 **Depth:** 54 **Sample Number:** 17

△ **Source of Sample:** HS-1 **Depth:** 59 **Sample Number:** 18

◇ **Source of Sample:** HS-1 **Depth:** 64 **Sample Number:** 19

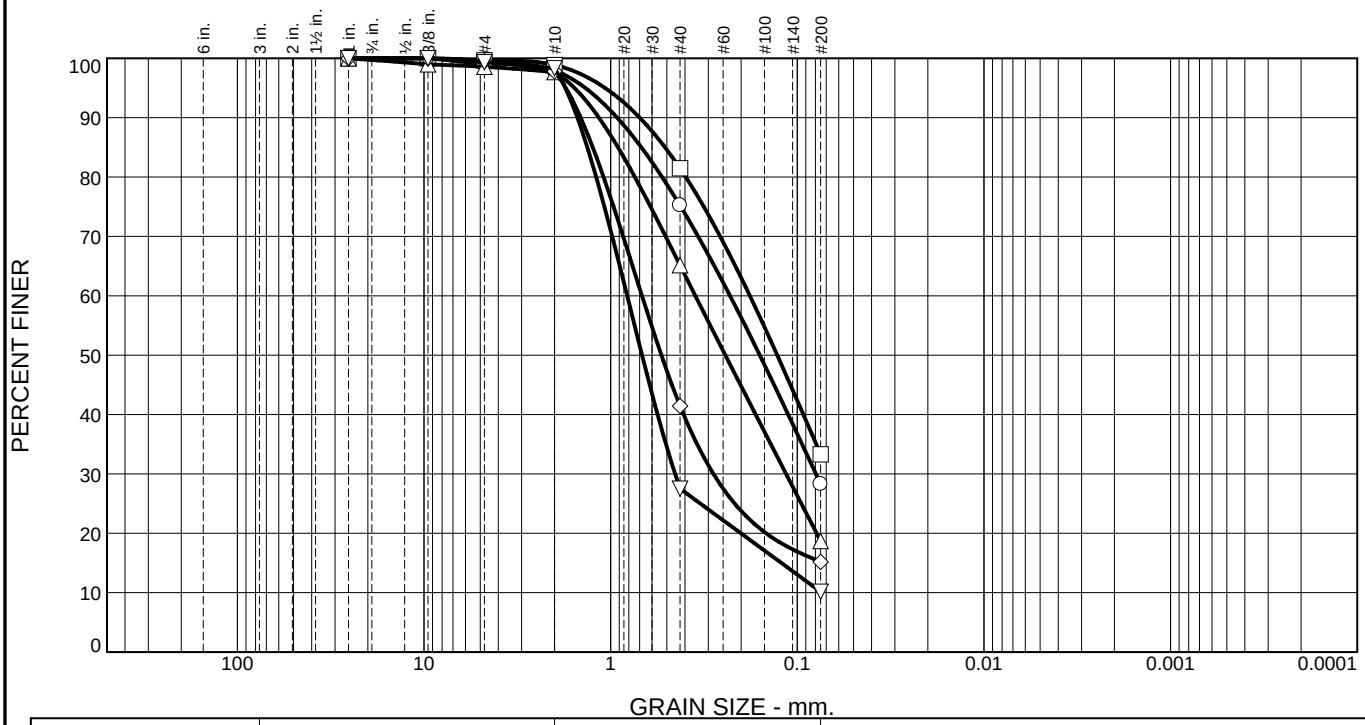
▽ **Source of Sample:** HS-1 **Depth:** 68 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.1	22.7	46.9	28.3	
□	0.0	1.1	17.4	48.2	33.3	
△	0.0	2.3	32.6	46.4	18.7	
◇	0.0	2.2	56.4	26.2	15.2	
▽	0.0	1.7	70.8	17.3	10.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6847	0.2293	0.1590	0.0795				
□	NV	NP	0.5111	0.1796	0.1282					
△	NV	NP	0.9135	0.3518	0.2430	0.1149				
◇	NV	NP	1.2466	0.6798	0.5349	0.2815				
▽	NV	NP	1.3331	0.8155	0.6789	0.4518	0.1217			

Material Description	USCS	AASHTO
○ Moist Loose black silty Coarse sandy Fine Sand trace of Fine gravel	SM	A-2-4(0)
□ Wet V. loose black silty Fine Sand w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)
△ Wet Loose gray Coarse sandy Fine Sand w/ some silt trace of Fine gravel	SM	A-2-4(0)
◇ Sat V. loose brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel	SM	A-1-b
▽ Sat Loose brown Coarse Sand w/ some Fine sand trace of silt trace of Fine gravel	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-2 **Depth:** 2 **Sample Number:** 1

□ **Source of Sample:** HS-2 **Depth:** 4 **Sample Number:** 2

△ **Source of Sample:** HS-2 **Depth:** 6 **Sample Number:** 3

◇ **Source of Sample:** HS-2 **Depth:** 8 **Sample Number:** 4

▽ **Source of Sample:** HS-2 **Depth:** 10 **Sample Number:** 5

Remarks:

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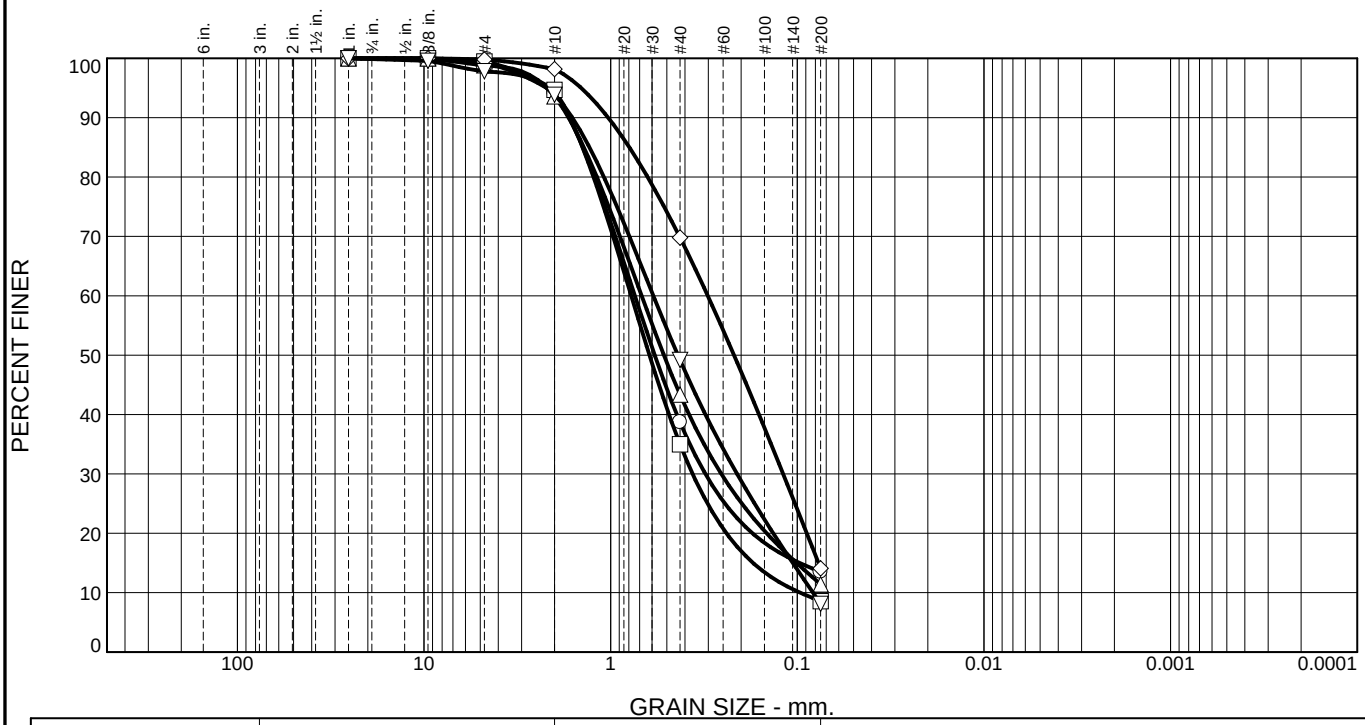
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.8	55.5	25.2	13.5	
□	0.0	5.3	59.7	26.4	8.6	
△	0.0	6.4	50.2	32.0	11.4	
◇	0.0	1.8	28.4	55.7	14.1	
▽	0.0	6.1	44.7	41.1	8.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4112	0.7417	0.5803	0.3108	0.0971			
□	NV	NP	1.4144	0.7758	0.6196	0.3640	0.1726	0.0966	1.77	8.03
△	NV	NP	1.3921	0.6823	0.5186	0.2553	0.1009			
◇	NV	NP	0.7943	0.3018	0.2183	0.1192	0.0770			
▽	NV	NP	1.2995	0.5906	0.4361	0.2103	0.1057	0.0824	0.91	7.17

Material Description	USCS	AASHTO
○ Wet V. loose brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel	SM	A-1-b
□ Moist M.dense brown Fine sandy Coarse Sand trace of silt trace of Fine gravel	SW-SM	A-1-b
△ Wet M.dense brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel	SP-SM	A-1-b
◇ Sat Loose brown Coarse sandy Fine Sand w/ some silt trace of Fine gravel	SM	A-2-4(0)
▽ Sat M.dense brown Fine Sand Coarse Sand trace of silt trace of Fine gravel	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-2 **Depth:** 12 **Sample Number:** 6

□ **Source of Sample:** HS-2 **Depth:** 14 **Sample Number:** 7

△ **Source of Sample:** HS-2 **Depth:** 16 **Sample Number:** 8

◇ **Source of Sample:** HS-2 **Depth:** 18 **Sample Number:** 9

▽ **Source of Sample:** HS-2 **Depth:** 24 **Sample Number:** 10

Remarks:

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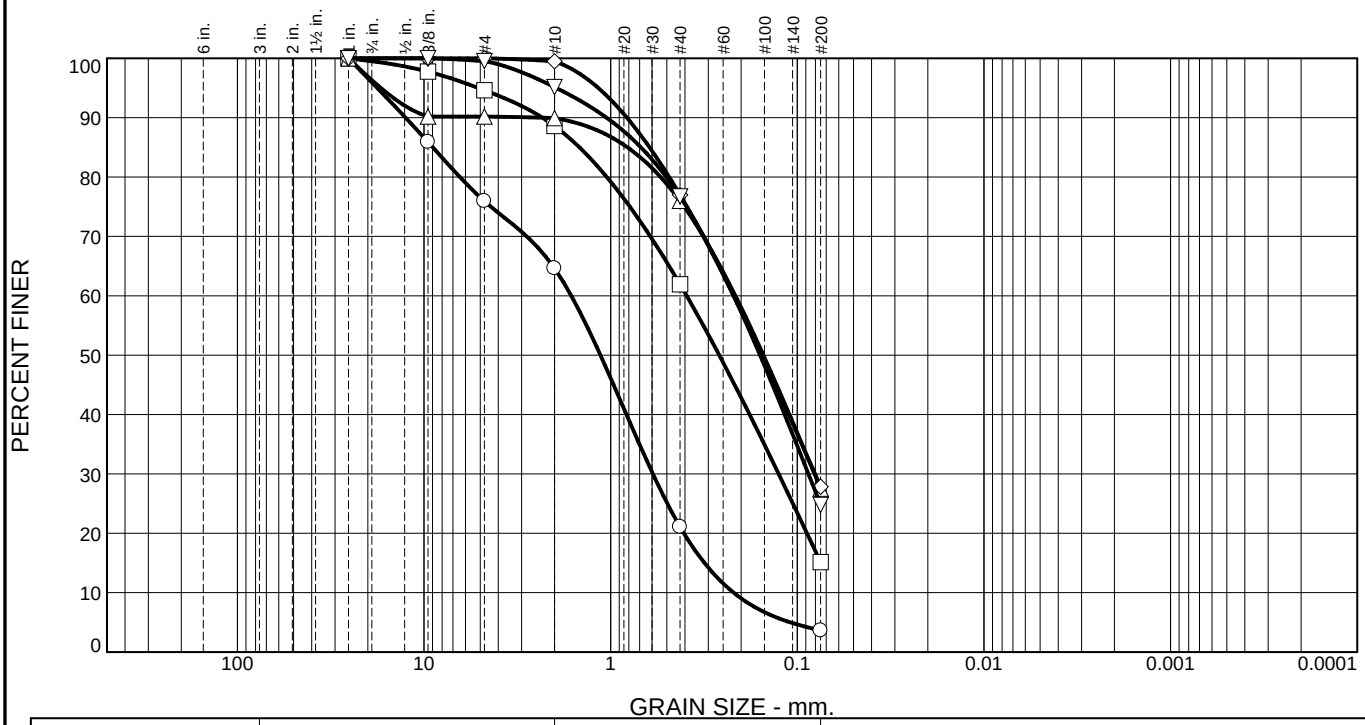
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	35.4	43.5	17.5	3.6	
□	0.0	11.4	26.7	46.8	15.1	
△	0.0	10.1	13.9	48.5	27.5	
◇	0.0	0.5	22.5	49.2	27.8	
▽	0.0	4.9	18.4	51.9	24.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	8.9708	1.6257	1.1347	0.5939	0.3143	0.2194	0.99	7.41
□	NV	NP	1.4691	0.3913	0.2619	0.1259				
△	NV	NP	0.8122	0.2146	0.1519	0.0809				
◇	NV	NP	0.6188	0.2194	0.1550	0.0804				
▽	NV	NP	0.6885	0.2194	0.1584	0.0872				

Material Description	USCS	AASHTO
○ Wet M.dense brown Fine gravelly Coarse Sand w/ some Fine sand trace of silt	SP	A-1-b
□ Sat M.dense gray Coarse sandy Fine Sand w/ some silt w/ some of Fine gravel	SM	A-2-4(0)
△ Sat M.dense gray silty Fine Sand w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)
◇ Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel	SM	A-2-4(0)
▽ Sat Stiff gray Fine sandy Silt w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-2 **Depth:** 28 **Sample Number:** 11

□ **Source of Sample:** HS-2 **Depth:** 34 **Sample Number:** 12

△ **Source of Sample:** HS-2 **Depth:** 38 **Sample Number:** 13

◇ **Source of Sample:** HS-2 **Depth:** 44 **Sample Number:** 14

▽ **Source of Sample:** HS-2 **Depth:** 48 **Sample Number:** 15

Remarks:

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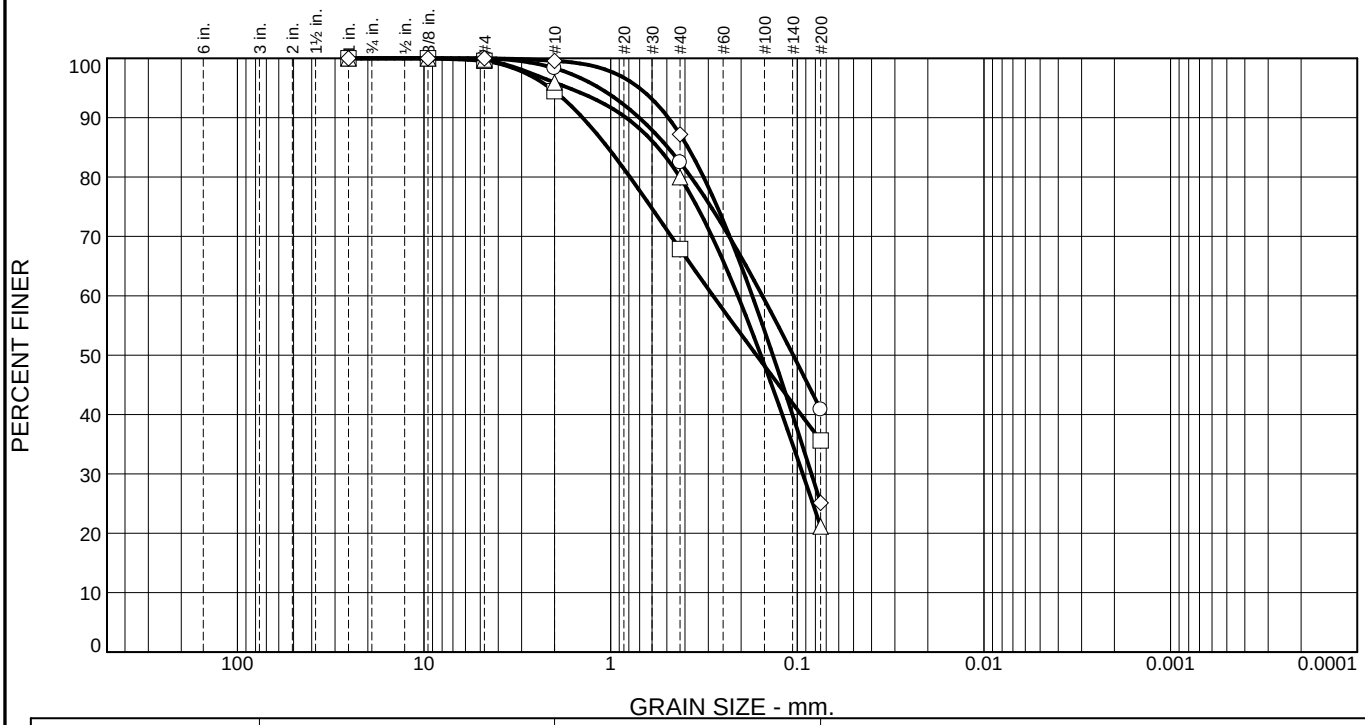
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.7	15.8	41.7	40.8	
□	0.0	5.5	26.6	32.3	35.6	
△	0.0	4.1	15.9	58.8	21.2	
◇	0.0	0.4	12.4	62.1	25.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4943	0.1540	0.1052					
□	NV	NP	1.0379	0.2827	0.1654					
△	NV	NP	0.5582	0.2082	0.1569	0.0935				
◇	NV	NP	0.3856	0.1744	0.1352	0.0840				

Material Description	USCS	AASHTO
○ Sat Hard gray Fine sandy Silt w/ some Coarse sand trace of Fine gravel	SM	A-4(0)
□ Sat V. Stiff gray Fine sandy Coarse sandy Silt trace of Fine gravel	SM	A-4(0)
△ Sat M.dense gray silty Fine Sand w/ some Coarse sand trace of Fine gravel	SM	A-2-4(0)
◇ Sat M.dense gray silty Fine Sand w/ some Coarse sand	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** HS-2 **Depth:** 54 **Sample Number:** 16

□ **Source of Sample:** HS-2 **Depth:** 58 **Sample Number:** 17

△ **Source of Sample:** HS-2 **Depth:** 64 **Sample Number:** 18

◇ **Source of Sample:** HS-2 **Depth:** 68 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

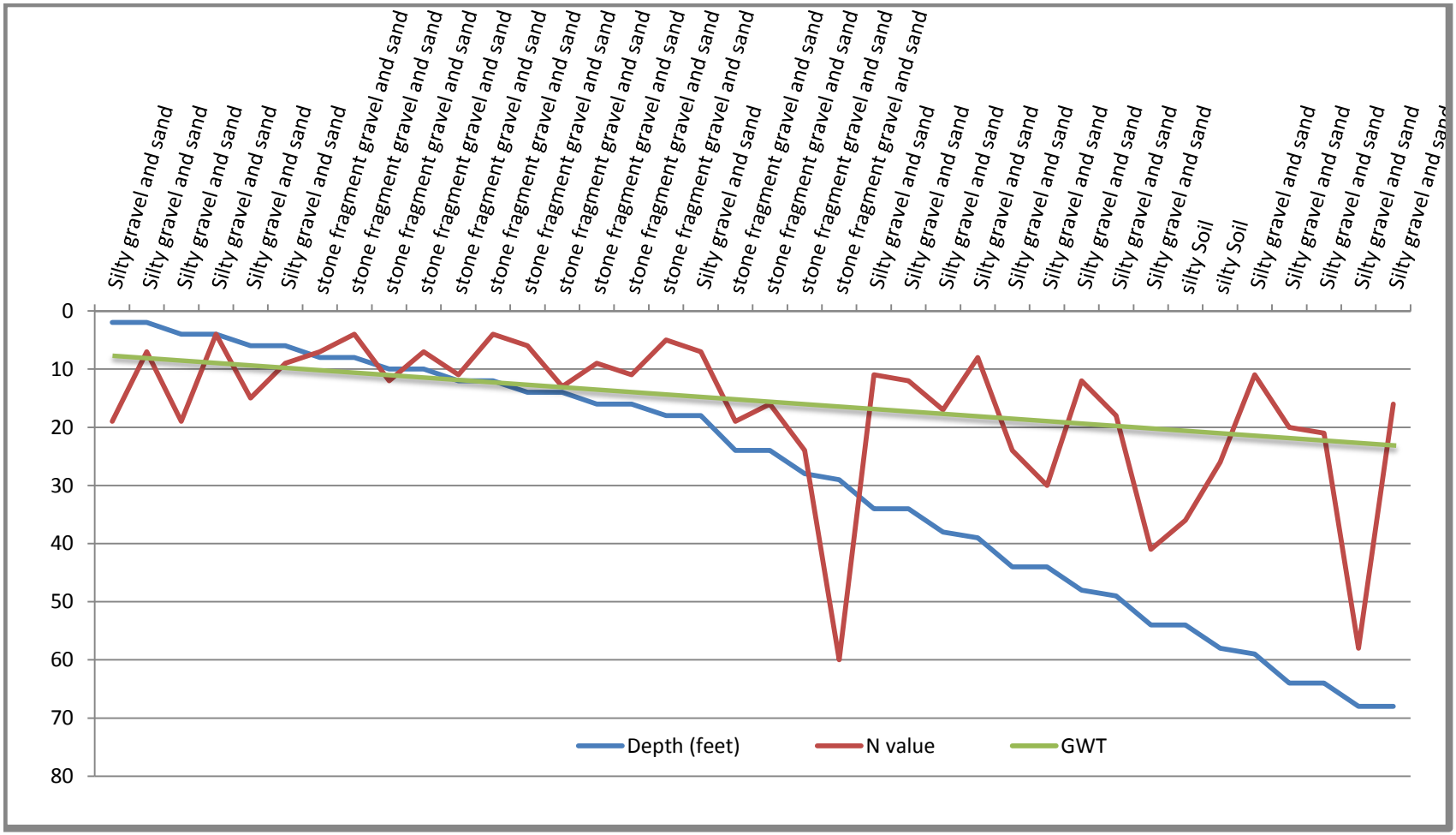
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
HS-1														
	1		Moist borown silty Fine sandy Coarse Sand, trace of Fine gravel	NV	NP	8.2	SM	A-2-4(0)	90.7	21.6	NA	NA	NA	NA
	2	2	Moist gray M.dense silty Fine Sand w/ some Coarse sand trace of Fine gravel	NV	NP	9.5	SM	A-2-4(0)	97.2	33.7	5	8	11	11
	3	4	Moist brown M.dense silty Fine Sand w/ some Coarse sand,trace of Fine gravel	NV	NP	13.6	SM	A-2-4(0)	92.5	27.7	7	9	10	9
	4	6	Wet M.dense gray Fine Sand Coarse Sand w/some silt, trace of Fine gravel	NV	NP	16.5	SM	A-2-4(0)	94.4	19.6	9	8	7	11
	5	8	Sat Loose gray Fine sandy Coarse Sand w/ some silt,trace of Fine gravel	NV	NP	20.2	SM	A-1-b	96.1	15.3	6	4	3	3
	6	10	Wet M.dense gray Coarse Sand w/ some silt and Fine sand, trace of Fine gravel	NV	NP	18	SM	A-1-b	99	13.9	3	5	7	9
	7	12	Wet M.dense gray Fine sandy Coarse Sand w/ some silt trace of Fine gravel	NV	NP	19.3	SM	A-1-b	98.3	16.4	2	5	6	5
	8	14	Sat Loose gray Fine sandy Coarse Sand trace of silt and Fine gravel	NV	NP	21.6	SP-SM	A-1-b	98.8	11	3	3	3	3
	9	16	Sat Loose brown Fine sandy Coarse Sand w/ some silt trace of Fine gravel	NV	NP	21.8	SW-SM	A-1-b	98.9	9.3	2	4	5	5
	10	18	Wet M.dense brown Coarse Sand w/some silt w/ some Fine sand, trace of Fine gravel	NV	NP	21.3	SP-SM	A-1-b	96	11.2	5	3	2	3
	11	24	Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand, trace of silt	NV	NP	18.9	SW-SM	A-1-b	94.7	8.3	10	8	11	13
	12	29	Moist V. Dence brown Coarse Sand Fine Gravel w/ some Fine sand, trace of silt	NV	NP	11	SW-SM	A-1-b	61.4	6	18	26	34	31
	13	34	Sat M.dense gray Fine Sand w/ some silt w/ some Coarse sand, trace of Fine gravel	NV	NP	25.1	SM	A-2-4(0)	98.4	16.2	3	5	6	9
	14	39	Sat Loose gray silty Fine Sand w/ some Coarse sand	NV	NP	29.2	SM	A-2-4(0)	99.9	25.4	3	3	5	9
	15	44	Sat M.dense gray silty Fine Sand w/ some Coarse sand	NV	NP	33.9	SM	A-2-4(0)	99.9	26.7	5	11	13	14
	16	49	Sat M.dense gray silty Fine Sand w/ some Coarse sand trace of Fine gravel	NV	NP	28.6	SM	A-2-4(0)	92.7	21.5	8	10	8	9
	17	54	Sat Dense gray silty Coarse sandy Fine Sand trace of Fine gravel	NV	NP	30.5	SM	A-2-4(0)	92.5	32.3	10	15	26	29
	18	59	Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel	NV	NP	38.5	SM	A-2-4(0)	98.8	21.2	10	5	6	8
	19	64	Sat M.dense gray Fine Sand w/ some silt trace of Coarse sand and Fine gravel	NV	NP	30.4	SM	A-2-4(0)	99.5	19	8	9	11	17
	20	68	Sat V. Dence Fine Sand w/ some silt w/ some Coarse sand	NV	NP	28	SM	A-2-4(0)	99.5	18.5	12	19	39	37
	1	2	Moist Loose black silty Coarse sandy Fine Sand trace of Fine gravel	NV	NP	14.6	SM	A-2-4(0)	97.9	28.3	2	3	4	5
	2	4	Wet V. loose black silty Fine Sand w/ some Coarse sand, trace of Fine gravel	NV	NP	19.5	SM	A-2-4(0)	98.9	33.3	2	2	2	2
	3	6	Wet Loose gray Coarse sandy Fine Sand w/ some silt, trace of Fine gravel	NV	NP	18	SM	A-2-4(0)	97.7	18.7	3	4	5	6
	4	8	Sat V. loose brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel	NV	NP	20.8	SM	A-1-b	97.8	15.2	2	2	2	2
	5	10	Sat Loose brown Coarse Sand w/ some Fine sand trace of silt and Fine gravel	NV	NP	21.8	SP-SM	A-1-b	98.3	10.2	3	3	4	3
	6	12	Wet V. loose brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel	NV	NP	19.5	SM	A-1-b	94.2	13.5	4	2	2	2
	7	14	Moist M.dense brown Fine sandy Coarse Sand trace of silt and Fine gravel	NV	NP	18.5	SW-SM	A-1-b	94.7	8.6	4	5	8	5
	8	16	Wet M.dense brown Fine sandy Coarse Sand w/ some silt, trace of Fine gravel	NV	NP	18.5	SP-SM	A-1-b	93.6	11.4	4	5	6	5
	9	18	Sat Loose brown Coarse sandy Fine Sand w/ some silt, trace of Fine gravel	NV	NP	22.1	SM	A-2-4(0)	98.2	14.1	3	3	4	3
	10	24	Sat M.dense brown Fine to Coarse Sand trace of silt and Fine gravel	NV	NP	20.4	SP-SM	A-1-b	93.9	8.1	6	7	9	9
	11	28	Wet M.dense brown Fine gravelly Coarse Sand w/ some Fine sand, trace of silt	NV	NP	15.1	SP	A-1-b	64.6	3.6	9	11	13	10
	12	34	Sat M.dense gray Coarse sandy Fine Sand w/ some silt and Fine gravel	NV	NP	23.3	SM	A-2-4(0)	88.6	15.1	4	5	7	11
	13	38	Sat M.dense gray silty Fine Sand w/ some Coarse sand, trace of Fine gravel	NV	NP	30.2	SM	A-2-4(0)	89.9	27.5	8	8	9	12
	14	44	Sat M.dense gray silty Coarse sandy Fine Sand trace of Fine gravel	NV	NP	36.4	SM	A-2-4(0)	99.5	27.8	11	14	16	21
	15	48	Sat Stiff gray Fine sandy Silt w/ some Coarse sand, trace of Fine gravel	NV	NP	30.2	SM	A-2-4(0)	95.1	24.8	11	7	5	9
	16	54	Sat Hard gray Fine sandy Silt w/ some Coarse sand, trace of Fine gravel	NV	NP	36.3	SM	A-4(0)	98.3	40.8	15	19	17	20
	17	58	Sat V. Stiff gray Fine sandy Coarse sandy Silt, trace of Fine gravel	NV	NP	38.1	SM	A-4(0)	94.5	35.6	12	15	11	17
	18	64	Sat M.dense gray silty Fine Sand w/ some Coarse sand, trace of Fine gravel	NV	NP	35.9	SM	A-2-4(0)	95.9	21.2	9	11	10	9
	19	68	Sat M.dense gray silty Fine Sand w/ some Coarse sand	NV	NP	30.9	SM	A-2-4(0)	99.6	25.1	7	7	9	8

DATE : **6-02-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-303A High Stump road over Cattail Branch Rd- Farmington, DE**



DATE : **6-02-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-303A High Stump road over Cattail Branch Rd- Farmington, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 6-09-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-371B on Chapel road over Hudson branch – Felton, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-30-2016. Walton Corporation-Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map ofKent County, Delaware According to Geologic Map Series No. 14 by Ramsey, K.W. October 2007. According to Geologic Map the area is situated in LYNCH HEIGHTS FORMATION as, Light gray to brown to light yellowish brown, medium to fine sand to very fine sand with discontinuous beds of course sand, gravel silt, and organic- rich clayey silt to silty sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Wyoming Area, Delaware by Durward H. Boggess and Christian F. Davis (1965) Atlas HA- 141. The nearest well to this site the groundwater historically had been measured as 16 feet on November 1959 and between the years of 1950 to 1962 appeared from 14 to 17 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 60 feet down is Silty soils (A-4) and from 60 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is less of 3 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Kent County Area, Map Series, No. 11 by Scott Andres 2003. The Recharge potential is a fair category.

5. Ground Cover

The ground cover for this site is 5 inches of asphalt top of 19 inches of fill material. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 9 feet and caved at 6.5 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 6.1 to 50.40 percent. The Atterberg limit is 26 percent, Liquid limits is 19.8 to 31.40 percent. The Plasticity Index is 3.4 to 4.8 and the Organic matter is 15 percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition, a layer of 4 feet in thickness of sandy silt material was appeared at 14 feet from the surface elevation this

layer may need to be considering in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had very good amount of all borrow type material to reuse according to Del-DOT standard specification type "B" borrow.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (9- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **6-08-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR2-371B on Chapel road over Hudson branch – Felton, DE**

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
BC-3	378773.226	628253.691	39.0399972	-75.5149361
BC-4	378750.101	628119.533	39.0399333	-75.5154083

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BC-3

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 378773.226
Easting: 628253.691
Boring Surface Elev.:
Reference:
Date Started: 3/30/16
Date Completed: 3/30/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/30/16	9.0	
3/30/16	Dry	6.5

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' 4.0'	6 4 4 4	Moist firm gray fine to coarse sandy silt w/ some clay, trace of fine gravel. 18" RECOVERY	A-4(0)	Hot-mix 5"
5.06		2	4.0' 6.0'	4 3 4 3	Moist loose gray silty coarse to fine sand w/ trace fine gravel and clay. 18" RECOVERY	A-2-4(0)	
7.59		3	6.0' 8.0'	3 3 3 3	Wet loose brown coarse sand w/some fine sand and silt, trace of fine gravel. 18" RECOVERY	A-1-b	
10.12	■	4	8.0' 10.0'	7 4 7 11	Wet medium dense brown coarse to fine sand and fine gravel w/some silt. 14" RECOVERY	A-1-b	
12.65		5	10.0' 12.0'	5 7 9 10	Wet medium dense brown coarse to fine sand w/some fine gravel and silt. 13" RECOVERY	A-1-b	
15.18		6	12.0' 14.0'	5 7 5 5	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 12" RECOVERY	A-1-b	
		7	14.0'	2 3 4 5	Wet firm brown coarse to fine sandy silt w/ trace fine gravel.	A-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-3
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		18" RECOVERY		
17.71		8	16.0' 18.0'	2 3 4 5	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel. 20" RECOVERY	A-1-b	
20.24		9	18.0' 20.0'	9 5 4 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
22.77							
25.3		10	24.0' 26.0'	7 9 11 16	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-3	
27.83							
30.36		11	28.0' 30.0'	5 7 9 6	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel. 18" RECOVERY	A-4(0)	
32.89							
35.42		12	34.0' 36.0'	5 6 5 5	Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter. 21" RECOVERY	A-4(0)	
37.95							
		13	38.0'	3	Saturated firm gray silt w/some fine to coarse	A-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-3
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				3 3 3	sand, trace of organic matter.		
			40.0'		21" RECOVERY		
40.48							
43.01							
		14	44.0'	4 4 3 4	Saturated loose gray silty coarse to fine sand w/trace fine gravel and organic matter.	A-2-4(0)	
45.54			46.0'		20" RECOVERY		
48.07							
		15	48.0'	7 9 11 9	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	A-3	
			50.0'		18" RECOVERY		
50.6							
53.13							
		16	54.0'	13 17 14 21	Saturated dense gray fine to coarse sand w/ trace fine gravel and silt.	A-3	
55.66			56.0'		21" RECOVERY		
58.19							
		17	58.0'	11 16 21 17	Saturated dense gray coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			60.0'		18" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-3
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	9 11 13 11	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt. 15" RECOVERY	A-1-b	
68.31		19	68.0' 70.0'	10 11 9 12	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt. 14" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BC-4

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 378750.101
Easting: 628119.533
Boring Surface Elev.:
Reference:
Date Started: 3/30/16
Date Completed: 3/30/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/30/16	8.5	
3/30/16	Dry	3.5

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' – 2.0'		Moist gray silty fine to coarse sand w trace fine gravel. 18" RECOVERY	A-2-4(0)	Hot-mix 5"
2.53		2	2.0' – 4.0'	12 10 10 8	Moist medium dense gray silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' – 6.0'	6 4 3 4	Moist loose gray fine gravelly coarse sand w/ some fine sand and silt. 12" RECOVERY	A-1-b	
7.59		4	6.0' – 8.0'	6 8 16 14	Wet medium dense gray fine to coarse sand w/some fine gravel and silt. 18" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' – 10.0'	2 2 2 3	Wet very loose brown fine to coarse sand w/ some silt. 20" RECOVERY	A-2-4(0)	
		6	10.0' – 12.0'	3 2 2 2	Wet very loose brown silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0' – 14.0'	5 6 7 8	Wet medium dense brown coarse to fine sand w/some silt. 13" RECOVERY	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-4
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' – 16.0'	3 2 3 3	Wet loose brown silty fine to coarse sand w/ trace fine gravel. 17" RECOVERY	A-2-4(0)	
17.71		9	16.0' – 18.0'	7 5 9 7	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
20.24		10	18.0' – 20.0'	4 5 7 10	Wet medium dense brown fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' – 26.0'	7 8 7 10	Wet medium dense brown silty fine sand w/ some coarse sand and fine gravel. 15" RECOVERY	A-2-4(0)	
27.83							
30.36		12	29.0' – 31.0'	3 4 3 3	Saturated firm gray fine sandy silt w/trace coarse sand. 12" RECOVERY	A-4(0)	
32.89							
35.42		13	34.0' – 36.0'	4 4 7 8	Saturated stiff gray fine sandy silt w trace coarse sand and organic matter. 11" RECOVERY	A-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-4
State Contract: T201407003

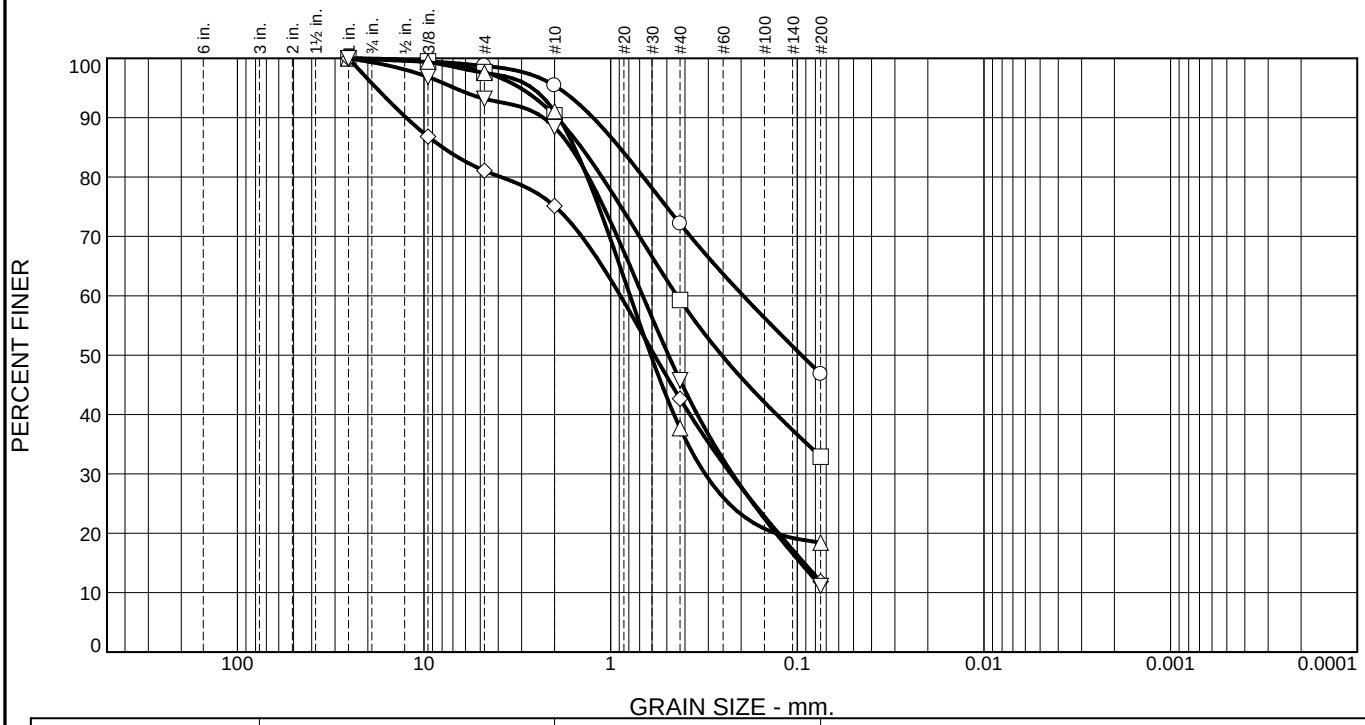
Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	2 4 5 7	Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter. 24" RECOVERY	A-4(0)	
43.01							
45.54		15	44.0' 46.0'	4 7 9 11	Saturated stiff gray coarse to fine sandy silt w/trace organic matter. 15" RECOVERY	A-4(0)	
48.07							
50.6		16	49.0' 51.0'	5 9 10 15	Saturated medium dense gray coarse to fine sand w/trace silt. 14" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	7 8 12 20	Saturated medium dense gray fine to coarse sand w/trace silt. 17" RECOVERY	A-3	
58.19							
		18	59.0'	11 13 15	Saturated medium dense gray fine to coarse	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BC-4
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				19	sand w/trace fine gravel.		
60.72			61.0'		21" RECOVERY		
63.25							
		19	64.0'	12 17 21 23	Saturated dense gray coarse to fine sand w/ trace silt.	A-1-b	
65.78			66.0'		24" RECOVERY		
68.31		20	68.0'	10 17 21 27	Saturated dense gray coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			70.0'		23" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.6	23.3	25.3	46.8	
□	0.0	9.6	31.1	26.4	32.9	
△	0.0	8.9	53.4	19.3	18.4	
◇	0.0	24.9	32.4	30.8	11.9	
▽	0.0	11.6	42.6	34.7	11.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19.8	15.0	0.8970	0.1948	0.0949					
□	19.9	16.5	1.4371	0.4401	0.2540					
△	NV	NP	1.5634	0.7869	0.6091	0.3119				
◇	NV	NP	7.9578	0.8867	0.5824	0.2268	0.0919			
▽	NV	NP	1.6363	0.6731	0.4901	0.2224	0.0959			

Material Description	USCS	AASHTO
○ Moist firm gray fine to coarse sandy silt w/some clay, trace of fine gravel.	SC-SM	A-4(0)
□ Moist loose gray silty coarse to fine sand w/trace fine gravel and clay.	SC-SM	A-2-4(0)
△ Wet loose brown coarse sand w/some fine sand and silt, trace of fine gravel.	SM	A-1-b
◇ Wet medium dense brown coarse to fine sand and fine gravel w/some silt.	SP-SM	A-1-b
▽ Wet medium dense brown coarse to fine sand w/some fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-3 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** BC-3 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** BC-3 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** BC-3 **Depth:** 8.0 **Sample Number:** 4

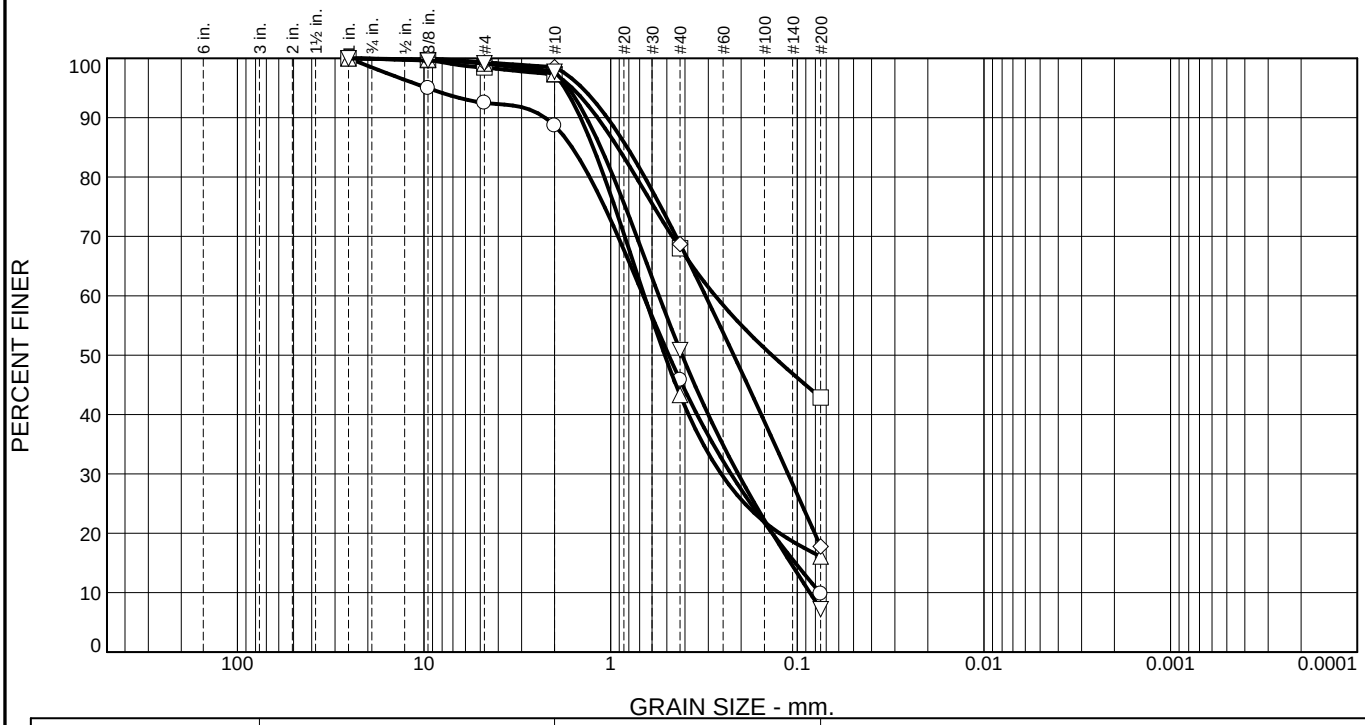
▽ **Source of Sample:** BC-3 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.3	42.9	36.0	9.8	
□	0.0	2.7	29.3	25.1	42.9	
△	0.0	2.6	54.1	27.2	16.1	
◇	0.0	1.5	29.8	50.9	17.8	
▽	0.0	2.3	46.8	43.7	7.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6109	0.6679	0.4884	0.2265	0.1023	0.0759	1.01	8.81
□	25.1	NP	0.9169	0.2753	0.1369					
△	NV	NP	1.2415	0.6600	0.5130	0.2557				
◇	NV	NP	0.8161	0.3102	0.2190	0.1120				
▽	NV	NP	1.1305	0.5515	0.4142	0.2075	0.1084	0.0857	0.91	6.44

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
□ Wet firm brown coarse to fine sandy silt w/trace fine gravel.	SM	A-4(0)
△ Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
◇ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-3 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** BC-3 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** BC-3 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** BC-3 **Depth:** 18.0 **Sample Number:** 9

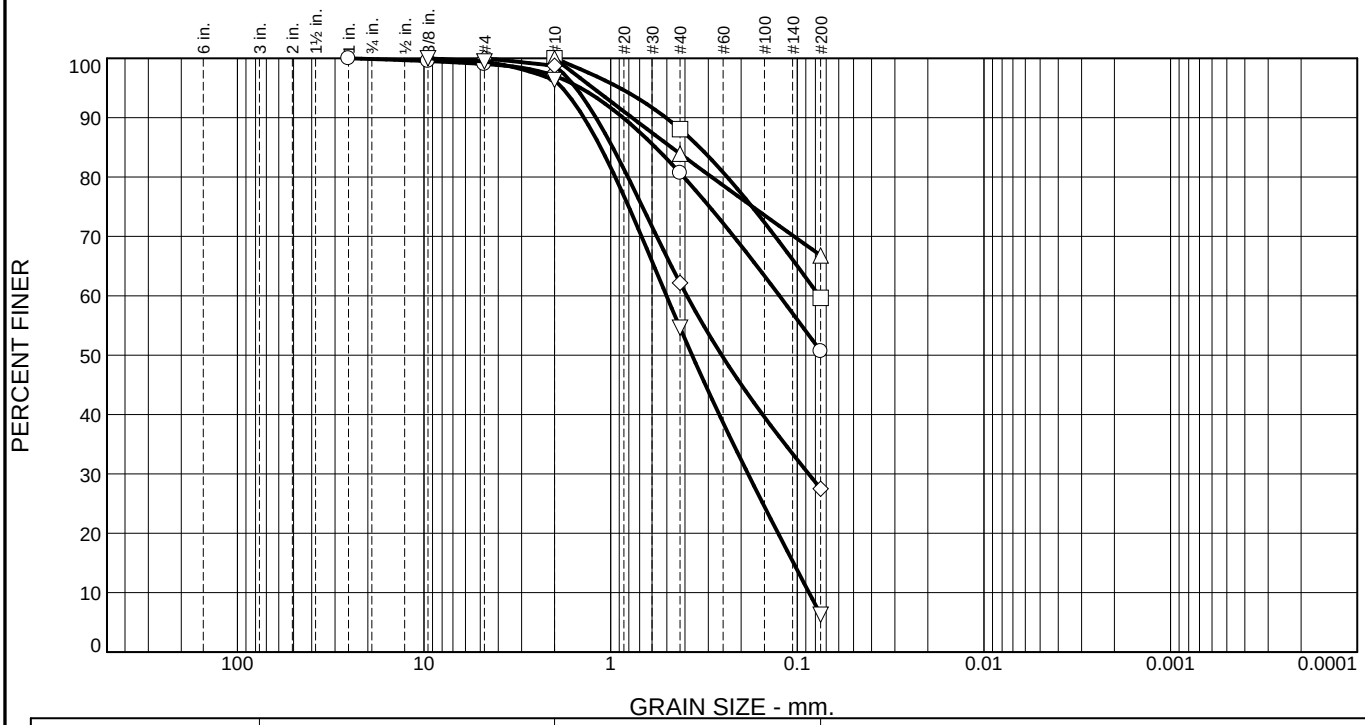
▽ **Source of Sample:** BC-3 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.0	16.3	30.0	50.7	
□	0.0	0.0	11.9	28.4	59.7	
△	0.0	0.0	16.1	17.1	66.8	
◇	0.0	1.2	36.6	34.7	27.5	
▽	0.0	3.6	41.8	48.3	6.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27.1	NP	0.5750	0.1246						
□	27.2	NP	0.3338	0.0764						
△	30.6	NP	0.4723							
◇	NV	NP	0.9761	0.3904	0.2540	0.0869				
▽	NV	NP	1.1322	0.5021	0.3663	0.1837	0.1048	0.0865	0.78	5.80

Material Description	USCS	AASHTO
○ Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	ML	A-4(0)
□ Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter.	ML	A-4(0)
△ Saturated firm gray silt w/some fine to coarse sand, trace of organic matter.	ML	A-4(0)
◇ Saturated loose gray silty coarse to fine sand w/trace fine gravel and organic matter.	SM	A-2-4(0)
▽ Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-3 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** BC-3 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** BC-3 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** BC-3 **Depth:** 44.0 **Sample Number:** 14

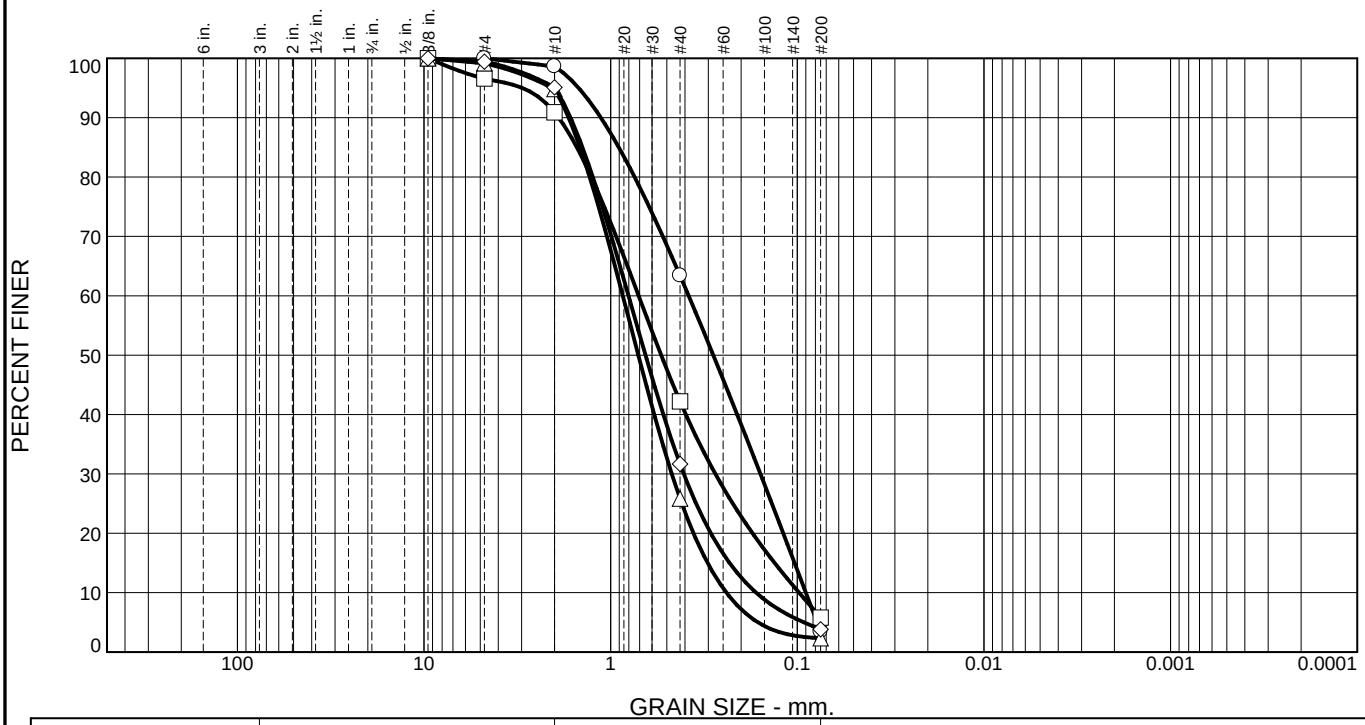
▽ **Source of Sample:** BC-3 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.4	35.2	60.0	3.4	
□	0.0	9.1	48.7	36.4	5.8	
△	0.0	5.2	69.0	23.5	2.3	
◇	0.0	4.9	63.4	27.9	3.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9042	0.3820	0.2818	0.1577	0.1035	0.0900	0.72	4.24
□	NV	NP	1.5169	0.7080	0.5361	0.2748	0.1323	0.0979	1.09	7.23
△	NV	NP	1.4606	0.8609	0.7110	0.4704	0.3024	0.2398	1.07	3.59
◇	NV	NP	1.4160	0.8025	0.6508	0.4058	0.2306	0.1663	1.23	4.83

Material Description	USCS	AASHTO
○ Saturated dense gray fine to coarse sand w/trace fine gravel and silt.	SP	A-3
□ Saturated dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-3 **Depth:** 54.0 **Sample Number:** 16

□ **Source of Sample:** BC-3 **Depth:** 58.0 **Sample Number:** 17

△ **Source of Sample:** BC-3 **Depth:** 64.0 **Sample Number:** 18

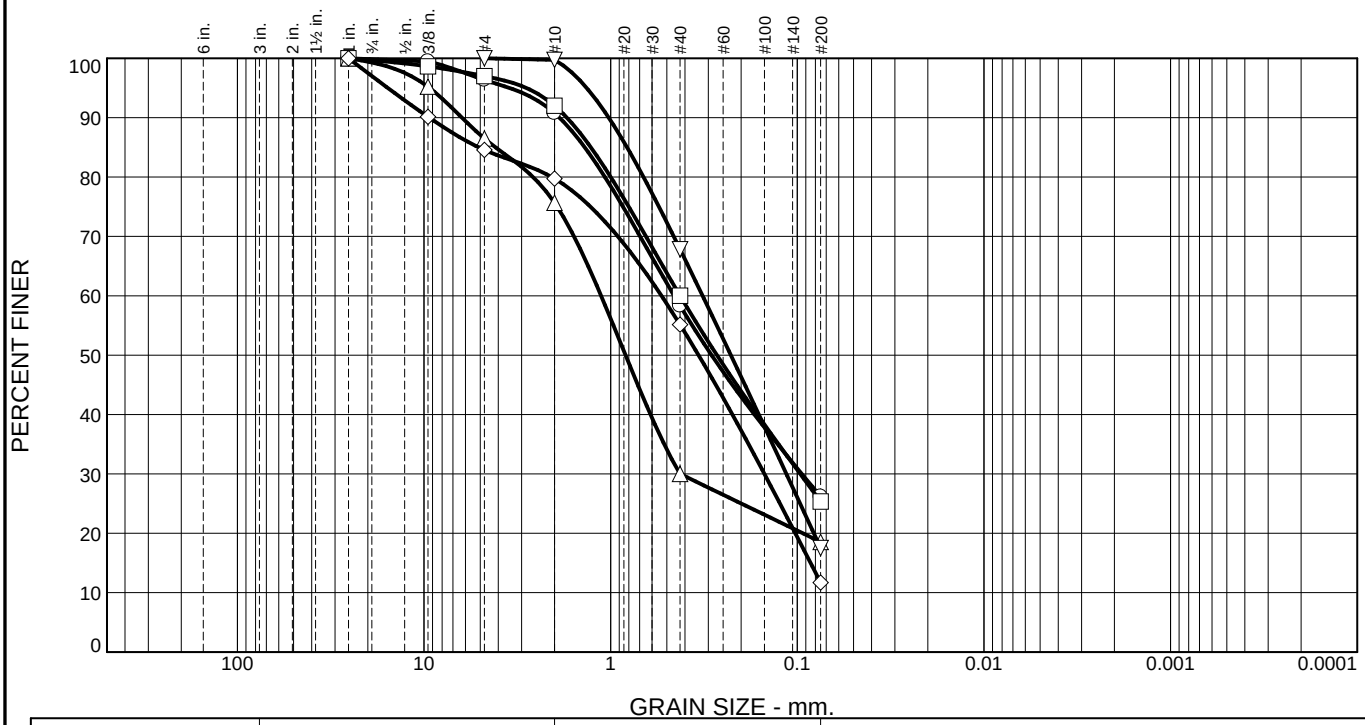
◇ **Source of Sample:** BC-3 **Depth:** 68.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.2	32.5	32.1	26.2	
□	0.0	8.0	32.0	34.6	25.4	
△	0.0	24.3	45.7	11.5	18.5	
◇	0.0	20.3	24.6	43.4	11.7	
▽	0.0	0.3	31.9	50.3	17.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3764	0.4570	0.2878	0.0946				
□	NV	NP	1.2770	0.4247	0.2694	0.0965				
△	NV	NP	4.1366	1.1252	0.8321	0.4248				
◇	NV	NP	5.0923	0.5341	0.3381	0.1501	0.0849			
▽	NV	NP	0.8169	0.3217	0.2270	0.1145				

Material Description	USCS	AASHTO
○ Moist gray silty fine to coarse sand w trace fine gravel.	SM	A-2-4(0)
□ Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Moist loose gray fine gravelly coarse sand w/some fine sand and silt.	SM	A-1-b
◇ Wet medium dense gray fine to coarse sand w/some fine gravel and silt.	SP-SM	A-2-4(0)
▽ Wet very loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-4 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** BC-4 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** BC-4 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** BC-4 **Depth:** 6.0 **Sample Number:** 4

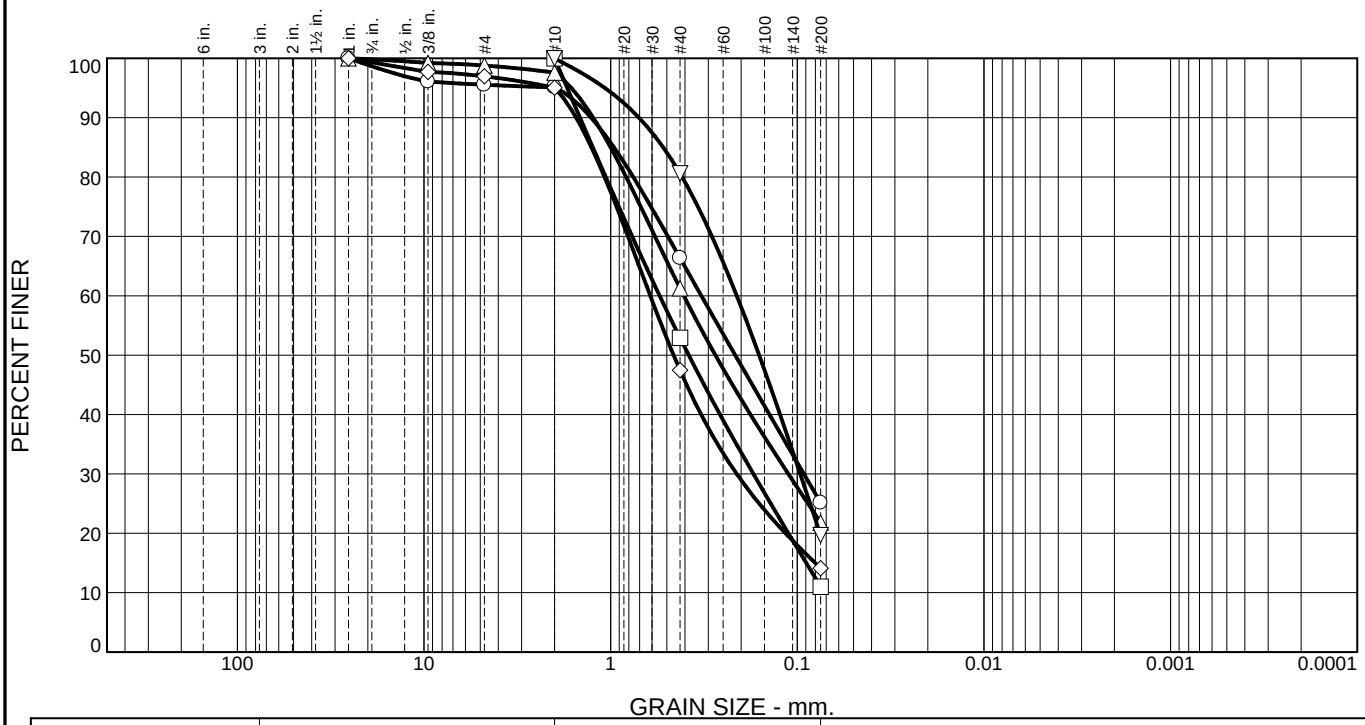
▽ **Source of Sample:** BC-4 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.9	28.7	41.3	25.1	
□	0.0	0.0	47.1	41.9	11.0	
△	0.0	2.4	36.3	39.5	21.8	
◇	0.0	5.0	47.5	33.4	14.1	
▽	0.0	0.0	19.4	60.9	19.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9603	0.3266	0.2150	0.0923				
□	NV	NP	1.2465	0.5465	0.3816	0.1719	0.0896			
△	NV	NP	1.0003	0.4057	0.2746	0.1117				
◇	NV	NP	1.2674	0.6133	0.4599	0.2111	0.0802			
▽	NV	NP	0.5230	0.2110	0.1602	0.0965				

Material Description	USCS	AASHTO
○ Wet very loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown coarse to fine sand w/some silt.	SP-SM	A-2-4(0)
△ Wet loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
▽ Wet medium dense brown fine sand w/some coarse sand and silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-4 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** BC-4 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** BC-4 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** BC-4 **Depth:** 16.0 **Sample Number:** 9

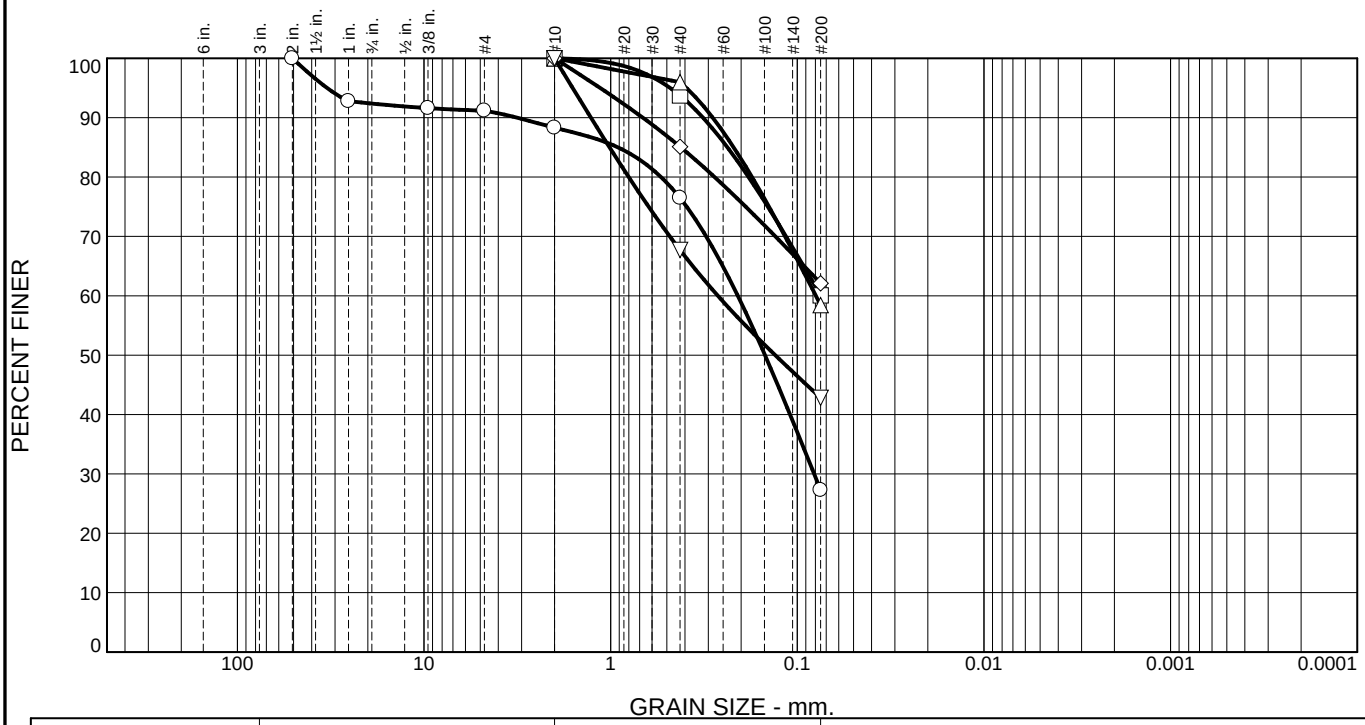
▽ **Source of Sample:** BC-4 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.7	11.8	49.2	27.3	
□	0.0	0.0	6.3	33.6	60.1	
△	0.0	0.0	4.0	37.6	58.4	
◇	0.0	0.0	14.9	23.0	62.1	
▽	0.0	0.0	32.3	24.9	42.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9149	0.2084	0.1490	0.0813				
□	29.4	NP	0.2367							
△	29.6	NP	0.2194	0.0795						
◇	31.4	NP	0.4207							
▽	30.3	NP	1.0139	0.2664	0.1314					

Material Description	USCS	AASHTO
○ Wet medium dense brown silty fine sand w/some coarse sand and fine gravel.	SM	A-2-4(0)
□ Saturated firm gray fine sandy silt w/trace coarse sand.	ML	A-4(0)
△ Saturated stiff gray fine sandy silt w trace coarse sand and organic matter.	ML	A-4(0)
◇ Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter.	ML	A-4(0)
▽ Saturated stiff gray coarse to fine sandy silt w/trace organic matter.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-4 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** BC-4 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** BC-4 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** BC-4 **Depth:** 39.0 **Sample Number:** 14

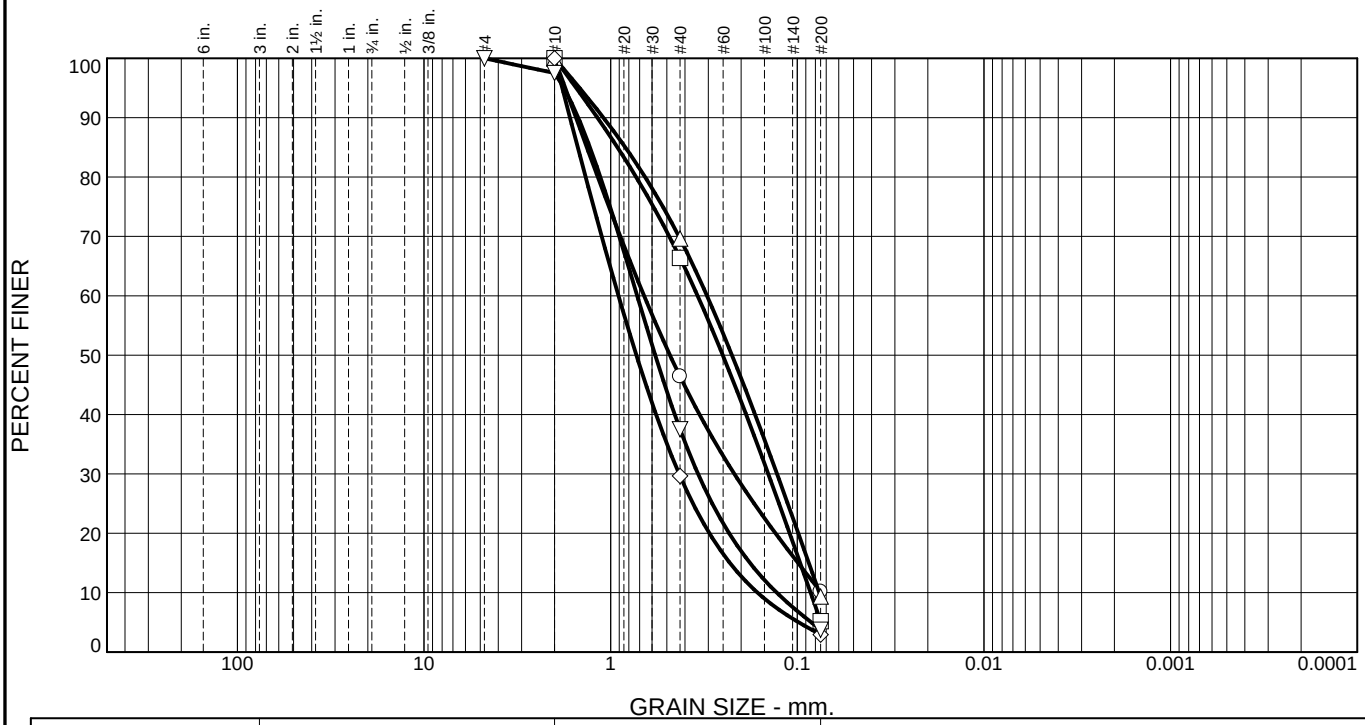
▽ **Source of Sample:** BC-4 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	53.6	36.2	10.2	
□	0.0	0.0	33.6	61.2	5.2	
△	0.0	0.0	30.4	60.3	9.3	
◇	0.0	0.0	70.3	26.8	2.9	
▽	0.0	2.5	60.0	33.7	3.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3423	0.6621	0.4812	0.2174	0.0991			
□	NV	NP	0.9197	0.3420	0.2507	0.1432	0.0966	0.0849	0.71	4.03
△	NV	NP	0.8349	0.3046	0.2239	0.1285	0.0868	0.0763	0.71	3.99
◇	NV	NP	1.5009	0.9080	0.7281	0.4296	0.2297	0.1634	1.24	5.56
▽	NV	NP	1.2921	0.7208	0.5768	0.3403	0.1794	0.1289	1.25	5.59

Material Description	USCS	AASHTO
○ Saturated medium dense gray coarse to fine sand w/trace silt.	SP-SM	A-1-b
□ Saturated medium dense gray fine to coarse sand w/trace silt.	SP-SM	A-3
△ Saturated medium dense gray fine to coarse sand w/trace fine gravel.	SP-SM	A-3
◇ Saturated dense gray coarse to fine sand w/trace silt.	SP	A-1-b
▽ Saturated dense gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BC-4 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** BC-4 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** BC-4 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** BC-4 **Depth:** 64.0 **Sample Number:** 19

▽ **Source of Sample:** BC-4 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

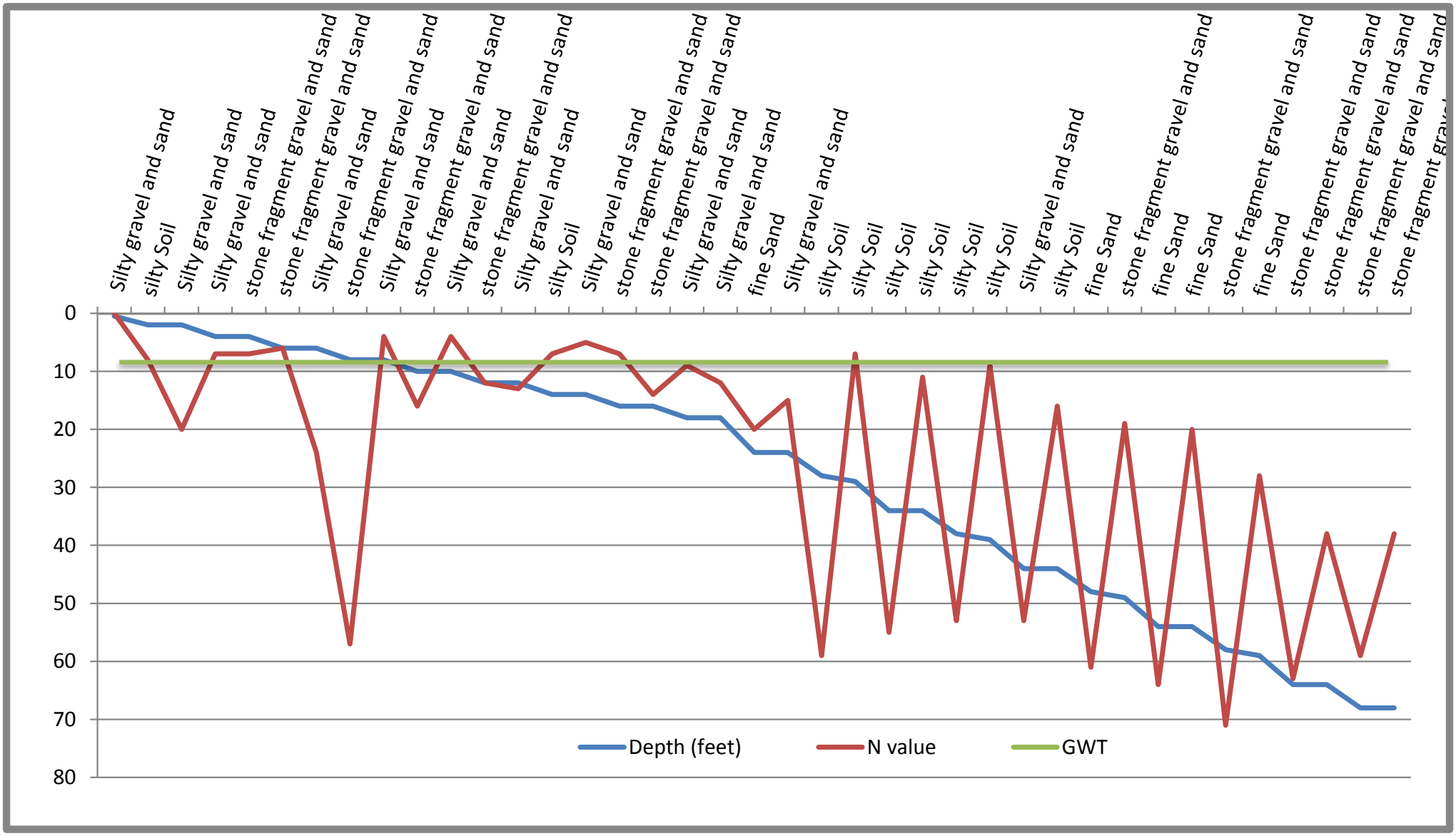
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
BC-3	1	2	Moist firm gray fine to coarse sandy silt w/some clay, trace of fine gravel.	19.8	4.8	12.5	SC-SM	A-4(0)	95.4	46.8	6	4	4	4
	2	4	Moist loose gray silty coarse to fine sand w/trace fine gravel and clay.	19.9	3.4	10.8	SC-SM	A-2-4(0)	90.4	32.9	4	3	4	3
	3	6	Wet loose brown coarse sand w/some fine sand and silt, trace of fine gravel.	NV	NP	16	SM	A-1-b	91.1	18.4	3	3	3	3
	4	8	Wet medium dense brown coarse to fine sand and fine gravel w/some silt.	NV	NP	15.2	SP-SM	A-1-b	75.1	11.9	7	4	7	11
	5	10	Wet medium dense brown coarse to fine sand w/some fine gravel and silt.	NV	NP	20.5	SP-SM	A-1-b	88.4	11.1	5	7	9	10
	6	12	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	18.2	SW-SM	A-1-b	88.7	9.8	5	7	5	5
	7	14	Wet firm brown coarse to fine sandy silt w/trace fine gravel.	25.1	NP	26.3	SM	A-4(0)	97.3	42.9	2	3	4	5
	8	16	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	21.8	SM	A-1-b	97.4	16.1	2	3	4	5
	9	18	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	21.9	SM	A-2-4(0)	98.5	17.8	9	5	4	5
	10	24	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	22.6	SP-SM	A-3	97.7	7.2	7	9	11	16
	11	28	Wet stiff brown fine sandy silt w/some coarse sand, trace of fine gravel.	27.1	NP	32.3	ML	A-4(0)	97	50.7	5	7	9	6
	12	34	Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter.	27.2	NP	47.7	ML	A-4(0)	100	59.7	5	6	5	5
	13	38	Saturated firm gray silt w/some fine to coarse sand, trace of organic matter.	30.6	NP	48.8	ML	A-4(0)	100	66.8	3	3	3	3
	14	44	Saturated loose gray silty coarse to fine sand w/trace fine gravel and organic matter.	NV	NP	34.8	SM	A-2-4(0)	98.8	27.5	4	4	3	4
	15	48	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	25.6	SP-SM	A-3	96.4	6.3	7	9	11	9
	16	54	Saturated dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	23.5	SP	A-3	98.6	3.4	13	17	14	21
	17	58	Saturated dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.8	SW-SM	A-1-b	90.9	5.8	11	16	21	17
	18	64	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.5	SP	A-1-b	94.8	2.3	9	11	13	11
	19	68	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	20	SP	A-1-b	95.1	3.8	10	11	9	12
		70	End Boring											
	1	0.5	Moist gray silty fine to coarse sand w trace fine gravel.	NV	NP	6.1	SM	A-2-4(0)	90.8	26.2				
	2	2	Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	8.2	SM	A-2-4(0)	92	25.4	12	10	10	8
	3	4	Moist loose gray fine gravelly coarse sand w/some fine sand and silt.	NV	NP	10.6	SM	A-1-b	75.7	18.5	6	4	3	4
	4	6	Wet medium dense gray fine to coarse sand w/some fine gravel and silt.	NV	NP	15.1	SP-SM	A-2-4(0)	79.7	11.7	6	8	16	14
	5	8	Wet very loose brown fine to coarse sand w/some silt.	NV	NP	22.6	SM	A-2-4(0)	99.7	17.5	2	2	2	3
	6	10	Wet very loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	21.2	SM	A-2-4(0)	95.1	25.1	3	2	2	2
	7	12	Wet medium dense brown coarse to fine sand w/some silt.	NV	NP	24.4	SP-SM	A-2-4(0)	100	11	5	6	7	8
	8	14	Wet loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	23.5	SM	A-2-4(0)	97.6	21.8	3	2	3	3
	9	16	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	18	SM	A-1-b	95	14.1	7	5	9	7
	10	18	Wet medium dense brown fine sand w/some coarse sand and silt.	NV	NP	23.4	SM	A-2-4(0)	100	19.7	4	5	7	10
	11	24	Wet medium dense brown silty fine sand w/some coarse sand and fine gravel.	NV	NP	25	SM	A-2-4(0)	88.3	27.3	7	8	7	10
	12	29	Saturated firm gray fine sandy silt w/trace coarse sand.	29.4	NP	37.6	ML	A-4(0)	100	60.1	3	4	3	3
	13	34	Saturated stiff gray fine sandy silt w trace coarse sand and organic matter.	29.6	NP	39.5	ML	A-4(0)	100	58.4	4	4	7	8
	14	39	Saturated stiff gray fine sandy silt w some coarse sand, trace of organic matter.	31.4	NP	50.4	ML	A-4(0)	100	62.1	2	4	5	7
	15	44	Saturated stiff gray coarse to fine sandy silt w/trace organic matter.	30.3	NP	44.3	SM	A-4(0)	100	42.8	4	7	9	11
	16	49	Saturated medium dense gray coarse to fine sand w/trace silt.	NV	NP	26.4	SP-SM	A-1-b	100	10.2	5	9	10	15
	17	54	Saturated medium dense gray fine to coarse sand w/trace silt.	NV	NP	24.8	SP-SM	A-3	100	5.2	7	8	12	20
	18	59	Saturated medium dense gray fine to coarse sand w/trace fine gravel.	NV	NP	23.3	SP-SM	A-3	100	9.3	11	13	15	19
	19	64	Saturated dense gray coarse to fine sand w/trace silt.	NV	NP	21.3	SP	A-1-b	100	2.9	12	17	21	23
	20	68	Saturated dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	26.4	SP	A-1-b	97.5	3.8	10	17	21	27
		70	End Boring											

DATE : **6-08-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-371B on Chapel road over Hudson branch – Felton, DE**


Silty gravel and sand
silty Soil
Silty gravel and sand
Silty gravel and sand
stone fragment gravel and sand
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Silty gravel and sand
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10
20
30
40
50
60
70
80
Depth (feet)
N value
GWT

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 6-17-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-384C on Killens Pond road over Browns Branch- Harrington, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-31-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map of Kent County, Delaware According to Geologic Map Series No. 14 by Ramsey, K.W. October 2007. According to Geologic Map the area is situated in Swamp Deposit as, black to brown organic- rich, silty and clayey, fine to coarse quartz sand with thin inter-beds of medium to coarse quartz sand.

3. Ground Water Background

According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Harrington Area, Delaware by Durward H. Boggess and Christian F. Davis (1964) Atlas HA- 136. The

nearest well to this site the groundwater historically had been measured as 36 feet on November 1959 and between the years of 1950 to 1962 appeared from 34 to 39 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is range 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 20 to 30 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Kent County Area, Map Series, No. 11 by Scott Andres 2003. The Recharge potential is an excellent category.

5. Ground Cover

The ground cover for this site is 6 inches of asphalt top of 18 inches of fill. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 7.8 feet and caved at 6 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 4 to 57.1 percent. The Atterberg limit is 22 percent, Liquid limits is 20.2 to 31.3. The Plasticity Index was not encountered for all the entire samples and the Organic matter is 16 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition a layer of 10 feet in thickness of loose fine sand material was appeared from the surface elevation down at KP-1 south side of the bridge only this layer may need to be considering in the design. In addition the

entire sample from the depth of 2 to 10 feet from the surface had very good amount of all borrow type material to reuse according to Del-DOT standard specification except type "B" borrow.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (9- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **6-17-2016**
PROJECT NUMBER : **T201407003**
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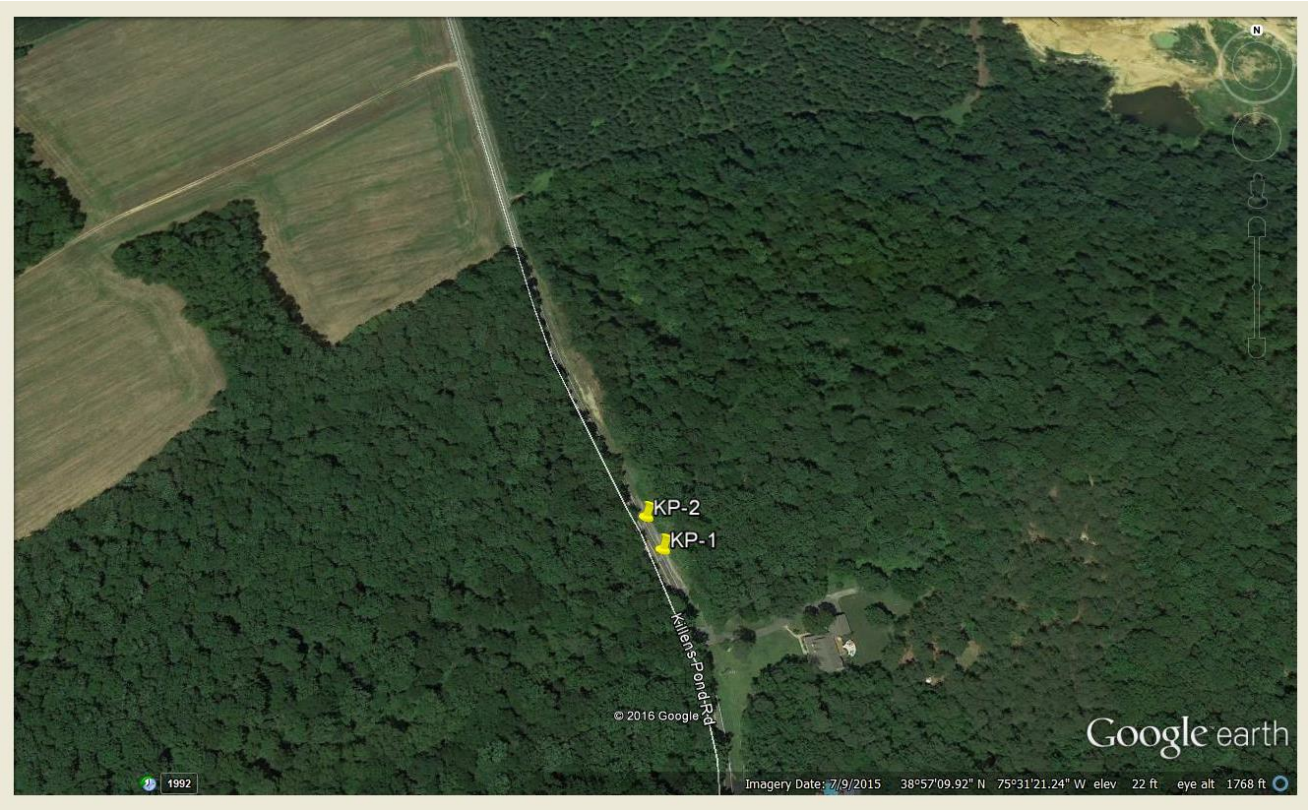


Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
KP-1	346678.648	626052.095	38.9518722	-75.5225556
KP-2	346741.409	626022.938	38.9520444	-75.5226583

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING KP-1

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 346678.648
Easting: 626052.095
Boring Surface Elev.:
Reference:
Date Started: 3/31/16
Date Completed: 3/31/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/31/16	7.8	
3/31/16	6"	22.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burdt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' 2.0'		Moist gray coarse to fine sand w/some silt, trace of fine gravel. 12" RECOVERY	A-2-4(0)	Hot-mix 6"
2.53		2	2.0' 4.0'	10 5 4 4	Moist loose gray coarse to fine sand w some silt, trace of fine gravel. 21" RECOVERY	A-1-b	
5.06		3	4.0' 6.0'	2 1 2 1	Wet very loose gray coarse to fine sand w/ some silt, trace of fine gravel. 21" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	1 1 2 3	Saturated coarse loose gray fine to coarse sand w/some silt, trace of fine gravel and organic matter. 18" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	2 2 4 5	Saturated firm gray fine to coarse sandy silt w/trace organic matter. 24" RECOVERY	A-4(0)	
		6	10.0' 12.0'	6 6 9 9	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0' 14.0'	6 6 7 8	Saturated stiff gray dense sandy silt w/trace coarse sand and organic matter. 24" RECOVERY	A-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** KP-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' – 16.0'	3 5 6 7	Saturated stiff gray coarse sandy silt w/trace coarse sand. 24" RECOVERY	A-4(0)	
17.71		9	16.0' – 18.0'	4 3 5 7	Saturated loose gray fine sand w/some silt, trace of coarse sand. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' – 20.0'	5 9 11 35	Saturated medium dense gray silty fine sand w/trace coarse sand. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	24.0' – 26.0'	3 4 7 8	Saturated medium dense gray silty fine sand w/some coarse sand and clay. 23" RECOVERY	A-2-4(0)	
27.83							
30.36		12	29.0' – 31.0'	7 13 17 14	Saturated medium dense gray fine sand w/ trace coarse sand and silt. 18" RECOVERY	A-3	
32.89							
35.42		13	34.0' – 36.0'	10 30 35 50/3	Saturated very dense gray fine sand w/trace coarse sand and silt. 24" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** KP-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	10 40 40 50/4	Saturated very dense gray fine sand w/trace coarse sand and silt. 21" RECOVERY	A-3	
43.01							
45.54		15	44.0' 46.0'	4 3 5 6	Saturated loose gray fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
48.07							
50.6		16	49.0' 51.0'	4 7 9 11	Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
53.13							
55.66		17	54.0' 56.0'	50	Saturated very dense gray fine sand w/some silt, trace of coarse sand. 12" RECOVERY	A-2-4(0)	
58.19							
		18	59.0'	50/3	Saturated very dense gray fine sand w/some	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** KP-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
					silt, trace of coarse sand.		
60.72			61.0'		16" RECOVERY		
63.25							
		19	64.0'	16 26 26 50/3	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
65.78			66.0'		24" RECOVERY		
68.31		20	68.0'	13 26 50/4	Saturated very dense gray fine to coarse sand w/some silt.	A-2-4(0)	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING KP-2

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 346741.409
Easting: 626022.938
Boring Surface Elev.:
Reference:
Date Started: 3/31/16
Date Completed: 3/31/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/31/16	12.0	
3/31/16	4.5	6.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	5 6 5 7	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 17" RECOVERY	A-2-4(0)	Hot-mix 6" Fill 18"
5.06	▼	2	4.0' – 6.0'	6 8 9 13	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
7.59		3	6.0' – 8.0'	9 10 11 10	Moist medium dense gray fine to coarse sand w/some fine gravel and silt. 20" RECOVERY	A-2-4(0)	
10.12		4	8.0' – 10.0'	7 9 9 10	Moist medium dense gray fine gravel and fine to coarse sand w/some silt. 14" RECOVERY	A-1-b	
12.65		5	10.0' – 12.0'	4 4 3 5	Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter. 14" RECOVERY	A-2-4(0)	
15.18	■	6	12.0' – 14.0'	3 3 4 3	Saturated firm gray fine sandy silt w/some coarse sand, trace of fine gravel and organic matter. 14" RECOVERY	A-4(0)	
		7	14.0'	4 5 5 4	Saturated loose gray silty fine sand w trace coarse sand and organic matter.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** KP-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		19" RECOVERY		
		8	16.0'	2 2 2 3	Saturated very loose gray fine gravelly fine sand w/some coarse sand and silt.	A-2-4(0)	
17.71			18.0'		6" RECOVERY		
		9	18.0'	15 9 8 9	Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	A-2-4(0)	
20.24			20.0'		24" RECOVERY		
22.77							
		10	24.0'	9 11 13 16	Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	A-2-4(0)	
25.3			26.0'		9" RECOVERY		
27.83							
		11	28.0'	10 13 16 17	Saturated medium dense gray fine gravelly fine sand w/some silt, trace of coarse sand.	A-2-4(0)	
30.36			30.0'		16" RECOVERY		
32.89							
		12	34.0'	11 13 15 25	No sieve analysis - Indication of saturated medium dense gray fine gravelly fine sand w/ some silt, trace of coarse sand.		
35.42			36.0'		20" RECOVERY		
37.95							
		13	38.0'	9	No sieve analysis - Indication of saturated		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** KP-2
State Contract: T201407003

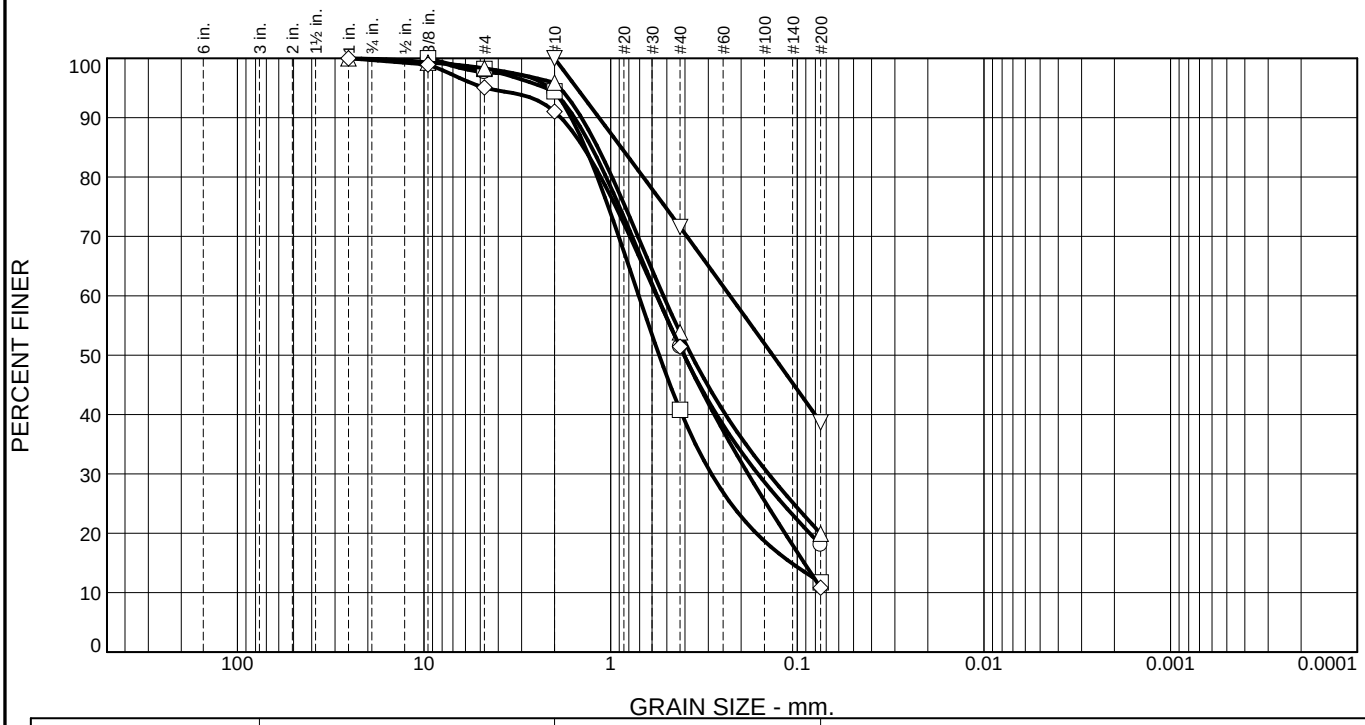
Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			40.0'	12 11 10	medium dense gray fine gravelly fine sand w/ some silt, trace of coarse sand. 15" RECOVERY		
40.48							
43.01							
		14	44.0' 46.0'	3 3 3 3	Saturated loose gray fine sand w/some coarse sand and silt, trace of fine gravel. 21" RECOVERY	A-2-4(0)	
45.54							
48.07							
		15	48.0' 50.0'	9 10 9 11	Saturated medium dense gray fine sand w/ trace coarse sand and silt. 15" RECOVERY	A-3	
50.6							
53.13							
		16	54.0' 56.0'	7 9 9 12	Saturated medium dense gray fine sand w/ some silt, trace of coarse sand. 16" RECOVERY	A-2-4(0)	
55.66							
58.19							
		17	58.0' 60.0'	8 9 11 9	Saturated medium dense gray silty fine sand w/trace coarse sand. 13" RECOVERY	A-2-4(0)	
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: KP-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	8 9 9 11	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt. 17" RECOVERY	A-1-b	
68.31		19	68.0' 70.0'	10 11 9 10	Saturated medium dense gray coarse to fine sand w/trace silt and fine gravel. 16" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.7	42.9	33.4	18.0	
□	0.0	5.6	53.6	29.1	11.7	
△	0.0	4.1	42.0	34.0	19.9	
◇	0.0	9.0	39.6	40.6	10.8	
▽	0.0	0.0	28.4	32.9	38.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2654	0.5634	0.4045	0.1626				
□	NV	NP	1.3678	0.7071	0.5496	0.2883	0.1075			
△	NV	NP	1.1730	0.5219	0.3695	0.1426				
◇	NV	NP	1.3992	0.5668	0.4043	0.1836	0.0917			
▽	31.3	NP	0.8787	0.2294	0.1356					

Material Description	USCS	AASHTO
○ Moist gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist loose gray coarse to fine sand w some silt, trace of fine gravel.	SP-SM	A-1-b
△ Wet very loose gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Saturated coarse loose gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SP-SM	A-2-4(0)
▽ Saturated firm gray fine to coarse sandy silt w/trace organic matter.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** KP-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** KP-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** KP-1 **Depth:** 6.0 **Sample Number:** 4

▽ **Source of Sample:** KP-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
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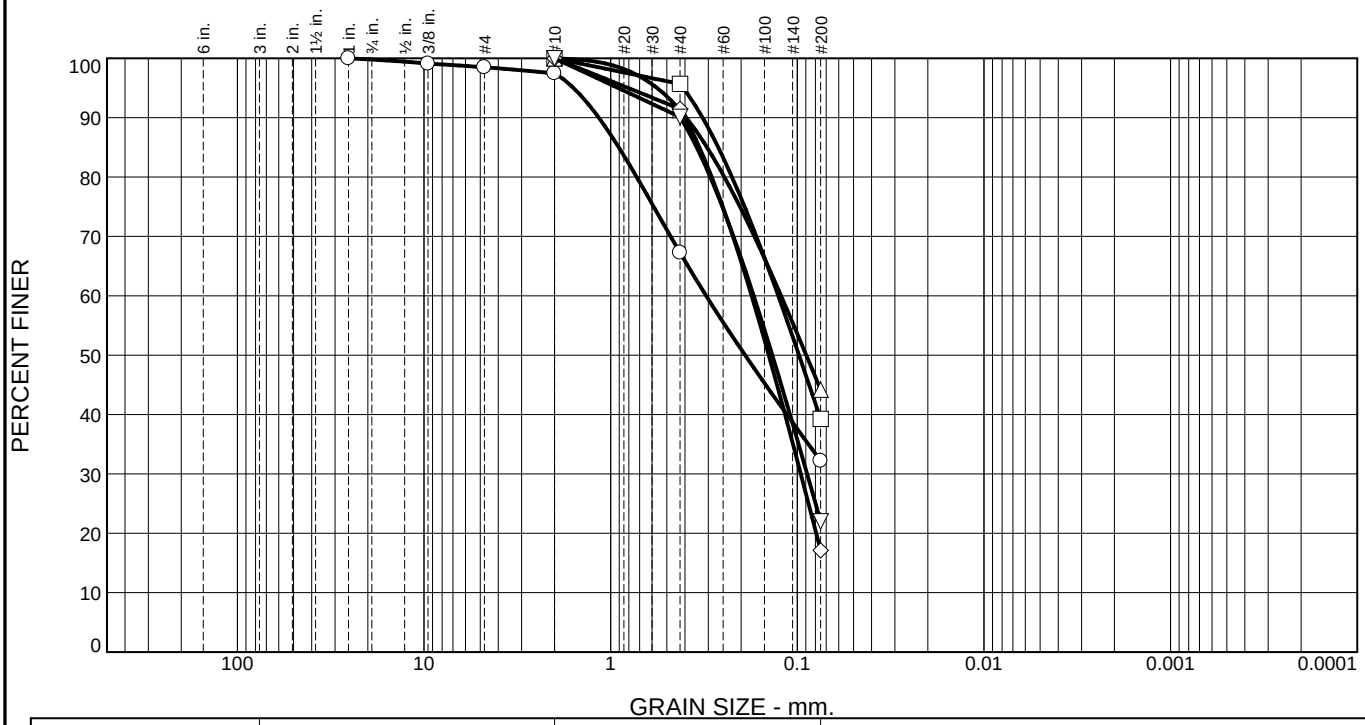
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.5	30.2	35.1	32.2	
□	0.0	0.0	4.3	56.4	39.3	
△	0.0	0.0	8.7	47.1	44.2	
◇	0.0	0.0	8.5	74.4	17.1	
▽	0.0	0.0	9.9	68.1	22.0	

╳	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27.7	NP	0.9049	0.3079	0.1905					
□	25.3	NP	0.2651	0.1265	0.0979					
△	24.4	NP	0.3046	0.1222	0.0896					
◇	NV	NP	0.3344	0.1757	0.1422	0.0958				
▽	NV	NP	0.3457	0.1713	0.1362	0.0886				

Material Description	USCS	AASHTO
○ Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Saturated stiff gray dense sandy silt w/trace coarse sand and organic matter.	SM	A-4(0)
△ Saturated stiff gray coarse sandy silt w/trace coarse sand.	SM	A-4(0)
◇ Saturated loose gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
▽ Saturated medium dense gray silty fine sand w/trace coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

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○ **Source of Sample:** KP-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** KP-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** KP-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** KP-1 **Depth:** 16.0 **Sample Number:** 9

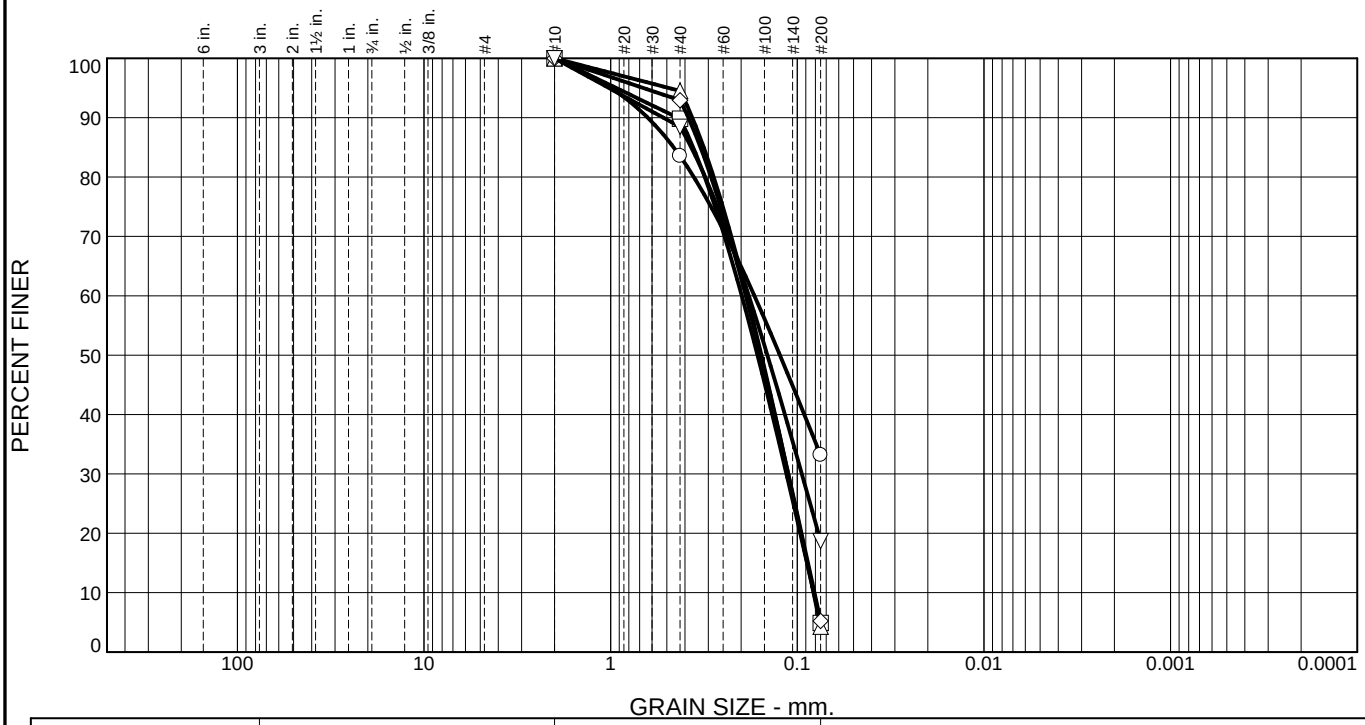
▽ **Source of Sample:** KP-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	16.5	50.3	33.2	
□	0.0	0.0	10.2	84.9	4.9	
△	0.0	0.0	5.5	90.2	4.3	
◇	0.0	0.0	7.1	87.7	5.2	
▽	0.0	0.0	11.5	69.8	18.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25.7	NP	0.4597	0.1699	0.1240					
□	NV	NP	0.3612	0.1984	0.1634	0.1144	0.0887	0.0816	0.81	2.43
△	NV	NP	0.3172	0.1861	0.1558	0.1120	0.0885	0.0819	0.82	2.27
◇	NV	NP	0.3299	0.1890	0.1572	0.1118	0.0877	0.0809	0.82	2.34
▽	NV	NP	0.3699	0.1819	0.1447	0.0946				

Material Description	USCS	AASHTO
○ Saturated medium dense gray silty fine sand w/some coarse sand and clay.	SM	A-2-4(0)
□ Saturated medium dense gray fine sand w/trace coarse sand and silt.	SP	A-3
△ Saturated very dense gray fine sand w/trace coarse sand and silt.	SP	A-3
◇ Saturated very dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
▽ Saturated loose gray fine sand w/some coarse sand and silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** KP-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** KP-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** KP-1 **Depth:** 39.0 **Sample Number:** 14

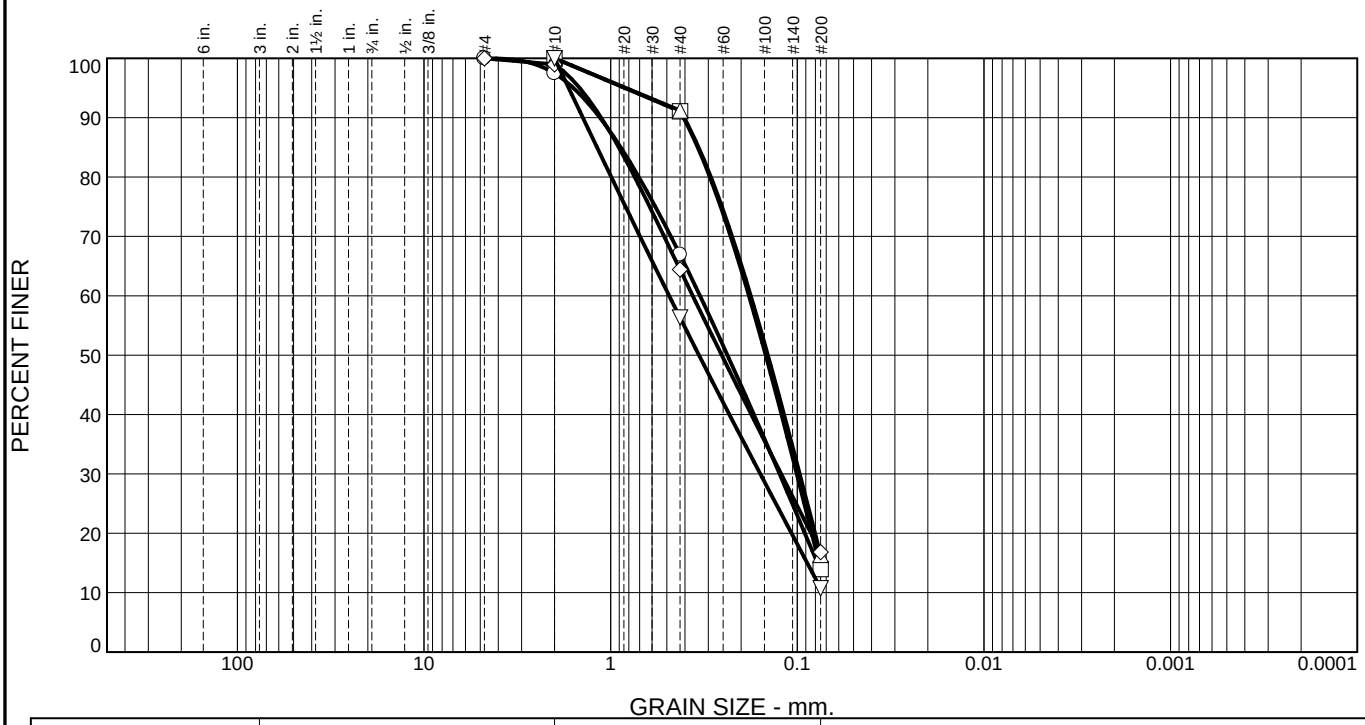
▽ **Source of Sample:** KP-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.5	30.6	53.2	13.7	
□	0.0	0.0	8.9	77.1	14.0	
△	0.0	0.0	8.8	74.8	16.4	
◇	0.0	1.0	34.6	47.6	16.8	
▽	0.0	0.0	43.7	45.6	10.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8831	0.3322	0.2367	0.1245	0.0780			
□	NV	NP	0.3414	0.1817	0.1478	0.1007	0.0764			
△	NV	NP	0.3379	0.1777	0.1438	0.0971				
◇	NV	NP	0.9044	0.3634	0.2539	0.1221				
▽	NV	NP	1.1835	0.4858	0.3364	0.1579	0.0885			

Material Description	USCS	AASHTO
○ Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated very dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
△ Saturated very dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
◇ Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated very dense gray fine to coarse sand w/some silt.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** KP-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** KP-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** KP-1 **Depth:** 64.0 **Sample Number:** 19

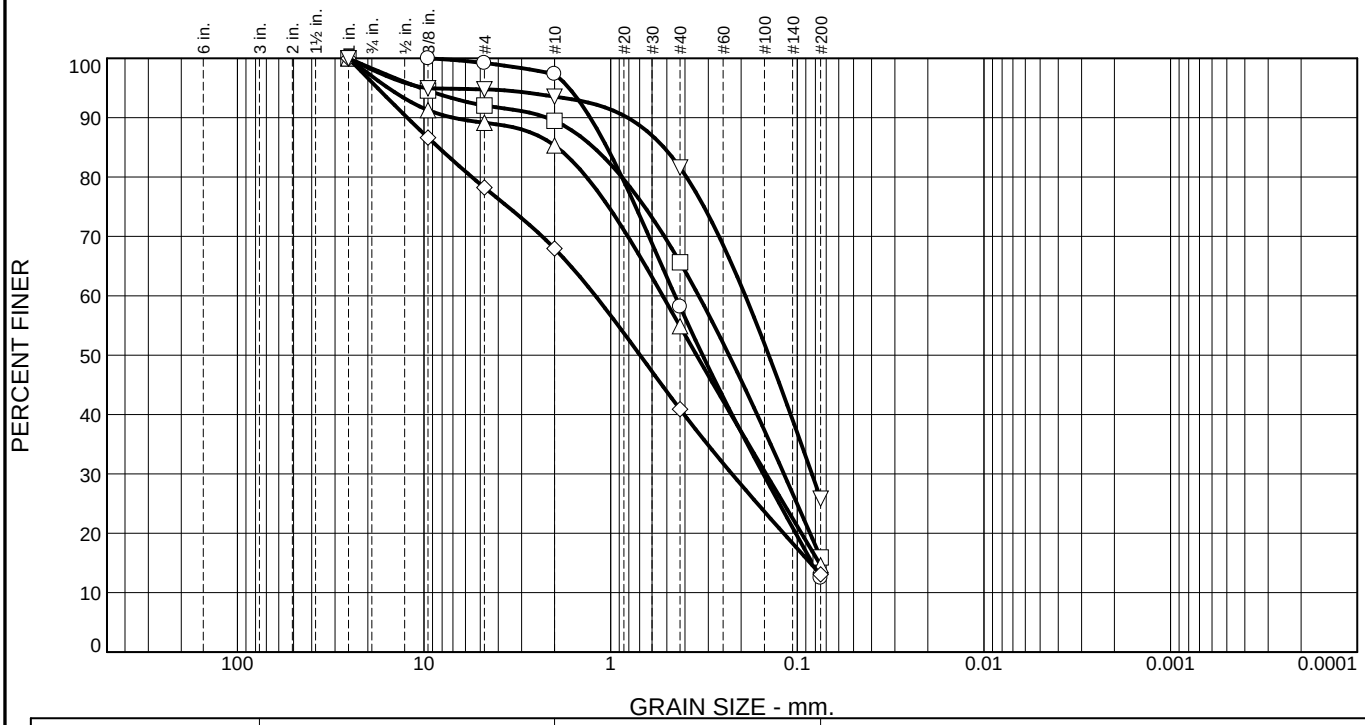
▽ **Source of Sample:** KP-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	39.2	45.7	12.5	
□	0.0	10.5	23.9	49.7	15.9	
△	0.0	14.7	30.4	40.3	14.6	
◇	0.0	32.0	27.1	27.8	13.1	
▽	0.0	6.5	11.9	55.8	25.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0463	0.4515	0.3217	0.1523	0.0831			
□	NV	NP	1.2349	0.3375	0.2322	0.1180				
△	NV	NP	1.9383	0.5261	0.3465	0.1470	0.0763			
◇	NV	NP	8.3720	1.2073	0.6957	0.2239	0.0852			
▽	NV	NP	0.5185	0.1900	0.1423	0.0835				

Material Description	USCS	AASHTO
○ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Moist medium dense gray fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
◇ Moist medium dense gray fine gravel and fine to coarse sand w/some silt.	SM	A-1-b
▽ Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-2 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** KP-2 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** KP-2 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** KP-2 **Depth:** 8.0 **Sample Number:** 4

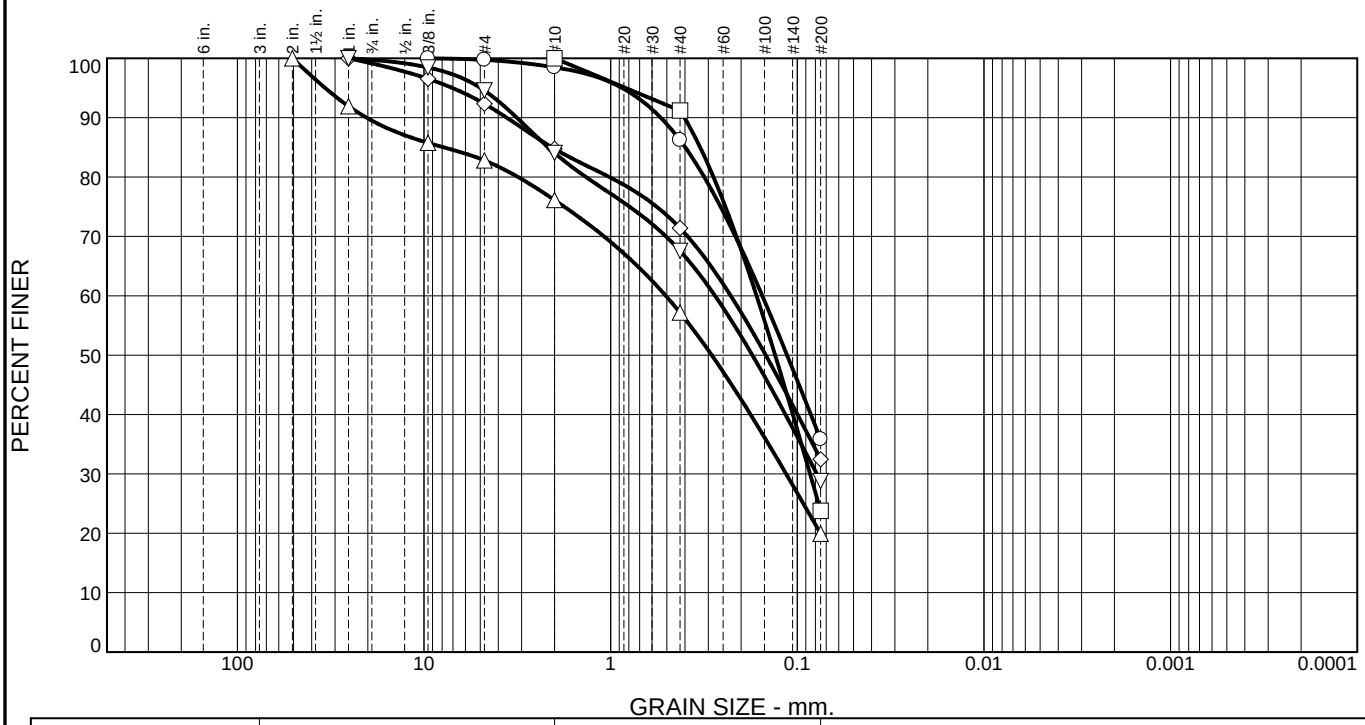
▽ **Source of Sample:** KP-2 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.5	12.3	50.4	35.8	
□	0.0	0.0	8.8	67.4	23.8	
△	0.0	23.9	18.9	37.3	19.9	
◇	0.0	15.3	13.3	38.9	32.5	
▽	0.0	15.9	16.5	38.8	28.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26.7	NP	0.3982	0.1541	0.1135					
□	NV	NP	0.3314	0.1654	0.1315	0.0855				
△	NV	NP	7.8254	0.5064	0.2872	0.1148				
◇	23.1	NP	2.0630	0.2272	0.1477					
▽	20.2	NP	2.1629	0.2758	0.1742	0.0786				

Material Description	USCS	AASHTO
○ Saturated firm gray fine sandy silt w/some coarse sand, trace of fine gravel and organic matter.	SM	A-4(0)
□ Saturated loose gray silty fine sand w trace coarse sand and organic matter.	SM	A-2-4(0)
△ Saturated very loose gray fine gravelly fine sand w/some coarse sand and silt.	SM	A-2-4(0)
◇ Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	SM	A-2-4(0)
▽ Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-2 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** KP-2 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** KP-2 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** KP-2 **Depth:** 18.0 **Sample Number:** 9

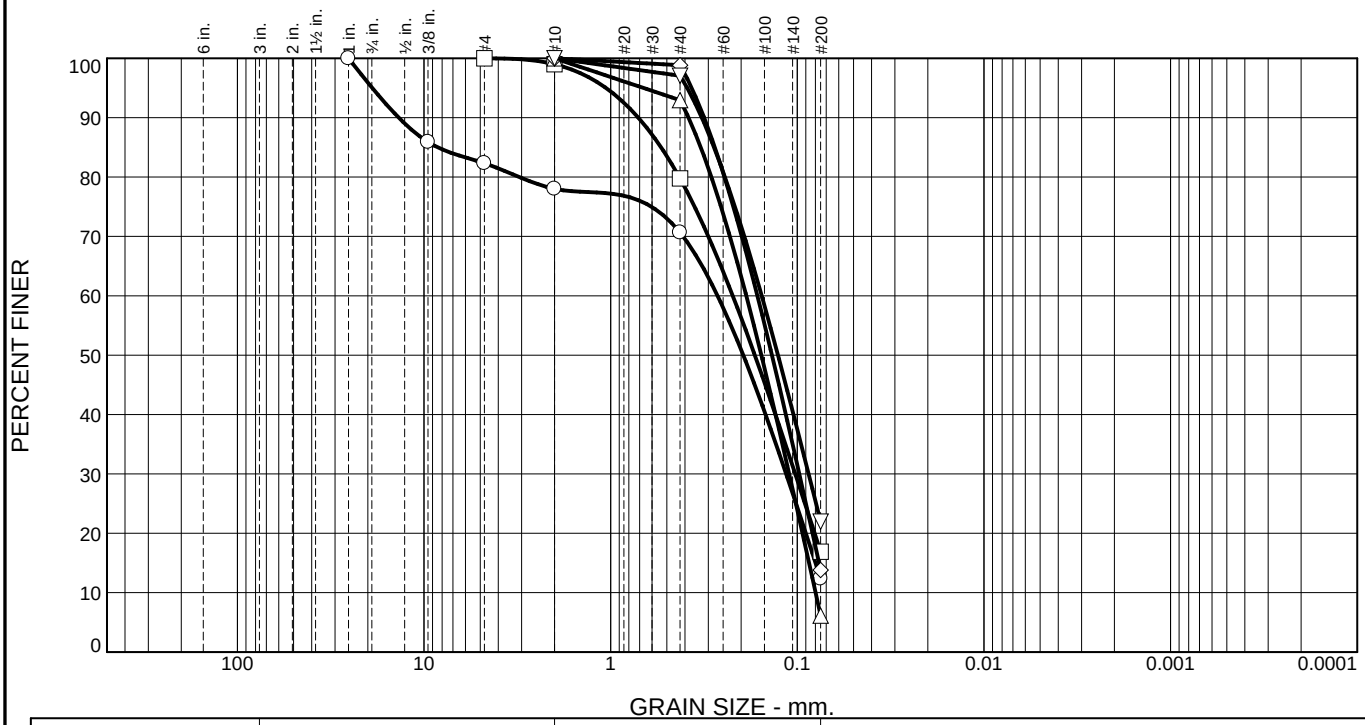
▽ **Source of Sample:** KP-2 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	22.0	7.3	58.3	12.4	
□	0.0	1.0	19.2	62.9	16.9	
△	0.0	0.0	7.0	86.9	6.1	
◇	0.0	0.0	1.2	85.0	13.8	
▽	0.0	0.0	2.9	75.1	22.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	8.4413	0.2674	0.1948	0.1148	0.0799			
□	NV	NP	0.5367	0.2217	0.1690	0.1026				
△	NV	NP	0.3290	0.1877	0.1559	0.1106	0.0865	0.0798	0.82	2.35
◇	NV	NP	0.2766	0.1637	0.1368	0.0976	0.0765			
▽	NV	NP	0.2793	0.1552	0.1270	0.0870				

Material Description	USCS	AASHTO
○ Saturated medium dense gray fine gravelly fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
□ Saturated loose gray fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated medium dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
◇ Saturated medium dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
▽ Saturated medium dense gray silty fine sand w/trace coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-2 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** KP-2 **Depth:** 44.0 **Sample Number:** 14

△ **Source of Sample:** KP-2 **Depth:** 48.0 **Sample Number:** 15

◇ **Source of Sample:** KP-2 **Depth:** 54.0 **Sample Number:** 16

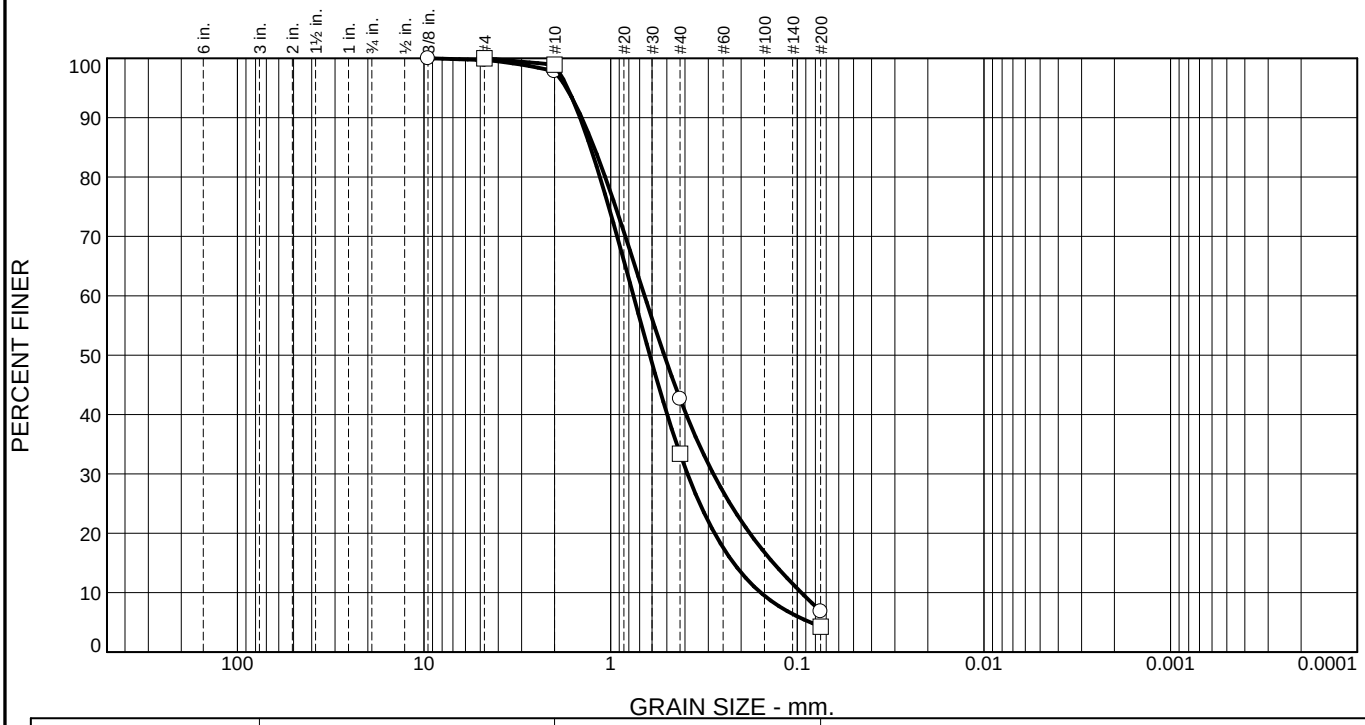
▽ **Source of Sample:** KP-2 **Depth:** 58.0 **Sample Number:** 17

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.2	55.2	35.8	6.8	
□	0.0	1.1	65.5	29.1	4.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2269	0.6581	0.5162	0.2816	0.1343	0.0951	1.27	6.92
□	NV	NP	1.2831	0.7549	0.6169	0.3877	0.2196	0.1571	1.27	4.81

Material Description	USCS	AASHTO
○ Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Saturated medium dense gray coarse to fine sand w/trace silt and fine gravel.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** KP-2 **Depth:** 64.0 **Sample Number:** 18

□ **Source of Sample:** KP-2 **Depth:** 68.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

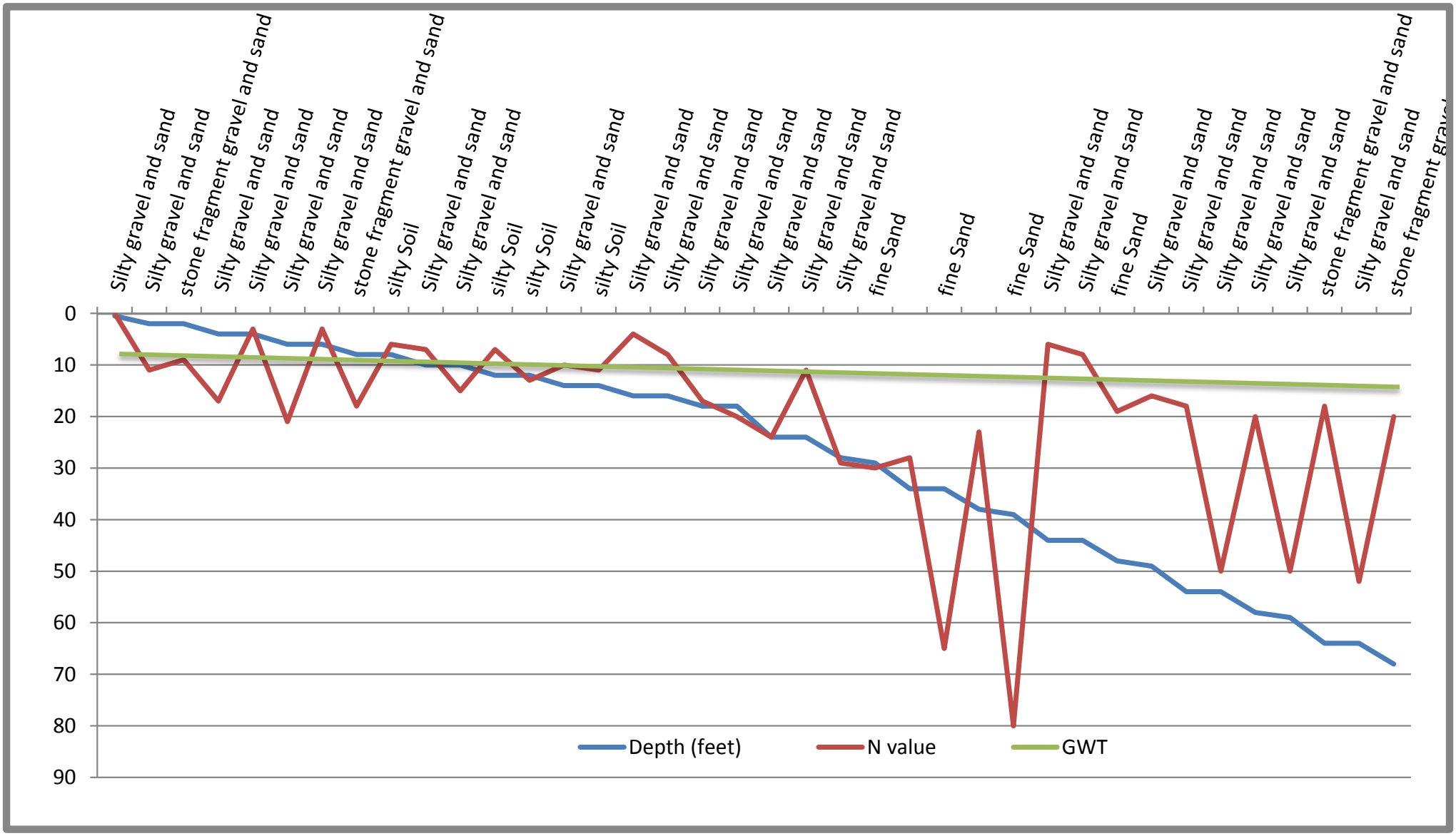
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
BC-3	1	0.5	Moist gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	4	SM	A-2-4(0)	94.3	18				
	2	2	Moist loose gray coarse to fine sand w some silt, trace of fine gravel.	NV	NP	5.4	SP-SM	A-1-b	94.4	11.7	10	5	4	4
	3	4	Wet very loose gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	21.8	SM	A-2-4(0)	95.9	19.9	2	1	2	1
	4	6	Saturated coarse loose gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	38.1	SP-SM	A-2-4(0)	91	10.8	1	1	2	3
	5	8	Saturated firm gray fine to coarse sandy silt w/trace organic matter.	31.3	NP	38.6	SM	A-4(0)	100	38.7	2	2	4	5
	6	10	Saturated medium dense gray silty fine to coarse sand w/trace fine gravel.	27.7	NP	28.8	SM	A-2-4(0)	97.5	32.2	6	6	9	9
	7	12	Saturated stiff gray dense sandy silt w/trace coarse sand and organic matter.	25.3	NP	28.9	SM	A-4(0)	100	39.3	6	6	7	8
	8	14	Saturated stiff gray coarse sandy silt w/trace coarse sand.	24.4	NP	28.2	SM	A-4(0)	100	44.2	3	5	6	7
	9	16	Saturated loose gray fine sand w/some silt, trace of coarse sand.	NV	NP	32.4	SM	A-2-4(0)	100	17.1	4	3	5	7
	10	18	Saturated medium dense gray silty fine sand w/trace coarse sand.	NV	NP	22.7	SM	A-2-4(0)	100	22	5	9	11	35
	11	24	Saturated medium dense gray silty fine sand w/some coarse sand and clay.	25.7	NP	57.1	SM	A-2-4(0)	100	33.2	3	4	7	8
	12	29	Saturated medium dense gray fine sand w/trace coarse sand and silt.	NV	NP	23.2	SP	A-3	100	4.9	7	13	17	14
	13	34	Saturated very dense gray fine sand w/trace coarse sand and silt.	NV	NP	25.4	SP	A-3	100	4.3	10	30	35	50/3
	14	39	Saturated very dense gray fine sand w/trace coarse sand and silt.	NV	NP	22	SP-SM	A-3	100	5.2	10	40	40	50/4
	15	44	Saturated loose gray fine sand w/some coarse sand and silt.	NV	NP	33.5	SM	A-2-4(0)	100	18.7	4	3	5	6
	16	49	Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	28.2	SM	A-2-4(0)	97.5	13.7	4	7	9	11
	17	54	Saturated very dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	30.8	SM	A-2-4(0)	100	14	50			
	18	59	Saturated very dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	34.7	SM	A-2-4(0)	100	16.4	50/3			
	19	64	Saturated very dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	30.4	SM	A-2-4(0)	99	16.8	16	26	26	50/3
	20	68	Saturated very dense gray fine to coarse sand w/some silt.	NV	NP	21.1	SP-SM	A-2-4(0)	100	10.7	13	26	50/4	
		70	End Boring											
	1	2	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	8.1	SM	A-2-4(0)	97.4	12.5	5	6	5	7
	2	4	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	13.3	SM	A-2-4(0)	89.5	15.9	6	8	9	13
	3	6	Moist medium dense gray fine to coarse sand w/some fine gravel and silt.	NV	NP	11	SM	A-2-4(0)	85.3	14.6	9	10	11	10
	4	8	Moist medium dense gray fine gravel and fine to coarse sand w/some silt.	NV	NP	13.7	SM	A-1-b	68	13.1	7	9	9	10
	5	10	Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter.	NV	NP	28	SM	A-2-4(0)	93.5	25.8	4	4	3	5
	6	12	Saturated firm gray fine sandy silt w/some coarse sand, trace of fine gravel and organic matter.	26.7	NP	31.8	SM	A-4(0)	98.5	35.8	3	3	4	3
	7	14	Saturated loose gray silty fine sand w trace coarse sand and organic matter.	NV	NP	28.1	SM	A-2-4(0)	100	23.8	4	5	5	4
	8	16	Saturated very loose gray fine gravelly fine sand w/some coarse sand and silt.	NV	NP	25.5	SM	A-2-4(0)	76.1	19.9	2	2	2	3
	9	18	Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	23.1	NP	21	SM	A-2-4(0)	84.7	32.5	15	9	8	9
	10	24	Saturated medium dense gray silty fine sand w/some coarse sand and fine gravel.	20.2	NP	19.4	SM	A-2-4(0)	84.1	28.8	9	11	13	16
	11	28	Saturated medium dense gray fine gravelly fine sand w/some silt, trace of coarse sand.	NV	NP	21.8	SM	A-2-4(0)	78	12.4	10	13	16	17
	12	34	No sieve analysis - Indication of saturated medium dense gray fine gravelly fine sand w/some silt, trace of c								11	13	15	25
	13	38	No sieve analysis - Indication of saturated medium dense gray fine gravelly fine sand w/some silt, trace of c								9	12	11	10
	14	44	Saturated loose gray fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	30.1	SM	A-2-4(0)	99	16.9	3	3	3	3
	15	48	Saturated medium dense gray fine sand w/trace coarse sand and silt.	NV	NP	27.7	SP-SM	A-3	100	6.1	9	10	9	11
	16	54	Saturated medium dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	32.2	SM	A-2-4(0)	100	13.8	7	9	9	12
	17	58	Saturated medium dense gray silty fine sand w/trace coarse sand.	NV	NP	33.1	SM	A-2-4(0)	100	22	8	9	11	9
	18	64	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	25.6	SW-SM	A-1-b	97.8	6.8	8	9	9	11
	19	68	Saturated medium dense gray coarse to fine sand w/trace silt and fine gravel.	NV	NP	22	SP	A-1-b	98.9	4.3	10	11	9	10
		70	End Boring											

DATE : **6-17-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-384C on Killens Pond road over Browns Branch- Harrington, DE**


Silty gravel and sand
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stone fragment gravel and sand
Silty gravel and sand
stone fragment gravel
0
10
20
30
40
50
60
70
80
90
Depth (feet)
N value
GWT

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 6-15-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR2-442A on Abbotts Pond road over Tantrough – Greenwood, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 4-20-2016. Walton Corporation-Newark, Delaware drilled three Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map of Mispillion River Quadrangles, Delaware Map Series No. 8 by Ramsey, K.W June 1993. According to Geologic Map the area is situated in Columbia Formation is Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to reddish-gray clayey silt are common. In places, the upper 5 to 25 feet consists of grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand.

3. Ground Water Background

According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Wyoming Area, Delaware by Durward H. Boggess, Christian F. Davis, and O.J Coskery (1964) Atlas HA-133. The nearest well to this site the groundwater historically had been measured as 41 feet on November 1959 and between the years of 1950 to 1962 appeared from 39 to 45 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is range 6 to 9 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Kent County Area, Map Series, No. 11 by Scott Andres 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 4 inches of asphalt top of 3 inches of stone. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 9 feet and caved at 8.2 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 8.7 to 28.2 percent. The Atterberg limit and Organic matter was not encountered for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition, a layer of 8 feet in thickness of fine sand material was appeared at 10 feet from the surface elevation at the

borings at the east side of the bridge AP-1 this layer may need to be considering in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had very good amount of all borrow type material to reuse according to Del-DOT standard specification except type "B" borrow.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 6-15-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR2-442A on Abbotts Pond road over Tantrough – Greenwood, DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
AP-1	323965.672	635327.360	38.8895361	-75.4898778
AP-2	324009.266	635215.118	38.8896556	-75.4902722

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING AP-1

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 323965.672
Easting: 635327.360
Boring Surface Elev.:
Reference:
Date Started: 4/20/16
Date Completed: 4/20/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
4/20/16	9.0	
4/20/16	6.0	8.2

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	7 6 6 3	Moist medium dense gray silty fine to coarse sand w/trace fine gravel. 20" RECOVERY	A-2-4(0)	Hot-mix 6" Stone 3"
5.06		2	4.0' – 6.0'	3 3 3 3	Wet loose gray silty fine to coarse sand w/ trace fine gravel. 19" RECOVERY	A-2-4(0)	
7.59	▽	3	6.0' – 8.0'	7 10 8 11	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 19" RECOVERY	A-2-4(0)	
10.12	■	4	8.0' – 10.0'	4 5 5 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 21" RECOVERY	A-2-4(0)	
12.65		5	10.0' – 12.0'	2 3 3 2	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 19" RECOVERY	A-1-b	
15.18		6	12.0' – 14.0'	2 2 2 1	Wet very loose brown fine to coarse sand w/ trace fine gravel and silt. 12" RECOVERY	A-3	
		7	14.0'	2 3 4 3	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AP-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		10" RECOVERY		
		8	16.0'	3 4 5 5	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	A-3	
17.71			18.0'		15" RECOVERY		
		9	18.0'	6 7 9 11	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
20.24			20.0'		17" RECOVERY		
22.77							
		10	24.0'	7 8 7 7	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
25.3			26.0'		17" RECOVERY		
27.83							
		11	28.0'	7 9 8 7	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
30.36			30.0'		16" RECOVERY		
32.89							
		12	34.0'	5 6 6 8	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
35.42			36.0'		18" RECOVERY		
37.95							
		13	38.0'	2	Wet loose brown fine gravelly coarse sand w/	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AP-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				4 5 3	trace fine sand and silt.		
			40.0'		15" RECOVERY		
40.48							
43.01							
		14	44.0'	7 9 11 15	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	A-1-b	
45.54			46.0'		21" RECOVERY		
48.07							
		15	48.0'	4 4 5 4	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			50.0'		15" RECOVERY		
50.6							
53.13							
		16	54.0'	7 9 15 22	Wet medium dense brown coarse sandy fine gravel w/trace fine sand and silt.	A-1-a	
55.66			56.0'		19" RECOVERY		
58.19							
		17	58.0'	5 7 9 11	Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	A-1-b	
			60.0'		11" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: AP-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	5 6 8 7	Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt. 18" RECOVERY	A-1-b	
68.31		19	68.0' 70.0'	6 7 9 13	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 15" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING AP-2

Project Name: Bridge Concept Design
Location:
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 324009.266
Easting: 635215.118
Boring Surface Elev.:
Reference:
Date Started: 4/20/16
Date Completed: 4/20/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
4/20/16	9.0	
4/20/16	5.5	10.1

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		Moist brown fine to coarse sand w/some silt. 20" RECOVERY	A-2-4(0)	Hot-mix 4"
2.53		2	2.0' 4.0'	12 8 6 3	Moist medium dense brown silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
5.06	▽	3	4.0' 6.0'	2 1 3 4	Wet very loose brown silty fine to coarse sand w/trace fine gravel. 18" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	3 7 7 15	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12	■	5	8.0' 10.0'	10 7 5 5	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
		6	10.0' 12.0'	3 3 3 4	Wet loose brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
12.65		7	12.0'	4 5 7 8	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	A-3	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AP-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	4 6 7 8	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 19" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	6 5 6 8	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 21" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	6 7 7 9	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	24.0' 26.0'	4 6 7 8	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 19" RECOVERY	A-1-b	
27.83							
30.36		12	29.0' 31.0'	6 9 9 17	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	34.0' 36.0'	7 9 11 15	Wet medium dense brown coarse sand w/ some fine sand and fine gravel, trace of silt. 20" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AP-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	6 8 7 9	Wet medium dense brown coarse sand w/ some fine gravel, trace of fine sand and silt. 18" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	6 11 12 11	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 21" RECOVERY	A-1-b	
48.07							
50.6		16	49.0' 51.0'	10 11 12 9	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 21" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	13 16 17 19	Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt. 20" RECOVERY	A-1-b	
58.19							
				6			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AP-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	9 12 13	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	A-3	
60.72			61.0'		18" RECOVERY		
63.25							
		19	64.0'	7 9 14 18	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	A-3	
65.78			66.0'		22" RECOVERY		
68.31		20	68.0'	6 9 9 13	Wet medium dense brown fine sand w/some silt, trace of coarse sand.	A-2-4(0)	
			70.0'		21" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

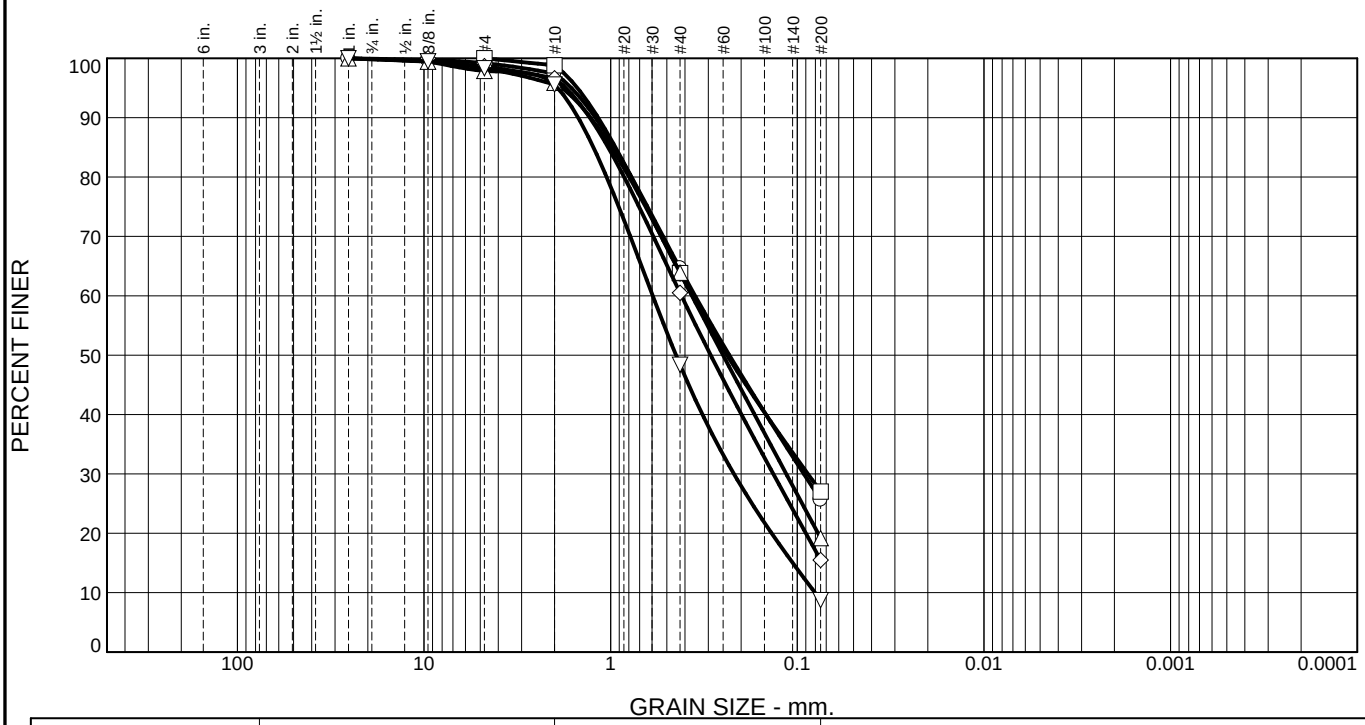
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	32.8	39.0	25.6	
□	0.0	1.2	35.0	36.8	27.0	
△	0.0	4.1	32.0	44.7	19.2	
◇	0.0	3.4	36.1	45.0	15.5	
▽	0.0	4.4	47.2	39.7	8.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9541	0.3531	0.2313	0.0923				
□	NV	NP	0.9426	0.3654	0.2378	0.0878				
△	NV	NP	0.9920	0.3666	0.2498	0.1146				
◇	NV	NP	1.0315	0.4175	0.2909	0.1345				
▽	NV	NP	1.2371	0.5949	0.4465	0.2186	0.1057	0.0804	1.00	7.40

Material Description	USCS	AASHTO
○ Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Wet loose gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-1 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** AP-1 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** AP-1 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** AP-1 **Depth:** 8.0 **Sample Number:** 4

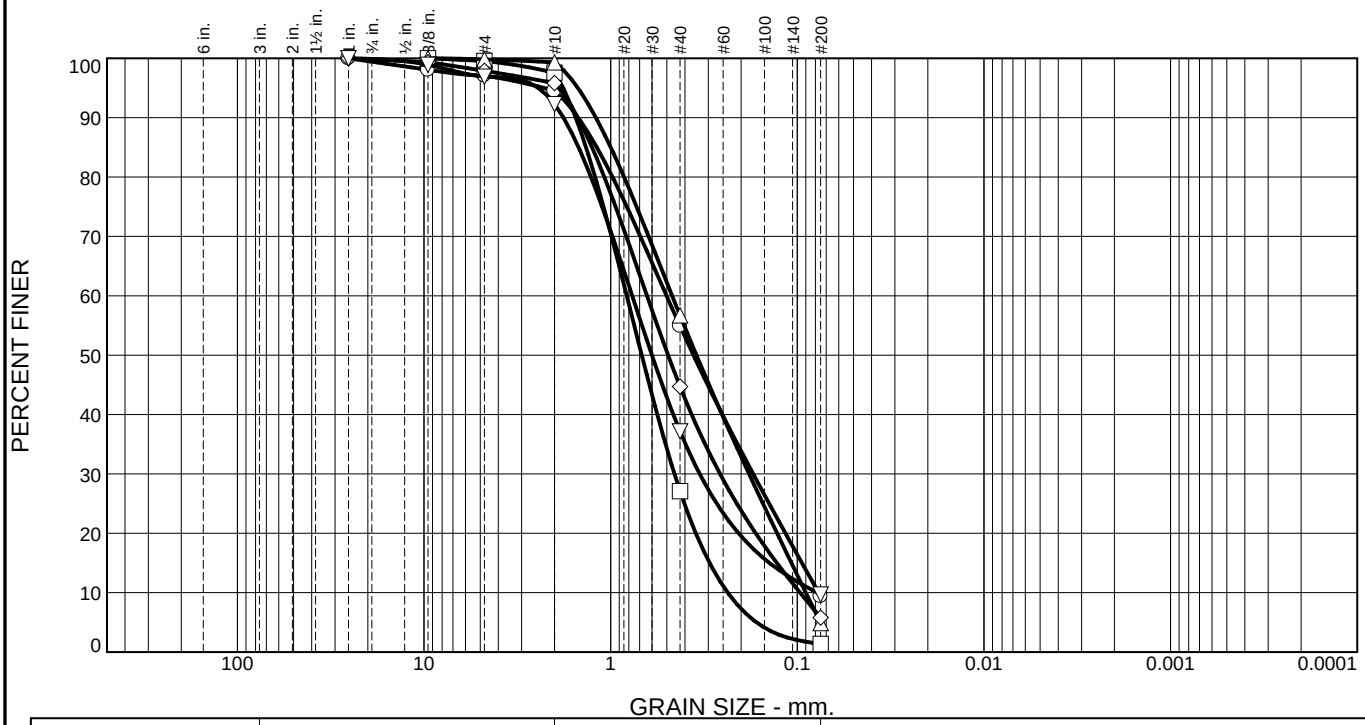
▽ **Source of Sample:** AP-1 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.5	39.6	45.5	9.4	
□	0.0	2.4	70.5	25.7	1.4	
△	0.0	0.7	42.6	51.8	4.9	
◇	0.0	4.2	51.1	38.9	5.8	
▽	0.0	7.7	55.1	27.5	9.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1868	0.5019	0.3600	0.1725	0.0944	0.0769	0.77	6.53
□	NV	NP	1.3554	0.8201	0.6814	0.4552	0.2949	0.2358	1.07	3.48
△	NV	NP	0.9991	0.4683	0.3471	0.1814	0.1076	0.0901	0.78	5.20
◇	NV	NP	1.2585	0.6390	0.4925	0.2593	0.1287	0.0966	1.09	6.61
▽	NV	NP	1.4859	0.7666	0.6010	0.3335	0.1410	0.0784	1.85	9.78

Material Description	USCS	AASHTO
○ Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
△ Wet loose brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
◇ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-1 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** AP-1 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** AP-1 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** AP-1 **Depth:** 18.0 **Sample Number:** 9

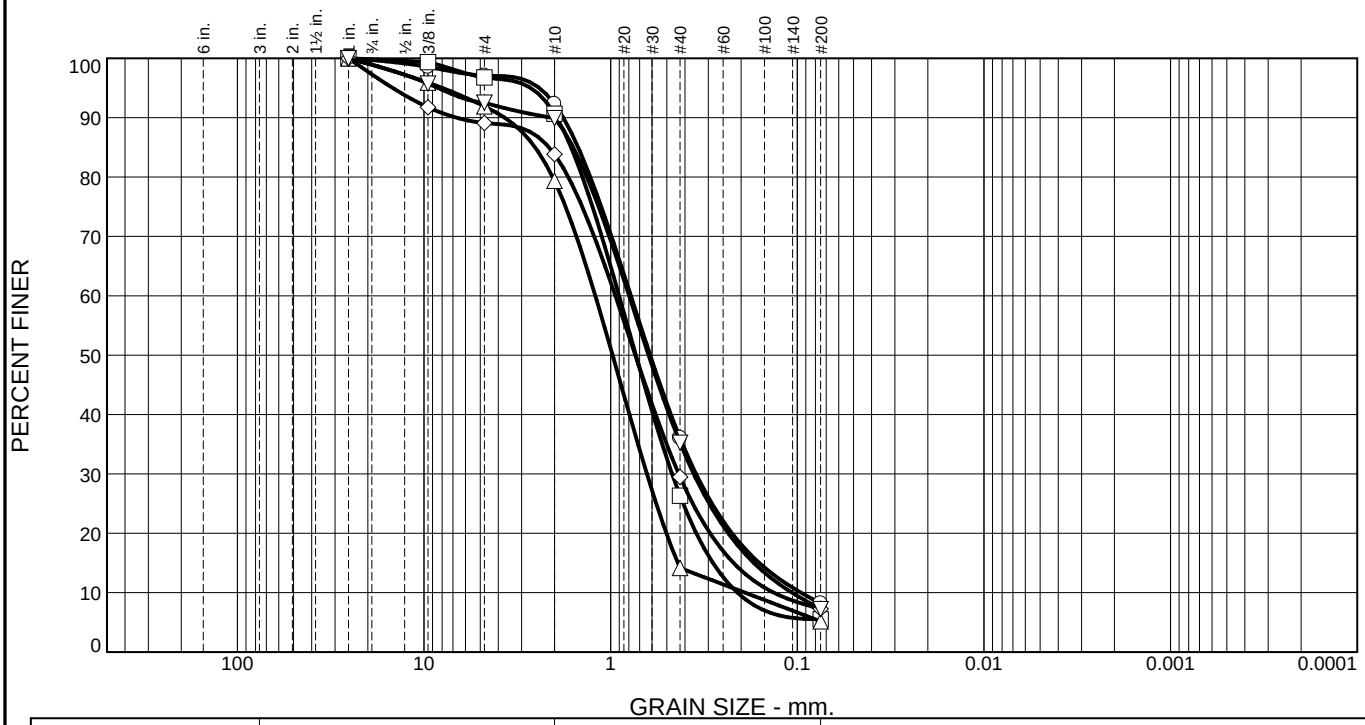
▽ **Source of Sample:** AP-1 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.7	56.3	27.8	8.2	
□	0.0	9.3	64.4	20.8	5.5	
△	0.0	20.6	65.3	8.9	5.2	
◇	0.0	16.2	54.3	22.2	7.3	
▽	0.0	10.1	54.7	28.0	7.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4943	0.7793	0.6141	0.3489	0.1600	0.0956	1.63	8.15
□	NV	NP	1.6292	0.9013	0.7330	0.4688	0.2831	0.2094	1.16	4.30
△	NV	NP	2.5406	1.2086	0.9768	0.6394	0.4365	0.1906	1.77	6.34
◇	NV	NP	2.1399	0.9440	0.7379	0.4319	0.2197	0.1338	1.48	7.05
▽	NV	NP	1.5871	0.7964	0.6267	0.3590	0.1710	0.1068	1.51	7.46

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet loose brown fine gravelly coarse sand w/trace fine sand and silt.	SW-SM	A-1-b
◇ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
▽ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-1 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** AP-1 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** AP-1 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** AP-1 **Depth:** 44.0 **Sample Number:** 14

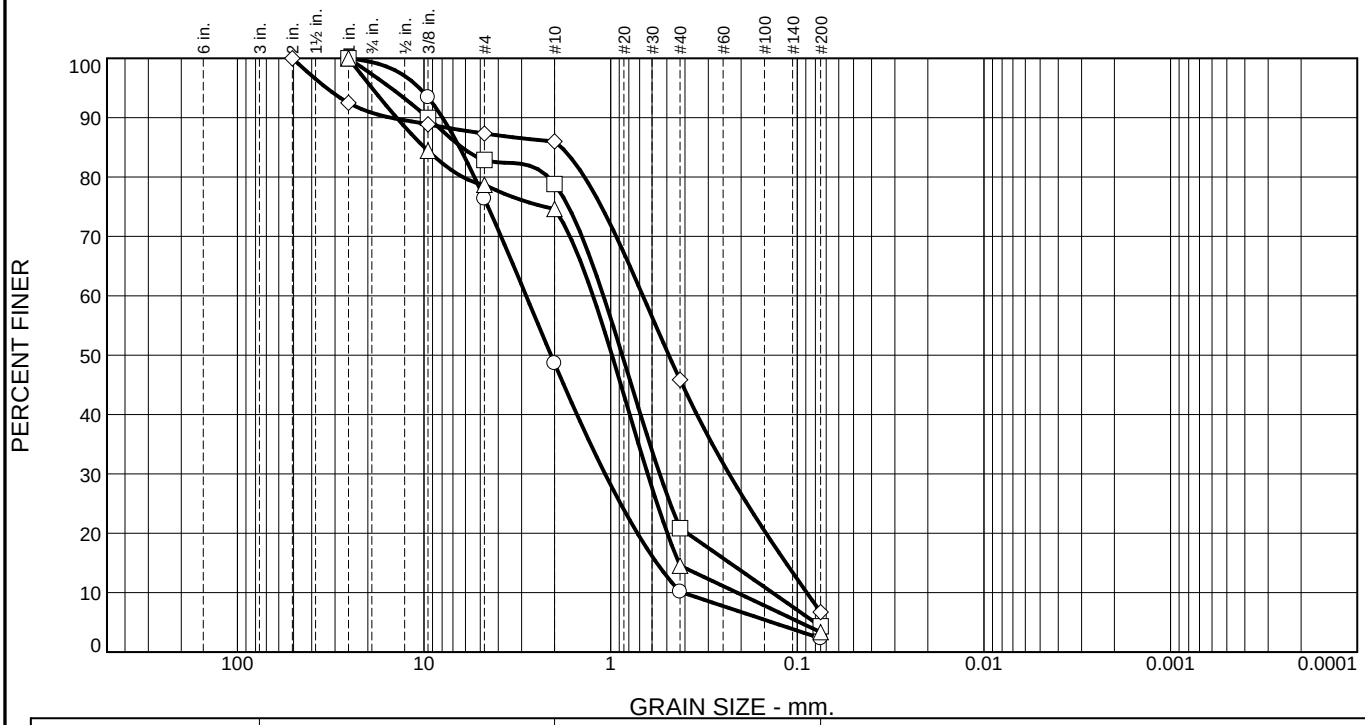
▽ **Source of Sample:** AP-1 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	51.4	38.5	7.8	2.3	
□	0.0	21.2	57.9	16.6	4.3	
△	0.0	25.4	60.1	11.2	3.3	
◇	0.0	14.0	40.1	39.2	6.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	6.4483	2.8380	2.0873	1.0714	0.5658	0.4112	0.98	6.90
□	NV	NP	6.2721	1.0942	0.8670	0.5460	0.2298	0.1360	2.00	8.05
△	NV	NP	9.9492	1.2434	0.9840	0.6336	0.4310	0.2102	1.54	5.92
◇	NV	NP	1.8356	0.6721	0.4880	0.2319	0.1149	0.0889	0.90	7.56

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse sandy fine gravel w/trace fine sand and silt.	SP	A-1-a
□ Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SW	A-1-b
△ Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SP	A-1-b
◇ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-1 **Depth:** 54.0 **Sample Number:** 16

□ **Source of Sample:** AP-1 **Depth:** 58.0 **Sample Number:** 17

△ **Source of Sample:** AP-1 **Depth:** 64.0 **Sample Number:** 18

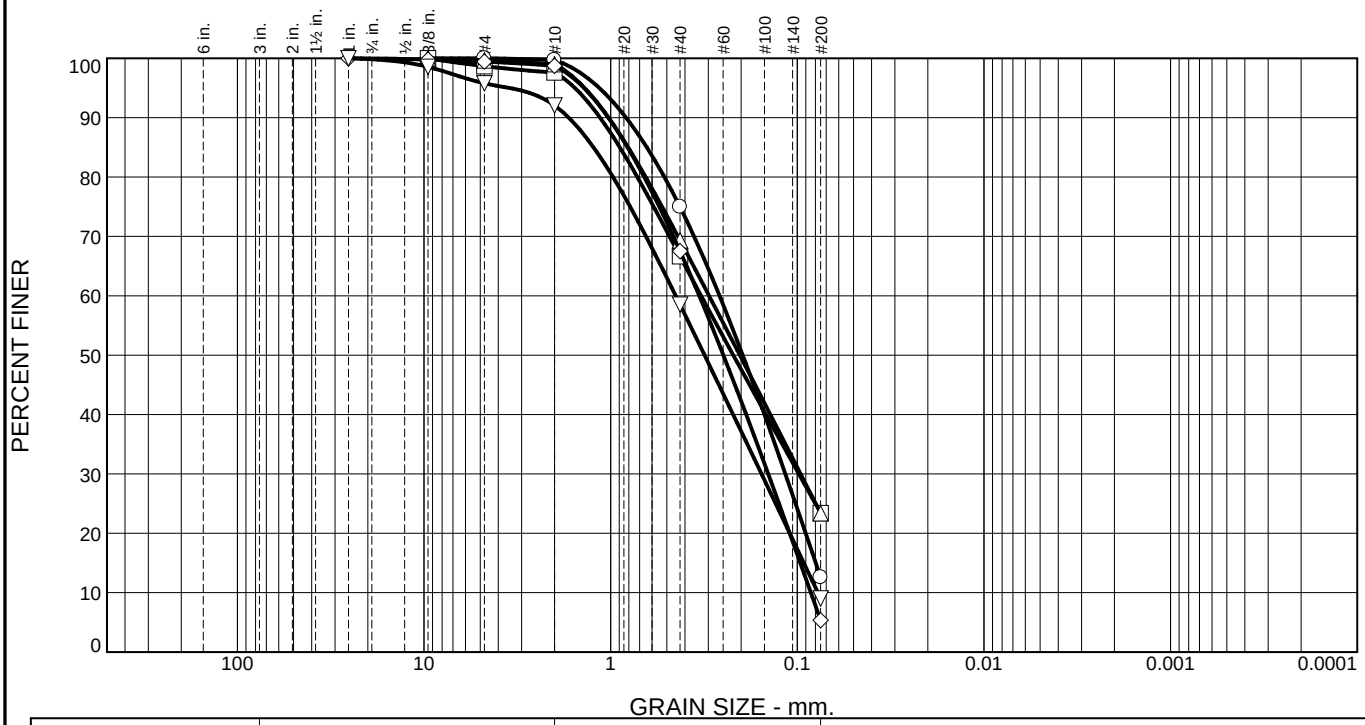
◇ **Source of Sample:** AP-1 **Depth:** 68.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	24.7	62.4	12.6	
□	0.0	2.4	30.9	43.3	23.4	
△	0.0	1.0	29.7	45.9	23.4	
◇	0.0	1.3	31.2	62.1	5.4	
▽	0.0	7.9	33.6	49.5	9.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6401	0.2610	0.1962	0.1160	0.0796			
□	NV	NP	0.8929	0.3277	0.2204	0.0982				
△	NV	NP	0.8061	0.2970	0.2032	0.0961				
◇	NV	NP	0.8112	0.3350	0.2490	0.1432	0.0964	0.0846	0.72	3.96
▽	NV	NP	1.2357	0.4482	0.3139	0.1555	0.0923	0.0776	0.70	5.78

Material Description	USCS	AASHTO
○ Moist brown fine to coarse sand w/some silt.	SM	A-2-4(0)
□ Moist medium dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Wet very loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** AP-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** AP-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** AP-2 **Depth:** 6.0 **Sample Number:** 4

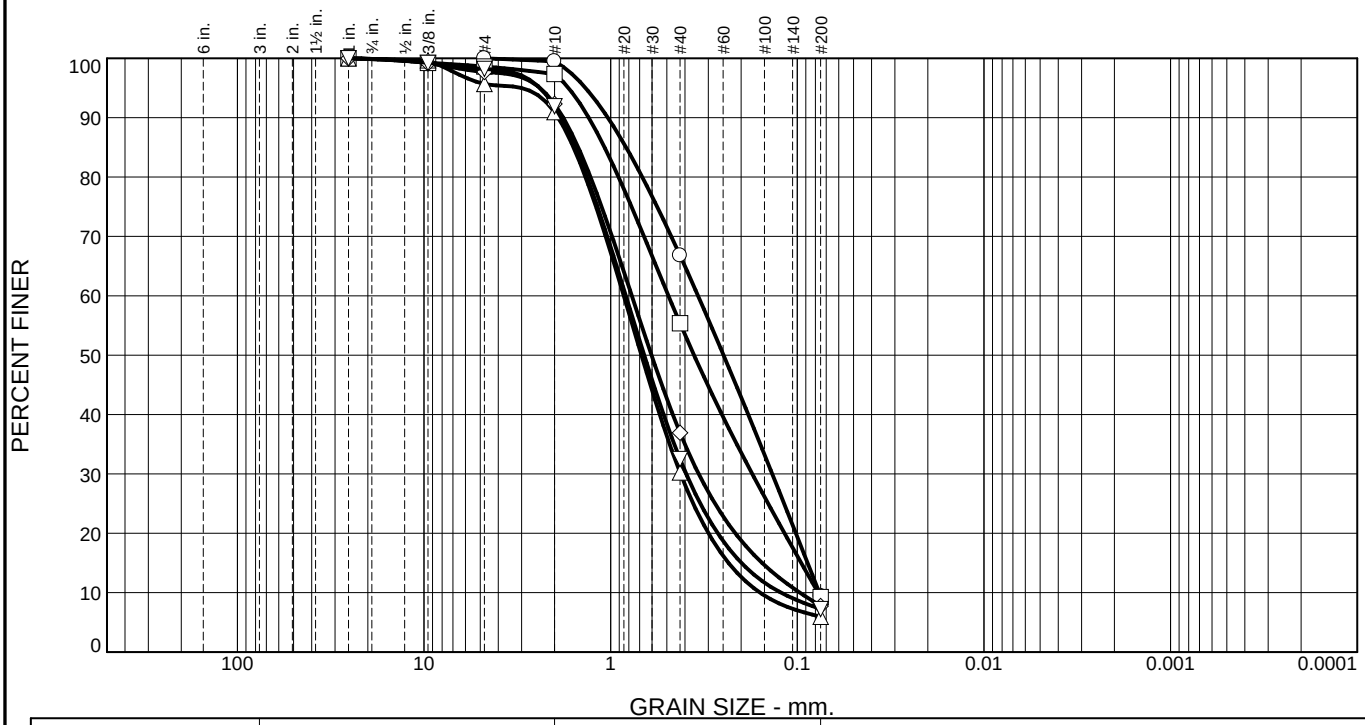
▽ **Source of Sample:** AP-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.5	32.7	57.4	9.4	
□	0.0	2.6	42.0	46.1	9.3	
△	0.0	9.1	60.7	24.3	5.9	
◇	0.0	7.7	55.4	29.2	7.7	
▽	0.0	8.1	59.4	25.3	7.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8268	0.3402	0.2484	0.1363	0.0881	0.0762	0.72	4.46
□	NV	NP	1.0783	0.4902	0.3575	0.1744	0.0953	0.0774	0.80	6.34
△	NV	NP	1.5817	0.8507	0.6844	0.4222	0.2334	0.1586	1.32	5.37
◇	NV	NP	1.4936	0.7705	0.6040	0.3376	0.1544	0.0969	1.53	7.95
▽	NV	NP	1.5480	0.8292	0.6611	0.3937	0.1992	0.1224	1.53	6.78

Material Description	USCS	AASHTO
○ Wet loose brown fine to coarse sand w/trace silt.	SP-SM	A-3
□ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
◇ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** AP-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** AP-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** AP-2 **Depth:** 16.0 **Sample Number:** 9

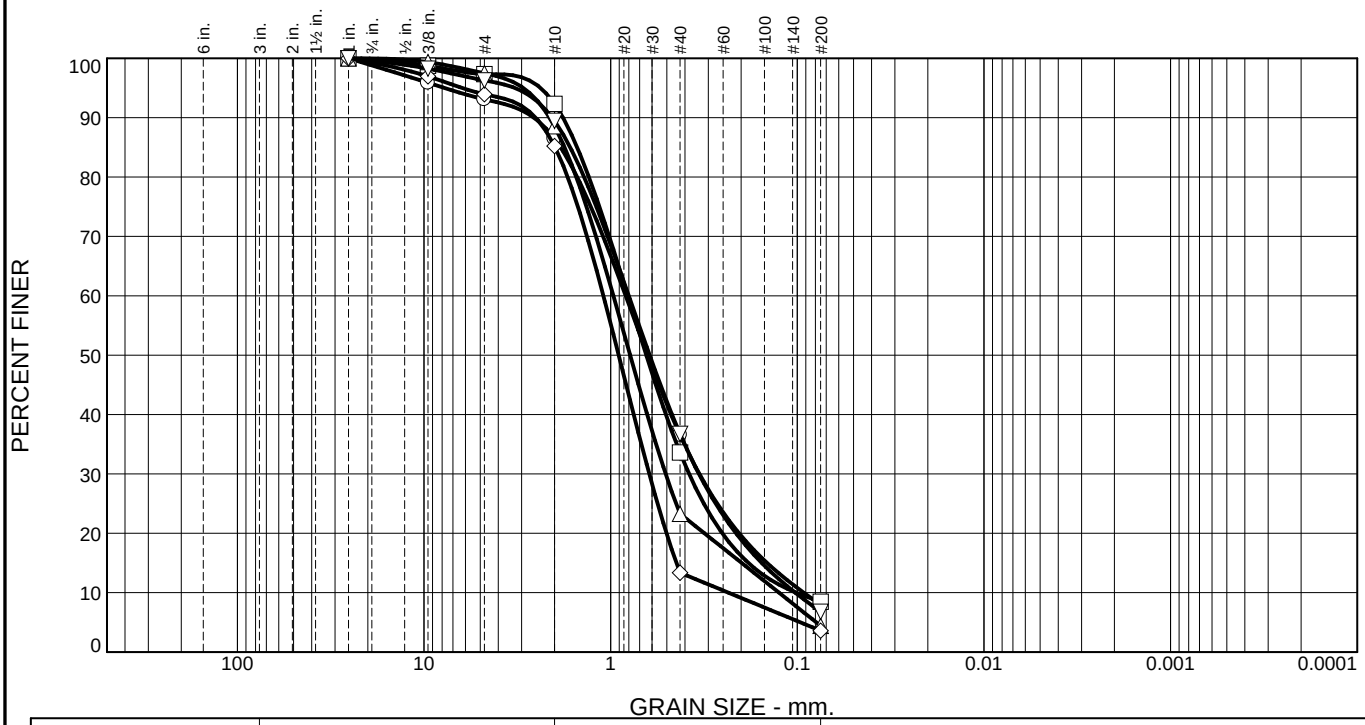
▽ **Source of Sample:** AP-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	13.5	50.0	28.5	8.0	
□	0.0	7.7	58.7	25.1	8.5	
△	0.0	11.4	65.3	18.9	4.4	
◇	0.0	14.8	71.8	9.8	3.6	
▽	0.0	10.5	52.8	29.9	6.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8548	0.8308	0.6332	0.3347	0.1452	0.0924	1.46	9.00
□	NV	NP	1.5125	0.8090	0.6444	0.3799	0.1830	0.1015	1.76	7.97
△	NV	NP	1.7661	0.9673	0.7865	0.5074	0.1985	0.1254	2.12	7.72
◇	NV	NP	1.9844	1.0938	0.9060	0.6210	0.4443	0.2340	1.51	4.67
▽	NV	NP	1.6480	0.8000	0.6181	0.3367	0.1551	0.1026	1.38	7.80

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	SW	A-1-b
◇ Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b
▽ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** AP-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** AP-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** AP-2 **Depth:** 39.0 **Sample Number:** 14

▽ **Source of Sample:** AP-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report

	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	16.4	57.1	22.0	4.5	
□	0.0	16.4	70.9	9.8	2.9	
△	0.0	1.6	30.0	58.9	9.5	
◇	0.0	1.7	40.1	50.6	7.6	
▽	0.0	0.0	0.9	87.0	12.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.1516	0.9851	0.7777	0.4715	0.2680	0.1914	1.18	5.15
□	NV	NP	2.4637	1.1033	0.9122	0.6265	0.4515	0.2635	1.35	4.19
△	NV	NP	0.8079	0.3216	0.2359	0.1323	0.0873	0.0761	0.72	4.22
◇	NV	NP	1.0073	0.4489	0.3268	0.1665	0.0980	0.0819	0.75	5.48
▽	NV	NP	0.2769	0.1656	0.1388	0.0997	0.0785			

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP	A-1-b
□ Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b
△ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Wet medium dense brown fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AP-2 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** AP-2 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** AP-2 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** AP-2 **Depth:** 64.0 **Sample Number:** 19

▽ **Source of Sample:** AP-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

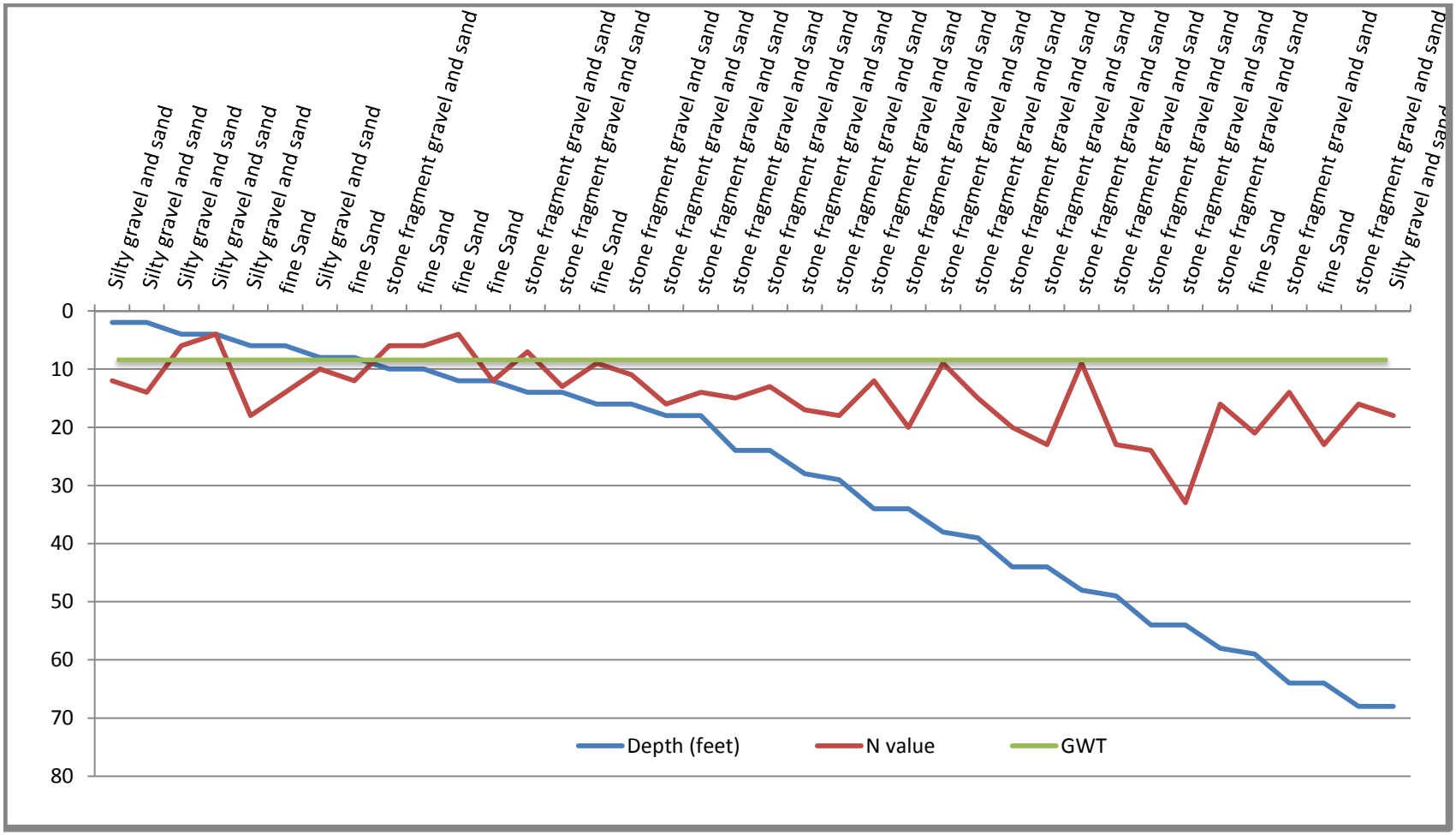
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
BC-3	1	2	Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	8.7	SM	A-2-4(0)	97.4	25.6	7	6	6	3
	2	4	Wet loose gray silty fine to coarse sand w/trace fine gravel.	NV	NP	15.6	SM	A-2-4(0)	98.8	27	3	3	3	3
	3	6	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	22	SM	A-2-4(0)	95.9	19.2	7	10	8	11
	4	8	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.1	SM	A-2-4(0)	96.6	15.5	4	5	5	5
	5	10	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.2	SP-SM	A-1-b	95.6	8.7	2	3	3	2
	6	12	Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.2	SP-SM	A-3	94.5	9.4	2	2	2	1
	7	14	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.9	SP	A-1-b	97.6	1.4	2	3	4	3
	8	16	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	20.3	SP	A-3	99.3	4.9	3	4	5	5
	9	18	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.6	SW-SM	A-1-b	95.8	5.8	6	7	9	11
	10	24	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16	SW-SM	A-1-b	92.3	9.7	7	8	7	7
	11	28	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.6	SW-SM	A-1-b	92.3	8.2	7	9	8	7
	12	34	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.3	SP-SM	A-1-b	90.7	5.5	5	6	6	8
	13	38	Wet loose brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	18.1	SW-SM	A-1-b	79.4	5.2	2	4	5	3
	14	44	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	18.8	SW-SM	A-1-b	83.8	7.3	7	9	11	15
	15	48	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.9	SW-SM	A-1-b	89.9	7.2	4	4	5	4
	16	54	Wet medium dense brown coarse sandy fine gravel w/trace fine sand and silt.	NV	NP	18	SP	A-1-a	48.6	2.3	7	9	15	22
	17	58	Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	17.1	SW	A-1-b	78.8	4.3	5	7	9	11
	18	64	Wet medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	16.2	SP	A-1-b	74.6	3.3	5	6	8	7
	19	68	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	19.3	SP-SM	A-1-b	86	6.7	6	7	9	13
		70	End Boring											
	1		Moist brown fine to coarse sand w/some silt.	NV	NP	11.1	SM	A-2-4(0)	99.7	12.6				
	2	2	Moist medium dense brown silty fine to coarse sand w/trace fine gravel.	NV	NP	10.9	SM	A-2-4(0)	97.6	23.4	12	8	6	3
	3	4	Wet very loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	22.3	SM	A-2-4(0)	99	23.4	2	1	3	4
	4	6	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	19.6	SP-SM	A-3	98.7	5.4	3	7	7	15
	5	8	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.4	SP-SM	A-3	92.1	9	10	7	5	5
	6	10	Wet loose brown fine to coarse sand w/trace silt.	NV	NP	21.1	SP-SM	A-3	99.5	9.4	3	3	3	4
	7	12	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.9	SP-SM	A-3	97.4	9.3	4	5	7	8
	8	14	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.9	SP-SM	A-1-b	90.9	5.9	4	6	7	8
	9	16	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.3	SW-SM	A-1-b	92.3	7.7	6	5	6	8
	10	18	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.2	SW-SM	A-1-b	91.9	7.2	6	7	7	9
	11	24	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	16.4	SW-SM	A-1-b	86.5	8	4	6	7	8
	12	29	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.1	SW-SM	A-1-b	92.3	8.5	6	9	9	17
	13	34	Wet medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	16.8	SW	A-1-b	88.6	4.4	7	9	11	15
	14	39	Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	15.8	SP	A-1-b	85.2	3.6	6	8	7	9
	15	44	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.8	SW-SM	A-1-b	89.5	6.8	6	11	12	11
	16	49	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	17.6	SP	A-1-b	83.6	4.5	10	11	12	9
	17	54	Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	15.5	SP	A-1-b	83.6	2.9	13	16	17	19
	18	59	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	23.4	SP-SM	A-3	98.4	9.5	6	9	12	13
	19	64	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	23.3	SP-SM	A-3	98.3	7.6	7	9	14	18
	20	68	Wet medium dense brown fine sand w/some silt, trace of coarse sand.	NV	NP	28.2	SM	A-2-4(0)	100	12.1	6	9	9	13
		70	End Boring											

DATE : **6-15-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-442A on Abbotts Pond road over Tantrough – Greenwood, DE**



DATE : **6-15-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-442A on Abbotts Pond road over Tantrough – Greenwood, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 12-30-2015**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-132 on Sunnyside road over GUM BRANCH- Bridgeville DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 8-10-2015 and 8-12-2015. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in Columbia Formation is Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to reddish-gray clayey silt are common. In places, the upper 5 to 25 feet consists of grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John K. Adams and Durward H. Boggess (1965) Atlas HA-99. The nearest well to this site the groundwater historically had been measured as 32 feet on October 1950 and between the years of 1950 to 1962 appeared from 29 to 34 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 21feet down is Silty or Clayey gravel and sand (A-2-4) and from 21 to 48 feet down is fine sand (A-3).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 7 to 11 inches of asphalt top of 4 to 7 inches of stone.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 5 feet, noted at the completion of the drilling is 12 feet and caved at 7.5 feet all the measurements is below the ground surface elevation. Rotary mud was added at 12 feet depth during the drilling. more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 2.5 to 31.9 percent. The Atterberg limit is 8 percent, Liquid limits is 16.5 percent and none of Plasticity Index. The Organic matter is 3 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition and 12 feet in thickness of loose fine sand layer appeared at 6 feet down from the surface elevation at the west side of the bridge only this layer need to consider in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had been met borrow type material "A, and "C" according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 18-1692 T201407003 BR3-132 0n Sunnyside Road in Sussex Co.

Google earth

feet 600

meters 100

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING SR-1

Project Name: Faulkland Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 273890.057
Easting: 617354.014
Boring Surface Elev.:
Reference:
Date Started: 10/15/15
Date Completed: 10/15/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 12.0
From Depth of: 12.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
10/15/15	6.0	
10/15/15	4.5	5.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	0 1 3 5	Moist very loose brown coarse to fine sand and fine gravel w/trace silt. 10" RECOVERY	A-1-b	Hot-mix 11", 4" crushed stone
2.53		2	2.0' 4.0'	4 4 5 5	Moist loose brown coarse to fine sand w/trace silt. 24" RECOVERY	A-1-b	
5.06	▽	3	4.0' 6.0'	2 4 5 5	Wet loose reddish brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
7.59	■	4	6.0' 8.0'	2 2 1 2	Wet very loose reddish brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12		5	8.0' 10.0'	1 1 3 2	Wet very loose brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
		6	10.0' 12.0'	1 0 1 0	Wet very loose brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
12.65		7	12.0'	4 1 1 2	Saturated very loose orange silty fine sand w/ trace coarse sand and fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003
Boring No.: SR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	3 2 1 1	Saturated very loose orange fine sand w/some silt, trace of coarse sand. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	1 1 2 5	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel./ 24" RECOVERY	A-4(0)	
20.24 22.77		10	18.0' 20.0'	3 4 5 11	Saturated loose orange coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
25.3 27.83		11	23.0' 25.0'	5 9 9 13	Saturated medium dense orange fine to coarse sand w/some silt and fine gravel. 24" RECOVERY	A-1-b	
30.36 32.89		12	28.0' 30.0'	6 6 7 8	Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt. 24" RECOVERY	A-1-b	
35.42		13	33.0' 35.0'	5 6 7 7	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003

Boring No.: SR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	8 23 21 16	Saturated dense orange coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	8 8 12 16	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	4 4 9 14	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	11 17 20 23	Saturated dense gray fine sand w/some coarse sand, trace of silt.	A-3	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	9 20 32 24	Saturated very dense gray fine sand w/trace coarse sand, fine gravel and silt.	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003

Boring No.: SR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	14 23 27 31	Saturated dense gray fine sand w/trace coarse sand and silt.	A-3	
			65.0'		18" RECOVERY		
65.78							
68.31		20	68.0'	11 19 40 50	Saturated very dense orange fine sand w/trace coarse sand and silt.	A-3	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Clean sand & gravelly sand
	Poorly graded, silty or clayey sands and gravel
	Silty soils
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING SR-2

Project Name: Faulkland Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 273858.650
Easting: 617384.071
Boring Surface Elev.:
Reference:
Date Started: 10/16/15
Date Completed: 10/16/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** — **From Depth of:** 0.0 **To:** 12.0
Mud Rotary: — **From Depth of:** 12.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
10/16/15	5.0	
10/16/15	4.5	7.5

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' – 2.0'	0 2 5 8	Moist loose reddish brown fine to coarse sand w/some fine gravel, trace of silt. 14" RECOVERY	A-3	Hot-mix 7", 3" crushed stone
2.53		2	2.0' – 4.0'	5 5 6 8	Wet medium dense brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
5.06	▽	3	4.0' – 6.0'	4 4 5 6	Saturated loose dark brown fine to coarse sand w/some silt, trace of fine gravel and organic matter. 24" RECOVERY	A-2-4(0)	
7.59		4	6.0' – 8.0'	4 5 5 7	Saturated loose light brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12		5	8.0' – 10.0'	6 6 7 8	Saturated medium dense white fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
		6	10.0' – 12.0'	4 4 5 7	Saturated loose orange coarse to fine sand w/ some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
12.65		7	12.0'	6 6 7 9	Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003

Boring No.: SR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	3 1 1 1	Saturated very loose orange fine gravelly fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	3 4 3 2	Saturated loose orange fine gravelly fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	1 2 7 13	Saturated loose orange coarse to fine sand w/ some fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	3 4 4 11	Saturated loose orange fine to coarse sand w/ some fine gravel and silt. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	4 5 6 6	Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	4 6 6 12	Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003

Boring No.: SR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	8 13 15 20	Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt. 24" RECOVERY	A-1-b	
40.48							
43.01							
		15	43.0' 45.0'	8 11 16 19	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	3 3 4 6	Saturated loose orange fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
50.6							
53.13							
		17	53.0' 55.0'	15 42 45 50	Saturated very dense gray fine sand w/trace coarse sand and silt. 24" RECOVERY	A-3	
55.66							
58.19							
		18	58.0'	9 24 26 31	Saturated very dense gray fine sand w/some silt, trace of coarse sand.	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Faulkland Road
State Contract: T201407003

Boring No.: SR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	15 30 46 50	Saturated very dense gray fine sand w/trace coarse sand and silt.	A-3	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	23 37 43 50	Saturated very dense brown fine sand w some silt, trace of coarse sand.	A-2-4(0)	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description

Strata symbols

	Clean sand & gravelly sand
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands

Misc. Symbols

	Description not given for: "WATER2"

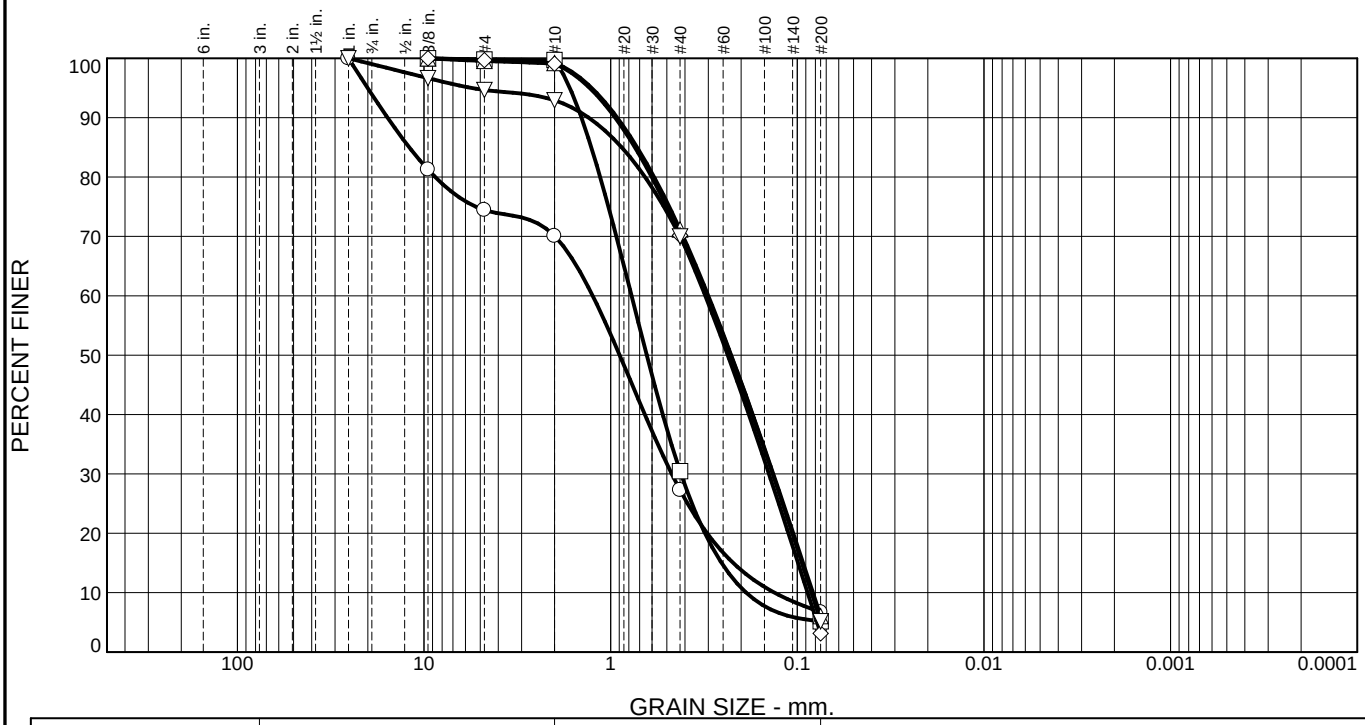
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	29.9	42.8	20.6	6.7	
□	0.0	0.3	69.2	25.3	5.2	
△	0.0	0.8	28.0	65.1	6.1	
◇	0.0	0.9	28.9	67.1	3.1	
▽	0.0	7.1	22.9	64.8	5.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	11.9958	1.2482	0.8949	0.4708	0.2206	0.1325	1.34	9.42
□	NV	NP	1.2698	0.7728	0.6406	0.4201	0.2544	0.1880	1.21	4.11
△	NV	NP	0.7215	0.2998	0.2261	0.1346	0.0931	0.0825	0.73	3.63
◇	NV	NP	0.7414	0.3112	0.2358	0.1419	0.0991	0.0881	0.73	3.53
▽	NV	NP	0.8730	0.3038	0.2271	0.1355	0.0945	0.0840	0.72	3.62

Material Description	USCS	AASHTO
○ Moist very loose brown coarse to fine sand and fine gravel w/trace silt.	SW-SM	A-1-b
□ Moist loose brown coarse to fine sand w/trace silt.	SP-SM	A-1-b
△ Wet loose reddish brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet very loose reddish brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
▽ Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** SR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** SR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** SR-1 **Depth:** 6.0 **Sample Number:** 4

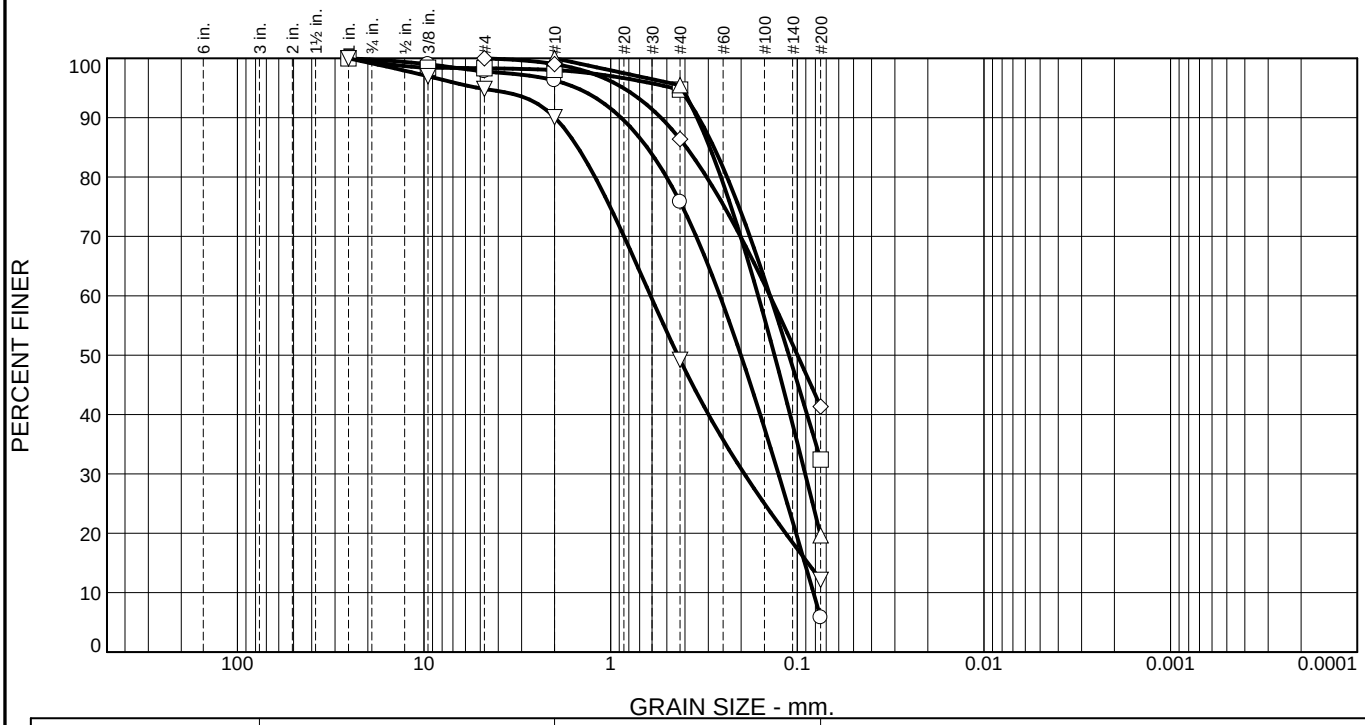
▽ **Source of Sample:** SR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.7	20.5	70.0	5.8	
□	0.0	1.9	3.4	62.3	32.4	
△	0.0	0.0	4.5	75.8	19.7	
◇	0.0	1.0	12.6	45.1	41.3	
▽	0.0	9.9	40.9	37.0	12.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6380	0.2598	0.2007	0.1262	0.0912	0.0820	0.75	3.17
□	NV	NP	0.2796	0.1400	0.1109					
△	NV	NP	0.2944	0.1621	0.1325	0.0907				
◇	16.5	NP	0.3929	0.1402	0.0998					
▽	NV	NP	1.5007	0.6110	0.4369	0.1922	0.0878			

Material Description	USCS	AASHTO
○ Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Saturated very loose orange silty fine sand w/trace coarse sand and fine gravel.	SM	A-2-4(0)
△ Saturated very loose orange fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
◇ Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel./	SM	A-4(0)
▽ Saturated loose orange coarse to fine sand w/trace fine gravel and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** SR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** SR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** SR-1 **Depth:** 16.0 **Sample Number:** 9

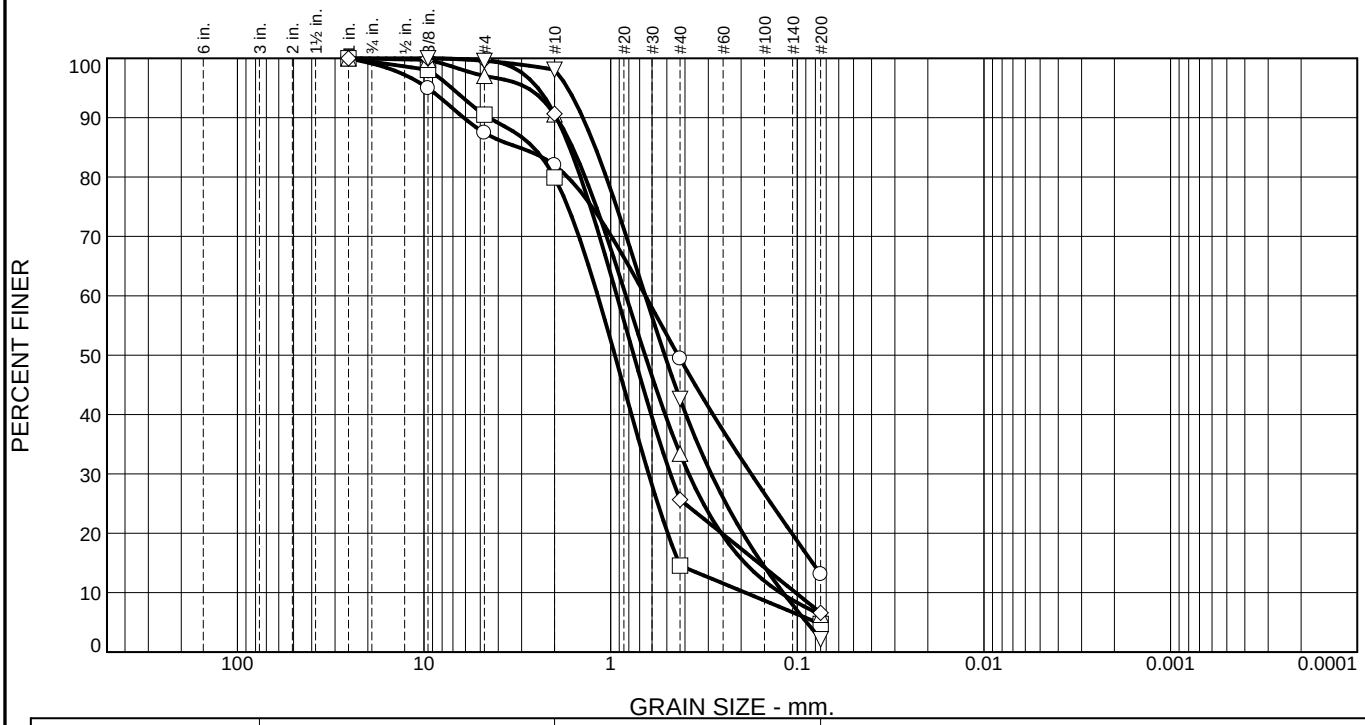
▽ **Source of Sample:** SR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	18.0	32.6	36.3	13.1	
□	0.0	20.1	65.3	9.9	4.7	
△	0.0	9.4	57.2	27.1	6.3	
◇	0.0	9.3	65.0	19.1	6.6	
▽	0.0	1.9	55.5	40.5	2.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.1089	0.6512	0.4353	0.1767	0.0828			
□	NV	NP	2.5962	1.1723	0.9495	0.6261	0.4307	0.1899	1.76	6.17
△	NV	NP	1.6015	0.8278	0.6543	0.3817	0.1908	0.1232	1.43	6.72
◇	NV	NP	1.6606	0.9264	0.7522	0.4785	0.1609	0.1021	2.42	9.08
▽	NV	NP	1.2101	0.6518	0.5134	0.2892	0.1551	0.1191	1.08	5.47

Material Description	USCS	AASHTO
○ Saturated medium dense orange fine to coarse sand w/some silt and fine gravel.	SM	A-1-b
□ Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt.	SW	A-1-b
△ Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
◇ Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** SR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** SR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** SR-1 **Depth:** 38.0 **Sample Number:** 14

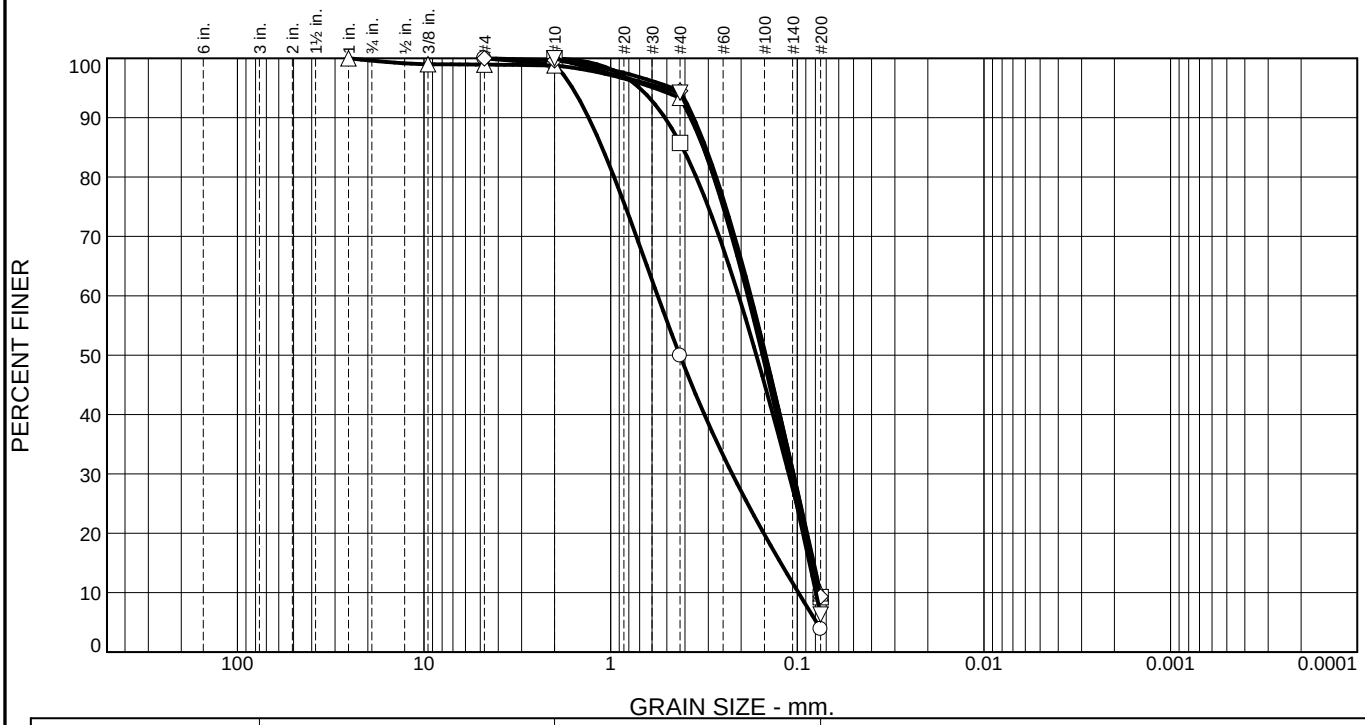
▽ **Source of Sample:** SR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.0	49.1	46.0	3.9	
□	0.0	0.0	14.3	76.5	9.2	
△	0.0	1.2	5.5	83.4	9.9	
◇	0.0	0.3	5.2	85.1	9.4	
▽	0.0	0.0	5.8	87.9	6.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1129	0.5597	0.4260	0.2231	0.1227	0.0986	0.90	5.67
□	NV	NP	0.4131	0.2062	0.1658	0.1111	0.0835	0.0761	0.79	2.71
△	NV	NP	0.3188	0.1795	0.1486	0.1048	0.0816	0.0751	0.81	2.39
◇	NV	NP	0.3096	0.1776	0.1477	0.1050	0.0822	0.0758	0.82	2.34
▽	NV	NP	0.3180	0.1842	0.1536	0.1096	0.0861	0.0795	0.82	2.32

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
□ Saturated dense gray fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
△ Saturated very dense gray fine sand w/trace coarse sand, fine gravel and silt.	SP-SM	A-3
◇ Saturated dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
▽ Saturated very dense orange fine sand w/trace coarse sand and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** SR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** SR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** SR-1 **Depth:** 63.0 **Sample Number:** 19

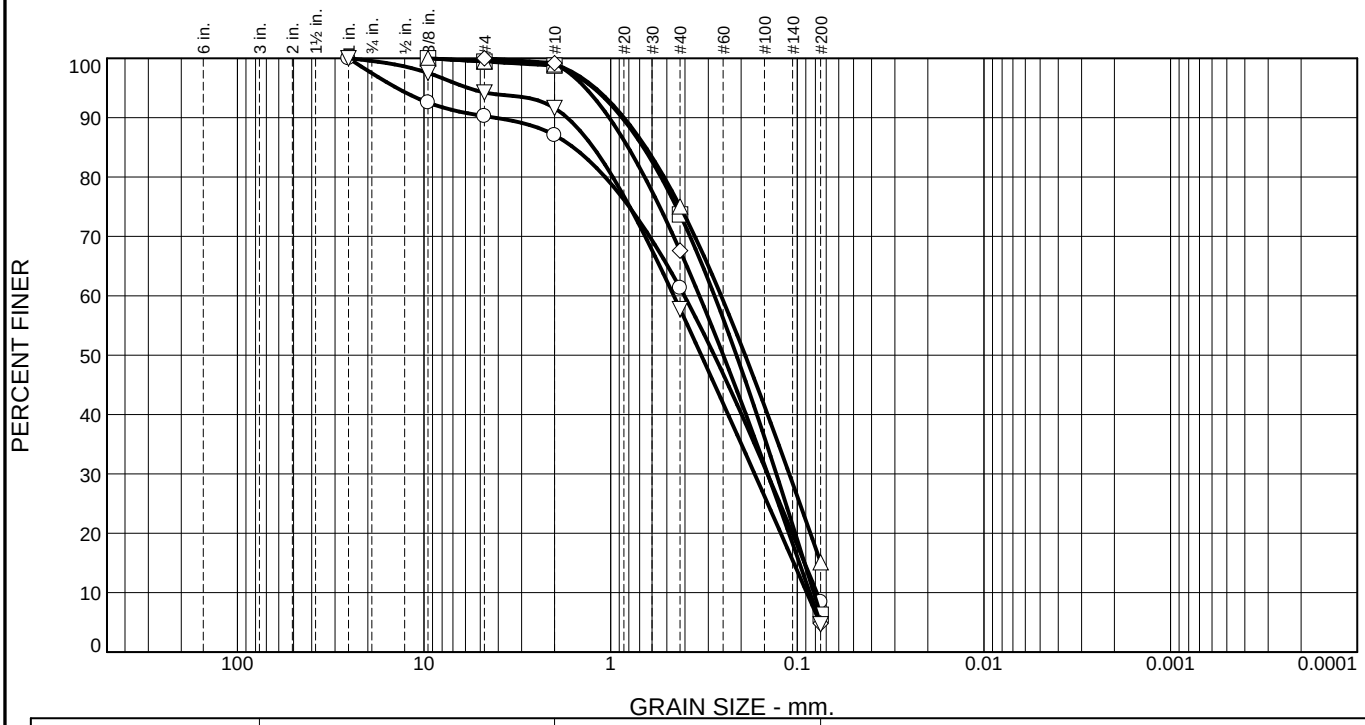
▽ **Source of Sample:** SR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.9	25.8	52.9	8.4	
□	0.0	1.2	25.1	67.4	6.3	
△	0.0	1.0	23.9	60.0	15.1	
◇	0.0	0.8	31.6	62.8	4.8	
▽	0.0	8.4	33.8	53.1	4.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5848	0.4031	0.2785	0.1446	0.0914	0.0786	0.66	5.13
□	NV	NP	0.6677	0.2777	0.2119	0.1295	0.0915	0.0816	0.74	3.40
△	NV	NP	0.6487	0.2558	0.1904	0.1105				
◇	NV	NP	0.8058	0.3346	0.2492	0.1441	0.0974	0.0857	0.72	3.91
▽	NV	NP	1.2399	0.4587	0.3271	0.1694	0.1044	0.0890	0.70	5.16

Material Description	USCS	AASHTO
○ Moist loose reddish brown fine to coarse sand w/some fine gravel, trace of silt.	SP-SM	A-3
□ Wet medium dense brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Saturated loose dark brown fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SM	A-2-4(0)
◇ Saturated loose light brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
▽ Saturated medium dense white fine to coarse sand w/trace silt and fine gravel.	SP	A-3

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** SR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** SR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** SR-2 **Depth:** 6.0 **Sample Number:** 4

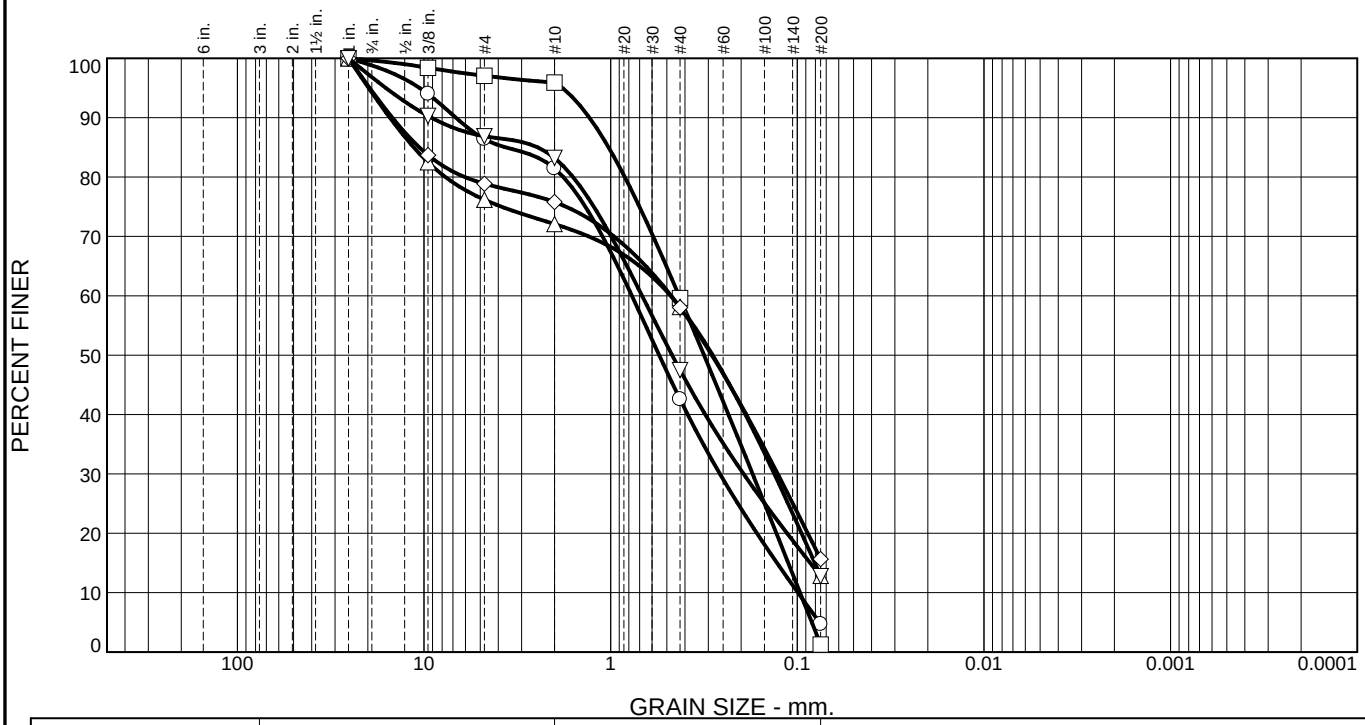
▽ **Source of Sample:** SR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	18.5	38.9	37.9	4.7	
□	0.0	4.1	36.3	58.3	1.3	
△	0.0	27.9	14.0	45.3	12.8	
◇	0.0	24.2	17.8	42.3	15.7	
▽	0.0	16.8	35.7	34.7	12.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.6527	0.7698	0.5496	0.2596	0.1285	0.0992	0.88	7.76
□	NV	NP	1.0259	0.4301	0.3161	0.1737	0.1119	0.0967	0.73	4.45
△	NV	NP	11.3537	0.4767	0.2839	0.1328	0.0805			
◇	NV	NP	10.6029	0.4740	0.2869	0.1274				
▽	NV	NP	2.4611	0.6787	0.4685	0.1941	0.0853			

Material Description	USCS	AASHTO
○ Saturated loose orange coarse to fine sand w/some fine gravel, trace of silt.	SP	A-1-b
□ Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	SP	A-3
△ Saturated very loose orange fine gravelly fine sand w/some coarse sand and silt.	SM	A-2-4(0)
◇ Saturated loose orange fine gravelly fine sand w/some coarse sand and silt.	SM	A-2-4(0)
▽ Saturated loose orange coarse to fine sand w/some fine gravel and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** SR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** SR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** SR-2 **Depth:** 16.0 **Sample Number:** 9

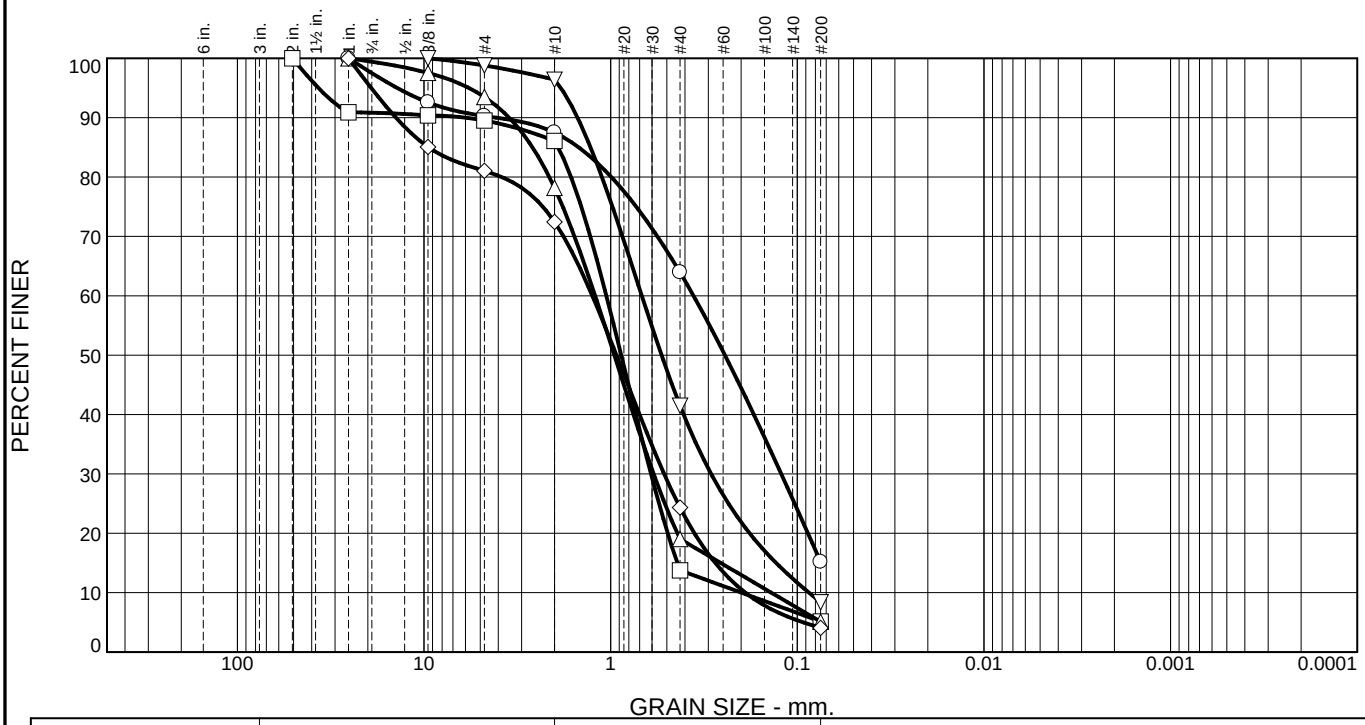
▽ **Source of Sample:** SR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.5	23.6	48.7	15.2	
□	0.0	13.9	72.3	8.6	5.2	
△	0.0	21.8	59.2	13.9	5.1	
◇	0.0	27.6	48.1	20.2	4.1	
▽	0.0	3.6	54.9	33.1	8.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4839	0.3598	0.2442	0.1220				
□	NV	NP	1.9133	1.0548	0.8779	0.6083	0.4391	0.1993	1.76	5.29
△	NV	NP	2.6241	1.2116	0.9558	0.5884	0.2571	0.1379	2.07	8.79
◇	NV	NP	9.4600	1.2543	0.9317	0.5172	0.2749	0.1900	1.12	6.60
▽	NV	NP	1.2821	0.6809	0.5335	0.2895	0.1300	0.0866	1.42	7.86

Material Description	USCS	AASHTO
○ Saturated loose orange fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
□ Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt.	SP-SM	A-1-b
△ Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	SW-SM	A-1-b
◇ Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	SW	A-1-b
▽ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** SR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** SR-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** SR-2 **Depth:** 38.0 **Sample Number:** 14

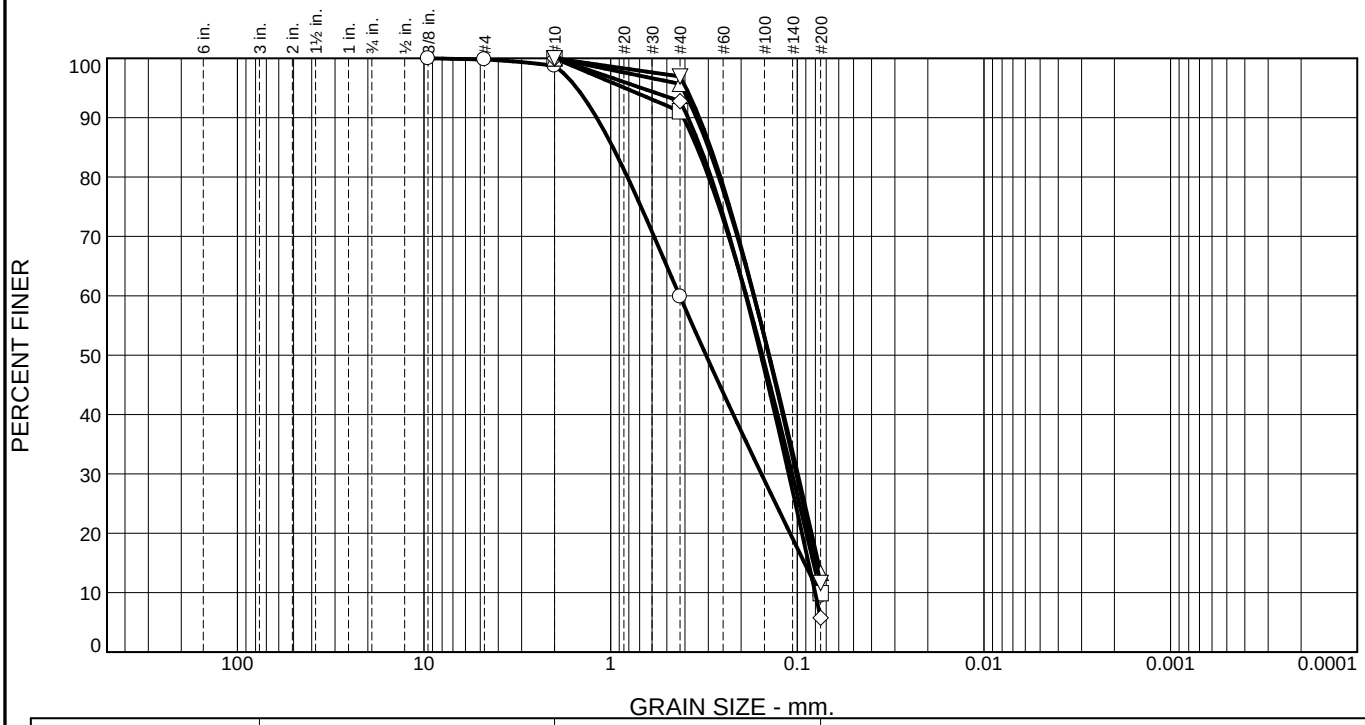
▽ **Source of Sample:** SR-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.3	38.8	50.5	9.4	
□	0.0	0.0	8.9	81.2	9.9	
△	0.0	0.0	4.3	82.4	13.3	
◇	0.0	0.0	7.2	87.0	5.8	
▽	0.0	0.0	3.1	85.3	11.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9729	0.4268	0.3084	0.1558	0.0915	0.0765	0.74	5.58
□	NV	NP	0.3444	0.1877	0.1539	0.1066	0.0819	0.0751	0.81	2.50
△	NV	NP	0.2995	0.1710	0.1416	0.0995	0.0771			
◇	NV	NP	0.3309	0.1887	0.1567	0.1112	0.0870	0.0803	0.82	2.35
▽	NV	NP	0.2919	0.1706	0.1423	0.1012	0.0792			

Material Description	USCS	AASHTO
○ Saturated loose orange fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Saturated very dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
△ Saturated very dense gray fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
◇ Saturated very dense gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
▽ Saturated very dense brown fine sand w some silt, trace of coarse sand.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Faulkland Road

○ **Source of Sample:** SR-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** SR-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** SR-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** SR-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** SR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

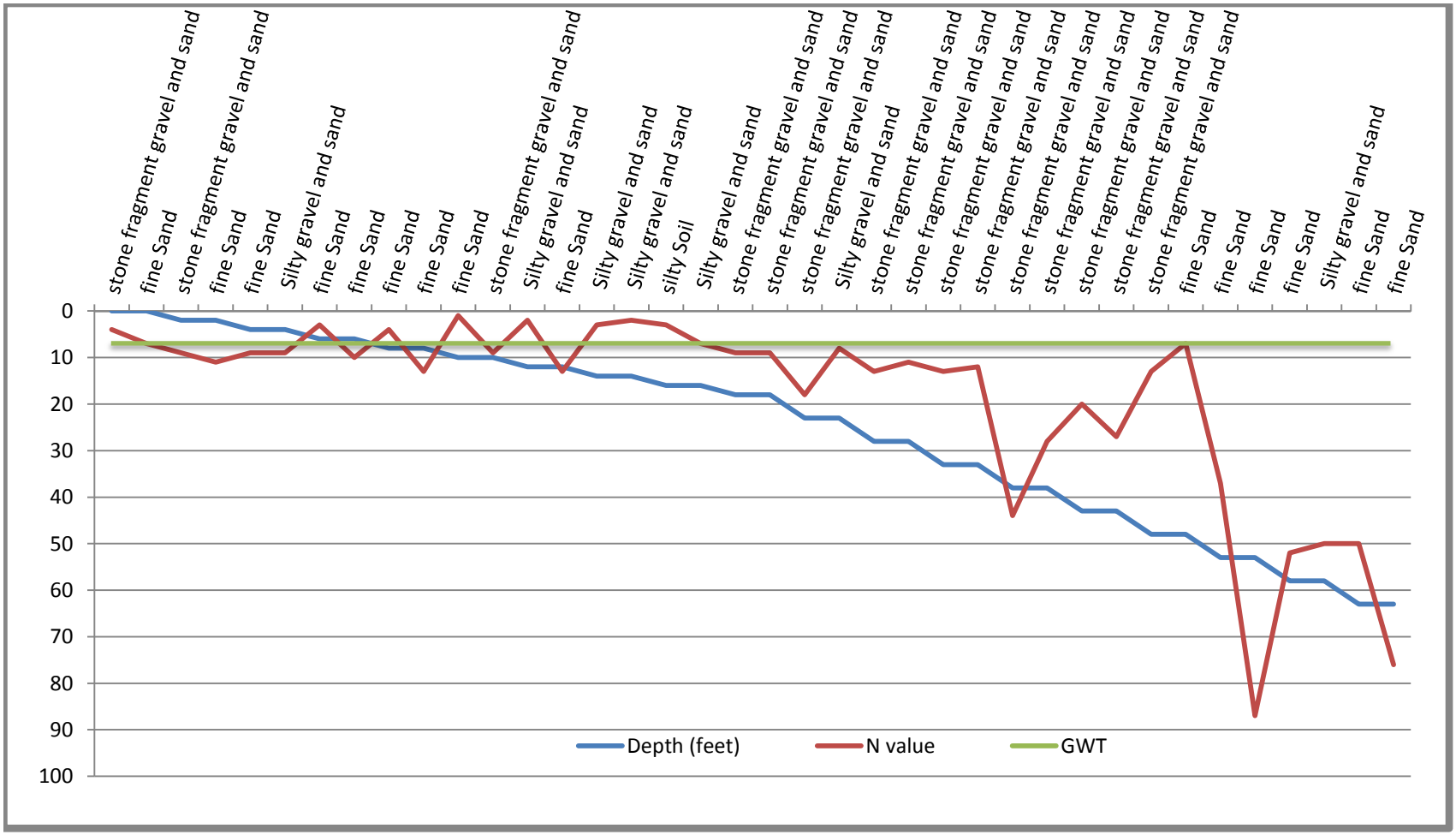
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
SR-1														
	1		Moist very loose brown coarse to fine sand and fine gravel w/trace silt.	NV	NP	2.5	SW-SM	A-1-b	70.1	6.7		1	3	5
	2	2	Moist loose brown coarse to fine sand w/trace silt.	NV	NP	9.4	SP-SM	A-1-b	99.7	5.2	4	4	5	5
	3	4	Wet loose reddish brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	15.7	SP-SM	A-3	99.2	6.1	2	4	5	5
	4	6	Wet very loose reddish brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.7	SP	A-3	99.1	3.1	2	2	1	2
	5	8	Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	17.7	SP-SM	A-3	92.9	5.2	1	1	3	2
	6	10	Wet very loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	22.3	SP-SM	A-3	96.3	5.8	1		1	
	7	12	Saturated very loose orange silty fine sand w/trace coarse sand and fine gravel.	NV	NP	31.9	SM	A-2-4(0)	98.1	32.4	4	1	1	2
	8	14	Saturated very loose orange fine sand w/some silt, trace of coarse sand.	NV	NP	30.1	SM	A-2-4(0)	100	19.7	3	2	1	1
	9	16	Saturated soft brown fine sandy silt w some coarse sand, trace of fine gravel./	16.5	NP	26.7	SM	A-4(0)	99	41.3	1	1	2	5
	10	18	Saturated loose orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.4	SM	A-1-b	90.1	12.2	3	4	5	11
	11	23	Saturated medium dense orange fine to coarse sand w/some silt and fine gravel.	NV	NP	17.2	SM	A-1-b	82	13.1	5	9	9	13
	12	28	Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	18.3	SW	A-1-b	79.9	4.7	6	6	7	8
	13	33	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	NV	NP	18.6	SW-SM	A-1-b	90.6	6.3	5	6	7	7
	14	38	Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.9	SW-SM	A-1-b	90.7	6.6	8	23	21	16
	15	43	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	19.7	SP	A-1-b	98.1	2.1	8	8	12	16
	16	48	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.7	SP	A-1-b	99	3.9	4	4	9	14
	17	53	Saturated dense gray fine sand w/some coarse sand, trace of silt.	NV	NP	18.3	SP-SM	A-3	100	9.2	11	17	20	23
	18	58	Saturated very dense gray fine sand w/trace coarse sand, fine gravel and silt.	NV	NP	19.3	SP-SM	A-3	98.8	9.9	9	20	32	24
	19	63	Saturated dense gray fine sand w/trace coarse sand and silt.	NV	NP	19	SP-SM	A-3	99.7	9.4	14	23	27	31
	20	68	Saturated very dense orange fine sand w/trace coarse sand and silt.	NV	NP	19.6	SP-SM	A-3	100	6.3	11	19	40	50
		70	End Boring											
SR-2														
	1		Moist loose reddish brown fine to coarse sand w/some fine gravel, trace of silt.	NV	NP	4.4	SP-SM	A-3	87.1	8.4		2	5	8
	2	2	Wet medium dense brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	10.4	SP-SM	A-3	98.8	6.3	5	5	6	8
	3	4	Saturated loose dark brown fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	31.4	SM	A-2-4(0)	99	15.1	4	4	5	6
	4	6	Saturated loose light brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.3	SP	A-3	99.2	4.8	4	5	5	7
	5	8	Saturated medium dense white fine to coarse sand w/trace silt and fine gravel.	NV	NP	18.3	SP	A-3	91.6	4.7	6	6	7	8
	6	10	Saturated loose orange coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	15.6	SP	A-1-b	81.5	4.7	4	4	5	7
	7	12	Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.4	SP	A-3	95.9	1.3	6	6	7	9
	8	14	Saturated very loose orange fine gravelly fine sand w/some coarse sand and silt.	NV	NP	21.2	SM	A-2-4(0)	72.1	12.8	3	1	1	1
	9	16	Saturated loose orange fine gravelly fine sand w/some coarse sand and silt.	NV	NP	23.2	SM	A-2-4(0)	75.8	15.7	3	4	3	2
	10	18	Saturated loose orange coarse to fine sand w/some fine gravel and silt.	NV	NP	18.4	SM	A-1-b	83.2	12.8	1	2	7	13
	11	23	Saturated loose orange fine to coarse sand w/some fine gravel and silt.	NV	NP	17.9	SM	A-2-4(0)	87.5	15.2	3	4	4	11
	12	28	Saturated medium dense orange coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	13.7	SP-SM	A-1-b	86.1	5.2	4	5	6	6
	13	33	Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	16.6	SW-SM	A-1-b	78.2	5.1	4	6	6	12
	14	38	Saturated medium dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	10.5	SW	A-1-b	72.4	4.1	8	13	15	20
	15	43	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.6	SW-SM	A-1-b	96.4	8.4	8	11	16	19
	16	48	Saturated loose orange fine to coarse sand w/trace fine gravel and silt.	NV	NP	18	SP-SM	A-3	98.7	9.4	3	3	4	6
	17	53	Saturated very dense gray fine sand w/trace coarse sand and silt.	NV	NP	17.5	SP-SM	A-3	100	9.9	15	42	45	50
	18	58	Saturated very dense gray fine sand w/some silt, trace of coarse sand.	NV	NP	19.9	SM	A-2-4(0)	100	13.3	9	24	26	31
	19	63	Saturated very dense gray fine sand w/trace coarse sand and silt.	NV	NP	19.1	SP-SM	A-3	100	5.8	15	30	46	50
	20	68	Saturated very dense brown fine sand w some silt, trace of coarse sand.	NV	NP	19.5	SP-SM	A-2-4(0)	100	11.6	23	37	43	50
		70	End Boring											

DATE : **12-30-2015**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-132 on Sunnyside road over GUM BRANCH- Bridgeville DE**



DATE : 12-30-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-132 on Sunnyside road over GUM BRANCH- Bridgeville DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 1-04-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-139 on Tuckers road - Greenwood DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 9-19-2015 and 9-20-2015. Hillis Carnes Engineering Associates (HCEA) drilled two Standard Penetration Test borings that were scheduled to depths of 75 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990. This site is situated in Columbia Formation is Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to reddish-gray clayey silt are common. In places, the upper 5 to 25 feet consists of grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John K. Adams and Durward H. Boggess (1965) Atlas HA-99. The nearest well to this site the groundwater historically had been measured as 32 feet on October 1950 and between the years of 1950 to 1962 appeared from 29 to 34 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 21 feet down is Silty or Clayey gravel and sand (A-2-4) and from 21 to 48 feet down is fine sand (A-3).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 6 and 8 feet and caved at 7 and 8 feet all the measurements are below the ground surface elevation. Rotary mud was added at 10 feet depth during the drilling. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 6.3 to 33.1 percent. The Atterberg limit is 10 percent, Liquid limits is 14.2 to 23.2 percent and none of Plasticity Index or Organic matter is encounter for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is not in good condition and 20 feet in thickness of loose fine sand layer appeared at 8 feet down from the surface elevation this layer needs to be considered in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had been met borrow type material "A, and "C" according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (9- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 16-1692 T201407003 BR3-139 on Tuckers Road in Sussex County

Google earth

feet 2000
meters 600

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING TR-1

Project Name: Tuckers Road BR3-139 **Location:** Sussex County, DE
State Contract #: T201407003 **Federal Contract #:**
Station/Offset: **Northing:** 624730.305 **Easting:** 281802.653
Boring Surface Elev.: **Reference:**
Date Started: 10/19/15 **Date Completed:** 10/19/15

Wt. of Sample Hammer: 140 **Lbs.** **Average Fall:** 30 **IN.**
Type of: **D-Sampler:** Split Barrel **O.D.** **O.D. of Sampler:** 2 **IN.**
S-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
U-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
Core Bit: **O.D.** **O.D. of Rock Core:** **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** **From Depth of:** 0.0 **To:** 10.0
Mud Rotary: **From Depth of:** 10.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
10/19/15	8.0	
10/19/15	12.0	8.0

Boring Contractor: Hillis Carnes Engineering Associates **Equipment/Rig Type:** B-30 Truck Rig
Driller: John M. **Logged By:**

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	0 15 29 10	Moist dense brown silty fine to coarse sand. 10" RECOVERY	A-2-4(0)	
2.53		2	2.0' 4.0'	9 10 11 13	Moist very stiff brown fine sandy silt w/trace coarse sand and fine gravel. 24" RECOVERY	A-4(0)	
5.06		3	4.0' 6.0'	8 9 10 13	Moist medium dense brown fine sand w/ some silt, trace of coarse sand. 24" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	3 12 11 17	Wet medium dense orange fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
10.12	■	5	8.0' 10.0'	1 2 4 6	Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
	▽	6	10.0' 12.0'	4 2 2 2	Wet very loose gray coarse sand w/trace fine gravel, fine sand and silt. 24" RECOVERY	A-1-b	
12.65		7	12.0'	1 2 2 3	Wet very loose brown coarse to fine sand w/ some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	0 1 1 2	Wet very loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	2 2 4 5	Wet loose brown silty fine sand w/trace coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	2 3 5 5	Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	2 6 9 11	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	4 11 11 12	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	5 8 9 11	Wet medium dense orange coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	2 11 13 22	Wet medium dense orange coarse sand w/ some fine sand, trace of fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	11 14 17 21	Wet dense orange fine gravel and coarse sand w/some fine sand, trace of silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	9 18 19 21	Wet dense orange fine gravel and coarse to fine sand w/trace silt.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	7 14 20 23	Wet dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	A-1-b	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	13 21 27 40	Wet dense orange fine to coarse sand w some fine gravel, trace of silt./	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	17 23 29 34	Wet very dense orange fine gravelly coarse to fine sand w/trace silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	14 21 24 31	Wet dense orange coarse to fine sand w some fine gravel, trace of silt./	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING TR-2

Project Name: Tuckers Road BR3-139 **Location:** Sussex County, DE
State Contract #: T201407003 **Federal Contract #:**
Station/Offset: **Northing:** 624613.871 **Easting:** 281709.653
Boring Surface Elev.: **Reference:**
Date Started: 10/20/15 **Date Completed:** 10/20/15

Wt. of Sample Hammer: 140 **Lbs.** **Average Fall:** 30 **IN.**
Type of: **D-Sampler:** Split Barrel **O.D.** **O.D. of Sampler:** 2 **IN.**
S-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
U-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
Core Bit: **O.D.** **O.D. of Rock Core:** **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** **From Depth of:** 0.0 **To:** 10.0
Mud Rotary: **From Depth of:** 10.0 **To:** 75.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
10/20/15	6.0	
10/20/15	6.0	7.0

Boring Contractor: Hillis Carnes Engineering Associates **Equipment/Rig Type:** B-30 Truck Rig
Driller: John M. **Logged By:** Mike Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	5 9 12 11	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
2.53		2	2.0' 4.0'	1 2 2 3	Wet very loose gray silty fine to coarse sand w/trace fine gravel and organic matter. 22" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	1 9 14 15	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter. 18" RECOVERY	A-2-4(0)	
7.59	▼	4	6.0' 8.0'	2 4 5 3	Wet loose gray fine to coarse sand w/trace silt, fine gravel and organic matter. 17" RECOVERY	A-3	
10.12		5	8.0' 10.0'	1 1 1 2	Wet very loose gray fine to coarse sand w/ some silt, trace of fine gravel. 16" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	WH 1 1 1	Wet very loose gray fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0'	1 0 1 1	Wet very loose gray fine to coarse sand w/ some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 0 1 0	Wet soft gray silty fine sand w/trace coarse sand and fine gravel. 24" RECOVERY	A-4(0)	
17.71		9	16.0' 18.0'	1 0 1 1	Saturated soft brown fine sandy silt w trace coarse sand. 24" RECOVERY	A-4(0)	
20.24		10	18.0' 20.0'	1 1 1 1	Saturated very loose orange silty fine sand w/ trace coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	4 3 4 3	Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	3 7 9 10	Saturated medium dense tan coarse sand w/ some fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	8 10 12 15	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	7 11 11 17	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	4 11 13 19	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	11 13 13 19	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	10 10 19 20	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	26 40 40 28	Saturated very dense orange coarse sand w/ some fine sand, trace of fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Tuckers Road
State Contract: T201407003

Boring No.: TR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	4 4 4 6	Saturated loose gray silty fine sand w some coarse sand and fine gravel.	A-2-4(0)	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	14 50 1	Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	A-4(0)	
			70.0'		24" RECOVERY		
70.84							
73.37		21	73.0'	9 18 27 28	Saturated dense gray fine to coarse sand w/ trace silt.	A-3	
			75.0'		24" RECOVERY		
					End Boring		
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Silty soils
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

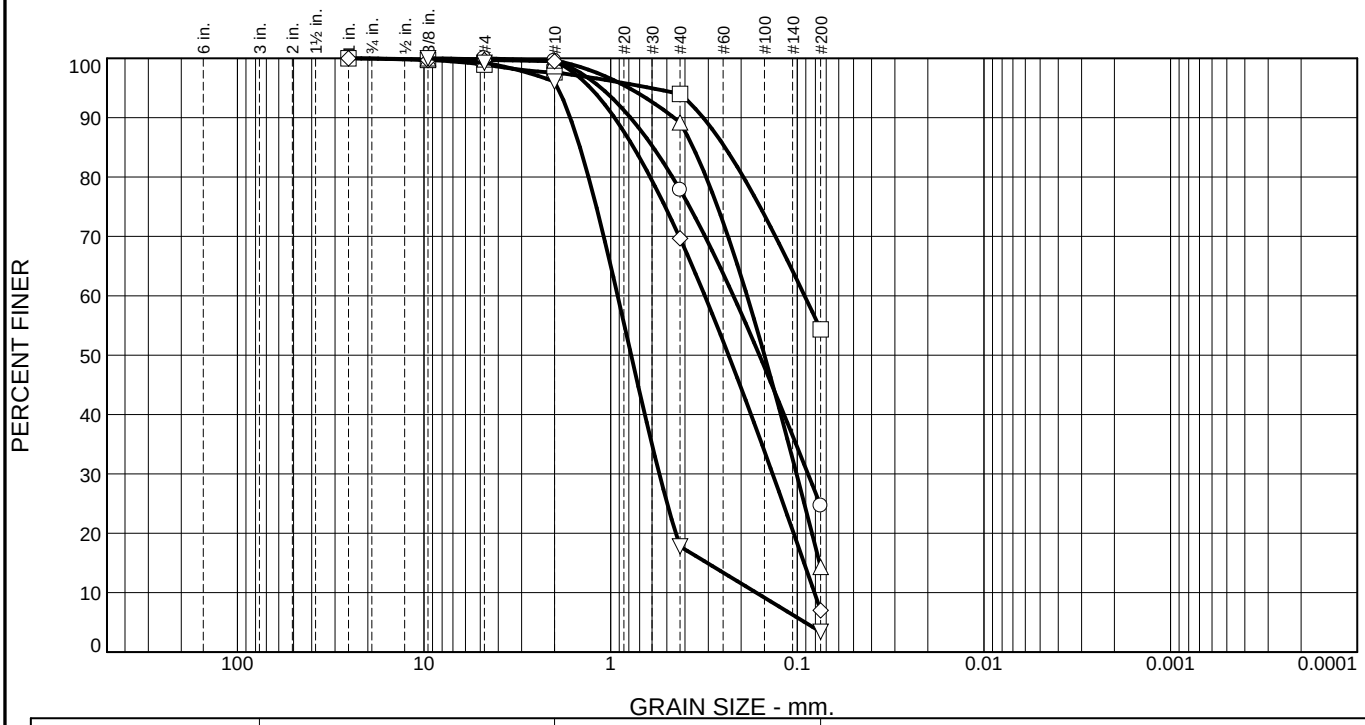
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.4	21.8	53.1	24.7	
□	0.0	2.4	3.6	39.7	54.3	
△	0.0	0.4	10.4	74.9	14.3	
◇	0.0	0.5	29.8	62.7	7.0	
▽	0.0	3.9	78.3	14.4	3.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.5918	0.2201	0.1597	0.0877				
□	15.5	NP	0.2440	0.0914						
△	NV	NP	0.3618	0.1859	0.1501	0.1010	0.0759			
◇	NV	NP	0.7535	0.3129	0.2335	0.1357	0.0920	0.0809	0.73	3.87
▽	NV	NP	1.4608	0.9176	0.7766	0.5486	0.3036	0.1661	1.97	5.53

Material Description	USCS	AASHTO
○ Moist dense brown silty fine to coarse sand.	SM	A-2-4(0)
□ Moist very stiff brown fine sandy silt w/trace coarse sand and fine gravel.	ML	A-4(0)
△ Moist medium dense brown fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
◇ Wet medium dense orange fine to coarse sand w/trace silt.	SP-SM	A-3
▽ Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** TR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** TR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** TR-1 **Depth:** 6.0 **Sample Number:** 4

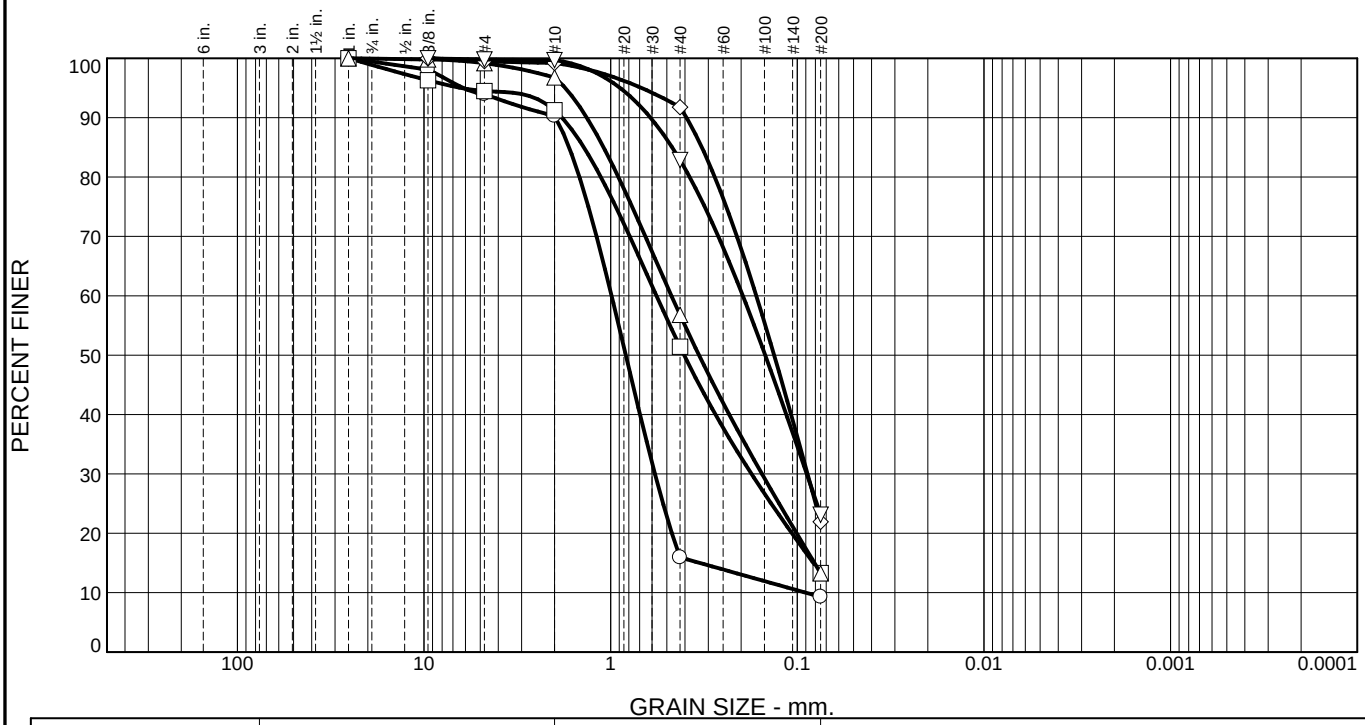
▽ **Source of Sample:** TR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.7	74.4	6.6	9.3	
□	0.0	8.8	39.8	38.1	13.3	
△	0.0	3.2	40.0	43.5	13.3	
◇	0.0	0.8	7.4	69.9	21.9	
▽	0.0	0.3	16.8	59.8	23.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6700	0.9892	0.8298	0.5789	0.3329	0.0902	3.76	10.97
□	NV	NP	1.3915	0.5683	0.4039	0.1760	0.0821			
△	NV	NP	1.0916	0.4725	0.3361	0.1547	0.0810			
◇	NV	NP	0.3246	0.1659	0.1331	0.0882				
▽	NV	NP	0.4680	0.1959	0.1487	0.0890				

Material Description	USCS	AASHTO
○ Wet very loose gray coarse sand w/trace fine gravel, fine sand and silt.	SP-SM	A-1-b
□ Wet very loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose brown silty fine sand w/trace coarse sand and fine gravel.	SM	A-2-4(0)
▽ Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** TR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** TR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** TR-1 **Depth:** 16.0 **Sample Number:** 9

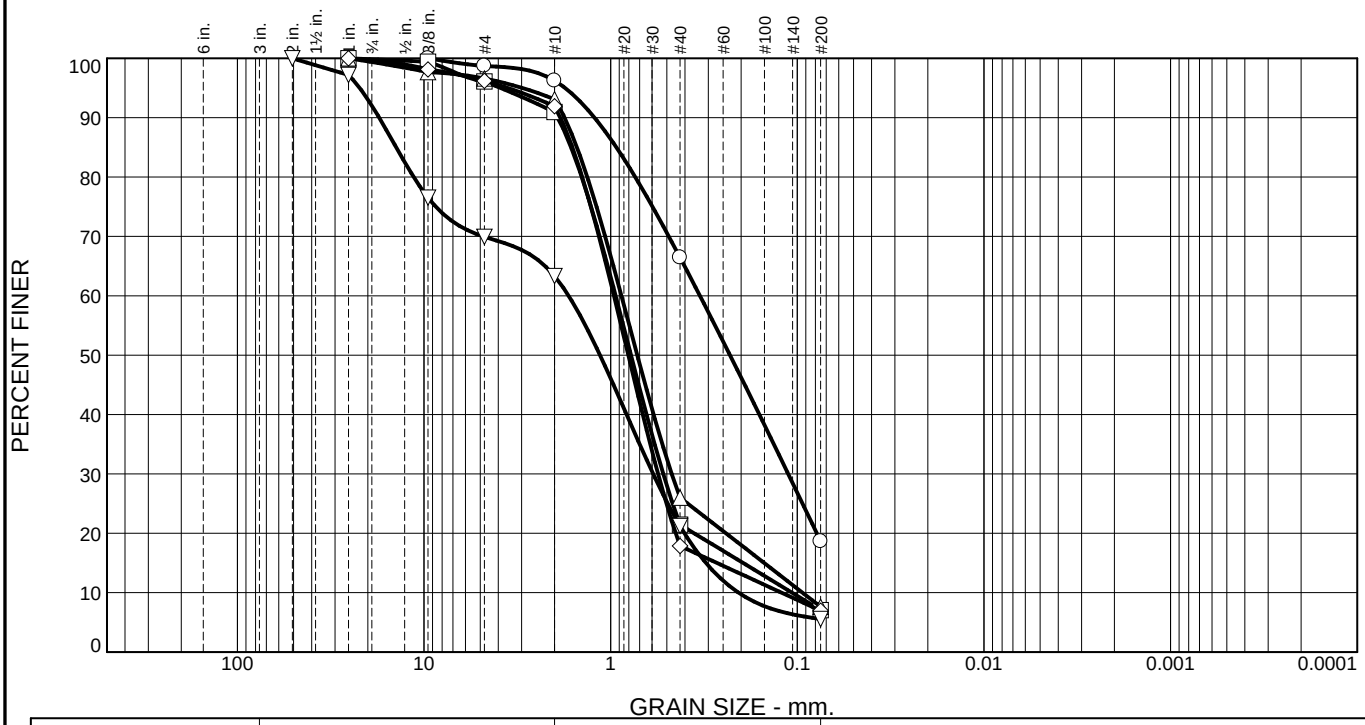
▽ **Source of Sample:** TR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.8	29.8	47.7	18.7	
□	0.0	9.0	69.6	14.3	7.1	
△	0.0	6.9	67.1	18.4	7.6	
◇	0.0	8.1	74.0	10.9	7.0	
▽	0.0	36.7	42.1	15.6	5.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9319	0.3324	0.2294	0.1119				
□	NV	NP	1.6297	0.9408	0.7784	0.5225	0.1953	0.1069	2.71	8.80
△	NV	NP	1.5162	0.8756	0.7200	0.4708	0.1504	0.0938	2.70	9.33
◇	NV	NP	1.6033	0.9604	0.8044	0.5571	0.2693	0.1215	2.66	7.90
▽	NV	NP	14.0934	1.6805	1.1407	0.5918	0.3087	0.2064	1.01	8.14

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
△ Wet medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Wet medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
▽ Wet dense orange fine gravel and coarse sand w/some fine sand, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** TR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** TR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** TR-1 **Depth:** 38.0 **Sample Number:** 14

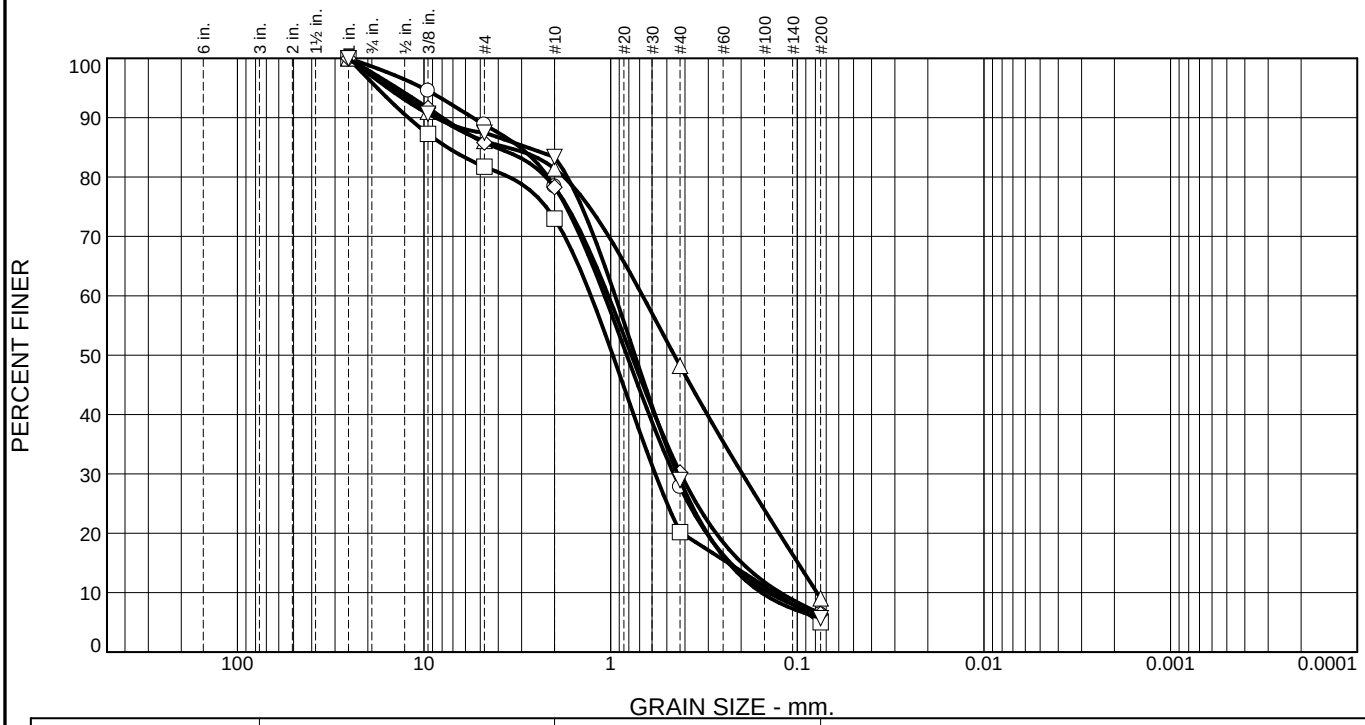
▽ **Source of Sample:** TR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	21.6	50.6	21.5	6.3	
□	0.0	27.0	52.8	15.2	5.0	
△	0.0	18.6	33.2	39.2	9.0	
◇	0.0	21.7	48.1	23.8	6.4	
▽	0.0	16.6	54.4	23.3	5.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	3.0534	1.0783	0.8197	0.4588	0.2278	0.1429	1.37	7.55
□	NV	NP	7.4987	1.2759	0.9742	0.5769	0.2345	0.1325	1.97	9.63
△	NV	NP	3.6050	0.6744	0.4561	0.1970	0.0992	0.0785	0.73	8.59
◇	NV	NP	4.1218	1.0291	0.7740	0.4215	0.1981	0.1234	1.40	8.34
▽	NV	NP	2.8039	0.9466	0.7413	0.4388	0.2335	0.1557	1.31	6.08

Material Description	USCS	AASHTO
○ Wet dense orange fine gravel and coarse to fine sand w/trace silt.	SW-SM	A-1-b
□ Wet dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	SW-SM	A-1-b
△ Wet dense orange fine to coarse sand w some fine gravel, trace of silt./	SP-SM	A-1-b
◇ Wet very dense orange fine gravelly coarse to fine sand w/trace silt.	SW-SM	A-1-b
▽ Wet dense orange coarse to fine sand w some fine gravel, trace of silt./	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** TR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** TR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** TR-1 **Depth:** 63.0 **Sample Number:** 19

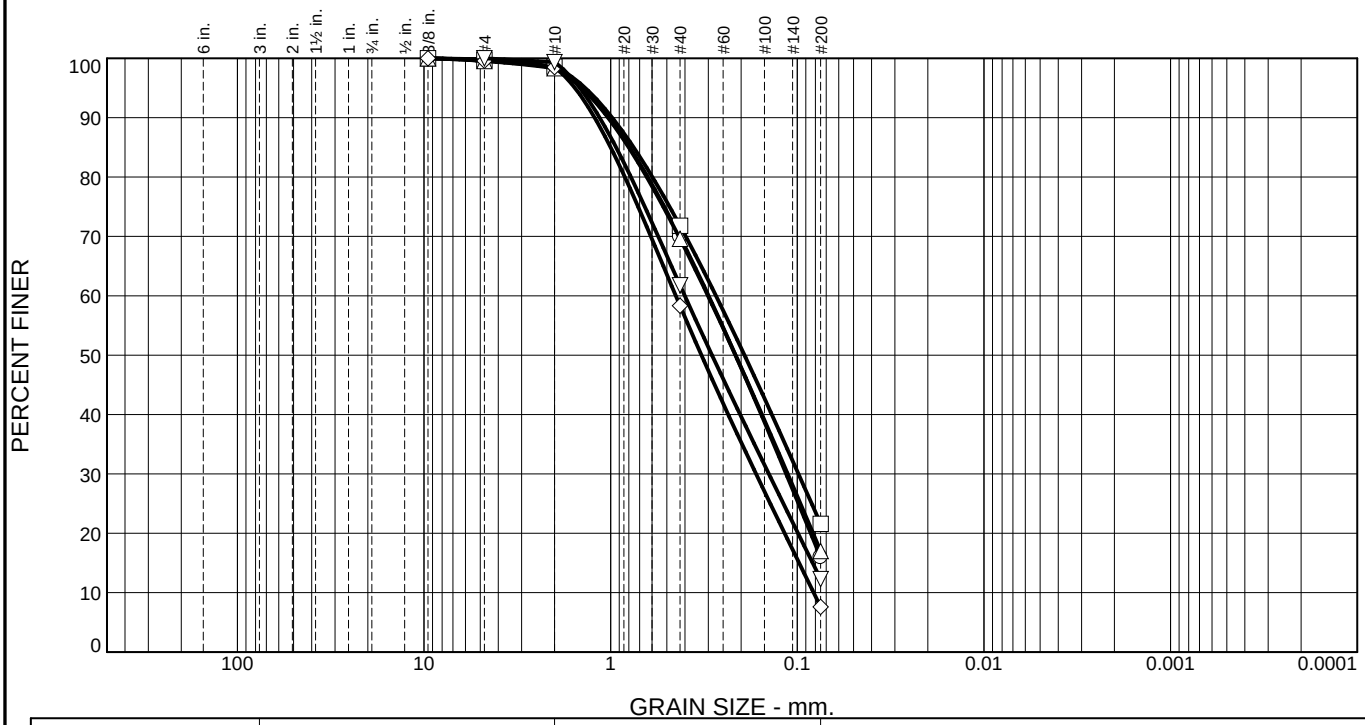
▽ **Source of Sample:** TR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.6	28.5	54.0	15.9	
□	0.0	1.4	26.8	50.2	21.6	
△	0.0	1.7	28.7	52.6	17.0	
◇	0.0	1.5	40.2	50.7	7.6	
▽	0.0	0.6	37.6	49.5	12.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7916	0.2987	0.2143	0.1147				
□	NV	NP	0.7533	0.2727	0.1920	0.0986				
△	NV	NP	0.8003	0.3010	0.2144	0.1126				
◇	NV	NP	1.0004	0.4477	0.3263	0.1664	0.0978	0.0817	0.76	5.48
▽	NV	NP	0.9355	0.4008	0.2863	0.1421	0.0828			

Material Description	USCS	AASHTO
○ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet very loose gray silty fine to coarse sand w/trace fine gravel and organic matter.	SM	A-2-4(0)
△ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SM	A-2-4(0)
◇ Wet loose gray fine to coarse sand w/trace silt, fine gravel and organic matter.	SP-SM	A-3
▽ Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** TR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** TR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** TR-2 **Depth:** 6.0 **Sample Number:** 4

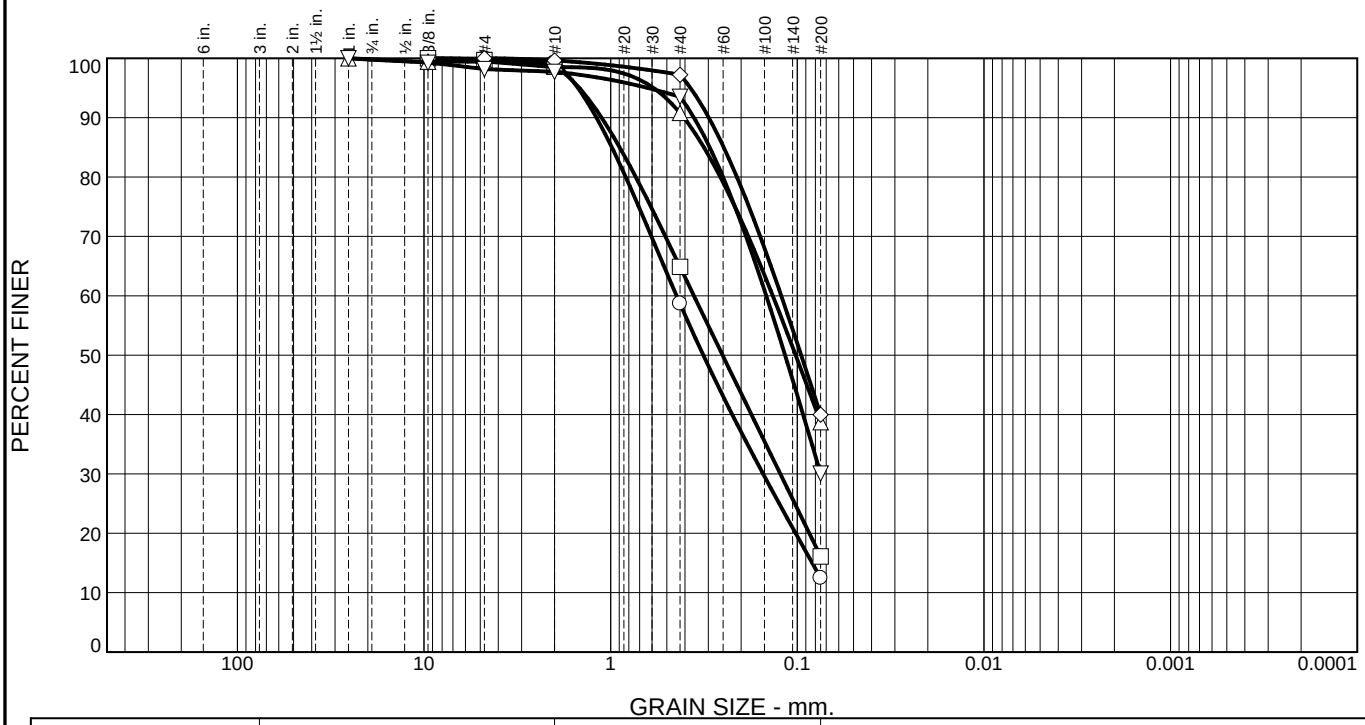
▽ **Source of Sample:** TR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.8	40.5	46.2	12.5	
□	0.0	1.3	33.8	48.8	16.1	
△	0.0	1.4	7.8	52.1	38.7	
◇	0.0	0.4	2.4	57.2	40.0	
▽	0.0	2.3	4.2	63.4	30.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9854	0.4433	0.3188	0.1525	0.0832			
□	NV	NP	0.8948	0.3581	0.2514	0.1233				
△	19.7	NP	0.3164	0.1354	0.1021					
◇	23.2	NP	0.2478	0.1219	0.0954					
▽	NV	NP	0.2946	0.1467	0.1163					

Material Description	USCS	AASHTO
○ Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet soft gray silty fine sand w/trace coarse sand and fine gravel.	SM	A-4(0)
◇ Saturated soft brown fine sandy silt w trace coarse sand.	SM	A-4(0)
▽ Saturated very loose orange silty fine sand w/trace coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** TR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** TR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** TR-2 **Depth:** 16.0 **Sample Number:** 9

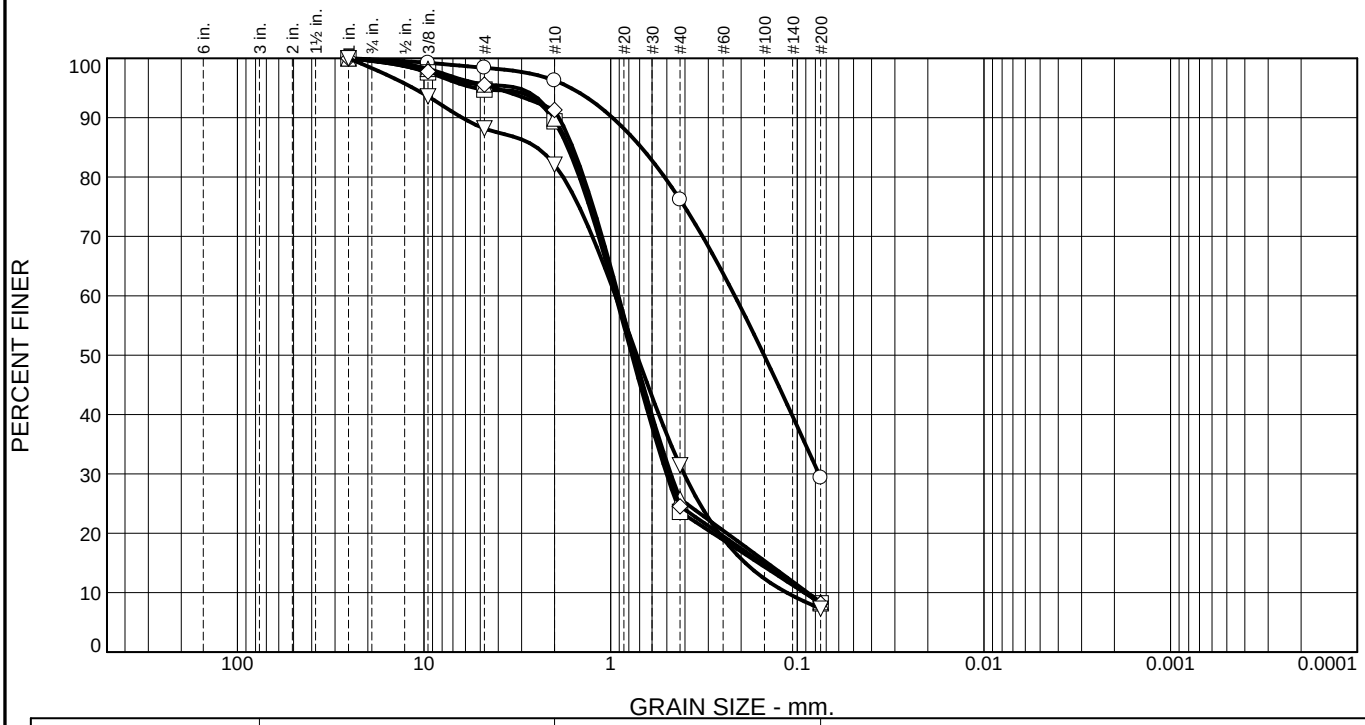
▽ **Source of Sample:** TR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.7	20.1	46.8	29.4	
□	0.0	10.6	65.8	15.4	8.2	
△	0.0	10.1	64.1	17.4	8.4	
◇	0.0	8.7	66.8	16.3	8.2	
▽	0.0	17.9	50.7	24.1	7.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6856	0.2164	0.1507	0.0766				
□	NV	NP	1.6984	0.9403	0.7691	0.5016	0.1612	0.0917	2.92	10.25
△	NV	NP	1.6687	0.9162	0.7449	0.4763	0.1448	0.0879	2.82	10.42
◇	NV	NP	1.5981	0.9080	0.7457	0.4887	0.1546	0.0910	2.89	9.98
▽	NV	NP	2.4939	0.9433	0.7236	0.4043	0.1900	0.1139	1.52	8.28

Material Description	USCS	AASHTO
○ Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
□ Saturated medium dense tan coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b
△ Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** TR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** TR-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** TR-2 **Depth:** 38.0 **Sample Number:** 14

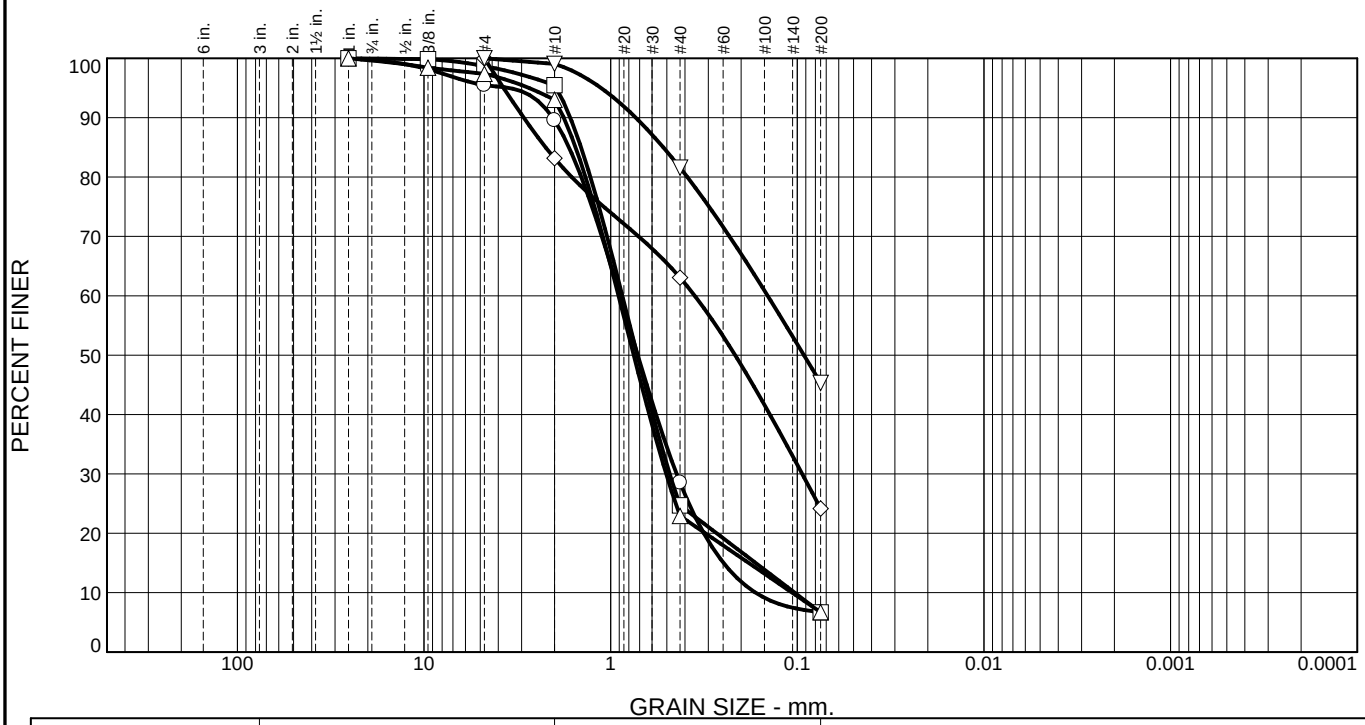
▽ **Source of Sample:** TR-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	10.4	61.1	21.8	6.7	
□	0.0	4.5	70.8	18.0	6.7	
△	0.0	7.0	70.1	16.2	6.7	
◇	0.0	16.8	20.1	38.9	24.2	
▽	0.0	0.9	17.5	36.3	45.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6730	0.8903	0.7157	0.4433	0.2483	0.1675	1.32	5.31
□	NV	NP	1.4412	0.8658	0.7197	0.4827	0.1672	0.1033	2.60	8.38
△	NV	NP	1.5420	0.9077	0.7523	0.5043	0.1820	0.1066	2.63	8.52
◇	NV	NP	2.2318	0.3544	0.2153	0.0942				
▽	14.2	NP	0.5222	0.1442	0.0922					

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	SP-SM	A-1-b
□ Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
△ Saturated very dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Saturated loose gray silty fine sand w some coarse sand and fine gravel.	SM	A-2-4(0)
▽ Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** TR-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** TR-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** TR-2 **Depth:** 63.0 **Sample Number:** 19

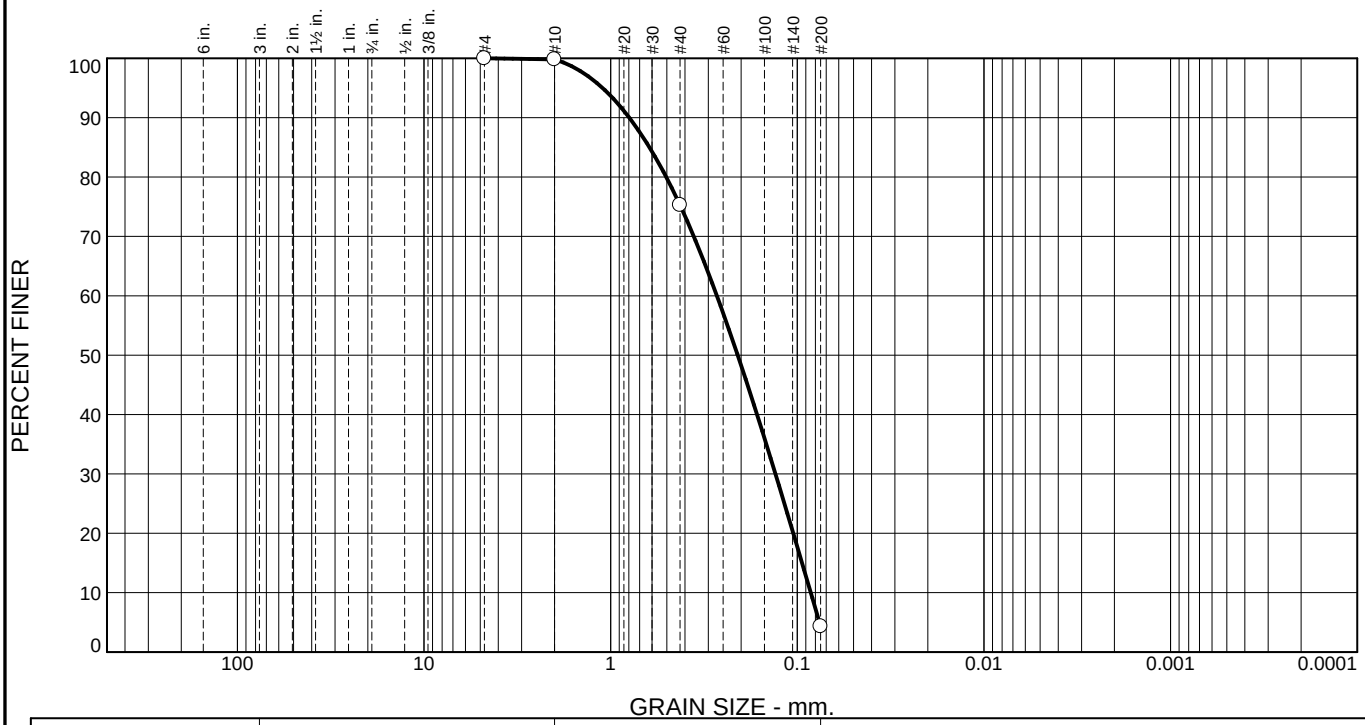
▽ **Source of Sample:** TR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.2	24.5	71.0	4.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6194	0.2696	0.2087	0.1310	0.0943	0.0847	0.75	3.18

Material Description	USCS	AASHTO
○ Saturated dense gray fine to coarse sand w/trace silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Tuckers Road

○ **Source of Sample:** TR-2 **Depth:** 73.0 **Sample Number:** 21

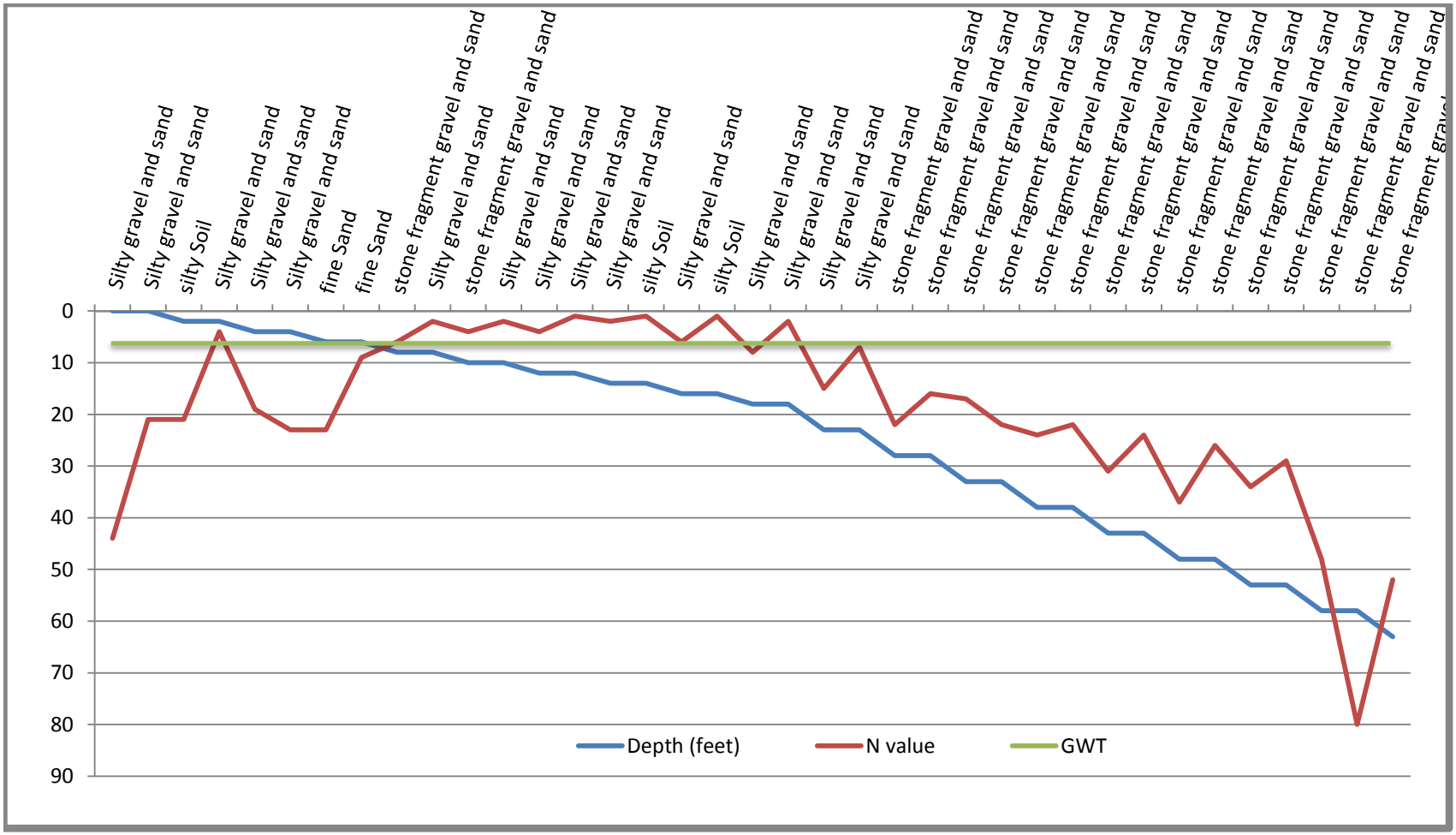
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
TR-1														
	1		Moist dense brown silty fine to coarse sand.	NV	NP	6.3	SM	A-2-4(0)	99.6	24.7		15	29	10
	2	2	Moist very stiff brown fine sandy silt w/trace coarse sand and fine gravel.	15.5	NP	12.6	ML	A-4(0)	97.6	54.3	9	10	11	13
	3	4	Moist medium dense brown fine sand w/some silt, trace of coarse sand.	NV	NP	11	SM	A-2-4(0)	99.6	14.3	8	9	10	13
	4	6	Wet medium dense orange fine to coarse sand w/trace silt.	NV	NP	20	SP-SM	A-3	99.5	7	3	12	11	17
	5	8	Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	18.4	SP	A-1-b	96.1	3.4	1	2	4	6
	6	10	Wet very loose gray coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	19.2	SP-SM	A-1-b	90.3	9.3	4	2	2	2
	7	12	Wet very loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	16.2	SM	A-2-4(0)	91.2	13.3	1	2	2	3
	8	14	Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.1	SM	A-2-4(0)	96.8	13.3		1	1	2
	9	16	Wet loose brown silty fine sand w/trace coarse sand and fine gravel.	NV	NP	23.1	SM	A-2-4(0)	99.2	21.9	2	2	4	5
	10	18	Wet loose brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	24.9	SM	A-2-4(0)	99.7	23.1	2	3	5	5
	11	23	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.2	SM	A-2-4(0)	96.2	18.7	2	6	9	11
	12	28	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.4	SW-SM	A-1-b	91	7.1	4	11	11	12
	13	33	Wet medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	17.5	SW-SM	A-1-b	93.1	7.6	5	8	9	11
	14	38	Wet medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	16	SW-SM	A-1-b	91.9	7	2	11	13	22
	15	43	Wet dense orange fine gravel and coarse sand w/some fine sand, trace of silt.	NV	NP	10.7	SW-SM	A-1-b	63.3	5.6	11	14	17	21
	16	48	Wet dense orange fine gravel and coarse to fine sand w/trace silt.	NV	NP	12.8	SW-SM	A-1-b	78.4	6.3	9	18	19	21
	17	53	Wet dense orange fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	11.9	SW-SM	A-1-b	73	5	7	14	20	23
	18	58	Wet dense orange fine to coarse sand w some fine gravel, trace of silt./	NV	NP	27	SP-SM	A-1-b	81.4	9	13	21	27	40
	19	63	Wet very dense orange fine gravelly coarse to fine sand w/trace silt.	NV	NP	12.5	SW-SM	A-1-b	78.3	6.4	17	23	29	34
	20	68	Wet dense orange coarse to fine sand w some fine gravel, trace of silt./	NV	NP	14.3	SW-SM	A-1-b	83.4	5.7	14	21	24	31
		70	End Boring											
TR-2	1		Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	7.4	SM	A-2-4(0)	98.4	15.9	5	9	12	11
	2	2	Wet very loose gray silty fine to coarse sand w/trace fine gravel and organic matter.	NV	NP	19.6	SM	A-2-4(0)	98.6	21.6	1	2	2	3
	3	4	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	15.4	SM	A-2-4(0)	98.3	17	1	9	14	15
	4	6	Wet loose gray fine to coarse sand w/trace silt, fine gravel and organic matter.	NV	NP	20	SP-SM	A-3	98.5	7.6	2	4	5	3
	5	8	Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	24.9	SM	A-2-4(0)	99.4	12.3	1	1	1	2
	6	10	Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	23.6	SM	A-2-4(0)	99.2	12.5	WH	1	1	1
	7	12	Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	23.8	SM	A-2-4(0)	98.7	16.1	1		1	1
	8	14	Wet soft gray silty fine sand w/trace coarse sand and fine gravel.	19.7	NP	28.4	SM	A-4(0)	98.6	38.7	1		1	
	9	16	Saturated soft brown fine sandy silt w trace coarse sand.	23.2	NP	33.1	SM	A-4(0)	99.6	40	1		1	1
	10	18	Saturated very loose orange silty fine sand w/trace coarse sand and fine gravel.	NV	NP	31.6	SM	A-2-4(0)	97.7	30.1	1	1	1	1
	11	23	Saturated loose brown silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	27.9	SM	A-2-4(0)	96.3	29.4	4	3	4	3
	12	28	Saturated medium dense tan coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	17.4	SW-SM	A-1-b	89.4	8.2	3	7	9	10
	13	33	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	15.4	SW-SM	A-1-b	89.9	8.4	8	10	12	15
	14	38	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	14.9	SW-SM	A-1-b	91.3	8.2	7	11	11	17
	15	43	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	15.5	SW-SM	A-1-b	82.1	7.3	4	11	13	19
	16	48	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	NV	NP	11.6	SP-SM	A-1-b	89.6	6.7	11	13	13	19
	17	53	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	14.1	SW-SM	A-1-b	95.5	6.7	10	10	19	20
	18	58	Saturated very dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	31.8	SW-SM	A-1-b	93	6.7	26	40	40	28
	19	63	Saturated loose gray silty fine sand w some coarse sand and fine gravel.	NV	NP	18.6	SM	A-2-4(0)	83.2	24.2	4	4	4	6
	20	68	Saturated hard gray fine sandy silt w/some coarse sand, trace of fine gravel.	14.2	NP	18.7	SM	A-4(0)	99.1	45.3	14	50	1	
	21	73	Saturated dense gray fine to coarse sand w/trace silt.	NV	NP	22.7	SP	A-3	99.8	4.3	9	18	27	28
		75	End Boring											

DATE : 1-04-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-139 on Tuckers road - Greenwood DE



DATE : 1-04-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-139 on Tuckers road - Greenwood DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 4-19-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-236 on Elks road over Clear brook Branch- Bridgeville DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-12-2016 and 2-17-2016. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 50 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in Beaverdam Formation White-greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Bridgeville Area, Delaware by John K. Adams, Durward H. Boggess and O.J Coskery (1964) Atlas HA- 106. The nearest well to this site the groundwater historically had been measured as 29 feet on October 1960 and between the years of 1950 to 1962 appeared from

28 to 30 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 14 feet down is Silty soils (A-4) and from 14 to 72 feet down Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 20 to 30 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good to fair category.

5. Ground Cover

The ground cover for this site is 7 inches of asphalt top of 6 inches of stone.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 6 feet, noted at the completion of the drilling is 4 and 10 feet and caved at 7.5 feet all the measurements is below the ground surface elevation. Rotary mud was added at 10 feet depth during the drilling. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 5.1 to 42.9 percent. The Atterberg limit is 3 percent, Liquid limits is 25.8 percent and none of Plasticity Index. The Organic matter is 6 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in not a good condition and loose fine sand layer appeared from the surface elevation to 25 feet down this layer need to consider in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had been

met all borrow type material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (9- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 30-1692 T201407003 BR3-236 on Elks Road (Old Furnace Road) in Sussex County

Google earth

feet 1000

meters 300

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING ER-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 251882.833
Easting: 604047.388
Boring Surface Elev.:
Reference:
Date Started: 2/12/16
Date Completed: 2/12/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 10.0
From Depth of: 10.0 **To:** 50.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/12/16	6.0	
2/12/16	11.0	4.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: B-30
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' – 2.0'	2 3 5	Moist loose brown fine to coarse sand w/ some silt, trace of fine gravel. 14" RECOVERY	A-2-4(0)	Hot-mix 7"
2.53		2	2.0' – 4.0'	4 5 5 4	Moist loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' – 6.0'	1 2 1 1	Wet very loose brown fine to coarse sand w/ some silt. 24" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' – 8.0'	1 6 10 10	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
10.12		5	8.0' – 10.0'	1 2 7 8	Wet loose brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
	▽	6	10.0' – 12.0'	3 5 7 13	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
12.65		7	12.0' – 14.0'	11 13 15	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ER-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	3 4 5 5	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	2 2 3 4	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	3 3 5 5	Wet loose white coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	1 2 5 7	Wet loose white coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	3 4 6 10	Wet loose orange fine to coarse sand w some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' 35.0'	1 2 5 9	Wet loose brown fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ER-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	16 16 16 18	Wet dense orange fine to coarse sand w some fine gravel and silt. 24" RECOVERY	A-2-4(0)	
40.48							
43.01							
		15	43.0' 45.0'	9 11 16 23	Wet medium dense brown coarse sand w/ some fine gravel, trace of fine sand and silt. 10" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	13 17 20 24	Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt. 24" RECOVERY	A-1-b	
50.6					End Boring		
53.13							
55.66							
58.19							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING ER-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 251924.494
Easting: 603950.290
Boring Surface Elev.:
Reference:
Date Started: 2/12/16
Date Completed: 2/12/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 10.0
From Depth of: 10.0 **To:** 50.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/17/16	6.0	
2/17/16	10.0	8.50

Boring Contractor: Walton Corporation
Equipment/Rig Type: B-30
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' 2.0'	3 3 6	Moist loose brown fine to coarse sand w/ some fine gravel and silt. 18" RECOVERY	A-2-4(0)	Hot-mix 6", stone 3"
2.53		2	2.0' 4.0'	4 3 4 3	Moist loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	1 1 1 1	Saturated soft gray fine to coarse sandy silt w/trace organic matter. 24" RECOVERY	A-4(0)	
7.59	■	4	6.0' 8.0'	1 1 2 4	Saturated very loose orange fine sand w/some coarse sand, fine gravel and organic matter, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
10.12	▽	5	8.0' 10.0'	3 6 6 12	Saturated medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
		6	10.0' 12.0'	5 5 5 5	Saturated loose brown fine to coarse sand w/ trace silt. 24" RECOVERY	A-3	
12.65		7	12.0' 14.0'	3 1 1 2	Saturated very loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ER-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	1 1 1 1	Saturated very loose brown coarse to fine sand w/some silt, trace of fine. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	1 2 2 1	Saturated very loose white coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	3 3 5 5	Saturated loose white coarse sand w/some fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	2 3 5 7	Saturated loose brown coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	3 5 5 5	Saturated loose orange silty fine sand w/some coarse sand. 14" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' 35.0'	3 6 6 6	Saturated medium dense brown fine sand w/ some coarse sand and silt. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** ER-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	3 6 11 7	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
40.48							
43.01							
		15	43.0' 45.0'	3 11 22 22	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	4 12 16 30	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
50.6					End Boring		
53.13							
55.66							
58.19							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

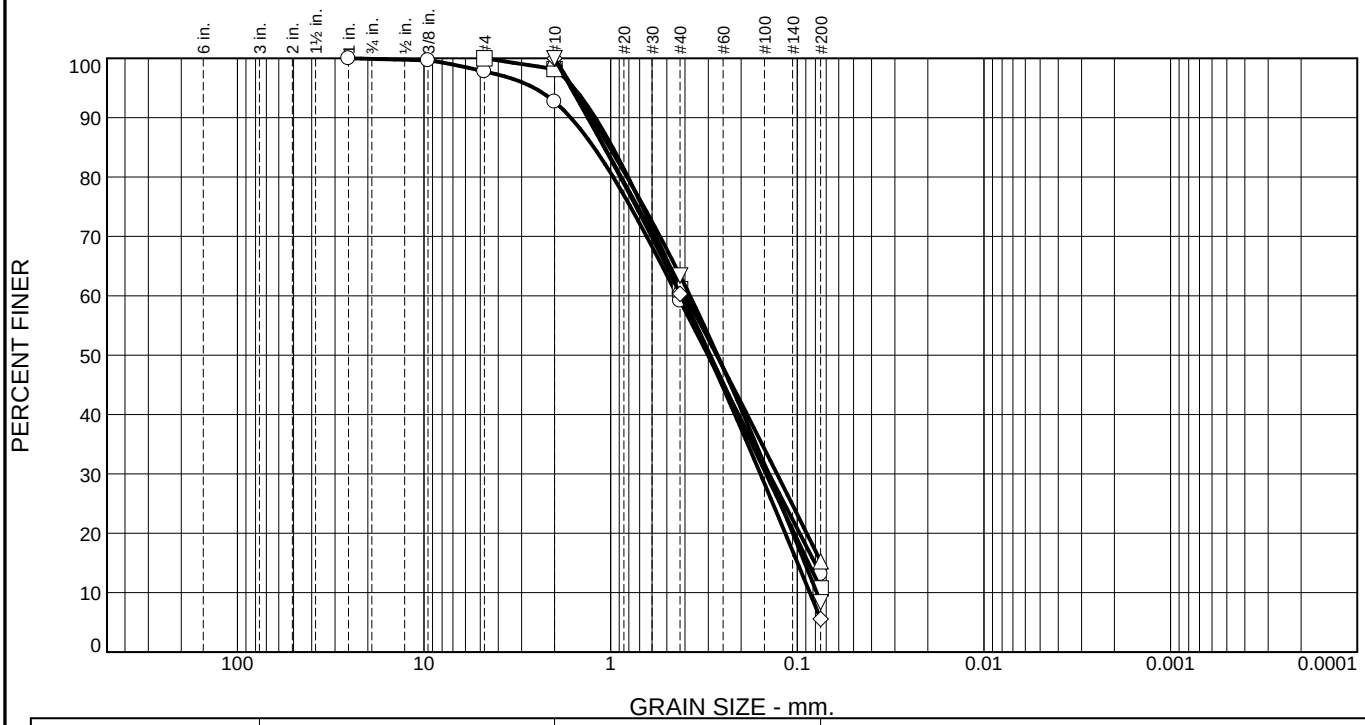
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.3	33.5	46.1	13.1	
□	0.0	1.8	37.1	50.4	10.7	
△	0.0	0.0	38.2	46.5	15.3	
◇	0.0	0.0	39.7	54.7	5.6	
▽	0.0	0.0	36.6	55.0	8.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2299	0.4385	0.3011	0.1417	0.0805			
□	NV	NP	0.9766	0.4095	0.2927	0.1472	0.0871			
△	NV	NP	1.0770	0.3963	0.2703	0.1285				
◇	NV	NP	1.0824	0.4201	0.2988	0.1578	0.0997	0.0857	0.69	4.90
▽	NV	NP	1.0136	0.3759	0.2675	0.1428	0.0912	0.0787	0.69	4.78

Material Description	USCS	AASHTO
○ Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Wet very loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
▽ Wet loose brown fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** ER-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** ER-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** ER-1 **Depth:** 6.0 **Sample Number:** 4

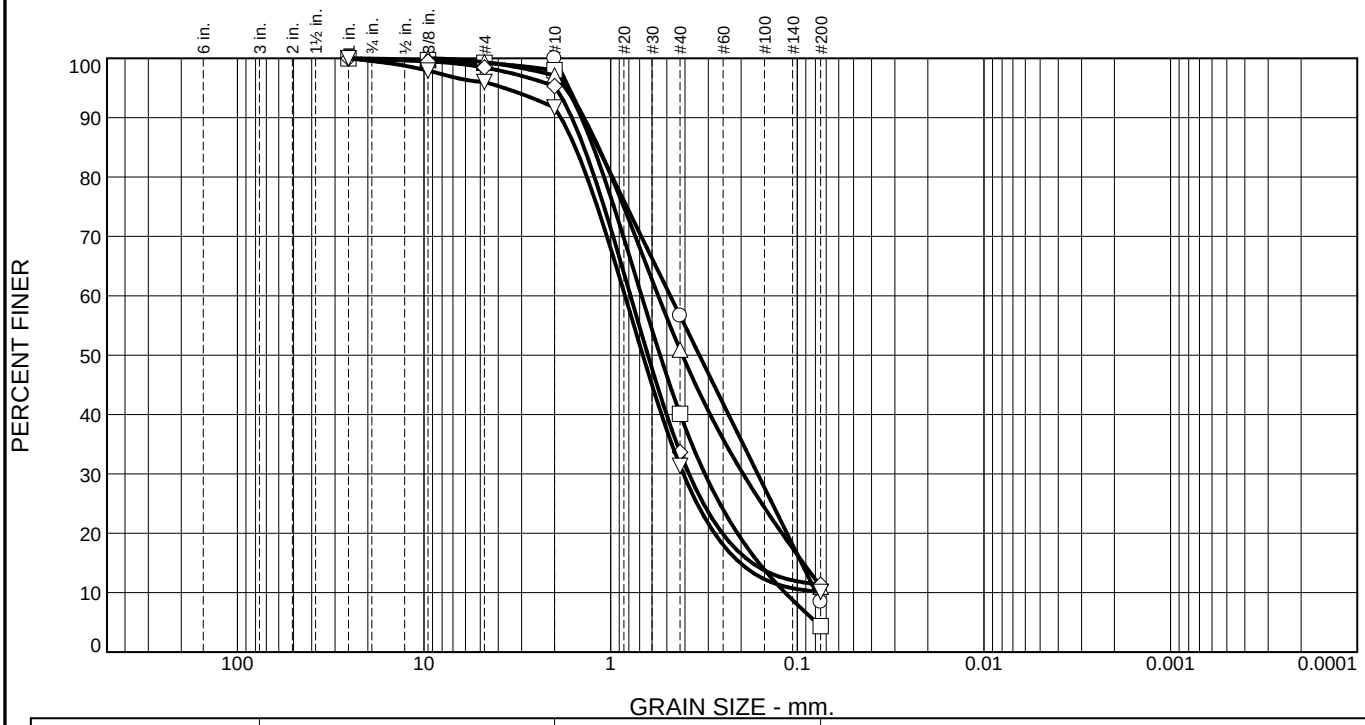
▽ **Source of Sample:** ER-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	43.3	48.2	8.5	
□	0.0	2.0	57.9	35.7	4.4	
△	0.0	2.9	46.2	39.9	11.0	
◇	0.0	4.7	61.6	22.4	11.3	
▽	0.0	8.3	60.3	21.3	10.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1711	0.4791	0.3347	0.1630	0.0950	0.0793	0.70	6.04
□	NV	NP	1.2368	0.6829	0.5435	0.3128	0.1608	0.1162	1.23	5.88
△	NV	NP	1.1603	0.5559	0.4128	0.1952	0.0930			
◇	NV	NP	1.3904	0.7827	0.6314	0.3806	0.1747			
▽	NV	NP	1.5467	0.8376	0.6726	0.4079	0.2025			

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
△ Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
◇ Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
▽ Wet loose white coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** ER-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** ER-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** ER-1 **Depth:** 16.0 **Sample Number:** 9

▽ **Source of Sample:** ER-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report

	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.1	70.8	19.7	8.4	
□	0.0	1.5	32.9	47.1	18.5	
△	0.0	0.0	35.4	51.8	12.8	
◇	0.0	17.1	27.7	39.9	15.3	
▽	0.0	16.1	72.5	8.4	3.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3272	0.8110	0.6737	0.4455	0.1340	0.0863	2.84	9.40
□	NV	NP	0.8850	0.3476	0.2412	0.1150				
△	NV	NP	0.9954	0.3572	0.2505	0.1294	0.0805			
◇	NV	NP	2.5884	0.5285	0.3374	0.1410				
▽	NV	NP	2.0861	1.1334	0.9389	0.6461	0.4674	0.3186	1.16	3.56

Material Description	USCS	AASHTO
○ Wet loose white coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
□ Wet loose orange fine to coarse sand w some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Wet dense orange fine to coarse sand w some fine gravel and silt.	SM	A-2-4(0)
▽ Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** ER-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** ER-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** ER-1 **Depth:** 38.0 **Sample Number:** 14

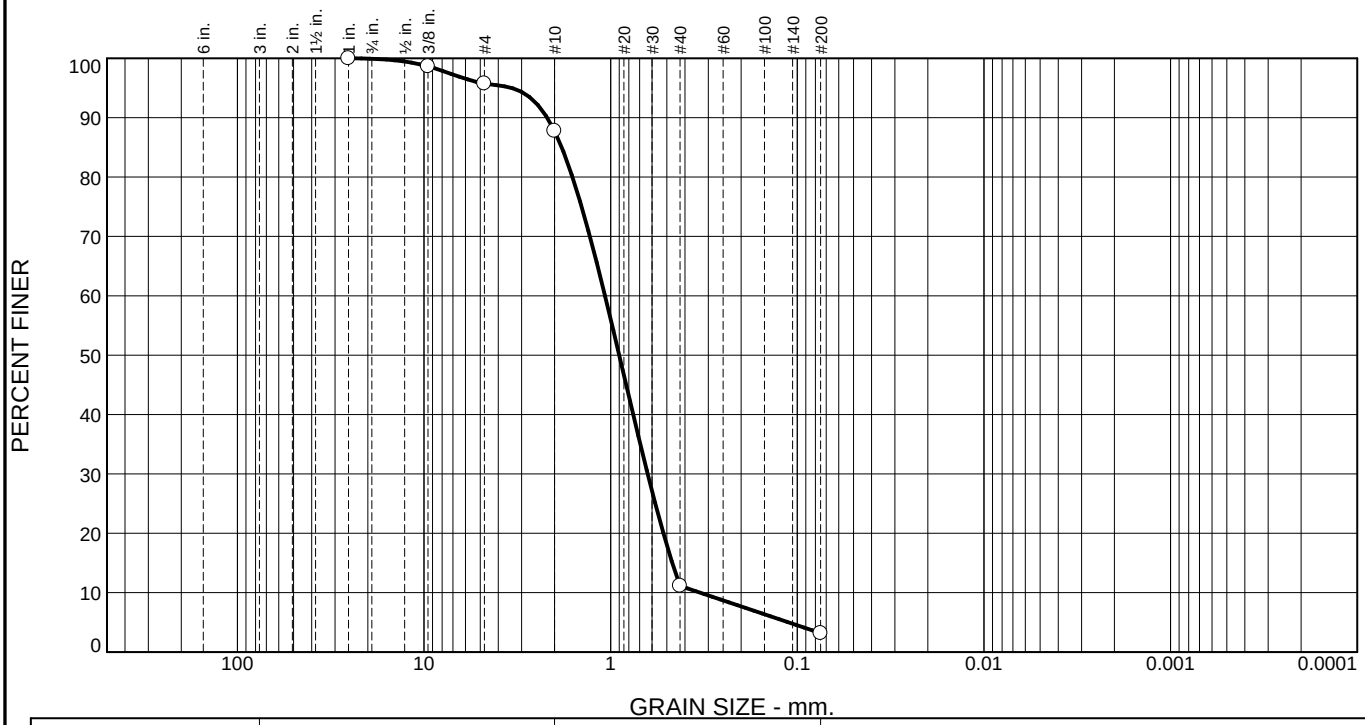
▽ **Source of Sample:** ER-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.2	76.7	7.9	3.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8297	1.0726	0.9002	0.6336	0.4674	0.3314	1.13	3.24

Material Description	USCS	AASHTO
○ Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

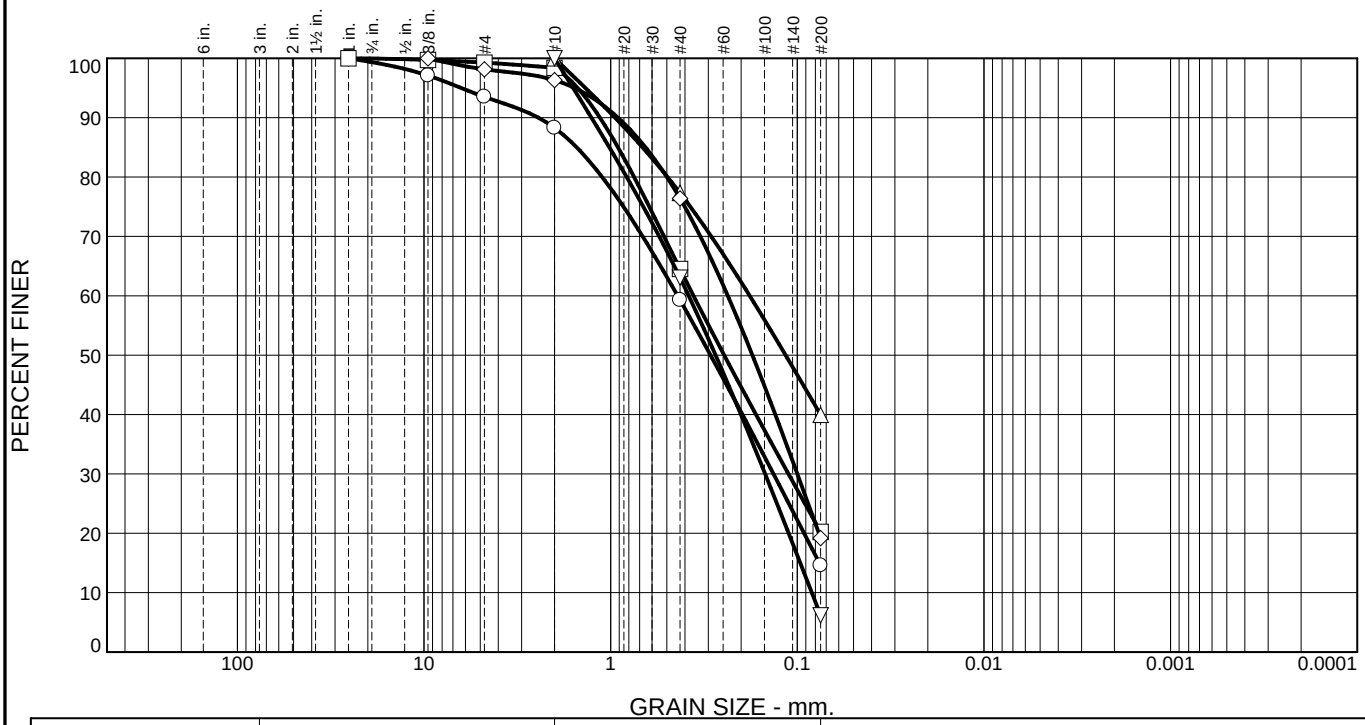
○ **Source of Sample:** ER-1 **Depth:** 48.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.7	29.0	44.7	14.6	
□	0.0	1.6	33.9	44.3	20.2	
△	0.0	0.0	22.7	37.4	39.9	
◇	0.0	3.7	19.9	57.2	19.2	
▽	0.0	0.0	37.0	56.8	6.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5215	0.4377	0.2916	0.1342	0.0762			
□	NV	NP	0.9139	0.3600	0.2465	0.1115				
△	25.8	NP	0.6749	0.1800	0.1155					
◇	NV	NP	0.6502	0.2356	0.1741	0.1000				
▽	NV	NP	1.0162	0.3819	0.2739	0.1488	0.0964	0.0836	0.69	4.57

Material Description	USCS	AASHTO
○ Moist loose brown fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
□ Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated soft gray fine to coarse sandy silt w/trace organic matter.	SM	A-4(0)
◇ Saturated very loose orange fine sand w/some coarse sand, fine gravel and organic matter, trace of fine	SM	A-2-4(0)
▽ Saturated medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-2 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** ER-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** ER-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** ER-2 **Depth:** 6.0 **Sample Number:** 4

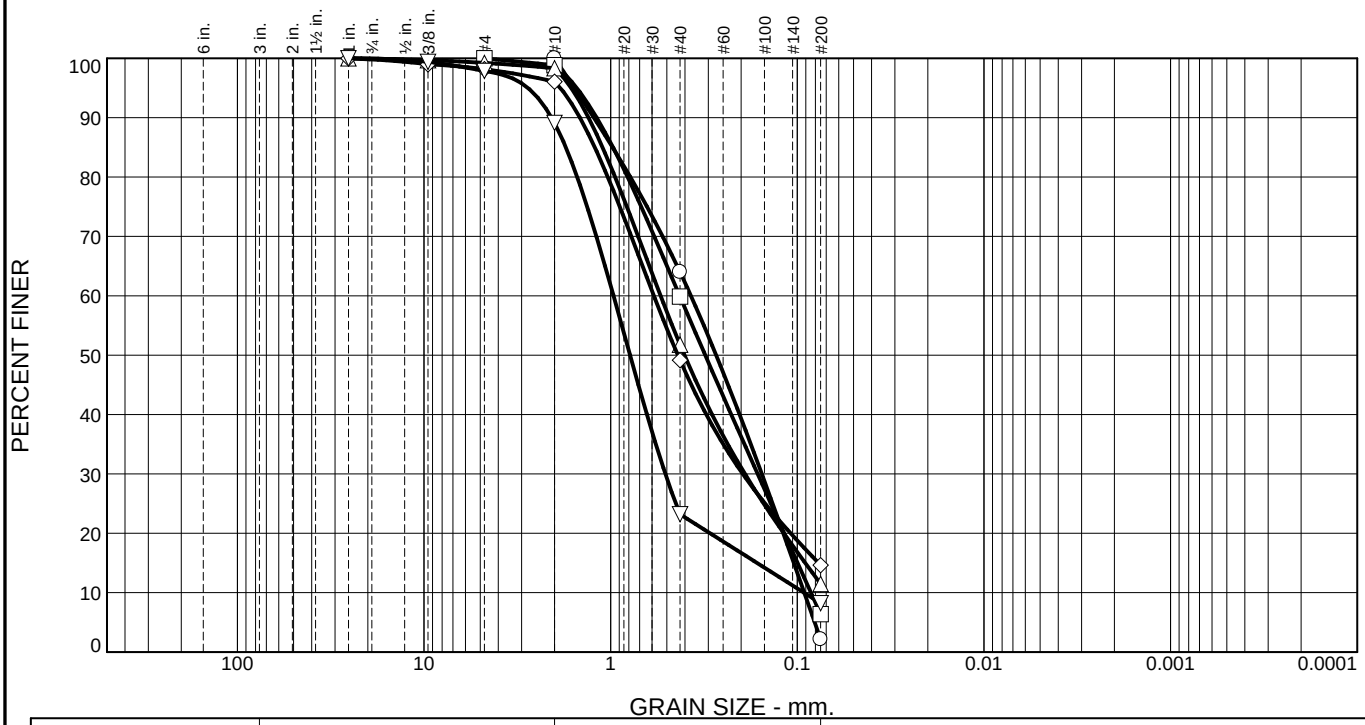
▽ **Source of Sample:** ER-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	36.0	61.9	2.1	
□	0.0	1.2	38.9	53.5	6.4	
△	0.0	1.7	46.5	40.3	11.5	
◇	0.0	3.9	46.9	34.6	14.6	
▽	0.0	10.9	65.9	15.0	8.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9769	0.3716	0.2721	0.1550	0.1044	0.0918	0.70	4.05
□	NV	NP	0.9718	0.4269	0.3113	0.1632	0.0997	0.0845	0.74	5.05
△	NV	NP	1.1056	0.5400	0.4023	0.1908	0.0907			
◇	NV	NP	1.2166	0.5865	0.4366	0.1961	0.0770			
▽	NV	NP	1.7389	0.9656	0.7872	0.5092	0.1643	0.0921	2.92	10.48

Material Description	USCS	AASHTO
○ Saturated loose brown fine to coarse sand w/trace silt.	SP	A-3
□ Saturated very loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Saturated very loose brown coarse to fine sand w/some silt, trace of fine.	SP-SM	A-2-4(0)
◇ Saturated very loose white coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
▽ Saturated loose white coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** ER-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** ER-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** ER-2 **Depth:** 16.0 **Sample Number:** 9

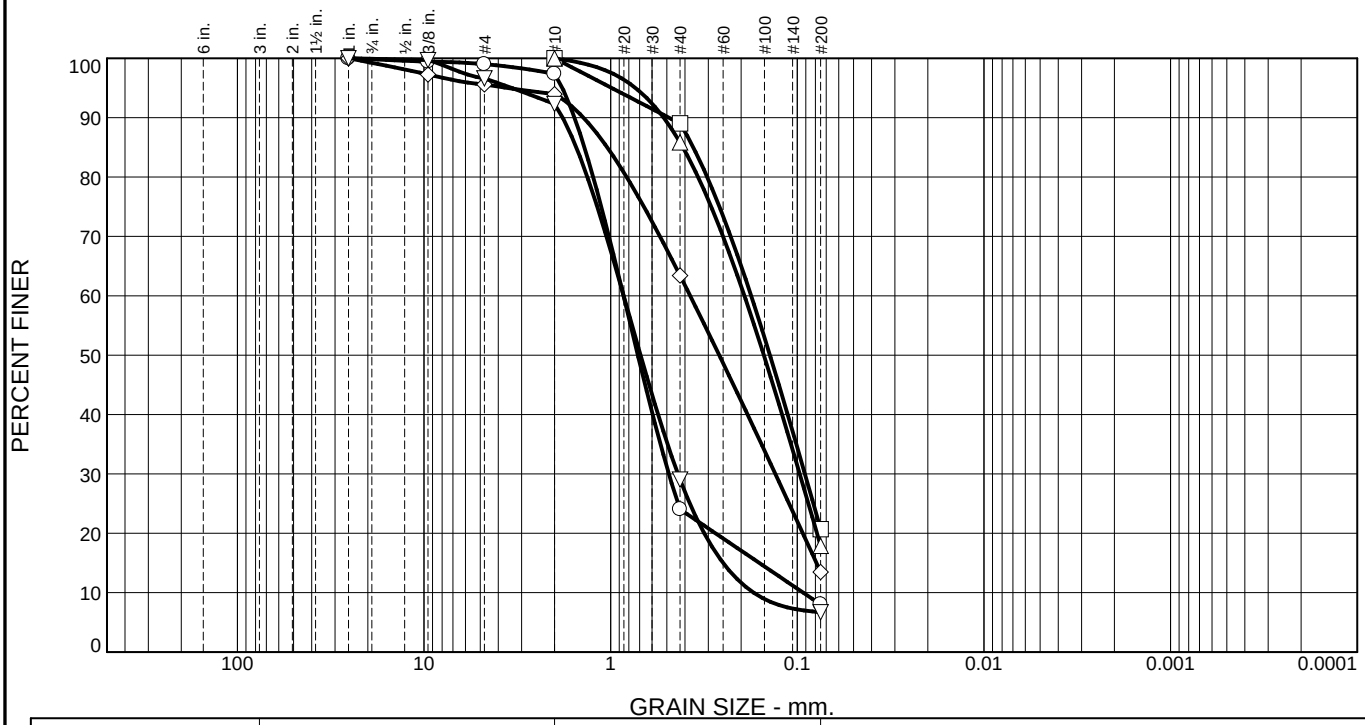
▽ **Source of Sample:** ER-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	73.4	16.0	8.0	
□	0.0	0.0	11.0	68.3	20.7	
△	0.0	0.0	14.2	67.9	17.9	
◇	0.0	6.0	30.6	49.9	13.5	
▽	0.0	7.7	63.3	22.3	6.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3826	0.8536	0.7151	0.4877	0.1597	0.0930	3.00	9.18
□	NV	NP	0.3608	0.1767	0.1402	0.0911				
△	NV	NP	0.4101	0.1921	0.1512	0.0971				
◇	NV	NP	1.0428	0.3749	0.2620	0.1312	0.0790			
▽	NV	NP	1.5290	0.8515	0.6914	0.4362	0.2496	0.1716	1.30	4.96

Material Description	USCS	AASHTO
○ Saturated loose brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
□ Saturated loose orange silty fine sand w/some coarse sand.	SM	A-2-4(0)
△ Saturated medium dense brown fine sand w/some coarse sand and silt.	SM	A-2-4(0)
◇ Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** ER-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** ER-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** ER-2 **Depth:** 38.0 **Sample Number:** 14

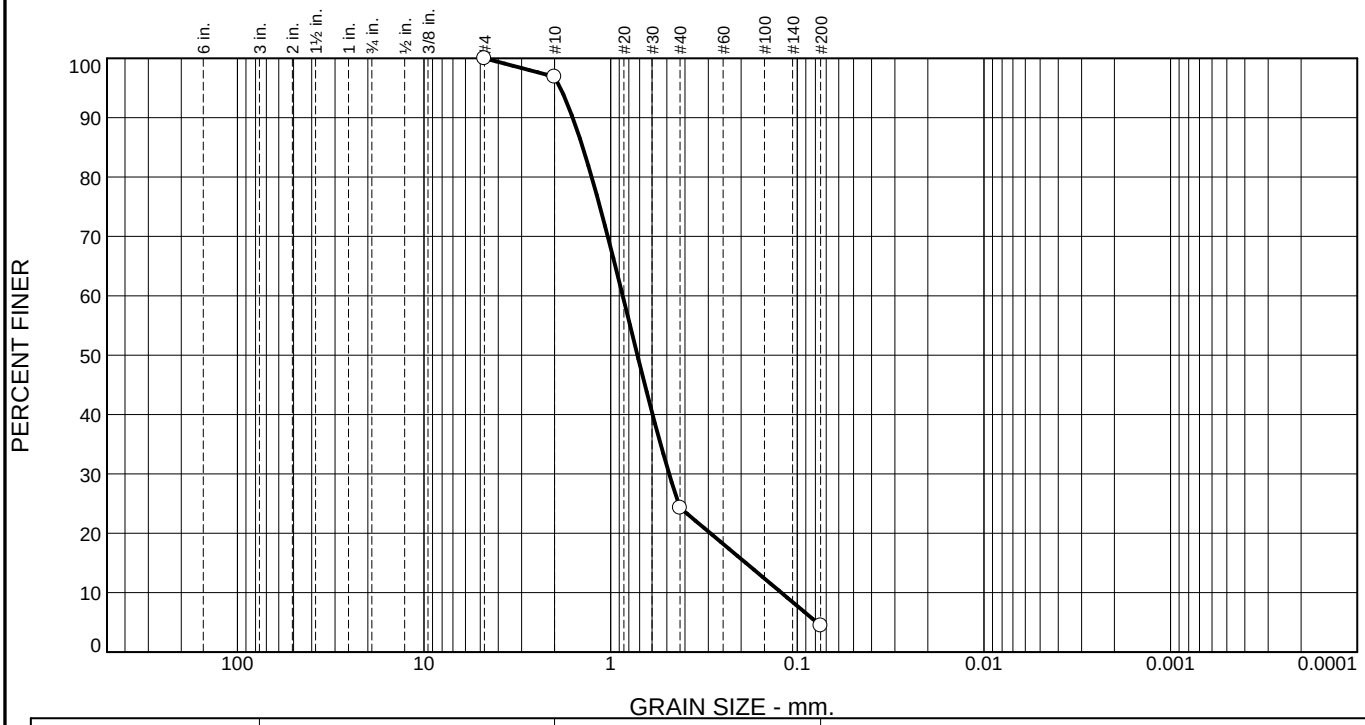
▽ **Source of Sample:** ER-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.1	72.6	19.8	4.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4118	0.8618	0.7187	0.4858	0.1886	0.1218	2.25	7.08

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** ER-2 **Depth:** 48.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

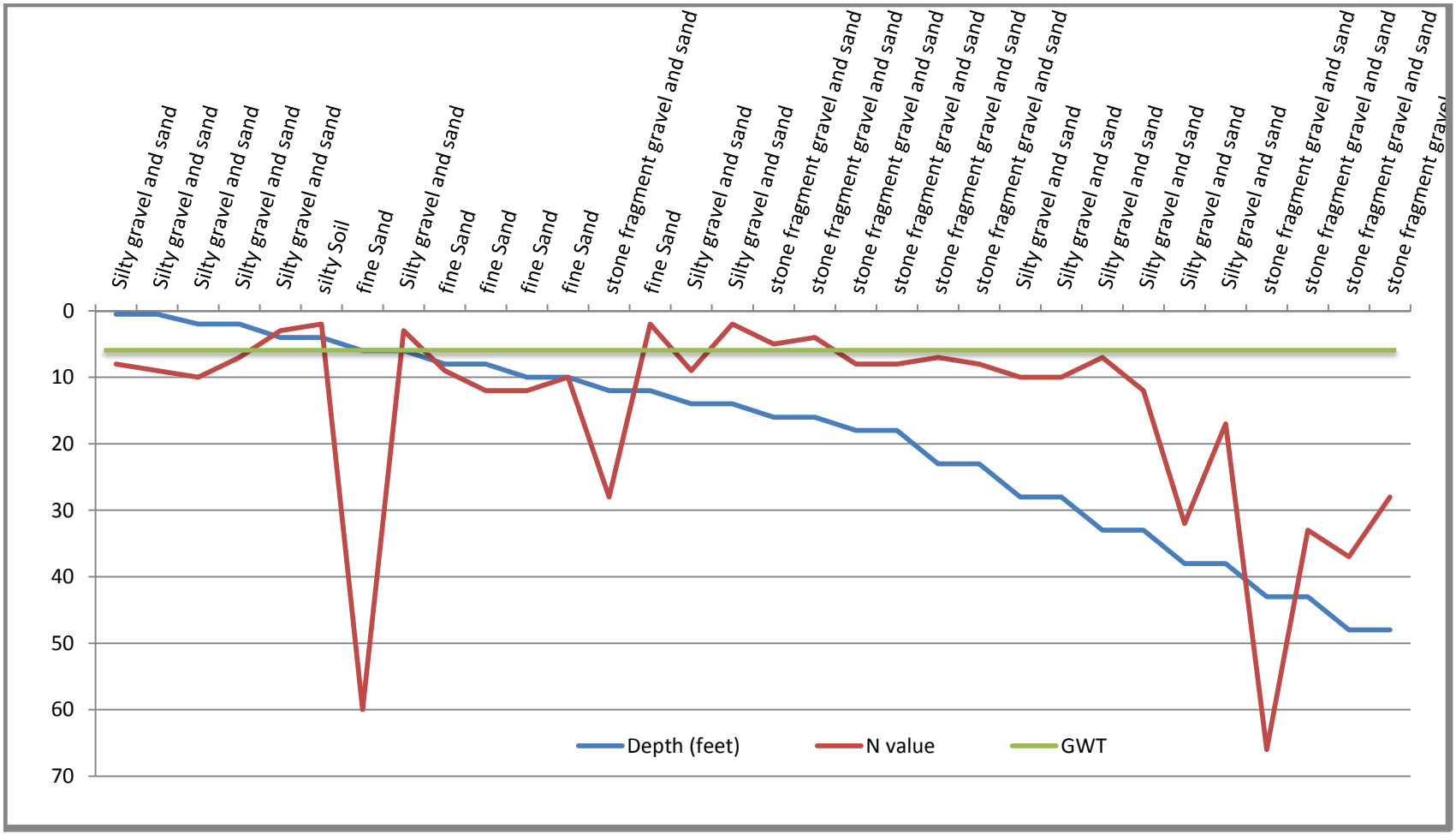
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
ER-1														
	1	0.5	Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	5.1	SM	A-2-4(0)	92.7	13.1	2	3	5	
	2	2	Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	13.7	SP-SM	A-2-4(0)	98.2	10.7	4	5	5	4
	3	4	Wet very loose brown fine to coarse sand w/some silt.	NV	NP	19	SM	A-2-4(0)	100	15.3	1	2	1	1
	4	6	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	19.9	SP-SM	A-3	100	5.6	1	6	10	10
	5	8	Wet loose brown fine to coarse sand w/trace silt.	NV	NP	19.8	SP-SM	A-3	100	8.4	1	2	7	8
	6	10	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	20.4	SP-SM	A-3	100	8.5	3	5	7	13
	7	12	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.6	SP	A-1-b	98	4.4	11	13	15	
	8	14	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	23.6	SP-SM	A-2-4(0)	97.1	11	3	4	5	5
	9	16	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	20.5	SP-SM	A-1-b	95.3	11.3	2	2	3	4
	10	18	Wet loose white coarse to fine sand w/trace fine gravel and silt.	NV	NP	21	SP-SM	A-1-b	91.7	10.1	3	3	5	5
	11	23	Wet loose white coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	17.7	SW-SM	A-1-b	98.9	8.4	1	2	5	7
	12	28	Wet loose orange fine to coarse sand w some silt, trace of fine gravel.	NV	NP	19.8	SM	A-2-4(0)	98.5	18.5	3	4	6	10
	13	33	Wet loose brown fine to coarse sand w/some silt.	NV	NP	24.5	SM	A-2-4(0)	100	12.8	1	2	5	9
	14	38	Wet dense orange fine to coarse sand w some fine gravel and silt.	NV	NP	15.7	SM	A-2-4(0)	82.9	15.3	16	16	16	18
	15	43	Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	13.8	SP	A-1-b	83.9	3	9	11	16	23
	16	48	Wet dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	12.9	SP	A-1-b	87.8	3.2	13	17	20	24
		50	End Boring											
ER-2														
	1	0.5	Moist loose brown fine to coarse sand w/some fine gravel and silt.	NV	NP	7.5	SM	A-2-4(0)	88.3	14.6	3	3	6	
	2	2	Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	13.6	SM	A-2-4(0)	98.4	20.2	4	3	4	3
	3	4	Saturated soft gray fine to coarse sandy silt w/trace organic matter.	25.8	NP	41.4	SM	A-4(0)	100	39.9	1	1	1	1
	4	6	Saturated very loose orange fine sand w/some coarse sand, fine gravel and organic matter, trace of fine gra	NV	NP	42.9	SM	A-2-4(0)	96.3	19.2	1	1	2	4
	5	8	Saturated medium dense brown fine to coarse sand w/trace silt.	NV	NP	18.2	SP-SM	A-3	100	6.2	3	6	6	12
	6	10	Saturated loose brown fine to coarse sand w/trace silt.	NV	NP	17.8	SP	A-3	100	2.1	5	5	5	5
	7	12	Saturated very loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	21.4	SP-SM	A-3	98.8	6.4	3	1	1	2
	8	14	Saturated very loose brown coarse to fine sand w/some silt, trace of fine.	NV	NP	22.2	SP-SM	A-2-4(0)	98.3	11.5	1	1	1	1
	9	16	Saturated very loose white coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	22.9	SM	A-1-b	96.1	14.6	1	2	2	1
	10	18	Saturated loose white coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	17.2	SW-SM	A-1-b	89.1	8.2	3	3	5	5
	11	23	Saturated loose brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	20.1	SW-SM	A-1-b	97.4	8	2	3	5	7
	12	28	Saturated loose orange silty fine sand w/some coarse sand.	NV	NP	21.7	SM	A-2-4(0)	100	20.7	3	5	5	5
	13	33	Saturated medium dense brown fine sand w/some coarse sand and silt.	NV	NP	24.9	SM	A-2-4(0)	100	17.9	3	6	6	6
	14	38	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.6	SM	A-2-4(0)	94	13.5	3	6	11	7
	15	43	Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	13.6	SP-SM	A-1-b	92.3	6.7	3	11	22	22
	16	48	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	14.8	SW	A-1-b	96.9	4.5	4	12	16	30
		50	End Boring											

DATE : **4-19-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-236 on Elks road over Clear brook Branch- Bridgeville DE**



DATE : **4-19-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-236 on Elks road over Clear brook Branch- Bridgeville DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 4-19-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-317 on Laurel Road - Laurel DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-26-2016 and 1-27-2016. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in TURTLE BRANCH FORMATION On the west side of the Nanticoke River: Clean, well-sorted, white to pale-yellow, fine sand grading down into fine to coarse sand overlying greenish-gray fine sand with scattered zones of chalky Crassostrea (oyster) shells. The shelly fine sand overlies a greenish-gray clayey silt to silty clay. At the base of the deposit is a fine to coarse, gray, pebbly sand with layers of organic silt and woody material (twigs and roots). Along stream valleys tributary to the east side of the Nanticoke River: Clean, well-sorted, white to pale-yellow, fine sand grading down to interlaminated fine to coarse sand with opaque heavy mineral laminae

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Pond Area, Delaware by John Adam, and Durward H. Boggess (1964) Atlas HA-120. The nearest well to this site the groundwater historically had been measured 31 feet on October 1960 and between the years of 1950 to 1960 appeared from 29 to 33 feet below the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 9 feet down is Silty or Clayey gravel and sand (A-2-4), from 9 to 30 feet down is Silty soils (A-4) and from 30 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter as 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good to excellent category.

5. Ground Cover

The ground cover for this site is 6.5 inches of Asphalt; more detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 5 and 8.5 feet, noted at the completion of the drilling is 8 and 23.5 feet and caved at 15 and 17 feet below the ground surface Rotary mud was added at 12 feet depth during the drilling more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 6.5 to 28.7 percent. The Atterberg limit is 15 percent, Liquid limits is range from 17.1 to 25.9 percent and Plasticity Index is range from 4.1 to 8 also the organic matter for the entire sample is 5 percent more detail show in Appendix- D

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition assume the foundation design will be below 6 feet from the surface. In addition all the sample from the depth of 2 to 10 feet from the surface had been met all the borrow material according to Del-DOT standard specification with 50 % percent amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 29-1692 T201407003 BR3-317 on Laurel Road in Sussex Co.

Google earth

feet 2000
meters 600

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING LR-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 194840.006
Easting: 644246.897
Boring Surface Elev.:
Reference:
Date Started: 1/26/16
Date Completed: 1/26/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** — **From Depth of:** 0.0 **To:** 14.0
Mud Rotary: — **From Depth of:** 14.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/26/16	5.0	
1/26/16	18.0	15.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John Martin
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' – 2.0'	2 10 12	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	Hot-mix 6.5"
2.53		2	2.0' – 4.0'	2 2 2 3	Wet soft black clayey fine sandy silt w/some coarse sand and organic matter, trace of fine gravel. 24" RECOVERY	A-4(0)	
5.06	■	3	4.0' – 6.0'	3 3 2 2	Wet loose brown silty fine to coarse sand w/ trace fine gravel. 24" RECOVERY	A-2-4(0)	
7.59		4	6.0' – 8.0'	3 3 5 5	Wet loose orange coarse to fine sand w trace fine gravel and silt. 24" RECOVERY	A-1-b	
10.12		5	8.0' – 10.0'	4 6 6 8	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
		6	10.0' – 12.0'	1 2 5 9	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0' – 14.0'	4 4 9 9	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' – 16.0'	7 8 9 12	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
17.71	▽	9	16.0' – 18.0'	4 4 4 4	Wet loose gray silty fine to coarse sand w/ trace fine gravel. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' – 20.0'	4 5 6 10	Wet medium dense gray silty fine sand w/ some coarse sand. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' – 25.0'	4 4 5 6	Wet loose gray silty fine sand w/some coarse sand. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' – 30.0'	9 7 8 12	Wet medium dense brown fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' – 35.0'	5 9 8 8	Wet medium dense orange fine sand w/some silt, trace of coarse sand. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	5 6 8 8	Wet medium dense orange fine sand w/some silt, trace of coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
40.48							
43.01							
		15	43.0' 45.0'	3 9 15 15	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
45.54							
48.07							
		16	48.0' 50.0'	4 15 20 23	Wet dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
50.6							
53.13							
		17	53.0' 55.0'	11 24 27 33	Wet very dense brown coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	23 28 30	Wet very dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	9 18 24 32	Wet dense gray coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	11 12 12 12	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING LR-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 194829.610
Easting: 644328.794
Boring Surface Elev.:
Reference:
Date Started: 1/27/16
Date Completed: 1/27/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 12.0
From Depth of: 12.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/27/16	5.0	
1/27/16	23.5	17.5

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John Martin
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	2 8 10 12	Moist medium dense brown coarse to fine sand w/some fine gravel and silt. 24" RECOVERY	A-1-b	Hot-mix 4.5"
2.53		2	2.0' 4.0'	3 3 3 3	Wet firm black fine sandy silt w/some coarse sand, trace of clay and organic matter. 24" RECOVERY	A-4(0)	
5.06	■	3	4.0' 6.0'	WH 2 3 3	Wet firm gray fine sandy silt w/some clay, trace of coarse sand and fine gravel. 18" RECOVERY	A-4(0)	
7.59		4	6.0' 8.0'	2 3 4 4	Wet firm gray clayey fine sandy silt w trace coarse sand. 24" RECOVERY	A-4(1)	
10.12		5	8.0' 10.0'	1 1 1 1	Wet very loose brown silty fine sand w trace coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	2 2 3 5	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
12.65		7	12.0'	2 5 8 12	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 3 4 10	Wet loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
17.71		9	16.0' 18.0'	3 4 10 12	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	2 4 8 10	Wet medium dense brown silty fine sand w/ trace coarse sand. 24" RECOVERY	A-2-4(0)	
22.77							
25.3	▽	11	23.0' 25.0'	4 7 7 7	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	3 6 10 15	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' 35.0'	3 7 9 13	Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	5 10 15 20	Wet medium dense orange fine sand w/some silt, trace of coarse sand. 24" RECOVERY	A-2-4(0)	
40.48							
43.01							
		15	43.0' 45.0'	10 15 23 46	Wet dense brown fine sand w/some coarse sand and fine gravel, trace of silt. 24" RECOVERY	A-3	
45.54							
48.07							
		16	48.0' 50.0'	7 13 14 19	Wet medium dense orange coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-1-b	
50.6							
53.13							
		17	53.0' 55.0'	24 32 41 47	Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	19 25 50	Wet very dense brown coarse to fine sand and fine gravel w/trace silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** LR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		18" RECOVERY		
60.72							
63.25		19	63.0'	17 21 27 30	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			65.0'		18" RECOVERY		
65.78							
68.31		20	68.0'	19 24 30 35	Wet very dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

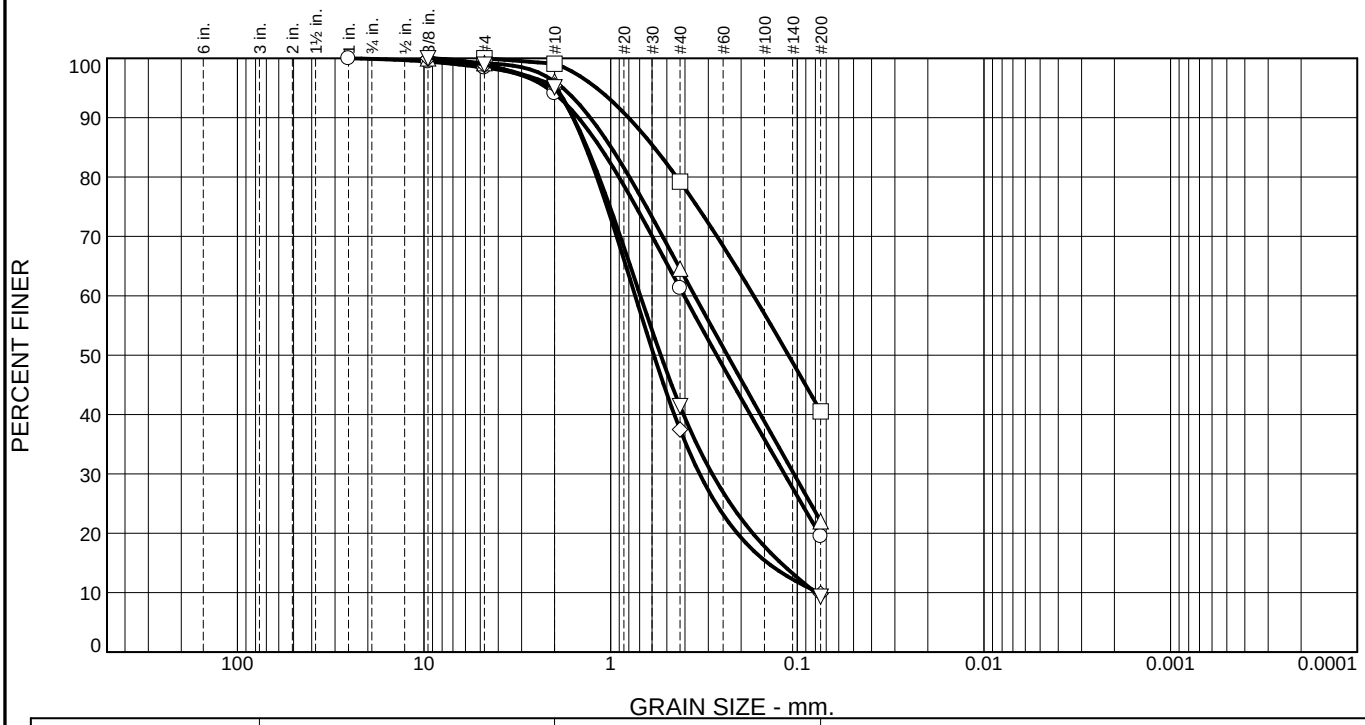
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.9	32.8	41.8	19.5	
□	0.0	0.9	19.9	38.7	40.5	
△	0.0	3.9	31.5	42.6	22.0	
◇	0.0	4.6	57.9	27.7	9.8	
▽	0.0	4.9	53.7	32.1	9.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1379	0.4038	0.2701	0.1172				
□	25.9	17.9	0.5851	0.1714	0.1116					
△	NV	NP	0.9946	0.3544	0.2369	0.1043				
◇	NV	NP	1.3590	0.7389	0.5866	0.3337	0.1440	0.0769	1.96	9.61
▽	NV	NP	1.3381	0.6934	0.5390	0.2857	0.1223	0.0798	1.48	8.70

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet soft black clayey fine sandy silt w/some coarse sand and organic matter, trace of fine gravel.	SC	A-4(0)
△ Wet loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
◇ Wet loose orange coarse to fine sand w trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** LR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** LR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** LR-1 **Depth:** 6.0 **Sample Number:** 4

▽ **Source of Sample:** LR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
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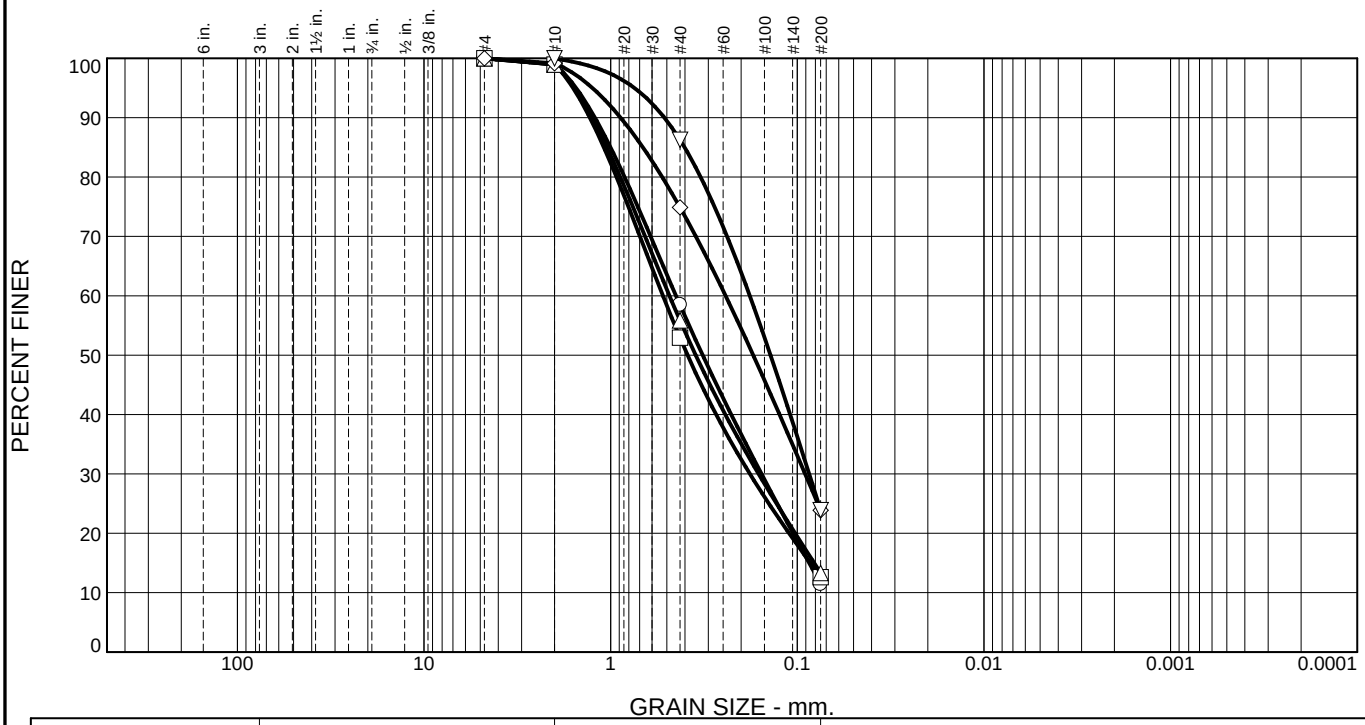
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.0	40.6	47.0	11.4	
□	0.0	1.0	46.1	40.3	12.6	
△	0.0	1.1	43.1	42.5	13.3	
◇	0.0	0.8	24.3	51.0	23.9	
▽	0.0	0.0	13.7	62.4	23.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0019	0.4466	0.3214	0.1556	0.0864			
□	NV	NP	1.0878	0.5246	0.3870	0.1795	0.0852			
△	NV	NP	1.0478	0.4840	0.3502	0.1613	0.0812			
◇	NV	NP	0.6721	0.2422	0.1723	0.0908				
▽	NV	NP	0.4014	0.1798	0.1392	0.0864				

Material Description	USCS	AASHTO
○ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
□ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
▽ Wet medium dense gray silty fine sand w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** LR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** LR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** LR-1 **Depth:** 16.0 **Sample Number:** 9

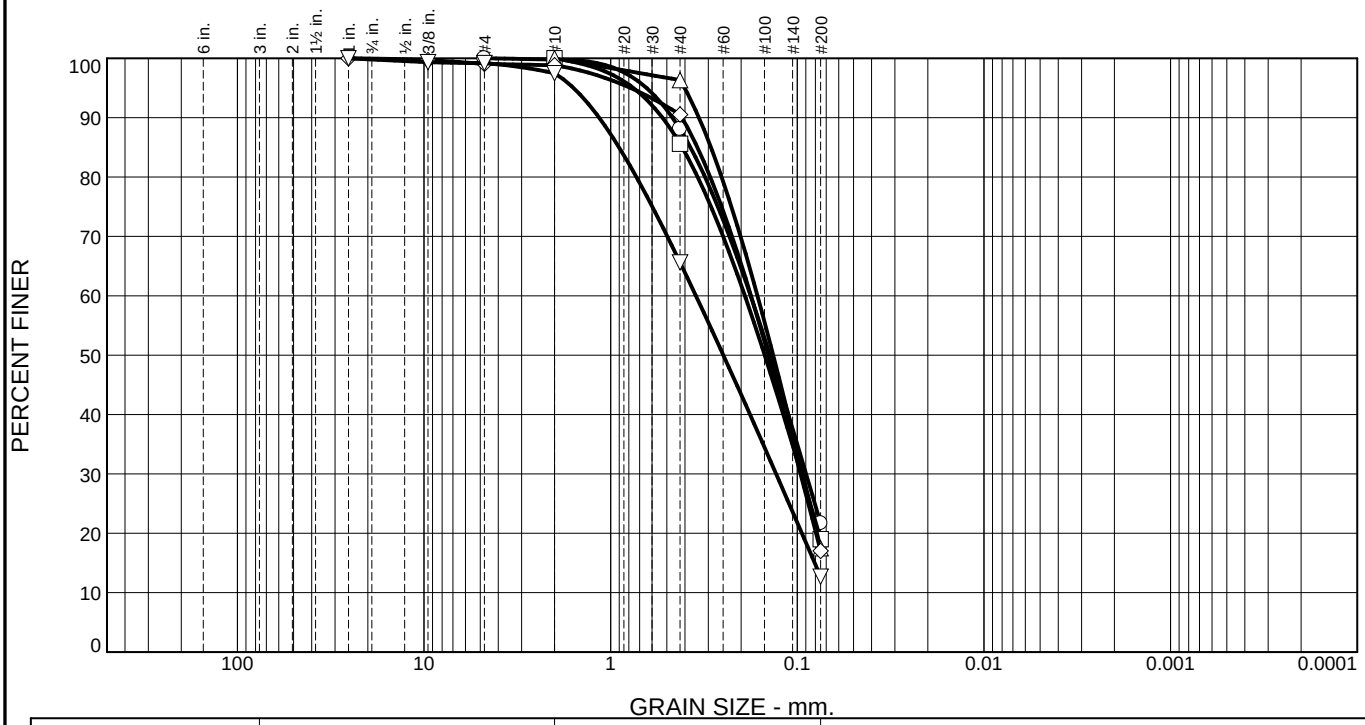
▽ **Source of Sample:** LR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.2	11.7	66.4	21.7	
□	0.0	0.0	14.4	66.6	19.0	
△	0.0	0.0	3.7	78.8	17.5	
◇	0.0	1.2	8.3	73.5	17.0	
▽	0.0	2.5	31.9	52.9	12.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.3736	0.1779	0.1401	0.0898				
□	NV	NP	0.4139	0.1910	0.1496	0.0953				
△	NV	NP	0.2901	0.1636	0.1347	0.0936				
◇	NV	NP	0.3429	0.1771	0.1430	0.0961				
▽	NV	NP	0.9019	0.3493	0.2490	0.1299	0.0807			

Material Description	USCS	AASHTO
○ Wet loose gray silty fine sand w/some coarse sand.	SM	A-2-4(0)
□ Wet medium dense brown fine sand w/some coarse sand and silt.	SM	A-2-4(0)
△ Wet medium dense orange fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
◇ Wet medium dense orange fine sand w/some silt, trace of coarse sand and fine gravel.	SM	A-2-4(0)
▽ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** LR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** LR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** LR-1 **Depth:** 38.0 **Sample Number:** 14

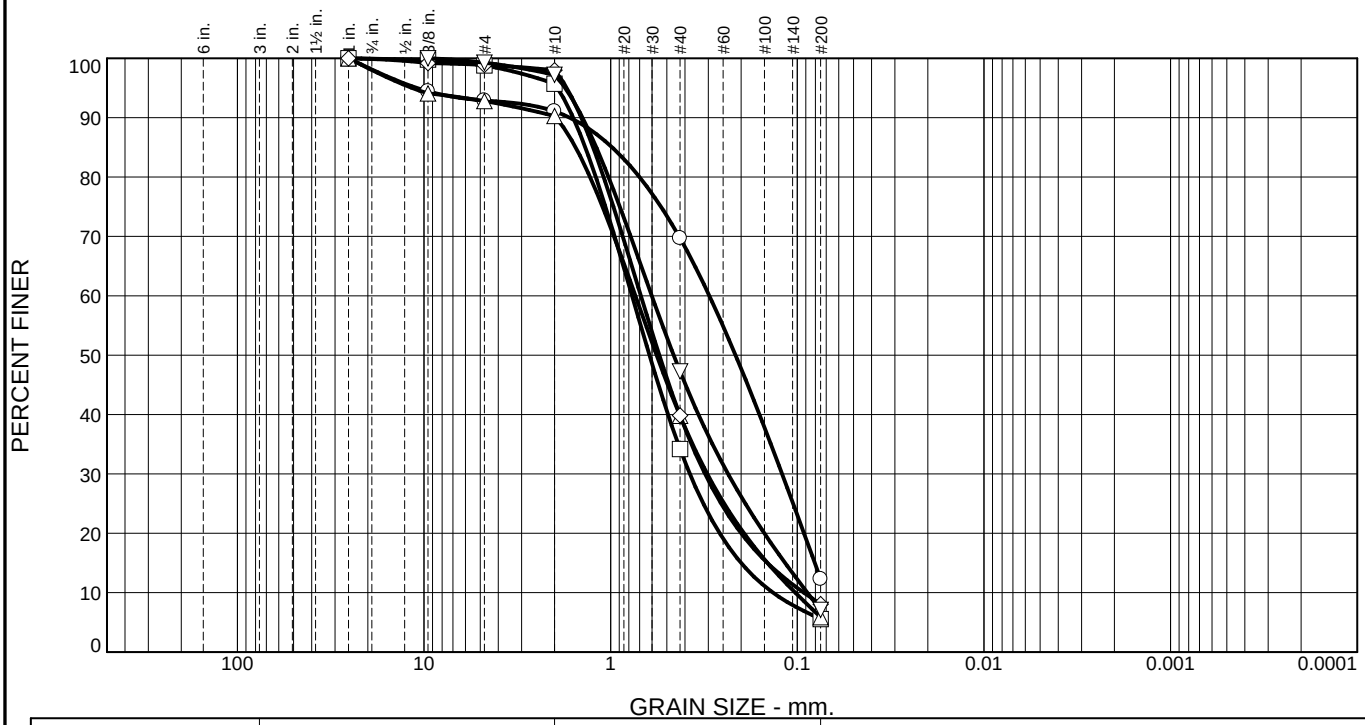
▽ **Source of Sample:** LR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.9	21.4	57.4	12.3	
□	0.0	4.3	61.5	28.6	5.6	
△	0.0	9.7	50.5	33.9	5.9	
◇	0.0	2.0	58.2	31.7	8.1	
▽	0.0	2.8	49.9	40.2	7.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9820	0.2959	0.2143	0.1207	0.0806			
□	NV	NP	1.3676	0.7681	0.6195	0.3765	0.2000	0.1350	1.37	5.69
△	NV	NP	1.5413	0.7369	0.5672	0.3037	0.1445	0.1025	1.22	7.19
◇	NV	NP	1.2417	0.6889	0.5486	0.3121	0.1446	0.0922	1.53	7.47
▽	NV	NP	1.1939	0.6020	0.4597	0.2349	0.1162	0.0883	1.04	6.81

Material Description	USCS	AASHTO
○ Wet dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Wet dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** LR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** LR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** LR-1 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** LR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
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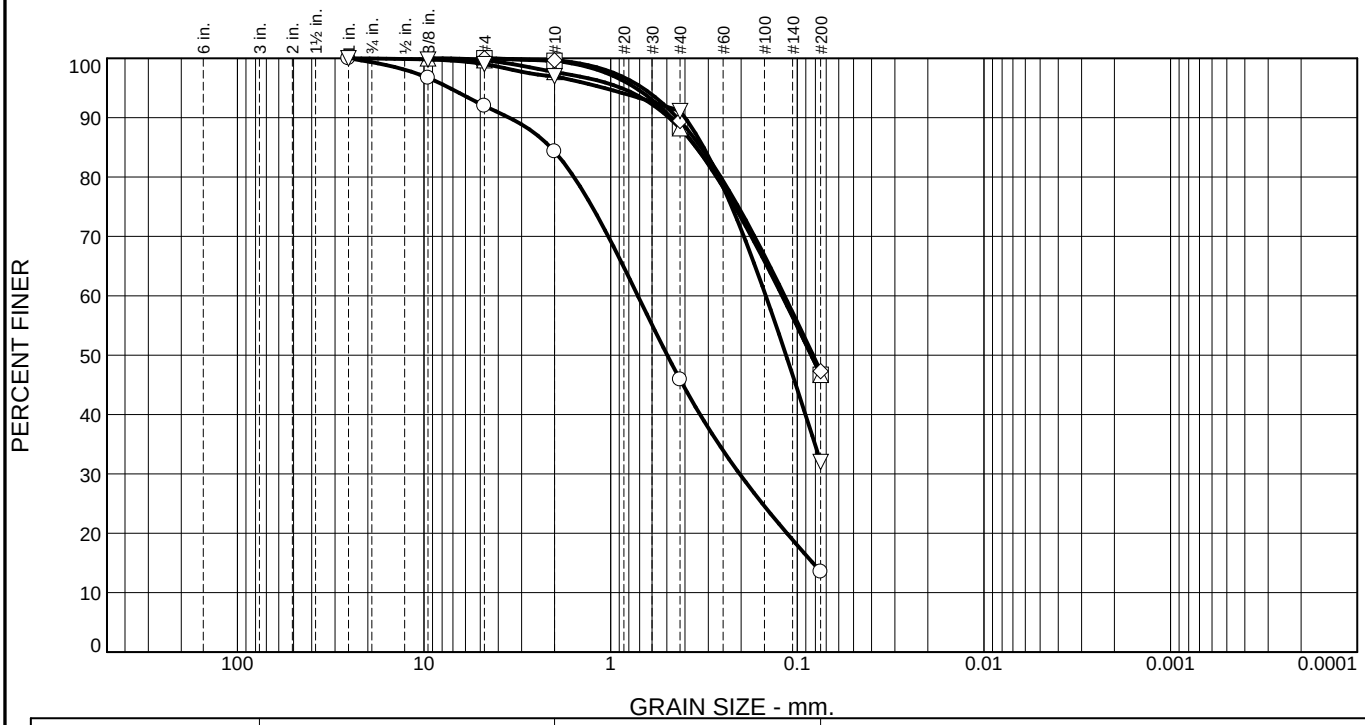
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	15.7	38.4	32.4	13.5	
□	0.0	0.4	11.2	41.7	46.7	
△	0.0	2.3	9.5	41.5	46.7	
◇	0.0	0.3	10.2	42.2	47.3	
▽	0.0	3.0	5.9	59.1	32.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.0974	0.7149	0.4975	0.2037	0.0825			
□	19.2	13.8	0.3475	0.1207	0.0843					
△	17.1	13.0	0.3476	0.1199	0.0842					
◇	22.1	14.1	0.3280	0.1171	0.0824					
▽	18.5	NP	0.3177	0.1476	0.1149					

Material Description	USCS	AASHTO
○ Moist medium dense brown coarse to fine sand w/some fine gravel and silt.	SM	A-1-b
□ Wet firm black fine sandy silt w/some coarse sand, trace of clay and organic matter.	SC-SM	A-4(0)
△ Wet firm gray fine sandy silt w/some clay, trace of coarse sand and fine gravel.	SC-SM	A-4(0)
◇ Wet firm gray clayey fine sandy silt w trace coarse sand.	SC	A-4(1)
▽ Wet very loose brown silty fine sand w trace coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** LR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** LR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** LR-2 **Depth:** 6.0 **Sample Number:** 4

▽ **Source of Sample:** LR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
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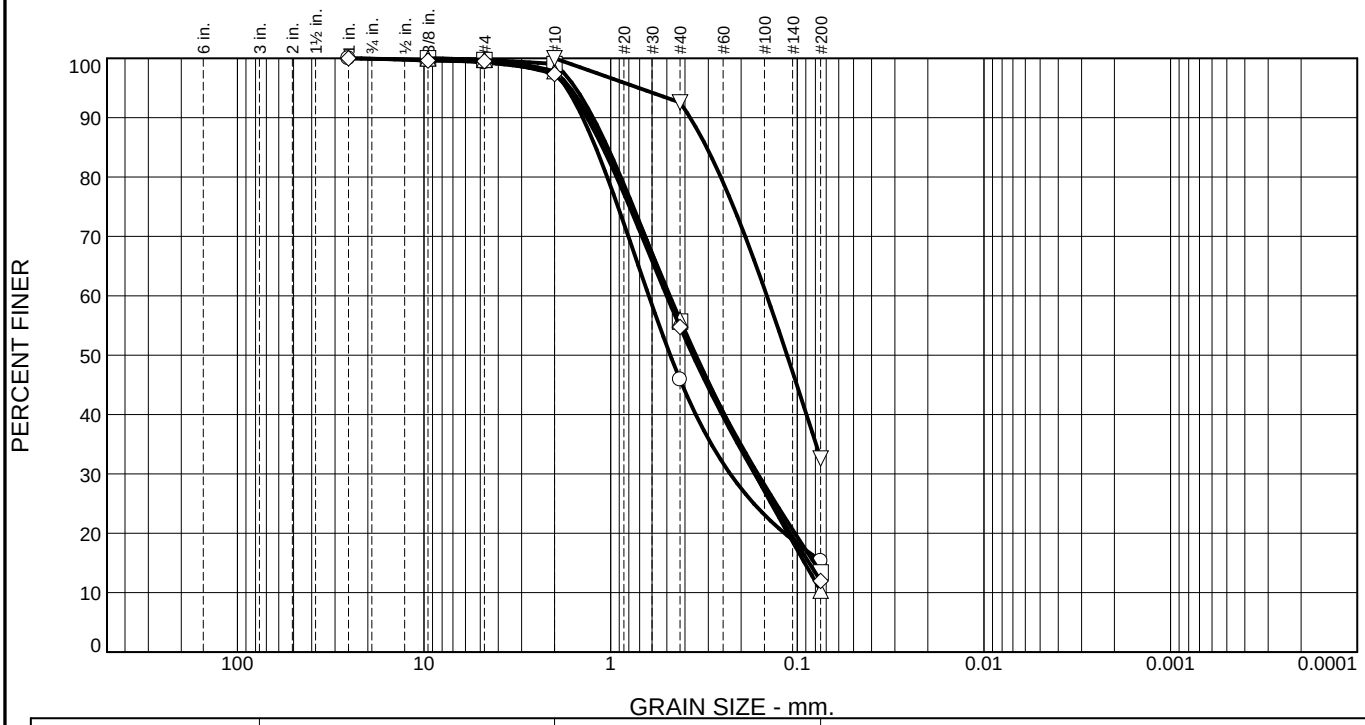
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.3	51.8	30.6	15.3	
□	0.0	1.0	43.3	42.3	13.4	
△	0.0	2.2	41.8	45.7	10.3	
◇	0.0	2.7	42.5	42.8	12.0	
▽	0.0	0.0	7.4	60.0	32.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2032	0.6247	0.4793	0.2287				
□	NV	NP	1.0375	0.4859	0.3532	0.1627	0.0810			
△	NV	NP	1.0669	0.4820	0.3495	0.1684	0.0912			
◇	NV	NP	1.1036	0.5013	0.3631	0.1691	0.0864			
▽	17.6	NP	0.3059	0.1456	0.1135					

Material Description	USCS	AASHTO
○ Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
□ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
▽ Wet medium dense brown silty fine sand w/trace coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** LR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** LR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** LR-2 **Depth:** 16.0 **Sample Number:** 9

▽ **Source of Sample:** LR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

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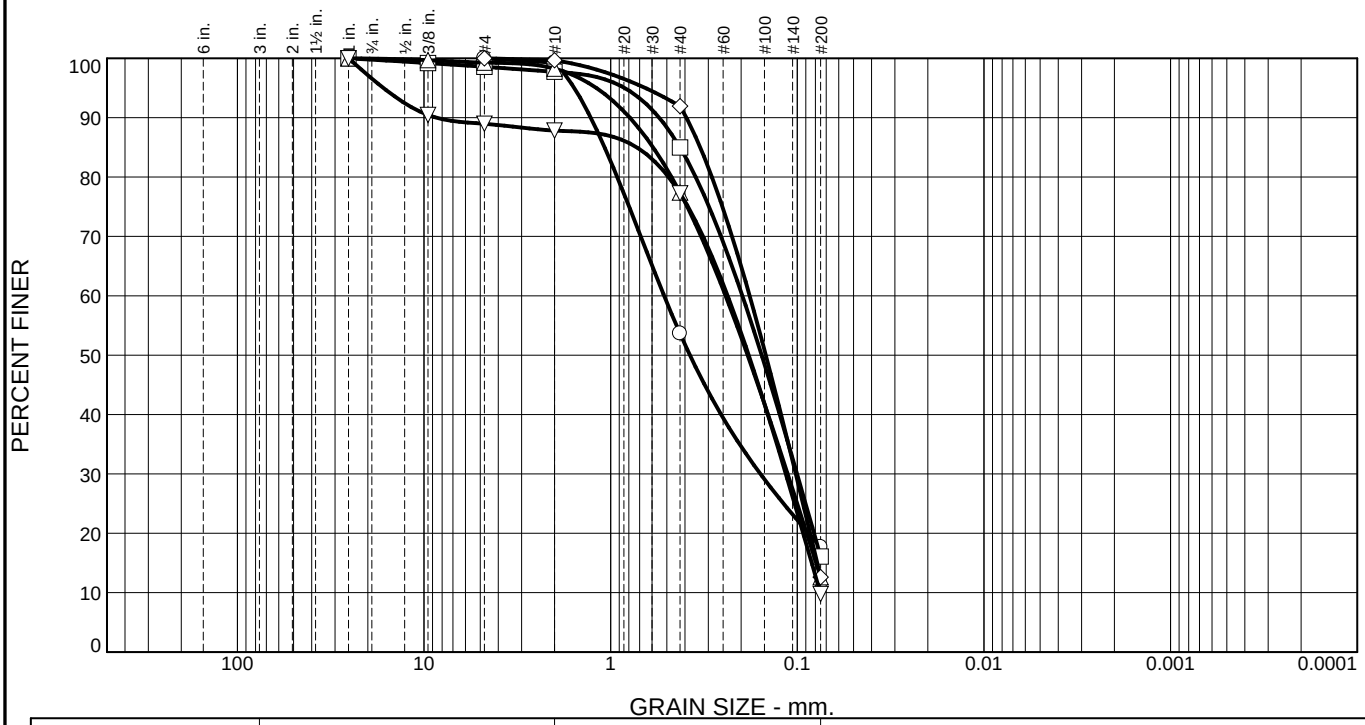
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.8	45.6	35.9	17.7	
□	0.0	2.3	12.7	68.9	16.1	
△	0.0	1.7	20.9	64.8	12.6	
◇	0.0	0.3	7.8	79.3	12.6	
▽	0.0	12.2	10.5	67.5	9.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0779	0.5170	0.3762	0.1577				
□	NV	NP	0.4254	0.1970	0.1553	0.1003				
△	NV	NP	0.5927	0.2422	0.1847	0.1127	0.0793			
◇	NV	NP	0.3313	0.1801	0.1475	0.1020	0.0782			
▽	NV	NP	0.7247	0.2361	0.1822	0.1153	0.0837	0.0754	0.75	3.13

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense orange fine sand w/some silt, trace of coarse sand.	SM	A-2-4(0)
▽ Wet dense brown fine sand w/some coarse sand and fine gravel, trace of silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** LR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** LR-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** LR-2 **Depth:** 38.0 **Sample Number:** 14

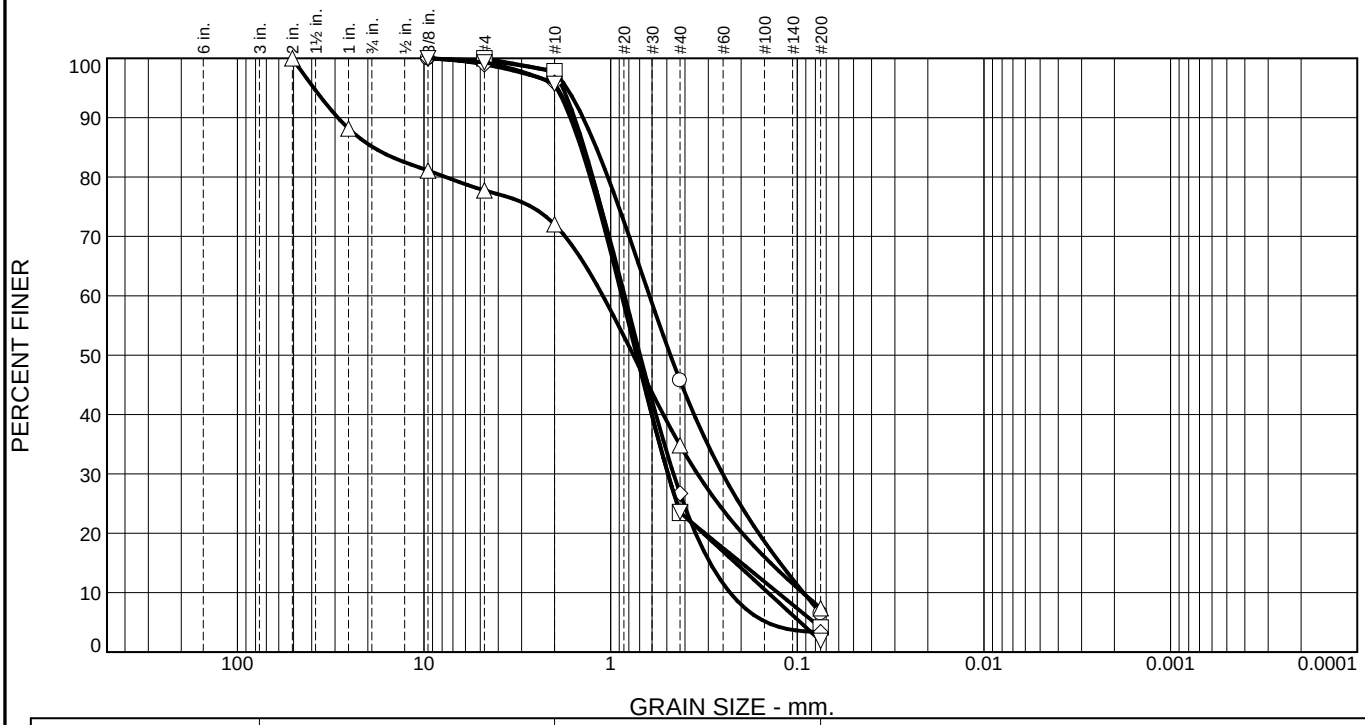
▽ **Source of Sample:** LR-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.3	52.0	39.2	6.5	
□	0.0	2.2	74.4	19.3	4.1	
△	0.0	28.0	37.2	27.4	7.4	
◇	0.0	4.1	69.2	23.4	3.3	
▽	0.0	4.3	72.1	21.7	1.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1962	0.6196	0.4784	0.2510	0.1237	0.0927	1.10	6.68
□	NV	NP	1.3877	0.8600	0.7209	0.4934	0.1993	0.1271	2.23	6.76
△	NV	NP	18.7271	1.1013	0.7558	0.3426	0.1392	0.0935	1.14	11.77
◇	NV	NP	1.4136	0.8408	0.6955	0.4604	0.2931	0.2295	1.10	3.66
▽	NV	NP	1.4424	0.8721	0.7269	0.4928	0.2140	0.1435	1.94	6.08

Material Description	USCS	AASHTO
○ Wet medium dense orange coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
□ Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b
△ Wet very dense brown coarse to fine sand and fine gravel w/trace silt.	SW-SM	A-1-b
◇ Wet dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** LR-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** LR-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** LR-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** LR-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** LR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
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Figure

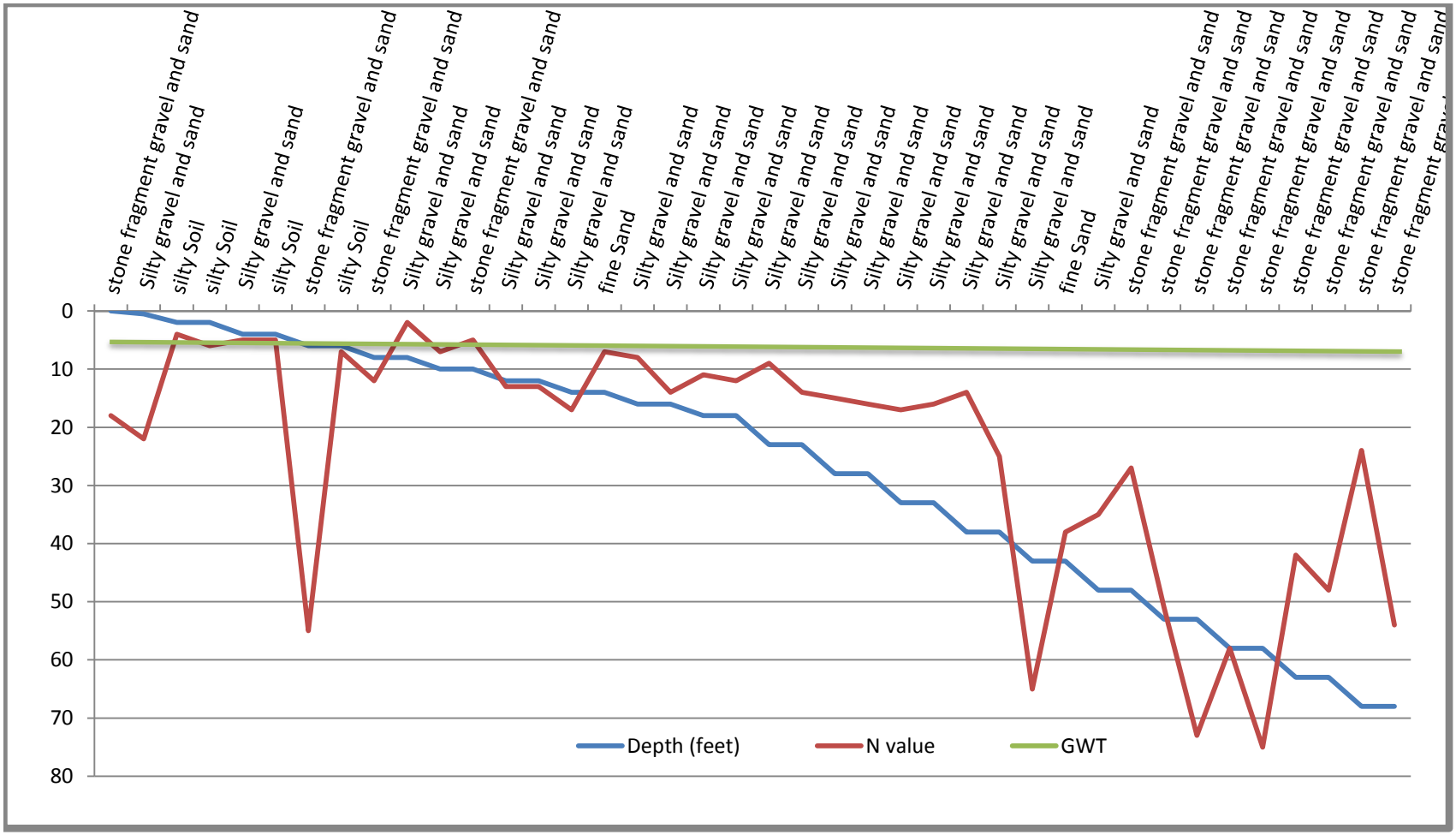
Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
LR-1														
	1	0.5	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	6.5	SM	A-2-4(0)	94.1	19.5	2	10	12	
	2	2	Wet soft black clayey fine sandy silt w/some coarse sand and organic matter, trace of fine gravel.	25.9	8	23.7	SC	A-4(0)	99.1	40.5	2	2	2	3
	3	4	Wet loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	20.1	SM	A-2-4(0)	96.1	22	3	3	2	2
	4	6	Wet loose orange coarse to fine sand w trace fine gravel and silt.	NV	NP	19.1	SW-SM	A-1-b	95.4	9.8	3	3	5	5
	5	8	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.5	SW-SM	A-1-b	95.1	9.3	4	6	6	8
	6	10	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	21.4	SP-SM	A-2-4(0)	99	11.4	1	2	5	9
	7	12	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	20.4	SM	A-2-4(0)	99	12.6	4	4	9	9
	8	14	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.6	SM	A-2-4(0)	98.9	13.3	7	8	9	12
	9	16	Wet loose gray silty fine to coarse sand w/trace fine gravel.	NV	NP	23.6	SM	A-2-4(0)	99.2	23.9	4	4	4	4
	10	18	Wet medium dense gray silty fine sand w/some coarse sand.	NV	NP	28.7	SM	A-2-4(0)	100	23.9	4	5	6	10
	11	23	Wet loose gray silty fine sand w/some coarse sand.	NV	NP	21.7	SM	A-2-4(0)	99.8	21.7	4	4	5	6
	12	28	Wet medium dense brown fine sand w/some coarse sand and silt.	NV	NP	21.9	SM	A-2-4(0)	100	19	9	7	8	12
	13	33	Wet medium dense orange fine sand w/some silt, trace of coarse sand.	NV	NP	22.5	SM	A-2-4(0)	100	17.5	5	9	8	8
	14	38	Wet medium dense orange fine sand w/some silt, trace of coarse sand and fine gravel.	NV	NP	18.6	SM	A-2-4(0)	98.8	17	5	6	8	8
	15	43	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.7	SM	A-2-4(0)	97.5	12.7	3	9	15	15
	16	48	Wet dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	16.3	SM	A-2-4(0)	91.1	12.3	4	15	20	23
	17	53	Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.7	SP-SM	A-1-b	95.7	5.6	11	24	27	33
	18	58	Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	12.2	SW-SM	A-1-b	90.3	5.9	23	28	30	
	19	63	Wet dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.1	SW-SM	A-1-b	98	8.1	9	18	24	32
	20	68	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.8	SW-SM	A-1-b	97.2	7.1	11	12	12	12
		70	End Boring											
LR-2														
	1		Moist medium dense brown coarse to fine sand w/some fine gravel and silt.	NV	NP	7.9	SM	A-1-b	84.3	13.5	2	8	10	12
	2	2	Wet firm black fine sandy silt w/some coarse sand, trace of clay and organic matter.	19.2	5.4	18.4	SC-SM	A-4(0)	99.6	46.7	3	3	3	3
	3	4	Wet firm gray fine sandy silt w/some clay, trace of coarse sand and fine gravel.	17.1	4.1	17.5	SC-SM	A-4(0)	97.7	46.7	WH	2	3	3
	4	6	Wet firm gray clayey fine sandy silt w trace coarse sand.	22.1	8	19.2	SC	A-4(1)	99.7	47.3	2	3	4	4
	5	8	Wet very loose brown silty fine sand w trace coarse sand and fine gravel.	18.5	NP	25.4	SM	A-2-4(0)	97	32	1	1	1	1
	6	10	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	24.6	SM	A-1-b	97.7	15.3	2	2	3	5
	7	12	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	23.5	SM	A-2-4(0)	99	13.4	2	5	8	12
	8	14	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	21.4	SP-SM	A-3	97.8	10.3	2	3	4	10
	9	16	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	19.8	SP-SM	A-2-4(0)	97.3	12	3	4	10	12
	10	18	Wet medium dense brown silty fine sand w/trace coarse sand.	17.6	NP	24.7	SM	A-2-4(0)	100	32.6	2	4	8	10
	11	23	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	24.5	SM	A-2-4(0)	99.2	17.7	4	7	7	7
	12	28	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	20.6	SM	A-2-4(0)	97.7	16.1	3	6	10	15
	13	33	Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	23.1	SM	A-2-4(0)	98.3	12.6	3	7	9	13
	14	38	Wet medium dense orange fine sand w/some silt, trace of coarse sand.	NV	NP	22.7	SM	A-2-4(0)	99.7	12.6	5	10	15	20
	15	43	Wet dense brown fine sand w/some coarse sand and fine gravel, trace of silt.	NV	NP	17.2	SP-SM	A-3	87.8	9.8	10	15	23	46
	16	48	Wet medium dense orange coarse to fine sand w/trace silt and fine gravel.	NV	NP	19.3	SW-SM	A-1-b	97.7	6.5	7	13	14	19
	17	53	Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	11.9	SW	A-1-b	97.8	4.1	24	32	41	47
	18	58	Wet very dense brown coarse to fine sand and fine gravel w/trace silt.	NV	NP	10.1	SW-SM	A-1-b	72	7.4	19	25	50	
	19	63	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.2	SP	A-1-b	95.9	3.3	17	21	27	30
	20	68	Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.7	SW	A-1-b	95.7	1.9	19	24	30	35
		70	End Boring											

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4

DATE : 4-19-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-317 on Laurel Road - Laurel DE



DATE : 4-19-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-317 on Laurel Road - Laurel DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 12-18-2015**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-323 on Johnson Road - Laurel DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 9-29-2015 and 10-05-2015. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in Beaverdam Formation White-greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Laurel Area, Delaware by John Adam, and Durward H. Boggess (1964) Atlas HA-123. The nearest well to this site the groundwater historically had been measured 22 feet on October 1960 and between the years of 1950 to 1960 appeared from 20 to 24 feet below

the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter as 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 20 to 30 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a fair to good category.

5. Ground Cover

The ground cover for this site is 9 inches of Asphalt; more detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 8 to 9 feet, noted at the completion of the drilling is 9 to 10 feet and caved at 9 to 11 feet below the ground surface elevation more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 3.6 to 25.2 percent. The Atterberg limit and the organic matter was not encountered for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is not in a good condition and 18 feet in thickness of loose coarse sand layer appeared at 10 feet down from the surface elevation need to consider in the design. In addition all the sample from the depth of 2 to 10 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 19-1692 T201407003 BR3-323 on Johnson Road in Sussex County

Google earth

feet 700

meters 200

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING JR-1

Project Name: Johnson Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 209099.657
Easting: 626675.161
Boring Surface Elev.:
Reference:
Date Started: 10/5/15
Date Completed: 10/5/15

Wt. of Sample Hammer: Lbs.
Type of: D-Sampler: Split Barrel O.D.
S-Sampler: O.D.
U-Sampler: O.D.
Core Bit: O.D.

Average Fall: IN.
O.D. of Sampler: 2 IN.
O.D. of Samp. Tube: IN.
O.D. of Samp. Tube: IN.
O.D. of Rock Core: IN.

Hollow Stem Auger Diameter: 3 1/4" Inches
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
10/5/15	8.0	
10/5/15	10.0	11.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: John M.
Logged By: M. Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	8 12 2 22	Moist dense brown fine to coarse sand and fine gravel w/some silt. 18" RECOVERY	A-1-b	
2.53		2	2.0' 4.0'	15 17 19 20	Moist dense reddish brown fine to coarse sand w/trace silt and fine gravel. 22" RECOVERY	A-3	
5.06		3	4.0' 6.0'	7 10 12 15	Moist medium dense reddish brown fine to coarse sand w/trace fine gravel and silt. 20" RECOVERY	A-3	
7.59		4	6.0' 8.0'	5 8 8 10	Moist medium dense brown fine to coarse sand w/trace fine gravel and silt. 20" RECOVERY	A-3	
	■	5	8.0' 10.0'	4 5 5 6	Moist loose brown fine to coarse sand w/trace fine gravel and silt. 18" RECOVERY	A-3	
10.12	▽	6	10.0' 12.0'	1 2 3 5	Saturated loose brown fine to coarse sand w/ trace fine gravel and silt. 21" RECOVERY	A-3	
12.65		7	12.0'	1 1 3 2	Saturated very loose brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 1 10 15	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
17.71		9	16.0' 18.0'	1 4 5 6	Saturated loose gray coarse to fine sand w/ trace fine gravel and silt. 19" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	0 1 1 1	Saturated very loose orange coarse sand w/ some fine sand and fine gravel, trace of silt. 22" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	3 6 9 10	Saturated medium dense orange coarse sand w/some fine gravel and fine sand, trace of silt. 22" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	2 6 7 9	Wet medium dense orange coarse sand w/ some fine sand and fine gravel, trace of silt. 22" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	2 3 5 6	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 22" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	7 26 15 18	Saturated dense brown coarse to fine sand w/ some fine gravel, trace of silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	3 8 9 12	Saturated medium dense orange coarse to fine sand w/some fine, trace of silt.	A-1-b	
			45.0'		22" RECOVERY		
45.54							
48.07							
		16	48.0'	5 9 15 16	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			50.0'		22" RECOVERY		
50.6							
53.13							
		17	53.0'	4 6 17 25	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	6 16 26 48	Saturated dense orange coarse to fine sand w trace fine gravel and silt./	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	2 10 16 30	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	12 33 50	Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Clean sand & gravelly sand
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING JR-2

Project Name: Johnson Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 209144.145
Easting: 626697.448
Boring Surface Elev.:
Reference:
Date Started: 9/29/15
Date Completed: 9/29/15

Wt. of Sample Hammer: Lbs.
Type of: D-Sampler: Split Barrel O.D.
S-Sampler: O.D.
U-Sampler: O.D.
Core Bit: O.D.

Average Fall: IN.
O.D. of Sampler: 2 IN.
O.D. of Samp. Tube: IN.
O.D. of Samp. Tube: IN.
O.D. of Rock Core: IN.

Hollow Stem Auger Diameter: 3 1/4" Inches
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
9/29/15	9.0	
9/29/15	11.0	9.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: John M.
Logged By: Jerry Johnson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	3 13 17 17	Moist medium dense brown fine to coarse sand and fine gravel w/some silt. 18" RECOVERY	A-1-b	Hot-mix 9'
2.53		2	2.0' 4.0'	14 18 18 23	Moist dense brown fine to coarse sand w/ trace silt and fine gravel. 22" RECOVERY	A-3	
5.06		3	4.0' 6.0'	8 8 9 11	Moist medium dense brown fine to coarse sand w/trace silt. 22" RECOVERY	A-3	
7.59		4	6.0' 8.0'	4 5 4 4	Moist loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12	■	5	8.0' 10.0'	3 2 2 3	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
	▼	6	10.0' 12.0'	2 1 2 2	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
12.65		7	12.0'	2 3 3 4	Saturated loose gray fine to coarse sand w/ trace silt and fine gravel.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 2 3 4	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 20" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	1 1 1 2	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt. 22" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	1 1 3 4	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	2 3 4 8	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 20" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	2 4 5 8	Saturated loose orange coarse sand w/some fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	6 7 7 9	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	15 7 8 8	Saturated medium dense orange coarse to fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
40.48							
43.01							
		15	43.0' 45.0'	6 6 11 12	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	2 6 6 8	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-1-b	
50.6							
53.13							
		17	53.0' 55.0'	5 5 10 13	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt. 23" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	7 17 21 29	Saturated dense brown coarse to fine sand w/ trace silt and fine gravel.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Johnson Road
State Contract: T201407003

Boring No.: JR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	12 20 27 40	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			65.0'		22" RECOVERY		
65.78							
68.31		20	68.0'	12 18 32 40	Saturated very dense gray fine to coarse sand w/trace silt and fine gravel.	A-3	
			70.0'		20" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

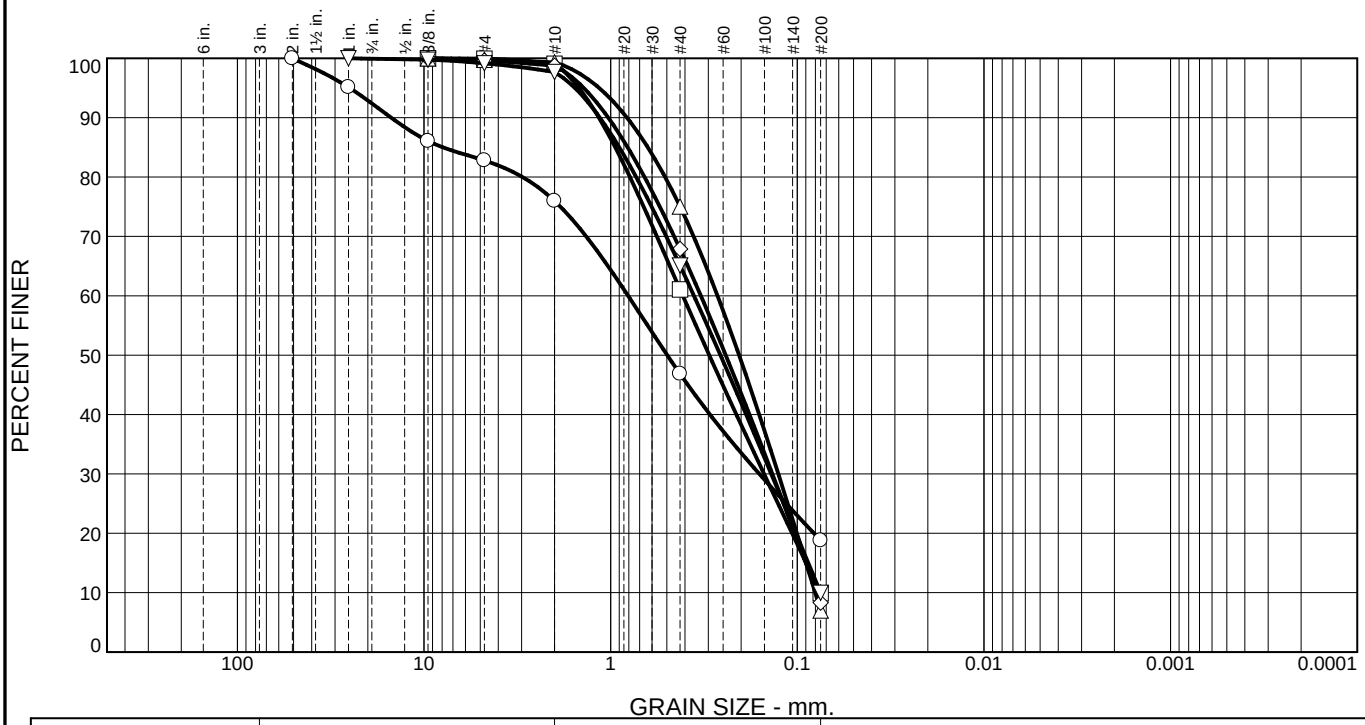
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	24.0	29.1	28.1	18.8	
□	0.0	0.9	38.0	51.2	9.9	
△	0.0	0.7	24.3	68.0	7.0	
◇	0.0	1.3	30.8	59.6	8.3	
▽	0.0	2.3	32.6	55.1	10.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	7.9334	0.8061	0.4974	0.1598				
□	NV	NP	0.9444	0.4106	0.2963	0.1507	0.0896	0.0753	0.74	5.45
△	NV	NP	0.6321	0.2675	0.2051	0.1264	0.0898	0.0802	0.74	3.33
◇	NV	NP	0.8110	0.3287	0.2418	0.1361	0.0900	0.0785	0.72	4.19
▽	NV	NP	0.8990	0.3580	0.2582	0.1380	0.0873	0.0751	0.71	4.77

Material Description	USCS	AASHTO
○ Moist dense brown fine to coarse sand and fine gravel w/some silt.	SM	A-1-b
□ Moist dense reddish brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Moist medium dense reddish brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Moist medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Moist loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** JR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** JR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** JR-1 **Depth:** 6.0 **Sample Number:** 4

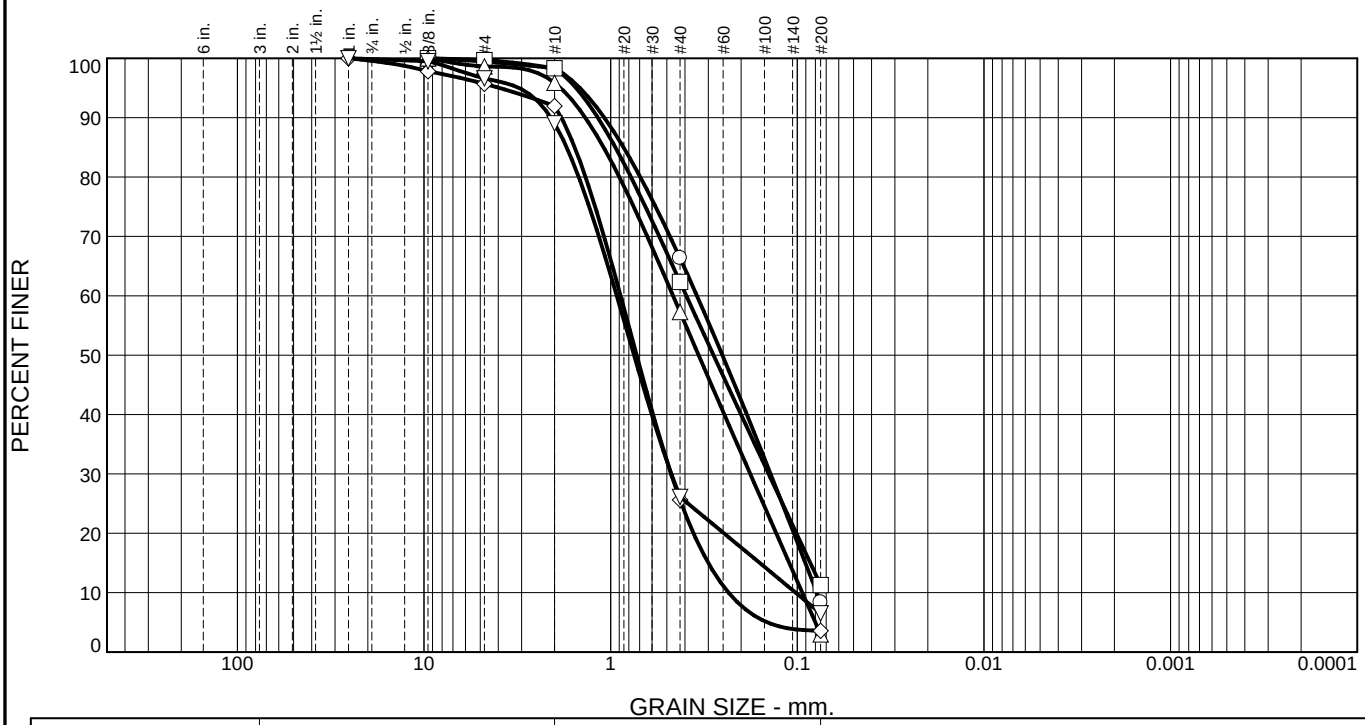
▽ **Source of Sample:** JR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.7	31.9	58.0	8.4	
□	0.0	1.7	36.0	51.0	11.3	
△	0.0	4.1	38.6	54.3	3.0	
◇	0.0	8.0	66.4	22.0	3.6	
▽	0.0	11.0	62.9	19.6	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8532	0.3449	0.2519	0.1391	0.0905	0.0786	0.71	4.39
□	NV	NP	0.9438	0.3931	0.2810	0.1424	0.0852			
△	NV	NP	1.0914	0.4631	0.3379	0.1788	0.1105	0.0941	0.73	4.92
◇	NV	NP	1.5582	0.8847	0.7257	0.4745	0.2998	0.2335	1.09	3.79
▽	NV	NP	1.7215	0.9277	0.7496	0.4731	0.1588	0.1021	2.36	9.09

Material Description	USCS	AASHTO
○ Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Saturated very loose brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
◇ Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Saturated very loose orange coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** JR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** JR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** JR-1 **Depth:** 16.0 **Sample Number:** 9

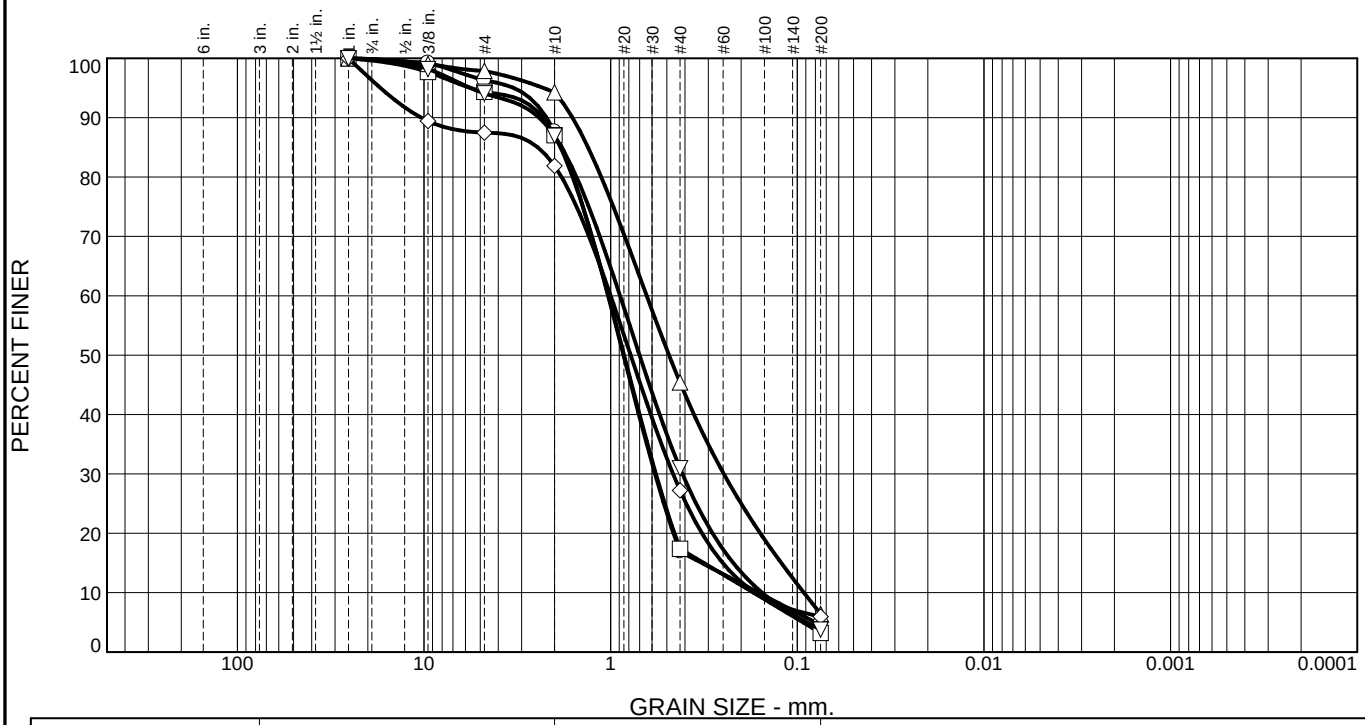
▽ **Source of Sample:** JR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.3	70.8	12.4	4.5	
□	0.0	13.0	69.6	14.2	3.2	
△	0.0	5.7	48.9	39.0	6.4	
◇	0.0	18.1	54.7	21.2	6.0	
▽	0.0	13.0	56.0	27.2	3.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8262	1.0323	0.8537	0.5785	0.3249	0.1612	2.01	6.40
□	NV	NP	1.8550	1.0274	0.8476	0.5723	0.3171	0.1719	1.85	5.98
△	NV	NP	1.3223	0.6412	0.4866	0.2477	0.1219	0.0922	1.04	6.95
◇	NV	NP	2.4579	1.0001	0.7813	0.4633	0.2508	0.1680	1.28	5.95
▽	NV	NP	1.8292	0.8906	0.7004	0.4127	0.2204	0.1547	1.24	5.76

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse sand w/some fine gravel and fine sand, trace of silt.	SW	A-1-b
□ Wet medium dense orange coarse sand w/some fine sand and fine gravel, trace of silt.	SP	A-1-b
△ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
▽ Saturated medium dense orange coarse to fine sand w/some fine, trace of silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** JR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** JR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** JR-1 **Depth:** 38.0 **Sample Number:** 14

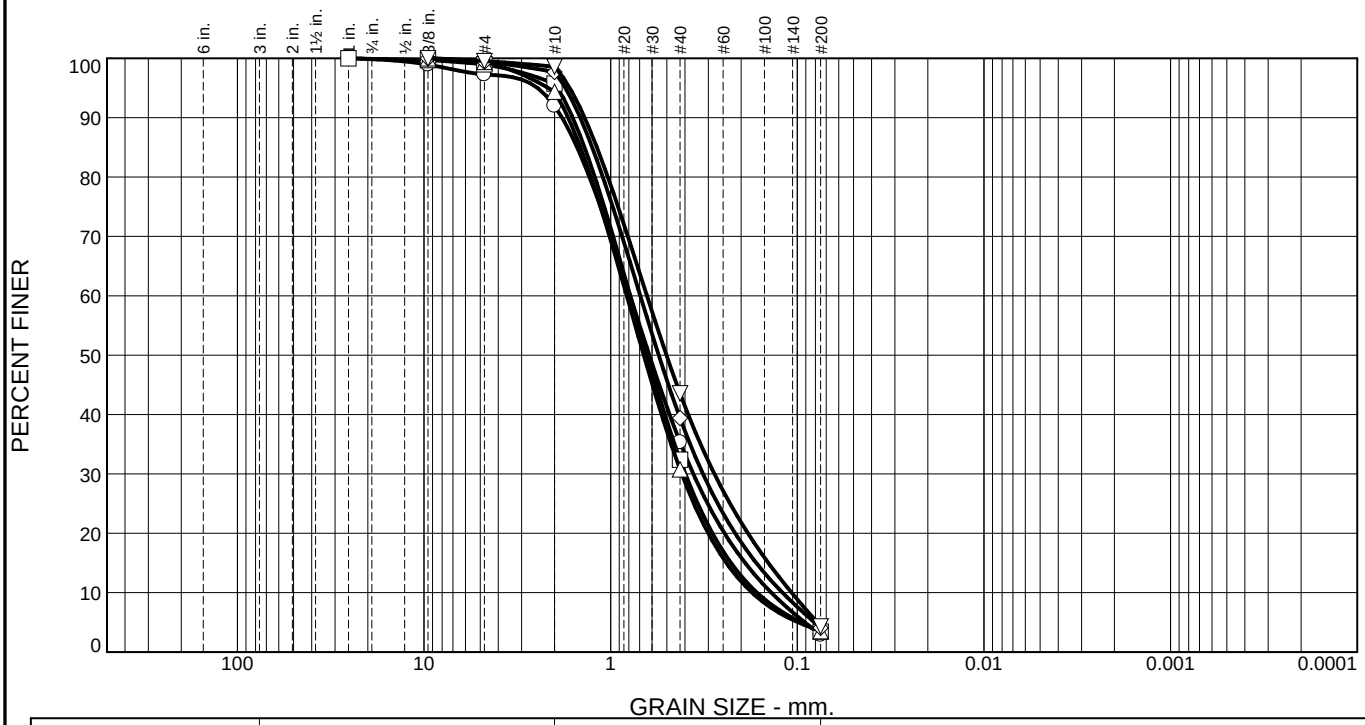
▽ **Source of Sample:** JR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.0	56.7	32.4	2.9	
□	0.0	4.2	63.4	29.0	3.4	
△	0.0	5.6	63.6	27.3	3.5	
◇	0.0	2.3	58.3	35.3	4.1	
▽	0.0	1.4	55.0	39.3	4.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5127	0.7862	0.6207	0.3608	0.1904	0.1379	1.20	5.70
□	NV	NP	1.3803	0.7860	0.6381	0.3980	0.2265	0.1645	1.23	4.78
△	NV	NP	1.4526	0.8198	0.6648	0.4162	0.2398	0.1750	1.21	4.69
◇	NV	NP	1.2555	0.6937	0.5527	0.3202	0.1660	0.1200	1.23	5.78
▽	NV	NP	1.1856	0.6392	0.5023	0.2779	0.1429	0.1073	1.13	5.96

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
□ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
△ Saturated dense orange coarse to fine sand w trace fine gravel and silt./	SP	A-1-b
◇ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** JR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** JR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** JR-1 **Depth:** 63.0 **Sample Number:** 19

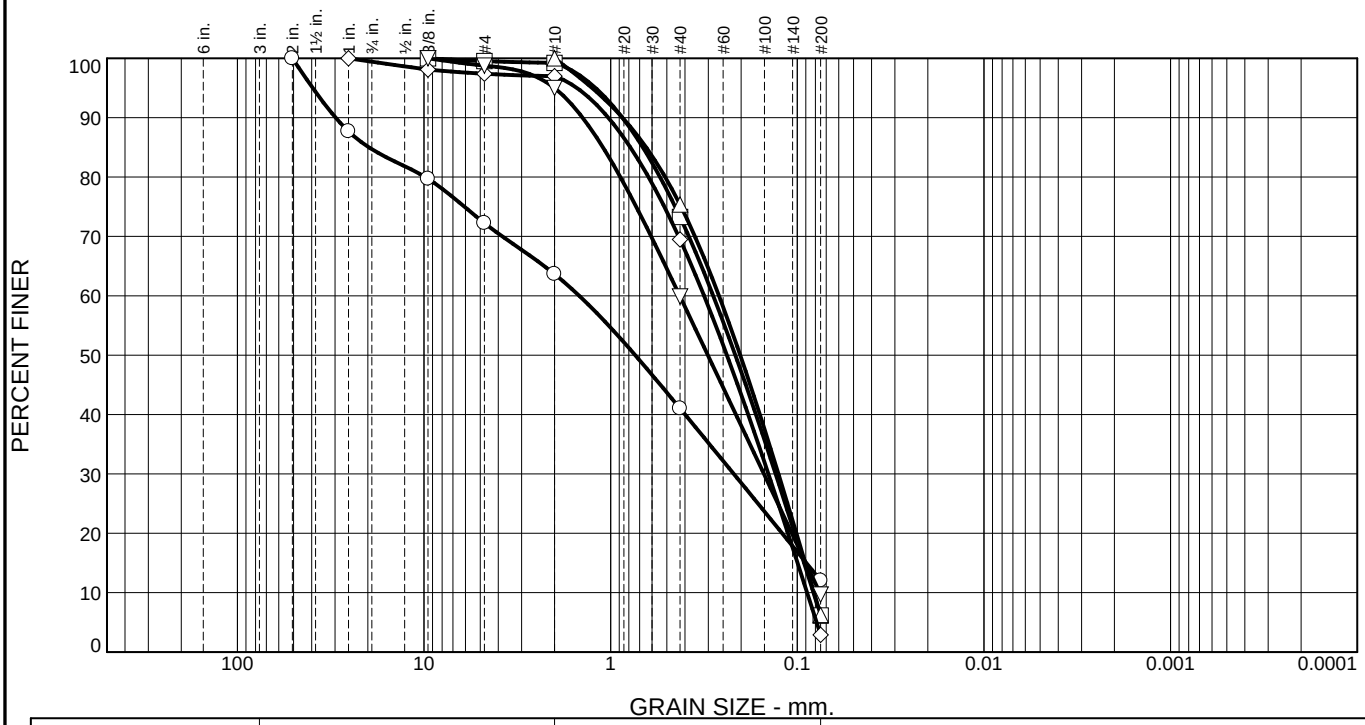
▽ **Source of Sample:** JR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	36.3	22.7	29.0	12.0	
□	0.0	0.8	25.9	67.2	6.1	
△	0.0	0.0	24.6	69.1	6.3	
◇	0.0	3.0	27.5	66.6	2.9	
▽	0.0	5.0	35.1	50.2	9.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	19.7417	1.4739	0.7386	0.2189	0.0895			
□	NV	NP	0.6721	0.2820	0.2148	0.1308	0.0920	0.0820	0.74	3.44
△	NV	NP	0.6457	0.2628	0.2022	0.1262	0.0907	0.0813	0.75	3.23
◇	NV	NP	0.7843	0.3159	0.2383	0.1429	0.0997	0.0886	0.73	3.56
▽	NV	NP	1.1001	0.4266	0.3015	0.1510	0.0901	0.0758	0.71	5.63

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand and fine gravel w/some silt.	SP-SM	A-1-b
□ Moist dense brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Moist medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
◇ Moist loose brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3
▽ Saturated very loose brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** JR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** JR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** JR-2 **Depth:** 6.0 **Sample Number:** 4

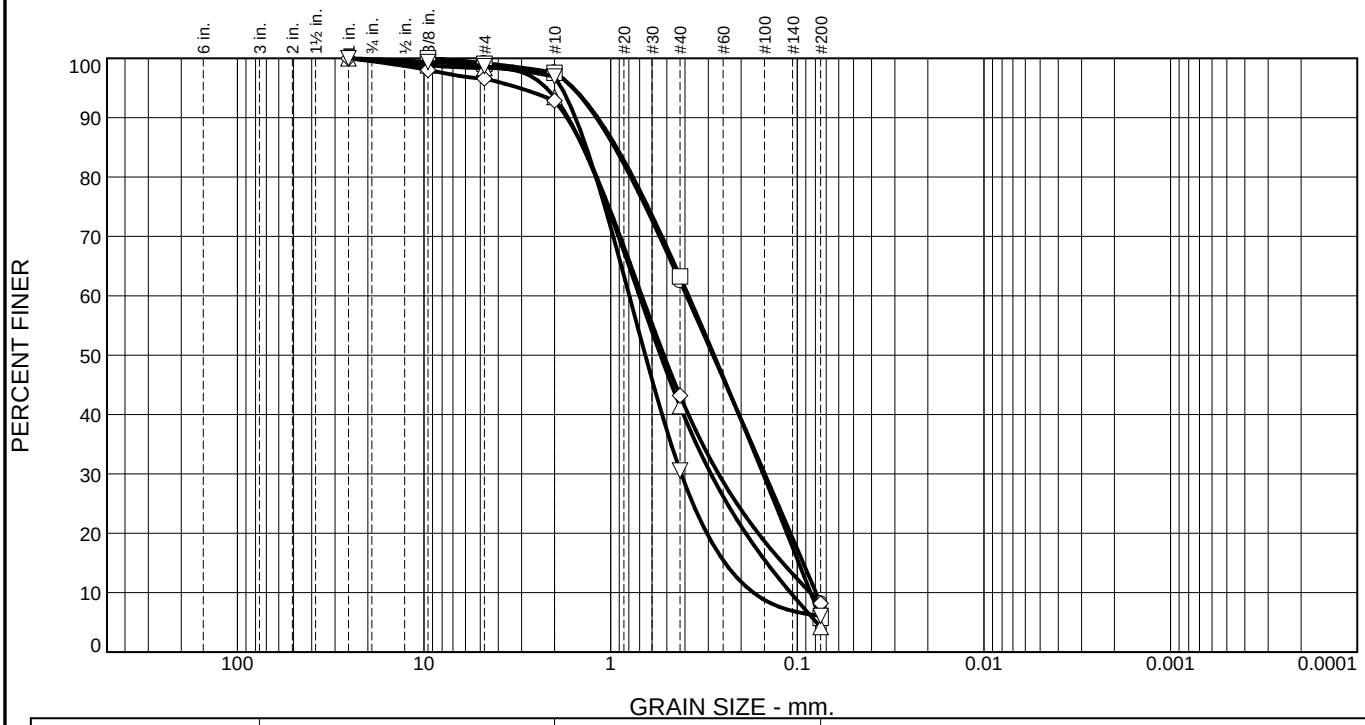
▽ **Source of Sample:** JR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.4	35.1	54.3	8.2	
□	0.0	2.4	34.3	57.5	5.8	
△	0.0	6.5	52.1	37.2	4.2	
◇	0.0	7.1	49.7	35.0	8.2	
▽	0.0	3.1	66.3	24.5	6.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9514	0.3920	0.2831	0.1493	0.0929	0.0794	0.72	4.94
□	NV	NP	0.9302	0.3826	0.2792	0.1525	0.0982	0.0849	0.72	4.51
△	NV	NP	1.4046	0.7012	0.5407	0.2902	0.1457	0.1086	1.11	6.46
◇	NV	NP	1.4023	0.6806	0.5189	0.2642	0.1197	0.0852	1.20	7.99
▽	NV	NP	1.3500	0.7943	0.6523	0.4186	0.2438	0.1719	1.28	4.62

Material Description	USCS	AASHTO
○ Saturated very loose brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
□ Saturated loose gray fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SW	A-1-b
◇ Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** JR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** JR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** JR-2 **Depth:** 16.0 **Sample Number:** 9

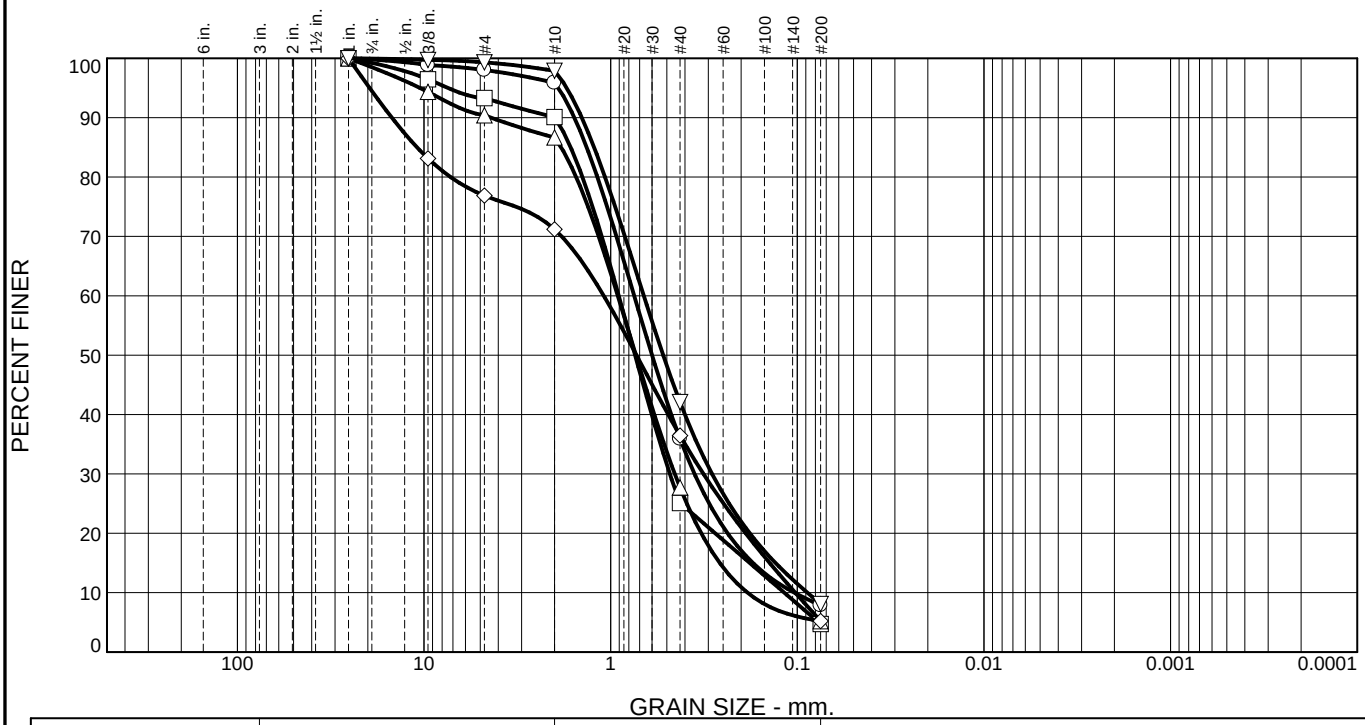
▽ **Source of Sample:** JR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.1	60.0	28.0	7.9	
□	0.0	9.9	65.0	20.4	4.7	
△	0.0	13.3	59.0	22.5	5.2	
◇	0.0	28.8	34.7	31.3	5.2	
▽	0.0	2.1	55.8	34.0	8.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3446	0.7479	0.6001	0.3554	0.1730	0.1038	1.63	7.21
□	NV	NP	1.6376	0.9049	0.7398	0.4817	0.1798	0.1175	2.18	7.70
△	NV	NP	1.8428	0.9160	0.7326	0.4535	0.2603	0.1850	1.21	4.95
◇	NV	NP	10.9029	1.0893	0.7270	0.3183	0.1407	0.1026	0.91	10.62
▽	NV	NP	1.2270	0.6644	0.5230	0.2863	0.1309	0.0883	1.40	7.52

Material Description	USCS	AASHTO
○ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Saturated loose orange coarse sand w/some fine sand and fine gravel, trace of silt.	SW	A-1-b
△ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
◇ Saturated medium dense orange coarse to fine sand and fine gravel, trace of silt.	SP-SM	A-1-b
▽ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** JR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** JR-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** JR-2 **Depth:** 38.0 **Sample Number:** 14

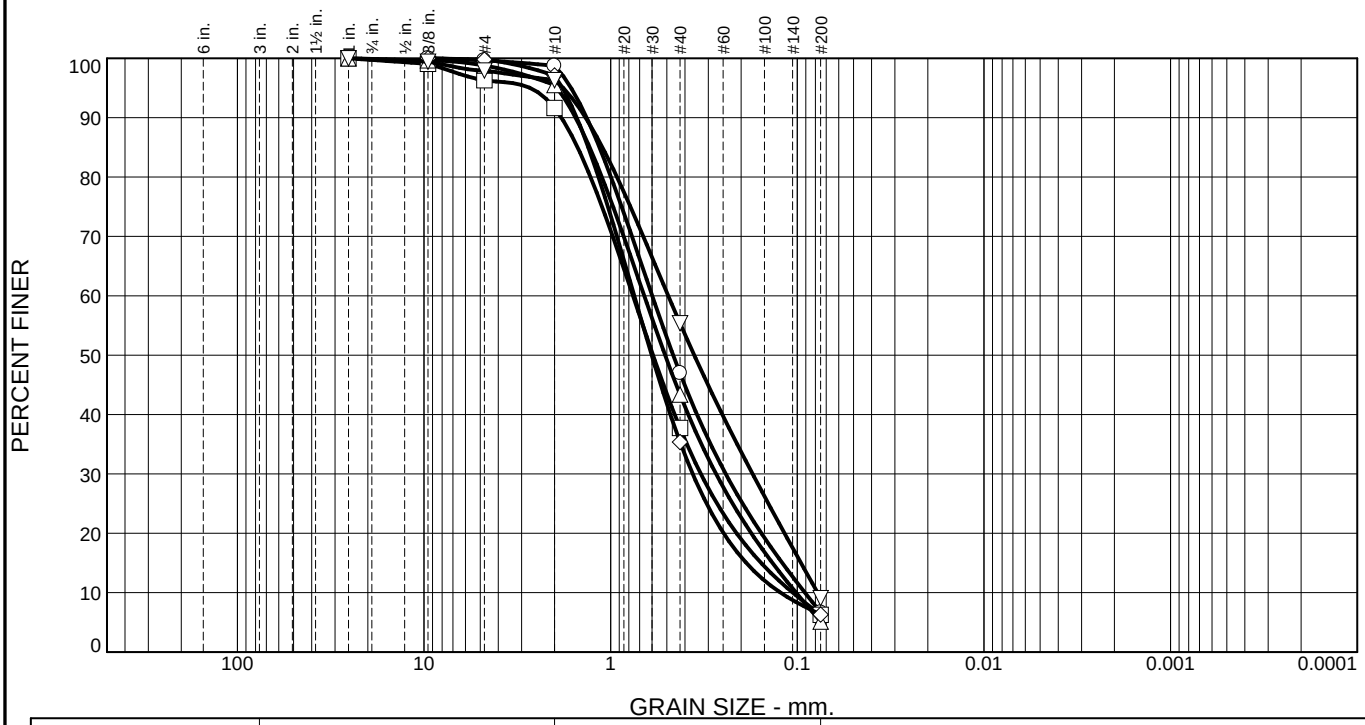
▽ **Source of Sample:** JR-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.3	51.7	40.3	6.7	
□	0.0	8.4	53.9	31.4	6.3	
△	0.0	4.5	52.1	38.3	5.1	
◇	0.0	2.9	61.7	29.1	6.3	
▽	0.0	3.7	40.9	46.3	9.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1484	0.5988	0.4623	0.2418	0.1204	0.0910	1.07	6.58
□	NV	NP	1.5048	0.7594	0.5927	0.3288	0.1563	0.1058	1.35	7.18
△	NV	NP	1.2959	0.6607	0.5107	0.2723	0.1359	0.1015	1.11	6.51
◇	NV	NP	1.3181	0.7474	0.6028	0.3635	0.1878	0.1230	1.44	6.08
▽	NV	NP	1.1072	0.4914	0.3566	0.1737	0.0956	0.0779	0.79	6.31

Material Description	USCS	AASHTO
○ Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
□ Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Saturated dense brown coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
◇ Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated very dense gray fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Johnson Road

○ **Source of Sample:** JR-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** JR-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** JR-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** JR-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** JR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

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Materials and Research Laboratory

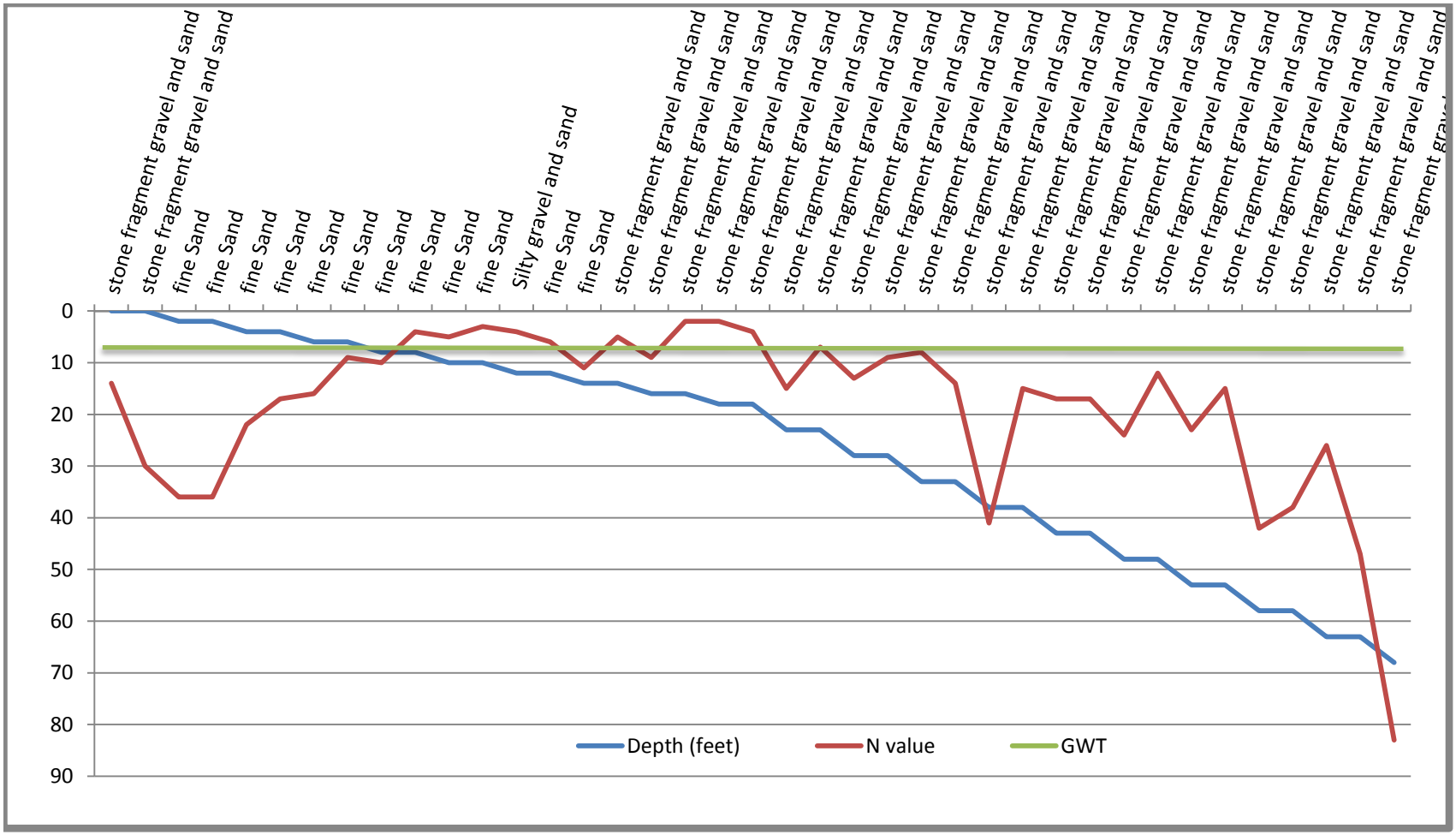
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
JR-1														
	1		Moist dense brown fine to coarse sand and fine gravel w/some silt.	NV	NP	5.8	SM	A-1-b	76	18.8	8	12	2	22
	2	2	Moist dense reddish brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	6.1	SP-SM	A-3	99.1	9.9	15	17	19	20
	3	4	Moist medium dense reddish brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	4.8	SP-SM	A-3	99.3	7	7	10	12	15
	4	6	Moist medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	6.9	SP-SM	A-3	98.7	8.3	5	8	8	10
	5	8	Moist loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	14.5	SP-SM	A-3	97.7	10	4	5	5	6
	6	10	Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	17	SP-SM	A-3	98.3	8.4	1	2	3	5
	7	12	Saturated very loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	19.3	SP-SM	A-2-4(0)	98.3	11.3	1	1	3	2
	8	14	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.9	SP	A-3	95.9	3	1	1	10	15
	9	16	Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.6	SP	A-1-b	92	3.6	1	4	5	6
	10	18	Saturated very loose orange coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	15.4	SW-SM	A-1-b	89	6.5		1	1	1
	11	23	Saturated medium dense orange coarse sand w/some fine gravel and fine sand, trace of silt.	NV	NP	13.4	SW	A-1-b	87.7	4.5	3	6	9	10
	12	28	Wet medium dense orange coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	13	SP	A-1-b	87	3.2	2	6	7	9
	13	33	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.7	SW-SM	A-1-b	94.3	6.4	2	3	5	6
	14	38	Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	12.1	SP-SM	A-1-b	81.9	6	7	26	15	18
	15	43	Saturated medium dense orange coarse to fine sand w/some fine, trace of silt.	NV	NP	17.4	SP	A-1-b	87	3.8	3	8	9	12
	16	48	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.8	SP	A-1-b	92	2.9	5	9	15	16
	17	53	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.5	SP	A-1-b	95.8	3.4	4	6	17	25
	18	58	Saturated dense orange coarse to fine sand w trace fine gravel and silt./	NV	NP	16.7	SP	A-1-b	94.4	3.5	6	16	26	48
	19	63	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.6	SP	A-1-b	97.7	4.1	2	10	16	30
	20	68	Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.7	SP	A-1-b	98.6	4.3	12	33	50	
		70	End Boring											
JR-2														
	1		Moist medium dense brown fine to coarse sand and fine gravel w/some silt.	NV	NP	10	SP-SM	A-1-b	63.7	12	3	13	17	17
	2	2	Moist dense brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	4.6	SP-SM	A-3	99.2	6.1	14	18	18	23
	3	4	Moist medium dense brown fine to coarse sand w/trace silt.	NV	NP	3.6	SP-SM	A-3	100	6.3	8	8	9	11
	4	6	Moist loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	6.4	SP	A-3	97	2.9	4	5	4	4
	5	8	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	14.8	SP-SM	A-3	95	9.7	3	2	2	3
	6	10	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	18.3	SP-SM	A-3	97.6	8.2	2	1	2	2
	7	12	Saturated loose gray fine to coarse sand w/trace silt and fine gravel.	NV	NP	16.7	SP-SM	A-3	97.6	5.8	2	3	3	4
	8	14	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19	SW	A-1-b	93.5	4.2	2	2	3	4
	9	16	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.2	SW-SM	A-1-b	92.9	8.2	1	1	1	2
	10	18	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.6	SP-SM	A-1-b	96.9	6.1	1	1	3	4
	11	23	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.9	SW-SM	A-1-b	95.9	7.9	2	3	4	8
	12	28	Saturated loose orange coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	15.5	SW	A-1-b	90.1	4.7	2	4	5	8
	13	33	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	12	SP-SM	A-1-b	86.7	5.2	6	7	7	9
	14	38	Saturated medium dense orange coarse to fine sand and fine gravel, trace of silt.	NV	NP	12.2	SP-SM	A-1-b	71.2	5.2	15	7	8	8
	15	43	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.1	SW-SM	A-1-b	97.9	8.1	6	6	11	12
	16	48	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	NV	NP	25.2	SW-SM	A-1-b	98.7	6.7	2	6	6	8
	17	53	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.1	SW-SM	A-1-b	91.6	6.3	5	5	10	13
	18	58	Saturated dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	16.9	SW-SM	A-1-b	95.5	5.1	7	17	21	29
	19	63	Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.2	SW-SM	A-1-b	97.1	6.3	12	20	27	40
	20	68	Saturated very dense gray fine to coarse sand w/trace silt and fine gravel.	NV	NP	14.4	SP-SM	A-3	96.3	9.1	12	18	32	40
		70	End Boring											

DATE : **12-18-2015**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-323 on Johnson Road - Laurel DE**



DATE : 12-18-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-323 on Johnson Road - Laurel DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 12-14-2015**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-335 on Bacons Road - Delmar DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 9-11-2015 to 9-14-2015. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in Beaverdam Formation White-greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Laurel Area, Delaware by John Adam, and Durward H. Boggess (1964) Atlas HA-123. The nearest well to this site the groundwater historically had been measured 22 feet on October 1960 and between the years of 1950 to 1960 appeared from 20 to 24 feet below

the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter as 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 20 to 30 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a fair to good category.

5. Ground Cover

The ground cover for this site is 4 to 5 inches of top soil more detail show in Appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 6 to 8.8 feet, noted at the completion of the drilling is 8 feet and caved at 8 feet below the ground surface elevation more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 3.8 to 24.2 percent. The Atterberg limit and the organic matter was not encountered for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general is in a good condition and 8 feet in thickness of loose silty fine sand layer appeared at 6 feet down from the surface elevation need to consider in the design. In addition all the sample from the depth of 2 to 10 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

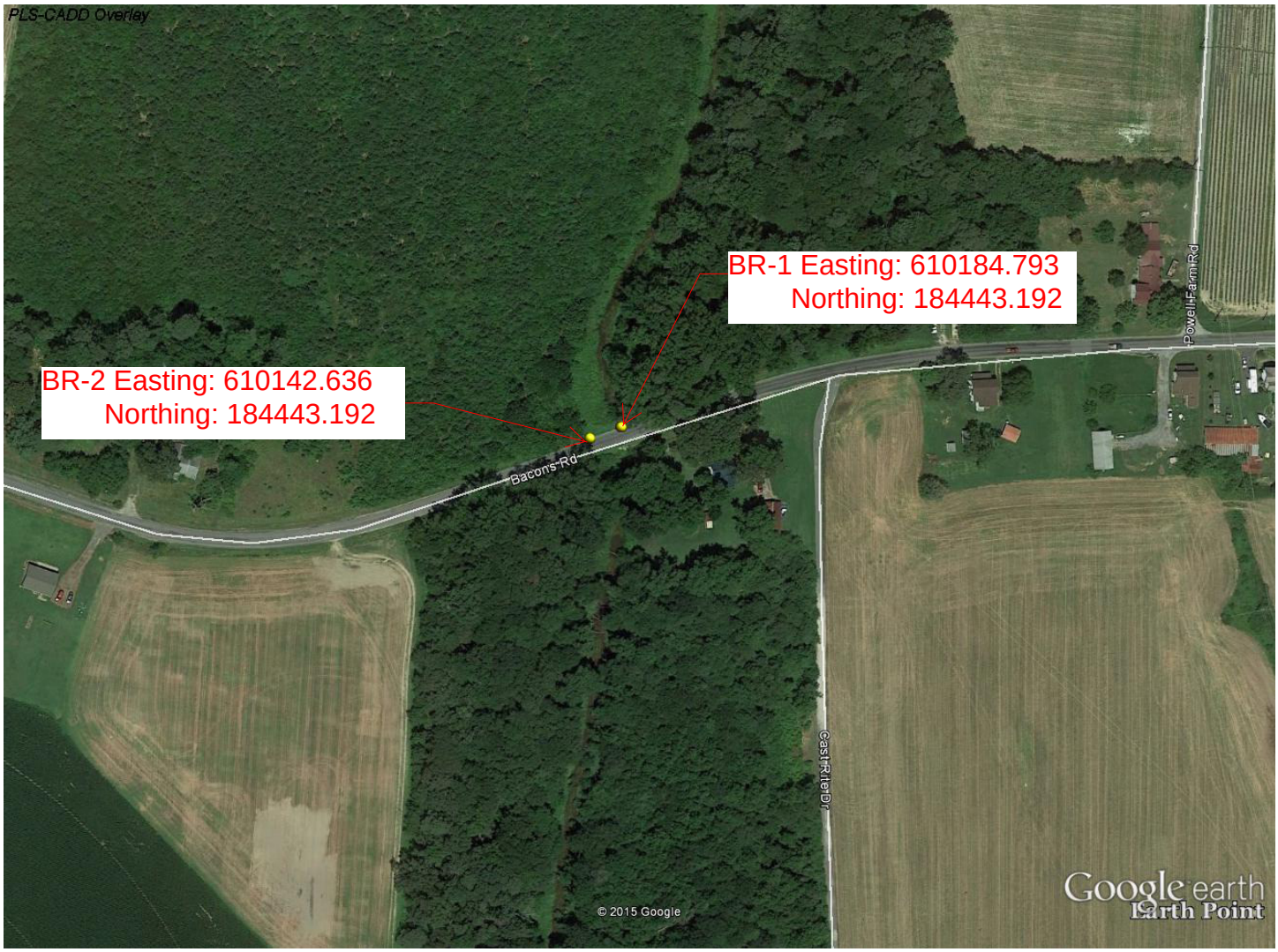
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 21-1692 T201407003 BR3-335 On Bacon Road in Sussex County



Google earth

feet 800

meters 200

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING B-1

Project Name: Bacons Road BR3-335 **Location:** New Castle County, DE
State Contract #: T201407003 **Federal Contract #:**
Station/Offset: **Northing:** 184443.192 **Easting:** 610184.793
Boring Surface Elev.: **Reference:**
Date Started: 9/11/15 **Date Completed:** 9/11/15

Wt. of Sample Hammer: 140 **Lbs.** **Average Fall:** 30 **IN.**
Type of: **D-Sampler:** Split Barrel **O.D.** **O.D. of Sampler:** 2 **IN.**
S-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
U-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
Core Bit: **O.D.** **O.D. of Rock Core:** **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** **From Depth of:** 0.0 **To:** 70.0
Mud Rotary: **From Depth of:** 10.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
9/11/15	6.0	
9/11/15	Dry	8.0

Boring Contractor: Hillis Carnes Engineering Accociates **Equipment/Rig Type:** B-30
Driller: D. Hebert **Logged By:** John Martin

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	6 9 10 10	Moist medium dense brown fine to coarse sand and fine gravel w/some silt. 12" RECOVERY	A-1-b	Topsoil 5"
2.53		2	2.0' 4.0'	4 4 3 2	Moist loose brown fine to coarse sand w/ some silt. 18" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	4 5 7 4	Moist medium dense brown fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' 8.0'	3 3 1 3	Wet very loose orange silty coarse sand w/ some fine sand, trace of fine gravel. 24" RECOVERY	A-1-b	
10.12		5	8.0' 10.0'	2 2 1 1	Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel. 24" RECOVERY	A-1-b	
		6	10.0' 12.0'	1 2 2 2	Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel. 24" RECOVERY	A-1-b	
12.65		7	12.0'	1 1 1 1	Wet very loose orange silty coarse to fine sand w/trace fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
		8	14.0'	2 2 2 2	Saturated very loose orange clayey coarse to fine sand w/some silt, trace of fine gravel.	A-2-4(0)	
15.18			16.0'		24" RECOVERY		
		9	16.0'	3 4 8 9	Saturated medium dense orange coarse to fine sand w/some silt, trace of fine gravel.	A-2-4(0)	
17.71			18.0'		24" RECOVERY		
		10	18.0'	4 5 7 12	Saturated medium dense brown silty fine sand w/some coarse sand.	A-2-4(0)	
20.24			20.0'		24" RECOVERY		
22.77							
		11	23.0'	3 4 5 7	Saturated loose orange coarse sand w/some fine sand, trace of silt and fine gravel.	A-1-b	
25.3			25.0'		24" RECOVERY		
27.83							
		12	28.0'	8 3 4 6	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
30.36			30.0'		24" RECOVERY		
32.89							
		13	33.0'	8 8 12 12	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	A-1-b	
35.42			35.0'		24" RECOVERY		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	4 7 8 10	Saturated medium dense brown coarse sand w/trace fine sand, fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	5 8 9 11	Saturated medium dense orange coarse sand w/some fine sand and fine gravel, trace of silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	8 11 11 12	Saturated medium dense brown coarse sand w/some fine sand, fine gravel and silt.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	15 20 20 23	Saturated dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	5 6 17 20	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	14 21 24 30	Saturated dense brown coarse to fine sand w/ trace silt and fine gravel.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	17 24 28 34	Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING B-2

Project Name: Bacons Road BR3-335 **Location:** New Castle County, DE
State Contract #: T201407003 **Federal Contract #:**
Station/Offset: **Northing:** 184443.192 **Easting:** 610142.636
Boring Surface Elev.: **Reference:**
Date Started: 9/14/15 **Date Completed:** 9/14/15

Wt. of Sample Hammer: 140 **Lbs.** **Average Fall:** 30 **IN.**
Type of: **D-Sampler:** Split Barrel **O.D.** **O.D. of Sampler:** 2 **IN.**
S-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
U-Sampler: **O.D.** **O.D. of Samp. Tube:** **IN.**
Core Bit: **O.D.** **O.D. of Rock Core:** **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** **From Depth of:** 0.0 **To:** 70.0
Mud Rotary: **From Depth of:** **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
9/14/15	4.0	
9/14/15	5.50	7.0

Boring Contractor: Hillis Carnes Engineering Accociates **Equipment/Rig Type:** B-30
Driller: D. Hebert **Logged By:** John Martin

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	2 3 3 3	Moist loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	Topsoil 4"
2.53		2	2.0' 4.0'	5 4 2 1	Wet loose brown fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	
5.06	■	3	4.0' 6.0'	1 1 2 1	Wet very loose black organic silty fine to coarse sand. 24" RECOVERY	A-2-5(0)	
7.59		4	6.0' 8.0'	5 6 7 7	Wet medium dense brown fine sand w/some coarse sand, trace of silt. 24" RECOVERY	A-3	
10.12		5	8.0' 10.0'	4 5 7 8	Wet medium dense brown fine sand w/some coarse sand, trace of silt. 24" RECOVERY	A-3	
		6	10.0' 12.0'	5 6 8 8	Wet medium dense orange fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
12.65		7	12.0'	5 8 8 8	Wet medium dense brown fine to coarse sand w/trace silt and fine gravel.	A-3	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	4 2 2 5	Saturated very loose brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
17.71		9	16.0' 18.0'	4 2 2 1	Saturated very loose orange fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	5 5 4 5	Saturated loose orange fine to coarse sand w some silt, trace of fine gravel./ 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	7 8 10 9	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	2 11 12 11	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	4 5 6 5	Saturated medium dense orange coarse sand w/some fine sand, trace of silt and fine gravel. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	8 6 6 8	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	15 21 25 30	Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	7 19 19 24	Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	10 13 15 20	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			55.0'		24" RECOVERY		
55.66							
58.19							
		18	58.0'	10 10 16 21	Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bacons Road
State Contract: T201407003

Boring No.: B-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	11 15 15 22	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	13 17 19 24	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

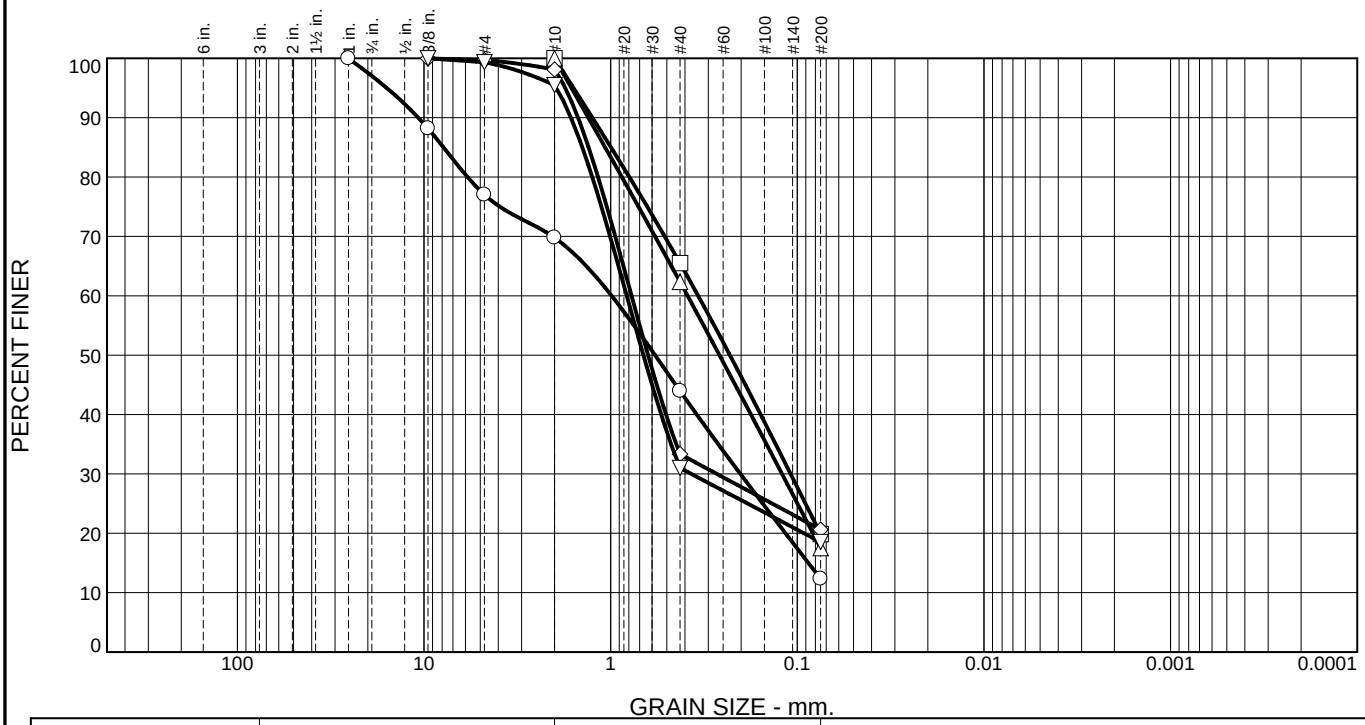
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	30.2	25.8	31.7	12.3	
□	0.0	0.0	34.5	45.6	19.9	
△	0.0	0.0	37.7	44.8	17.5	
◇	0.0	1.9	64.8	12.7	20.6	
▽	0.0	4.5	64.5	12.5	18.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	7.8658	0.9878	0.5784	0.2020	0.0872			
□	NV	NP	0.9960	0.3397	0.2296	0.1087				
△	NV	NP	1.0709	0.3872	0.2612	0.1208				
◇	NV	NP	1.3127	0.7730	0.6306	0.2697				
▽	NV	NP	1.4188	0.8201	0.6678	0.3696				

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand and fine gravel w/some silt.	SM	A-1-b
□ Moist loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Moist medium dense brown fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Wet very loose orange silty coarse sand w/some fine sand, trace of fine gravel.	SM	A-1-b
▽ Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** B-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** B-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** B-1 **Depth:** 6.0 **Sample Number:** 4

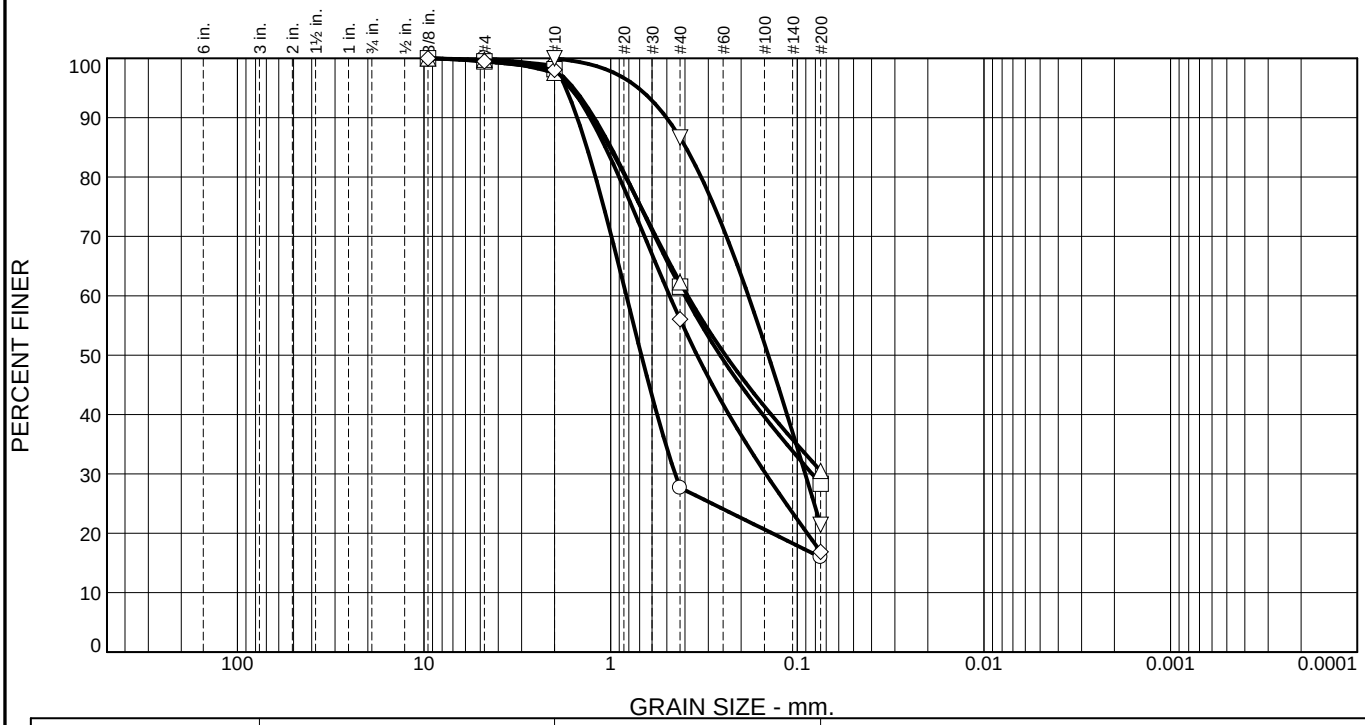
▽ **Source of Sample:** B-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.2	71.1	11.7	16.0	
□	0.0	1.8	36.7	33.2	28.3	
△	0.0	2.4	35.3	31.8	30.5	
◇	0.0	1.9	42.1	39.1	16.9	
▽	0.0	0.0	13.3	65.3	21.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3418	0.8236	0.6847	0.4513				
□	NV	NP	0.9965	0.4002	0.2591	0.0833				
△	24.4	16.2	1.0125	0.3868	0.2428					
◇	NV	NP	1.0668	0.4831	0.3444	0.1475				
▽	NV	NP	0.3958	0.1830	0.1432	0.0907				

Material Description	USCS	AASHTO
○ Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel.	SM	A-1-b
□ Wet very loose orange silty coarse to fine sand w/trace fine gravel.	SM	A-2-4(0)
△ Saturated very loose orange clayey coarse to fine sand w/some silt, trace of fine gravel.	SC	A-2-4(0)
◇ Saturated medium dense orange coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated medium dense brown silty fine sand w/some coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** B-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** B-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** B-1 **Depth:** 16.0 **Sample Number:** 9

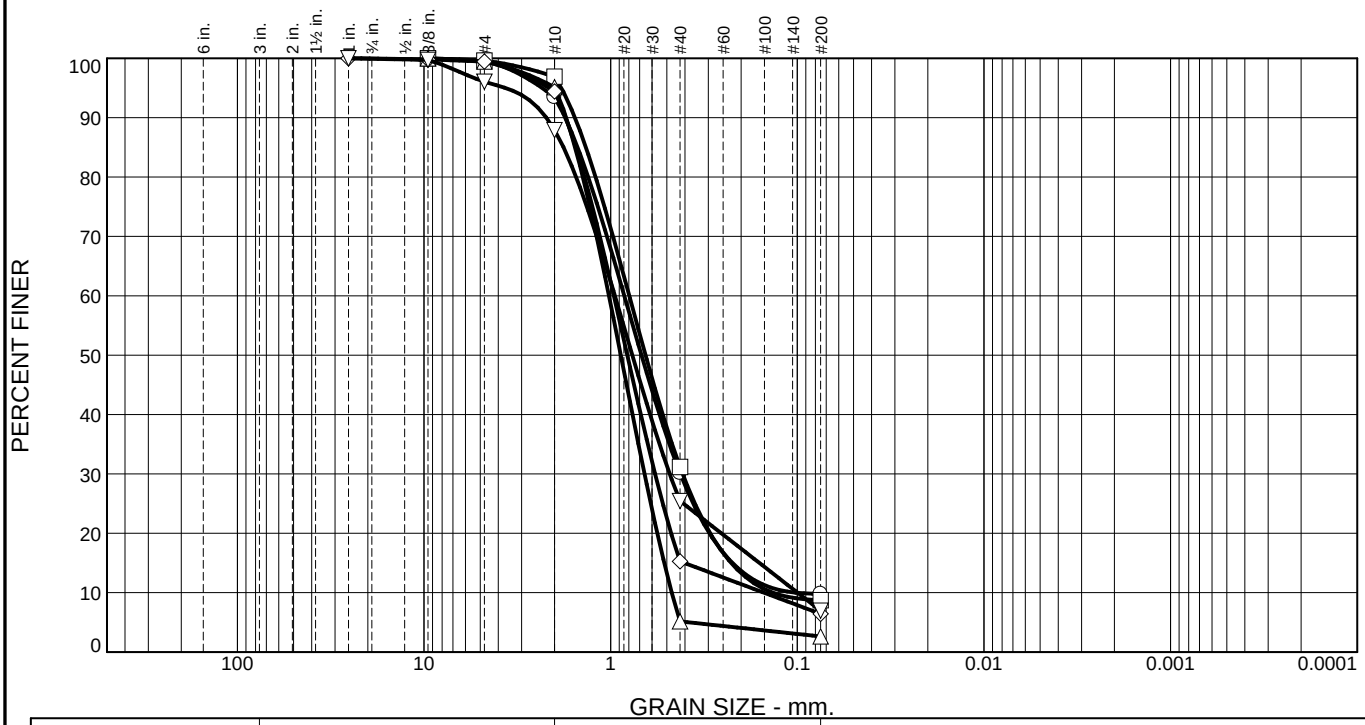
▽ **Source of Sample:** B-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	6.5	63.4	20.3	9.8	
□	0.0	3.1	65.7	22.5	8.7	
△	0.0	4.9	89.9	2.6	2.6	
◇	0.0	5.6	79.1	8.9	6.4	
▽	0.0	12.1	62.5	18.4	7.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5045	0.8451	0.6838	0.4233	0.2226	0.1022	2.07	8.27
□	NV	NP	1.3577	0.7948	0.6504	0.4116	0.2263	0.1354	1.57	5.87
△	NV	NP	1.5511	1.0215	0.8826	0.6586	0.5164	0.4705	0.90	2.17
◇	NV	NP	1.5366	0.9620	0.8147	0.5780	0.4027	0.1510	2.30	6.37
▽	NV	NP	1.7897	0.9494	0.7657	0.4827	0.1596	0.0998	2.46	9.52

Material Description	USCS	AASHTO
○ Saturated loose orange coarse sand w/some fine sand, trace of silt and fine gravel.	SW-SM	A-1-b
□ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b
◇ Saturated medium dense brown coarse sand w/trace fine sand, fine gravel and silt.	SW-SM	A-1-b
▽ Saturated medium dense orange coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** B-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** B-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** B-1 **Depth:** 38.0 **Sample Number:** 14

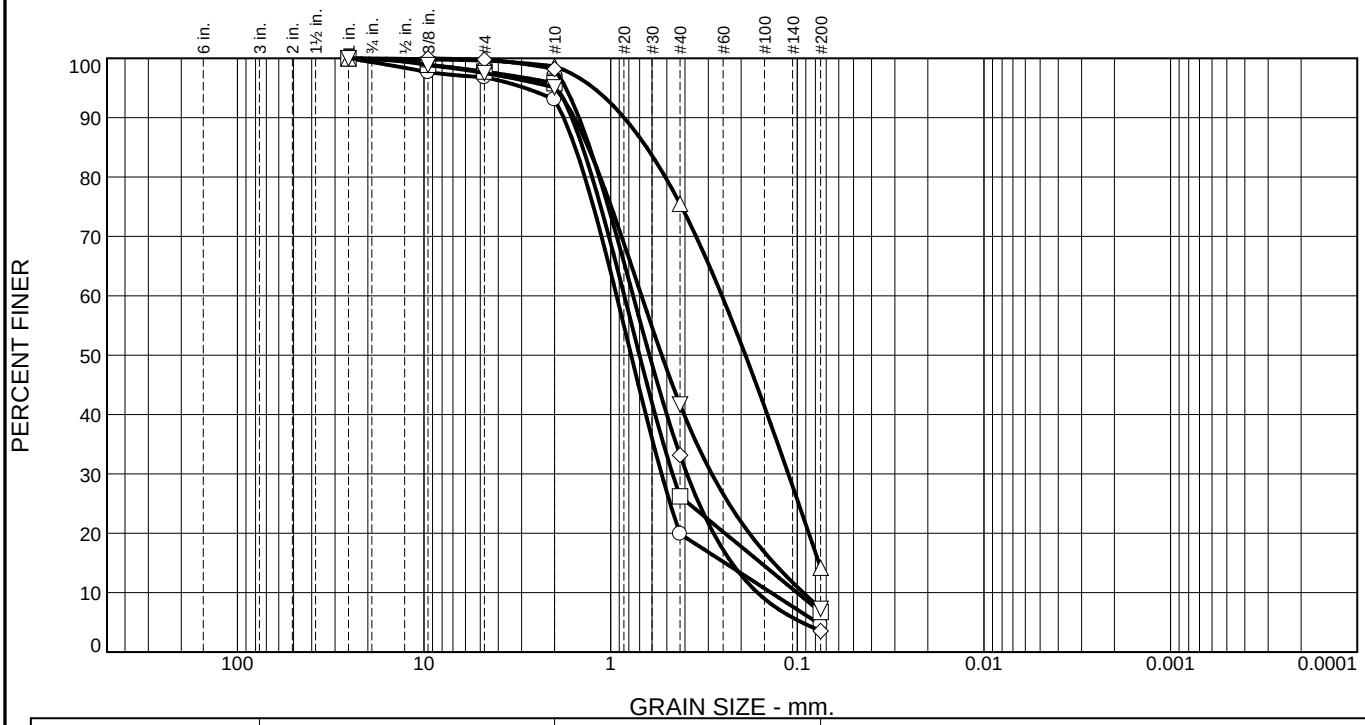
▽ **Source of Sample:** B-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	6.9	73.2	15.3	4.6	
□	0.0	4.2	69.6	19.5	6.7	
△	0.0	1.4	23.1	61.3	14.2	
◇	0.0	1.8	65.0	29.7	3.5	
▽	0.0	4.9	53.4	34.4	7.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5493	0.9295	0.7769	0.5339	0.2438	0.1382	2.22	6.73
□	NV	NP	1.4124	0.8448	0.7007	0.4662	0.1565	0.1003	2.56	8.42
△	NV	NP	0.6415	0.2532	0.1897	0.1117	0.0765			
◇	NV	NP	1.2947	0.7581	0.6196	0.3907	0.2243	0.1635	1.23	4.64
▽	NV	NP	1.3179	0.6835	0.5326	0.2871	0.1335	0.0929	1.30	7.36

Material Description	USCS	AASHTO
○ Saturated medium dense brown coarse sand w/some fine sand, fine gravel and silt.	SW	A-1-b
□ Saturated dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
△ Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Saturated dense brown coarse to fine sand w/trace silt and fine gravel.	SP	A-1-b
▽ Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** B-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** B-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** B-1 **Depth:** 63.0 **Sample Number:** 19

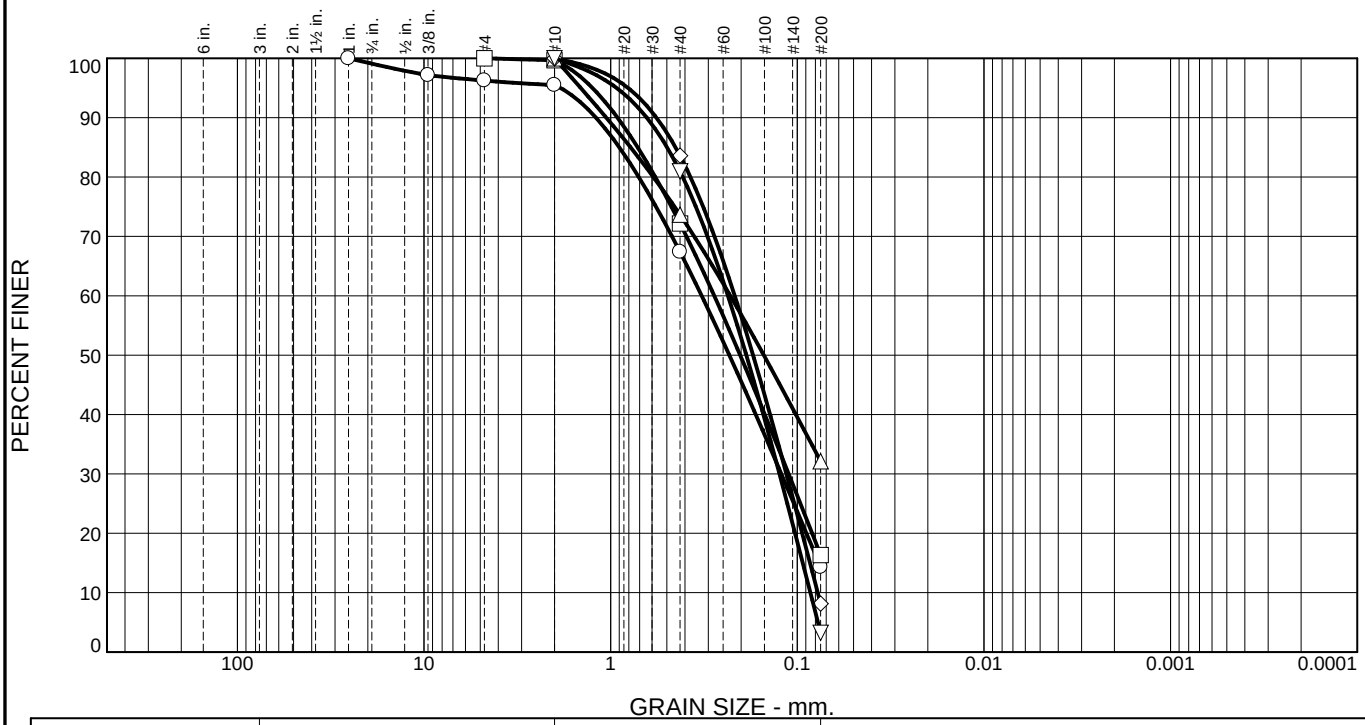
▽ **Source of Sample:** B-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.5	28.1	53.1	14.3	
□	0.0	0.3	27.5	55.9	16.3	
△	0.0	0.0	26.3	41.6	32.1	
◇	0.0	0.0	16.4	75.4	8.2	
▽	0.0	0.0	19.0	77.8	3.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8987	0.3253	0.2313	0.1218	0.0766			
□	NV	NP	0.7165	0.2785	0.2024	0.1113				
△	43.1	NP	0.7822	0.2285	0.1513					
◇	NV	NP	0.4491	0.2163	0.1727	0.1145	0.0855	0.0777	0.78	2.78
▽	NV	NP	0.4985	0.2352	0.1876	0.1247	0.0935	0.0851	0.78	2.76

Material Description	USCS	AASHTO
○ Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Wet very loose black organic silty fine to coarse sand.	SM	A-2-5(0)
◇ Wet medium dense brown fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
▽ Wet medium dense brown fine sand w/some coarse sand, trace of silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** B-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** B-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** B-2 **Depth:** 6.0 **Sample Number:** 4

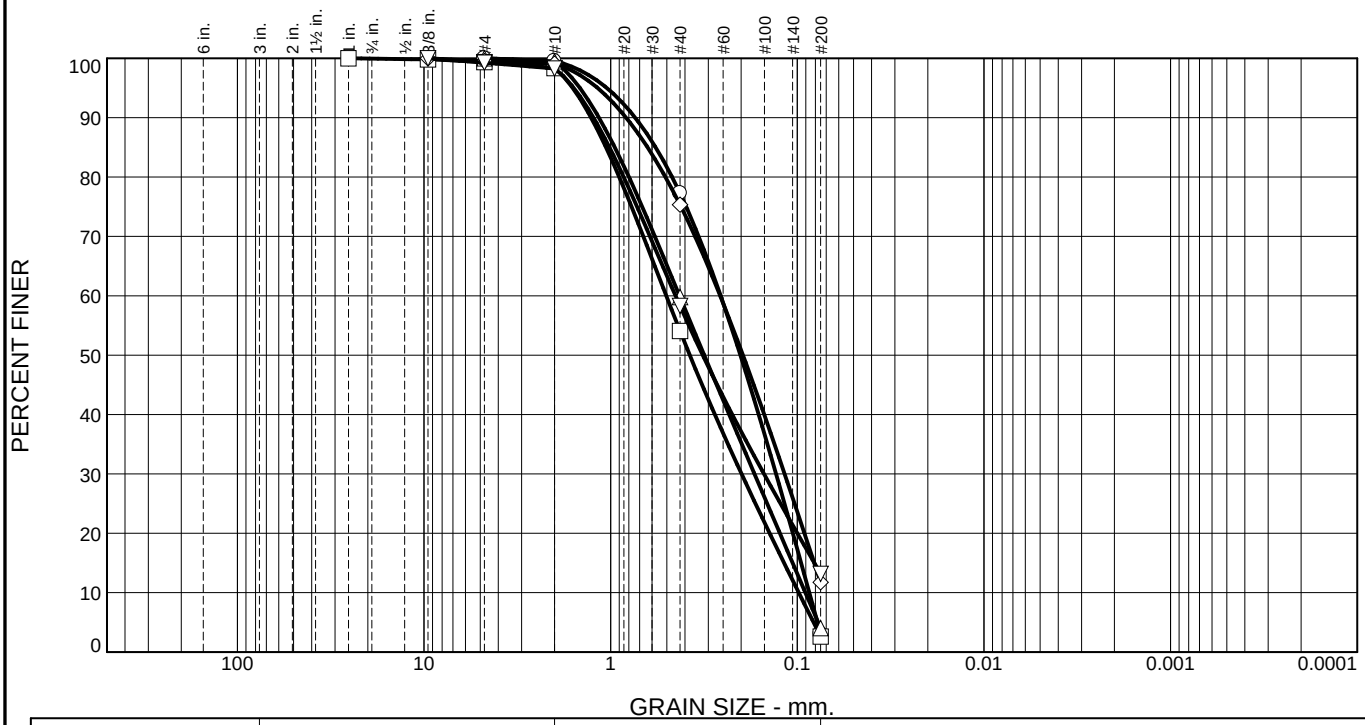
▽ **Source of Sample:** B-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.5	22.2	74.2	3.1	
□	0.0	1.7	44.2	51.5	2.6	
△	0.0	0.5	39.7	55.8	4.0	
◇	0.0	0.9	23.8	63.6	11.7	
▽	0.0	1.7	40.0	45.1	13.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.5742	0.2574	0.2019	0.1300	0.0954	0.0862	0.76	2.98
□	NV	NP	1.0592	0.5036	0.3768	0.1990	0.1177	0.0982	0.80	5.13
△	NV	NP	0.9509	0.4277	0.3153	0.1697	0.1060	0.0905	0.74	4.73
◇	NV	NP	0.6343	0.2589	0.1956	0.1170	0.0811			
▽	NV	NP	1.0149	0.4490	0.3211	0.1509	0.0810			

Material Description	USCS	AASHTO
○ Wet medium dense orange fine to coarse sand w/trace silt.	SP	A-3
□ Wet medium dense brown fine to coarse sand w/trace silt and fine gravel.	SP	A-3
△ Saturated very loose brown fine to coarse sand w/trace silt.	SP	A-3
◇ Saturated very loose orange fine to coarse sand w/some silt.	SP-SM	A-2-4(0)
▽ Saturated loose orange fine to coarse sand w some silt, trace of fine gravel./	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** B-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** B-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** B-2 **Depth:** 16.0 **Sample Number:** 9

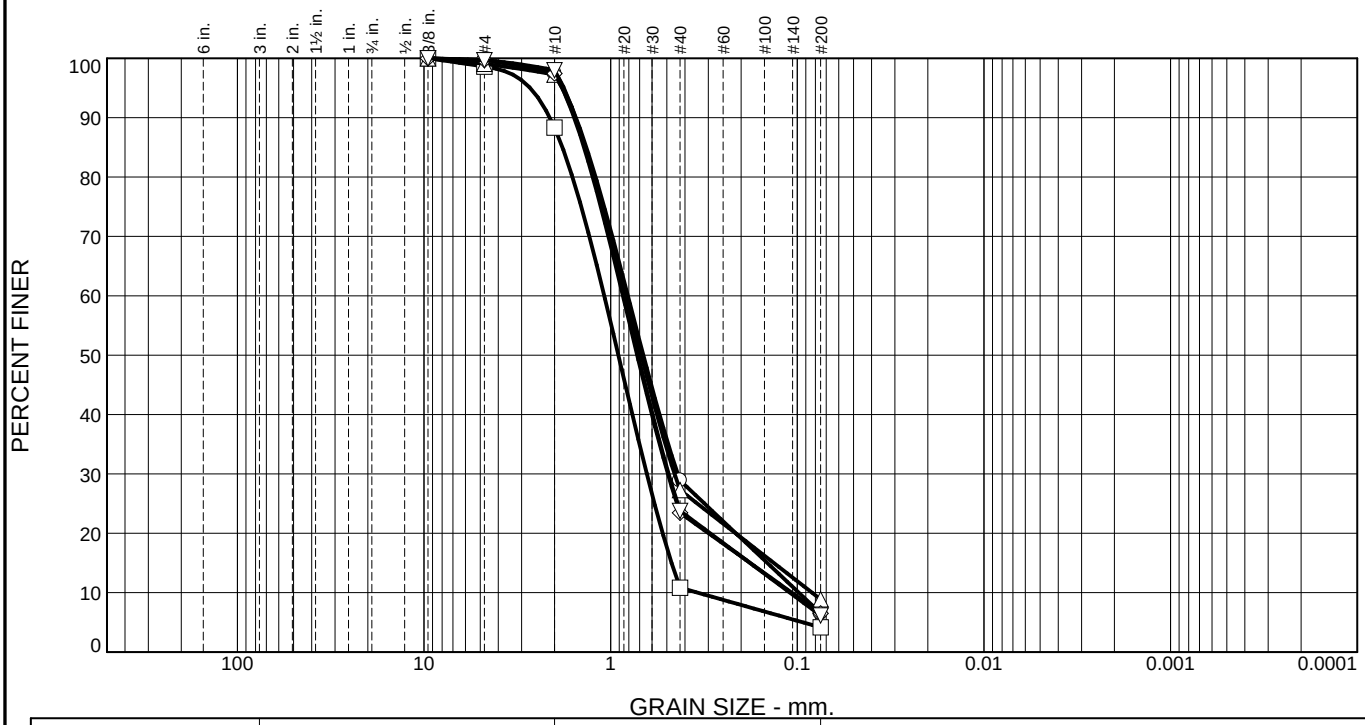
▽ **Source of Sample:** B-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.5	68.6	22.4	6.5	
□	0.0	11.7	77.5	6.6	4.2	
△	0.0	2.7	70.0	18.4	8.9	
◇	0.0	2.6	73.9	17.0	6.5	
▽	0.0	2.0	74.2	17.6	6.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3499	0.8087	0.6683	0.4371	0.1447	0.0982	2.41	8.24
□	NV	NP	1.8136	1.0824	0.9094	0.6400	0.4715	0.3420	1.11	3.17
△	NV	NP	1.3670	0.8266	0.6862	0.4547	0.1336	0.0834	3.00	9.91
◇	NV	NP	1.3890	0.8596	0.7208	0.4935	0.1788	0.1072	2.64	8.02
▽	NV	NP	1.3685	0.8504	0.7138	0.4894	0.1792	0.1095	2.57	7.77

Material Description	USCS	AASHTO
○ Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
□ Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b
△ Saturated medium dense orange coarse sand w/some fine sand, trace of silt and fine gravel.	SW-SM	A-1-b
◇ Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
▽ Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** B-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** B-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** B-2 **Depth:** 38.0 **Sample Number:** 14

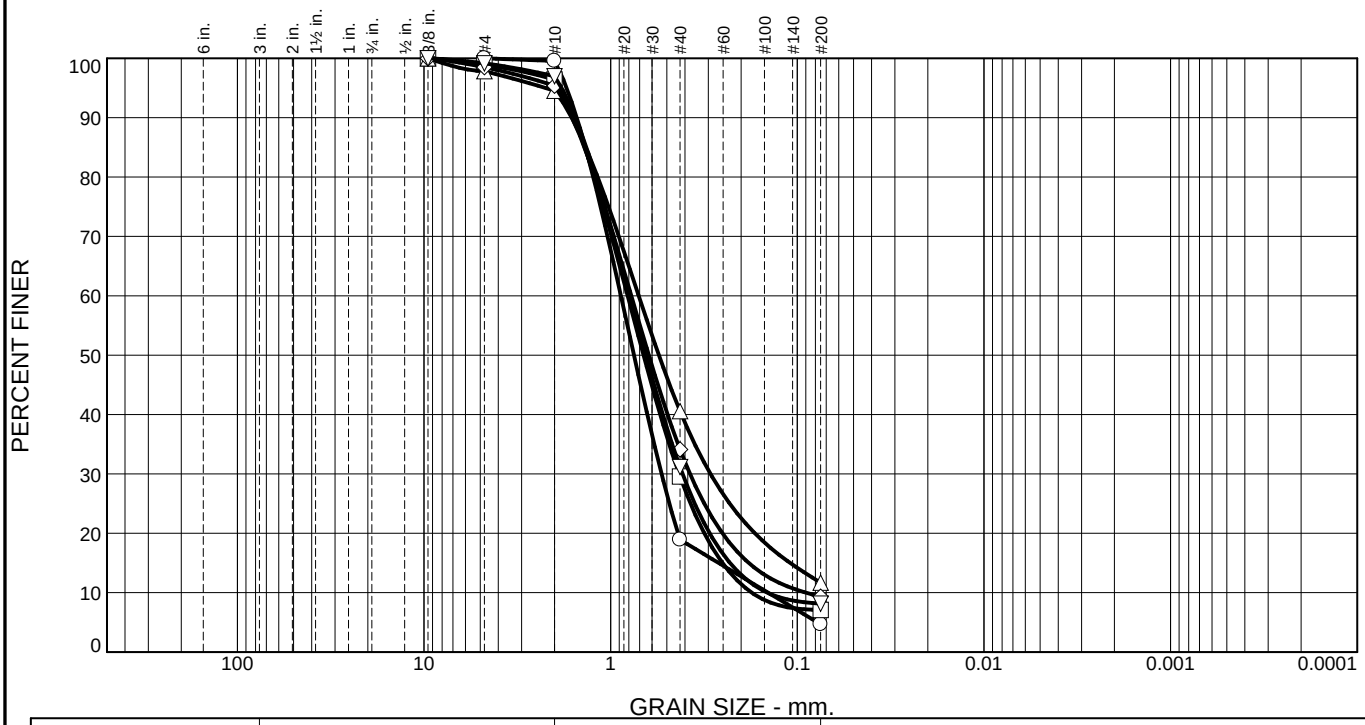
▽ **Source of Sample:** B-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.4	80.7	14.2	4.7	
□	0.0	3.6	66.8	22.5	7.1	
△	0.0	5.5	53.9	28.9	11.7	
◇	0.0	4.6	61.3	24.8	9.3	
▽	0.0	3.0	65.8	23.1	8.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3656	0.8815	0.7501	0.5336	0.2637	0.1434	2.25	6.15
□	NV	NP	1.3776	0.8111	0.6667	0.4300	0.2519	0.1755	1.30	4.62
△	NV	NP	1.3606	0.7075	0.5514	0.2918	0.1092			
◇	NV	NP	1.3831	0.7752	0.6245	0.3758	0.1821	0.0898	2.03	8.63
▽	NV	NP	1.3502	0.7917	0.6486	0.4119	0.2296	0.1450	1.48	5.46

Material Description	USCS	AASHTO
○ Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b
□ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
◇ Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Firemans Road

○ **Source of Sample:** B-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** B-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** B-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** B-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** B-2 **Depth:** 68.0 **Sample Number:** 20

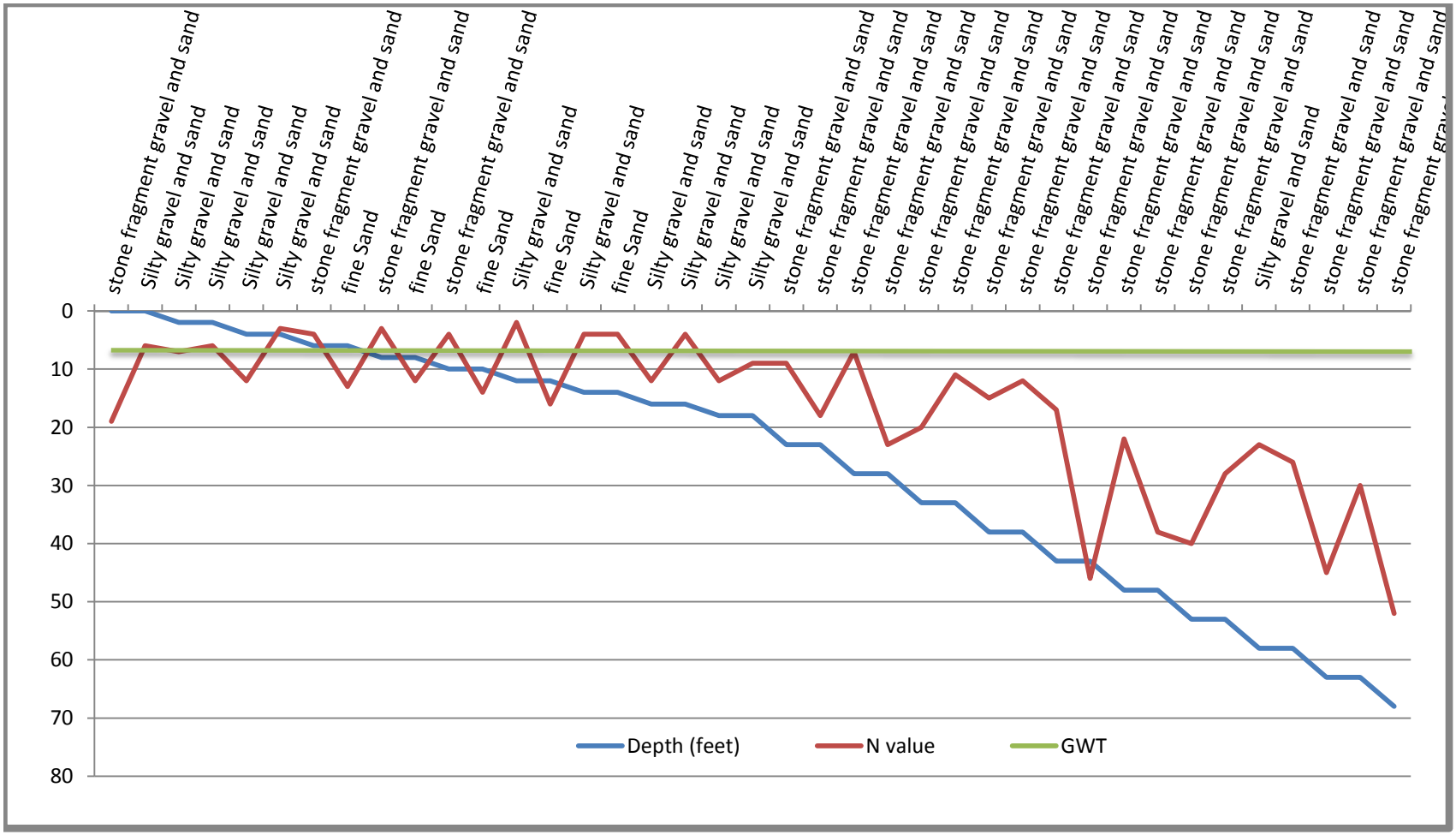
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
B-1														
	1		Moist medium dense brown fine to coarse sand and fine gravel w/some silt.	NV	NP	7.1	SM	A-1-b	69.8	12.3	6	9	10	10
	2	2	Moist loose brown fine to coarse sand w/some silt.	NV	NP	7.1	SM	A-2-4(0)	100	19.9	4	4	3	2
	3	4	Moist medium dense brown fine to coarse sand w/some silt.	NV	NP	9.1	SM	A-2-4(0)	100	17.5	4	5	7	4
	4	6	Wet very loose orange silty coarse sand w/some fine sand, trace of fine gravel.	NV	NP	19.1	SM	A-1-b	98.1	20.6	3	3	1	3
	5	8	Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel.	NV	NP	18.7	SM	A-1-b	95.5	18.5	2	2	1	1
	6	10	Wet very loose orange coarse sand w/some fine sand and silt, trace of fine gravel.	NV	NP	19.9	SM	A-1-b	98.8	16	1	2	2	2
	7	12	Wet very loose orange silty coarse to fine sand w/trace fine gravel.	NV	NP	21.5	SM	A-2-4(0)	98.2	28.3	1	1	1	1
	8	14	Saturated very loose orange clayey coarse to fine sand w/some silt, trace of fine gravel.	24.4	8.2	25.4	SC	A-2-4(0)	97.6	30.5	2	2	2	2
	9	16	Saturated medium dense orange coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	20.5	SM	A-2-4(0)	98.1	16.9	3	4	8	9
	10	18	Saturated medium dense brown silty fine sand w/some coarse sand.	NV	NP	25	SM	A-2-4(0)	100	21.4	4	5	7	12
	11	23	Saturated loose orange coarse sand w/some fine sand, trace of silt and fine gravel.	NV	NP	21.1	SW-SM	A-1-b	93.5	9.8	3	4	5	7
	12	28	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.7	SP-SM	A-1-b	96.9	8.7	8	3	4	6
	13	33	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	14.6	SP	A-1-b	95.1	2.6	8	8	12	12
	14	38	Saturated medium dense brown coarse sand w/trace fine sand, fine gravel and silt.	NV	NP	14.5	SW-SM	A-1-b	94.4	6.4	4	7	8	10
	15	43	Saturated medium dense orange coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	16	SW-SM	A-1-b	87.9	7	5	8	9	11
	16	48	Saturated medium dense brown coarse sand w/some fine sand, fine gravel and silt.	NV	NP	13	SW	A-1-b	93.1	4.6	8	11	11	12
	17	53	Saturated dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.1	SW-SM	A-1-b	95.8	6.7	15	20	20	23
	18	58	Saturated medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.1	SM	A-2-4(0)	98.6	14.2	5	6	17	20
	19	63	Saturated dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	15.1	SP	A-1-b	98.2	3.5	14	21	24	30
	20	68	Saturated very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.7	SW-SM	A-1-b	95.1	7.3	17	24	28	34
		70	End Boring											
B-2														
	1		Moist loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	9.5	SM	A-2-4(0)	95.5	14.3	2	3	3	3
	2	2	Wet loose brown fine to coarse sand w/some silt.	NV	NP	23.4	SM	A-2-4(0)	99.7	16.3	5	4	2	1
	3	4	Wet very loose black organic silty fine to coarse sand.	43.1	NP	98.5	SM	A-2-5(0)	100	32.1	1	1	2	1
	4	6	Wet medium dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	21.3	SP-SM	A-3	100	8.2	5	6	7	7
	5	8	Wet medium dense brown fine sand w/some coarse sand, trace of silt.	NV	NP	22.8	SP	A-3	100	3.2	4	5	7	8
	6	10	Wet medium dense orange fine to coarse sand w/trace silt.	NV	NP	19.3	SP	A-3	99.5	3.1	5	6	8	8
	7	12	Wet medium dense brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	17.5	SP	A-3	98.3	2.6	5	8	8	8
	8	14	Saturated very loose brown fine to coarse sand w/trace silt.	NV	NP	18.6	SP	A-3	99.5	4	4	2	2	5
	9	16	Saturated very loose orange fine to coarse sand w/some silt.	NV	NP	22.6	SP-SM	A-2-4(0)	99.1	11.7	4	2	2	1
	10	18	Saturated loose orange fine to coarse sand w some silt, trace of fine gravel./	NV	NP	20	SM	A-2-4(0)	98.3	13.2	5	5	4	5
	11	23	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	18.7	SW-SM	A-1-b	97.5	6.5	7	8	10	9
	12	28	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	14.8	SP	A-1-b	88.3	4.2	2	11	12	11
	13	33	Saturated medium dense orange coarse sand w/some fine sand, trace of silt and fine gravel.	NV	NP	20.3	SW-SM	A-1-b	97.3	8.9	4	5	6	5
	14	38	Saturated medium dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	15.2	SW-SM	A-1-b	97.4	6.5	8	6	6	8
	15	43	Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.1	SW-SM	A-1-b	98	6.2	15	21	25	30
	16	48	Saturated dense orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.6	SW	A-1-b	99.6	4.7	7	19	19	24
	17	53	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	12.4	SP-SM	A-1-b	96.4	7.1	10	13	15	20
	18	58	Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	11.2	SP-SM	A-1-b	94.5	11.7	10	10	16	21
	19	63	Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.8	SW-SM	A-1-b	95.4	9.3	11	15	15	22
	20	68	Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.6	SP-SM	A-1-b	97	8.1	13	17	19	24
		70	End Boring											

DATE : 12-14-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-335 on Bacons Road - Delmar DE



DATE : 12-14-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-335 on Bacons Road - Delmar DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-05-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-441 on Armory road at Herring Branch- Dagsboro DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-18-2016 and 2-19-2016. Hillis Carnes Engineering Associates (HCEA) drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in LYNCH HEIGHTS FORMATION as, Light gray to brown to light yellowish brown, medium to fine sand to very fine sand with discontinuous beds of course sand, gravel silt, and organic- rich clayey silt to silty sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Frankford Area, Delaware by John K. Adams, Durward H. Boggess, and O.J Coskery (1964) Atlas HA- 119. The nearest well to this site the groundwater historically had been

measured as 27 feet on October 1960 and between the years of 1950 to 1962 appeared from 24 to 28 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter less of 3 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware Map Series No. 7 by John H. Talley 1988 the maximum permitted discharge is 0.003 million gallons per day and the average daily discharge is 0.002 million gallons per day potential is a good category.

5. Ground Cover

The ground cover for site is 6 and 8 inches of asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 8 feet, noted at the completion of the drilling is 9 and 10 feet and caved at 10 and 11 feet below the ground surface elevation. Also contractor add a mud at 12 feet down from the surface elevation more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 4.5 to 29.1 percent. The Atterberg limit and the organic matter was not encountered for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition except the borings at south of the bridge has 22 feet in thickness of loose silty fine sand material from 6 feet from the surface elevation that layer may need to be considered in the design. In

addition all the sample from the depth of 2 to 10 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse with little of borrow type "B".

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 28-1692 T201407003 BR3-441 on Armory Road in Sussex County

Google earth

feet 1000

meters 300

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING AR-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 197062.166
Easting: 711957.351
Boring Surface Elev.:
Reference:
Date Started: 2/18/16
Date Completed: 2/18/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** — **From Depth of:** 0.0 **To:** 12.0
Mud Rotary: — **From Depth of:** 12.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/18/16	8.0	
2/18/16	10.0	11.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' – 2.0'	12 12 9 9	Moist medium dense black fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	Hot-mix 6"
2.53		2	2.0' – 4.0'	3 3 6 11	Moist loose brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
5.06		3	4.0' – 6.0'	7 13 26 22	Moist dense orange coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
7.59		4	6.0' – 8.0'	5 7 7 7	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
	■	5	8.0' – 10.0'	4 4 5 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
10.12	▽	6	10.0' – 12.0'	5 5 5 5	Wet loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
12.65		7	12.0'	5 6 6 6	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	3 3 4 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	3 3 3 6	Wet loose brown fine to coarse sand w/some fine gravel and silt. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	2 3 8 8	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	7 7 10 11	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	8 9 14 15	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	6 6 8 10	Wet medium dense white coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	6 6 6 10	Wet medium dense white coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
40.48							
43.01							
		15	43.0' 45.0'	5 10 10 11	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	5 10 17 21	Wet medium dense brown coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-1-b	
50.6							
53.13							
		17	53.0' 55.0'	10 13 13 16	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	10 11 15 18	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		18" RECOVERY		
60.72							
63.25		19	63.0'	12 15 17 21	Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	11 13 19 21	Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING AR-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 197033.869
Easting: 711983.630
Boring Surface Elev.:
Reference:
Date Started: 2/19/16
Date Completed: 2/19/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 14.0
From Depth of: 14.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/19/16	8.0	
2/19/16	9.0	10.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	0 8 28 20	Moist dense black coarse to fine sand w/some fine gravel and silt. 20" RECOVERY	A-1-b	Hot-mix 8"
2.53		2	2.0' 4.0'	4 6 6 8	Moist medium dense reddish brown silty fine sand w/some coarse sand. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	5 7 7 6	Wet medium dense reddish brown fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	2 2 3 3	Wet loose brown fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' 10.0'	1 1 1 1	Wet very loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	1 0 1 1	Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0'	1 1 6 7	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 2 2 2	Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	1 1 2 5	Wet very loose brown silty fine sand w some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	2 2 5 9	Wet loose brown silty fine sand w/some coarse sand and fine gravel. 24" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	1 3 5 9	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
27.83							
30.36		12	28.0' 30.0'	2 7 9 15	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	10 10 15 15	Wet medium dense orange coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** AR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	8 9 12 15	Wet medium dense white fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
40.48							
43.01							
		15	43.0' 45.0'	8 8 11 16	Wet medium dense white coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	8 10 8 13	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
50.6							
53.13							
		17	53.0' 55.0'	6 11 13 17	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	13 18 20 22	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: AR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	10 12 15 23	Wet medium dense brown coarse sand w/ some fine sand and fine gravel, trace of silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	9 11 17 21	Wet medium dense brown coarse sand w/ some fine sand and silt, trace of fine gravel.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

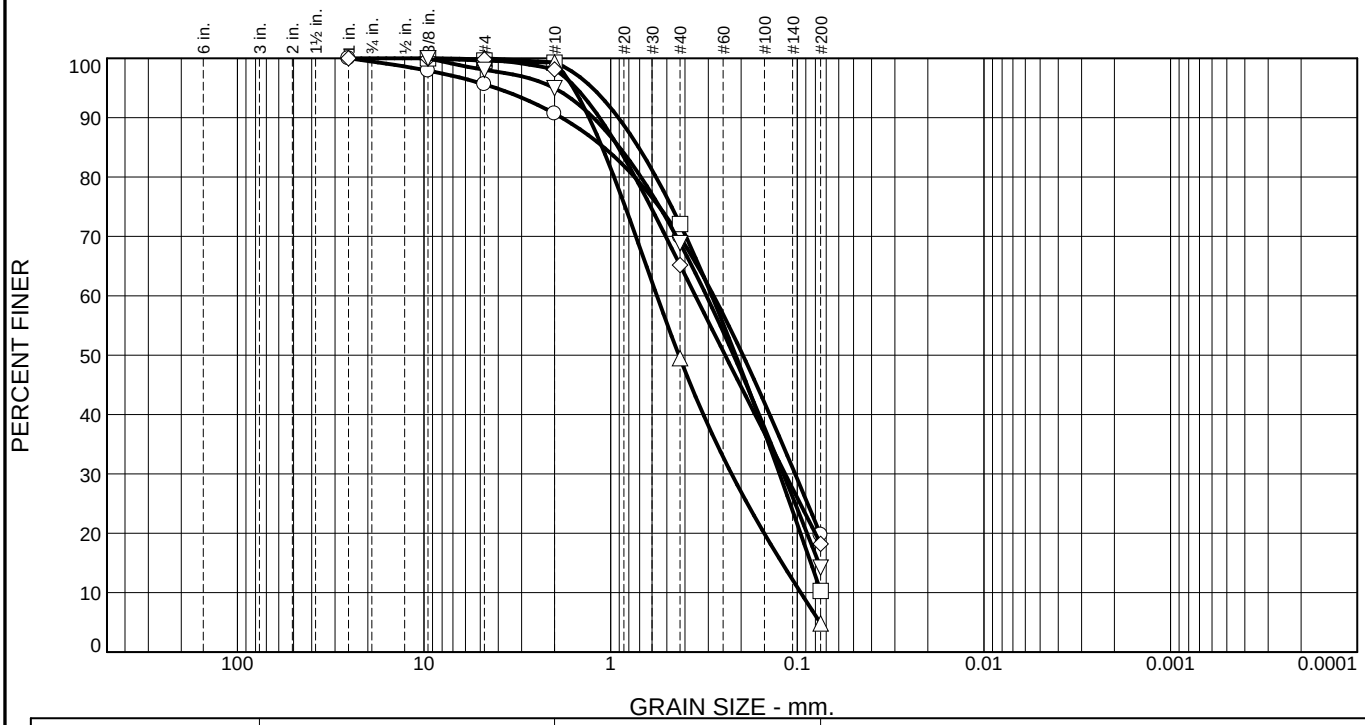
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.3	20.8	50.2	19.7	
□	0.0	0.7	27.2	61.8	10.3	
△	0.0	0.7	49.8	44.7	4.8	
◇	0.0	1.9	32.9	47.0	18.2	
▽	0.0	5.0	26.1	54.7	14.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0878	0.2806	0.1958	0.1028				
□	NV	NP	0.7081	0.2870	0.2141	0.1246	0.0846			
△	NV	NP	1.1102	0.5649	0.4313	0.2249	0.1207	0.0958	0.93	5.89
◇	NV	NP	0.9101	0.3517	0.2436	0.1162				
▽	NV	NP	0.8961	0.3066	0.2195	0.1189	0.0767			

Material Description	USCS	AASHTO
○ Moist medium dense black fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist loose brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Moist dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** AR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** AR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** AR-1 **Depth:** 6.0 **Sample Number:** 4

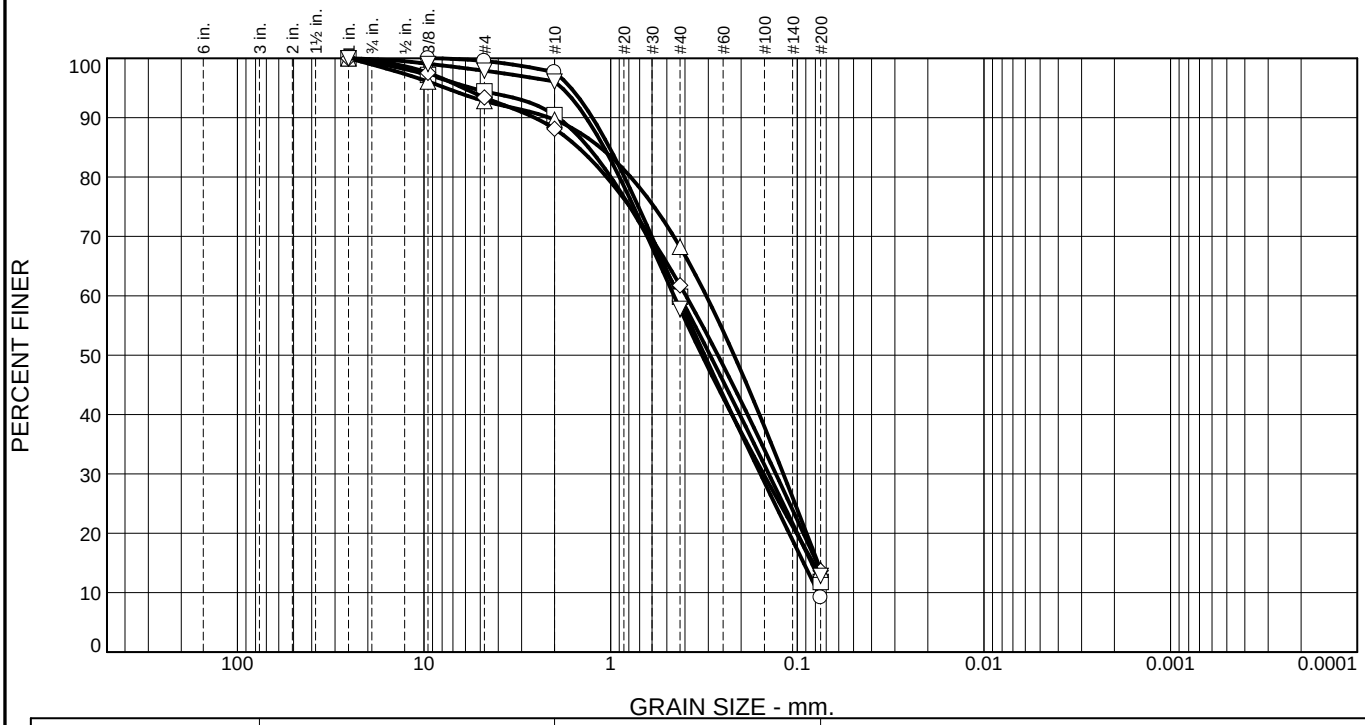
▽ **Source of Sample:** AR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.3	38.5	50.0	9.2	
□	0.0	9.6	30.6	48.0	11.8	
△	0.0	10.3	21.5	54.3	13.9	
◇	0.0	11.9	26.3	48.1	13.7	
▽	0.0	3.9	38.3	45.0	12.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0158	0.4362	0.3139	0.1577	0.0924	0.0772	0.74	5.65
□	NV	NP	1.3154	0.4275	0.2933	0.1423	0.0839			
△	NV	NP	1.1385	0.3074	0.2182	0.1188	0.0775			
◇	NV	NP	1.4925	0.3948	0.2664	0.1303	0.0784			
▽	NV	NP	1.0862	0.4577	0.3243	0.1517	0.0821			

Material Description	USCS	AASHTO
○ Wet loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose brown fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
▽ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** AR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** AR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** AR-1 **Depth:** 16.0 **Sample Number:** 9

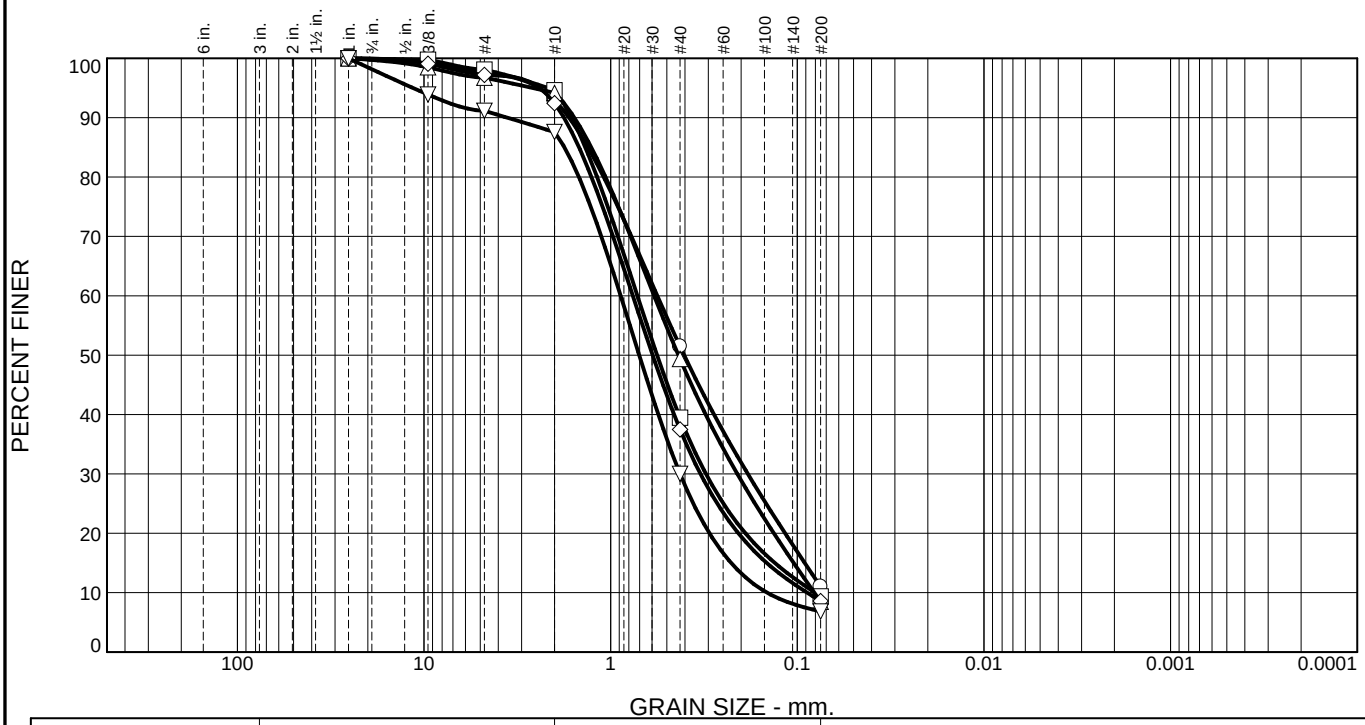
▽ **Source of Sample:** AR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.1	41.4	40.5	11.0	
□	0.0	5.4	55.1	30.1	9.4	
△	0.0	5.8	44.8	40.9	8.5	
◇	0.0	7.6	54.9	28.9	8.6	
▽	0.0	12.4	57.6	23.2	6.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3228	0.5623	0.4039	0.1842	0.0913			
□	NV	NP	1.3671	0.7189	0.5639	0.3087	0.1320	0.0803	1.65	8.95
△	NV	NP	1.2700	0.5848	0.4336	0.2097	0.1045	0.0811	0.93	7.21
◇	NV	NP	1.4776	0.7608	0.5958	0.3303	0.1459	0.0885	1.62	8.59
▽	NV	NP	1.7692	0.8839	0.7031	0.4248	0.2262	0.1453	1.41	6.08

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
□ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet medium dense white coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
◇ Wet medium dense white coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** AR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** AR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** AR-1 **Depth:** 38.0 **Sample Number:** 14

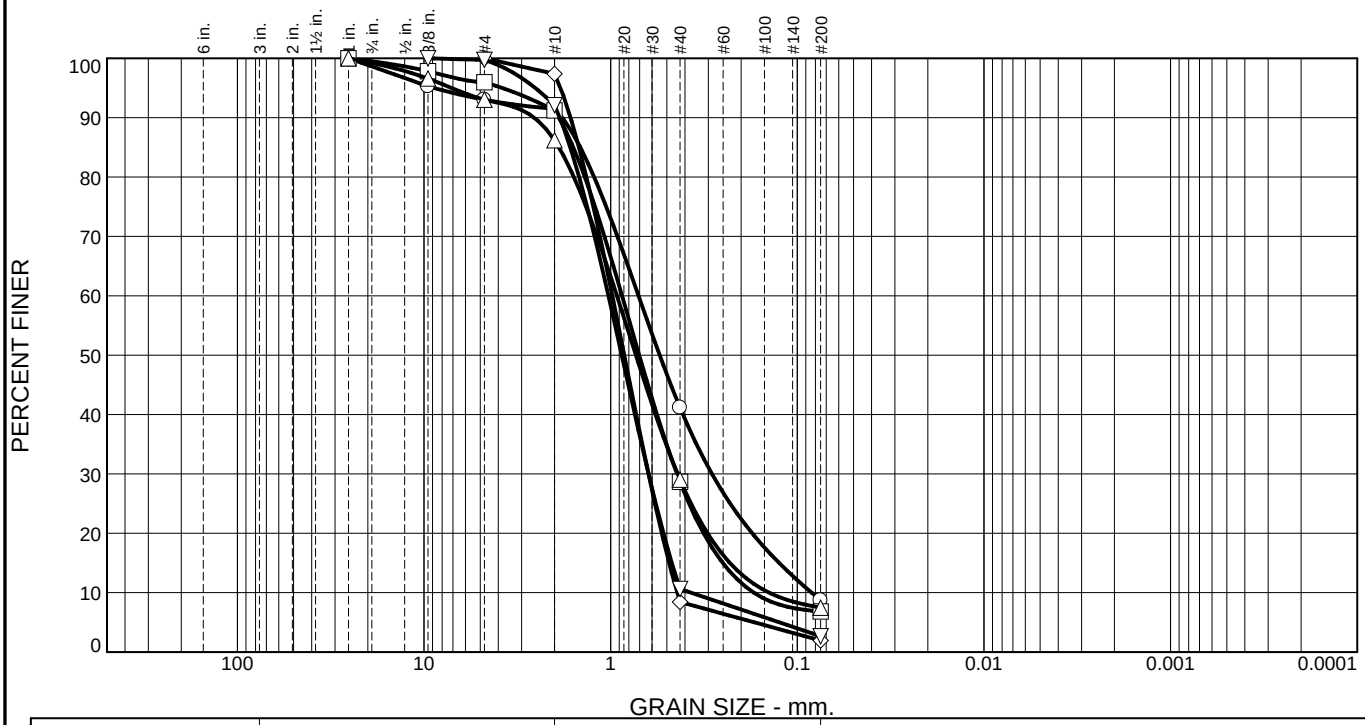
▽ **Source of Sample:** AR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.5	50.3	32.5	8.7	
□	0.0	8.8	62.5	21.9	6.8	
△	0.0	13.8	57.2	21.5	7.5	
◇	0.0	2.6	89.0	6.5	1.9	
▽	0.0	7.9	81.5	7.9	2.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4542	0.7090	0.5462	0.2864	0.1251	0.0839	1.38	8.45
□	NV	NP	1.5849	0.8690	0.7032	0.4411	0.2509	0.1711	1.31	5.08
△	NV	NP	1.8944	0.9261	0.7323	0.4379	0.2298	0.1419	1.46	6.53
◇	NV	NP	1.4792	0.9800	0.8456	0.6270	0.4862	0.4399	0.91	2.23
▽	NV	NP	1.6463	1.0279	0.8727	0.6266	0.4704	0.3712	1.03	2.77

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
◇ Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b
▽ Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** AR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** AR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** AR-1 **Depth:** 63.0 **Sample Number:** 19

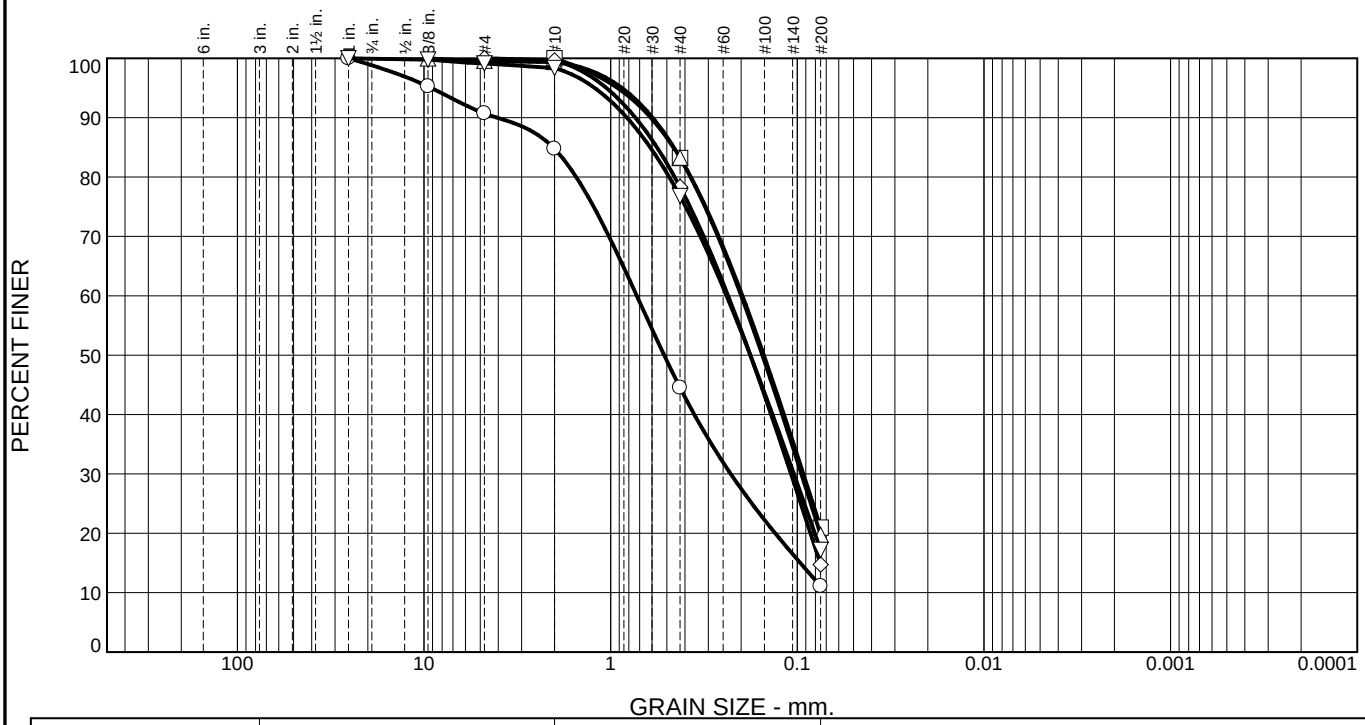
▽ **Source of Sample:** AR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	15.2	40.3	33.4	11.1	
□	0.0	0.0	16.8	62.2	21.0	
△	0.0	0.6	16.1	63.5	19.8	
◇	0.0	0.3	21.4	63.6	14.7	
▽	0.0	1.6	21.6	59.6	17.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.0346	0.7244	0.5169	0.2274	0.0964			
□	NV	NP	0.4614	0.1968	0.1512	0.0928				
△	NV	NP	0.4586	0.1998	0.1540	0.0952				
◇	NV	NP	0.5646	0.2347	0.1786	0.1081	0.0755			
▽	NV	NP	0.6138	0.2392	0.1786	0.1043				

Material Description	USCS	AASHTO
○ Moist dense black coarse to fine sand w/some fine gravel and silt.	SP-SM	A-1-b
□ Moist medium dense reddish brown silty fine sand w/some coarse sand.	SM	A-2-4(0)
△ Wet medium dense reddish brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
▽ Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** AR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** AR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** AR-2 **Depth:** 6.0 **Sample Number:** 4

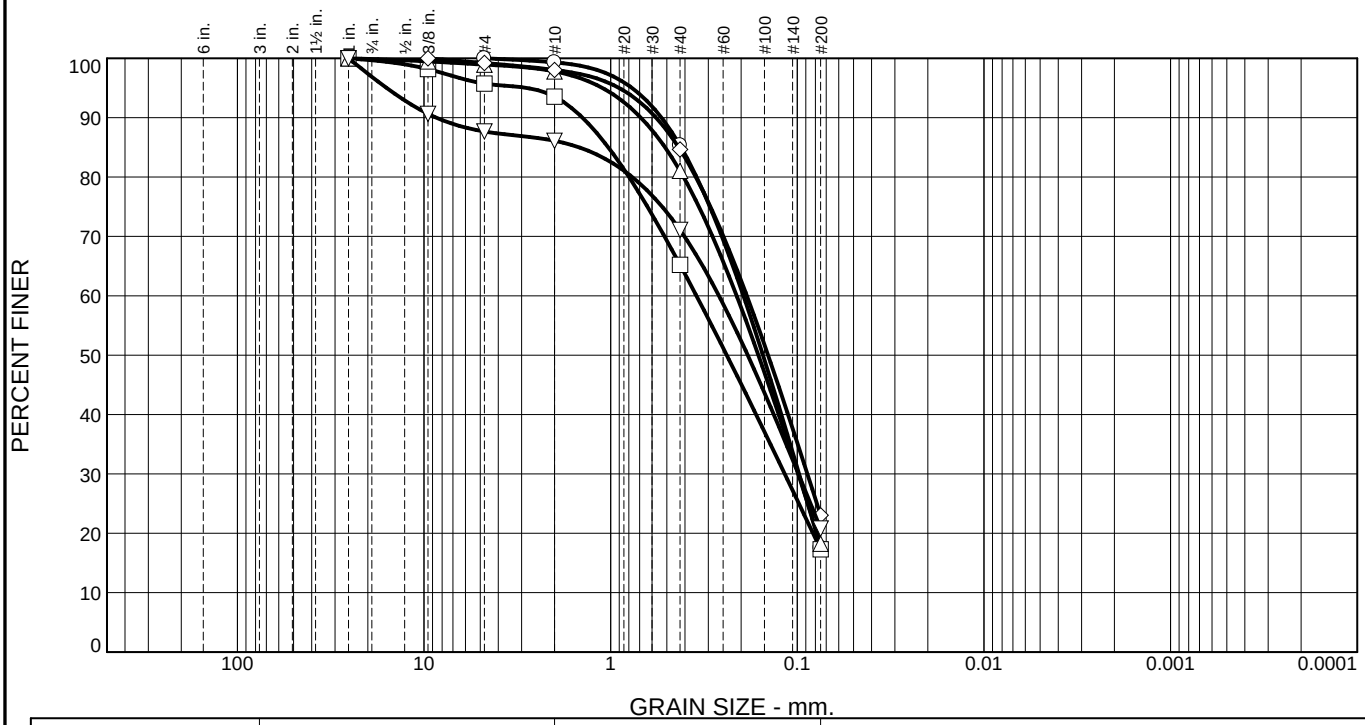
▽ **Source of Sample:** AR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.7	14.0	67.8	17.5	
□	0.0	6.5	28.3	47.9	17.3	
△	0.0	2.2	16.8	62.8	18.2	
◇	0.0	2.0	13.4	61.6	23.0	
▽	0.0	13.9	15.0	50.3	20.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4191	0.1945	0.1528	0.0979				
□	NV	NP	1.0299	0.3471	0.2388	0.1168				
△	NV	NP	0.5109	0.2113	0.1617	0.0990				
◇	NV	NP	0.4321	0.1864	0.1435	0.0884				
▽	NV	NP	1.4753	0.2629	0.1844	0.0986				

Material Description	USCS	AASHTO
○ Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet very loose brown silty fine sand w some coarse sand, trace of fine gravel.	SM	A-2-4(0)
▽ Wet loose brown silty fine sand w/some coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** AR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** AR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** AR-2 **Depth:** 16.0 **Sample Number:** 9

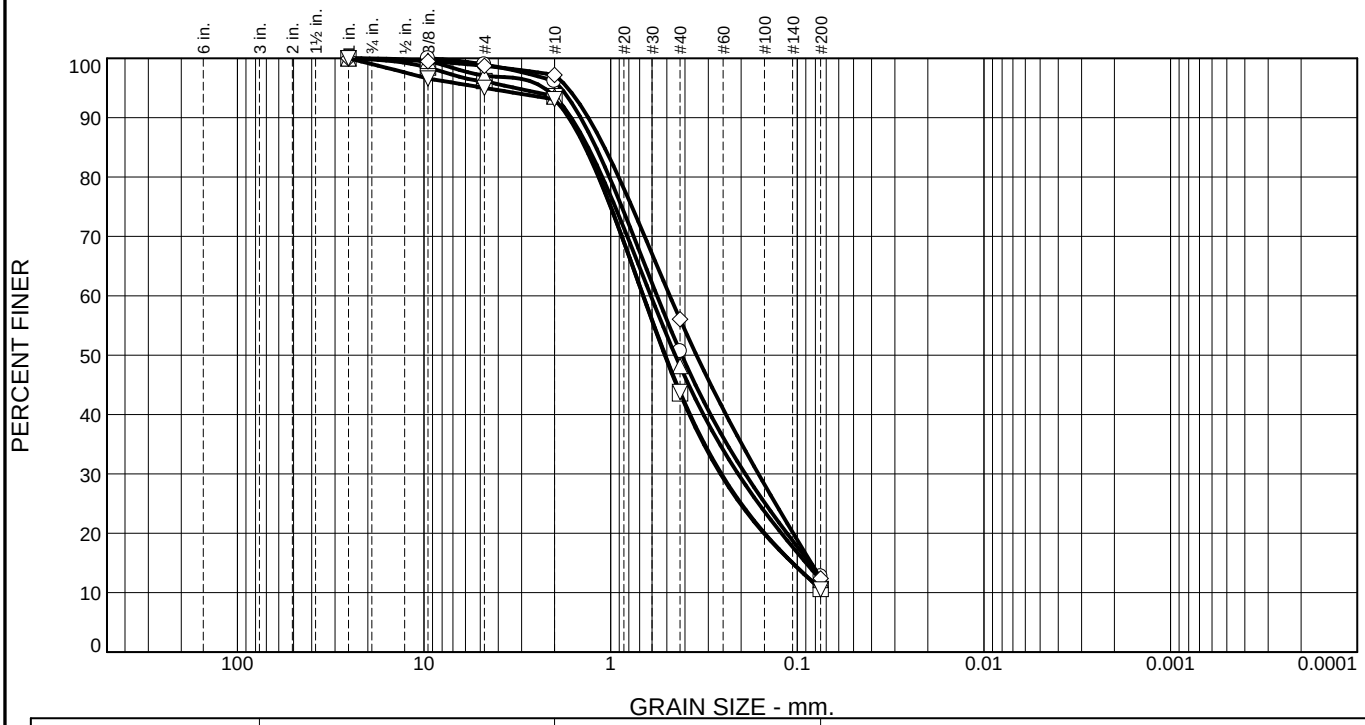
▽ **Source of Sample:** AR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.8	45.5	38.0	12.7	
□	0.0	6.4	50.0	33.0	10.6	
△	0.0	6.4	45.4	36.1	12.1	
◇	0.0	2.8	41.1	43.7	12.4	
▽	0.0	6.9	49.3	33.3	10.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1989	0.5642	0.4160	0.1901	0.0855			
□	NV	NP	1.3554	0.6700	0.5128	0.2579	0.1062			
△	NV	NP	1.3206	0.6092	0.4509	0.2076	0.0898			
◇	NV	NP	1.0802	0.4821	0.3469	0.1616	0.0842			
▽	NV	NP	1.3698	0.6686	0.5101	0.2550	0.1059			

Material Description	USCS	AASHTO
○ Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
△ Wet medium dense orange coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
◇ Wet medium dense white fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet medium dense white coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** AR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** AR-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** AR-2 **Depth:** 38.0 **Sample Number:** 14

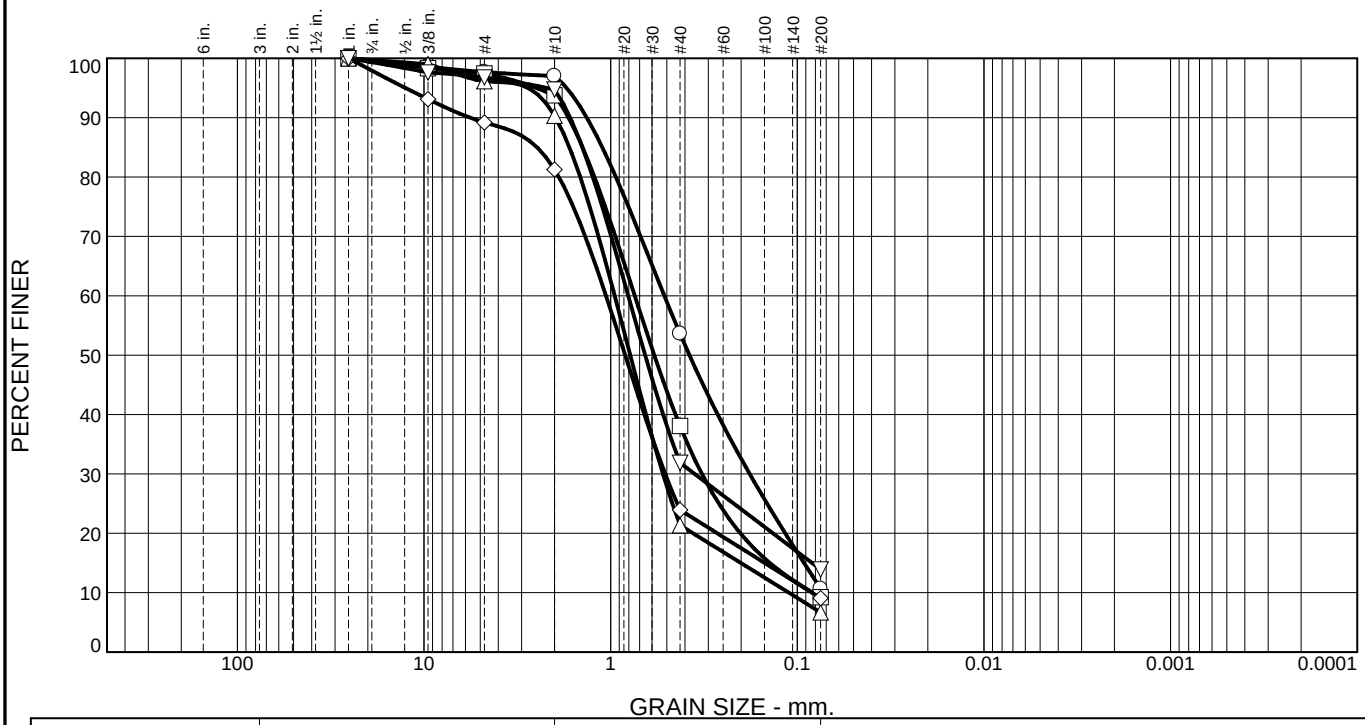
▽ **Source of Sample:** AR-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.0	43.4	42.9	10.7	
□	0.0	6.2	55.7	28.9	9.2	
△	0.0	9.7	68.9	14.7	6.7	
◇	0.0	18.7	57.4	14.8	9.1	
▽	0.0	5.3	62.8	18.0	13.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1090	0.5157	0.3784	0.1800	0.0920			
□	NV	NP	1.4141	0.7427	0.5839	0.3245	0.1404	0.0825	1.72	9.01
△	NV	NP	1.6642	0.9516	0.7855	0.5249	0.2006	0.1111	2.61	8.57
◇	NV	NP	2.4796	1.0595	0.8362	0.5102	0.1496	0.0834	2.94	12.70
▽	NV	NP	1.4173	0.8054	0.6537	0.3548	0.0834			

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Wet medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b
▽ Wet medium dense brown coarse sand w/some fine sand and silt, trace of fine gravel.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** AR-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** AR-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** AR-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** AR-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** AR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

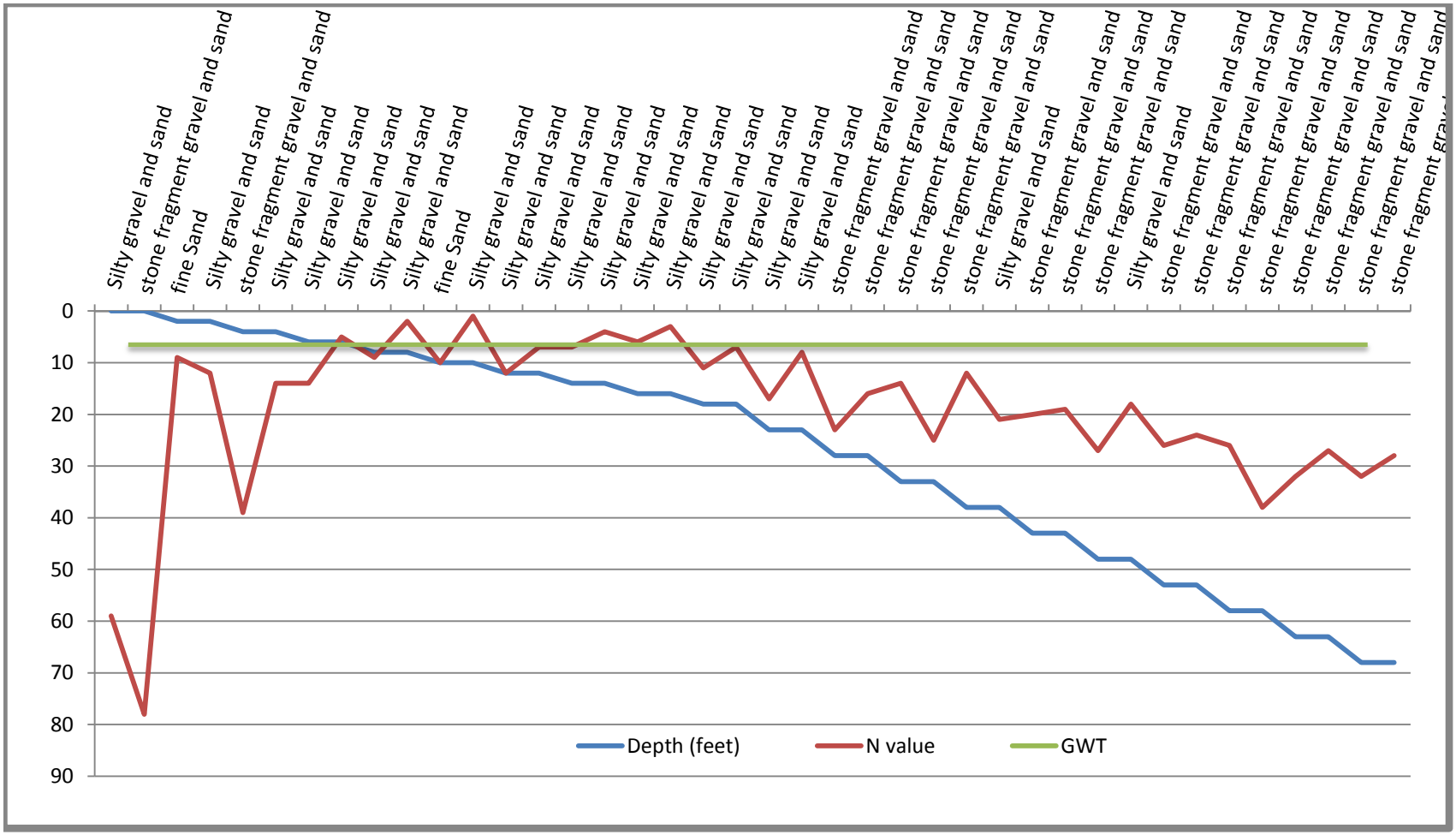
Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
PR-1	1		Moist medium dense black fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	10	SM	A-2-4(0)	90.7	19.7	12	12	9	9
	2	2	Moist loose brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	7.5	SP-SM	A-3	99.3	10.3	3	3	6	11
	3	4	Moist dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	6.9	SP	A-1-b	99.3	4.8	7	13	26	22
	4	6	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.9	SM	A-2-4(0)	98.1	18.2	5	7	7	7
	5	8	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.7	SM	A-2-4(0)	95	14.2	4	4	5	5
	6	10	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	21.9	SP-SM	A-3	97.7	9.2	5	5	5	5
	7	12	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.7	SP-SM	A-2-4(0)	90.4	11.8	5	6	6	6
	8	14	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	21.2	SM	A-2-4(0)	89.7	13.9	3	3	4	5
	9	16	Wet loose brown fine to coarse sand w/some fine gravel and silt.	NV	NP	19.5	SM	A-2-4(0)	88.1	13.7	3	3	3	6
	10	18	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	22.5	SM	A-2-4(0)	96.1	12.8	2	3	8	8
	11	23	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	17.1	SP-SM	A-2-4(0)	92.9	11	7	7	10	11
	12	28	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.4	SW-SM	A-1-b	94.6	9.4	8	9	14	15
	13	33	Wet medium dense white coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.8	SP-SM	A-1-b	94.2	8.5	6	6	8	10
	14	38	Wet medium dense white coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.8	SW-SM	A-1-b	92.4	8.6	6	6	6	10
	15	43	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	15.6	SW-SM	A-1-b	87.6	6.8	5	10	10	11
	16	48	Wet medium dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	21	SW-SM	A-1-b	91.5	8.7	5	10	17	21
	17	53	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.7	SP-SM	A-1-b	91.2	6.8	10	13	13	16
	18	58	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	17.4	SW-SM	A-1-b	86.2	7.5	10	11	15	18
	19	63	Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	14.3	SP	A-1-b	97.4	1.9	12	15	17	21
	20	68	Wet dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	13.2	SP	A-1-b	92.1	2.7	11	13	19	21
		70	End Boring											
PR-2	1		Moist dense black coarse to fine sand w/some fine gravel and silt.	NV	NP	4.5	SP-SM	A-1-b	84.8	11.1		8	28	20
	2	2	Moist medium dense reddish brown silty fine sand w/some coarse sand.	NV	NP	13.9	SM	A-2-4(0)	100	21	4	6	6	8
	3	4	Wet medium dense reddish brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	15.8	SM	A-2-4(0)	99.4	19.8	5	7	7	6
	4	6	Wet loose brown fine to coarse sand w/some silt.	NV	NP	18.6	SM	A-2-4(0)	99.7	14.7	2	2	3	3
	5	8	Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	27.3	SM	A-2-4(0)	98.4	17.2	1	1	1	1
	6	10	Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	28.7	SM	A-2-4(0)	99.3	17.5	1		1	1
	7	12	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	19.1	SM	A-2-4(0)	93.5	17.3	1	1	6	7
	8	14	Wet very loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	29.1	SM	A-2-4(0)	97.8	18.2	1	2	2	2
	9	16	Wet very loose brown silty fine sand w some coarse sand, trace of fine gravel.	NV	NP	28.1	SM	A-2-4(0)	98	23	1	1	2	5
	10	18	Wet loose brown silty fine sand w/some coarse sand and fine gravel.	NV	NP	21.8	SM	A-2-4(0)	86.1	20.8	2	2	5	9
	11	23	Wet loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	17.6	SM	A-2-4(0)	96.2	12.7	1	3	5	9
	12	28	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	16.9	SP-SM	A-1-b	93.6	10.6	2	7	9	15
	13	33	Wet medium dense orange coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	16.1	SM	A-1-b	93.6	12.1	10	10	15	15
	14	38	Wet medium dense white fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.1	SM	A-2-4(0)	97.2	12.4	8	9	12	15
	15	43	Wet medium dense white coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	13.1	SP-SM	A-1-b	93.1	10.5	8	8	11	16
	16	48	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.3	SP-SM	A-2-4(0)	97	10.7	8	10	8	13
	17	53	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.2	SW-SM	A-1-b	93.8	9.2	6	11	13	17
	18	58	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	15.7	SW-SM	A-1-b	90.3	6.7	13	18	20	22
	19	63	Wet medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	20.7	SW-SM	A-1-b	81.3	9.1	10	12	15	23
	20	68	Wet medium dense brown coarse sand w/some fine sand and silt, trace of fine gravel.	NV	NP	14.4	SM	A-1-b	94.7	13.9	9	11	17	21
		70	End Boring											

DATE : **5-05-2016**

PROJECT NUMBER : **T201407003/ BR3-441 on Armory road at Herring Branch- Dagsboro DE**



DATE : 5-05-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-441 on Armory road at Herring Branch- Dagsboro DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 12-01-2015**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-564 on Fireman road over GUM Branch- Millsboro DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 8-13-2015 to 8-14-2015. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 75 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in LYNCH HEIGHTS FORMATION as, Light gray to brown to light yellowish brown, medium to fine sand to very fine sand with discontinuous beds of course sand, gravel silt, and organic- rich clayey silt to silty sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Millsboro Area, Delaware by John K. Adams and Durward H. Boggess (1965) Atlas HA-121. The nearest well to this site the groundwater historically had been measured as 34 feet

on October 1950 and between the years of 1950 to 1962 appeared from 32 to 36 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for site is 5 inches of asphalt top of 4 inches GABC.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 7 feet, noted at the completion of the drilling is 8’ 8” to 9 feet and caved at 9 feet below the ground surface elevation more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 5.1 to 51.1 percent. The Atterberg limit is 15 percent, Liquid limits is range from 17.4 to 25.40 percent and Plastic limit is 1.4 to 8.6 percent. The organic matter was encountered 5 percent for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is not in a good condition and loose silty fine sand layer appeared from the surface to 25 feet down need to consider in the design. In addition all the sample from the depth of 2 to 10 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse if not saturated except borrow type “B”.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (9- sheets)

APPENDIX D

- Summary of the Borings (2- sheets)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 22-1692 T201407003 BR3-564 on Firemans Road in Sussex County

Google earth

feet 600

meters 100

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING FR-1

Project Name:
Location: New Castle County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 171772.686
Easting: 670785.016
Boring Surface Elev.:
Reference:
Date Started: 8/13/15
Date Completed: 8/13/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 75.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
8/13/15	7.0	
8/13/15	8.0	9.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: J. Martin
Logged By: Jerry Johnson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' – 2.0'	1 21 26 17	Moist dense gray coarse to fine sand and fine gravel w/some silt. 20" RECOVERY	A-1-b	Hot-mix 5", 4" GABC
2.53		2	2.0' – 4.0'	5 10 6 5	Moist medium dense gray silty fine to coarse sand and fine gravel. 20" RECOVERY	A-2-4(0)	
5.06		3	4.0' – 6.0'	3 2 2 3	Moist very loose brown fine gravelly fine sand w/some coarse sand and silt. 22" RECOVERY	A-2-4(0)	
7.59	▼	4	6.0' – 8.0'	3 3 6 9	Wet loose brown fine sand w/some coarse sand, trace of silt and fine gravel. 22" RECOVERY	A-3	
10.12		5	8.0' – 10.0'	1 1 1 2	Wet soft gray coarse sandy silt w/some fine sand, trace of fine gravel. 23" RECOVERY	A-4(0)	
		6	10.0' – 12.0'	1 1 1 2	Wet soft gray coarse sandy silt w/some fine sand, trace of clay. 24" RECOVERY	A-4(0)	
12.65		7	12.0'	2 4 5 9	Wet stiff gray fine sandy silt w/some coarse sand, trace of clay.	A-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:
State Contract: T201407003

Boring No.: FR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
		8	14.0'	2 2 2 5	Wet soft gray fine sandy silt w/some coarse sand, trace of fine gravel and clay.	A-4(0)	
15.18			16.0'		24" RECOVERY		
		9	16.0'	4 6 7 8	Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	
17.71			18.0'		20" RECOVERY		
		10	18.0'	4 2 3 2	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
20.24			20.0'		24" RECOVERY		
22.77							
		11	23.0'	1 2 3 6	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
25.3			25.0'		20" RECOVERY		
27.83							
		12	28.0'	3 5 6 8	Wet medium dense brown fine to coarse sand w/some silt.	A-2-4(0)	
30.36			30.0'		24" RECOVERY		
32.89							
		13	33.0'	1 5 7 10	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
35.42			35.0'		20" RECOVERY		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:
State Contract: T201407003

Boring No.: FR-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	3 6 10 12	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			40.0'		14" RECOVERY		
40.48							
43.01							
		15	43.0'	1 2 4 6	Wet loose gray coarse to fine sand w/some fine gravel and silt.	A-1-b	
			45.0'		22" RECOVERY		
45.54							
48.07							
		16	48.0'	5 10 18 22	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	3 7 15 16	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			55.0'		22" RECOVERY		
55.66							
58.19							
		18	58.0'	2 3 7 13	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:

Boring No.: FR-1

State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	1 2 3 10	Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	A-2-4(0)	
			65.0'		19" RECOVERY		
65.78							
68.31		20	68.0'	3 10 12 14	Wet medium dense gray silty fine sand w/ some coarse sand, trace of fine gravel.	A-2-4(0)	
			70.0'		20" RECOVERY		
70.84							
73.37		21	73.0'	3 17 19 26	Wet dense gray coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			75.0'		23" RECOVERY		
					End Boring		
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Silty soils
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING FR-2

Project Name:
Location: New Castle County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 171730.197
Easting: 670785.039
Boring Surface Elev.:
Reference:
Date Started: 8/14/15
Date Completed: 8/14/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: D-Sampler: Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 75.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
8/14/15	7.0	
8/14/15	8.8	9.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: J. Martin
Logged By: Jerry Johnson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	0 4 12 10	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	Hot-mix 6"
2.53		2	2.0' 4.0'	3 3 2 1	Wet loose dark gray organic silty fine sand w/some coarse sand. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	4 2 1 5	Wet soft dark gray organic fine sandy silt w/ some coarse sand. 24" RECOVERY	A-4(0)	
7.59	■	4	6.0' 8.0'	3 2 3 3	Wet loose gray fine sand w/trace coarse sand and silt. 24" RECOVERY	A-3	
10.12	▽	5	8.0' 10.0'	1 2 5 7	Wet loose gray silty fine sand w/trace coarse sand. 22" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	1 3 5 5	Wet loose gray fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
12.65		7	12.0'	3 10 11 11	Wet medium dense gray fine to coarse sand w/trace silt.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:
State Contract: T201407003

Boring No.: FR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		18" RECOVERY		
15.18		8	14.0' 16.0'	1 1 2 1	Wet very loose gray coarse to fine sand w/ trace fine gravel and silt. 20" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	2 2 5 6	Wet loose gray silty fine to coarse sand w/ trace fine gravel. 9" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	4 4 3 6	Wet firm gray clayey fine sandy silt w trace coarse sand./ 20" RECOVERY	A-4(4)	
25.3		11	23.0' 25.0'	2 2 5 10	Wet loose brown silty fine sand w/trace coarse sand. 20" RECOVERY	A-2-4(0)	
30.36		12	28.0' 30.0'	4 2 8 15	Wet medium dense light gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
35.42		13	33.0' 35.0'	3 3 9 10	No Recovery NR" RECOVERY		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:

Boring No.: FR-2

State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	6 3 2 2	Wet loose brown fine to coarse sand w/some silt.	A-2-4(0)	
			40.0'		20" RECOVERY		
40.48							
43.01							
		15	43.0'	3 6 9 15	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	4 9 9 13	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			50.0'		21" RECOVERY		
50.6							
53.13							
		17	53.0'	4 10 10 9	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			55.0'		22" RECOVERY		
55.66							
58.19							
		18	58.0'	2 2 8 15	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name:

Boring No.: FR-2

State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	2 4 4 6	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			65.0'		23" RECOVERY		
65.78							
68.31		20	68.0'	2 6 9 14	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			70.0'		20" RECOVERY		
70.84							
73.37		21	73.0'	3 8 10 17	Wet medium dense gray coarse to fine sand w/trace silt and fine gravel,	A-1-b	
			75.0'		21" RECOVERY		
					End Boring		
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

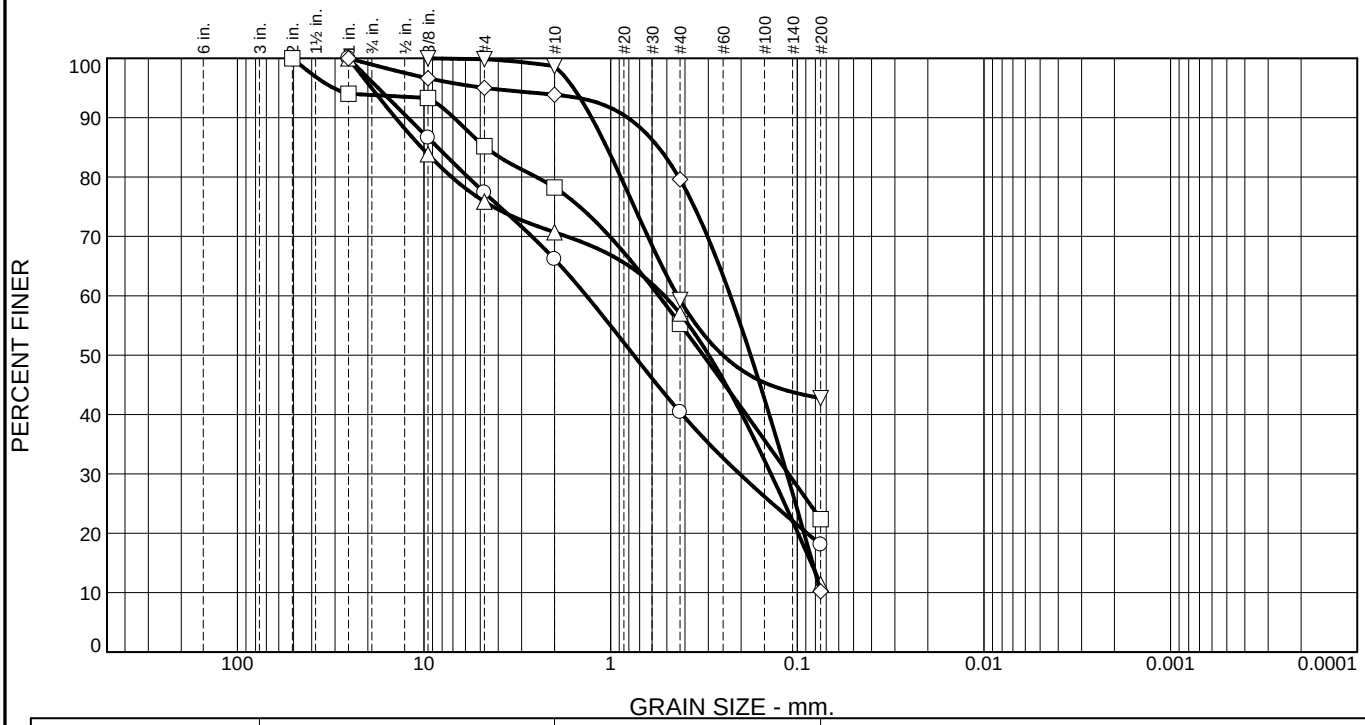
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	33.8	25.8	22.3	18.1	
□	0.0	21.8	22.9	32.9	22.4	
△	0.0	29.3	13.7	45.6	11.4	
◇	0.0	6.1	14.3	69.4	10.2	
▽	0.0	1.3	39.4	16.5	42.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	8.4575	1.3470	0.7523	0.2038				
□	NV	NP	4.6665	0.5523	0.3195	0.1114				
△	NV	NP	10.3319	0.5148	0.2979	0.1384	0.0842			
◇	NV	NP	0.5534	0.2282	0.1779	0.1136	0.0828			
▽	20.1	NP	1.0488	0.4378	0.2508					

Material Description	USCS	AASHTO
○ Moist dense gray coarse to fine sand and fine gravel w/some silt.	SM	A-1-b
□ Moist medium dense gray silty fine to coarse sand and fine gravel.	SM	A-2-4(0)
△ Moist very loose brown fine gravelly fine sand w/some coarse sand and silt.	SP-SM	A-2-4(0)
◇ Wet loose brown fine sand w/some coarse sand, trace of silt and fine gravel.	SP-SM	A-3
▽ Wet soft gray coarse sandy silt w/some fine sand, trace of fine gravel.	SM	A-4(0)

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** FR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** FR-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** FR-1 **Depth:** 6.0 **Sample Number:** 4

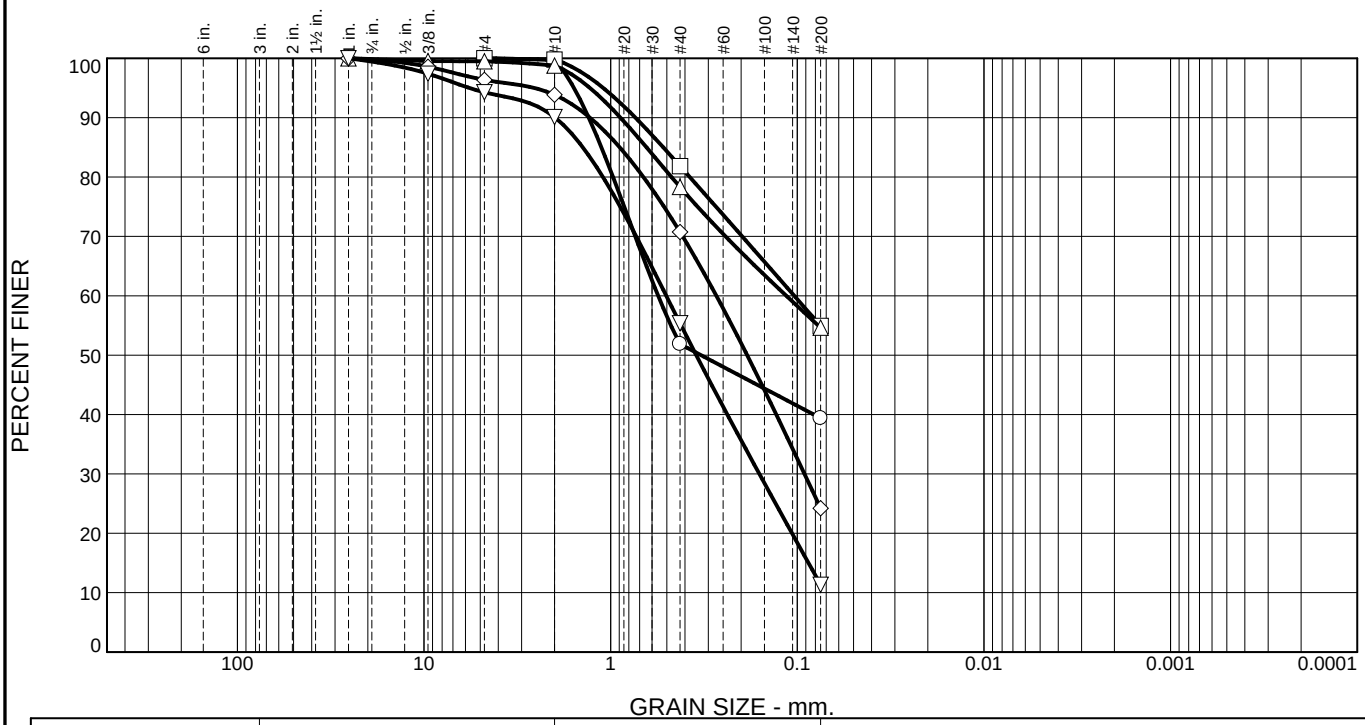
▽ **Source of Sample:** FR-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	47.8	12.5	39.4	
□	0.0	0.2	18.0	26.9	54.9	
△	0.0	1.2	20.5	23.7	54.6	
◇	0.0	6.1	23.2	46.5	24.2	
▽	0.0	9.9	34.7	44.1	11.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	20.2	18.8	1.1211	0.5565	0.3280					
□	17.4	15.3	0.5227	0.1039						
△	21.0	18.1	0.6427	0.1145						
◇	NV	NP	0.8945	0.2714	0.1857	0.0916				
▽	NV	NP	1.4103	0.5036	0.3479	0.1598	0.0871			

Material Description	USCS	AASHTO
○ Wet soft gray coarse sandy silt w/some fine sand, trace of clay.	SM	A-4(0)
□ Wet stiff gray fine sandy silt w/some coarse sand, trace of clay.	ML	A-4(0)
△ Wet soft gray fine sandy silt w/some coarse sand, trace of fine gravel and clay.	ML	A-4(0)
◇ Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
▽ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** FR-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** FR-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** FR-1 **Depth:** 16.0 **Sample Number:** 9

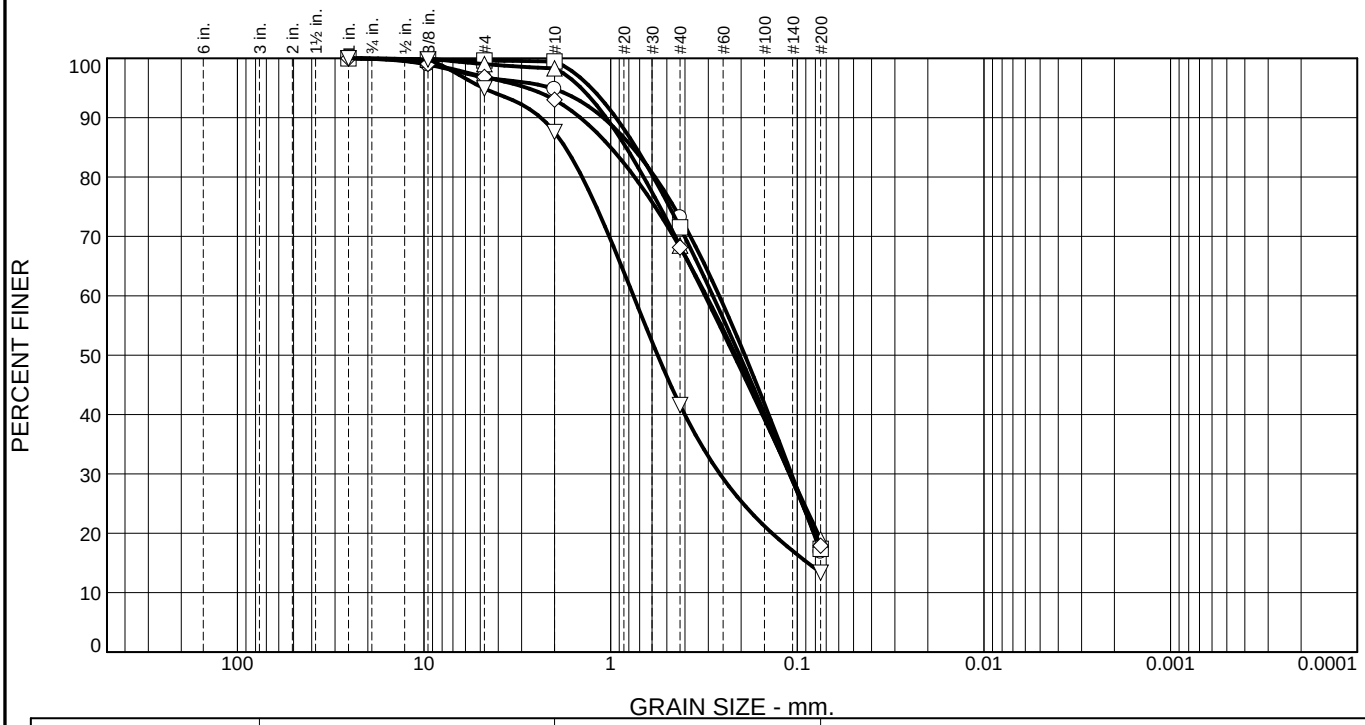
▽ **Source of Sample:** FR-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.2	21.6	56.3	16.9	
□	0.0	0.5	28.0	54.1	17.4	
△	0.0	1.7	29.9	49.4	19.0	
◇	0.0	7.0	24.9	50.2	17.9	
▽	0.0	12.4	46.0	28.2	13.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7639	0.2621	0.1911	0.1075				
□	NV	NP	0.7326	0.2834	0.2041	0.1097				
△	NV	NP	0.8268	0.3118	0.2183	0.1093				
◇	NV	NP	1.0003	0.3073	0.2140	0.1102				
▽	NV	NP	1.7485	0.7552	0.5600	0.2597	0.0877			

Material Description	USCS	AASHTO
○ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet loose gray coarse to fine sand w/some fine gravel and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** FR-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** FR-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** FR-1 **Depth:** 38.0 **Sample Number:** 14

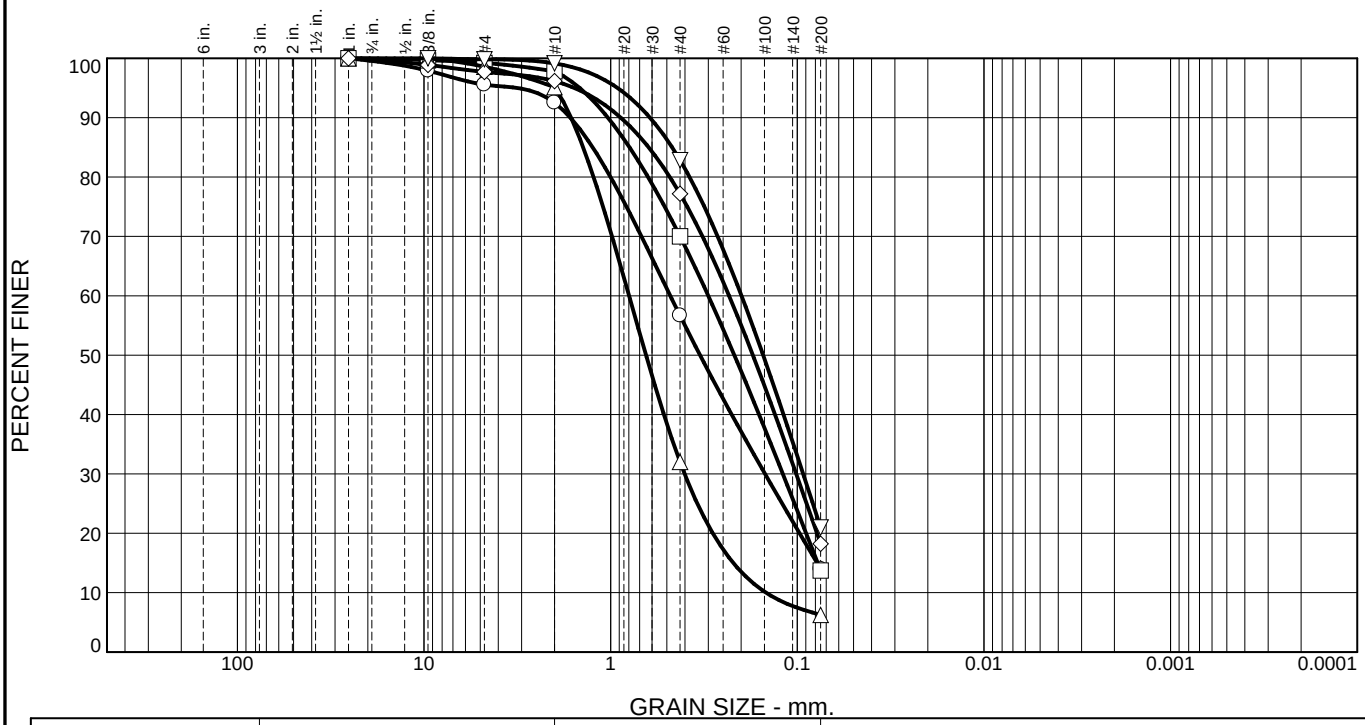
▽ **Source of Sample:** FR-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.5	35.8	42.7	14.0	
□	0.0	2.2	27.8	56.3	13.7	
△	0.0	4.9	63.1	25.7	6.3	
◇	0.0	3.8	19.0	59.0	18.2	
▽	0.0	0.9	16.2	61.9	21.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2490	0.4790	0.3320	0.1489	0.0784			
□	NV	NP	0.7924	0.2999	0.2175	0.1196	0.0778			
△	NV	NP	1.4045	0.7968	0.6464	0.4017	0.2203	0.1473	1.37	5.41
◇	NV	NP	0.6258	0.2320	0.1731	0.1014				
▽	NV	NP	0.4684	0.1991	0.1525	0.0930				

Material Description	USCS	AASHTO
○ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
◇ Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet medium dense gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** FR-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** FR-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** FR-1 **Depth:** 63.0 **Sample Number:** 19

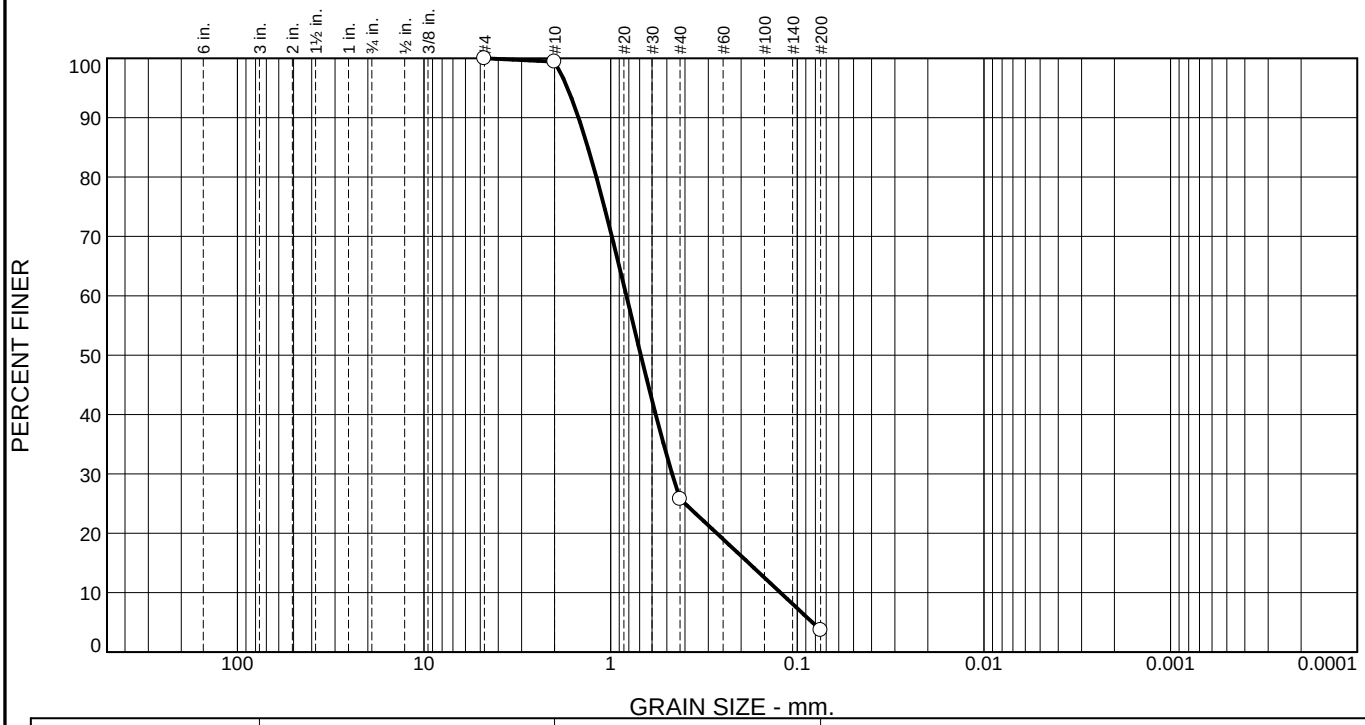
▽ **Source of Sample:** FR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.6	73.6	22.1	3.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3249	0.8236	0.6896	0.4683	0.1822	0.1231	2.16	6.69

Material Description	USCS	AASHTO
○ Wet dense gray coarse to fine sand w/trace fine gravel and silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project:

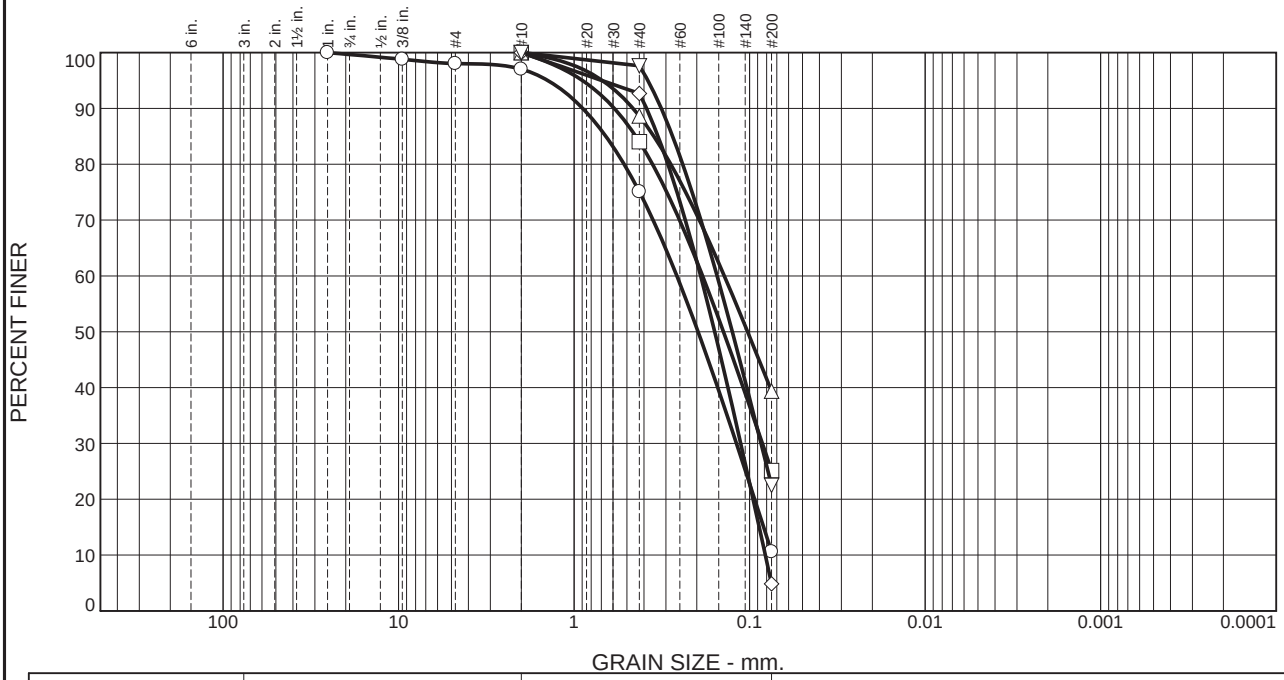
○ **Source of Sample:** FR-1 **Depth:** 73.0 **Sample Number:** 21

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.0	21.9	64.5	10.6	
□	0.0	0.0	16.0	58.9	25.1	
△	0.0	0.0	11.4	49.2	39.4	
◇	0.0	0.0	7.3	87.8	4.9	
▽	0.0	0.0	2.4	75.1	22.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6592	0.2597	0.1968	0.1189	0.0832			
□	NV	NP	0.4449	0.1855	0.1410	0.0846				
△	25.8	NP	0.3509	0.1394	0.1027					
◇	NV	NP	0.3326	0.1902	0.1582	0.1124	0.0882	0.0814	0.82	2.34
▽	NV	NP	0.2745	0.1533	0.1256	0.0861				

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
□ Wet loose dark gray organic silty fine sand w/some coarse sand.	SM	A-2-4(0)
△ Wet soft dark gray organic fine sandy silt w/some coarse sand.	SM	A-4(0)
◇ Wet loose gray fine sand w/trace coarse sand and silt.	SP	A-3
▽ Wet loose gray silty fine sand w/trace coarse sand.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** FR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** FR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** FR-2 **Depth:** 6.0 **Sample Number:** 4

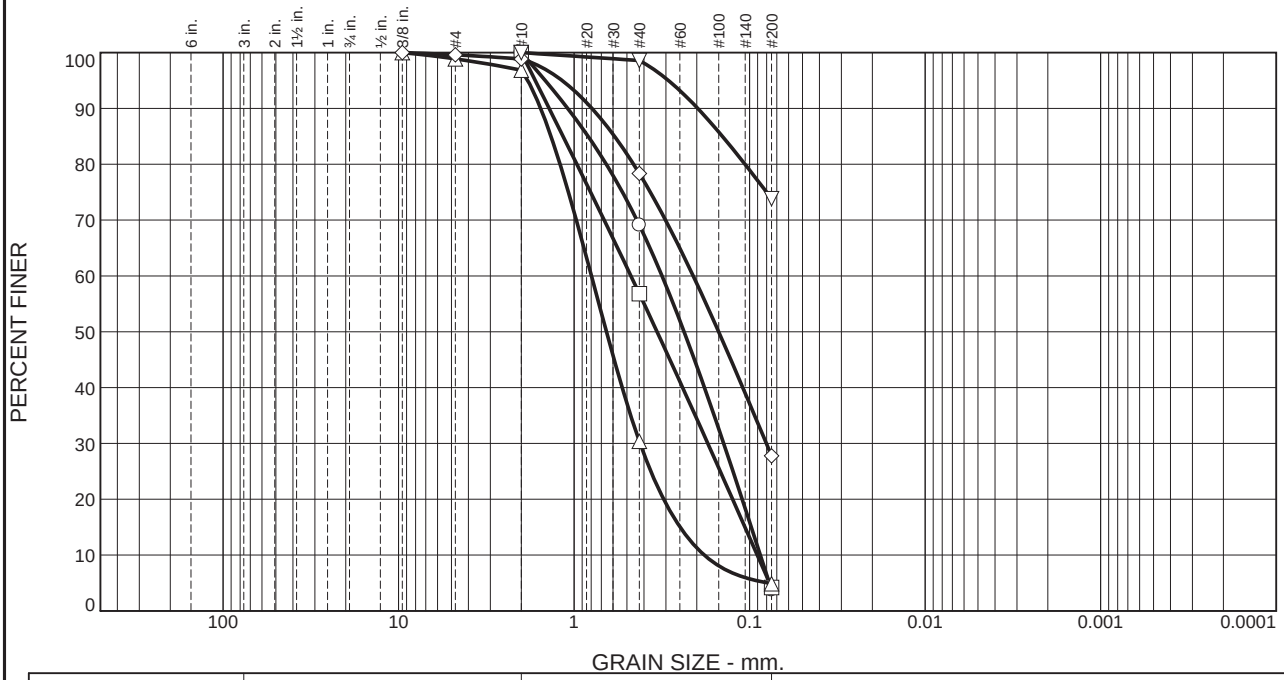
▽ **Source of Sample:** FR-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	30.9	65.3	3.8	
□	0.0	0.0	43.2	52.6	4.2	
△	0.0	3.1	66.5	25.5	4.9	
◇	0.0	1.1	20.6	50.5	27.8	
▽	0.0	0.0	1.4	24.8	73.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8321	0.3155	0.2362	0.1406	0.0979	0.0869	0.72	3.63
□	NV	NP	1.1563	0.4745	0.3368	0.1732	0.1063	0.0905	0.70	5.25
△	NV	NP	1.3541	0.7963	0.6540	0.4208	0.2489	0.1814	1.23	4.39
◇	NV	NP	0.5879	0.2097	0.1503	0.0803				
▽	25.9	17.3	0.1429							

Material Description	USCS	AASHTO
○ Wet loose gray fine to coarse sand w/trace silt.	SP	A-3
□ Wet medium dense gray fine to coarse sand w/trace silt.	SP	A-3
△ Wet very loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Wet loose gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
▽ Wet firm gray clayey fine sandy silt w trace coarse sand./	CL	A-4(4)

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** FR-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** FR-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** FR-2 **Depth:** 16.0 **Sample Number:** 9

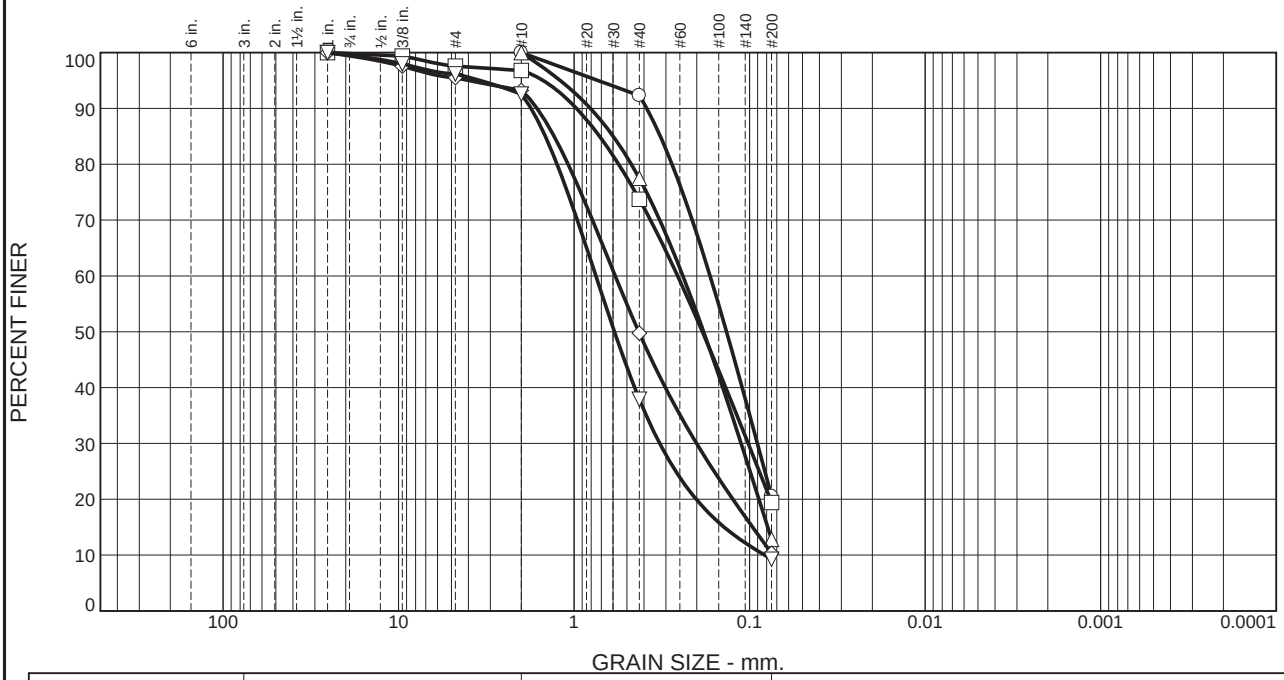
▽ **Source of Sample:** FR-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	7.7	71.8	20.5	
□	0.0	3.2	23.1	54.3	19.4	
△	0.0	0.0	22.5	64.7	12.8	
◇	0.0	6.8	43.5	39.4	10.3	
▽	0.0	7.4	54.7	28.6	9.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.3226	0.1681	0.1354	0.0904				
□	NV	NP	0.7155	0.2571	0.1859	0.1019				
△	NV	NP	0.5986	0.2399	0.1830	0.1119	0.0789			
◇	NV	NP	1.2997	0.5831	0.4285	0.2006	0.0962			
▽	NV	NP	1.4583	0.7515	0.5888	0.3253	0.1398	0.0821	1.71	9.15

Material Description	USCS	AASHTO
○ Wet loose brown silty fine sand w/trace coarse sand.	SM	A-2-4(0)
□ Wet medium dense light gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
▽ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** FR-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** FR-2 **Depth:** 38.0 **Sample Number:** 14

◇ **Source of Sample:** FR-2 **Depth:** 43.0 **Sample Number:** 15

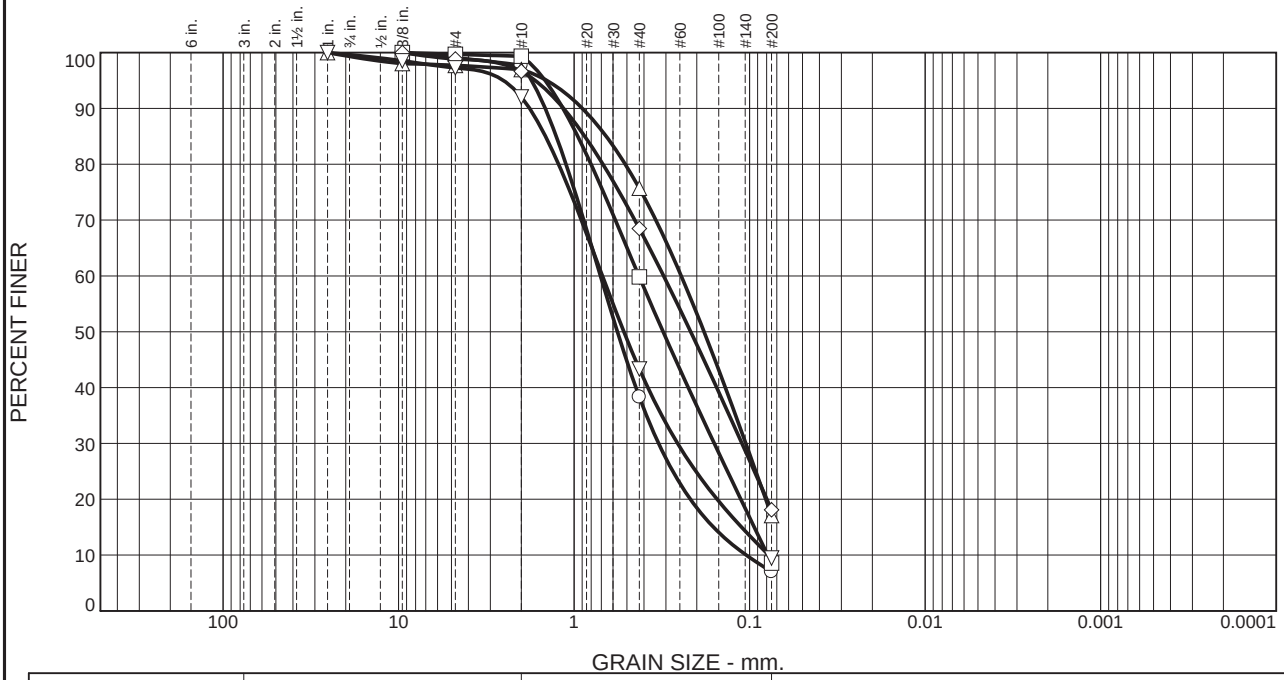
▽ **Source of Sample:** FR-2 **Depth:** 48.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.3	59.4	31.3	7.0	
□	0.0	0.6	39.6	51.2	8.6	
△	0.0	3.1	21.2	58.6	17.1	
◇	0.0	3.4	28.1	50.4	18.1	
▽	0.0	7.9	48.8	33.8	9.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2640	0.7075	0.5664	0.3302	0.1609	0.1046	1.47	6.77
□	NV	NP	0.9531	0.4274	0.3110	0.1590	0.0941	0.0789	0.75	5.42
△	NV	NP	0.6561	0.2453	0.1819	0.1052				
◇	NV	NP	0.8693	0.3090	0.2167	0.1106				
▽	NV	NP	1.4556	0.6894	0.5205	0.2571	0.1112	0.0779	1.23	8.84

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Wet loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet medium dense gray coarse to fine sand w/trace silt and fine gravel,	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project:

○ **Source of Sample:** FR-2 **Depth:** 53.0 **Sample Number:** 17

□ **Source of Sample:** FR-2 **Depth:** 58.0 **Sample Number:** 18

△ **Source of Sample:** FR-2 **Depth:** 63.0 **Sample Number:** 19

◇ **Source of Sample:** FR-2 **Depth:** 68.0 **Sample Number:** 20

▽ **Source of Sample:** FR-2 **Depth:** 73.0 **Sample Number:** 21

Remarks:

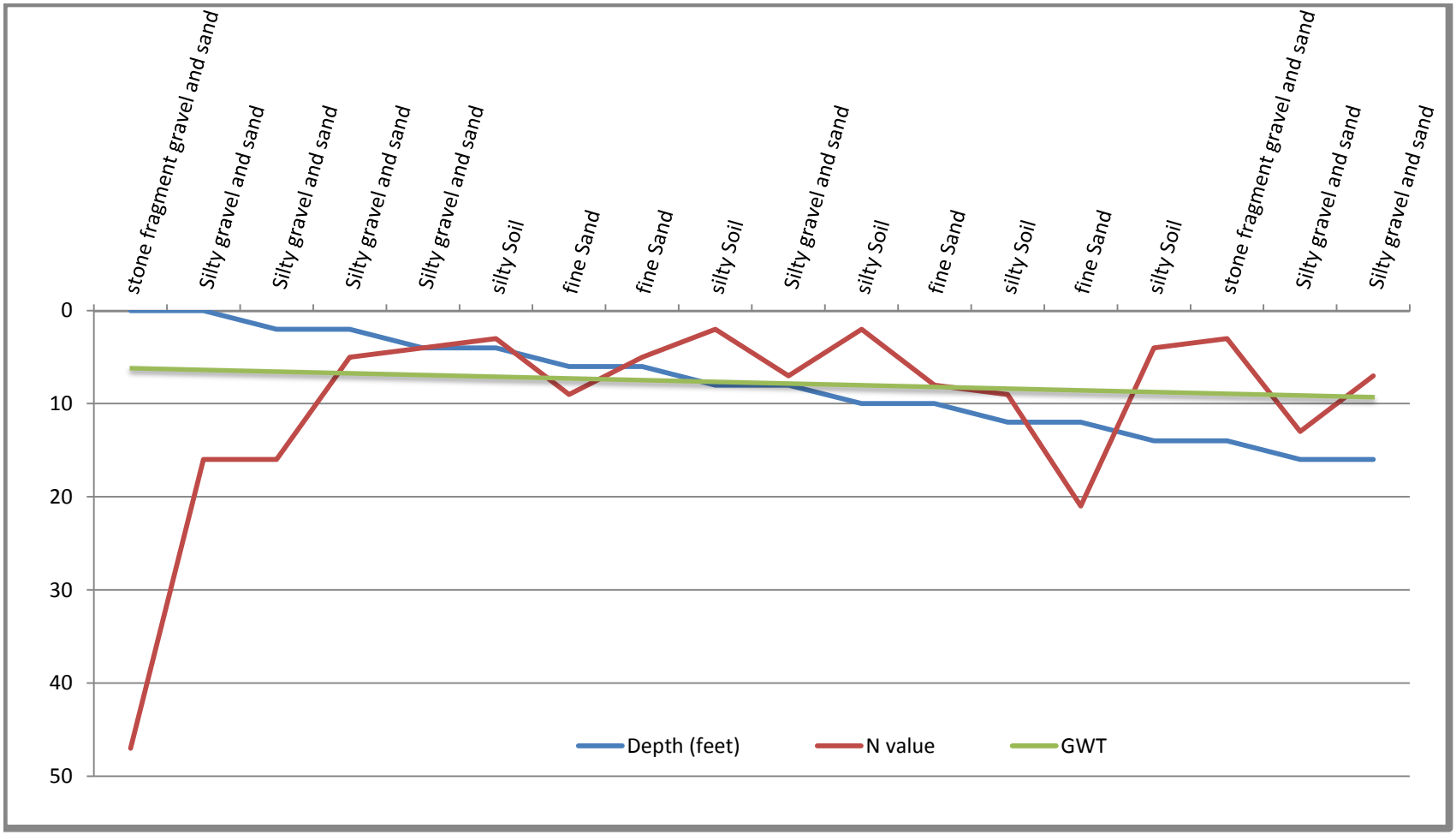
Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
FR-1														
	1		Moist dense gray coarse to fine sand and fine gravel w/some silt.	NV	NP	5.1	SM	A-1-b	66.2	18.1	1	21	26	17
	2	2	Moist medium dense gray silty fine to coarse sand and fine gravel.	NV	NP	8.5	SM	A-2-4(0)	78.2	22.4	5	10	6	5
	3	4	Moist very loose brown fine gravelly fine sand w/some coarse sand and silt.	NV	NP	13.3	SP-SM	A-2-4(0)	70.7	11.4	3	2	2	3
	4	6	Wet loose brown fine sand w/some coarse sand, trace of silt and fine gravel.	NV	NP	18	SP-SM	A-3	93.9	10.2	3	3	6	9
	5	8	Wet soft gray coarse sandy silt w/some fine sand, trace of fine gravel.	20.1	NP	23.8	SM	A-4(0)	98.7	42.8	1	1	1	2
	6	10	Wet soft gray coarse sandy silt w/some fine sand, trace of clay.	20.2	1.4	22.4	SM	A-4(0)	99.7	39.4	1	1	1	2
	7	12	Wet stiff gray fine sandy silt w/some coarse sand, trace of clay.	17.4	2.1	18.8	ML	A-4(0)	99.8	54.9	2	4	5	9
	8	14	Wet soft gray fine sandy silt w/some coarse sand, trace of fine gravel and clay.	21	2.9	21.9	ML	A-4(0)	98.8	54.6	2	2	2	5
	9	16	Wet medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	16	SM	A-2-4(0)	93.9	24.2	4	6	7	8
	10	18	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	15.4	SP-SM	A-2-4(0)	90.1	11.3	4	2	3	2
	11	23	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.1	SM	A-2-4(0)	94.8	16.9	1	2	3	6
	12	28	Wet medium dense brown fine to coarse sand w/some silt.	NV	NP	19	SM	A-2-4(0)	99.5	17.4	3	5	6	8
	13	33	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.4	SM	A-2-4(0)	98.3	19	1	5	7	10
	14	38	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	16.3	SM	A-2-4(0)	93	17.9	3	6	10	12
	15	43	Wet loose gray coarse to fine sand w/some fine gravel and silt.	NV	NP	17.1	SM	A-1-b	87.6	13.4	1	2	4	6
	16	48	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	14.7	SM	A-2-4(0)	92.5	14	5	10	18	22
	17	53	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.4	SM	A-2-4(0)	97.8	13.7	3	7	15	16
	18	58	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.9	SP-SM	A-1-b	95.1	6.3	2	3	7	13
	19	63	Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	18.2	SM	A-2-4(0)	96.2	18.2	1	2	3	10
	20	68	Wet medium dense gray silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	17.2	SM	A-2-4(0)	99.1	21	3	10	12	14
	21	73	Wet dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.8	SW	A-1-b	99.4	3.7	3	17	19	26
		75	End Boring											
FR-2														
	1		Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	6.5	SP-SM	A-2-4(0)	97	10.6		4	12	10
	2	2	Wet loose dark gray organic silty fine sand w/some coarse sand.	NV	NP	51.1	SM	A-2-4(0)	100	25.1	3	3	2	1
	3	4	Wet soft dark gray organic fine sandy silt w/some coarse sand.	25.8	NP	44.6	SM	A-4(0)	100	39.4	4	2	1	5
	4	6	Wet loose gray fine sand w/trace coarse sand and silt.	NV	NP	15.8	SP	A-3	100	4.9	3	2	3	3
	5	8	Wet loose gray silty fine sand w/trace coarse sand.	NV	NP	25.2	SM	A-2-4(0)	100	22.5	1	2	5	7
	6	10	Wet loose gray fine to coarse sand w/trace silt.	NV	NP	20.8	SP	A-3	100	3.8	1	3	5	5
	7	12	Wet medium dense gray fine to coarse sand w/trace silt.	NV	NP	20.8	SP	A-3	100	4.2	3	10	11	11
	8	14	Wet very loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.9	SP	A-1-b	96.9	4.9	1	1	2	1
	9	16	Wet loose gray silty fine to coarse sand w/trace fine gravel.	NV	NP	21.1	SM	A-2-4(0)	98.9	27.8	2	2	5	6
	10	18	Wet firm gray clayey fine sandy silt w trace coarse sand./	25.9	8.6	20.8	CL	A-4(4)	100	73.8	4	4	3	6
	11	23	Wet loose brown silty fine sand w/trace coarse sand.	NV	NP	20.4	SM	A-2-4(0)	100	20.5	2	2	5	10
	12	28	Wet medium dense light gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	24.5	SM	A-2-4(0)	96.8	19.4	4	2	8	15
	13	33	No Recovery								3	3	9	10
	14	38	Wet loose brown fine to coarse sand w/some silt.	NV	NP	22.3	SM	A-2-4(0)	100	12.8	6	3	2	2
	15	43	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.1	SP-SM	A-1-b	93.2	10.3	3	6	9	15
	16	48	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.4	SW-SM	A-1-b	92.6	9.3	4	9	9	13
	17	53	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.4	SW-SM	A-1-b	97.7	7	4	10	10	9
	18	58	Wet loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	19.1	SP-SM	A-3	99.4	8.6	2	2	8	15
	19	63	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.4	SM	A-2-4(0)	96.9	17.1	2	4	4	6
	20	68	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17	SM	A-2-4(0)	96.6	18.1	2	6	9	14
	21	73	Wet medium dense gray coarse to fine sand w/trace silt and fine gravel,	NV	NP	15.4	SW-SM	A-1-b	92.1	9.5	3	8	10	17

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
		75	End Boring											

DATE : 12-01-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-564 on Fireman road over GUM Branch- Millsboro DE



DATE : 12-01-2015
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-564 on Fireman road over GUM Branch- Millsboro DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-22-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-576 along Whitesville road on North Fork Green Run- Millsboro DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-28-2016 and 1-29-2016. Hillis Carnes Engineering Associates (HCEA) was drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using Southern Delaware by Kelvin W. Ramsey and William S. Schenck June 1990 this site is situated in LYNCH HEIGHTS FORMATION as, Light gray to brown to light yellowish brown, medium to fine sand to very fine sand with discontinuous beds of course sand, gravel silt, and organic- rich clayey silt to silty sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Trap Pond Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA- 120. The nearest well to this site the groundwater historically had been measured as 44 feet on

October 1960 and between the years of 1950 to 1962 appeared from 42 to 48 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 29 feet down is fine sand (A-3), from 29 to 39 feet down is Silty or Clayey gravel and sand (A-2-4) and from 39 to 72 feet down is Silty soils (A-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounters less of 3 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 10 to 20 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a Fair to Poor category.

5. Ground Cover

The ground cover for site is 5 and 15 inches of asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 10 and 15 feet and caved at 20 feet below the ground surface elevation. Contractor use mud for the drilling operation at 14 feet down from the surface elevation; more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 7.9 to 37 percent. The Atterberg limit is 30 percent, Liquid limits is range from 25.5 to 48.5 percent and Plasticity Index is 4.5 to 25.3 percent. The organic matter wasn't encountered for the entire sample more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition. In addition the borrow material according to Del-DOT standard specification for all entire sample from the depth of 2 to 10 feet from the surface had very little amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (2- sheets)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 27-1692 T201407003 BR3-576 on Whitesville Road in Sussex County

Google earth

feet 100
meters 30

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING WR-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 171279.042
Easting: 657612.543
Boring Surface Elev.:
Reference:
Date Started: 1/28/16
Date Completed: 1/28/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/28/16	15.0	
1/28/16	13.0	20.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: John M.
Logged By: Michael Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 0.5'	4	Moist very loose brown fine to coarse sand and fine gravel w/trace silt. 6" RECOVERY	A-1-b	Hot-mix 15"
2.53		2	2.0' 4.0'	6 11 7 5	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 4" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	2 2 2 4	No Recovery NR" RECOVERY		
7.59		4	6.0' 8.0'	1 2 3 3	Wet firm gray silty clay w/some fine sand, trace of coarse sand. 20" RECOVERY	A-6(14)	
10.12		U-1	8.0' 10.0'		No Recovery NR" RECOVERY		Shelby Tube - Press Sample
		6	10.0' 12.0'	1 2 5 7	Wet firm gray clay w/some silt, trace of fine sand. 22" RECOVERY	A-7-6(25)	
12.65	▽	7	12.0'	4 4 9 10	Wet stiff gray clay w/some very sand and silt.	A-7-6(16)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18	■	8	14.0' 16.0'	1 5 7 7	Wet stiff gray clayey fine sandy silt coarse sand. 19" RECOVERY	A-4(5)	
17.71		9	16.0' 18.0'	3 5 7 16	Wet stiff gray clayey fine sandy silt w/trace coarse sand. 24" RECOVERY	A-4(1)	
20.24		10	18.0' 20.0'	4 8 5 5	Wet medium dense gray fine sand w/some silt , trace of coarse sand. 21" RECOVERY	A-2-4(0)	
22.77							
25.3		11	23.0' 25.0'	5 7 9 10	Wet medium dense gray fine sand w/some coarse sand, trace of silt. 24" RECOVERY	A-3	
27.83							
30.36		12	28.0' 30.0'	7 8 11 14	Wet medium dense gray fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
32.89							
35.42		13	33.0' 35.0'	5 15 18 20	Wet dense orange fine to coarse sand w trace fine gravel and silt. 24" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	2 7 9 15	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
40.48							
43.01							
		15	43.0' 45.0'	2 9 18 25	Wet medium dense gray coarse to fine sand w/trace silt. 22" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	7 9 11 14	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
50.6							
53.13							
		17	53.0' 55.0'	4 15 21 29	Wet dense orange coarse to fine sand w trace fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	4 6 6 6	Wet medium dense gray coarse to fine sand w/trace silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WR-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		18" RECOVERY		
60.72							
63.25		19	63.0'	6 11 22 26	Wet dense gray fine to coarse sand w/trace fine gravel and silt.	A-3	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	8 18 28 33	Wet dense brown silty fine to coarse sand w/ trace fine gravel.	A-2-4(0)	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Plastic clays
	Expansive plastic clays
	Silty soils
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING WR-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset: 0.0
Northing: 171303.361
Easting: 657605.288
Boring Surface Elev.:
Reference:
Date Started: 1/29/16
Date Completed: 1/29/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 14.0
From Depth of: 14.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/29/16	10.0	
1/29/16	6.0	20.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	14 7 7	Moist medium dense brown coarse sandy fine gravel w/some fine sand, trace of silt. 18" RECOVERY	A-1-b	
2.53		2	2.0' 4.0'	7 6 5 4	Moist medium dense brown silty fine to coarse sand w/trace fine gravel. 24" RECOVERY	A-2-4(0)	
5.06	▼	3	4.0' 6.0'	2 3 3 3	Saturated firm brown silty fine sandy clay w/ trace coarse sand. 24" RECOVERY	A-6(10)	
7.59		4	6.0' 8.0'	3 3 6 8	Saturated stiff brown silty clay w/trace fine to coarse sand. 24" RECOVERY	A-6(16)	
		U-1	8.0' 10.0'		No Recovery NR" RECOVERY		Shelby Tube - Press Sample
10.12	■	6	10.0' 12.0'	5 5 8 8	Saturated stiff gray silty clay w/trace fine to coarse sand. 24" RECOVERY	A-7-6(28)	
12.65		7	12.0'	4 6 9 10	Saturated stiff gray silty clay w/trace fine sand.	A-7-6(21)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	4 6 9 11	Saturated stiff gray silty fine sandy clay w/ trace coarse sand. 24" RECOVERY	A-6(8)	
17.71		9	16.0' 18.0'	4 10 14 20	Saturated very stiff gray fine sandy silt w/ some clay, trace of coarse sand. 24" RECOVERY	A-4(0)	
20.24		10	18.0' 20.0'	3 3 6 6	Saturated loose gray fine sand w/trace coarse sand and silt. 24" RECOVERY	A-3	
22.77							
25.3		11	23.0' 25.0'	2 15 16 15	Saturated dense gray fine to coarse sand w/ trace silt. 24" RECOVERY	A-3	
27.83							
30.36		12	28.0' 30.0'	5 5 8 11	Saturated medium dense gray coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	14 20 21 21	Saturated dense gray fine to coarse sand w/ trace silt and fine gravel. 24" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** WR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	5 10 16 25	Saturated medium dense orange fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
40.48							
43.01							
		15	43.0' 45.0'	10 20 21 19	Saturated dense orange coarse to fine sand w/ trace fine gravel and silt. 18" RECOVERY	A-1-b	
45.54							
48.07							
		16	48.0' 50.0'	10 13 15 18	Saturated medium dense orange silty fine sand w/some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
50.6							
53.13							
		17	53.0' 55.0'	16 19 24 32	Saturated dense orange coarse to fine sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
55.66							
58.19							
		18	58.0'	15 15 21 23	Saturated dense orange coarse to fine sand w/ trace fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: WR-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	19 30 37 37	Saturated very dense orange fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	13 19 23 31	Saturated dense orange fine to coarse sand w/ some silt, trace of fine gravel.	A-2-4(0)	
			70.0'		18" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Plastic clays
	Expansive plastic clays
	Silty soils
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

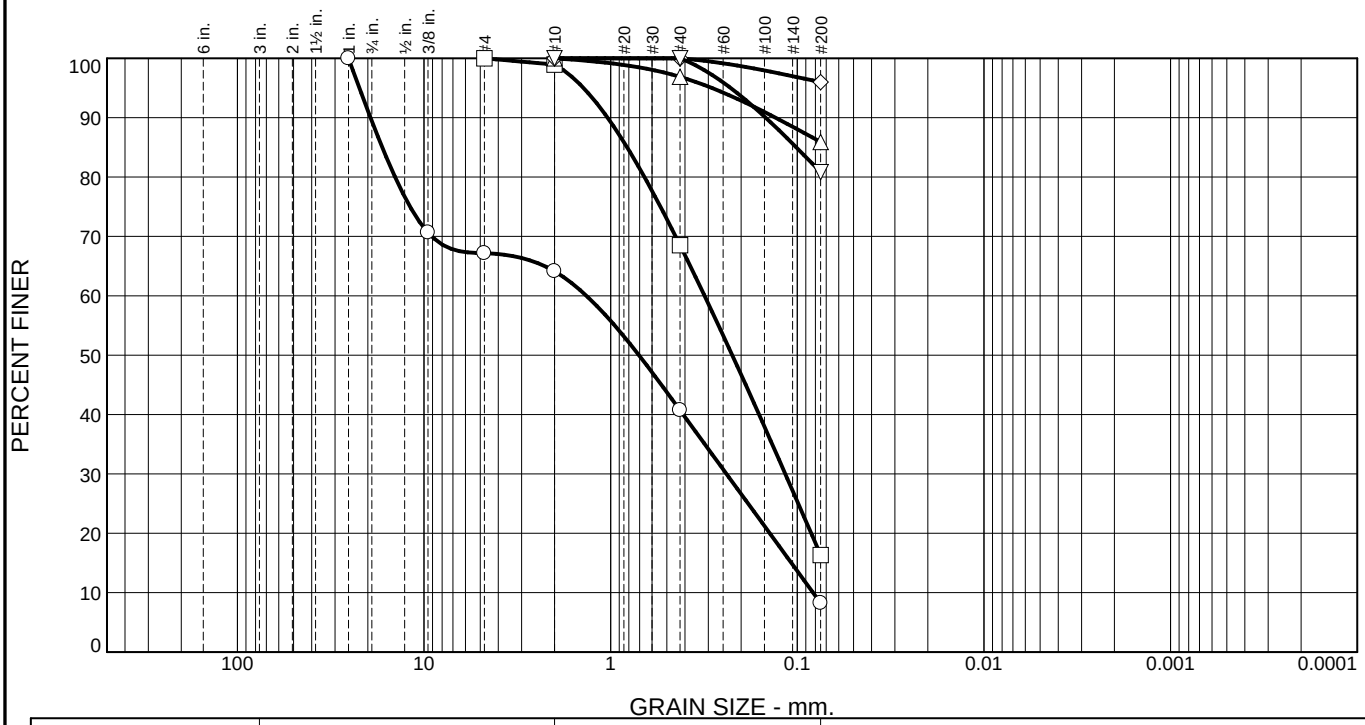
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	35.9	23.4	32.5	8.2	
□	0.0	1.1	30.4	52.2	16.3	
△	0.0	0.0	3.1	11.0	85.9	
◇	0.0	0.0	0.0	4.0	96.0	
▽	0.0	0.0	0.0	19.2	80.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	16.7453	1.3486	0.7056	0.2396	0.1076	0.0824	0.52	16.37
□	NV	NP	0.8163	0.3139	0.2232	0.1160				
△	38.1	21.6								
◇	48.5	24.8								
▽	42.3	23.0	0.1013							

Material Description	USCS	AASHTO
○ Moist very loose brown fine to coarse sand and fine gravel w/trace silt.	SP-SM	A-1-b
□ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet firm gray silty clay w/some fine sand, trace of coarse sand.	CL	A-6(14)
◇ Wet firm gray clay w/some silt, trace of fine sand.	CL	A-7-6(25)
▽ Wet stiff gray clay w/some very sand and silt.	CL	A-7-6(16)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** WR-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** WR-1 **Depth:** 6.0 **Sample Number:** 4

◇ **Source of Sample:** WR-1 **Depth:** 10.0 **Sample Number:** 6

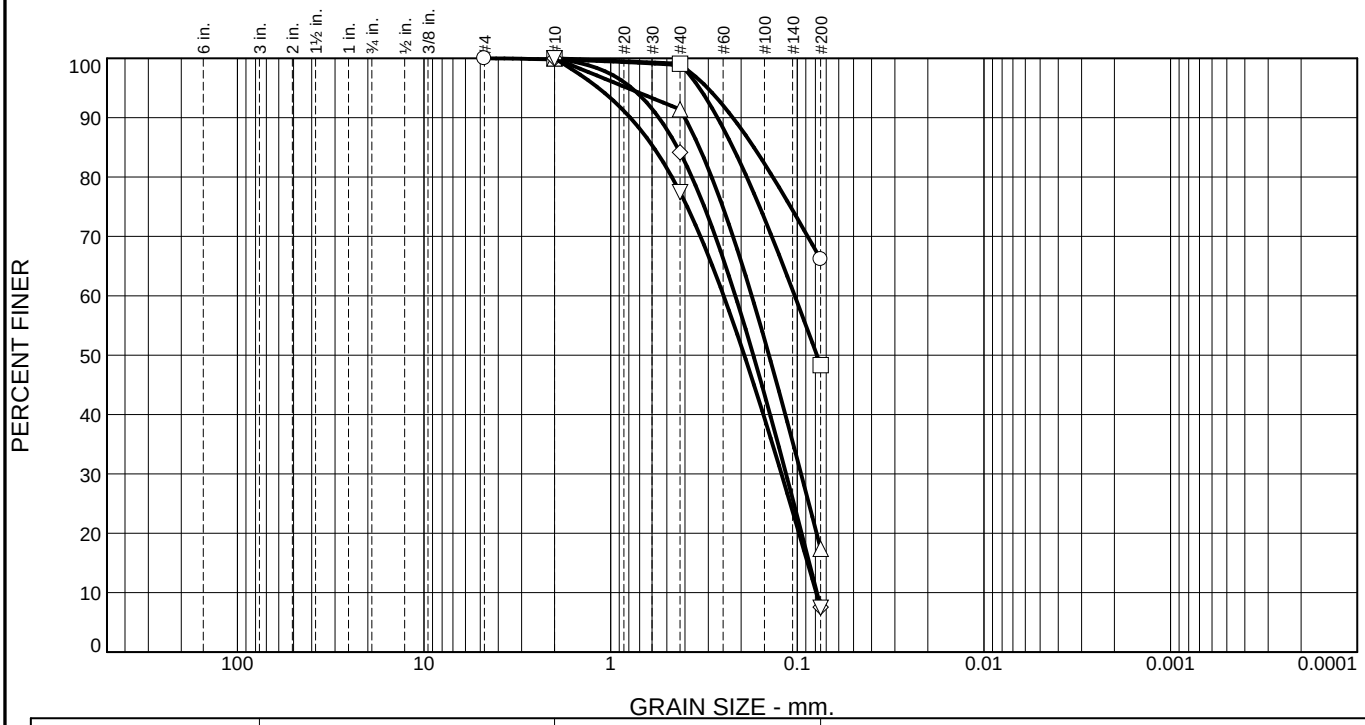
▽ **Source of Sample:** WR-1 **Depth:** 12.0 **Sample Number:** 7

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.2	0.9	32.7	66.2	
□	0.0	0.0	0.9	50.8	48.3	
△	0.0	0.0	8.6	74.0	17.4	
◇	0.0	0.0	15.8	76.6	7.6	
▽	0.0	0.0	22.5	70.0	7.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	34.0	24.2	0.1709							
□	26.6	20.1	0.2213	0.1032	0.0785					
△	NV	NP	0.3351	0.1755	0.1419	0.0954				
◇	NV	NP	0.4390	0.2148	0.1722	0.1149	0.0863	0.0785	0.78	2.74
▽	NV	NP	0.5887	0.2480	0.1924	0.1216	0.0880	0.0792	0.75	3.13

Material Description	USCS	AASHTO
○ Wet stiff gray clayey fine sandy silt coarse sand.	CL	A-4(5)
□ Wet stiff gray clayey fine sandy silt w/trace coarse sand.	SC-SM	A-4(1)
△ Wet medium dense gray fine sand w/some silt , trace of coarse sand.	SM	A-2-4(0)
◇ Wet medium dense gray fine sand w/some coarse sand, trace of silt.	SP-SM	A-3
▽ Wet medium dense gray fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-1 **Depth:** 14.0 **Sample Number:** 8

□ **Source of Sample:** WR-1 **Depth:** 16.0 **Sample Number:** 9

△ **Source of Sample:** WR-1 **Depth:** 18.0 **Sample Number:** 10

◇ **Source of Sample:** WR-1 **Depth:** 23.0 **Sample Number:** 11

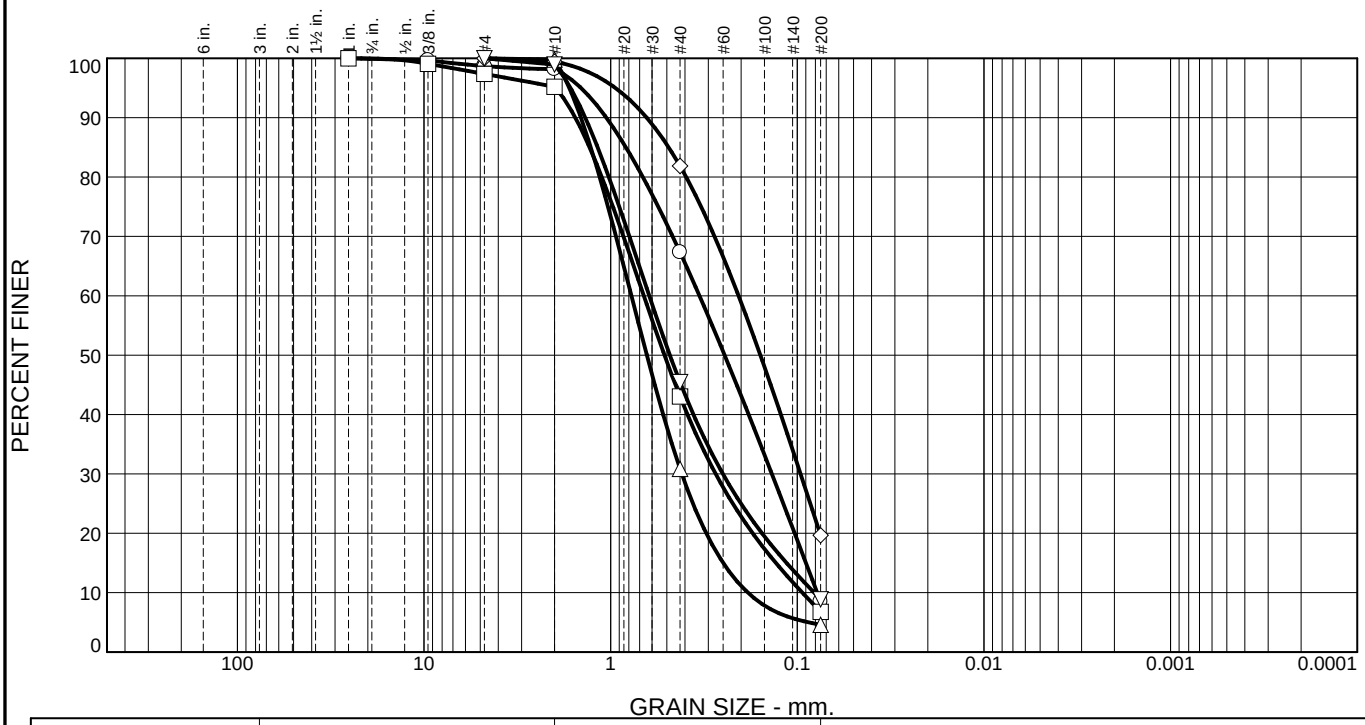
▽ **Source of Sample:** WR-1 **Depth:** 28.0 **Sample Number:** 12

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.8	30.9	58.8	8.5	
□	0.0	4.8	52.2	36.2	6.8	
△	0.0	0.2	69.0	26.2	4.6	
◇	0.0	0.6	17.5	62.2	19.7	
▽	0.0	1.1	53.4	36.6	8.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8284	0.3343	0.2452	0.1369	0.0899	0.0783	0.72	4.27
□	NV	NP	1.2972	0.6644	0.5149	0.2737	0.1303	0.0940	1.20	7.07
△	NV	NP	1.2787	0.7740	0.6397	0.4160	0.2495	0.1842	1.21	4.20
◇	NV	NP	0.4888	0.2065	0.1578	0.0961				
▽	NV	NP	1.1744	0.6214	0.4817	0.2504	0.1141	0.0812	1.24	7.65

Material Description	USCS	AASHTO
○ Wet dense orange fine to coarse sand w trace fine gravel and silt.	SP-SM	A-3
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet medium dense gray coarse to fine sand w/trace silt.	SP	A-1-b
◇ Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet dense orange coarse to fine sand w trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-1 **Depth:** 33.0 **Sample Number:** 13

□ **Source of Sample:** WR-1 **Depth:** 38.0 **Sample Number:** 14

△ **Source of Sample:** WR-1 **Depth:** 43.0 **Sample Number:** 15

◇ **Source of Sample:** WR-1 **Depth:** 48.0 **Sample Number:** 16

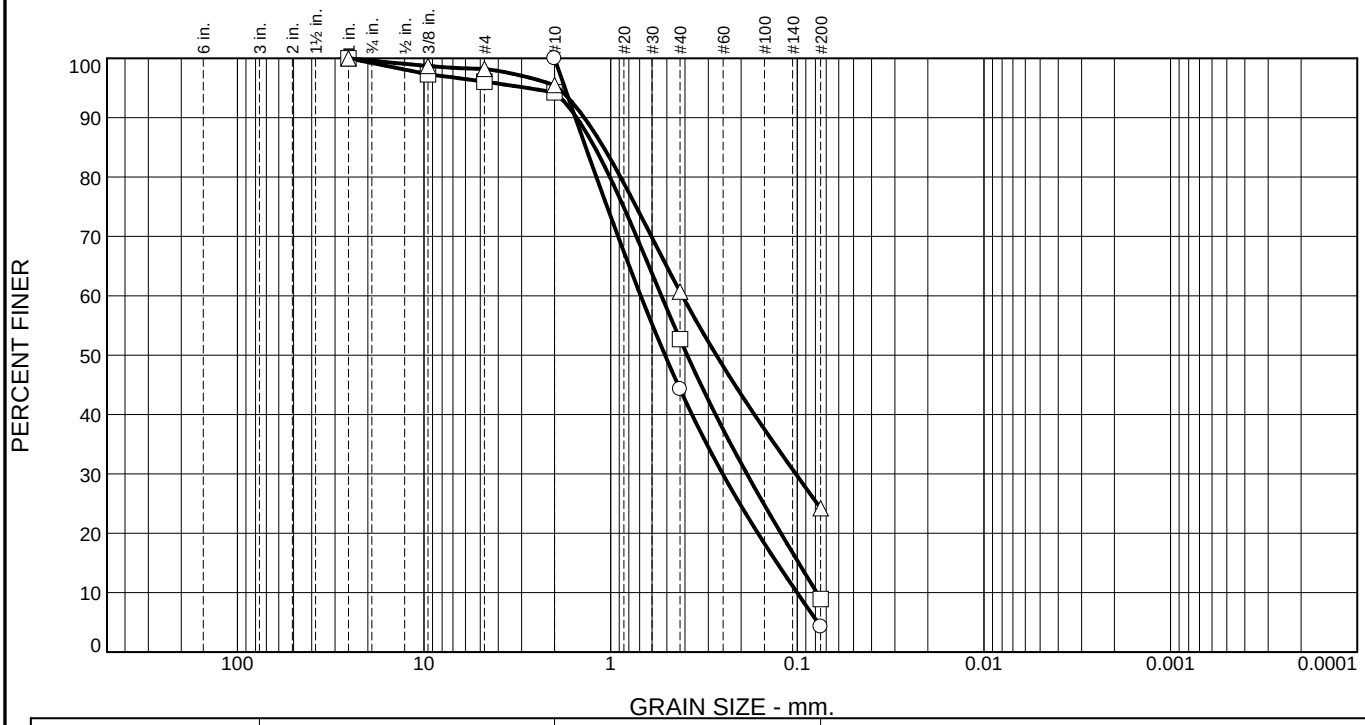
▽ **Source of Sample:** WR-1 **Depth:** 53.0 **Sample Number:** 17

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	55.7	40.0	4.3	
□	0.0	5.7	41.6	43.8	8.9	
△	0.0	4.5	34.8	36.5	24.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3592	0.6900	0.5114	0.2509	0.1283	0.1002	0.91	6.88
□	NV	NP	1.2166	0.5347	0.3891	0.1863	0.0983	0.0787	0.82	6.80
△	NV	NP	1.0913	0.4133	0.2715	0.1019				

Material Description	USCS	AASHTO
○ Wet medium dense gray coarse to fine sand w/trace silt.	SP	A-1-b
□ Wet dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Wet dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-1 **Depth:** 58.0 **Sample Number:** 18

□ **Source of Sample:** WR-1 **Depth:** 63.0 **Sample Number:** 19

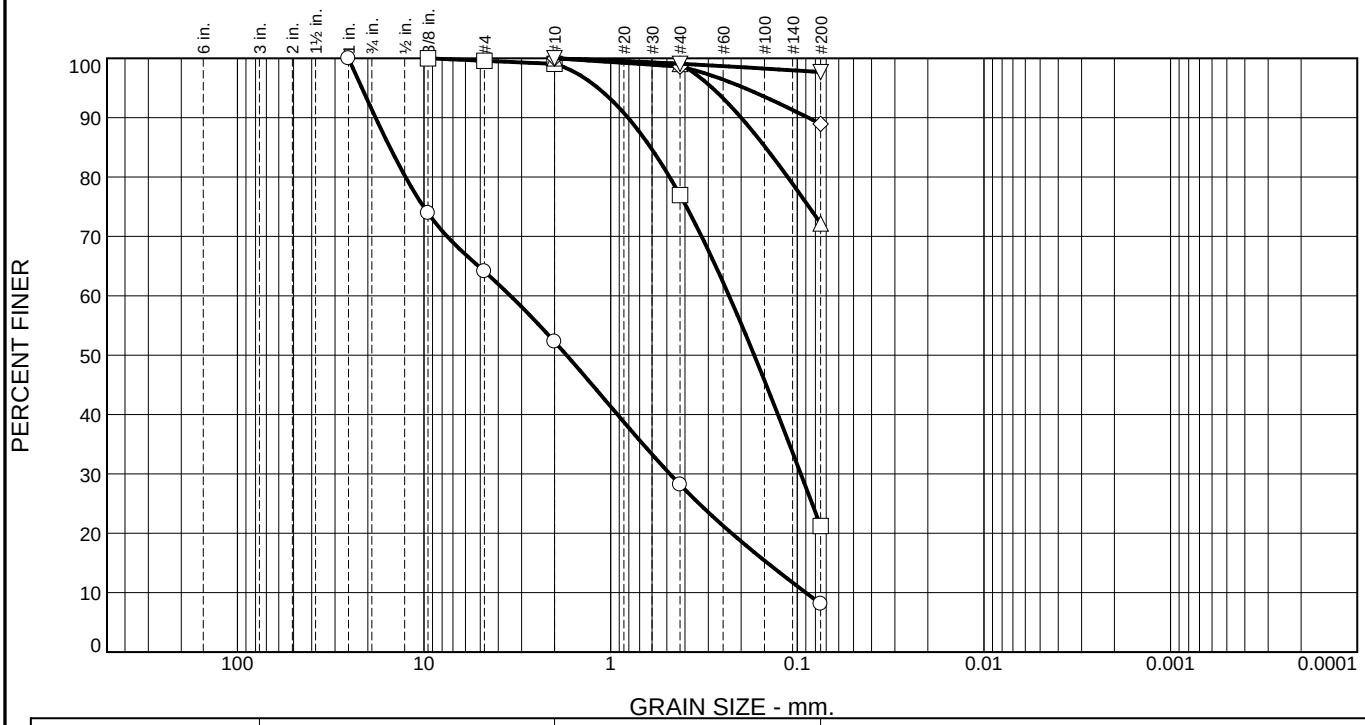
△ **Source of Sample:** WR-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	47.7	24.1	20.1	8.1	
□	0.0	0.9	22.1	55.8	21.2	
△	0.0	0.0	0.9	26.9	72.2	
◇	0.0	0.0	1.4	9.6	89.0	
▽	0.0	0.0	0.9	1.4	97.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	15.2257	3.4439	1.7241	0.4818	0.1445	0.0900	0.75	38.25
□	NV	NP	0.6109	0.2321	0.1703	0.0958				
△	38.1	23.1	0.1482							
◇	38.6	21.3								
▽	48.5	23.2								

Material Description	USCS	AASHTO
○ Moist medium dense brown coarse sandy fine gravel w/some fine sand, trace of silt.	SP-SM	A-1-b
□ Moist medium dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Saturated firm brown silty fine sandy clay w/trace coarse sand.	CL	A-6(10)
◇ Saturated stiff brown silty clay w/trace fine to coarse sand.	CL	A-6(16)
▽ Saturated stiff gray silty clay w/trace fine to coarse sand.	CL	A-7-6(28)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** WR-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** WR-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** WR-2 **Depth:** 6.0 **Sample Number:** 4

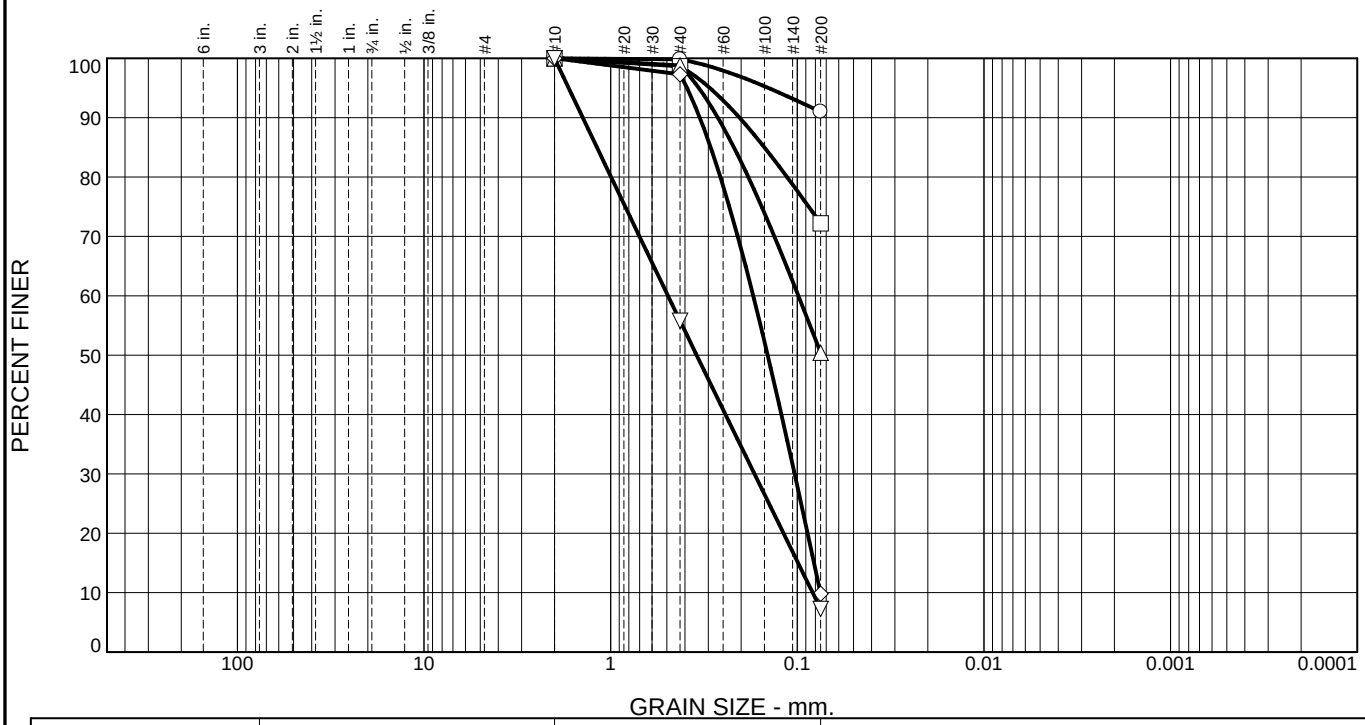
▽ **Source of Sample:** WR-2 **Depth:** 10.0 **Sample Number:** 6

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	0.2	8.8	91.0	
□	0.0	0.0	1.4	26.4	72.2	
△	0.0	0.0	1.2	48.4	50.4	
◇	0.0	0.0	2.7	87.5	9.8	
▽	0.0	0.0	44.2	48.5	7.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	44.5	22.6								
□	38.0	25.6	0.1502							
△	25.5	21.2	0.2186	0.0987						
◇	NV	NP	0.2911	0.1723	0.1442	0.1034	0.0814	0.0752	0.82	2.29
▽	NV	NP	1.1850	0.4931	0.3462	0.1697	0.0991	0.0828	0.71	5.96

Material Description	USCS	AASHTO
○ Saturated stiff gray silty clay w/trace fine sand.	CL	A-7-6(21)
□ Saturated stiff gray silty fine sandy clay w/trace coarse sand.	ML	A-6(8)
△ Saturated very stiff gray fine sandy silt w/some clay, trace of coarse sand.	CL-ML	A-4(0)
◇ Saturated loose gray fine sand w/trace coarse sand and silt.	SP-SM	A-3
▽ Saturated dense gray fine to coarse sand w/trace silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-2 **Depth:** 12.0 **Sample Number:** 7

□ **Source of Sample:** WR-2 **Depth:** 14.0 **Sample Number:** 8

△ **Source of Sample:** WR-2 **Depth:** 16.0 **Sample Number:** 9

◇ **Source of Sample:** WR-2 **Depth:** 18.0 **Sample Number:** 10

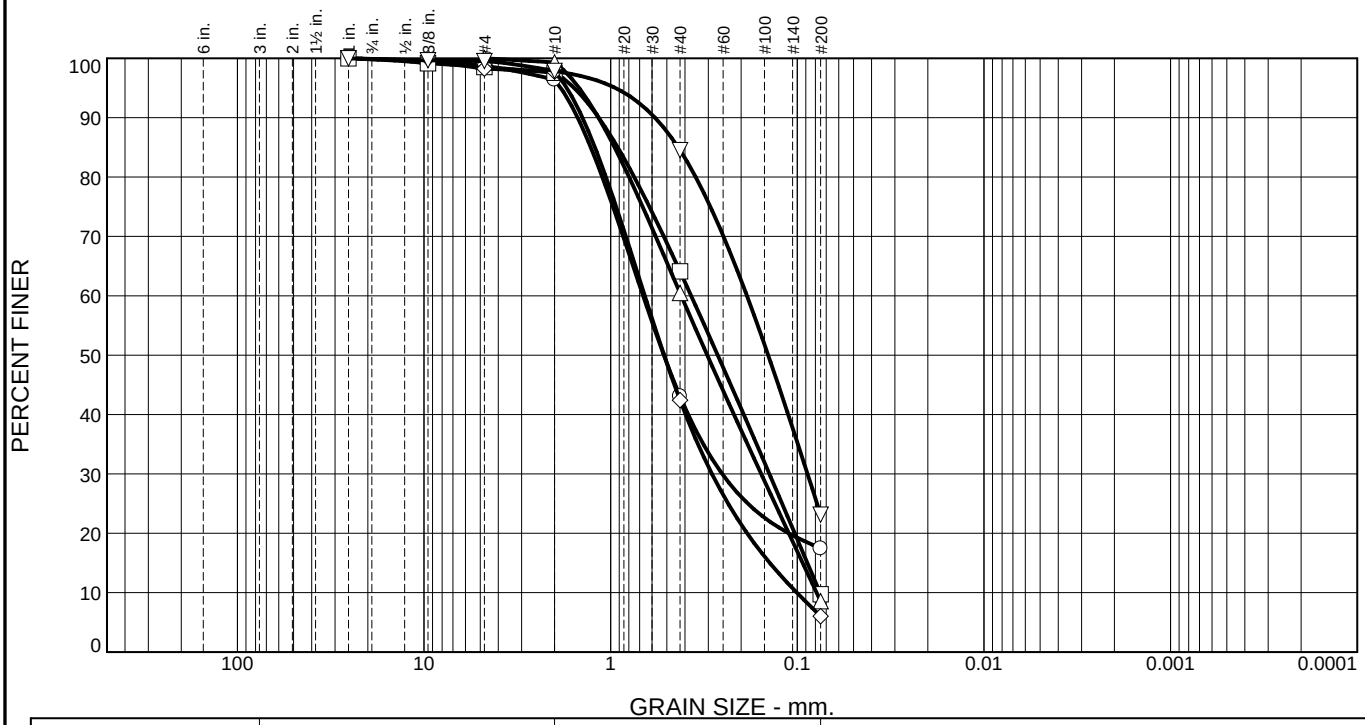
▽ **Source of Sample:** WR-2 **Depth:** 23.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.6	53.3	25.7	17.4	
□	0.0	2.4	33.5	54.4	9.7	
△	0.0	0.7	38.8	51.9	8.6	
◇	0.0	2.3	55.3	36.4	6.0	
▽	0.0	2.1	13.4	61.4	23.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2780	0.6701	0.5187	0.2526				
□	NV	NP	0.9167	0.3705	0.2669	0.1412	0.0884	0.0756	0.71	4.90
△	NV	NP	0.9524	0.4187	0.3037	0.1562	0.0936	0.0788	0.74	5.31
◇	NV	NP	1.2145	0.6563	0.5171	0.2865	0.1404	0.1006	1.24	6.53
▽	NV	NP	0.4345	0.1862	0.1433	0.0882				

Material Description	USCS	AASHTO
○ Saturated medium dense gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
□ Saturated dense gray fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Saturated medium dense orange fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
◇ Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated medium dense orange silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-2 **Depth:** 28.0 **Sample Number:** 12

□ **Source of Sample:** WR-2 **Depth:** 33.0 **Sample Number:** 13

△ **Source of Sample:** WR-2 **Depth:** 38.0 **Sample Number:** 14

◇ **Source of Sample:** WR-2 **Depth:** 43.0 **Sample Number:** 15

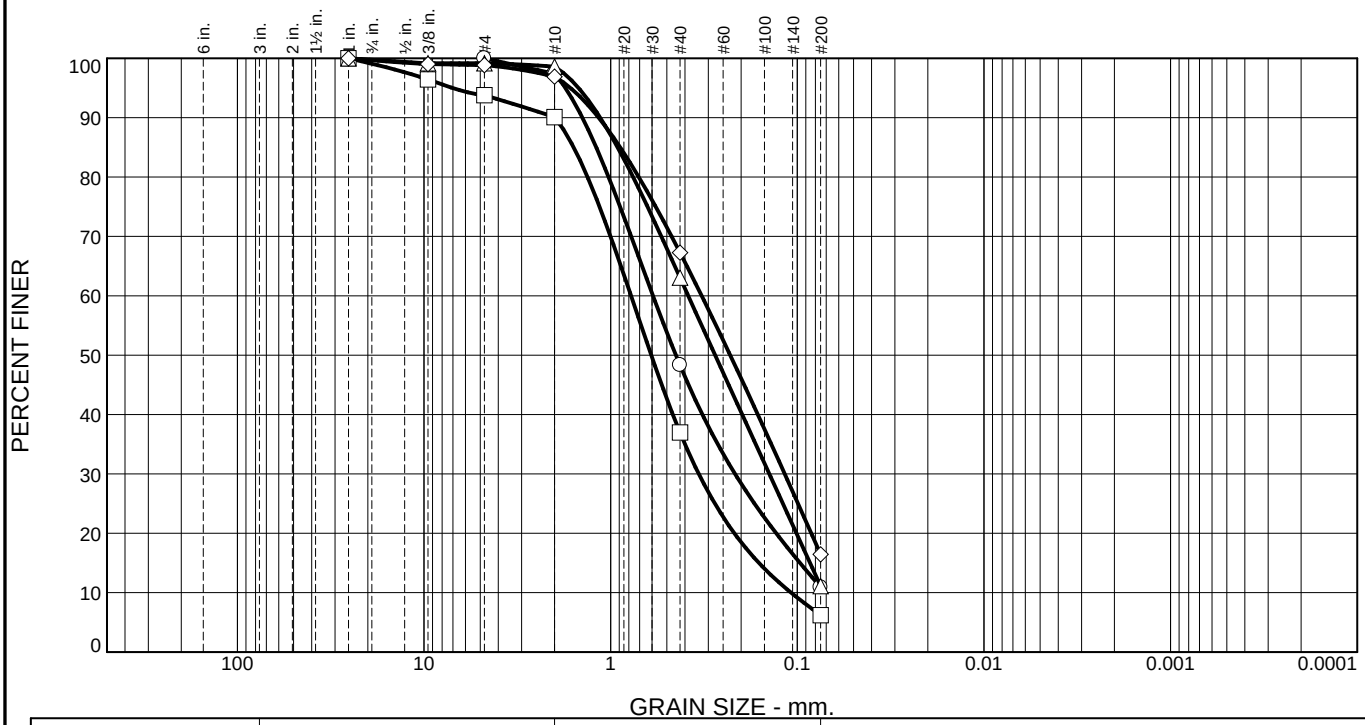
▽ **Source of Sample:** WR-2 **Depth:** 48.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	49.1	37.4	10.9	
□	0.0	9.9	53.1	30.8	6.2	
△	0.0	1.4	35.5	52.0	11.1	
◇	0.0	3.1	29.6	50.8	16.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1953	0.5932	0.4473	0.2156	0.0967			
□	NV	NP	1.5784	0.7775	0.6059	0.3372	0.1606	0.1080	1.35	7.20
△	NV	NP	0.9177	0.3841	0.2755	0.1413	0.0855			
◇	NV	NP	0.8891	0.3254	0.2288	0.1169				

Material Description	USCS	AASHTO
○ Saturated dense orange coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
□ Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Saturated very dense orange fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
◇ Saturated dense orange fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** WR-2 **Depth:** 53.0 **Sample Number:** 17

□ **Source of Sample:** WR-2 **Depth:** 58.0 **Sample Number:** 18

△ **Source of Sample:** WR-2 **Depth:** 63.0 **Sample Number:** 19

◇ **Source of Sample:** WR-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

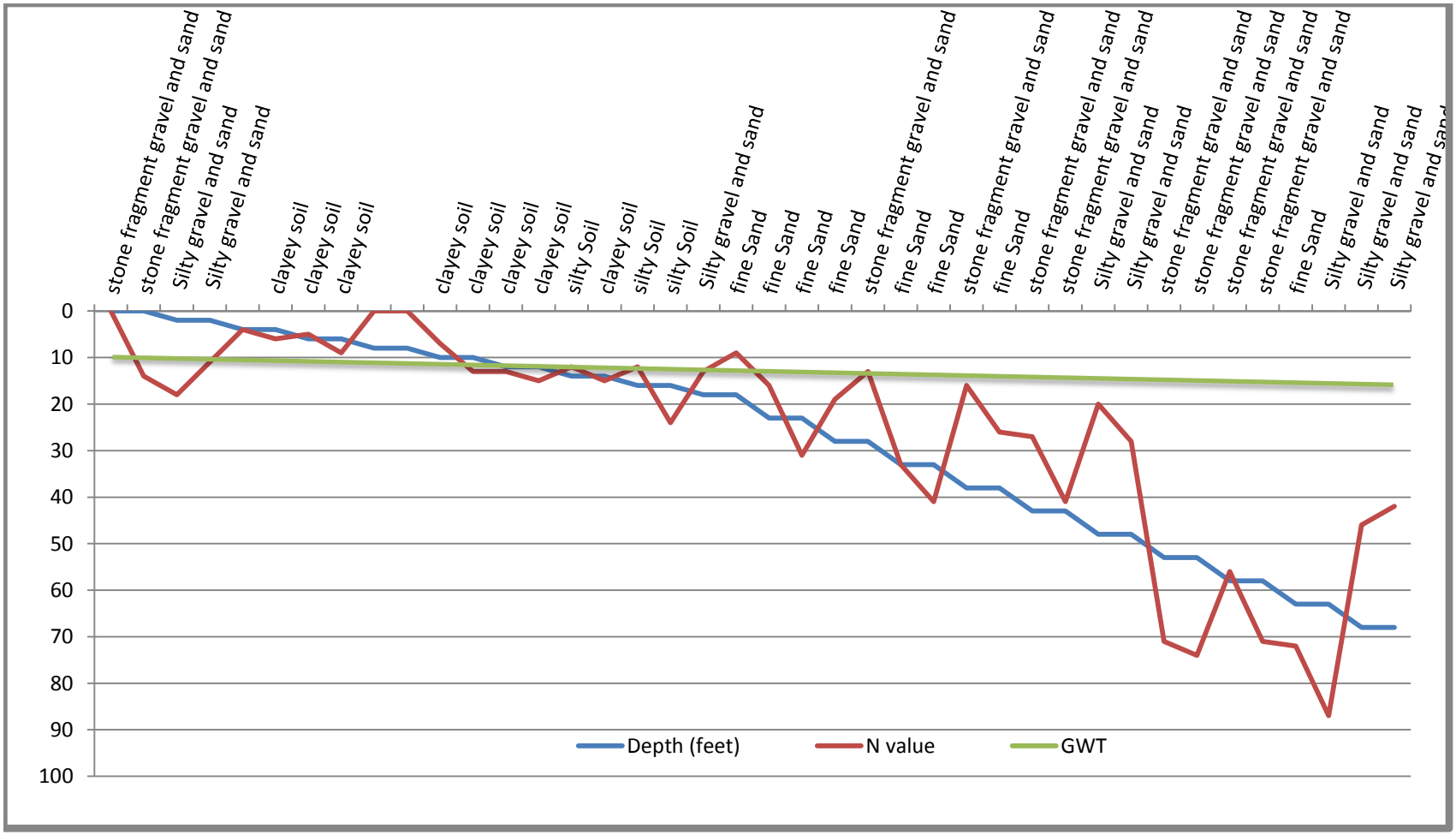
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
CL-1	1		Moist very loose brown fine to coarse sand and fine gravel w/trace silt.	NV	NP	11.7	SP-SM	A-1-b	64.1	8.2	4			
	2	2	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	9.8	SM	A-2-4(0)	98.9	16.3	6	11	7	5
	3	4	No Recovery								2	2	2	4
	4	6	Wet firm gray silty clay w/some fine sand, trace of coarse sand.	38.1	16.5	27.8	CL	A-6(14)	100	85.9	1	2	3	3
	U-1	8	No Recovery											
	6	10	Wet firm gray clay w/some silt, trace of fine sand.	48.5	23.7	29	CL	A-7-6(25)	100	96	1	2	5	7
	7	12	Wet stiff gray clay w/some very sand and silt.	42.3	19.3	28.1	CL	A-7-6(16)	100	80.8	4	4	9	10
	8	14	Wet stiff gray clayey fine sandy silt coarse sand.	34	9.8	26.7	CL	A-4(5)	99.8	66.2	1	5	7	7
	9	16	Wet stiff gray clayey fine sandy silt w/trace coarse sand.	26.6	6.5	22.6	SC-SM	A-4(1)	100	48.3	3	5	7	16
	10	18	Wet medium dense gray fine sand w/some silt , trace of coarse sand.	NV	NP	22.3	SM	A-2-4(0)	100	17.4	4	8	5	5
	11	23	Wet medium dense gray fine sand w/some coarse sand, trace of silt.	NV	NP	21.7	SP-SM	A-3	100	7.6	5	7	9	10
	12	28	Wet medium dense gray fine to coarse sand w/trace silt.	NV	NP	23	SP-SM	A-3	100	7.5	7	8	11	14
	13	33	Wet dense orange fine to coarse sand w trace fine gravel and silt.	NV	NP	19.9	SP-SM	A-3	98.2	8.5	5	15	18	20
	14	38	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.6	SW-SM	A-1-b	95.2	6.8	2	7	9	15
	15	43	Wet medium dense gray coarse to fine sand w/trace silt.	NV	NP	13.3	SP	A-1-b	99.8	4.6	2	9	18	25
	16	48	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	26.7	SM	A-2-4(0)	99.4	19.7	7	9	11	14
	17	53	Wet dense orange coarse to fine sand w trace fine gravel and silt.	NV	NP	15.7	SW-SM	A-1-b	98.9	8.9	4	15	21	29
	18	58	Wet medium dense gray coarse to fine sand w/trace silt.	NV	NP	16.3	SP	A-1-b	100	4.3	4	6	6	6
	19	63	Wet dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	15.3	SP-SM	A-3	94.3	8.9	6	11	22	26
	20	68	Wet dense brown silty fine to coarse sand w/trace fine gravel.	NV	NP	17.7	SM	A-2-4(0)	95.5	24.2	8	18	28	33
		70	End Boring											
CL-2	1		Moist medium dense brown coarse sandy fine gravel w/some fine sand, trace of silt.	NV	NP	7.9	SP-SM	A-1-b	52.3	8.1	14	7	7	
	2	2	Moist medium dense brown silty fine to coarse sand w/trace fine gravel.	NV	NP	11.7	SM	A-2-4(0)	99.1	21.2	7	6	5	4
	3	4	Saturated firm brown silty fine sandy clay w/trace coarse sand.	38.1	15	37	CL	A-6(10)	100	72.2	2	3	3	3
	4	6	Saturated stiff brown silty clay w/trace fine to coarse sand.	38.6	17.3	28.2	CL	A-6(16)	100	89	3	3	6	8
	U-1	8	No Recovery											
	6	10	Saturated stiff gray silty clay w/trace fine to coarse sand.	48.5	25.3	31.2	CL	A-7-6(28)	100	97.7	5	5	8	8
	7	12	Saturated stiff gray silty clay w/trace fine sand.	44.5	21.9	28.2	CL	A-7-6(21)	100	91	4	6	9	10
	8	14	Saturated stiff gray silty fine sandy clay w/trace coarse sand.	38	12.4	31.8	ML	A-6(8)	100	72.2	4	6	9	11
	9	16	Saturated very stiff gray fine sandy silt w/some clay, trace of coarse sand.	25.5	4.3	23.6	CL-ML	A-4(0)	100	50.4	4	10	14	20
	10	18	Saturated loose gray fine sand w/trace coarse sand and silt.	NV	NP	25	SP-SM	A-3	100	9.8	3	3	6	6
	11	23	Saturated dense gray fine to coarse sand w/trace silt.	NV	NP	19.2	SP-SM	A-3	100	7.3	2	15	16	15
	12	28	Saturated medium dense gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	21.3	SM	A-1-b	96.4	17.4	5	5	8	11
	13	33	Saturated dense gray fine to coarse sand w/trace silt and fine gravel.	NV	NP	20.2	SP-SM	A-3	97.6	9.7	14	20	21	21
	14	38	Saturated medium dense orange fine to coarse sand w/trace silt and fine gravel.	NV	NP	20.5	SP-SM	A-3	99.3	8.6	5	10	16	25
	15	43	Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.4	SW-SM	A-1-b	97.7	6	10	20	21	19
	16	48	Saturated medium dense orange silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	25.9	SM	A-2-4(0)	97.9	23.1	10	13	15	18
	17	53	Saturated dense orange coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	14.5	SP-SM	A-1-b	97.4	10.9	16	19	24	32
	18	58	Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.5	SW-SM	A-1-b	90.1	6.2	15	15	21	23
	19	63	Saturated very dense orange fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	21.3	SP-SM	A-2-4(0)	98.6	11.1	19	30	37	37
	20	68	Saturated dense orange fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	27.8	SM	A-2-4(0)	96.9	16.5	13	19	23	31
		70	End Boring											

DATE : 3-22-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-576 along Whitesville road on North Fork Green Run- Millsboro DE



DATE : 3-22-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-576 along Whitesville road on North Fork Green Run- Millsboro DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-12-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-626 on Ellendale Forest road over Number One Prong - Ellendale DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-15-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated in Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Ellendale Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-101. The nearest well to this site the groundwater historically had been measured as 46 feet

on October 1960 and between the years of 1950 to 1962 appeared from 42 to 47 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 17 feet down is Silty soils (A-4), from 17 to 42 feet down is clayey soil (A-7) and from 42 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 9 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good to excellent category.

5. Ground Cover

The ground cover for this site is 3 to 4 inches of asphalt. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 7.1 and 8.0 feet and caved at 4 and 5.1 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 8.1 to 48.5 percent. The Atterberg limit is 8 percent, Liquid limits is 19.9 to 44.5 percent and Plasticity Index is 11 percent. Organic matter is 5 percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition and 4 feet in thickness of loose fine sand layer appeared at 10 feet down from the surface elevation this layer needs to be considered in the design. In addition the entire sample from the depth of 2 to 10 feet

from the surface had been met all borrow type material according to Del-DOT standard specification with very good amount to reuse except borrow type ”B”.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

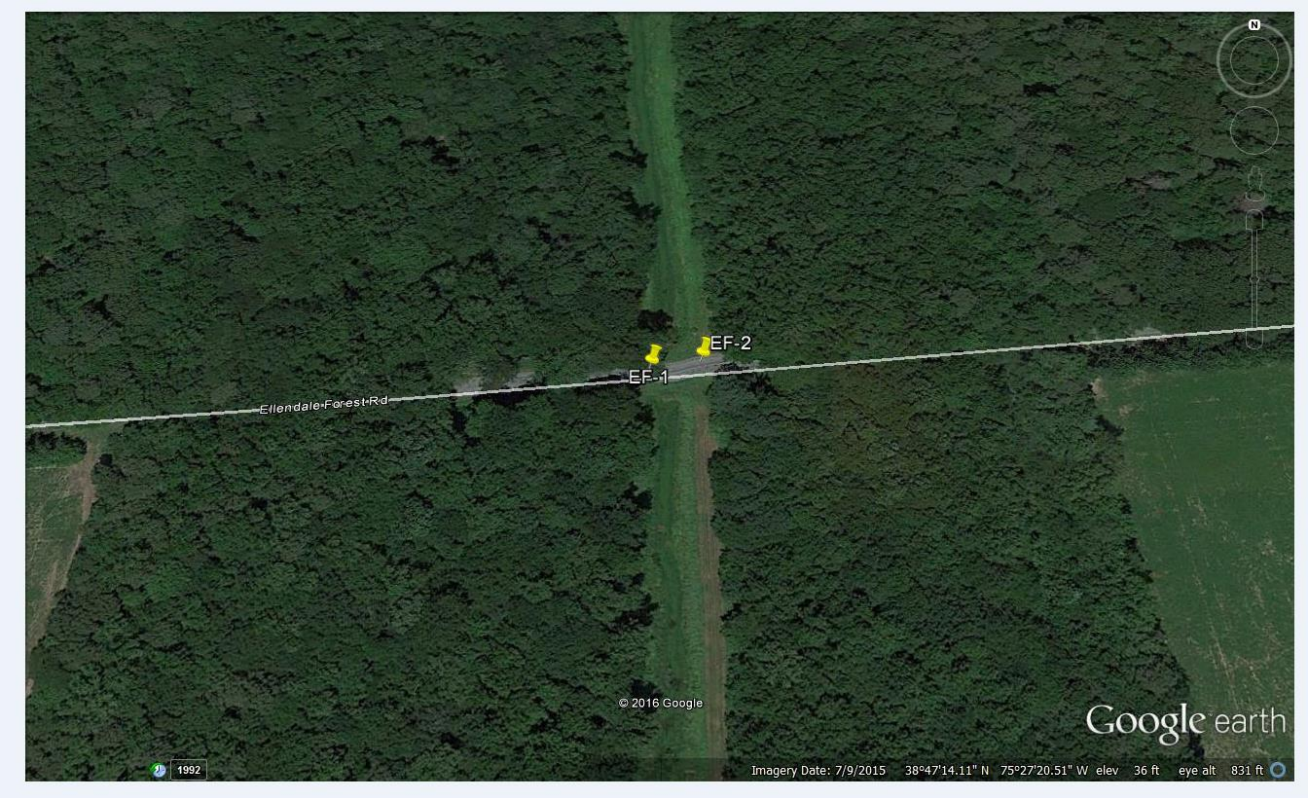
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **5-12-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR3-626 on Ellendale Forest road over Number One Prong - Ellendale DE**



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
EF-1	286732.232	645030.548	38.7873222	-75.4557333
EF-2	286737.272	645074.100	38.7873361	-75.4555806

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING EF-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 286732.232
Easting: 645030.548
Boring Surface Elev.:
Reference:
Date Started: 3/15/16
Date Completed: 3/15/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/15/16	8.0	
3/15/16	Dry	4.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	2 2 3 5	Saturated firm gray fine sandy silt w/trace coarse sand and fine gravel. 20" RECOVERY	A-4(0)	Hot-mix 4"
2.53		2	2.0' 4.0'	3 5 5 7	Saturated loose gray fine to coarse sand w/ some silt, trace of fine gravel. 16" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	6 7 5 6	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt. 19" RECOVERY	A-3	
7.59		4	6.0' 8.0'	2 3 3 4	Saturated loose gray fine to coarse sand w/ some silt. 17" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' 10.0'	4 5 6 5	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt. 23" RECOVERY	A-3	
		6	10.0' 12.0'	2 2 2 2	Saturated very loose gray silty fine sand w/ some coarse sand, trace of fine gravel. 23" RECOVERY	A-2-4(0)	
12.65		7	12.0'	5 7 6 5	Saturated dense medium gray fine to coarse sand w/trace silt and fine gravel.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** EF-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		19" RECOVERY		
15.18		8	14.0' 16.0'	3 3 5 7	Saturated loose gray coarse to fine sand w/ trace fine gravel and silt. 23" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	8 7 8 6	Saturated medium dense gray silty coarse to fine sand w/trace fine gravel. 17" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	13 8 8 8	Saturated medium dense gray fine gravelly coarse to fine sand w/trace silt. 15" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	8 6 8 10	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt. 17" RECOVERY	A-1-b	
30.36		12	28.0' 30.0'	7 9 8 9	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 14" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	5 6 6 7	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 14" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** EF-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	8 7 8 9	Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt. 24" RECOVERY	A-1-b	
40.48							
43.01							
		15	44.0' 46.0'	4 5 4 5	No Recovery NR" RECOVERY		
45.54							
48.07							
		16	48.0' 50.0'	11 12 16 13	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 18" RECOVERY	A-1-b	
50.6							
53.13							
		17	54.0' 56.0'	8 7 7 10	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
55.66							
58.19		18	58.0'	17 15 13 17	Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: EF-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		13" RECOVERY		
60.72							
63.25							
		19	64.0'	7 7 8 10	Saturated medium dense brown coarse sand and fine gravel w/trace fine sand and silt.	A-1-a	
65.78			66.0'		20" RECOVERY		
68.31		20	68.0'	6 7 9 8	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	A-1-b	
			70.0'		23" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING EF-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 286737.272
Easting: 645074.100
Boring Surface Elev.:
Reference:
Date Started: 3/15/16
Date Completed: 3/15/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/15/16	7.1	
3/15/16	5.3	5.10

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' – 2.0'		Moist gray coarse to fine sand w/some fine gravel and silt. 21" RECOVERY	A-2-4(0)	Hot-mix 3"
2.53		2	2.0' – 4.0'	7 6 6 7	Saturated stiff gray clayey fine sandy silt w/ some coarse sand and organic matter. 24" RECOVERY	A-5(5)	
5.06	▼	3	4.0' – 6.0'	1 5 6 8	Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter. 20" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' – 8.0'	7 8 4 7	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12		5	8.0' – 10.0'	1 3 5 5	Saturated loose gray fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
		6	10.0' – 12.0'	2 3 4 6	Saturated loose gray fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0'	8 6 8 8	Saturated medium dense gray fine sand w/ some coarse sand and silt, trace of fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** EF-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 1 1 3	Saturated very loose gray fine sand w/some coarse sand and silt, trace of fine gravel. 16" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	2 3 5 6	Saturated loose gray coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	4 6 9 9	Saturated medium dense gray coarse sand w/ some fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	16 8 8 7	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-1-b	
30.36		12	29.0' 31.0'	5 7 7 9	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	20 17 12 12	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt. 20" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003

Boring No.: EF-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	7 7 9 11	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	6 12 19 17	Saturated dense brown coarse to fine sand w/ some fine gravel, trace of silt. 10" RECOVERY	A-1-b	
48.07							
50.6		16	49.0' 51.0'	7 15 17 21	Saturated dense brown coarse sand w/some fine sand and fine gravel, trace of silt. 20" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	5 15 16 16	Saturated dense brown coarse to fine sand w/ some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
58.19							
				10			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** EF-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	12 12 13	Saturated medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	A-1-b	
60.72			61.0'		18" RECOVERY		
63.25							
		19	64.0'	7 9 12 9	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	A-1-b	
65.78			66.0'		18" RECOVERY		
68.31		20	68.0'	5 7 9 12	Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	A-1-b	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Elastic Silts
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

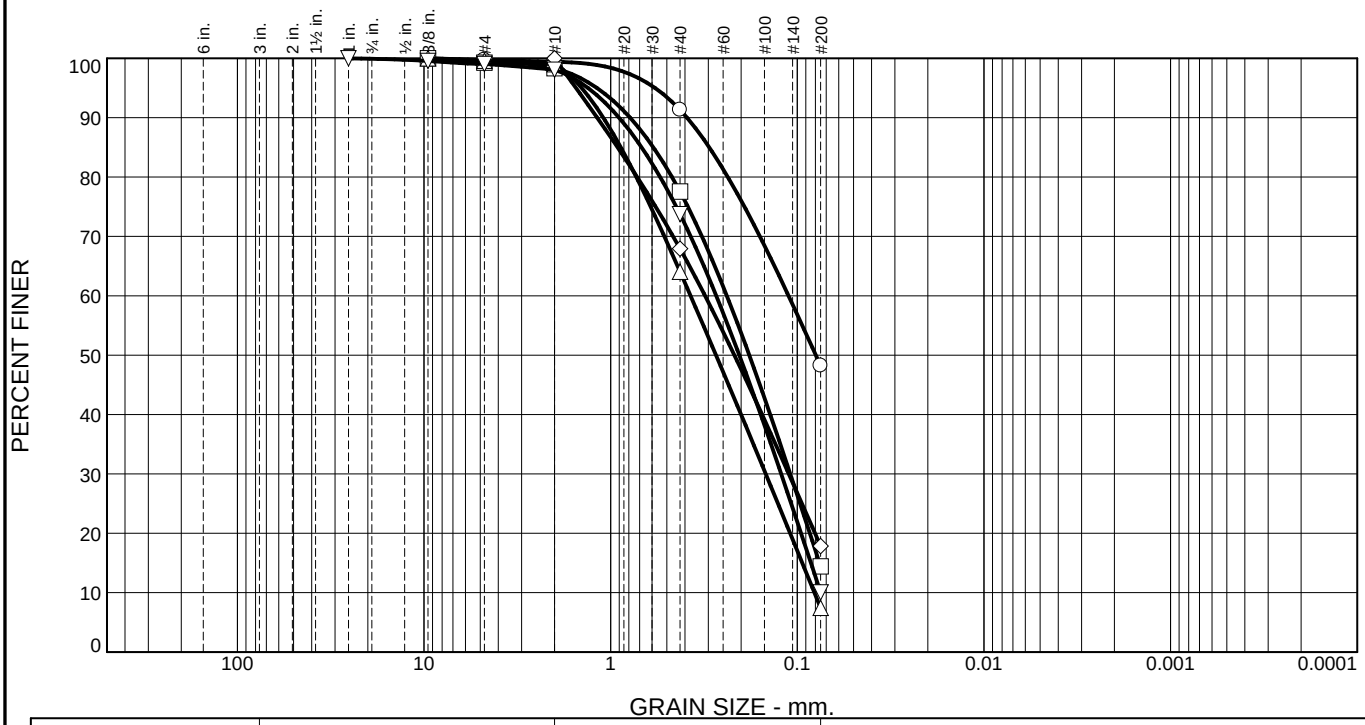
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.6	8.1	43.1	48.2	
□	0.0	1.7	20.7	63.2	14.4	
△	0.0	1.0	34.9	56.7	7.4	
◇	0.0	0.0	32.1	50.0	17.9	
▽	0.0	1.9	24.3	63.8	10.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40.3	NP	0.2963	0.1115	0.0796					
□	NV	NP	0.5905	0.2385	0.1809	0.1091	0.0760			
△	NV	NP	0.8821	0.3733	0.2725	0.1477	0.0941	0.0810	0.72	4.61
◇	NV	NP	0.9181	0.3119	0.2173	0.1111				
▽	NV	NP	0.6826	0.2717	0.2047	0.1221	0.0846			

Material Description	USCS	AASHTO
○ Saturated firm gray fine sandy silt w/trace coarse sand and fine gravel.	SM	A-4(0)
□ Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Saturated loose gray fine to coarse sand w/some silt.	SM	A-2-4(0)
▽ Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** EF-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** EF-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** EF-1 **Depth:** 6.0 **Sample Number:** 4

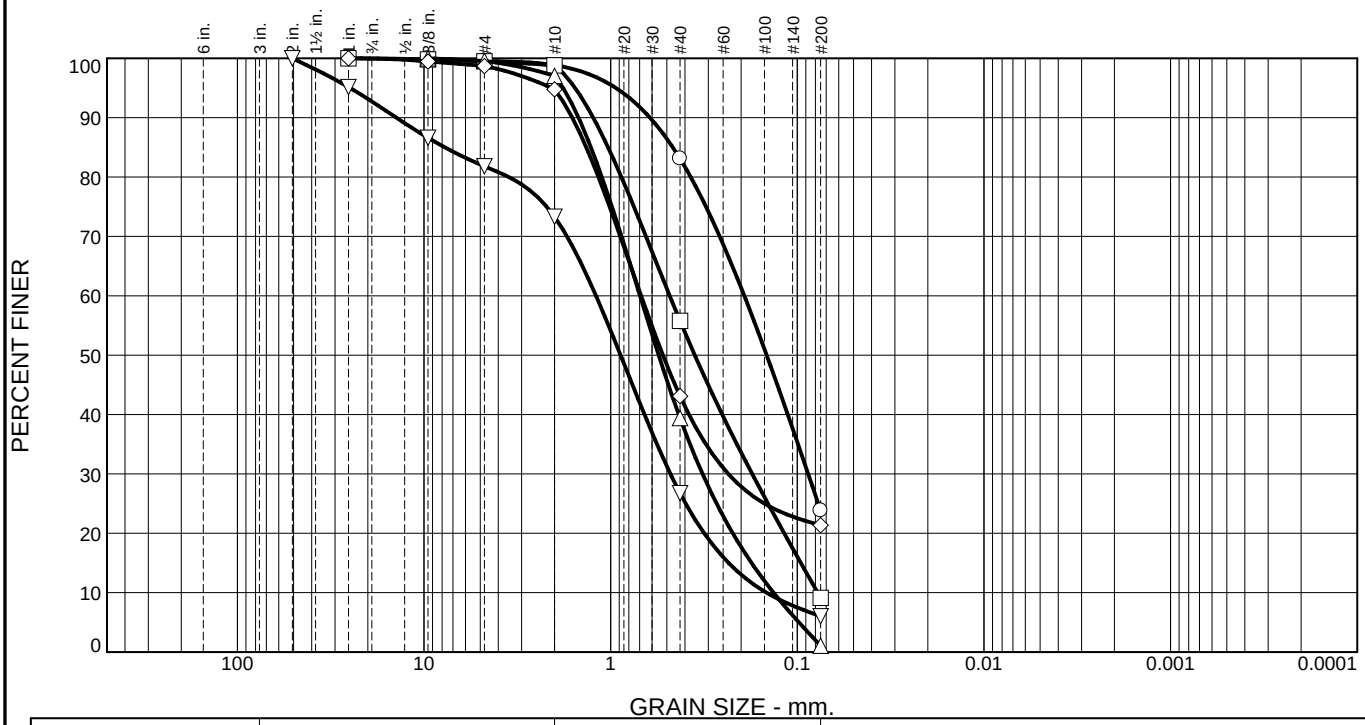
▽ **Source of Sample:** EF-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.2	15.7	59.3	23.8	
□	0.0	1.2	43.0	46.7	9.1	
△	0.0	2.9	57.7	38.3	1.1	
◇	0.0	5.2	51.7	21.7	21.4	
▽	0.0	26.7	46.5	20.8	6.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4643	0.1923	0.1460	0.0875				
□	NV	NP	1.0324	0.4826	0.3542	0.1746	0.0957	0.0778	0.81	6.20
△	NV	NP	1.2764	0.6962	0.5532	0.3219	0.1760	0.1342	1.11	5.19
◇	NV	NP	1.3508	0.6867	0.5247	0.2341				
▽	NV	NP	7.7328	1.1990	0.8849	0.4783	0.2333	0.1464	1.30	8.19

Material Description	USCS	AASHTO
○ Saturated very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
□ Saturated dense medium gray fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
△ Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Saturated medium dense gray silty coarse to fine sand w/trace fine gravel.	SM	A-1-b
▽ Saturated medium dense gray fine gravelly coarse to fine sand w/trace silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** EF-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** EF-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** EF-1 **Depth:** 16.0 **Sample Number:** 9

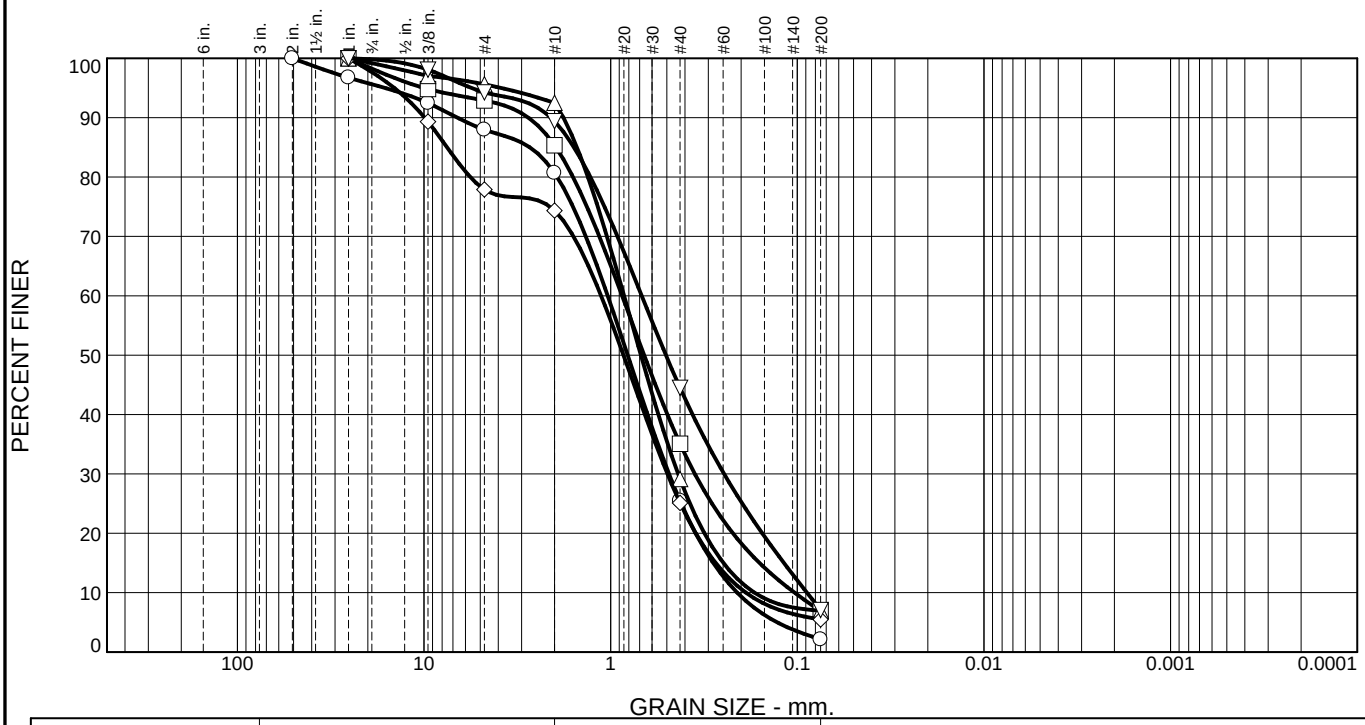
▽ **Source of Sample:** EF-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	19.3	55.2	23.4	2.1	
□	0.0	14.6	50.3	28.2	6.9	
△	0.0	7.5	63.4	22.1	7.0	
◇	0.0	25.6	49.3	19.6	5.5	
▽	0.0	10.6	44.9	37.4	7.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.7132	1.0375	0.8105	0.4867	0.2820	0.2099	1.09	4.94
□	NV	NP	1.9649	0.8683	0.6615	0.3539	0.1595	0.1034	1.39	8.40
△	NV	NP	1.5163	0.8471	0.6886	0.4352	0.2489	0.1699	1.32	4.99
◇	NV	NP	7.5265	1.1252	0.8538	0.4965	0.2737	0.1887	1.16	5.96
▽	NV	NP	1.5728	0.6817	0.5057	0.2467	0.1180	0.0888	1.01	7.67

Material Description	USCS	AASHTO
○ Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	SP	A-1-b
□ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
△ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
◇ Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SP-SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** EF-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** EF-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** EF-1 **Depth:** 38.0 **Sample Number:** 14

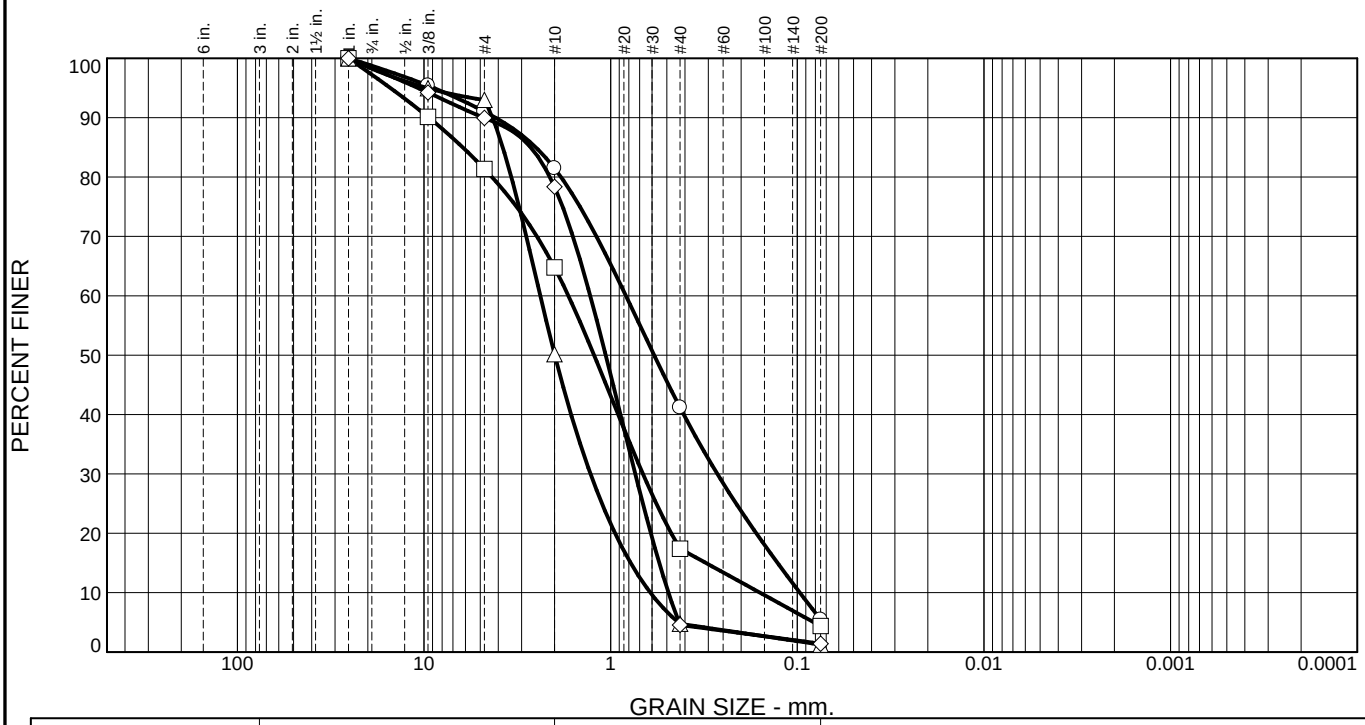
▽ **Source of Sample:** EF-1 **Depth:** 48.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	18.5	40.3	35.8	5.4	
□	0.0	35.2	47.4	13.0	4.4	
△	0.0	49.8	45.4	3.5	1.3	
◇	0.0	21.6	73.8	3.2	1.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.5191	0.8285	0.5849	0.2681	0.1276	0.0969	0.89	8.55
□	NV	NP	6.2002	1.6857	1.2275	0.6715	0.3086	0.1586	1.69	10.63
△	NV	NP	3.7834	2.3830	1.9940	1.2825	0.7813	0.6129	1.13	3.89
◇	NV	NP	2.6800	1.2867	1.0631	0.7383	0.5491	0.4901	0.86	2.63

Material Description	USCS	AASHTO
○ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
□ Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SW	A-1-b
△ Saturated medium dense brown coarse sand and fine gravel w/trace fine sand and silt.	SP	A-1-a
◇ Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-1 **Depth:** 54.0 **Sample Number:** 17

□ **Source of Sample:** EF-1 **Depth:** 58.0 **Sample Number:** 18

△ **Source of Sample:** EF-1 **Depth:** 64.0 **Sample Number:** 19

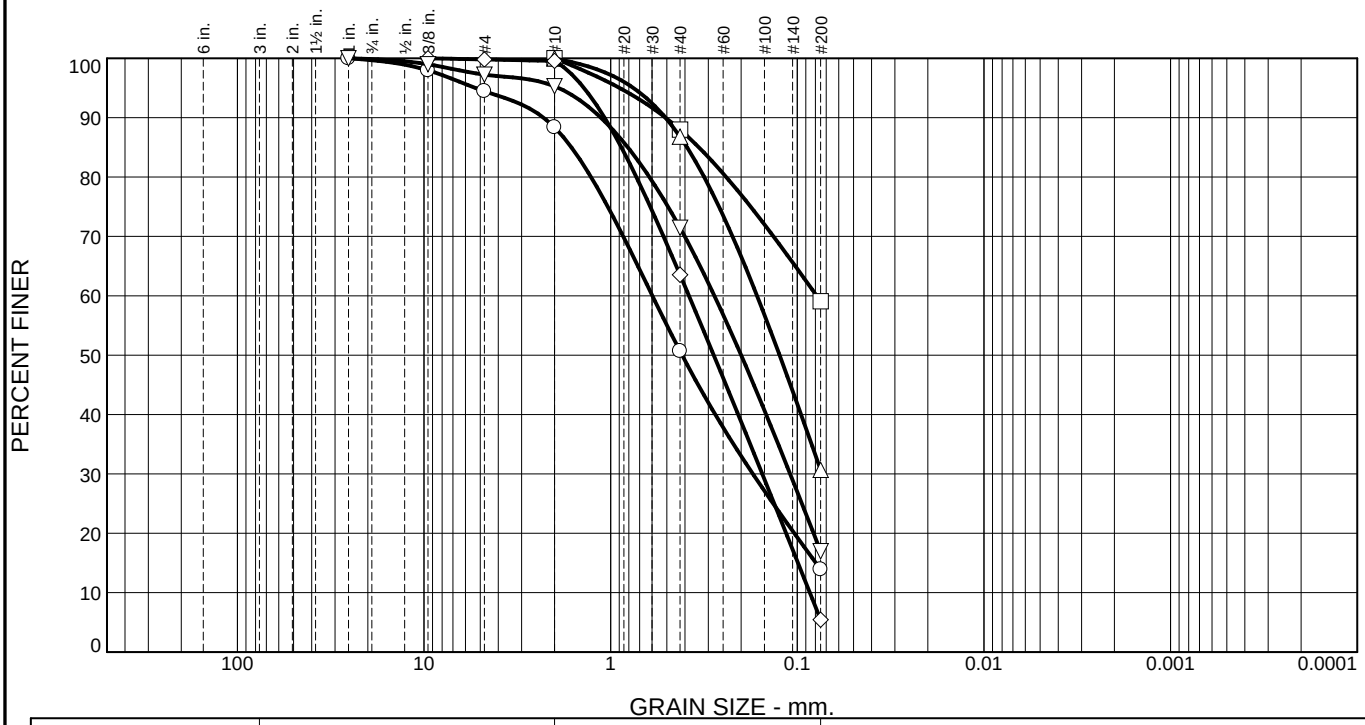
◇ **Source of Sample:** EF-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.6	37.7	36.8	13.9	
□	0.0	0.0	12.0	28.9	59.1	
△	0.0	0.0	13.2	56.1	30.7	
◇	0.0	0.4	36.1	58.1	5.4	
▽	0.0	4.7	23.8	54.5	17.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6228	0.5975	0.4141	0.1730	0.0795			
□	44.5	33.5	0.3368	0.0787						
△	19.9	NP	0.3896	0.1644	0.1245					
◇	NV	NP	0.8761	0.3807	0.2803	0.1542	0.0992	0.0857	0.73	4.44
▽	NV	NP	0.8094	0.2780	0.2000	0.1093				

Material Description	USCS	AASHTO
○ Moist gray coarse to fine sand w/some fine gravel and silt.	SM	A-2-4(0)
□ Saturated stiff gray clayey fine sandy silt w/some coarse sand and organic matter.	ML	A-5(5)
△ Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter.	SM	A-2-4(0)
◇ Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** EF-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** EF-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** EF-2 **Depth:** 6.0 **Sample Number:** 4

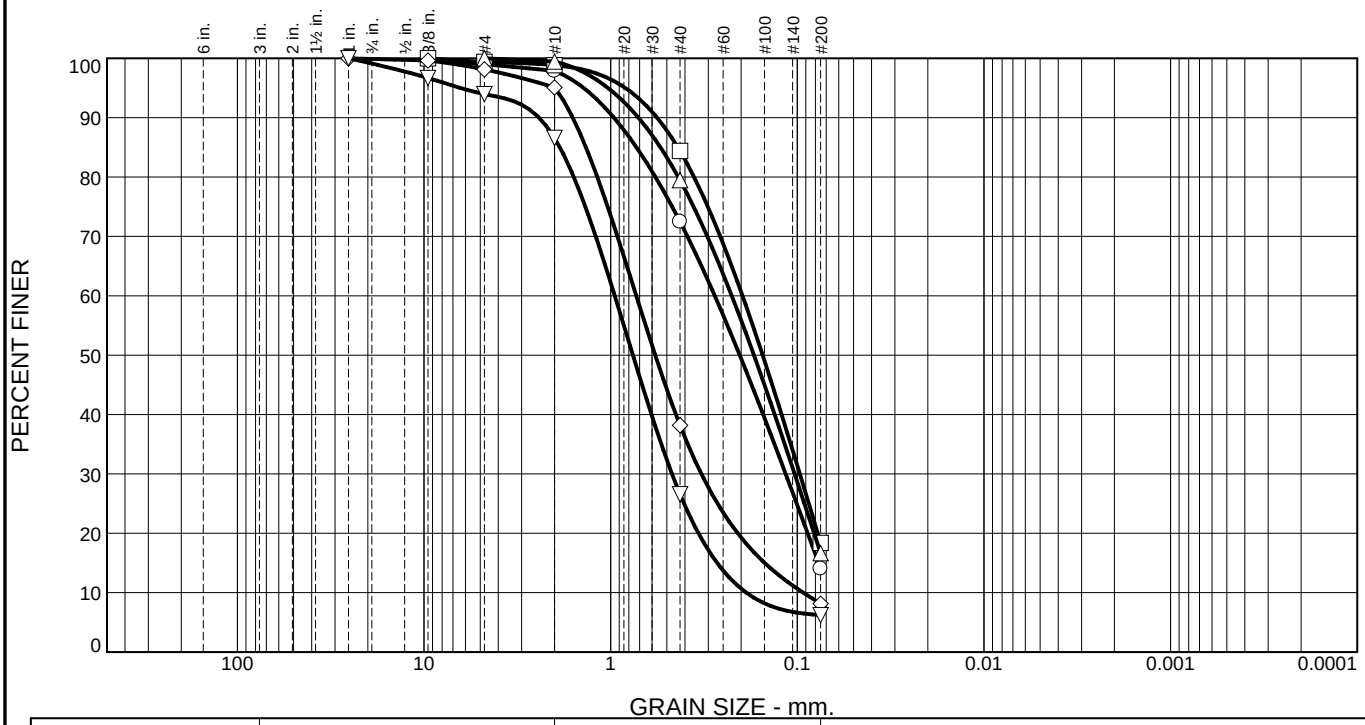
▽ **Source of Sample:** EF-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.1	25.4	58.5	14.0	
□	0.0	1.2	14.4	66.0	18.4	
△	0.0	0.5	20.0	62.8	16.7	
◇	0.0	4.9	56.9	30.1	8.1	
▽	0.0	13.4	60.0	20.4	6.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7271	0.2767	0.2035	0.1155	0.0769			
□	NV	NP	0.4365	0.1967	0.1534	0.0970				
△	NV	NP	0.5411	0.2245	0.1708	0.1034				
◇	NV	NP	1.3570	0.7291	0.5769	0.3266	0.1496	0.0929	1.57	7.85
▽	NV	NP	1.8711	0.9508	0.7599	0.4693	0.2687	0.1878	1.23	5.06

Material Description	USCS	AASHTO
○ Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated medium dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated very loose gray fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
◇ Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated medium dense gray coarse sand w/some fine sand and fine gravel, trace of silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** EF-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** EF-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** EF-2 **Depth:** 16.0 **Sample Number:** 9

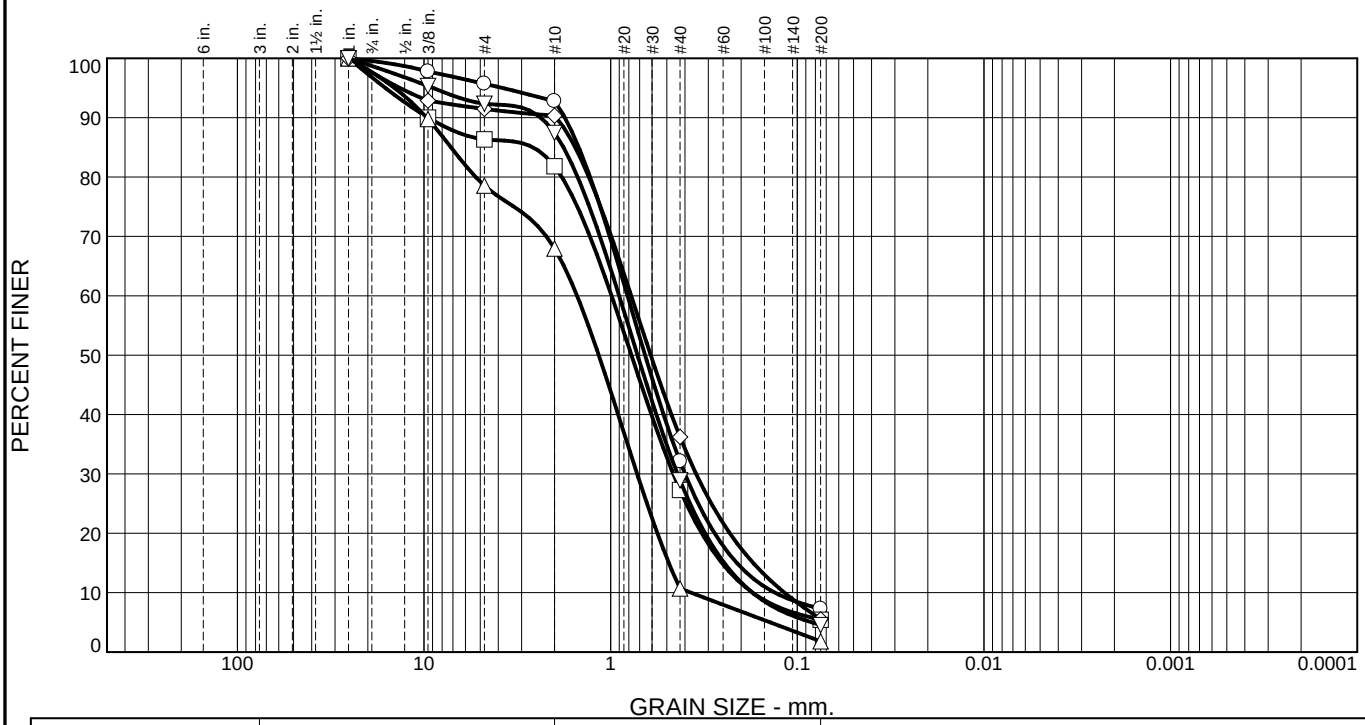
▽ **Source of Sample:** EF-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.2	60.7	24.8	7.3	
□	0.0	18.2	54.5	21.9	5.4	
△	0.0	32.0	57.3	8.9	1.8	
◇	0.0	9.7	54.1	30.7	5.5	
▽	0.0	12.6	58.5	24.4	4.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4827	0.8122	0.6541	0.3999	0.2109	0.1319	1.49	6.16
□	NV	NP	2.6048	0.9892	0.7740	0.4617	0.2535	0.1737	1.24	5.69
△	NV	NP	7.1704	1.5137	1.1586	0.7211	0.4882	0.3715	0.92	4.07
◇	NV	NP	1.5488	0.7762	0.6100	0.3484	0.1724	0.1172	1.33	6.62
▽	NV	NP	1.7905	0.9009	0.7180	0.4387	0.2462	0.1741	1.23	5.18

Material Description	USCS	AASHTO
○ Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
△ Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	SP	A-1-b
◇ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** EF-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** EF-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** EF-2 **Depth:** 39.0 **Sample Number:** 14

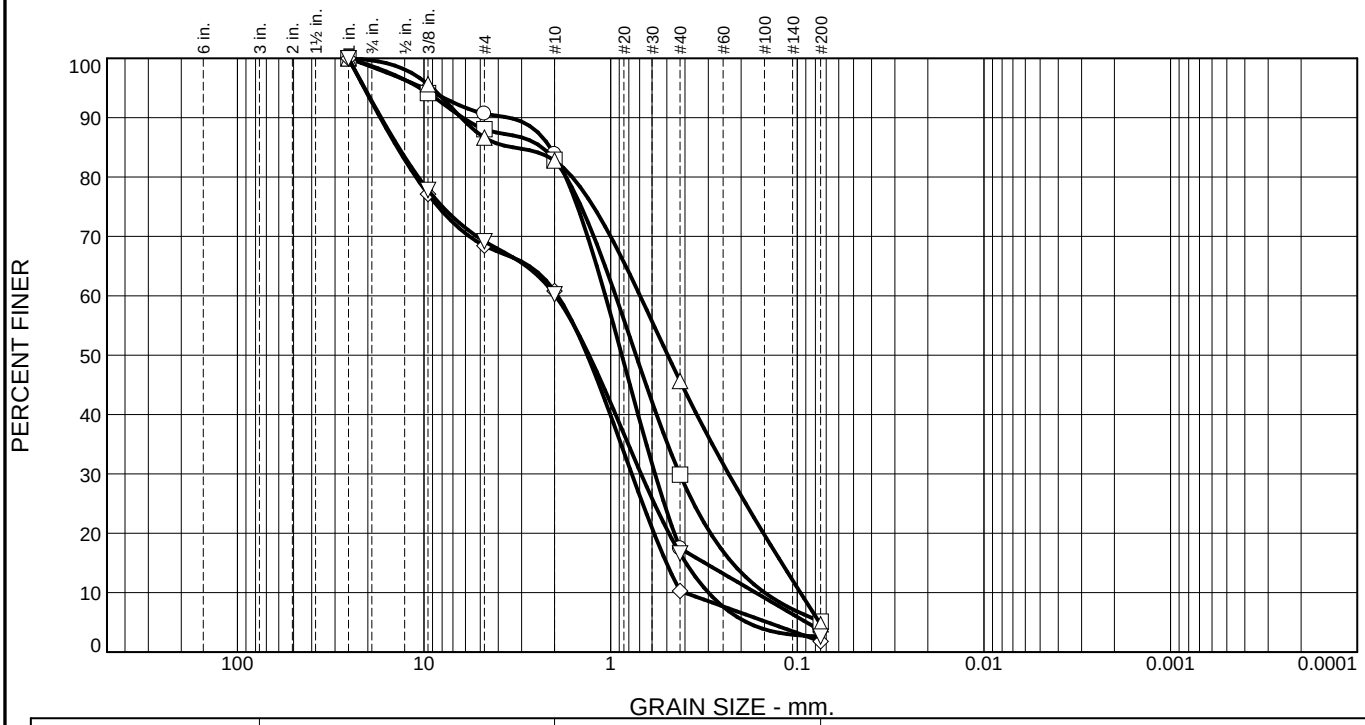
▽ **Source of Sample:** EF-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	16.1	66.4	13.9	3.6	
□	0.0	17.1	53.0	24.8	5.1	
△	0.0	17.2	37.1	41.0	4.7	
◇	0.0	39.2	50.5	8.5	1.8	
▽	0.0	39.8	43.6	14.0	2.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.1072	1.0673	0.8712	0.5784	0.3125	0.1670	1.88	6.39
□	NV	NP	2.3347	0.9407	0.7320	0.4267	0.2228	0.1497	1.29	6.28
△	NV	NP	3.3387	0.6958	0.4945	0.2333	0.1212	0.0962	0.81	7.23
◇	NV	NP	13.9240	1.9211	1.3338	0.7710	0.5022	0.4010	0.77	4.79
▽	NV	NP	13.6709	1.9744	1.3055	0.6874	0.3954	0.2993	0.80	6.60

Material Description	USCS	AASHTO
○ Saturated dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	SW	A-1-b
□ Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b
△ Saturated medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	SP	A-1-b
◇ Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	SP	A-1-b
▽ Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** EF-2 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** EF-2 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** EF-2 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** EF-2 **Depth:** 64.0 **Sample Number:** 19

▽ **Source of Sample:** EF-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

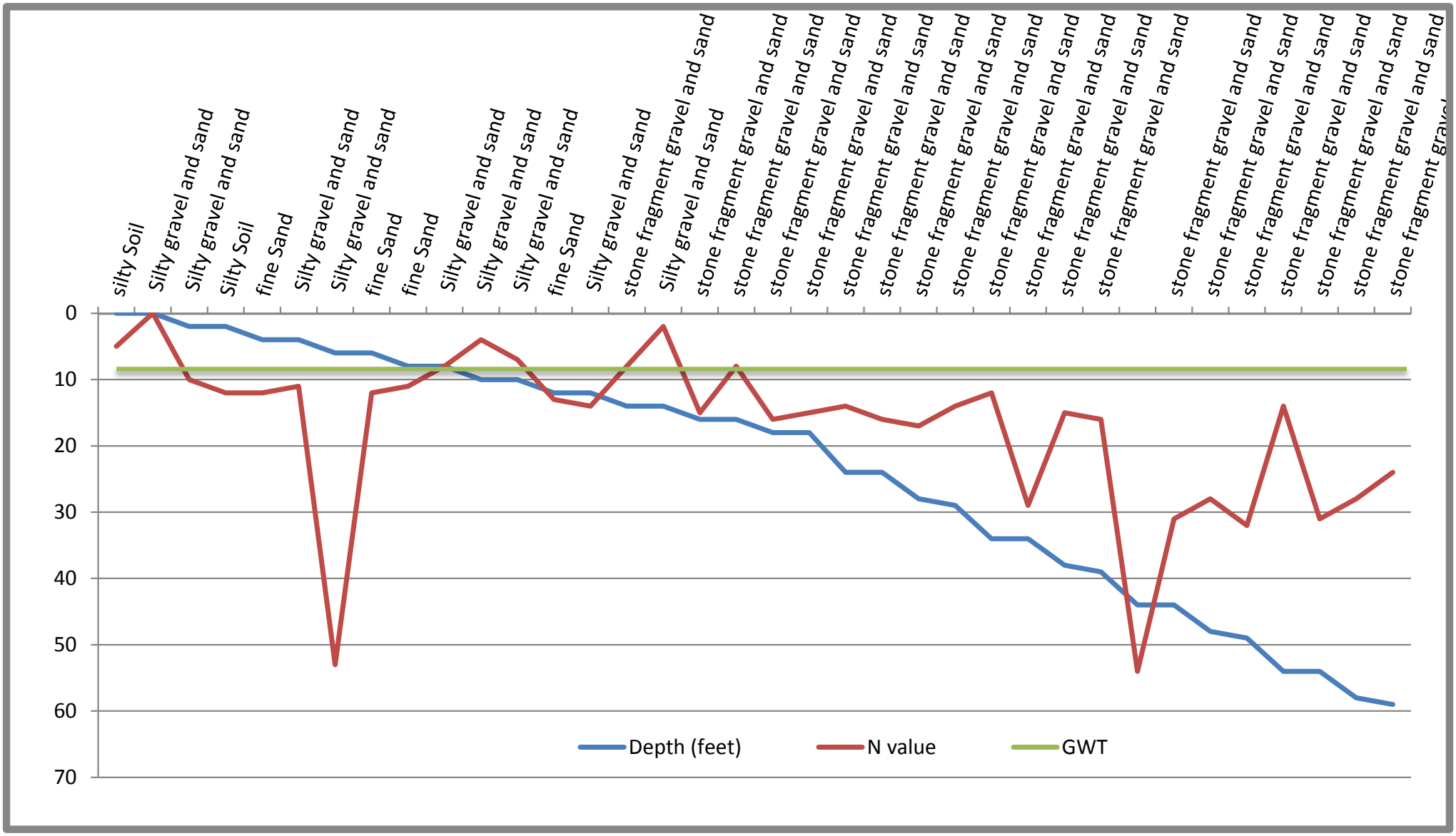
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
FT-1	1		Saturated firm gray fine sandy silt w/trace coarse sand and fine gravel.	40.3	NP	48.5	SM	A-4(0)	99.4	48.2	2	2	3	5
	2	2	Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	21.5	SM	A-2-4(0)	98.3	14.4	3	5	5	7
	3	4	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	22	SP-SM	A-3	99	7.4	6	7	5	6
	4	6	Saturated loose gray fine to coarse sand w/some silt.	NV	NP	28	SM	A-2-4(0)	100	17.9	2	3	3	4
	5	8	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	34	SP-SM	A-3	98.1	10	4	5	6	5
	6	10	Saturated very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	34.6	SM	A-2-4(0)	98.8	23.8	2	2	2	2
	7	12	Saturated dense medium gray fine to coarse sand w/trace silt and fine gravel.	NV	NP	25.5	SP-SM	A-3	98.8	9.1	5	7	6	5
	8	14	Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	22.2	SP	A-1-b	97.1	1.1	3	3	5	7
	9	16	Saturated medium dense gray silty coarse to fine sand w/trace fine gravel.	NV	NP	14.6	SM	A-1-b	94.8	21.4	8	7	8	6
	10	18	Saturated medium dense gray fine gravelly coarse to fine sand w/trace silt.	NV	NP	17.6	SW-SM	A-1-b	73.3	6	13	8	8	8
	11	24	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	14.7	SP	A-1-b	80.7	2.1	8	6	8	10
	12	28	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	20.9	SW-SM	A-1-b	85.4	6.9	7	9	8	9
	13	34	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.7	SP-SM	A-1-b	92.5	7	5	6	6	7
	14	38	Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	21.2	SP-SM	A-1-b	74.4	5.5	8	7	8	9
	15	44	No Recovery								4	5	4	5
	16	48	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	20.4	SW-SM	A-1-b	89.4	7.1	11	12	16	13
	17	54	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	22	SP-SM	A-1-b	81.5	5.4	8	7	7	10
	18	58	Saturated medium dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	16.1	SW	A-1-b	64.8	4.4	17	15	13	17
	19	64	Saturated medium dense brown coarse sand and fine gravel w/trace fine sand and silt.	NV	NP	19.5	SP	A-1-a	50.2	1.3	7	7	8	10
	20	68	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	20.1	SP	A-1-b	78.4	1.4	6	7	9	8
		70	End Boring											
FT-2														
	1		Moist gray coarse to fine sand w/some fine gravel and silt.	NV	NP	8.1	SM	A-2-4(0)	88.4	13.9				
	2	2	Saturated stiff gray clayey fine sandy silt w/some coarse sand and organic matter.	44.5	11	38.1	ML	A-5(5)	100	59.1	7	6	6	7
	3	4	Saturated medium dense gray silty fine sand w/some coarse sand, trace of organic matter.	19.9	NP	23.2	SM	A-2-4(0)	100	30.7	1	5	6	8
	4	6	Saturated medium dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.9	SP-SM	A-3	99.6	5.4	7	8	4	7
	5	8	Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	26.8	SM	A-2-4(0)	95.3	17	1	3	5	5
	6	10	Saturated loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	24.5	SM	A-2-4(0)	97.9	14	2	3	4	6
	7	12	Saturated medium dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	22.8	SM	A-2-4(0)	98.8	18.4	8	6	8	8
	8	14	Saturated very loose gray fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	29.1	SM	A-2-4(0)	99.5	16.7	1	1	1	3
	9	16	Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	21	SW-SM	A-1-b	95.1	8.1	2	3	5	6
	10	18	Saturated medium dense gray coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	16.5	SP-SM	A-1-b	86.6	6.2	4	6	9	9
	11	24	Saturated medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	22.1	SW-SM	A-1-b	92.8	7.3	16	8	8	7
	12	29	Saturated medium dense gray coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	18.2	SP-SM	A-1-b	81.8	5.4	5	7	7	9
	13	34	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	13.8	SP	A-1-b	68	1.8	20	17	12	12
	14	39	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.7	SW-SM	A-1-b	90.3	5.5	7	7	9	11
	15	44	Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	21.7	SP	A-1-b	87.4	4.5	6	12	19	17
	16	49	Saturated dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	17	SW	A-1-b	83.9	3.6	7	15	17	21
	17	54	Saturated dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	17.9	SW-SM	A-1-b	82.9	5.1	5	15	16	16
	18	59	Saturated medium dense brown fine to coarse sand w/some fine gravel, trace of silt.	NV	NP	19.4	SP	A-1-b	82.8	4.7	10	12	12	13
	19	64	Saturated medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	14.6	SP	A-1-b	60.8	1.8	7	9	12	9
	20	68	Saturated medium dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	NV	NP	10.9	SP	A-1-b	60.2	2.6	5	7	9	12

DATE : 5-12-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-626 on Ellendale Forest road over Number One Prong - Ellendale DE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10
20
30
40
50
60
70
Depth (feet)
N value
GWT

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-12-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-627 on Sammons road over Number One Prong - Ellendale DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 3-14-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated in Quaternary upland deposits consist of sheets and small dunes of structureless, white to tan to light gray y, fine to very fine sand with discontinuous beds of medium to coarse sand and rare pebbles. Beds of clayey sand and clayey silt are common in areas adjacent to upland swamps. Up to 15 feet in thickness. The unit is recognized by the general lack of sedimentary structures, finer sand sizes and lighter colors than the underlying Beaverdam Fm. Thin pebble layers commonly mark the

contact with the underlying Beaverdam Fm. These deposits are interpreted to be the result of eolian deposition during the cold climate of the late Pleistocene and early Holocene (Andres and Howard, 2000)

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Ellendale Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-101. The nearest well to this site the groundwater historically had been measured as 40 feet on October 1960 and between the years of 1950 to 1962 appeared from 37 to 42 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 17 feet down is Silty soils (A-4), from 17 to 42 feet down is clayey soil (A-7) and from 42 to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 2 inches of asphalt top of 22 inches of fill. More detail show in appendix- B

6. Groundwater

The depth to groundwater was noted during the drilling operations is 4 and 6.8 feet, about 5.9 feet at completion of the drilling and caved at 3.5 and 7.3 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 6.8 to 65.6 percent. The Atterberg limit is 3 percent,

Liquid limits is 38.1 percent and Plasticity Index is 10 percent. Organic matter is 5 percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition and 10 feet in thickness of loose fine sand layer appeared from the surface elevation this layer needs to be considered in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had been met all borrow type material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.
This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

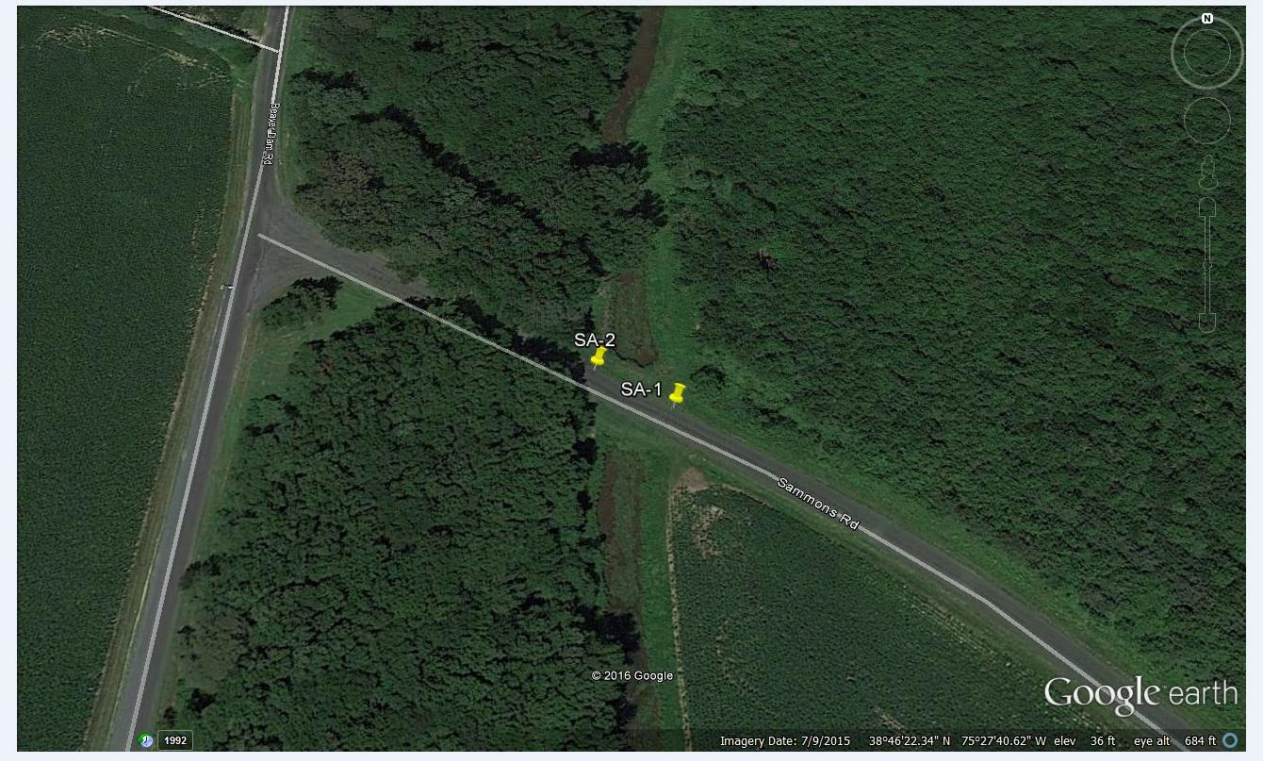
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **5-12-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR3-627 on Sammons road over Number One Prong - Ellendale DE**



Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
SA-1	281442.825	643473.636	38.7727972	-75.4611861
SA-2	281474.214	643418.213	38.7728833	-75.4613806

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING SA-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 281442.825
Easting: 643473.636
Boring Surface Elev.:
Reference: BR3-627
Date Started:
Date Completed:

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/14/16	4.0	
3/14/16	Dry	3.5

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Billy Holden
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
2.53		1	2.0' – 4.0'	4 4 5 3	Wet stiff gray organic clayey fine to coarse sandy silt. 14" RECOVERY	A-4(1)	Hot-mix 2" Fill 22"
5.06	■	2	4.0' – 6.0'	3 2 5 6	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
7.59		3	6.0' – 8.0'	4 5 4 5	Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter. 11" RECOVERY	A-2-4(0)	
10.12		4	8.0' – 10.0'	4 3 4 3	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 14" RECOVERY	A-1-b	
		5	10.0' – 12.0'	2 3 5 4	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 16" RECOVERY	A-1-b	
12.65		6	12.0' – 14.0'	3 5 5 10	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 20" RECOVERY	A-1-b	
15.18		7	14.0'	5 3 4 6	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			16.0'		16" RECOVERY		
		8	16.0'	5 5 5 9	Wet loose brown fine sand and fine gravel w/ some coarse sand, trace of silt.	A-1-b	
17.71			18.0'		6" RECOVERY		
		9	18.0'	4 5 6 5	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	A-1-b	
20.24			20.0'		6" RECOVERY		
22.77							
		10	24.0'	5 5 5 5	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
25.3			26.0'		9" RECOVERY		
27.83							
		11	28.0'	2 2 3 5	Wet loose brown coarse sand w/some fine sand and fine gravel, trace of silt.	A-1-b	
30.36			30.0'		10" RECOVERY		
32.89							
		12	34.0'	4 4 5 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
35.42			36.0'		18" RECOVERY		
37.95							
		13	38.0'	4	Wet medium dense brown fine sand w/some	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				5 6 6	coarse sand, trace of fine gravel and silt.		
			40.0'		18" RECOVERY		
40.48							
43.01							
		14	44.0'	3 4 4 5	Saturated loose brown fine sand w/some silt, trace of fine gravel.	A-2-4(0)	
45.54							
			46.0'		19" RECOVERY		
48.07							
		15	48.0'	3 4 5 6	Saturated loose brown fine sand w/some silt, trace of coarse sand and fine gravel.	A-2-4(0)	
			50.0'		18" RECOVERY		
50.6							
53.13							
		16	54.0'	4 5 10 11	Saturated medium dense brown fine sand w/ some coarse sand, trace of silt and fine gravel.	A-3	
55.66							
			56.0'		19" RECOVERY		
58.19							
		17	58.0'	11 13 11 14	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	A-1-b	
			60.0'		17" RECOVERY		
60.72							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
63.25							
65.78		18	64.0' 66.0'	6 9 13 11	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 16" RECOVERY	A-1-b	
68.31		19	68.0' 70.0'	7 8 9 9	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 17" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							
83.49							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Well graded gravels and sands
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING SA-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 281474.214
Easting: 643418.213
Boring Surface Elev.:
Reference:
Date Started: 3/14/16
Date Completed: 3/14/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
3/14/16	6.8	
3/14/16	5.9	7.3

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		Moist gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	Hot-mix 2"
2.53		2	2.0' 4.0'	3 3 5 5	Saturated loose gray silty fine to coarse sand. 17" RECOVERY	A-2-4(0)	
5.06	▼	3	4.0' 6.0'	1 2 1 2	Saturated very loose gray silty fine to coarse sand. 17" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' 8.0'	2 4 7 9	Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	1 1 2 2	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-1-b	
		6	10.0' 12.0'	1 1 2 9	Saturated very loose brown coarse to fine sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
12.65		7	12.0'	5 10 14 9	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 3 5 5	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 16" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	5 5 5 6	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	1 3 5 5	Saturated medium dense brown coarse to fine sand w/trace silt. 16" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	5 5 5 6	Saturated loose brown coarse sand w/some fine gravel, trace of fine sand and silt. 24" RECOVERY	A-1-b	
30.36		12	29.0' 31.0'	3 9 10 11	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt. 24" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	4 4 4 5	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 16" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	6 10 14 12	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 20" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	6 4 4 6	Saturated loose brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
48.07							
50.6		16	49.0' 51.0'	4 6 8 8	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
53.13							
55.66		17	54.0' 56.0'	7 9 8 11	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 16" RECOVERY	A-1-b	
58.19							
				10			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** SA-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		18	59.0'	17 35 27	Saturated very dense brown fine gravelly fine to coarse sand and silt.	A-2-4(0)	
60.72			61.0'		18" RECOVERY		
63.25							
		19	64.0'	5 10 11 17	Saturated medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
65.78			66.0'		24" RECOVERY		
68.31		20	68.0'	6 12 13 29	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	A-1-b	
			70.0'		24" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

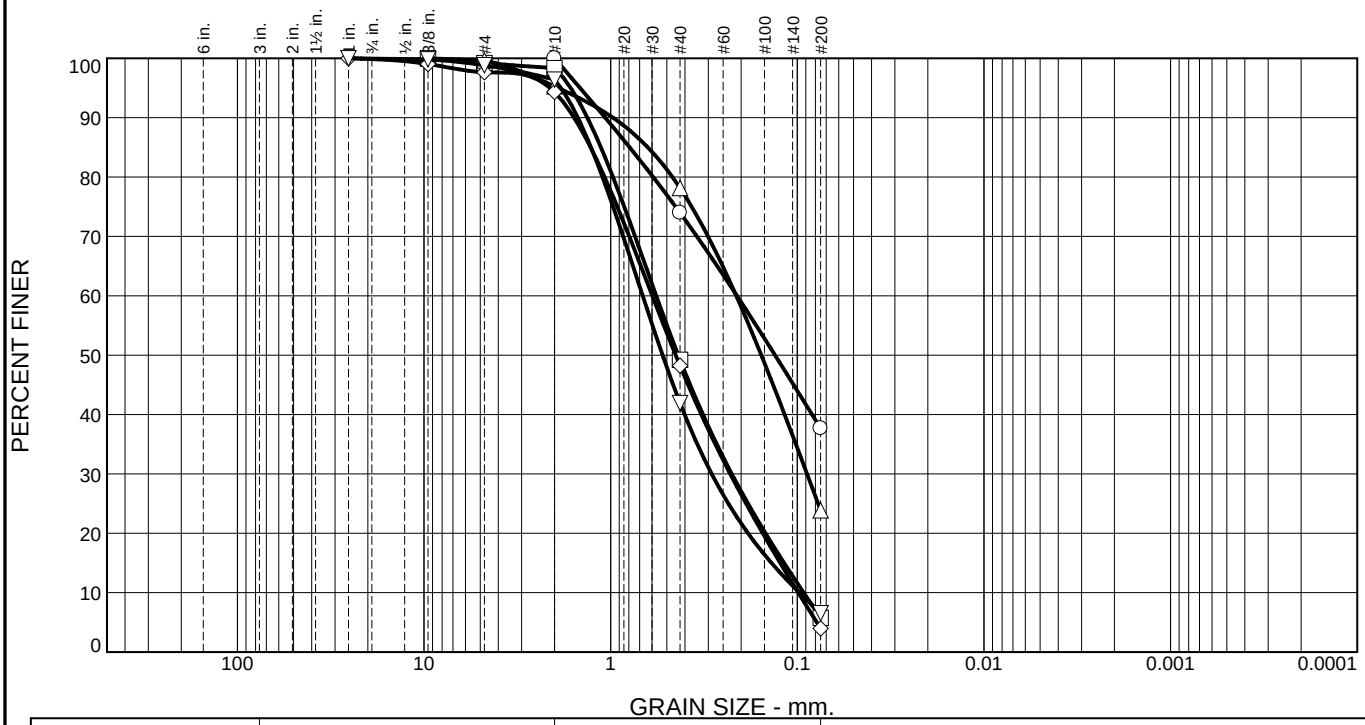
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	26.0	36.3	37.7	
□	0.0	1.7	49.1	43.4	5.8	
△	0.0	4.7	17.1	54.3	23.9	
◇	0.0	5.7	46.1	44.2	4.0	
▽	0.0	3.6	54.5	35.4	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	38.1	28.1	0.7912	0.2105	0.1317					
□	NV	NP	1.1279	0.5699	0.4346	0.2245	0.1177	0.0925	0.96	6.16
△	NV	NP	0.6321	0.2124	0.1560	0.0887				
◇	NV	NP	1.2805	0.5982	0.4483	0.2287	0.1235	0.0988	0.89	6.06
▽	NV	NP	1.2746	0.6735	0.5270	0.2874	0.1375	0.0974	1.26	6.91

Material Description	USCS	AASHTO
○ Wet stiff gray organic clayey fine to coarse sandy silt.	SM	A-4(1)
□ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter.	SM	A-2-4(0)
◇ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-1 **Depth:** 2.0 **Sample Number:** 1

□ **Source of Sample:** SA-1 **Depth:** 4.0 **Sample Number:** 2

△ **Source of Sample:** SA-1 **Depth:** 6.0 **Sample Number:** 3

◇ **Source of Sample:** SA-1 **Depth:** 8.0 **Sample Number:** 4

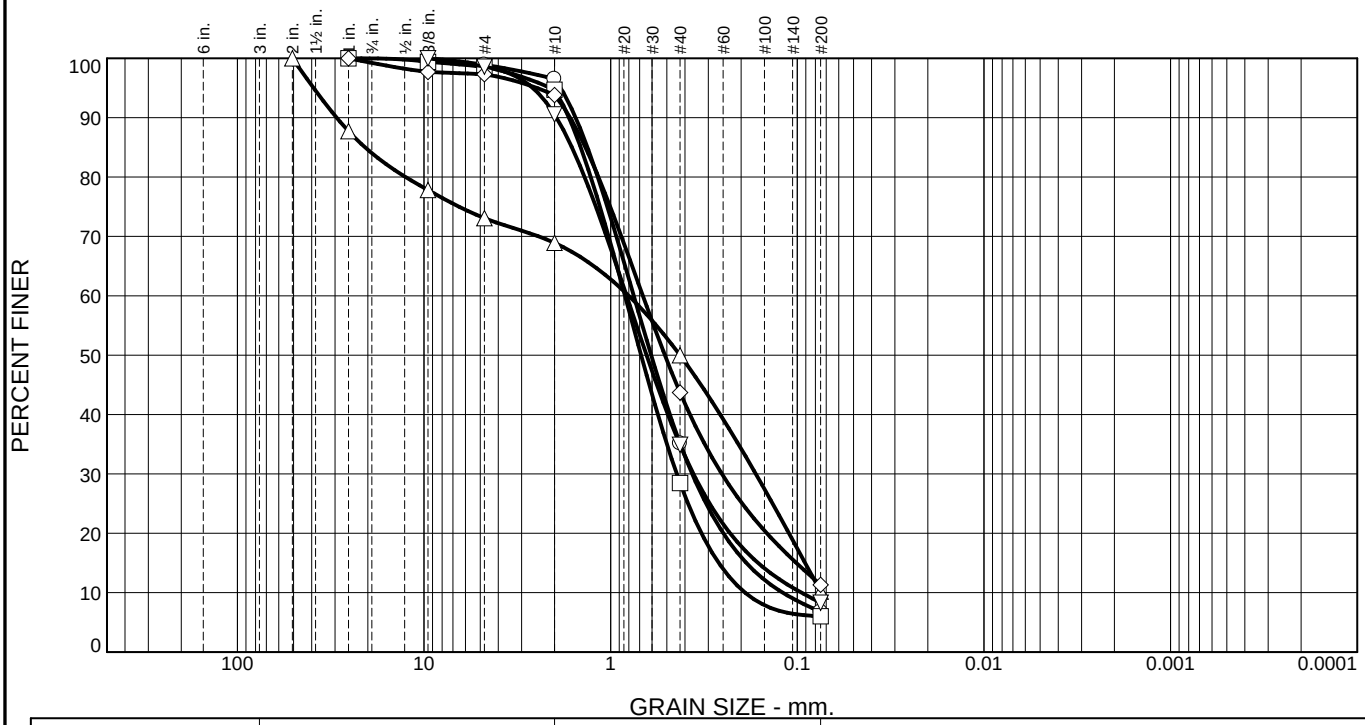
▽ **Source of Sample:** SA-1 **Depth:** 10.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.5	61.4	28.3	6.8	
□	0.0	5.3	66.2	22.5	6.0	
△	0.0	31.1	18.9	39.8	10.2	
◇	0.0	6.2	50.1	32.4	11.3	
▽	0.0	9.4	55.7	26.6	8.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3319	0.7521	0.6065	0.3659	0.1876	0.1199	1.48	6.27
□	NV	NP	1.4475	0.8382	0.6869	0.4424	0.2635	0.1905	1.23	4.40
△	NV	NP	20.6942	0.8005	0.4252	0.1670	0.0908			
◇	NV	NP	1.3650	0.6722	0.5122	0.2534	0.1012			
▽	NV	NP	1.6132	0.8214	0.6423	0.3603	0.1623	0.0950	1.66	8.65

Material Description	USCS	AASHTO
○ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet loose brown fine sand and fine gravel w/some coarse sand, trace of silt.	SP-SM	A-1-b
◇ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
▽ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-1 **Depth:** 12.0 **Sample Number:** 6

□ **Source of Sample:** SA-1 **Depth:** 14.0 **Sample Number:** 7

△ **Source of Sample:** SA-1 **Depth:** 16.0 **Sample Number:** 8

◇ **Source of Sample:** SA-1 **Depth:** 18.0 **Sample Number:** 9

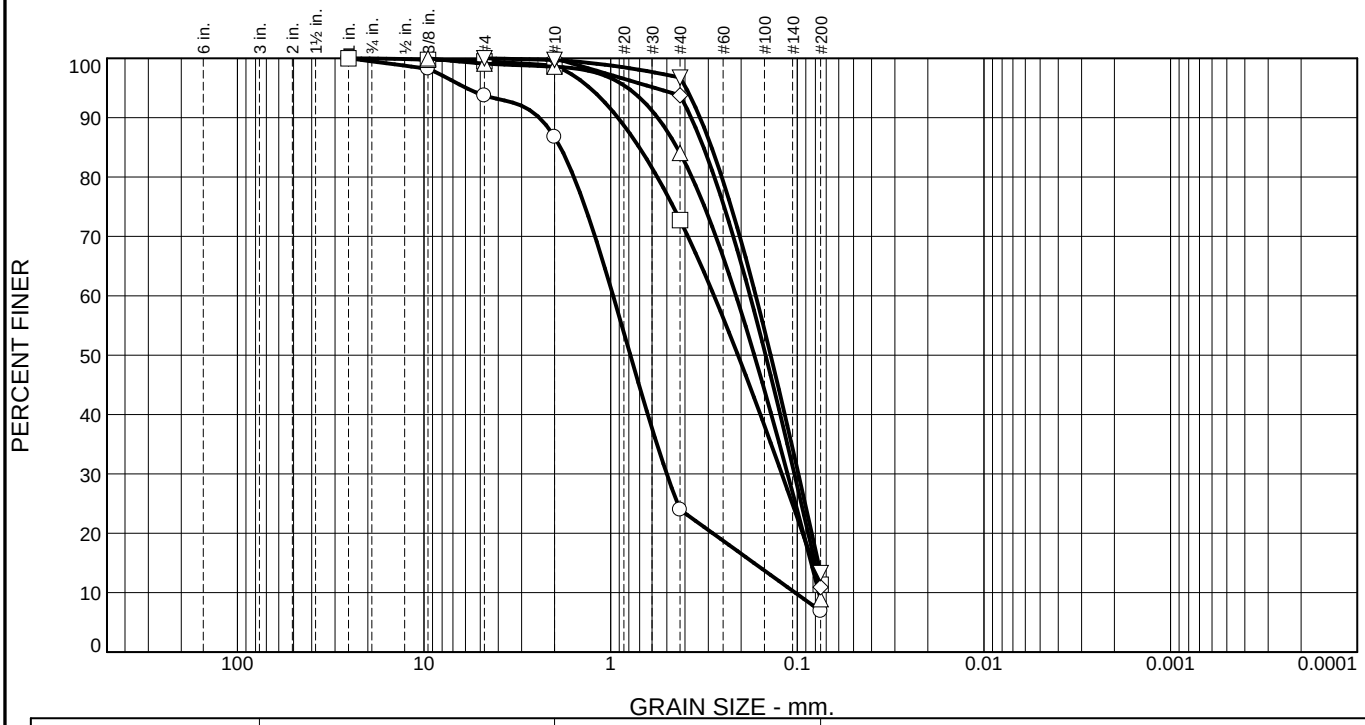
▽ **Source of Sample:** SA-1 **Depth:** 24.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	13.2	62.8	17.1	6.9	
□	0.0	1.3	26.0	61.3	11.4	
△	0.0	1.4	14.5	75.2	8.9	
◇	0.0	0.0	6.2	82.9	10.9	
▽	0.0	0.3	2.9	83.5	13.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8589	0.9701	0.7843	0.5004	0.1707	0.1027	2.51	9.44
□	NV	NP	0.7028	0.2791	0.2080	0.1211	0.0823			
△	NV	NP	0.4414	0.2128	0.1700	0.1128	0.0843	0.0766	0.78	2.78
◇	NV	NP	0.3178	0.1791	0.1479	0.1037	0.0803			
▽	NV	NP	0.2878	0.1669	0.1390	0.0987	0.0771			

Material Description	USCS	AASHTO
○ Wet loose brown coarse sand w/some fine sand and fine gravel, trace of silt.	SW-SM	A-1-b
□ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Wet medium dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
◇ Saturated loose brown fine sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
▽ Saturated loose brown fine sand w/some silt, trace of coarse sand and fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-1 **Depth:** 28.0 **Sample Number:** 11

□ **Source of Sample:** SA-1 **Depth:** 34.0 **Sample Number:** 12

△ **Source of Sample:** SA-1 **Depth:** 38.0 **Sample Number:** 13

◇ **Source of Sample:** SA-1 **Depth:** 44.0 **Sample Number:** 14

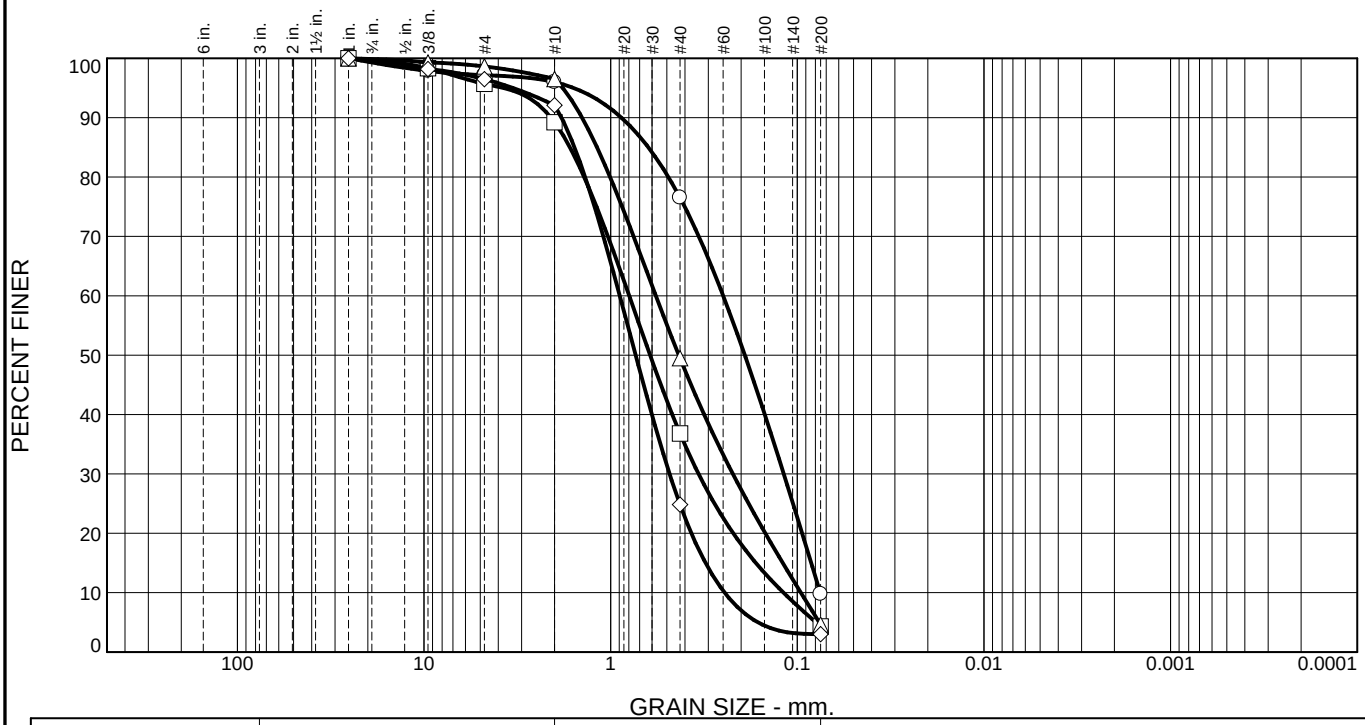
▽ **Source of Sample:** SA-1 **Depth:** 48.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.0	19.5	66.7	9.8	
□	0.0	10.8	52.4	32.5	4.3	
△	0.0	3.5	47.0	44.9	4.6	
◇	0.0	7.9	67.3	21.8	3.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6281	0.2495	0.1911	0.1183	0.0843	0.0754	0.74	3.31
□	NV	NP	1.6537	0.7955	0.6147	0.3381	0.1668	0.1187	1.21	6.70
△	NV	NP	1.1837	0.5724	0.4315	0.2214	0.1197	0.0958	0.89	5.98
◇	NV	NP	1.5627	0.8938	0.7347	0.4834	0.3102	0.2452	1.07	3.65

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine sand w/some coarse sand, trace of silt and fine gravel.	SP-SM	A-3
□ Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW	A-1-b
△ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-1 **Depth:** 54.0 **Sample Number:** 16

□ **Source of Sample:** SA-1 **Depth:** 58.0 **Sample Number:** 17

△ **Source of Sample:** SA-1 **Depth:** 64.0 **Sample Number:** 18

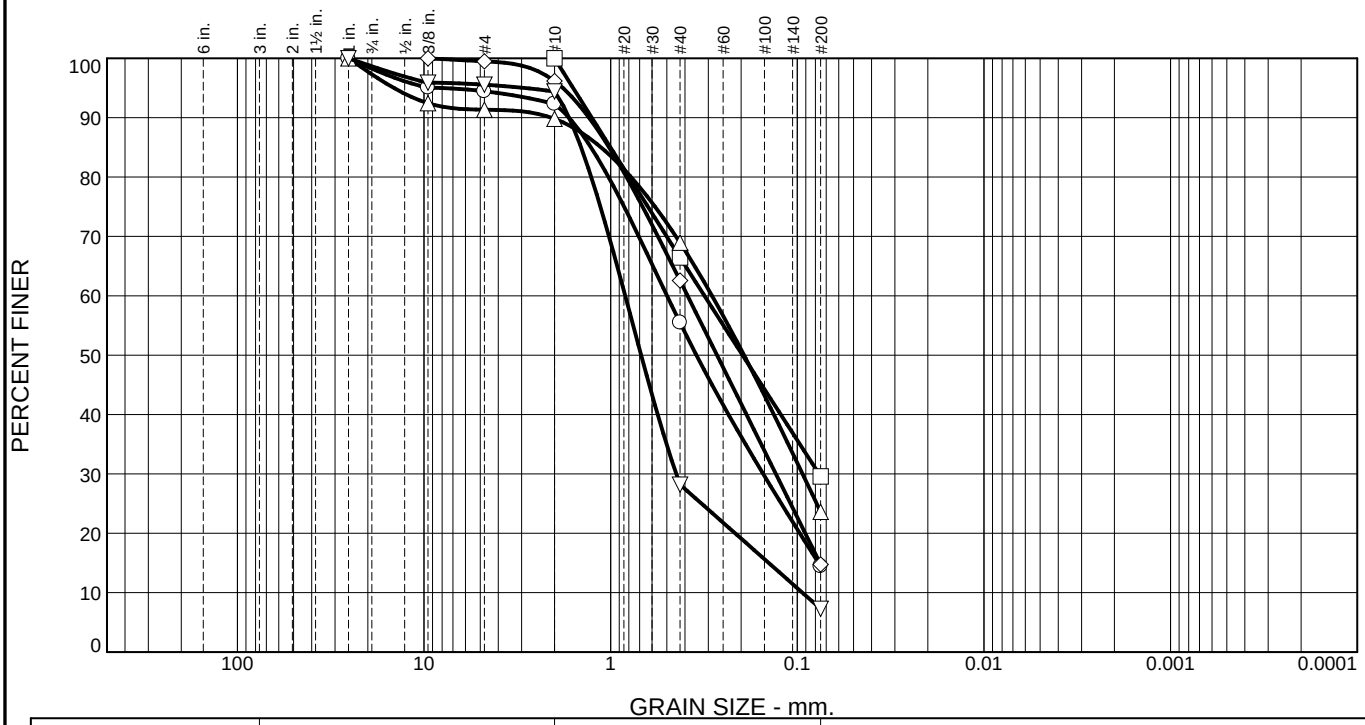
◇ **Source of Sample:** SA-1 **Depth:** 68.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.7	36.8	41.1	14.4	
□	0.0	0.0	33.5	36.9	29.6	
△	0.0	10.2	20.9	45.3	23.6	
◇	0.0	3.8	33.6	47.8	14.8	
▽	0.0	5.6	66.2	20.9	7.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2747	0.4989	0.3471	0.1523	0.0770			
□	NV	NP	1.0028	0.3143	0.1966	0.0765				
△	NV	NP	1.1264	0.2864	0.1930	0.0938				
◇	NV	NP	1.0202	0.3871	0.2692	0.1303	0.0757			
▽	NV	NP	1.4403	0.8355	0.6865	0.4452	0.1422	0.0939	2.53	8.89

Material Description	USCS	AASHTO
○ Moist gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated loose gray silty fine to coarse sand.	SM	A-2-4(0)
△ Saturated very loose gray silty fine to coarse sand.	SM	A-2-4(0)
◇ Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** SA-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** SA-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** SA-2 **Depth:** 6.0 **Sample Number:** 4

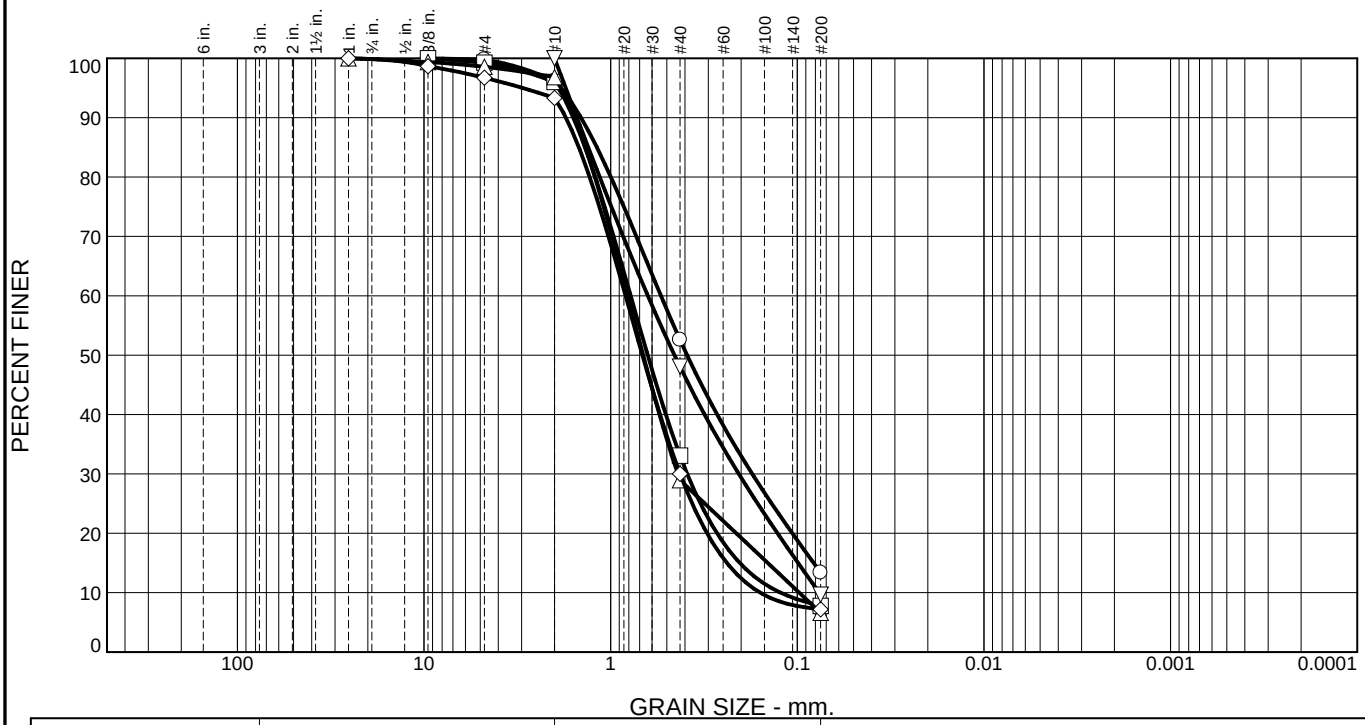
▽ **Source of Sample:** SA-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.8	43.6	39.2	13.4	
□	0.0	4.0	62.9	25.3	7.8	
△	0.0	3.2	67.9	22.3	6.6	
◇	0.0	6.7	63.3	22.8	7.2	
▽	0.0	0.0	51.9	38.4	9.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1859	0.5378	0.3895	0.1744	0.0818			
□	NV	NP	1.3724	0.7816	0.6332	0.3891	0.2034	0.1230	1.57	6.35
△	NV	NP	1.3650	0.8115	0.6695	0.4366	0.1440	0.0977	2.41	8.31
◇	NV	NP	1.4808	0.8320	0.6759	0.4249	0.2384	0.1581	1.37	5.26
▽	NV	NP	1.3189	0.6322	0.4548	0.2058	0.0990	0.0763	0.88	8.28

Material Description	USCS	AASHTO
○ Saturated very loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/trace silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** SA-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** SA-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** SA-2 **Depth:** 16.0 **Sample Number:** 9

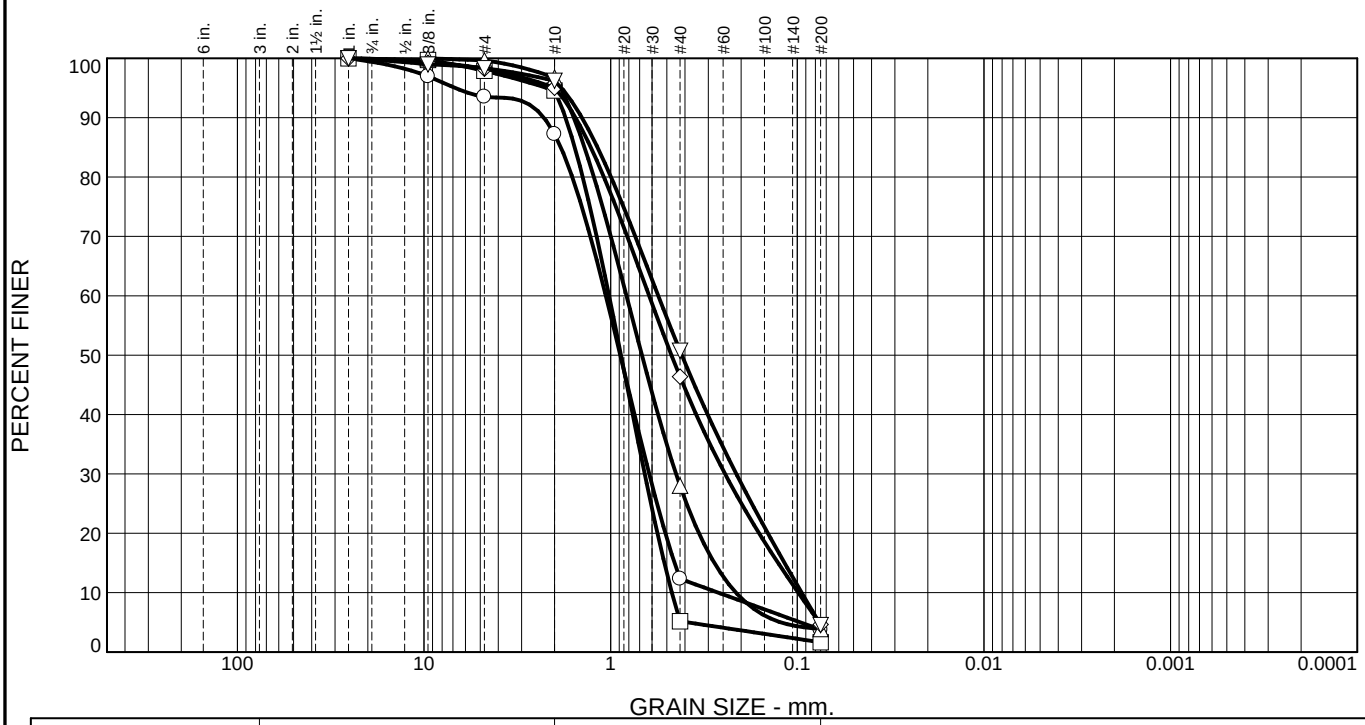
▽ **Source of Sample:** SA-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.8	74.9	8.5	3.8	
□	0.0	5.4	89.4	3.6	1.6	
△	0.0	3.3	68.7	24.1	3.9	
◇	0.0	5.0	48.6	41.8	4.6	
▽	0.0	3.8	45.5	46.2	4.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.8494	1.0617	0.8882	0.6214	0.4546	0.2649	1.37	4.01
□	NV	NP	1.5572	1.0197	0.8806	0.6570	0.5155	0.4699	0.90	2.17
△	NV	NP	1.3810	0.8228	0.6797	0.4465	0.2781	0.2133	1.14	3.86
◇	NV	NP	1.2779	0.6219	0.4722	0.2438	0.1267	0.0988	0.97	6.29
▽	NV	NP	1.1767	0.5559	0.4157	0.2122	0.1171	0.0948	0.85	5.86

Material Description	USCS	AASHTO
○ Saturated loose brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b
□ Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b
△ Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** SA-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** SA-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** SA-2 **Depth:** 39.0 **Sample Number:** 14

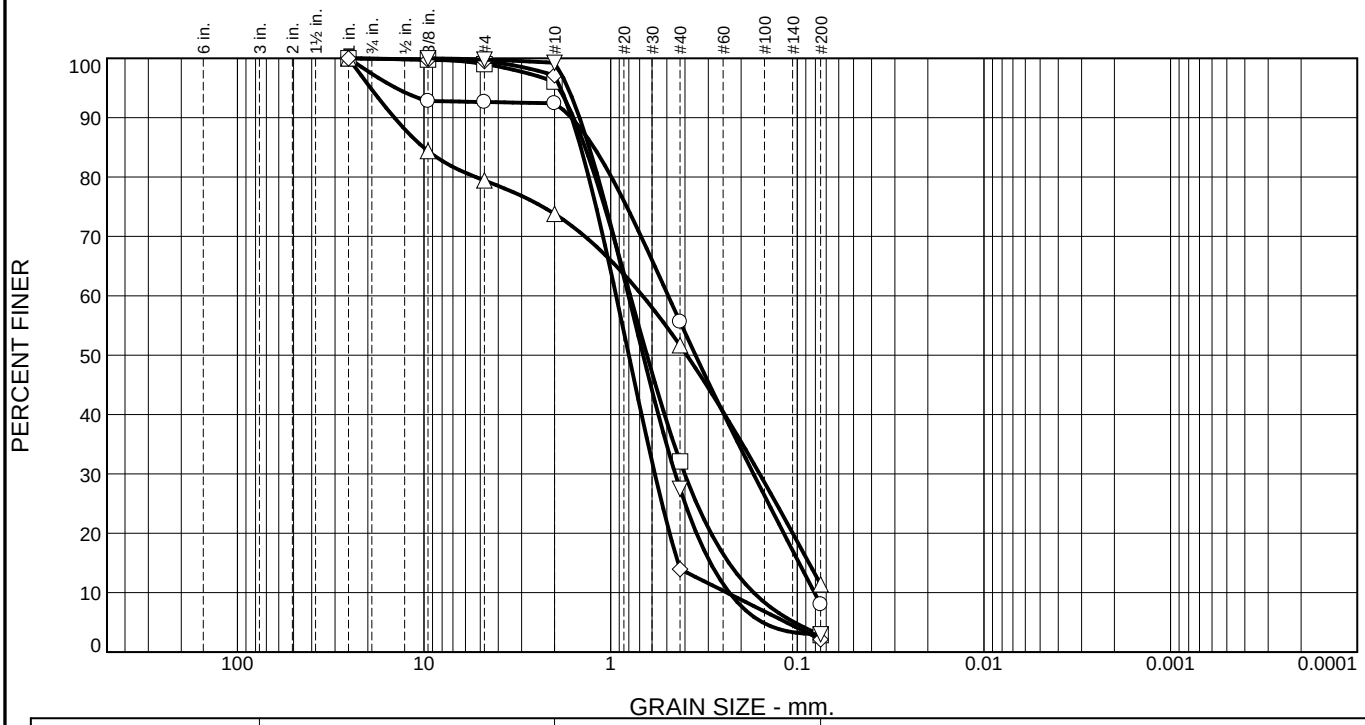
▽ **Source of Sample:** SA-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.6	36.8	47.6	8.0	
□	0.0	3.9	64.0	29.2	2.9	
△	0.0	26.2	22.1	40.3	11.4	
◇	0.0	2.9	83.1	11.9	2.1	
▽	0.0	0.8	71.7	24.5	3.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2301	0.4916	0.3511	0.1718	0.0978	0.0809	0.74	6.08
□	NV	NP	1.3695	0.7851	0.6390	0.4015	0.2322	0.1714	1.20	4.58
△	NV	NP	10.0666	0.6748	0.3908	0.1593	0.0866			
◇	NV	NP	1.4466	0.9348	0.7994	0.5794	0.4352	0.2382	1.51	3.93
▽	NV	NP	1.3033	0.8027	0.6699	0.4507	0.2918	0.2314	1.09	3.47

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
△ Saturated very dense brown fine gravelly fine to coarse sand and silt.	SP-SM	A-2-4(0)
◇ Saturated medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** SA-2 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** SA-2 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** SA-2 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** SA-2 **Depth:** 64.0 **Sample Number:** 19

▽ **Source of Sample:** SA-2 **Depth:** 68.0 **Sample Number:** 20

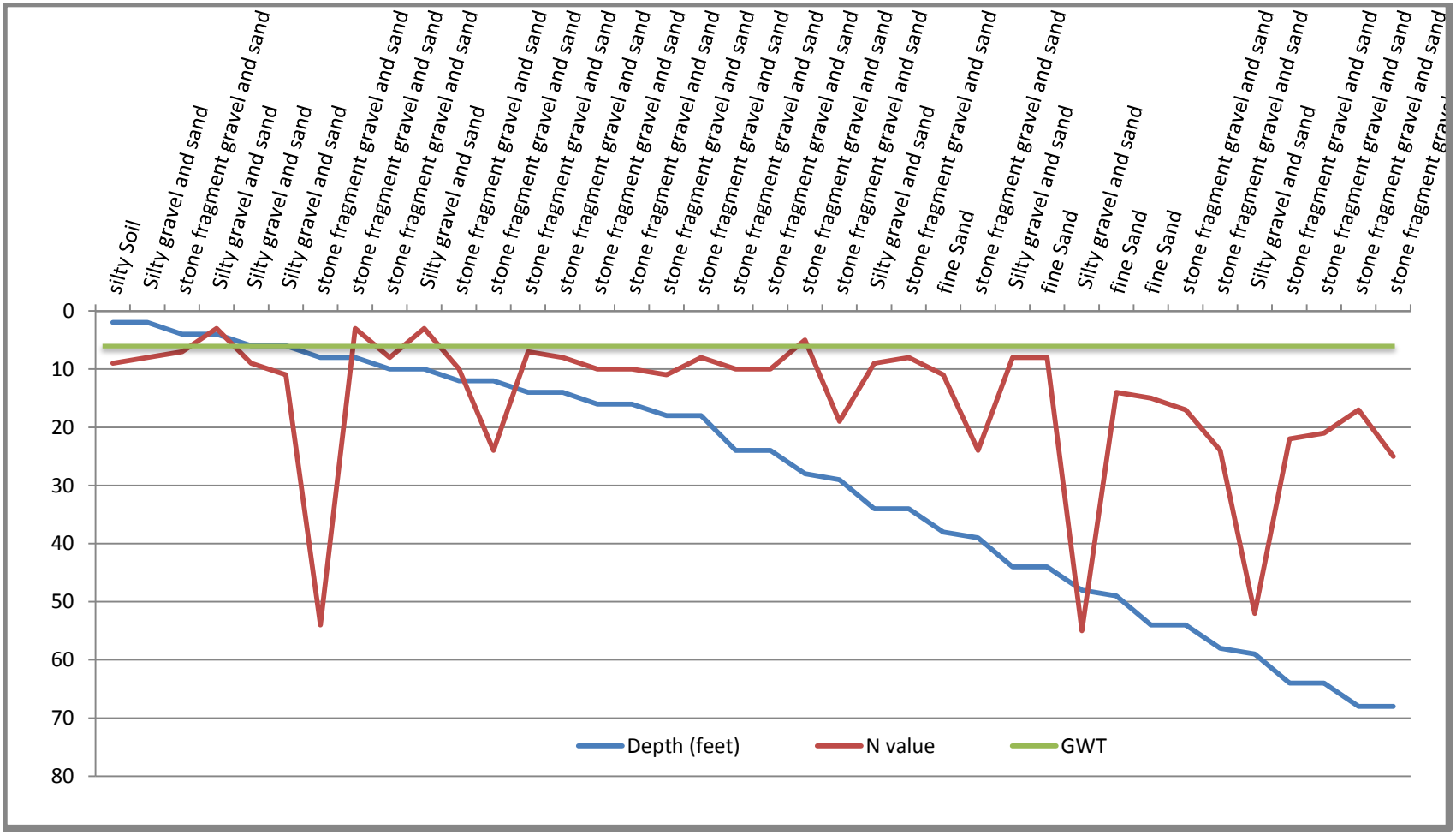
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
FT-1	1	2	Wet stiff gray organic clayey fine to coarse sandy silt.	38.1	10	65.6	SM	A-4(1)	100	37.7	4	4	5	3
	2	4	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	22.9	SP-SM	A-1-b	98.3	5.8	3	2	5	6
	3	6	Wet loose gray silty fine sand w/some coarse sand, trace of fine gravel and organic matter.	NV	NP	25	SM	A-2-4(0)	95.3	23.9	4	5	4	5
	4	8	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.4	SP	A-1-b	94.3	4	4	3	4	3
	5	10	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.7	SW-SM	A-1-b	96.4	6.5	2	3	5	4
	6	12	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	22	SW-SM	A-1-b	96.5	6.8	3	5	5	10
	7	14	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.7	SP-SM	A-1-b	94.7	6	5	3	4	6
	8	16	Wet loose brown fine sand and fine gravel w/some coarse sand, trace of silt.	NV	NP	15.7	SP-SM	A-1-b	68.9	10.2	5	5	5	9
	9	18	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	22.4	SP-SM	A-1-b	93.8	11.3	4	5	6	5
	10	24	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.5	SW-SM	A-1-b	90.6	8.3	5	5	5	5
	11	28	Wet loose brown coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	16.7	SW-SM	A-1-b	86.8	6.9	2	2	3	5
	12	34	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	27.8	SP-SM	A-2-4(0)	98.7	11.4	4	4	5	5
	13	38	Wet medium dense brown fine sand w/some coarse sand, trace of fine gravel and silt.	NV	NP	29.8	SP-SM	A-3	98.6	8.9	4	5	6	6
	14	44	Saturated loose brown fine sand w/some silt, trace of fine gravel.	NV	NP	31	SP-SM	A-2-4(0)	100	10.9	3	4	4	5
	15	48	Saturated loose brown fine sand w/some silt, trace of coarse sand and fine gravel.	NV	NP	31	SM	A-2-4(0)	99.7	13.3	3	4	5	6
	16	54	Saturated medium dense brown fine sand w/some coarse sand, trace of silt and fine gravel.	NV	NP	25.9	SP-SM	A-3	96	9.8	4	5	10	11
	17	58	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	18.7	SW	A-1-b	89.2	4.3	11	13	11	14
	18	64	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	22.5	SP	A-1-b	96.5	4.6	6	9	13	11
	19	68	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.9	SP	A-1-b	92.1	3	7	8	9	9
		70	End Boring											
FT-2	1		Moist gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	6.8	SM	A-2-4(0)	92.3	14.4				
	2	2	Saturated loose gray silty fine to coarse sand.	NV	NP	30.3	SM	A-2-4(0)	100	29.6	3	3	5	5
	3	4	Saturated very loose gray silty fine to coarse sand.	NV	NP	61.8	SM	A-2-4(0)	89.8	23.6	1	2	1	2
	4	6	Saturated medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	26.1	SM	A-2-4(0)	96.2	14.8	2	4	7	9
	5	8	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	27.8	SW-SM	A-1-b	94.4	7.3	1	1	2	2
	6	10	Saturated very loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	28.7	SM	A-2-4(0)	96.2	13.4	1	1	2	9
	7	12	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.9	SW-SM	A-1-b	96	7.8	5	10	14	9
	8	14	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.8	SW-SM	A-1-b	96.8	6.6	1	3	5	5
	9	16	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.3	SP-SM	A-1-b	93.3	7.2	5	5	5	6
	10	18	Saturated medium dense brown coarse to fine sand w/trace silt.	NV	NP	16.9	SP-SM	A-1-b	100	9.7	1	3	5	5
	11	24	Saturated loose brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	18.5	SP	A-1-b	87.2	3.8	5	5	5	6
	12	29	Saturated medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	20.9	SP	A-1-b	94.6	1.6	3	9	10	11
	13	34	Saturated loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.8	SP	A-1-b	96.7	3.9	4	4	4	5
	14	39	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.1	SP	A-1-b	95	4.6	6	10	14	12
	15	44	Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	24.5	SP	A-3	96.2	4.5	6	4	4	6
	16	49	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	21.4	SP-SM	A-3	92.4	8	4	6	8	8
	17	54	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	25.1	SP	A-1-b	96.1	2.9	7	9	8	11
	18	59	Saturated very dense brown fine gravelly fine to coarse sand and silt.	NV	NP	17.3	SP-SM	A-2-4(0)	73.8	11.4	10	17	35	27
	19	64	Saturated medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	20.8	SP	A-1-b	97.1	2.1	5	10	11	17
	20	68	Saturated medium dense brown coarse to fine sand w/trace silt and fine gravel.	NV	NP	19.5	SP	A-1-b	99.2	3	6	12	13	29
		70	End Boring											

DATE : 5-12-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-627 on Sammons road over Number One Prong - Ellendale DE



DATE : 5-12-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-627 on Sammons road over Number One Prong - Ellendale DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 5-04-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-630 on Maple Branch road - Ellendale DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-18-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CM-55 and CM-75 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Ellendale Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-101. The nearest well to this site the groundwater historically had been measured as 38 feet

on October 1960 and between the years of 1950 to 1962 appeared from 35 to 40 feet below the existing elevation.

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter is 3 to 9 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a good category.

5. Ground Cover

The ground cover for this site is 2 and 3 inches of asphalt.

6. Groundwater

The depth to groundwater was noted during the drilling operations is 7 and 8.3 feet and caved at 5 and 5.9 feet all the measurements are below the ground surface elevation. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing for the entire sample from the split spoon appeared the natural moisture content was in the range of the 4.8 to 32.4 percent. The Atterberg limit is 15 percent, Liquid limits is 14.8 to 39.7 percent and Plasticity Index is 10.2 to 17.9 percent. Organic matter is 5 percent for all the entire samples more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface at this site in general it is in good condition and 12 feet in thickness of loose fine sand layer appeared at 4 feet down from the surface elevation this layer needs to be considered in the design. In addition the entire sample from the depth of 2 to 10 feet from the surface had been met all borrow type material except borrow type “B” according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (2- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : **5-04-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR3-630 on Maple Branch road - Ellendale DE**

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
MB-1	275453.733	643295.655	38.7563528	-75.4618000
MB-2	275410.234	643287.712	38.7562333	-75.4618278

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MB-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 275453.733
Easting: 643295.655
Boring Surface Elev.:
Reference:
Date Started: 2/18/16
Date Completed: 2/18/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/18/16	8.3	
2/18/16	4.8	5.9

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' – 2.0'		Moist gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	Hot-mix 2"
2.53		2	2.0' – 4.0'	4 5 7 7	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
5.06	▽	3	4.0' – 6.0'	2 2 2 3	Wet very loose brown fine to coarse sand w/ trace silt. 17" RECOVERY	A-3	
7.59		4	6.0' – 8.0'	2 2 2 2	Wet very loose brown fine to coarse sand w/ some silt, trace of fine gravel and organic matter. 18" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' – 10.0'	2 2 2 2	Saturated very loose brown fine to coarse sand w/trace silt, fine gravel and organic matter. 14" RECOVERY	A-3	
		6	10.0' – 12.0'	2 2 2 2	Saturated very loose brown fine sand w some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0'	2 3 3 3	Saturated loose brown silty fine to coarse sand w/trace fine gravel.	A-2-4(0)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MB-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	1 2 2 1	Saturated very loose brown silty fine sand w/ trace coarse sand and fine gravel. 18" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	3 5 5 5	Saturated loose brown coarse to fine sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	5 6 10 15	Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 18" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	5 9 10 13	Saturated medium dense brown fine to coarse sand w/trace silt and fine gravel. 14" RECOVERY	A-3	
30.36		12	29.0' 31.0'	10 18 19 23	Saturated dense brown fine gravelly coarse sand w/some fine sand, trace of silt. 10" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	25 22 18 15	Saturated dense brown coarse sand and fine gravel w/some fine sand, trace of silt. 10" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: MB-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	31 12 11 12	Saturated medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt. 14" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	12 13 14 24	Saturated medium dense brown fine gravel and coarse sand w/some fine sand and silt. 12" RECOVERY	A-1-b	
48.07							
50.6		16	49.0' 51.0'	15 17 23 31	Saturated dense brown silty fine to coarse sand w/trace fine gravel. 10" RECOVERY	A-2-4(0)	
53.13							
55.66		17	54.0' 56.0'	8 9 9 15	Saturated medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt. 14" RECOVERY	A-1-b	
58.19							
				12			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MB-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72		18	59.0' 61.0'	14 15 22	Saturated very stiff brown coarse sandy clay w/some silt and fine sand, trace of fine gravel. 13" RECOVERY	A-6(4)	
63.25							
65.78		19	64.0' 66.0'	11 13 15 17	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt. 10" RECOVERY	A-1-b	
68.31		20	68.0' 70.0'	8 17 19 24	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
	Plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING MB-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 275410.234
Easting: 643287.712
Boring Surface Elev.:
Reference:
Date Started: 2/18/16
Date Completed: 2/18/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/18/16	7.0	
2/18/16	4.5	5.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 75 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'		Wet gray fine sandy silt w/trace coarse sand. 21" RECOVERY	A-4(0)	Hot-mix 3"
2.53		2	2.0' 4.0'	1 2 3 5	Wet firm gray fine sandy silt w/some coarse sand. 22" RECOVERY	A-4(0)	
5.06	▽	3	4.0' 6.0'	3 5 6 8	Wet medium dense brown silty fine sand w/ some coarse sand, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' 8.0'	8 9 10 7	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	6 6 2 3	Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel. 21" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	5 4 5 5	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
12.65		7	12.0'	2 4 4 4	Wet loose brown fine sand w/some coarse sand, trace of fine gravel and silt.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MB-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 4 2 3	Wet loose brown silty fine sand w/trace coarse sand. 20" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	3 6 5 8	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 16" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	2 3 4 6	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 23" RECOVERY	A-1-b	
22.77							
25.3		11	24.0' 26.0'	6 5 7 9	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 17" RECOVERY	A-1-b	
27.83							
30.36		12	29.0' 31.0'	10 14 16 12	Wet dense brown fine gravelly coarse sand w/some fine sand, trace of silt. 13" RECOVERY	A-1-b	
32.89							
35.42		13	34.0' 36.0'	4 7 9 10	Wet medium dense brown coarse sand w/ some fine gravel, trace of fine sand and silt. 9" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MB-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	11 15 7 7	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 9" RECOVERY	A-3	
43.01							
45.54		15	44.0' 46.0'	7 5 6 9	Wet stiff brown silty clay w/some fine sand, trace of coarse sand. 12" RECOVERY	A-6(7)	
48.07							
50.6		16	49.0' 51.0'	12 18 21 22	Wet dense brown coarse sand w/trace fine sand, fine gravel and silt. 17" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	7 10 12 14	Wet medium dense brown coarse sand w/ trace fine gravel, fine sand and silt. 20" RECOVERY	A-1-b	
58.19							
				6			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** MB-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72		18	59.0' 61.0'	11 15 18	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
63.25							
65.78		19	64.0' 66.0'	8 9 10 13	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
68.31		20	68.0' 70.0'	8 11 16 35	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel. 19" RECOVERY	A-1-b	
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty soils
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
	Plastic clays
Misc. Symbols	
	Description not given for: "WATER2"

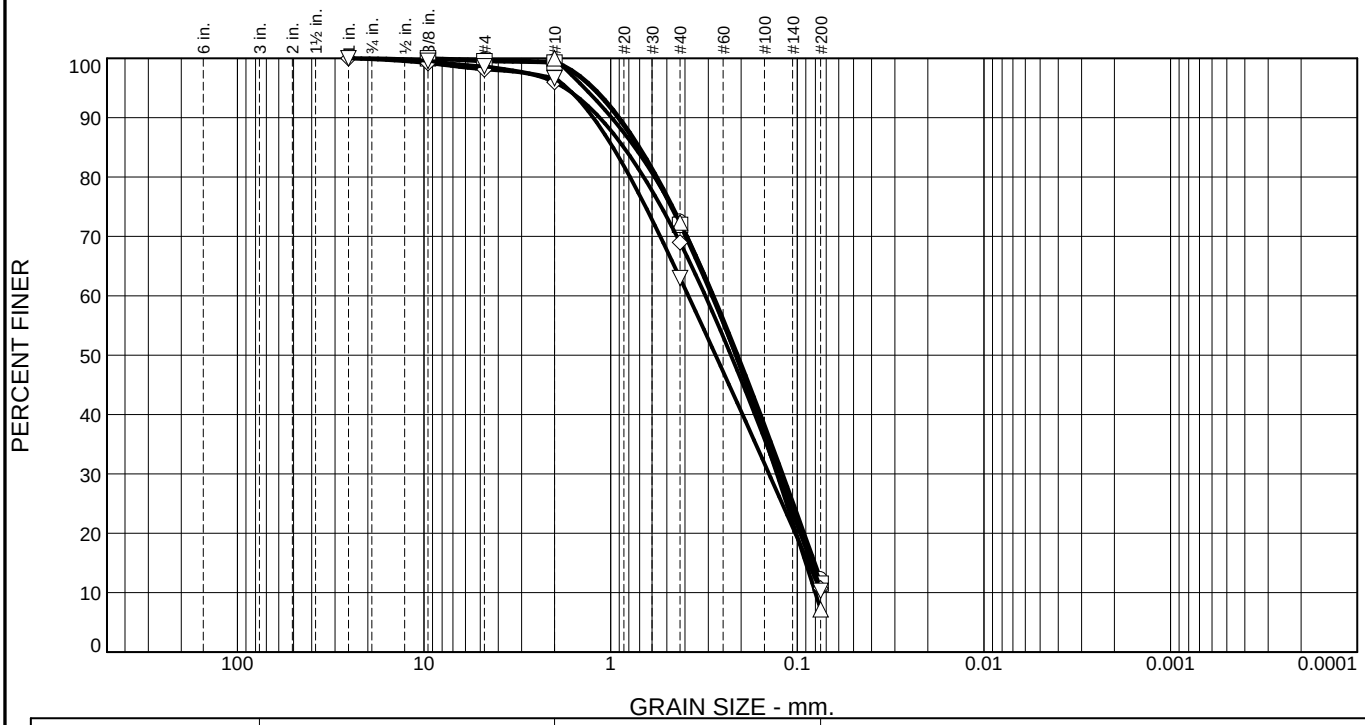
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.5	27.0	60.2	12.3	
□	0.0	0.7	27.3	60.5	11.5	
△	0.0	0.0	27.7	65.1	7.2	
◇	0.0	4.0	27.0	58.3	10.7	
▽	0.0	3.4	33.6	52.7	10.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.6999	0.2812	0.2086	0.1199	0.0806			
□	NV	NP	0.7125	0.2868	0.2127	0.1222	0.0821			
△	NV	NP	0.7419	0.2837	0.2139	0.1287	0.0901	0.0801	0.73	3.54
◇	NV	NP	0.8503	0.3110	0.2267	0.1271	0.0842			
▽	NV	NP	0.9722	0.3837	0.2739	0.1418	0.0872			

Material Description	USCS	AASHTO
○ Moist gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Wet very loose brown fine to coarse sand w/trace silt.	SP-SM	A-3
◇ Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel and organic matter.	SP-SM	A-2-4(0)
▽ Saturated very loose brown fine to coarse sand w/trace silt, fine gravel and organic matter.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** MB-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** MB-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** MB-1 **Depth:** 6.0 **Sample Number:** 4

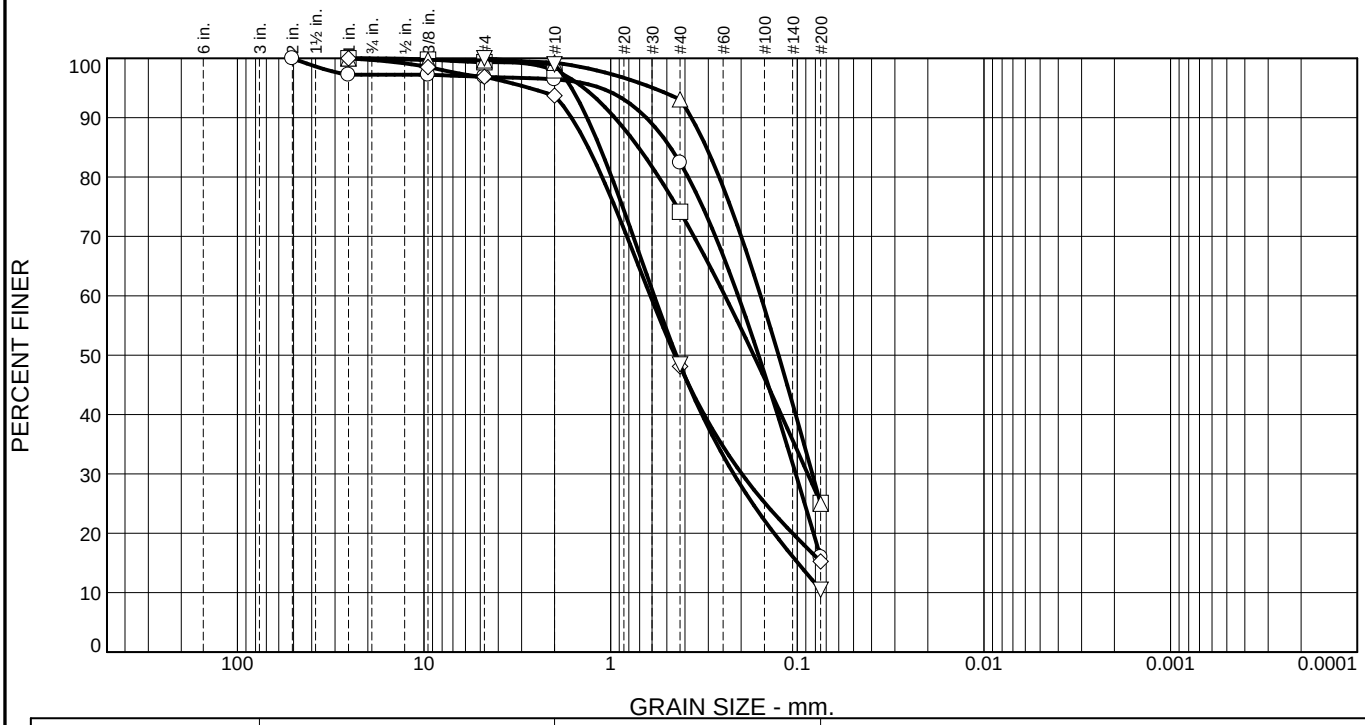
▽ **Source of Sample:** MB-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.6	14.0	66.4	16.0	
□	0.0	2.0	23.9	49.0	25.1	
△	0.0	0.7	6.2	68.1	25.0	
◇	0.0	6.3	45.6	32.8	15.3	
▽	0.0	1.0	50.6	37.9	10.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.4785	0.2075	0.1614	0.1020				
□	NV	NP	0.7094	0.2442	0.1714	0.0879				
△	NV	NP	0.3069	0.1573	0.1261	0.0831				
◇	NV	NP	1.3205	0.6127	0.4524	0.1982				
▽	NV	NP	1.1417	0.5843	0.4449	0.2192	0.0993			

Material Description	USCS	AASHTO
○ Saturated very loose brown fine sand w some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
□ Saturated loose brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
△ Saturated very loose brown silty fine sand w/trace coarse sand and fine gravel.	SM	A-2-4(0)
◇ Saturated loose brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
▽ Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** MB-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** MB-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** MB-1 **Depth:** 16.0 **Sample Number:** 9

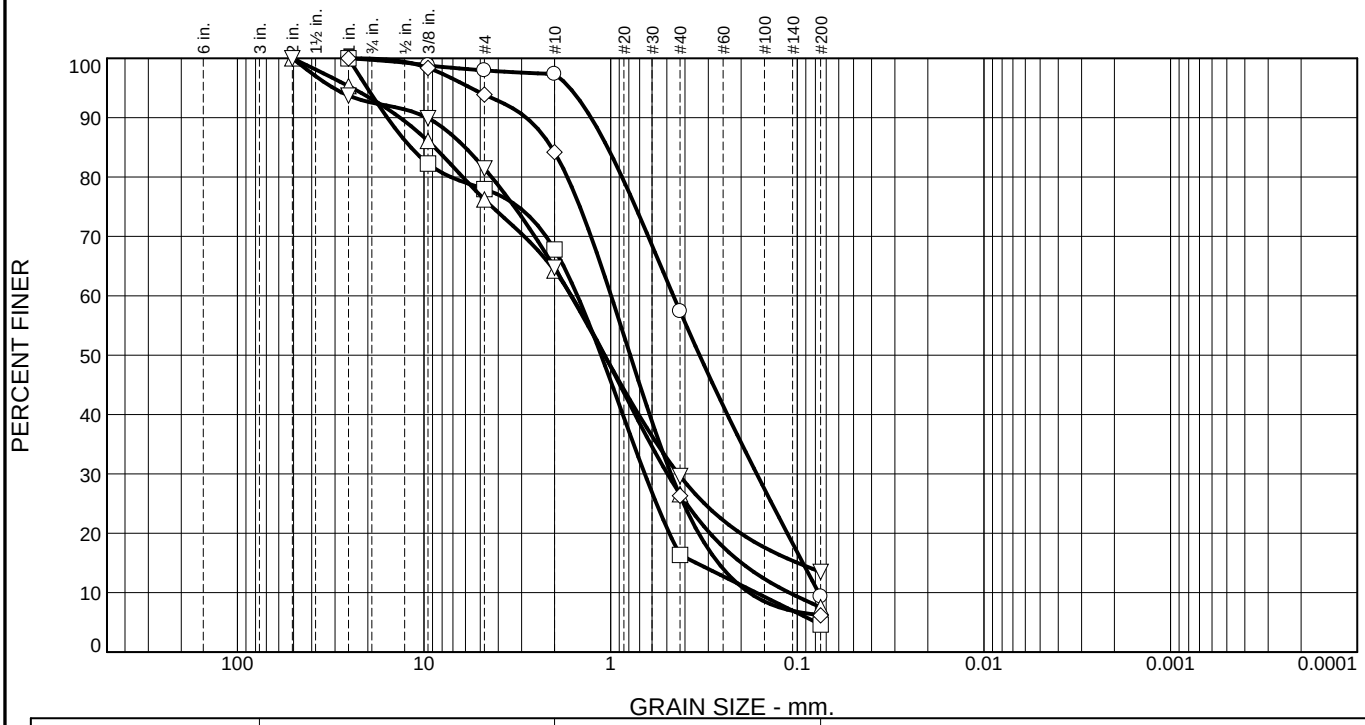
▽ **Source of Sample:** MB-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	40.0	48.1	9.3	
□	0.0	32.2	51.4	11.8	4.6	
△	0.0	35.8	37.6	19.1	7.5	
◇	0.0	15.8	57.9	20.1	6.2	
▽	0.0	35.3	35.1	16.1	13.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0395	0.4611	0.3340	0.1650	0.0933	0.0769	0.77	5.99
□	NV	NP	11.7614	1.5063	1.1251	0.6566	0.3478	0.1659	1.72	9.08
△	NV	NP	8.7785	1.6222	1.0774	0.4964	0.1989	0.1105	1.38	14.69
◇	NV	NP	2.0734	0.9944	0.7858	0.4750	0.2649	0.1812	1.25	5.49
▽	NV	NP	6.0198	1.6307	1.0795	0.4338	0.0992			

Material Description	USCS	AASHTO
○ Saturated medium dense brown fine to coarse sand w/trace silt and fine gravel.	SP-SM	A-3
□ Saturated dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SW	A-1-b
△ Saturated dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	SW-SM	A-1-b
◇ Saturated medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	SP-SM	A-1-b
▽ Saturated medium dense brown fine gravel and coarse sand w/some fine sand and silt.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** MB-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** MB-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** MB-1 **Depth:** 39.0 **Sample Number:** 14

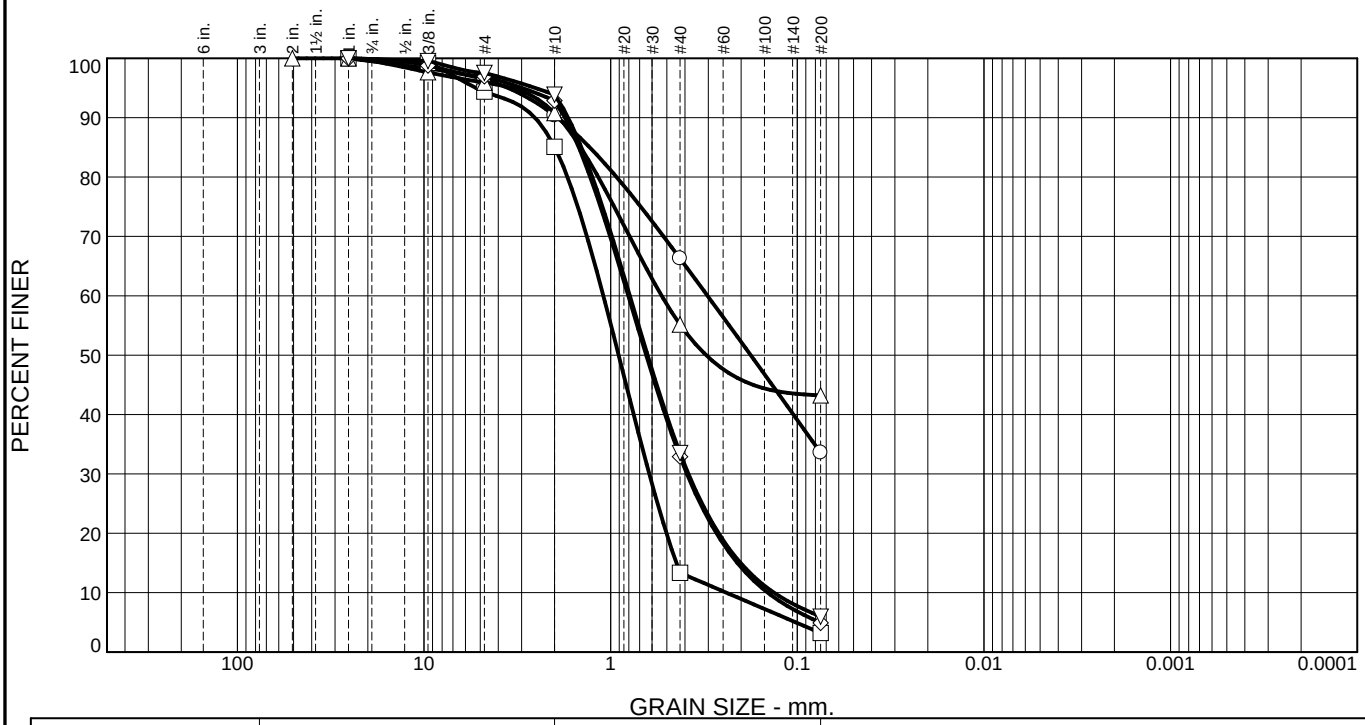
▽ **Source of Sample:** MB-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.6	24.1	32.7	33.6	
□	0.0	14.9	71.8	10.1	3.2	
△	0.0	9.2	35.6	12.0	43.2	
◇	0.0	7.1	60.0	28.0	4.9	
▽	0.0	6.1	60.4	27.5	6.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22.4	NP	1.2953	0.3027	0.1778					
□	NV	NP	1.9931	1.0946	0.9064	0.6211	0.4445	0.2400	1.47	4.56
△	39.7	21.8	1.4483	0.5329	0.3080					
◇	NV	NP	1.4823	0.8045	0.6450	0.3903	0.2095	0.1441	1.31	5.58
▽	NV	NP	1.4370	0.7896	0.6342	0.3833	0.2014	0.1334	1.39	5.92

Material Description	USCS	AASHTO
○ Saturated dense brown silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Saturated medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b
△ Saturated very stiff brown coarse sandy clay w/some silt and fine sand, trace of fine gravel.	SC	A-6(4)
◇ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** MB-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** MB-1 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** MB-1 **Depth:** 64.0 **Sample Number:** 19

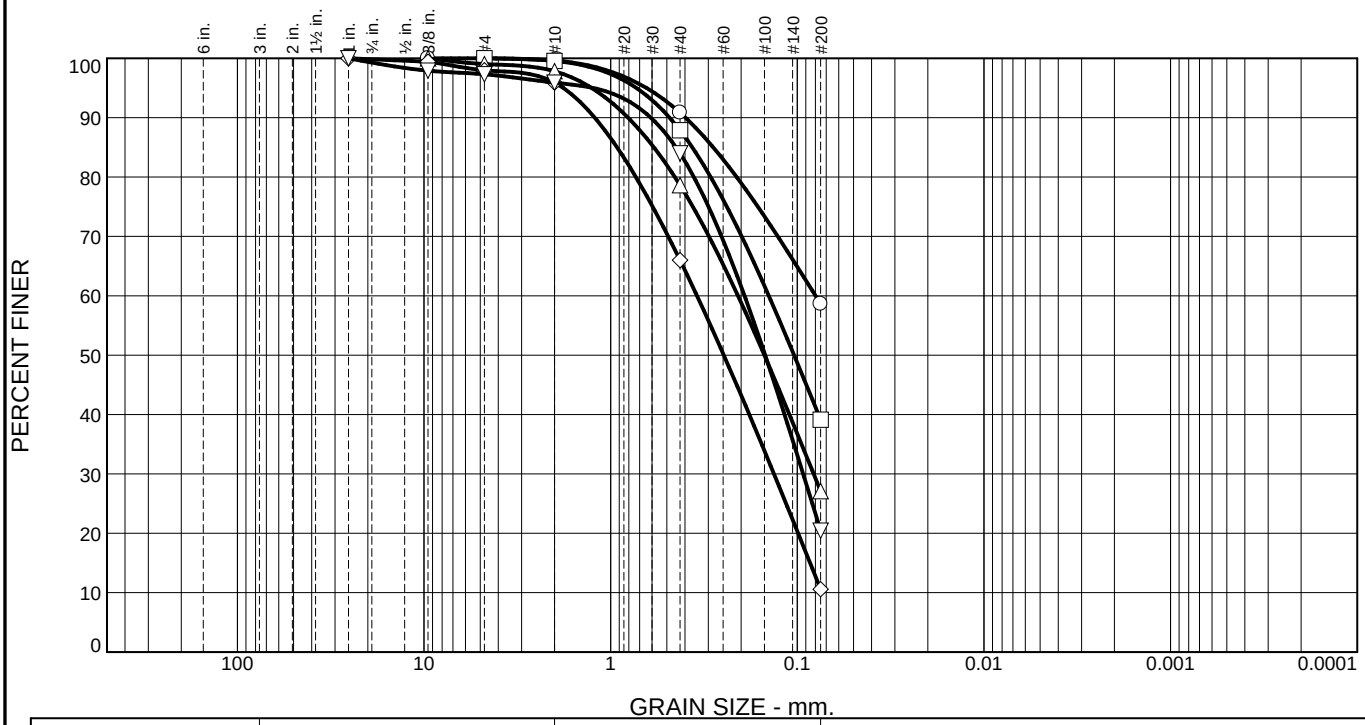
▽ **Source of Sample:** MB-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	8.9	32.2	58.6	
□	0.0	0.4	11.7	48.8	39.1	
△	0.0	2.2	19.2	51.5	27.1	
◇	0.0	4.1	29.9	55.4	10.6	
▽	0.0	4.1	11.9	63.6	20.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19.6	NP	0.2821	0.0799						
□	16.2	NP	0.3651	0.1422	0.1041					
△	14.8	NP	0.5865	0.2079	0.1502	0.0817				
◇	NV	NP	0.9237	0.3447	0.2477	0.1334	0.0854			
▽	NV	NP	0.4463	0.1918	0.1487	0.0931				

Material Description	USCS	AASHTO
○ Wet gray fine sandy silt w/trace coarse sand.	ML	A-4(0)
□ Wet firm gray fine sandy silt w/some coarse sand.	SM	A-4(0)
△ Wet medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
▽ Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-2 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** MB-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** MB-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** MB-2 **Depth:** 6.0 **Sample Number:** 4

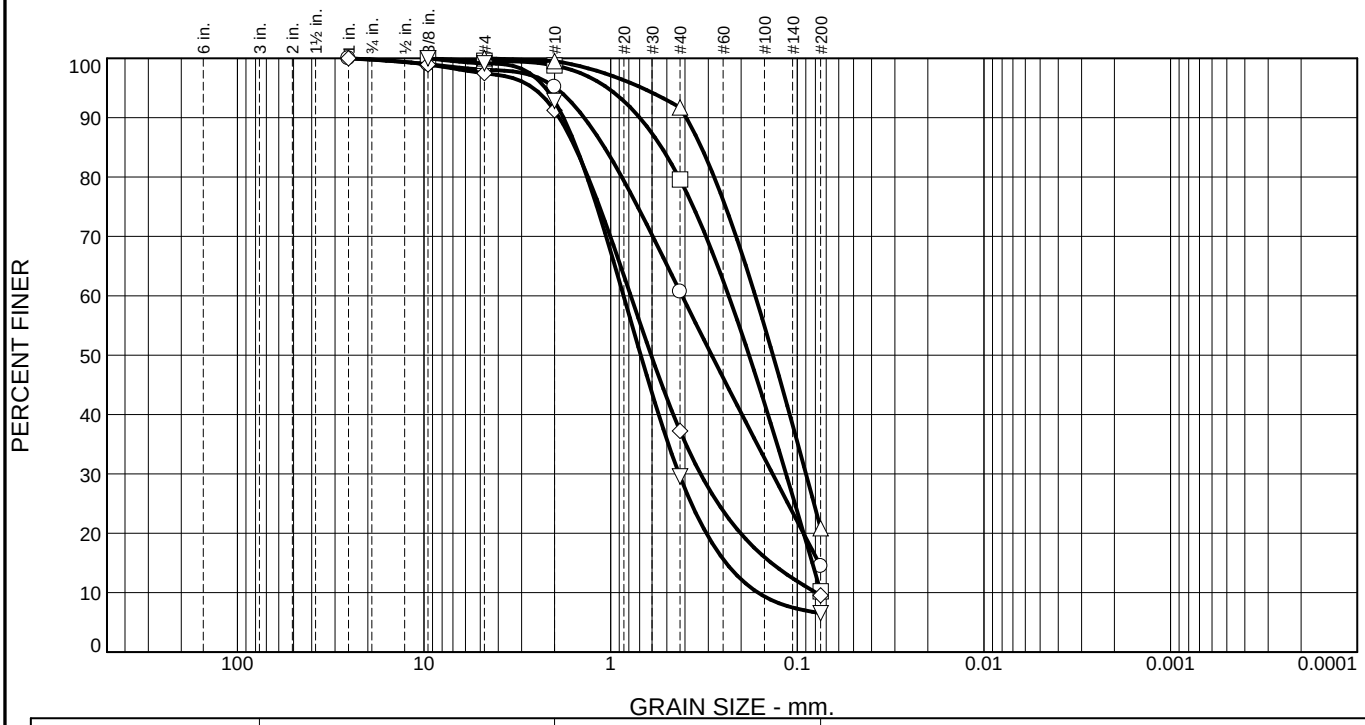
▽ **Source of Sample:** MB-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.8	34.5	46.2	14.5	
□	0.0	1.2	19.2	69.4	10.2	
△	0.0	0.5	7.8	70.8	20.9	
◇	0.0	8.8	54.0	27.7	9.5	
▽	0.0	7.2	63.2	23.1	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0800	0.4143	0.2874	0.1357	0.0765			
□	NV	NP	0.5338	0.2332	0.1814	0.1149	0.0831			
△	NV	NP	0.3265	0.1680	0.1351	0.0899				
◇	NV	NP	1.5507	0.7804	0.6067	0.3299	0.1377	0.0794	1.76	9.83
▽	NV	NP	1.5287	0.8528	0.6900	0.4301	0.2407	0.1625	1.33	5.25

Material Description	USCS	AASHTO
○ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet loose brown fine sand w/some coarse sand, trace of fine gravel and silt.	SP-SM	A-3
△ Wet loose brown silty fine sand w/trace coarse sand.	SM	A-2-4(0)
◇ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** MB-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** MB-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** MB-2 **Depth:** 16.0 **Sample Number:** 9

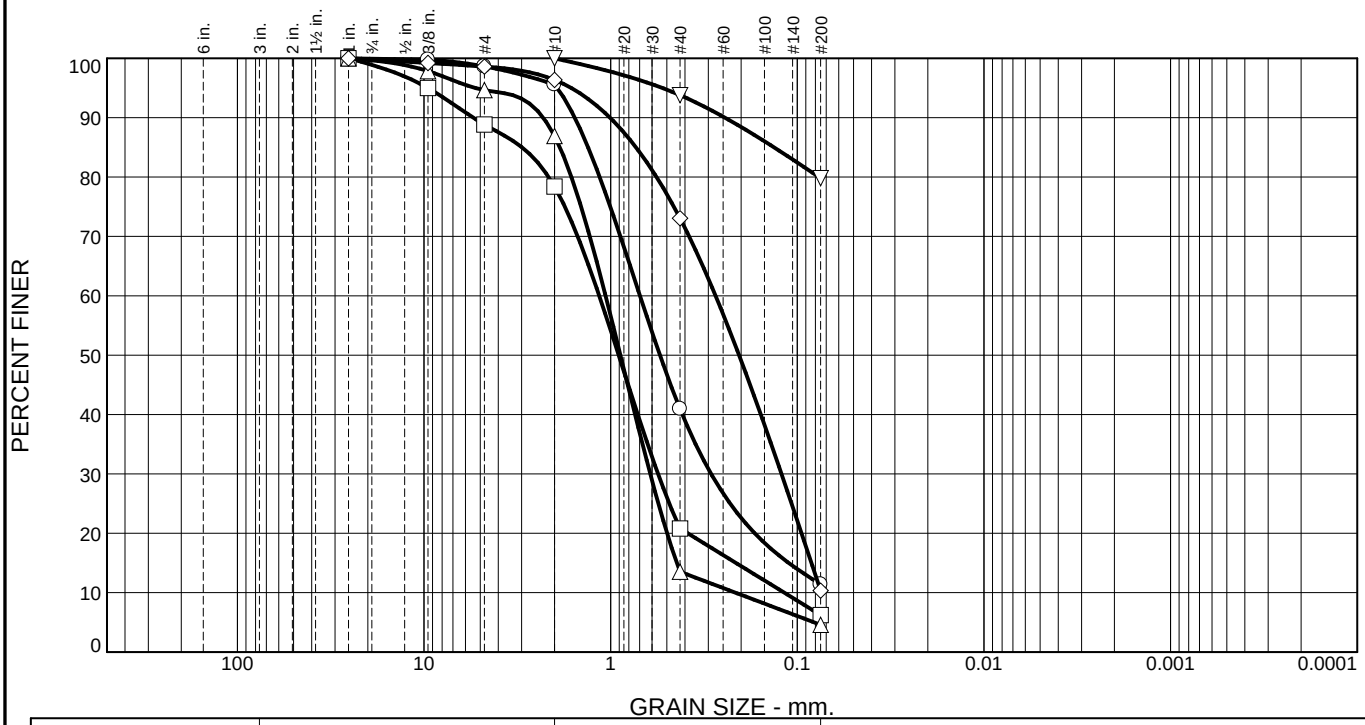
▽ **Source of Sample:** MB-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.4	54.6	29.6	11.4	
□	0.0	21.6	57.6	14.6	6.2	
△	0.0	13.1	73.4	8.9	4.6	
◇	0.0	3.6	23.3	62.8	10.3	
▽	0.0	0.0	6.2	14.0	79.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3214	0.6965	0.5442	0.2894	0.1111			
□	NV	NP	2.9869	1.1520	0.9060	0.5571	0.2130	0.1175	2.29	9.81
△	NV	NP	1.8716	1.0647	0.8868	0.6135	0.4420	0.2145	1.65	4.96
◇	NV	NP	0.7317	0.2741	0.2052	0.1216	0.0840			
▽	27.6	17.4	0.1333							

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
□ Wet dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	SW-SM	A-1-b
△ Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	SP	A-1-b
◇ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Wet stiff brown silty clay w/some fine sand, trace of coarse sand.	CL	A-6(7)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-2 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** MB-2 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** MB-2 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** MB-2 **Depth:** 39.0 **Sample Number:** 14

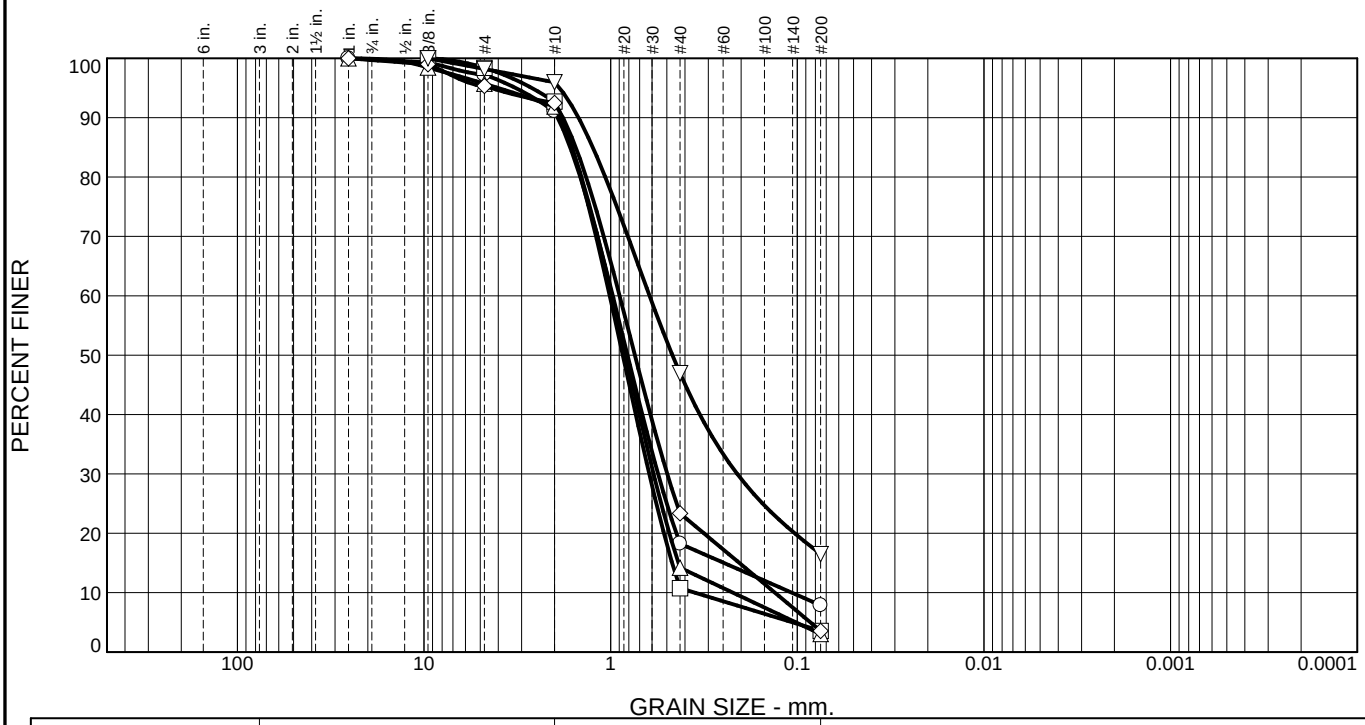
▽ **Source of Sample:** MB-2 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.9	72.8	10.4	7.9	
□	0.0	7.3	81.9	7.2	3.6	
△	0.0	8.1	77.7	11.2	3.0	
◇	0.0	7.5	69.1	19.8	3.6	
▽	0.0	4.0	49.0	30.5	16.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6478	0.9745	0.8127	0.5571	0.2468	0.1070	2.98	9.10
□	NV	NP	1.6121	1.0117	0.8610	0.6212	0.4683	0.3546	1.08	2.85
△	NV	NP	1.6134	0.9838	0.8308	0.5890	0.4334	0.2213	1.59	4.45
◇	NV	NP	1.5386	0.8956	0.7417	0.4977	0.2043	0.1319	2.10	6.79
▽	NV	NP	1.2467	0.6190	0.4668	0.2099				

Material Description	USCS	AASHTO
○ Wet dense brown coarse sand w/trace fine sand, fine gravel and silt.	SW-SM	A-1-b
□ Wet medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	SP	A-1-b
△ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b
◇ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b
▽ Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** MB-2 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** MB-2 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** MB-2 **Depth:** 59.0 **Sample Number:** 18

◇ **Source of Sample:** MB-2 **Depth:** 64.0 **Sample Number:** 19

▽ **Source of Sample:** MB-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

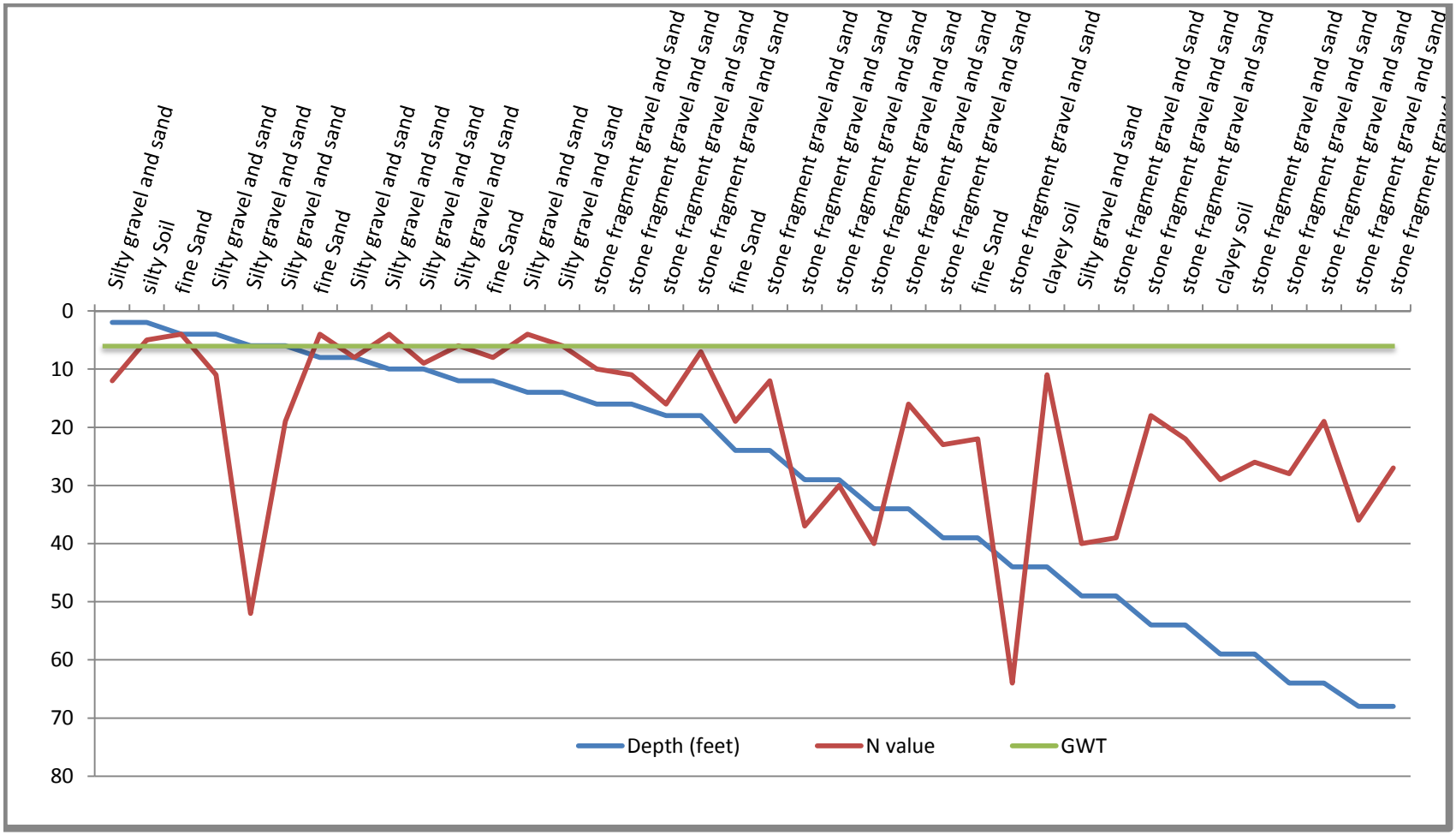
Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
FT-1	1		Moist gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	4.8	SM	A-2-4(0)	99.5	12.3				
	2	2	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	6.2	SP-SM	A-2-4(0)	99.3	11.5	4	5	7	7
	3	4	Wet very loose brown fine to coarse sand w/trace silt.	NV	NP	16.4	SP-SM	A-3	100	7.2	2	2	2	3
	4	6	Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel and organic matter.	NV	NP	16.9	SP-SM	A-2-4(0)	96	10.7	2	2	2	2
	5	8	Saturated very loose brown fine to coarse sand w/trace silt, fine gravel and organic matter.	NV	NP	31.8	SP-SM	A-3	96.6	10.3	2	2	2	2
	6	10	Saturated very loose brown fine sand w some coarse sand and silt, trace of fine gravel.	NV	NP	27	SM	A-2-4(0)	96.4	16	2	2	2	2
	7	12	Saturated loose brown silty fine to coarse sand w/trace fine gravel.	NV	NP	24.9	SM	A-2-4(0)	98	25.1	2	3	3	3
	8	14	Saturated very loose brown silty fine sand w/trace coarse sand and fine gravel.	NV	NP	32.4	SM	A-2-4(0)	99.3	25	1	2	2	1
	9	16	Saturated loose brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	23	SM	A-1-b	93.7	15.3	3	5	5	5
	10	18	Saturated medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	24.1	SP-SM	A-1-b	99	10.5	5	6	10	15
	11	24	Saturated medium dense brown fine to coarse sand w/trace silt and fine gravel.	NV	NP	23.7	SP-SM	A-3	97.4	9.3	5	9	10	13
	12	29	Saturated dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	14.4	SW	A-1-b	67.8	4.6	10	18	19	23
	13	34	Saturated dense brown coarse sand and fine gravel w/some fine sand, trace of silt.	NV	NP	12.1	SW-SM	A-1-b	64.2	7.5	25	22	18	15
	14	39	Saturated medium dense brown coarse sand w/some fine sand and fine gravel, trace of silt.	NV	NP	18.3	SP-SM	A-1-b	84.2	6.2	31	12	11	12
	15	44	Saturated medium dense brown fine gravel and coarse sand w/some fine sand and silt.	NV	NP	17.5	SM	A-1-b	64.7	13.5	12	13	14	24
	16	49	Saturated dense brown silty fine to coarse sand w/trace fine gravel.	22.4	NP	22	SM	A-2-4(0)	90.4	33.6	15	17	23	31
	17	54	Saturated medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	21.9	SP	A-1-b	85.1	3.2	8	9	9	15
	18	59	Saturated very stiff brown coarse sandy clay w/some silt and fine sand, trace of fine gravel.	39.7	17.9	26.6	SC	A-6(4)	90.8	43.2	12	14	15	22
	19	64	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.6	SP	A-1-b	92.9	4.9	11	13	15	17
	20	68	Saturated dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20.9	SP-SM	A-1-b	93.9	6	8	17	19	24
		70	End Boring											
FT-2														
	1		Wet gray fine sandy silt w/trace coarse sand.	19.6	NP	21.4	ML	A-4(0)	99.7	58.6				
	2	2	Wet firm gray fine sandy silt w/some coarse sand.	16.2	NP	14.3	SM	A-4(0)	99.6	39.1	1	2	3	5
	3	4	Wet medium dense brown silty fine sand w/some coarse sand, trace of fine gravel.	14.8	NP	15.6	SM	A-2-4(0)	97.8	27.1	3	5	6	8
	4	6	Wet medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.8	SP-SM	A-2-4(0)	95.9	10.6	8	9	10	7
	5	8	Wet loose brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	21.1	SM	A-2-4(0)	95.9	20.4	6	6	2	3
	6	10	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	24.4	SM	A-2-4(0)	95.2	14.5	5	4	5	5
	7	12	Wet loose brown fine sand w/some coarse sand, trace of fine gravel and silt.	NV	NP	19.1	SP-SM	A-3	98.8	10.2	2	4	4	4
	8	14	Wet loose brown silty fine sand w/trace coarse sand.	NV	NP	29	SM	A-2-4(0)	99.5	20.9	2	4	2	3
	9	16	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	23.2	SW-SM	A-1-b	91.2	9.5	3	6	5	8
	10	18	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.5	SP-SM	A-1-b	92.8	6.5	2	3	4	6
	11	24	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	24.8	SP-SM	A-1-b	95.6	11.4	6	5	7	9
	12	29	Wet dense brown fine gravelly coarse sand w/some fine sand, trace of silt.	NV	NP	16.5	SW-SM	A-1-b	78.4	6.2	10	14	16	12
	13	34	Wet medium dense brown coarse sand w/some fine gravel, trace of fine sand and silt.	NV	NP	18	SP	A-1-b	86.9	4.6	4	7	9	10
	14	39	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	24.6	SP-SM	A-3	96.4	10.3	11	15	7	7
	15	44	Wet stiff brown silty clay w/some fine sand, trace of coarse sand.	27.6	10.2	25.7	CL	A-6(7)	100	79.8	7	5	6	9
	16	49	Wet dense brown coarse sand w/trace fine sand, fine gravel and silt.	NV	NP	21.8	SW-SM	A-1-b	91.1	7.9	12	18	21	22
	17	54	Wet medium dense brown coarse sand w/trace fine gravel, fine sand and silt.	NV	NP	27.1	SP	A-1-b	92.7	3.6	7	10	12	14
	18	59	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	21.8	SP	A-1-b	91.9	3	6	11	15	18
	19	64	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	24.2	SW	A-1-b	92.5	3.6	8	9	10	13
	20	68	Wet medium dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	22.1	SM	A-1-b	96	16.5	8	11	16	35
		70	End Boring											

DATE : 5-04-2016

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-630 on Maple Branch road - Ellendale DE



DATE : **5-04-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-630 on Maple Branch road - Ellendale DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-16-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-681 on Cedar Lane- Georgetown, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 12-11-2015 and 12-14-2015. Hillis Carnes Engineering Associates (HCEA) drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model D-50 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using GM17 Geologic Map of the Harbeson Quadrangles, Delaware by Kelvin W. Ramsey and Jaime L. Tomlinson – 2011 this site for borings CL-1 at north west of the bridge is situated in Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

And borings CL-2 south east of the bridge situated in DUNE DEPOSITS Consist of white to light-yellow, well-sorted, medium to fine sand. Laminae of coarse sand are common. Thin, brown soil lamellae are commonly found at depths of 1 to 3 ft within the dunes. Deposits up to 16 ft thick. The deposits are eolian features related to cold-climate processes when arboreal vegetation was scarce and winds blew sand dunes across the landscape. Some of the dunes, which have well-

developed and deep (>3 ft) soil profiles, may be older than latest Pleistocene. Middle Pleistocene to Holocene.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Harbeson Area, Delaware by John K. Adams and Durward H. Boggess (1964) Atlas HA-108. The nearest well to this site the groundwater historically had been measured as 41 feet on October 1960 and between the years of 1950 to 1962 appeared from 38 to 42 feet below the existing elevation. The historical borings indicate the AASHTO soil classification from the surface to 72 feet down is Silty or Clayey gravel and sand (A-2-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter less of 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters range 30 to 40 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey of Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003. The Recharge potential is a GOOD category.

5. Ground Cover

The ground cover for site is 6.5 inches of asphalt. More detail show in Appendix- B

6. Groundwater

The depth to groundwater below the ground surface elevation was noted during the drilling operations is 4 and 5 feet, noted at the completion of the drilling is 10 and 13 feet and caved at 7 feet more detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 5.8 to 37.70 percent. Atterberg limit not encountered for the entire sample . The organic matter is 5 percent more detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition and 6 feet in thickness of loose fine sand layer appeared at 12 feet down from the surface elevation at the borings CL-2 only at south east side of the bridge this layer need to be considered in the design. In addition all the sample from the depth of 2 to 12 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 17-1692 T201407003 BR3-681 on Cedar Lane in Sussex County

Google earth

feet 400

meters 100

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING CL-1

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 241425.841
Easting: 677940.564
Boring Surface Elev.:
Reference:
Date Started: 12/11/15
Date Completed: 12/11/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
12/11/15	5.0	
12/11/15	7.0	7.5

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: D-50 Truck Rig
Driller: John M.
Logged By: Michael Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' 2.0'	9 14 9	Moist medium dense gray silty fine to coarse sand w/trace fine gravel. 16" RECOVERY	A-2-4(0)	Hot-mix 6.5"
2.53		2	2.0' 4.0'	3 4 5 7	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
5.06	■	3	4.0' 6.0'	2 2 6 7	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
7.59	▽	4	6.0' 8.0'	1 6 2 1	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 14" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	6 7 7 9	Wet medium dense gray fine to coarse sand w/trace fine gravel and silt. 18" RECOVERY	A-3	
		6	10.0' 12.0'	2 2 4 6	Wet loose gray fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
12.65		7	12.0' 14.0'	5 8 7 8	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: CL-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' – 16.0'	0 5 4 7	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
17.71		9	16.0' – 18.0'	2 5 6 7	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt. 22" RECOVERY	A-1-b	
20.24		10	18.0' – 20.0'	4 5 6 7	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt. 20" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' – 25.0'	2 11 12 13	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' – 30.0'	4 8 11 12	Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' – 35.0'	12 13 13 15	Wet medium dense orange silty fine sand w/ some coarse sand, trace of fine gravel. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road **Boring No.:** CL-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	7 12 16 18	Wet medium dense gray fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
40.48							
43.01							
45.54		15	45.0' 47.0'	3 12 14 15	Wet medium dense orange fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
48.07							
		16	48.0' 50.0'	4 11 21 24	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
50.6							
53.13							
		17	53.0' 55.0'	6 5 14 20	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19		18	58.0'	13 23 33 50/5	Wet dense gray coarse to fine sand w/some silt, trace of fine gravel.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003
Boring No.: CL-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	14 15 22 23	Wet dense gray fine to coarse sand w/trace fine gravel and silt.	A-3	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	13 23 28 23	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING CL-2

Project Name: Eagles Landing Road
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 241425.841
Easting: 677961.987
Boring Surface Elev.:
Reference:
Date Started: 12/14/15
Date Completed: 12/14/15

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
12/14/15	4.0	
12/14/15	7.0	7.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: D-50 Truck Rig
Driller: John M.
Logged By: Michael Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	1.0' 2.0'	3 3	Moist very loose gray fine to coarse sand w/ some silt, trace of fine gravel. 12" RECOVERY	A-2-4(0)	
2.53		2	2.0' 4.0'	3 2 1 3	Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
5.06	■	3	4.0' 6.0'	1 1 2 3	Saturated very loose gray fine to coarse sand w/trace silt and organic matter. 20" RECOVERY	A-3	
7.59	▼	4	6.0' 8.0'	2 3 4 5	Saturated loose gray coarse to fine sand w/ trace silt, fine gravel and organic matter. 20" RECOVERY	A-1-b	
10.12		5	8.0' 10.0'	2 4 5 5	Saturated loose gray coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
		6	10.0' 12.0'	4 3 4 6	Saturated loose gray coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
12.65		7	12.0' 14.0'	3 4 4 7	Saturated loose gray fine to coarse sand w/ trace fine gravel and silt. 20" RECOVERY	A-3	
		8	14.0'	0 1	Saturated loose gray fine to coarse sand w/	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road **Boring No.:** CL-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18			16.0'	7 7	trace fine gravel and silt. 18" RECOVERY		
17.71		9	16.0' 18.0'	2 3 5 6	Saturated loose brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
20.24		10	18.0' 20.0'	3 5 6 8	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
22.77							
25.3		11	23.0' 25.0'	7 7 3 3	Saturated loose brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
27.83							
30.36		12	28.0' 30.0'	5 5 7 11	Saturated medium dense brown fine sand w/ some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' 35.0'	3 3 5 7	Saturated loose gray fine to coarse sand w/ some silt. 16" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003

Boring No.: CL-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	4 10 11 14	Saturated medium dense gray silty fine sand w/trace coarse sand.	A-2-4(0)	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	5 23 35 43	Saturated very dense tan fine sand w/trace coarse sand and silt.	A-3	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	11 16 20 31	Saturated dense tan coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			50.0'		21" RECOVERY		
50.6							
53.13							
		17	53.0'	10 13 9 12	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			55.0'		23" RECOVERY		
55.66							
58.19							
		18	58.0'	1 9 11 13	Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	A-3	
			60.0'		22" RECOVERY		

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Eagles Landing Road
State Contract: T201407003

Boring No.: CL-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72							
63.25		19	63.0' 65.0'	14 22 21 20	Saturated dense orange fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
65.78							
68.31		20	68.0' 70.0'	15 20 30 37	Saturated dense orange coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

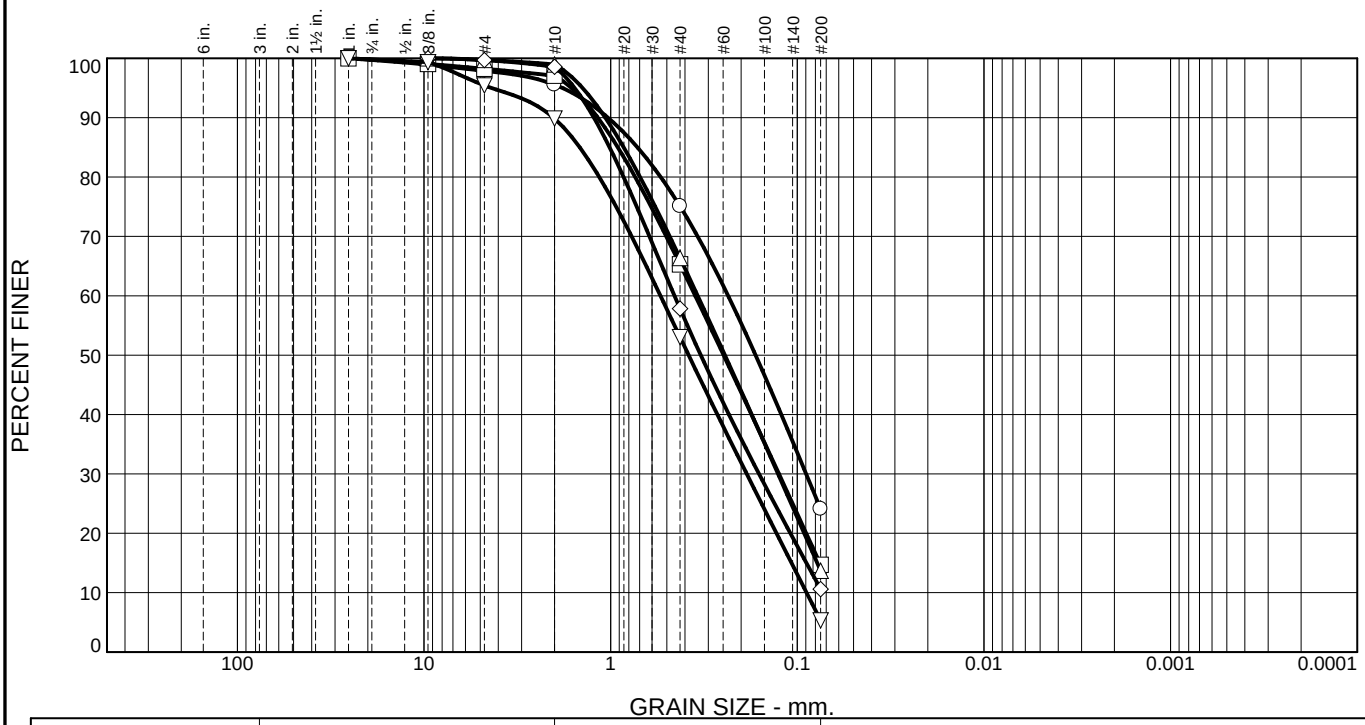
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.4	20.5	51.0	24.1	
□	0.0	2.9	31.8	50.6	14.7	
△	0.0	1.0	32.6	52.7	13.7	
◇	0.0	1.4	40.8	47.2	10.6	
▽	0.0	10.1	36.9	47.7	5.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7185	0.2347	0.1674	0.0897				
□	NV	NP	0.9156	0.3521	0.2482	0.1255	0.0758			
△	NV	NP	0.8513	0.3418	0.2442	0.1269	0.0782			
◇	NV	NP	1.0133	0.4550	0.3290	0.1604	0.0894			
▽	NV	NP	1.4645	0.5410	0.3821	0.1866	0.1074	0.0892	0.72	6.06

Material Description	USCS	AASHTO
○ Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
▽ Wet medium dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** CL-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** CL-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** CL-1 **Depth:** 6.0 **Sample Number:** 4

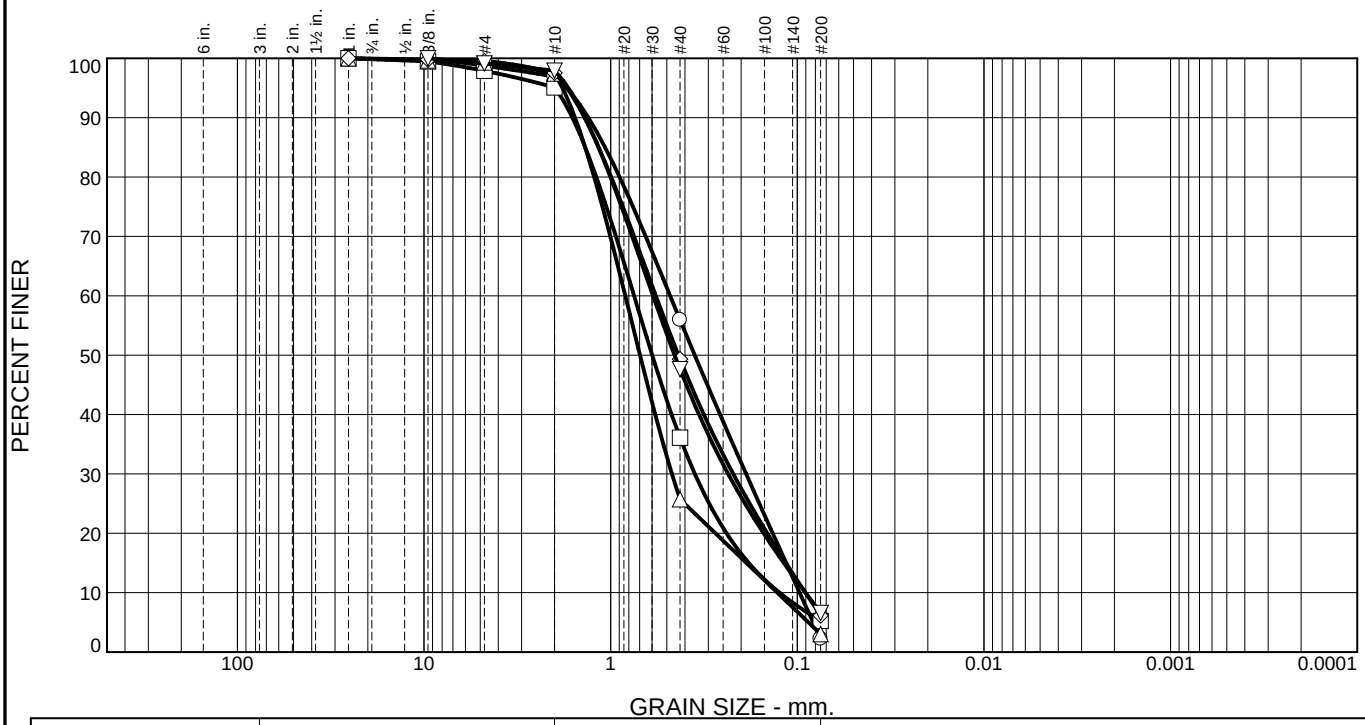
▽ **Source of Sample:** CL-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.1	41.0	53.7	2.2	
□	0.0	4.9	59.0	30.9	5.2	
△	0.0	2.6	71.7	22.7	3.0	
◇	0.0	2.5	48.2	43.1	6.2	
▽	0.0	2.1	50.3	41.0	6.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.0718	0.4801	0.3545	0.1881	0.1148	0.0972	0.76	4.94
□	NV	NP	1.3677	0.7491	0.5988	0.3540	0.1822	0.1246	1.34	6.01
△	NV	NP	1.3689	0.8348	0.6961	0.4696	0.1874	0.1279	2.07	6.53
◇	NV	NP	1.1593	0.5727	0.4333	0.2205	0.1151	0.0905	0.94	6.33
▽	NV	NP	1.1618	0.5929	0.4543	0.2346	0.1181	0.0904	1.03	6.56

Material Description	USCS	AASHTO
○ Wet loose gray fine to coarse sand w/trace fine gravel and silt.	SP	A-3
□ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SW	A-1-b
◇ Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
▽ Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** CL-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** CL-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** CL-1 **Depth:** 16.0 **Sample Number:** 9

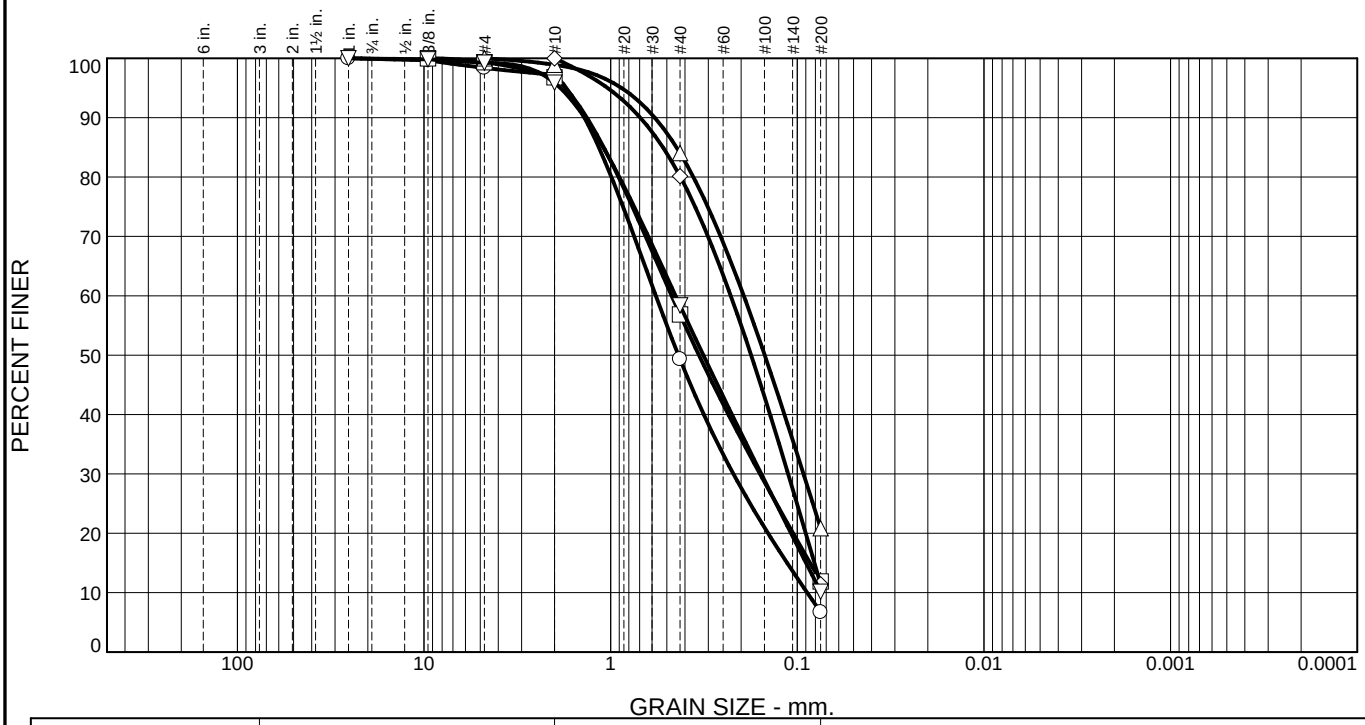
▽ **Source of Sample:** CL-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.8	47.9	42.6	6.7	
□	0.0	3.2	39.9	45.0	11.9	
△	0.0	1.1	14.9	63.1	20.9	
◇	0.0	0.0	19.9	68.7	11.4	
▽	0.0	4.1	37.5	48.2	10.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1571	0.5724	0.4336	0.2199	0.1133	0.0885	0.95	6.47
□	NV	NP	1.0893	0.4712	0.3365	0.1585	0.0855			
△	NV	NP	0.4438	0.1937	0.1495	0.0927				
◇	NV	NP	0.5248	0.2273	0.1769	0.1120	0.0810			
▽	NV	NP	1.0962	0.4490	0.3188	0.1560	0.0898			

Material Description	USCS	AASHTO
○ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
□ Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
△ Wet medium dense orange silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense gray fine sand w/some coarse sand and silt.	SP-SM	A-2-4(0)
▽ Wet medium dense orange fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** CL-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** CL-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** CL-1 **Depth:** 38.0 **Sample Number:** 14

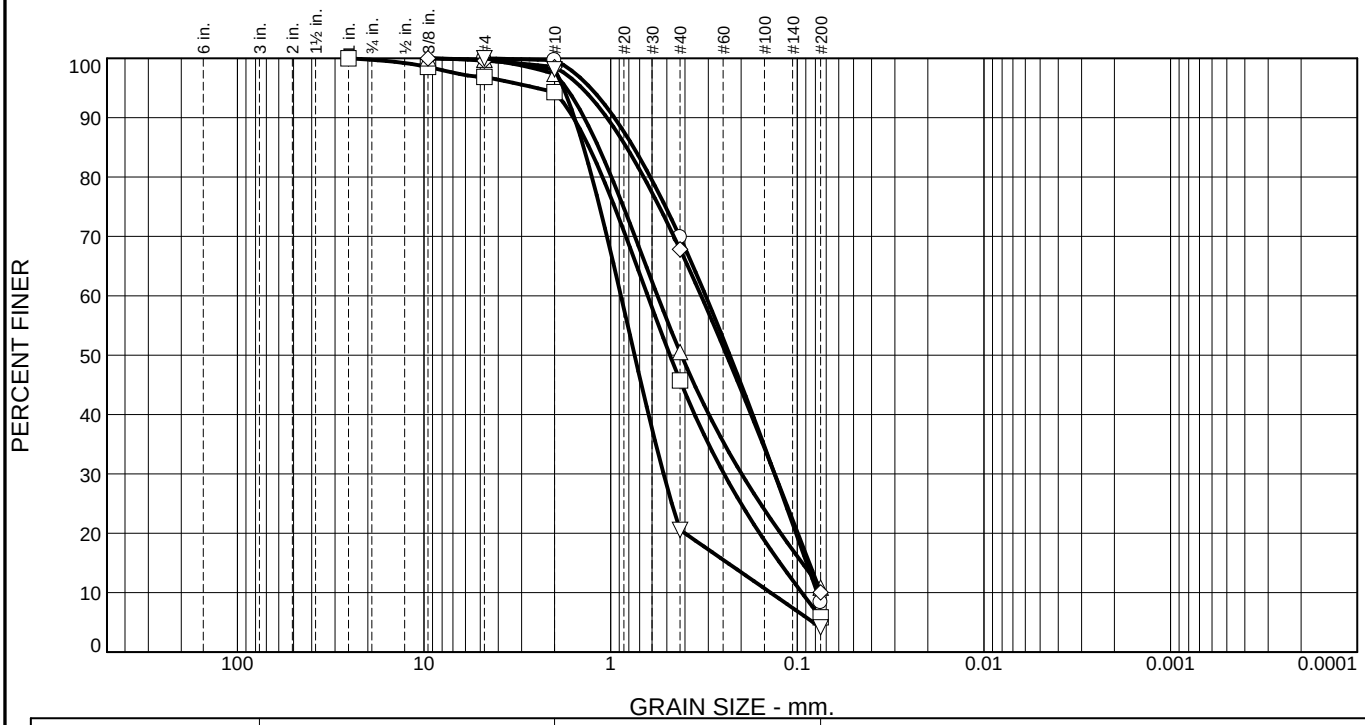
▽ **Source of Sample:** CL-1 **Depth:** 45.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.3	29.8	61.5	8.4	
□	0.0	5.7	48.6	39.9	5.8	
△	0.0	2.6	46.9	39.6	10.9	
◇	0.0	1.5	30.7	57.8	10.0	
▽	0.0	1.9	77.5	16.4	4.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7538	0.3096	0.2300	0.1324	0.0891	0.0782	0.72	3.96
□	NV	NP	1.3035	0.6331	0.4813	0.2469	0.1238	0.0946	1.02	6.69
△	NV	NP	1.1603	0.5610	0.4180	0.1987	0.0941			
◇	NV	NP	0.8218	0.3274	0.2390	0.1322	0.0863			
▽	NV	NP	1.3953	0.8813	0.7444	0.5205	0.2359	0.1391	2.21	6.33

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
□ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Wet dense gray coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
◇ Wet dense gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** CL-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** CL-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** CL-1 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** CL-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

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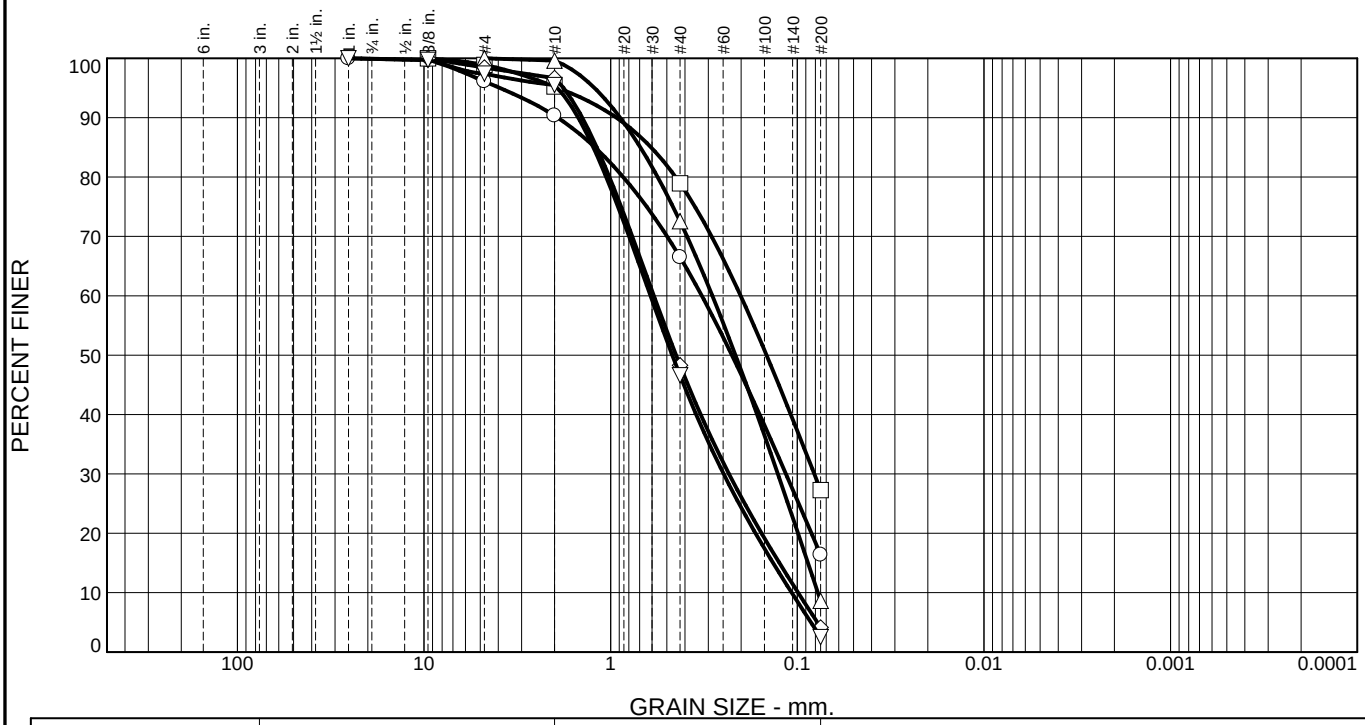
Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.7	23.8	50.1	16.4	
□	0.0	4.8	16.3	51.6	27.3	
△	0.0	0.4	27.0	64.0	8.6	
◇	0.0	3.3	48.4	44.2	4.1	
▽	0.0	4.5	48.9	44.1	2.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2144	0.3247	0.2240	0.1152				
□	NV	NP	0.6074	0.2012	0.1462	0.0811				
△	NV	NP	0.6931	0.2851	0.2145	0.1272	0.0877	0.0776	0.73	3.68
◇	NV	NP	1.1873	0.5867	0.4463	0.2323	0.1247	0.0990	0.93	5.92
▽	NV	NP	1.2386	0.6115	0.4676	0.2480	0.1348	0.1072	0.94	5.70

Material Description	USCS	AASHTO
○ Moist very loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
△ Saturated very loose gray fine to coarse sand w/trace silt and organic matter.	SP-SM	A-3
◇ Saturated loose gray coarse to fine sand w/trace silt, fine gravel and organic matter.	SP	A-1-b
▽ Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-2 **Depth:** 1.0 **Sample Number:** 1

□ **Source of Sample:** CL-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** CL-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** CL-2 **Depth:** 6.0 **Sample Number:** 4

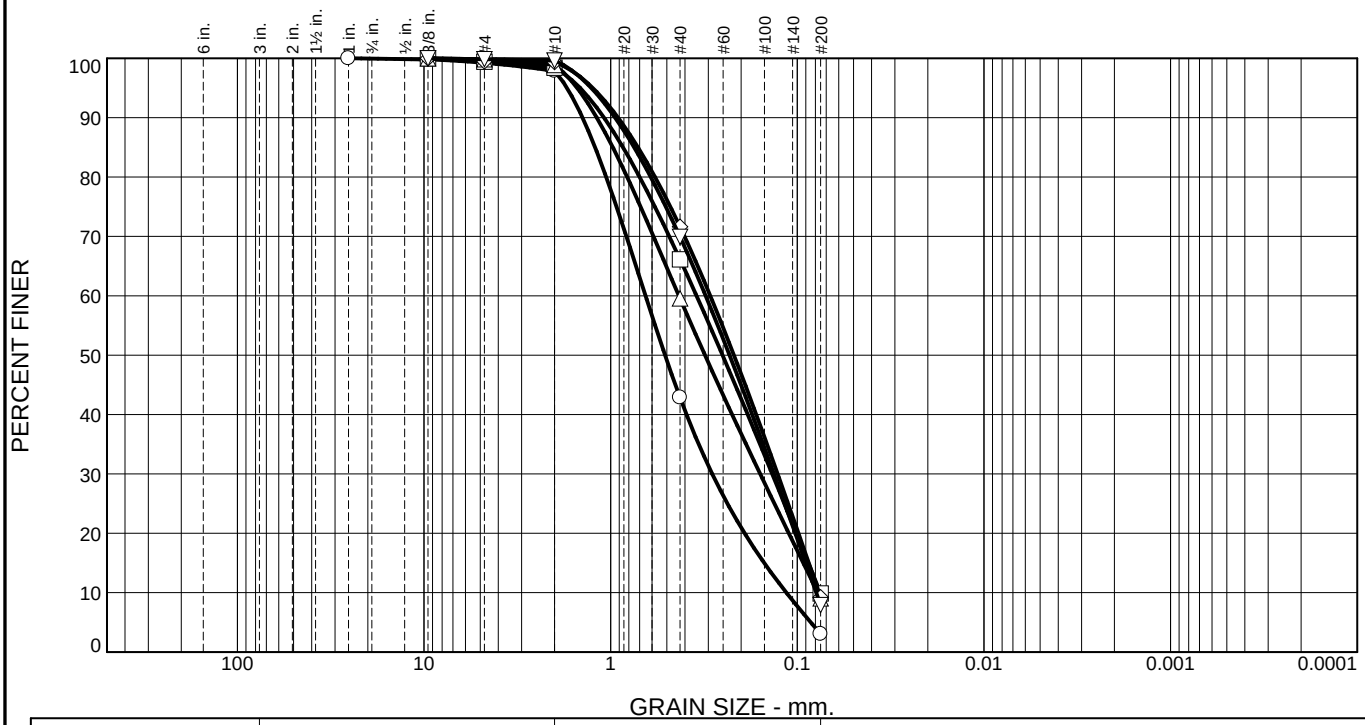
▽ **Source of Sample:** CL-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.1	55.0	39.9	3.0	
□	0.0	1.6	32.3	56.2	9.9	
△	0.0	1.1	39.4	50.5	9.0	
◇	0.0	0.6	27.8	62.4	9.2	
▽	0.0	0.4	29.7	62.0	7.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2124	0.6502	0.5112	0.2856	0.1504	0.1144	1.10	5.68
□	NV	NP	0.8589	0.3466	0.2515	0.1363	0.0873	0.0753	0.71	4.60
△	NV	NP	0.9741	0.4311	0.3124	0.1582	0.0929	0.0777	0.75	5.55
◇	NV	NP	0.7143	0.2926	0.2186	0.1276	0.0868	0.0765	0.73	3.83
▽	NV	NP	0.7481	0.3097	0.2307	0.1334	0.0901	0.0792	0.73	3.91

Material Description	USCS	AASHTO
○ Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
□ Saturated loose gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Saturated loose gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** CL-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** CL-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** CL-2 **Depth:** 16.0 **Sample Number:** 9

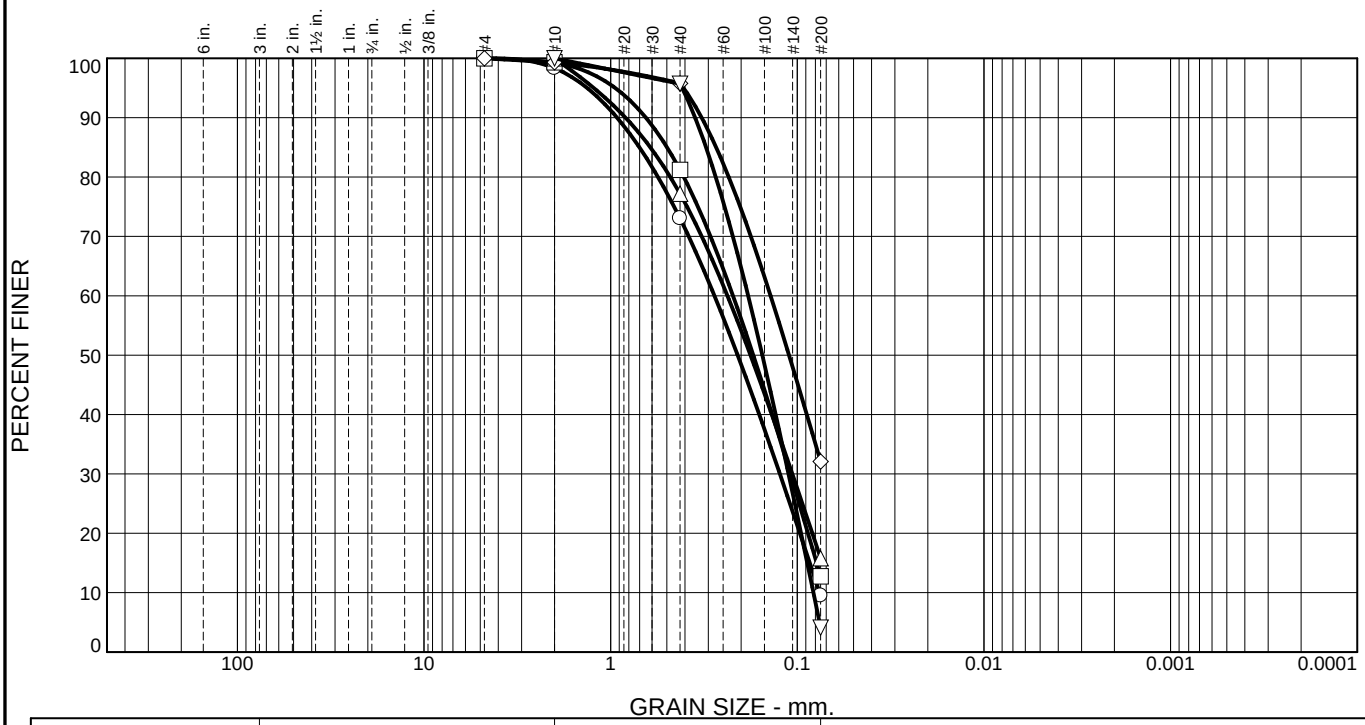
▽ **Source of Sample:** CL-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.7	25.2	63.6	9.5	
□	0.0	0.7	18.1	68.4	12.8	
△	0.0	0.0	22.8	61.4	15.8	
◇	0.0	0.7	3.5	63.7	32.1	
▽	0.0	0.0	4.3	91.6	4.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7012	0.2778	0.2088	0.1241	0.0857	0.0759	0.73	3.66
□	NV	NP	0.4985	0.2211	0.1722	0.1090	0.0787			
△	NV	NP	0.6131	0.2367	0.1783	0.1064				
◇	NV	NP	0.2720	0.1391	0.1108					
▽	NV	NP	0.3081	0.1834	0.1541	0.1115	0.0885	0.0820	0.83	2.24

Material Description	USCS	AASHTO
○ Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
□ Saturated medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Saturated loose gray fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Saturated medium dense gray silty fine sand w/trace coarse sand.	SM	A-2-4(0)
▽ Saturated very dense tan fine sand w/trace coarse sand and silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** CL-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** CL-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** CL-2 **Depth:** 38.0 **Sample Number:** 14

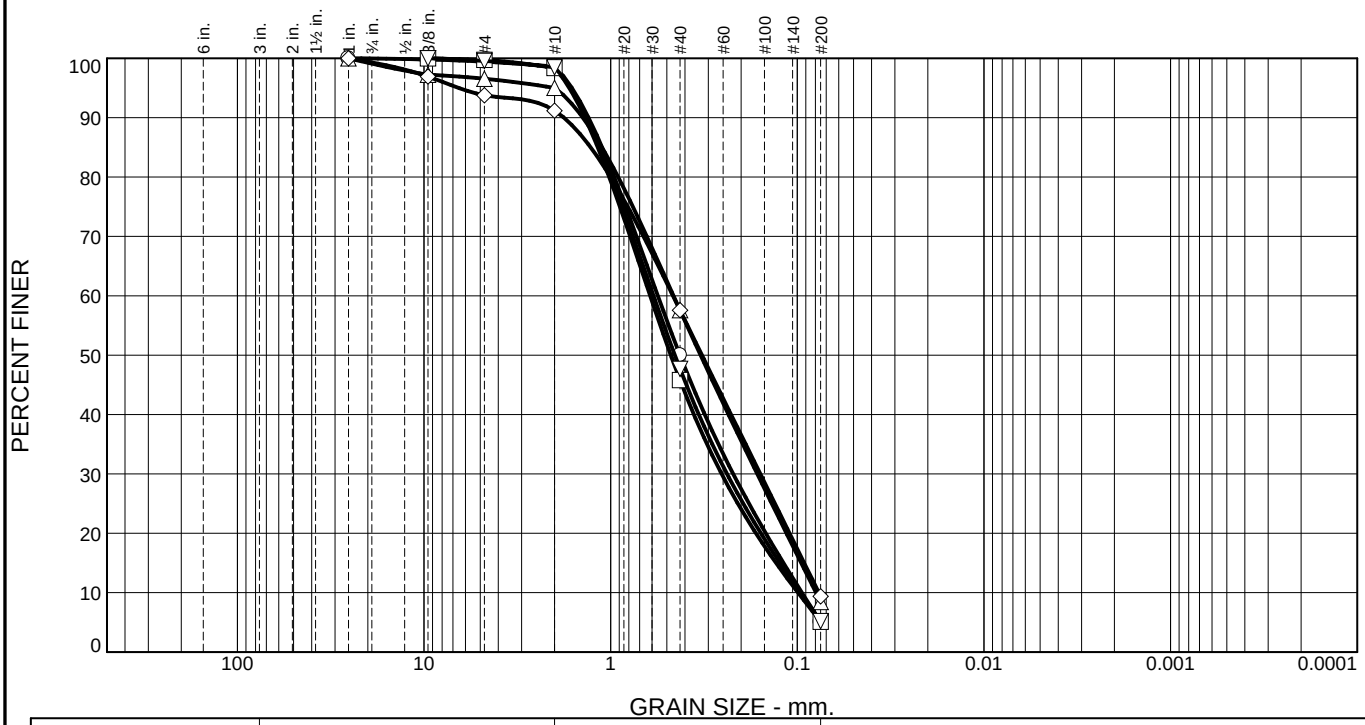
▽ **Source of Sample:** CL-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.4	48.6	45.0	5.0	
□	0.0	1.6	52.6	40.7	5.1	
△	0.0	5.0	37.4	49.2	8.4	
◇	0.0	8.8	33.6	48.2	9.4	
▽	0.0	1.5	50.8	42.5	5.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1115	0.5588	0.4252	0.2206	0.1187	0.0945	0.92	5.91
□	NV	NP	1.1725	0.6142	0.4763	0.2543	0.1300	0.0992	1.06	6.19
△	NV	NP	1.1130	0.4605	0.3298	0.1640	0.0953	0.0794	0.74	5.80
◇	NV	NP	1.2795	0.4634	0.3242	0.1579	0.0919	0.0767	0.70	6.04
▽	NV	NP	1.1450	0.5893	0.4531	0.2379	0.1239	0.0963	1.00	6.12

Material Description	USCS	AASHTO
○ Saturated dense tan coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
□ Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
△ Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Saturated dense orange fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Eagles Landing Road

○ **Source of Sample:** CL-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** CL-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** CL-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** CL-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** CL-2 **Depth:** 68.0 **Sample Number:** 20

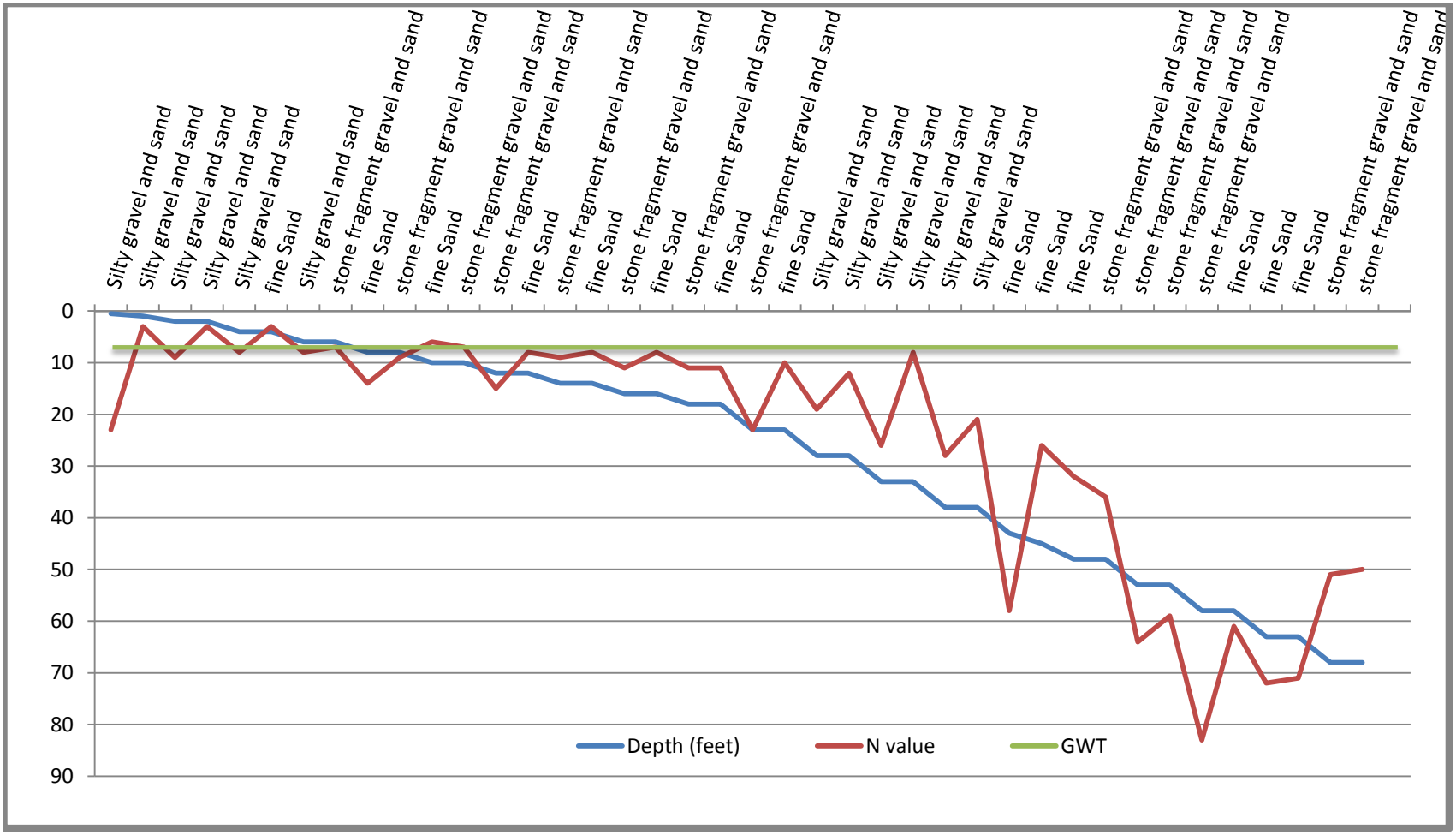
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
CL-1	1	0.5	Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	7.2	SM	A-2-4(0)	95.6	24.1	9	14	9	
	2	2	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.3	SM	A-2-4(0)	97.1	14.7	3	4	5	7
	3	4	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	25.2	SM	A-2-4(0)	99	13.7	2	2	6	7
	4	6	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	22.4	SP-SM	A-2-4(0)	98.6	10.6	1	6	2	1
	5	8	Wet medium dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.9	SP-SM	A-3	89.9	5.3	6	7	7	9
	6	10	Wet loose gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.9	SP	A-3	96.9	2.2	2	2	4	6
	7	12	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.7	SW-SM	A-1-b	95.1	5.2	5	8	7	8
	8	14	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	18	SW	A-1-b	97.4	3		5	4	7
	9	16	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	21	SP-SM	A-1-b	97.5	6.2	2	5	6	7
	10	18	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.3	SW-SM	A-1-b	97.9	6.6	4	5	6	7
	11	23	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.5	SP-SM	A-1-b	97.2	6.7	2	11	12	13
	12	28	Wet medium dense orange fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	16.7	SP-SM	A-2-4(0)	96.8	11.9	4	8	11	12
	13	33	Wet medium dense orange silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	20.4	SM	A-2-4(0)	98.9	20.9	12	13	13	15
	14	38	Wet medium dense gray fine sand w/some coarse sand and silt.	NV	NP	18.8	SP-SM	A-2-4(0)	100	11.4	7	12	16	18
	15	45	Wet medium dense orange fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.9	SP-SM	A-3	95.9	10.2	3	12	14	15
	16	48	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	20.8	SP-SM	A-3	99.7	8.4	4	11	21	24
	17	53	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.9	SW-SM	A-1-b	94.3	5.8	6	5	14	20
	18	58	Wet dense gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	13.5	SP-SM	A-1-b	97.4	10.9	13	23	33	50/5
	19	63	Wet dense gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	14	SP-SM	A-3	98.5	10	14	15	22	23
	20	68	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	14.7	SW	A-1-b	98.1	4.2	13	23	28	23
		70	End Boring											
CL-2	1	1	Moist very loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	5.8	SM	A-2-4(0)	90.3	16.4	3	3		
	2	2	Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	17.8	SM	A-2-4(0)	95.2	27.3	3	2	1	3
	3	4	Saturated very loose gray fine to coarse sand w/trace silt and organic matter.	NV	NP	37.7	SP-SM	A-3	99.6	8.6	1	1	2	3
	4	6	Saturated loose gray coarse to fine sand w/trace silt, fine gravel and organic matter.	NV	NP	23.7	SP	A-1-b	96.7	4.1	2	3	4	5
	5	8	Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	19	SP	A-1-b	95.5	2.5	2	4	5	5
	6	10	Saturated loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	16	SP	A-1-b	97.9	3	4	3	4	6
	7	12	Saturated loose gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	24.3	SP-SM	A-3	98.4	9.9	3	4	4	7
	8	14	Saturated loose gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	23.3	SP-SM	A-3	98.9	9		1	7	7
	9	16	Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	23.7	SP-SM	A-3	99.4	9.2	2	3	5	6
	10	18	Saturated medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	17.7	SP-SM	A-3	99.6	7.9	3	5	6	8
	11	23	Saturated loose brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	19.1	SP-SM	A-3	98.3	9.5	7	7	3	3
	12	28	Saturated medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	25.9	SM	A-2-4(0)	99.3	12.8	5	5	7	11
	13	33	Saturated loose gray fine to coarse sand w/some silt.	NV	NP	24.8	SM	A-2-4(0)	100	15.8	3	3	5	7
	14	38	Saturated medium dense gray silty fine sand w/trace coarse sand.	NV	NP	22.7	SM	A-2-4(0)	99.3	32.1	4	10	11	14
	15	43	Saturated very dense tan fine sand w/trace coarse sand and silt.	NV	NP	20.5	SP	A-3	100	4.1	5	23	35	43
	16	48	Saturated dense tan coarse to fine sand w/trace fine gravel and silt.	NV	NP	16.1	SP-SM	A-1-b	98.6	5	11	16	20	31
	17	53	Saturated medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	22	SW-SM	A-1-b	98.4	5.1	10	13	9	12
	18	58	Saturated medium dense orange fine to coarse sand w/trace fine gravel and silt.	NV	NP	20.5	SP-SM	A-3	95	8.4	1	9	11	13
	19	63	Saturated dense orange fine to coarse sand w/trace fine gravel and silt.	NV	NP	18.7	SP-SM	A-3	91.2	9.4	14	22	21	20
	20	68	Saturated dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	14.2	SP-SM	A-1-b	98.5	5.2	15	20	30	37
		70	End Boring											

DATE : 3-16-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-681 on Cedar Lane- Georgetown, DE



DATE : 3-16-2016

PROJECT NUMBER : T201407003

PROJECT NAME : BR3-681 on Cedar Lane- Georgetown, DE

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 3-18-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-913 Beach HGWY and SR16- Ellendale, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-14-2016 and 1-15-2016. Hillis Carnes Engineering Associates (HCEA) drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John Adam, and Durward H. Boggess (1964)

Atlas HA-99. The nearest well to this site the groundwater historically had been measured as 47 feet on October 1960 and between the years of 1950 to 1960 appeared from 44 to 48 feet below the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 48 feet down is Silty or Clayey gravel and sand (A-2-4) and from 48 to 72 feet down is fine sand (A-3).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter from 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounter from 40 to 50 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Geohydrology Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003 the recharge potential for this area is situated is in a GOOD and EXCELLENT Category.

5. Ground Cover

The ground cover for site is 8 inches of asphalt. More detail show in Appendix- B

6. Groundwater

The depth to groundwater below the ground surface elevation was noted during the drilling operations is 7 and 9 feet, noted at the completion of the drilling is 9 and 17 feet and caved at 10 and 11 feet. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 9.8 to 27.6 percent. The Atterberg limit is 3 percent, Liquid limits is 21.2 percent and Plasticity Index is 4.9 percent. The Organic matter not encountered for the entire sample. More detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition and 10 feet in thickness of loose fine sand layer appeared at 8 feet down from the surface elevation this layer need to be considered in the design. In addition all the sample from the depth of 2 to 12 feet from the surface had been met all the borrow material except Borrow type "B" according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

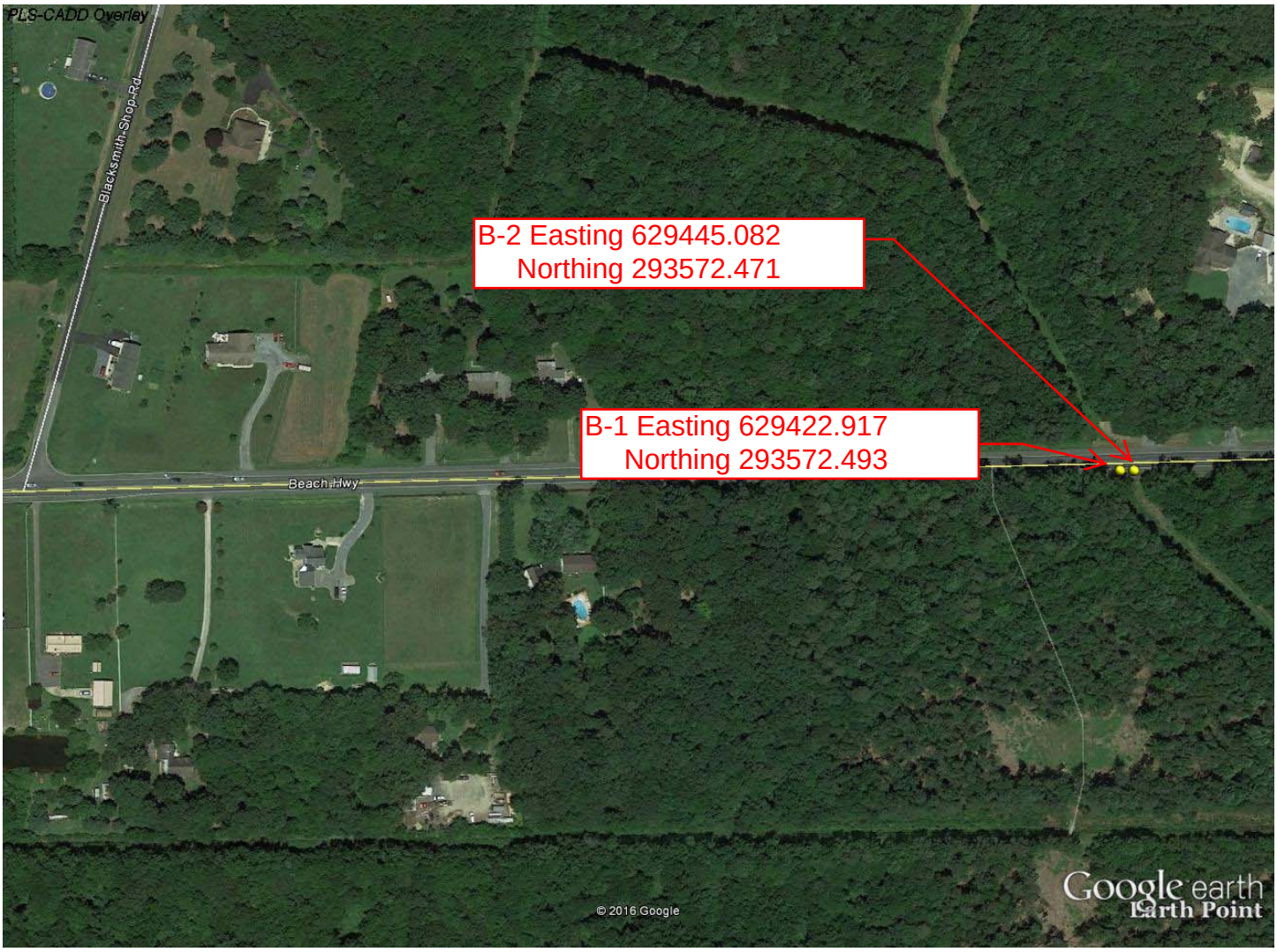
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 25-1692 T201407003 BR3-914 on Beach Highway in Sussex County



Google earth

feet 1000

meters 300

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING JR-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 209144.145
Easting: 626697.448
Boring Surface Elev.:
Reference:
Date Started: 9/29/15
Date Completed: 9/29/15

Wt. of Sample Hammer: Lbs.
Type of: D-Sampler: Split Barrel O.D.
S-Sampler: O.D.
U-Sampler: O.D.
Core Bit: O.D.

Average Fall: IN.
O.D. of Sampler: 2 IN.
O.D. of Samp. Tube: IN.
O.D. of Samp. Tube: IN.
O.D. of Rock Core: IN.

Hollow Stem Auger Diameter: 3 1/4" Inches
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
9/29/15	9.0	
9/29/15	11.0	9.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30
Driller: John M.
Logged By: Jerry Johnson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	3 13 17 17	Moist medium dense brown fine to coarse sand and fine gravel w/some silt. 18" RECOVERY	A-1-b	Hot-mix 9'
2.53		2	2.0' 4.0'	14 18 18 23	Moist dense brown fine to coarse sand w/ trace silt and fine gravel. 22" RECOVERY	A-3	
5.06		3	4.0' 6.0'	8 8 9 11	Moist medium dense brown fine to coarse sand w/trace silt. 22" RECOVERY	A-3	
7.59		4	6.0' 8.0'	4 5 4 4	Moist loose brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
10.12	■	5	8.0' 10.0'	3 2 2 3	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
	▼	6	10.0' 12.0'	2 1 2 2	Saturated very loose brown fine to coarse sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
12.65		7	12.0'	2 3 3 4	Saturated loose gray fine to coarse sand w/ trace silt and fine gravel.	A-3	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** JR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 2 3 4	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 20" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	1 1 1 2	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt. 22" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	1 1 3 4	Saturated very loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	2 3 4 8	Saturated loose brown coarse to fine sand w/ trace fine gravel and silt. 20" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	2 4 5 8	Saturated loose orange coarse sand w/some fine sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	6 7 7 9	Saturated medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** JR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	15 7 8 8	Saturated medium dense orange coarse to fine sand and fine gravel, trace of silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	6 6 11 12	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	2 6 6 8	Saturated medium dense orange coarse to fine sand w/trace silt and fine gravel.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	5 5 10 13	Saturated medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			55.0'		23" RECOVERY		
55.66							
58.19							
		18	58.0'	7 17 21 29	Saturated dense brown coarse to fine sand w/ trace silt and fine gravel.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** JR-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	12 20 27 40	Saturated dense brown coarse to fine sand w/ trace fine gravel and silt.	A-1-b	
			65.0'		22" RECOVERY		
65.78							
68.31		20	68.0'	12 18 32 40	Saturated very dense gray fine to coarse sand w/trace silt and fine gravel.	A-3	
			70.0'		20" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BH-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 293572.493
Easting: 629422.917
Boring Surface Elev.:
Reference:
Date Started: 1/14/16
Date Completed: 1/14/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches** **From Depth of:** 0.0 **To:** 25.0
Mud Rotary: **From Depth of:** 25.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/14/16	9.0	
1/14/16	17.0	10.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By: Michael Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 2.0'	3 5 10 10	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	Hot-mix 8"
2.53		2	2.0' 4.0'	3 8 8 10	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	2 2 4 4	Moist loose gray fine to coarse sand w some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	1 6 11 14	Wet medium dense gray fine to coarse sand w/some fine gravel and silt. 22" RECOVERY	A-2-4(0)	
10.12	■	5	8.0' 10.0'	3 4 5 5	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
		6	10.0' 12.0'	1 1 2 5	Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel. 16" RECOVERY	A-2-4(0)	
12.65		7	12.0'	2 2 4 7	Wet loose gray coarse to fine sand w/trace silt and fine gravel.	A-1-b	

Remarks:

Reviewed By: Hany Fekry **Soils Supervisor:** Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BH-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 2 5 7	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 22" RECOVERY	A-1-b	
17.71	▽	9	16.0' 18.0'	2 4 5 12	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	1 2 5 9	Wet loose gray coarse to fine sand w/trace silt and fine gravel. 24" RECOVERY	A-3	
22.77							
25.3		11	23.0' 25.0'	2 4 6 8	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	2 3 7 8	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' 35.0'	2 5 10 10	Wet medium dense gray coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BH-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	2 5 10 12	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
40.48							
43.01		15	43.0' 45.0'	2 5 15 12	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
45.54							
48.07		16	48.0' 50.0'	3 15 12 12	Wet medium dense gray fine to coarse sand and fine gravel, trace of silt. 24" RECOVERY	A-1-b	
50.6							
53.13		17	53.0' 55.0'	12 18 16 15	Wet dense orange fine to coarse sand w trace fine gravel and silt. 24" RECOVERY	A-3	
55.66							
58.19		18	58.0'	5 12 13 14	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: BH-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	13 14 14 25	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	5 12 21 24	Wet dense orange coarse to fine sand w trace silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Well graded gravels and sands
	Clean sand & gravelly sand
	Poorly graded, silty or clayey sands and gravel
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BH-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 293572.471
Easting: 629445.082
Boring Surface Elev.:
Reference:
Date Started: 1/15/16
Date Completed: 1/15/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 75.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/15/16	7.0	
1/15/16	11.0	11.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By: Michael Hooks

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' – 2.0'	6 11 14	Moist medium dense gray silty fine to coarse sand w/trace fine gravel. 18" RECOVERY	A-2-4(0)	Hot-mix 8"
2.53		2	2.0' – 4.0'	3 6 3 2	Moist loose gray fine to coarse sand w some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
5.06		3	4.0' – 6.0'	1 1 1 5	Wet soft gray fine sandy silt w/some coarse sand and clay. 21" RECOVERY	A-4(0)	
7.59	■	4	6.0' – 8.0'	4 8 7 5	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY	A-2-4(0)	
10.12		5	8.0' – 10.0'	1 2 2 4	Wet very loose gray fine sand w/some coarse sand and silt. 24" RECOVERY	A-2-4(0)	
	▽	6	10.0' – 12.0'	1 1 4 5	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 22" RECOVERY	A-2-4(0)	
12.65		7	12.0' – 14.0'	2 4 4 6	Wet loose gray coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BH-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	1 3 4 7	Wet loose gray coarse to fine sand w/some silt, trace of fine gravel. 24" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	2 3 3 4	Wet loose gray fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	
20.24		10	18.0' 20.0'	3 3 5 9	Wet loose gray coarse to fine sand w/trace fine gravel and silt. 22" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' 25.0'	1 6 9 13	Wet medium dense gray coarse sand w/some fine sand, trace of silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' 30.0'	3 3 5 10	Wet loose gray coarse to fine sand w/trace silt. 24" RECOVERY	A-1-b	
32.89							
35.42		13	33.0' 35.0'	3 6 10 12	Wet medium dense gray coarse to fine sand w/trace silt. 24" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BH-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0' 40.0'	2 4 4 5	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
40.48							
43.01		15	43.0' 45.0'	2 9 11 13	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
45.54							
48.07		16	48.0' 50.0'	7 15 17 20	Wet dense gray fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
50.6							
53.13		17	53.0' 55.0'	8 12 16 16	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
55.66							
58.19		18	58.0'	9 17 18 19	Wet dense orange coarse to fine sand w trace silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: BH-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		24" RECOVERY		
60.72							
63.25		19	63.0'	10 16 13 19	Wet medium dense orange coarse to fine sand w/trace silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	12 17 21 25	Wet dense orange fine to coarse sand w trace silt and fine gravel.	A-3	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

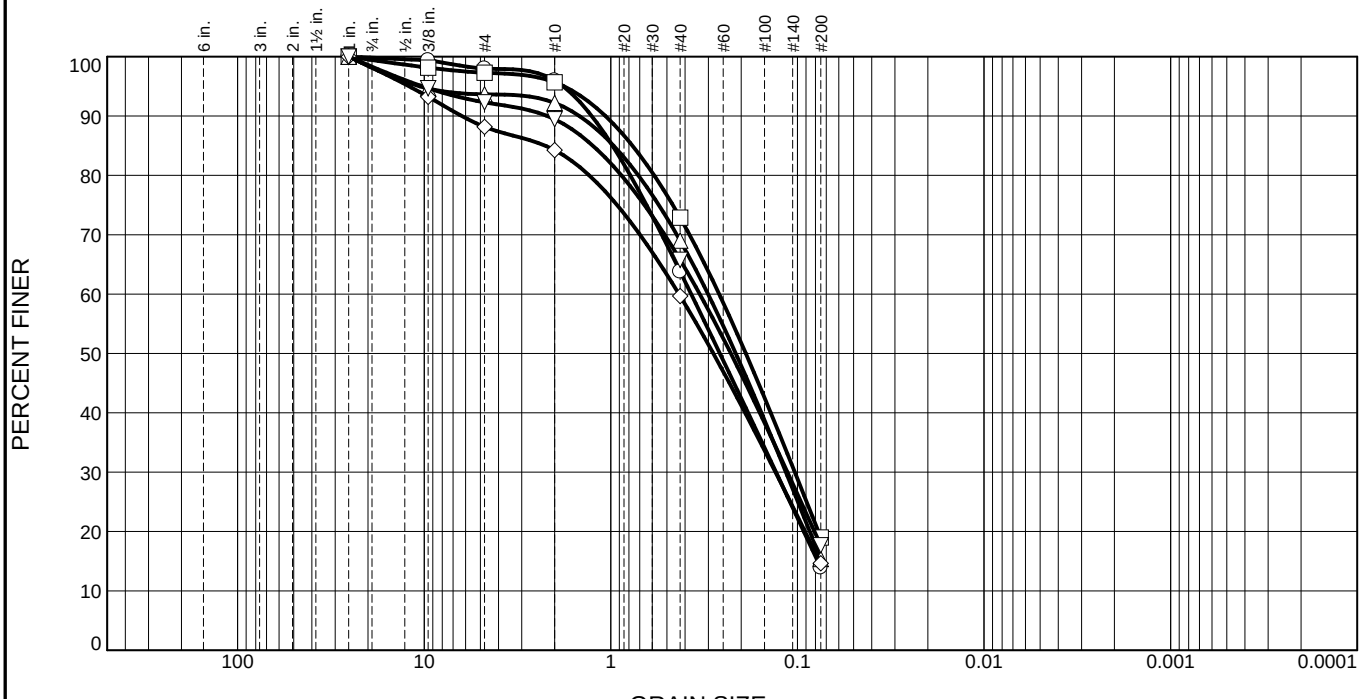
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.0	32.2	49.9	13.9	
□	0.0	4.3	22.8	53.9	19.0	
△	0.0	7.8	23.2	53.6	15.4	
◇	0.0	15.7	24.6	45.1	14.6	
▽	0.0	10.5	23.7	48.1	17.7	

╳	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9790	0.3711	0.2605	0.1301	0.0778			
□	NV	NP	0.7658	0.2627	0.1890	0.1033				
△	NV	NP	0.9665	0.3011	0.2140	0.1153				
◇	NV	NP	2.2473	0.4313	0.2823	0.1311	0.0760			
▽	NV	NP	1.2477	0.3338	0.2273	0.1131				

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Moist loose gray fine to coarse sand w some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense gray fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
▽ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** BH-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** BH-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** BH-1 **Depth:** 6.0 **Sample Number:** 4

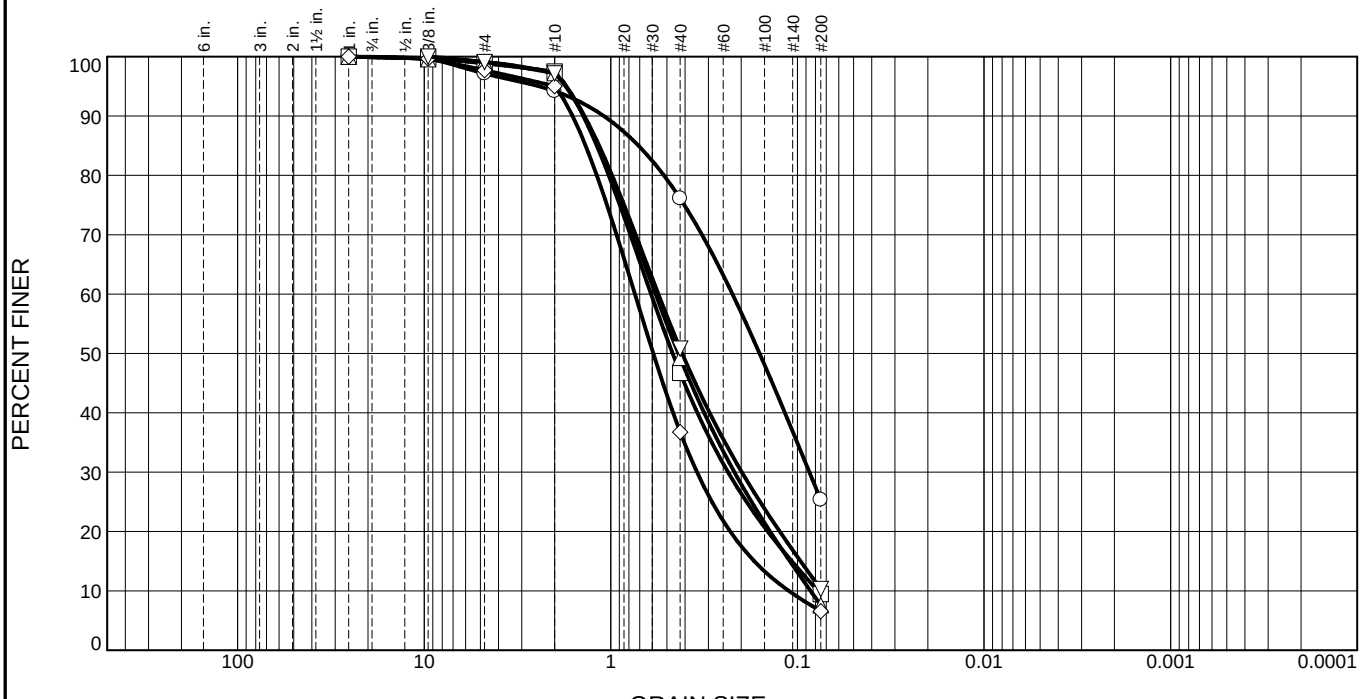
▽ **Source of Sample:** BH-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.8	18.1	50.8	25.3	
□	0.0	2.5	50.8	37.2	9.5	
△	0.0	2.8	48.0	41.6	7.6	
◇	0.0	5.0	58.2	30.2	6.6	
▽	0.0	2.8	46.4	40.5	10.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7105	0.2229	0.1595	0.0862				
□	NV	NP	1.1884	0.6086	0.4666	0.2354	0.1072	0.0776	1.17	7.84
△	NV	NP	1.1694	0.5757	0.4347	0.2175	0.1097	0.0850	0.97	6.77
◇	NV	NP	1.3638	0.7427	0.5921	0.3455	0.1703	0.1112	1.44	6.68
▽	NV	NP	1.1548	0.5563	0.4144	0.1985	0.0962			

Material Description	USCS	AASHTO
○ Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	SM	A-2-4(0)
□ Wet loose gray coarse to fine sand w/trace silt and fine gravel.	SW-SM	A-1-b
△ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
◇ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet loose gray coarse to fine sand w/trace silt and fine gravel.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** BH-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** BH-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** BH-1 **Depth:** 16.0 **Sample Number:** 9

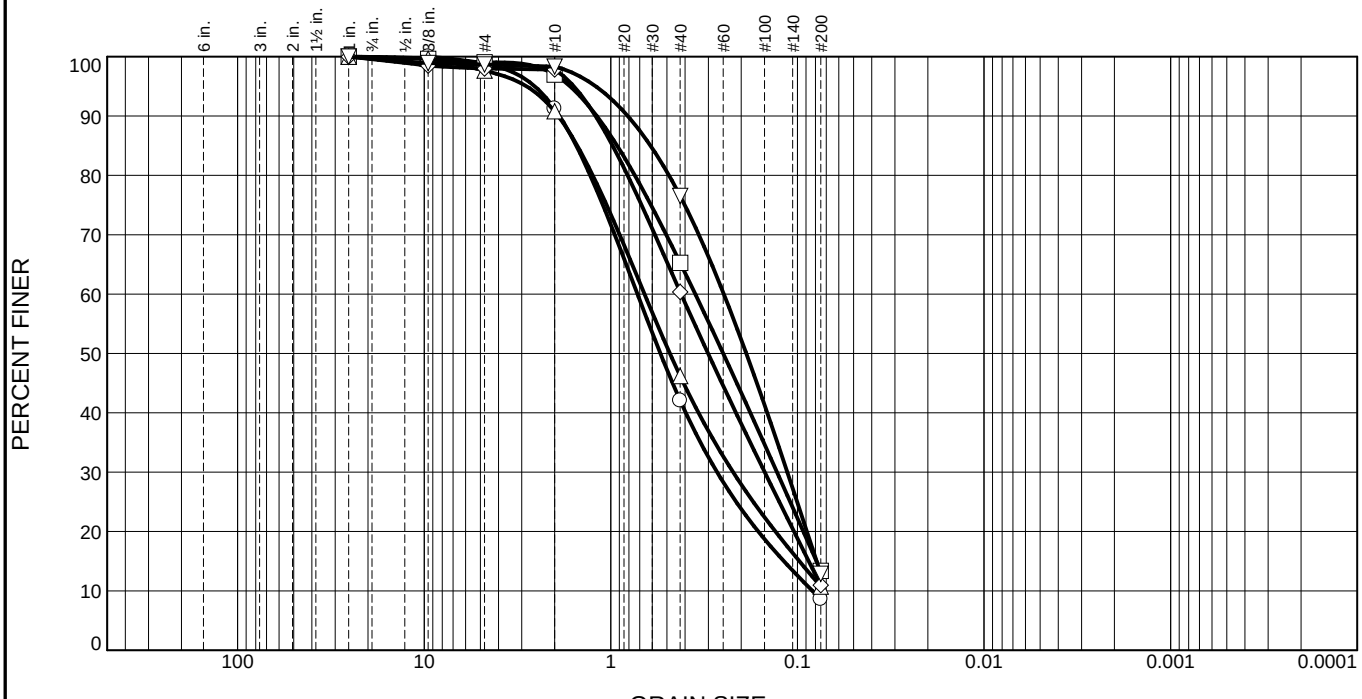
▽ **Source of Sample:** BH-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.8	49.1	33.5	8.6	
□	0.0	3.0	31.7	51.9	13.4	
△	0.0	9.2	44.6	35.5	10.7	
◇	0.0	2.2	37.4	49.4	11.0	
▽	0.0	1.7	21.8	63.6	12.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5306	0.7199	0.5424	0.2695	0.1182	0.0830	1.21	8.67
□	NV	NP	0.9250	0.3527	0.2499	0.1286	0.0791			
△	NV	NP	1.5118	0.6599	0.4825	0.2211	0.0976			
◇	NV	NP	0.9782	0.4200	0.3012	0.1497	0.0869			
▽	NV	NP	0.6127	0.2480	0.1879	0.1132	0.0789			

Material Description	USCS	AASHTO
○ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet medium dense gray coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-1-b
◇ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)
▽ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** BH-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** BH-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** BH-1 **Depth:** 38.0 **Sample Number:** 14

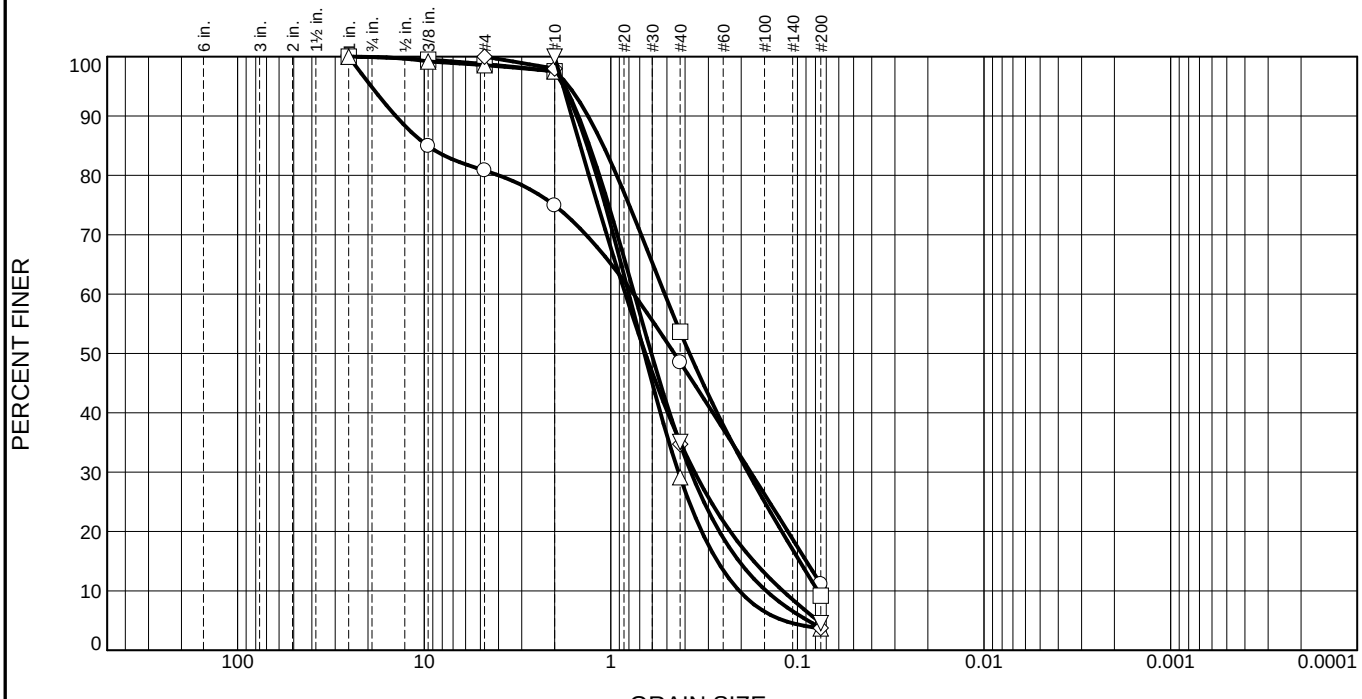
▽ **Source of Sample:** BH-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	25.1	26.4	37.4	11.1	
□	0.0	2.5	43.8	44.5	9.2	
△	0.0	2.5	68.4	25.4	3.7	
◇	0.0	2.0	63.3	30.9	3.8	
▽	0.0	0.0	64.9	30.5	4.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	9.5845	0.7543	0.4571	0.1781	0.0895			
□	NV	NP	1.0979	0.5141	0.3787	0.1842	0.0973	0.0778	0.85	6.61
△	NV	NP	1.3365	0.7997	0.6612	0.4340	0.2684	0.2048	1.15	3.90
◇	NV	NP	1.3010	0.7481	0.6064	0.3725	0.2055	0.1471	1.26	5.09
▽	NV	NP	1.4576	0.8356	0.6527	0.3556	0.1714	0.1196	1.27	6.98

Material Description	USCS	AASHTO
○ Wet medium dense gray fine to coarse sand and fine gravel, trace of silt.	SP-SM	A-1-b
□ Wet dense orange fine to coarse sand w trace fine gravel and silt.	SP-SM	A-3
△ Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
◇ Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b
▽ Wet dense orange coarse to fine sand w trace silt.	SW	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** BH-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** BH-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** BH-1 **Depth:** 63.0 **Sample Number:** 19

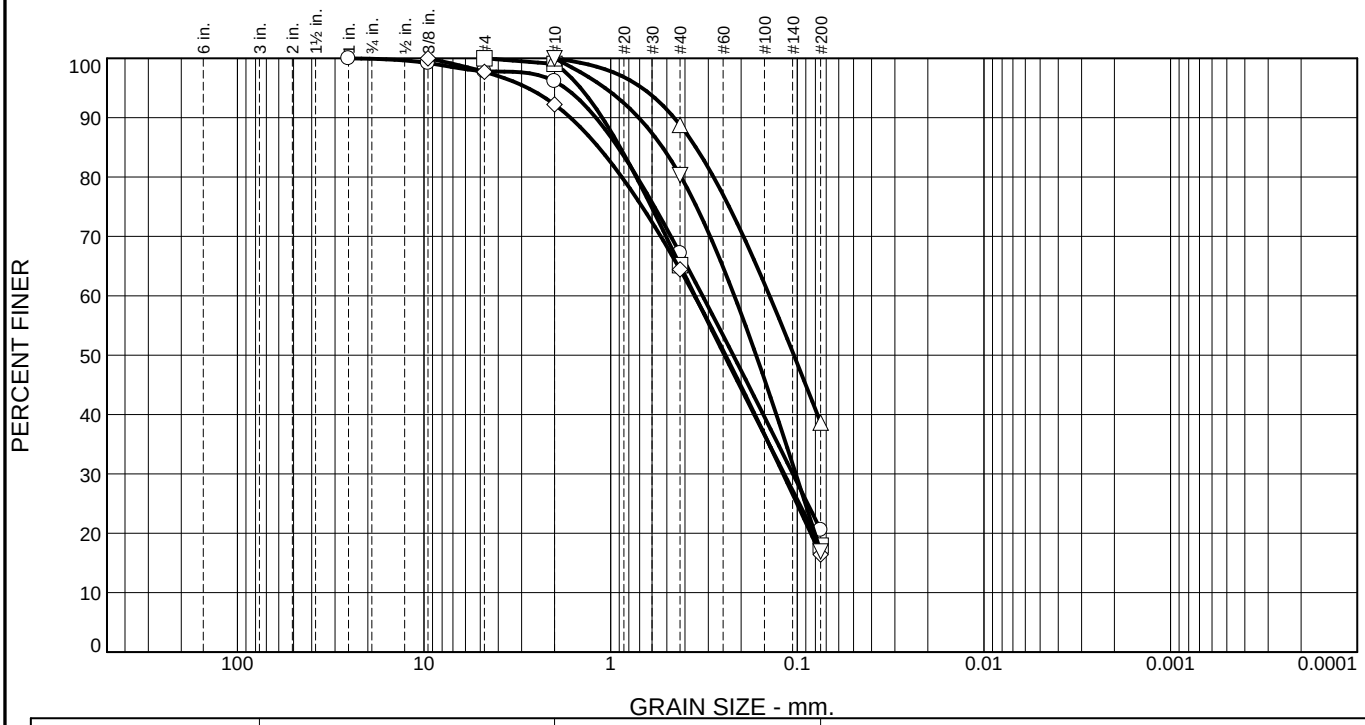
▽ **Source of Sample:** BH-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.9	28.9	46.6	20.6	
□	0.0	0.9	33.9	47.3	17.9	
△	0.0	0.0	11.2	50.2	38.6	
◇	0.0	7.8	27.8	48.0	16.4	
▽	0.0	0.0	19.7	63.4	16.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9128	0.3219	0.2205	0.1056				
□	NV	NP	0.8896	0.3532	0.2457	0.1175				
△	21.2	16.3	0.3494	0.1409	0.1043					
◇	NV	NP	1.1596	0.3550	0.2423	0.1192				
▽	NV	NP	0.5273	0.2174	0.1663	0.1019				

Material Description	USCS	AASHTO
○ Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	SM	A-2-4(0)
□ Moist loose gray fine to coarse sand w some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet soft gray fine sandy silt w/some coarse sand and clay.	SC-SM	A-4(0)
◇ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet very loose gray fine sand w/some coarse sand and silt.	SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-2 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** BH-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** BH-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** BH-2 **Depth:** 6.0 **Sample Number:** 4

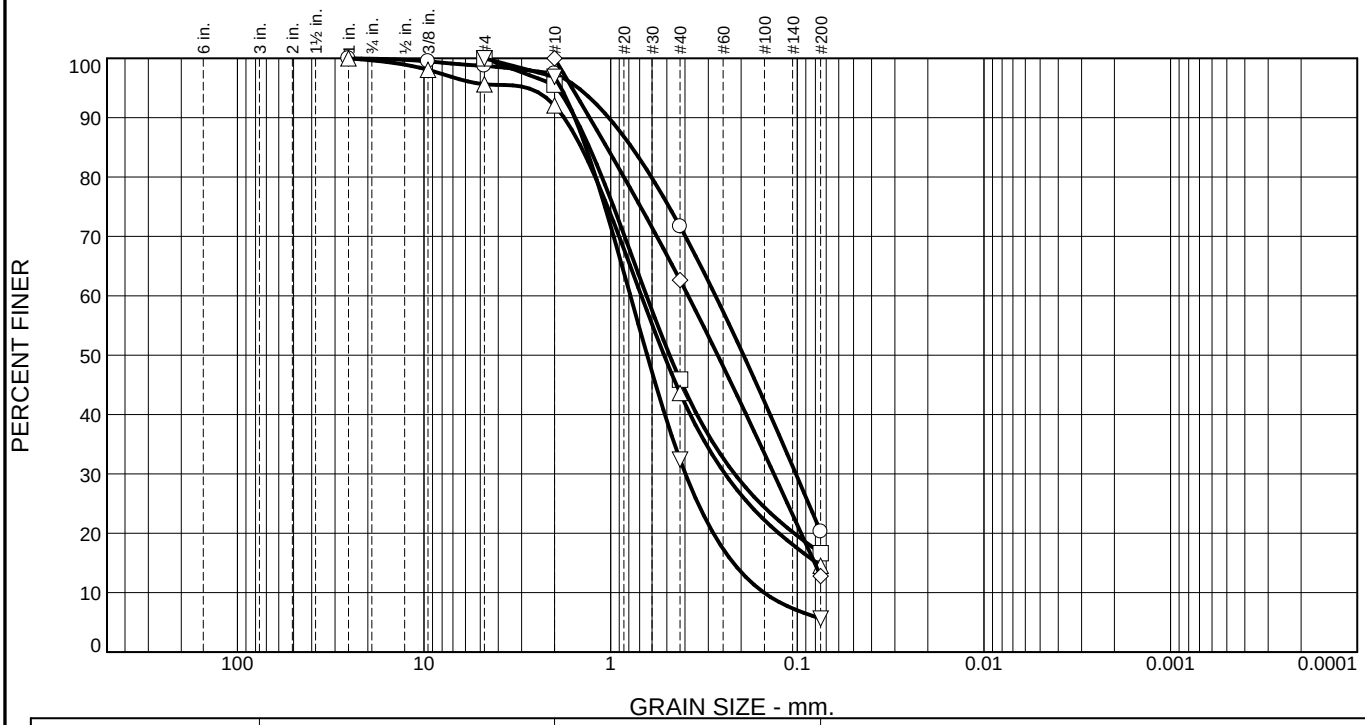
▽ **Source of Sample:** BH-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	2.6	25.7	51.4	20.3	
□	0.0	4.4	49.7	29.2	16.7	
△	0.0	7.9	48.5	29.1	14.5	
◇	0.0	0.0	37.4	49.8	12.8	
▽	0.0	3.1	64.5	26.8	5.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7710	0.2742	0.1943	0.1018				
□	NV	NP	1.2996	0.6423	0.4835	0.2167				
△	NV	NP	1.4362	0.6848	0.5174	0.2437	0.0785			
◇	NV	NP	1.0481	0.3846	0.2669	0.1336	0.0808			
▽	NV	NP	1.3575	0.7838	0.6376	0.3975	0.2201	0.1508	1.34	5.20

Material Description	USCS	AASHTO
○ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet loose gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
△ Wet loose gray coarse to fine sand w/some silt, trace of fine gravel.	SM	A-1-b
◇ Wet loose gray fine to coarse sand w/some silt.	SM	A-2-4(0)
▽ Wet loose gray coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** BH-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** BH-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** BH-2 **Depth:** 16.0 **Sample Number:** 9

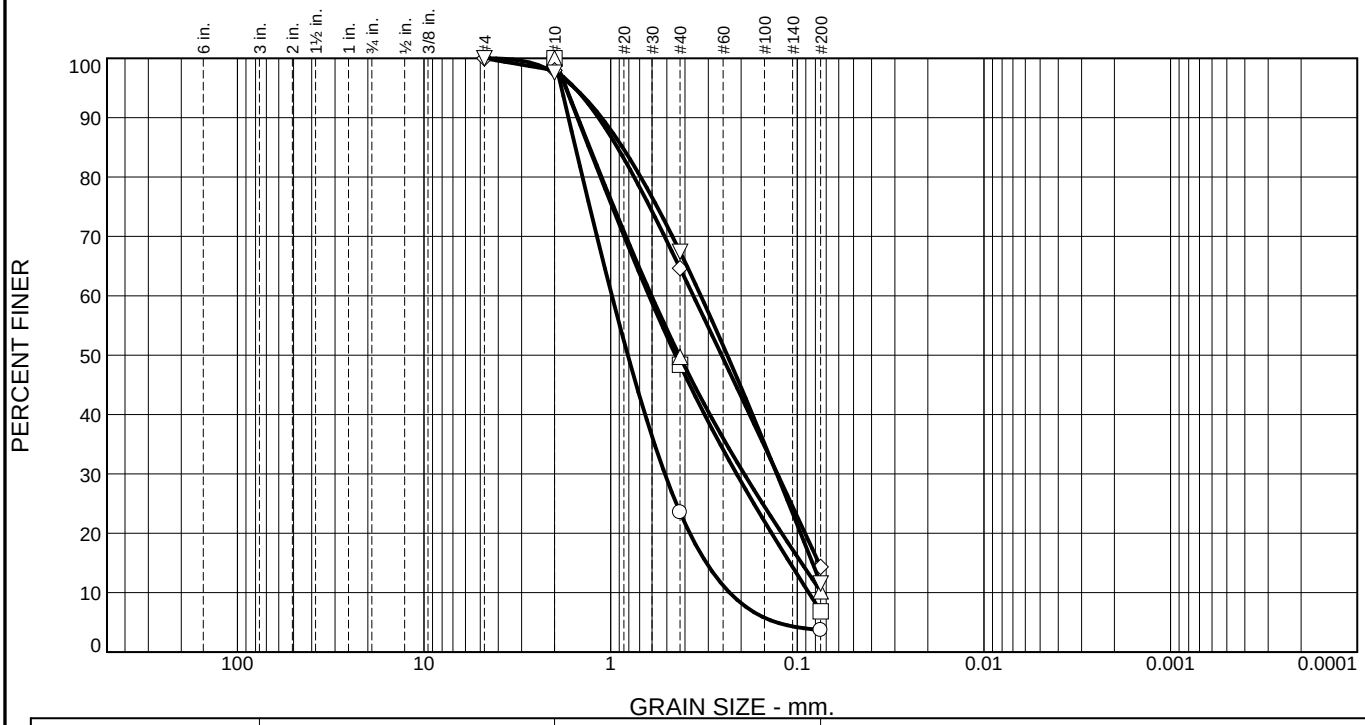
▽ **Source of Sample:** BH-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	76.5	19.8	3.7	
□	0.0	0.0	51.6	41.5	6.9	
△	0.0	0.0	50.3	39.5	10.2	
◇	0.0	2.0	33.4	50.3	14.3	
▽	0.0	2.4	30.2	55.8	11.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5447	0.9846	0.8093	0.5123	0.3068	0.2305	1.16	4.27
□	NV	NP	1.3088	0.6228	0.4492	0.2113	0.1094	0.0868	0.83	7.17
△	NV	NP	1.2962	0.6037	0.4295	0.1927	0.0949			
◇	NV	NP	0.9209	0.3607	0.2544	0.1279	0.0767			
▽	NV	NP	0.8637	0.3288	0.2373	0.1288	0.0829			

Material Description	USCS	AASHTO
○ Wet medium dense gray coarse sand w/some fine sand, trace of silt.	SP	A-1-b
□ Wet loose gray coarse to fine sand w/trace silt.	SP-SM	A-1-b
△ Wet medium dense gray coarse to fine sand w/trace silt.	SP-SM	A-1-b
◇ Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** BH-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** BH-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** BH-2 **Depth:** 38.0 **Sample Number:** 14

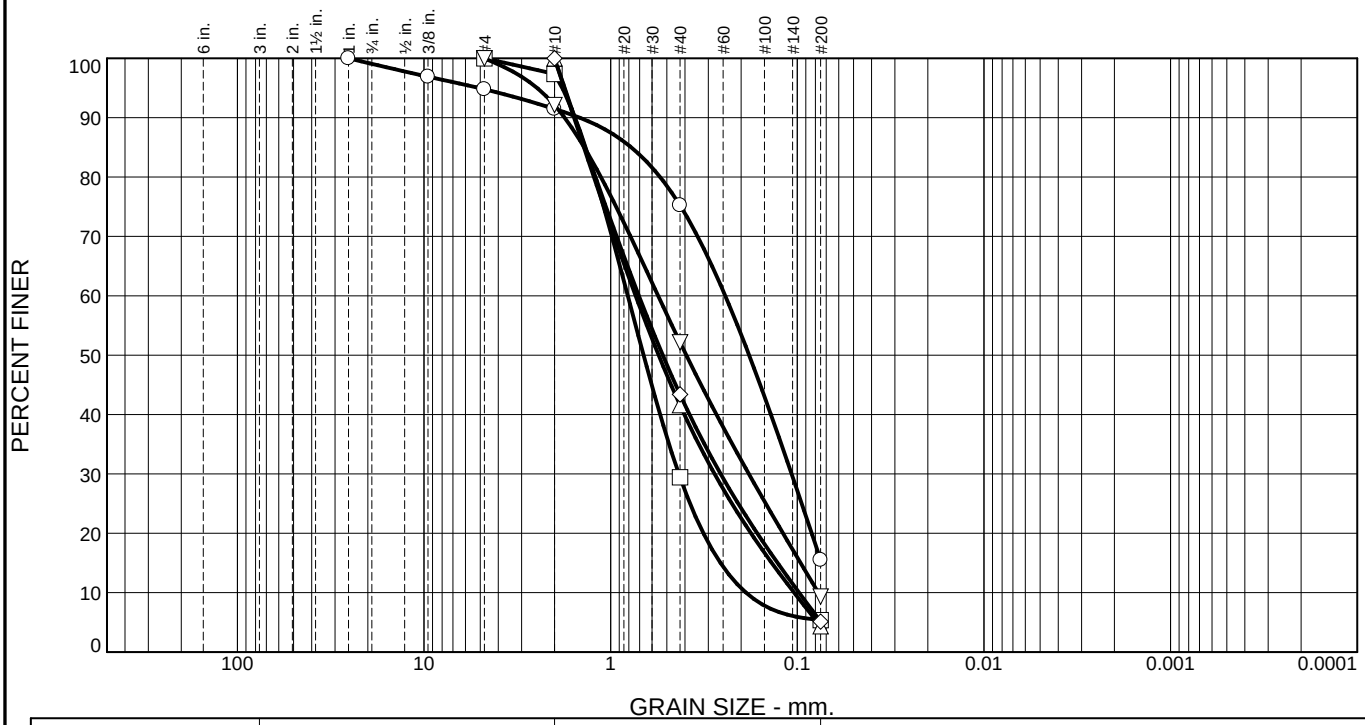
▽ **Source of Sample:** BH-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	8.5	16.3	59.7	15.5	
□	0.0	2.6	68.0	24.0	5.4	
△	0.0	0.0	58.4	37.3	4.3	
◇	0.0	0.0	56.6	38.3	5.1	
▽	0.0	7.9	39.9	42.9	9.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.7758	0.2432	0.1813	0.1073				
□	NV	NP	1.3632	0.8095	0.6663	0.4313	0.2578	0.1883	1.22	4.30
△	NV	NP	1.3914	0.7348	0.5533	0.2774	0.1370	0.1040	1.01	7.07
◇	NV	NP	1.3715	0.7062	0.5258	0.2574	0.1275	0.0978	0.96	7.22
▽	NV	NP	1.3860	0.5566	0.3935	0.1819	0.0961	0.0772	0.77	7.21

Material Description	USCS	AASHTO
○ Wet dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
□ Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet dense orange coarse to fine sand w trace silt.	SW	A-1-b
◇ Wet medium dense orange coarse to fine sand w/trace silt.	SP-SM	A-1-b
▽ Wet dense orange fine to coarse sand w trace silt and fine gravel.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BH-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** BH-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** BH-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** BH-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** BH-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

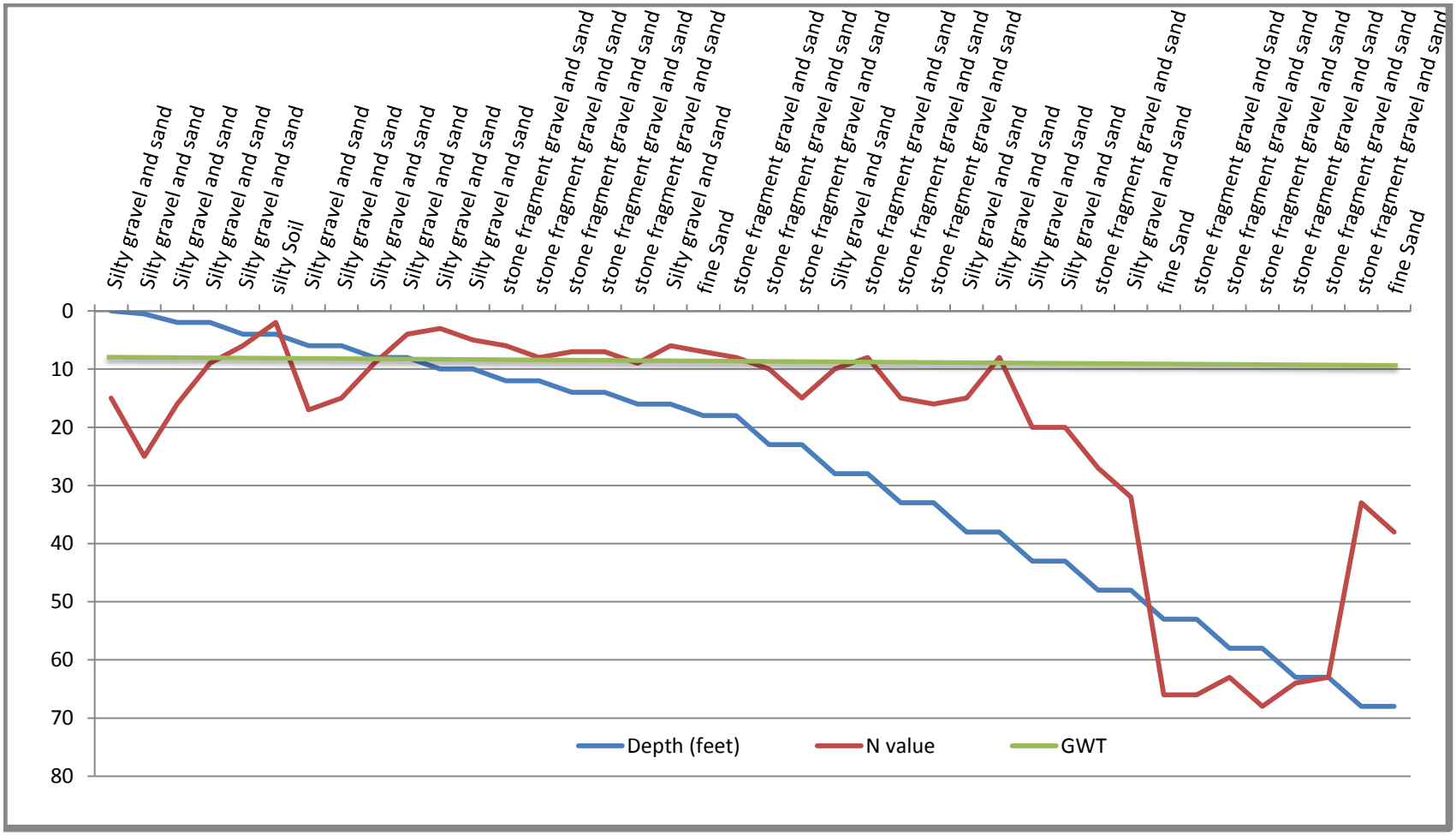
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
CL-1	1		Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	11.5	SM	A-2-4(0)	96	13.9	3	5	10	10
	2	2	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	12.2	SM	A-2-4(0)	95.7	19	3	8	8	10
	3	4	Moist loose gray fine to coarse sand w some silt, trace of fine gravel.	NV	NP	14.2	SM	A-2-4(0)	92.2	15.4	2	2	4	4
	4	6	Wet medium dense gray fine to coarse sand w/some fine gravel and silt.	NV	NP	15.6	SM	A-2-4(0)	84.3	14.6	1	6	11	14
	5	8	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	16.4	SM	A-2-4(0)	89.5	17.7	3	4	5	5
	6	10	Wet very loose gray silty fine sand w/some coarse sand, trace of fine gravel.	NV	NP	22.3	SM	A-2-4(0)	94.2	25.3	1	1	2	5
	7	12	Wet loose gray coarse to fine sand w/trace silt and fine gravel.	NV	NP	17	SW-SM	A-1-b	97.5	9.5	2	2	4	7
	8	14	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.4	SP-SM	A-1-b	97.2	7.6	2	2	5	7
	9	16	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.3	SW-SM	A-1-b	95	6.6	2	4	5	12
	10	18	Wet loose gray coarse to fine sand w/trace silt and fine gravel.	NV	NP	19.8	SP-SM	A-3	97.2	10.3	1	2	5	9
	11	23	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.6	SW-SM	A-1-b	91.2	8.6	2	4	6	8
	12	28	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.4	SM	A-2-4(0)	97	13.4	2	3	7	8
	13	33	Wet medium dense gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	13.9	SP-SM	A-1-b	90.8	10.7	2	5	10	10
	14	38	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.2	SP-SM	A-2-4(0)	97.8	11	2	5	10	12
	15	43	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	16.9	SM	A-2-4(0)	98.3	12.9	2	5	15	12
	16	48	Wet medium dense gray fine to coarse sand and fine gravel, trace of silt.	NV	NP	15.3	SP-SM	A-1-b	74.9	11.1	3	15	12	12
	17	53	Wet dense orange fine to coarse sand w trace fine gravel and silt.	NV	NP	19	SP-SM	A-3	97.5	9.2	12	18	16	15
	18	58	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.4	SP	A-1-b	97.5	3.7	5	12	13	14
	19	63	Wet medium dense orange coarse to fine sand w/trace fine gravel and silt.	NV	NP	13.8	SP	A-1-b	98	3.8	13	14	14	25
	20	68	Wet dense orange coarse to fine sand w trace silt.	NV	NP	15.5	SW	A-1-b	100	4.6	5	12	21	24
		70	End Boring											
CL-2	1	0.5	Moist medium dense gray silty fine to coarse sand w/trace fine gravel.	NV	NP	9.8	SM	A-2-4(0)	96.1	20.6	6	11	14	
	2	2	Moist loose gray fine to coarse sand w some silt, trace of fine gravel.	NV	NP	12.9	SM	A-2-4(0)	99.1	17.9	3	6	3	2
	3	4	Wet soft gray fine sandy silt w/some coarse sand and clay.	21.2	4.9	22.2	SC-SM	A-4(0)	100	38.6	1	1	1	5
	4	6	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	19	SM	A-2-4(0)	92.2	16.4	4	8	7	5
	5	8	Wet very loose gray fine sand w/some coarse sand and silt.	NV	NP	20.3	SM	A-2-4(0)	100	16.9	1	2	2	4
	6	10	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	20.3	SM	A-2-4(0)	97.4	20.3	1	1	4	5
	7	12	Wet loose gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	18.2	SM	A-1-b	95.6	16.7	2	4	4	6
	8	14	Wet loose gray coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	21.3	SM	A-1-b	92.1	14.5	1	3	4	7
	9	16	Wet loose gray fine to coarse sand w/some silt.	NV	NP	27.6	SM	A-2-4(0)	100	12.8	2	3	3	4
	10	18	Wet loose gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.6	SP-SM	A-1-b	96.9	5.6	3	3	5	9
	11	23	Wet medium dense gray coarse sand w/some fine sand, trace of silt.	NV	NP	16	SP	A-1-b	100	3.7	1	6	9	13
	12	28	Wet loose gray coarse to fine sand w/trace silt.	NV	NP	15.7	SP-SM	A-1-b	100	6.9	3	3	5	10
	13	33	Wet medium dense gray coarse to fine sand w/trace silt.	NV	NP	14.8	SP-SM	A-1-b	100	10.2	3	6	10	12
	14	38	Wet loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	23.4	SM	A-2-4(0)	98	14.3	2	4	4	5
	15	43	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.1	SP-SM	A-2-4(0)	97.6	11.6	2	9	11	13
	16	48	Wet dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	18.9	SM	A-2-4(0)	91.5	15.5	7	15	17	20
	17	53	Wet medium dense gray coarse to fine sand w/trace fine gravel and silt.	NV	NP	15.5	SP-SM	A-1-b	97.4	5.4	8	12	16	16
	18	58	Wet dense orange coarse to fine sand w trace silt.	NV	NP	16.7	SW	A-1-b	100	4.3	9	17	18	19
	19	63	Wet medium dense orange coarse to fine sand w/trace silt.	NV	NP	18	SP-SM	A-1-b	100	5.1	10	16	13	19
	20	68	Wet dense orange fine to coarse sand w trace silt and fine gravel.	NV	NP	18	SP-SM	A-3	92.1	9.3	12	17	21	25
		70	End Boring											

DATE : **3-16-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-913 Ellendale, DE**



DATE : **3-16-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-913 Ellendale, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO: **Jason Hasting**
Design Engineer
Bridge Section

FROM: **Hany Fekry, P.E.**
Geotechnical Engineer
Material & Research

DATE **: 3-18-2016**
PROJECT NUMBER **: T201407003**
PROJECT NAME **: BR3-914 Beach HGWY and SR16- Ellendale, DE**
SUBJECT **: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 1-20-2016 and 1-22016. Hillis Carnes Engineering Associates (HCEA) drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. HCEA provided a Truck Rig Mounted model B-30 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by HCEA using the drawing provide from the bridge section then HCEA recorded the borings location using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated Beaverdam Formation White- greenish gray medium Sand with scattered beds of coarse Sand, gravelly sand Silty Clay.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Greenwood Area, Delaware by John Adam, and Durward H. Boggess (1964)

Atlas HA-99. The nearest well to this site the groundwater historically had been measured as 47 feet on October 1960 and between the years of 1950 to 1960 appeared from 44 to 48 feet below the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 48 feet down is Silty or Clayey gravel and sand (A-2-4) and from 48 to 72 feet down is fine sand (A-3).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter from 3 to 6 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounter from 40 to 50 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Geohydrology Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003 the recharge potential for this area is situated is in a GOOD and EXCELLENT Category.

5. Ground Cover

The ground cover for site is 6 and 8 inches of asphalt. More detail show in Appendix- B

6. Groundwater

The depth to groundwater below the ground surface elevation was noted during the drilling operations is 6 feet, noted at the completion of the drilling is 9 feet and caved at 9.5 and 10 feet. Driller adds mud at 10 feet in depth. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 9 to 23.2 percent. The Atterberg limit and the Organic matter not encountered for the entire sample. More detail show in Appendix- D.

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition. In addition all the sample from the depth of 2 to 12 feet from the surface had been met all the borrow material according to Del-DOT standard specification with very good amount to reuse.

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.

This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.

This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

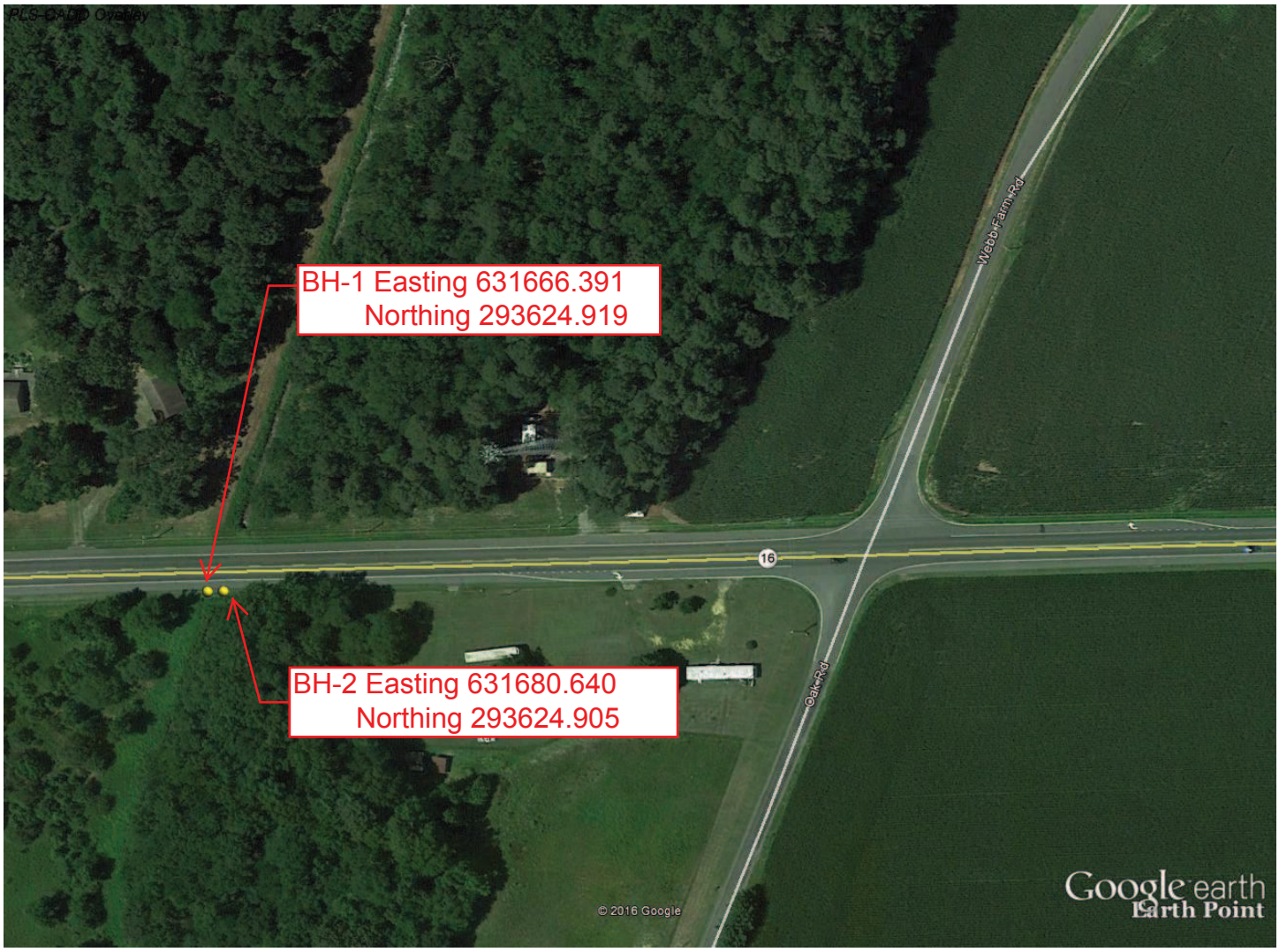
APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

Task 26-1692 T201407003 BR3-914 on Beach Highway in Sussex County



Google earth

feet 600

meters 100

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BHW-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 293624.919
Easting: 631666.391
Boring Surface Elev.:
Reference:
Date Started: 1/22/16
Date Completed: 1/22/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 10.0
From Depth of: 10.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/22/16	6.0	
1/22/16	9.0	9.5

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5'	2 4 5	Moist loose brown fine to coarse sand w/ some silt.	A-2-4(0)	Hot-mix 6"
2.53		2	2.0' 2.5' 4.0'	3 4 7 11	Wet medium dense orange fine to coarse sand w/some silt. 16" RECOVERY 18" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	5 8 12 12	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
7.59	■	4	6.0' 8.0'	6 6 10 12	Wet medium dense orange fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
10.12	▽	5	8.0' 10.0'	2 7 10 12	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
		6	10.0' 12.0'	7 8 8 9	Wet medium dense brown fine to coarse sand w/trace silt. 24" RECOVERY	A-3	
12.65		7	12.0' 14.0'	3 4 4 4	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BHW-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' 16.0'	4 4 5 6	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
17.71		9	16.0' 18.0'	3 3 3 3	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	2 4 6 8	Wet loose brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
25.3		11	23.0' 25.0'	3 3 5 5	Wet loose brown coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
30.36		12	28.0' 30.0'	2 5 5 6	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
35.42		13	33.0' 35.0'	8 10 20 21	Wet medium dense brown fine to coarse sand w/some silt. 24" RECOVERY	A-2-4(0)	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: BHW-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
		14	38.0'	5 5 11 13	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
			40.0'		24" RECOVERY		
40.48							
43.01							
		15	43.0'	13 19 20 23	Wet dense brown coarse to fine sand w/trace silt.	A-1-b	
			45.0'		24" RECOVERY		
45.54							
48.07							
		16	48.0'	20 28 30 32	Wet very dense brown coarse to fine sand w/ trace silt.	A-1-b	
			50.0'		24" RECOVERY		
50.6							
53.13							
		17	53.0'	10 13 13 16	Wet medium dense brown coarse to fine sand w/trace silt.	A-1-b	
			55.0'		18" RECOVERY		
55.66							
58.19							
		18	58.0'	11 17 21 24	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: BHW-1

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		20" RECOVERY		
60.72							
63.25		19	63.0'	10 12 17 18	Wet medium dense brown fine to coarse sand w/trace silt.	A-3	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	11 15 17 22	Wet dense brown coarse to fine sand w/trace silt.	A-1-b	
			70.0'		24" RECOVERY		
					End Boring		
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING BHW-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 293624.905
Easting: 631680.640
Boring Surface Elev.:
Reference:
Date Started: 1/20/16
Date Completed: 1/20/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 10.0
From Depth of: 10.0 **To:** 70.0

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
1/20/16	6.0	
1/20/16	9.0	10.0

Boring Contractor: Hillis Carnes Engineering Associates
Equipment/Rig Type: B-30 Truck Rig
Driller: John M.
Logged By:

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5' 2.0'	6 14 16	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	Hot-mix 8"
2.53		2	2.0' 4.0'	6 6 7 6	Moist medium dense brown silty fine to coarse sand. 24" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	1 2 2 3	Wet very loose brown fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
7.59	■	4	6.0' 8.0'	5 10 7 5	Wet medium dense brown coarse to fine sand and fine gravel w/trace silt. 14" RECOVERY	A-1-b	
10.12	▽	5	8.0' 10.0'	5 5 5 6	Wet loose brown fine gravelly coarse to fine sand w/trace silt. 24" RECOVERY	A-1-b	
		6	10.0' 12.0'	5 6 6 8	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 24" RECOVERY	A-1-b	
12.65		7	12.0' 14.0'	6 8 10 10	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BHW-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		8	14.0' – 16.0'	2 3 4 5	Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
17.71		9	16.0' – 18.0'	6 8 8 9	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' – 20.0'	2 2 3 5	Wet loose brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
22.77							
25.3		11	23.0' – 25.0'	5 6 9 11	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
27.83							
30.36		12	28.0' – 30.0'	7 11 13 13	Wet medium dense gray fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
32.89							
35.42		13	33.0' – 35.0'	5 6 10 12	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** BHW-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	38.0' 40.0'	4 6 8 8	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
43.01		15	43.0' 45.0'	12 16 18 22	Wet dense orange coarse to fine sand w trace fine gravel and silt. 24" RECOVERY	A-1-b	
45.54		16	48.0' 50.0'	32 35 25 25	Wet very dense brown coarse to fine sand w/ trace fine gravel and silt. 24" RECOVERY	A-1-b	
48.07		17	53.0' 55.0'	7 11 13 13	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 24" RECOVERY	A-1-b	
50.6		18	58.0'	9 12 13 15	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt.	A-1-b	
53.13							
55.66							
58.19							

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design
State Contract: T201407003
Boring No.: BHW-2

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			60.0'		14" RECOVERY		
60.72							
63.25		19	63.0'	10 15 18 25	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	A-1-b	
			65.0'		24" RECOVERY		
65.78							
68.31		20	68.0'	9 13 16 18	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	A-2-4(0)	
			70.0'		18" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

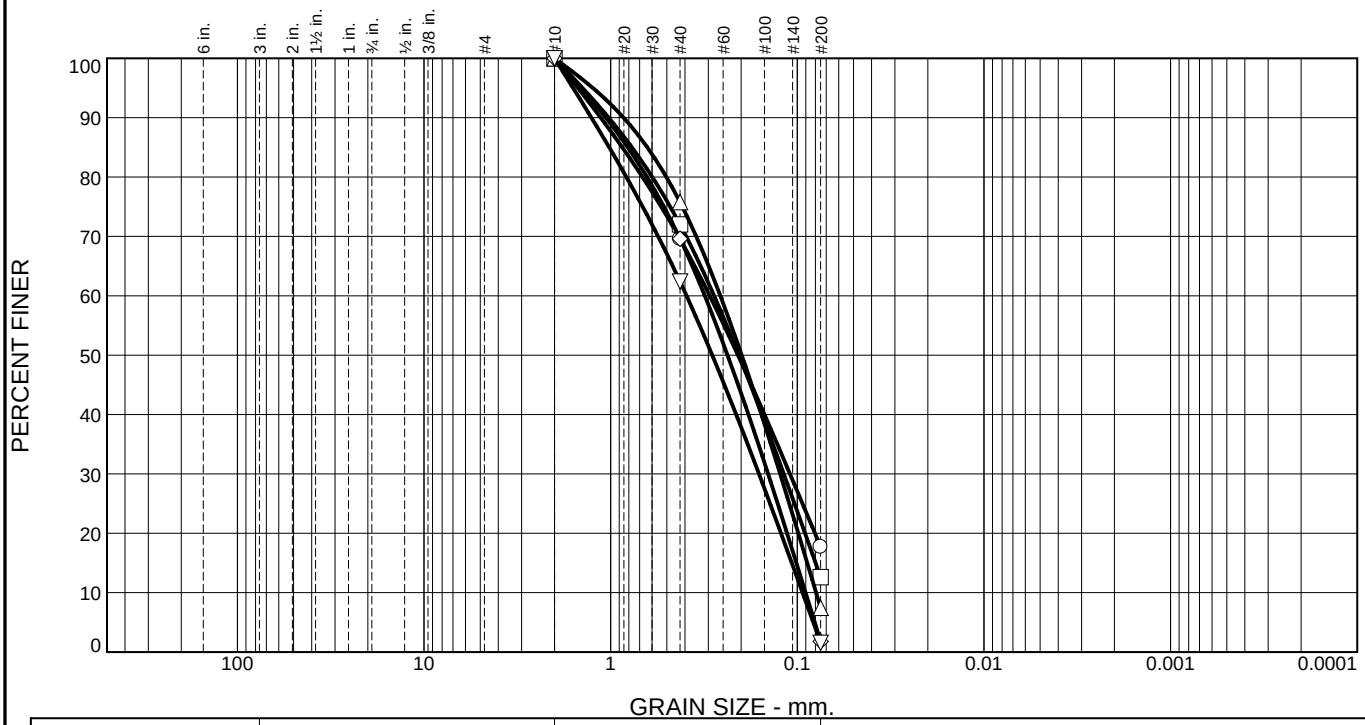
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	30.4	51.9	17.7	
□	0.0	0.0	28.0	59.4	12.6	
△	0.0	0.0	24.2	68.3	7.5	
◇	0.0	0.0	30.4	67.8	1.8	
▽	0.0	0.0	37.6	60.9	1.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.8665	0.2944	0.2079	0.1095				
□	NV	NP	0.7696	0.2791	0.2056	0.1182	0.0798			
△	NV	NP	0.6362	0.2584	0.1986	0.1236	0.0885	0.0793	0.75	3.26
◇	NV	NP	0.8100	0.3129	0.2364	0.1434	0.1012	0.0903	0.73	3.46
▽	NV	NP	1.0179	0.3920	0.2855	0.1605	0.1070	0.0937	0.70	4.18

Material Description	USCS	AASHTO
○ Moist loose brown fine to coarse sand w/some silt.	SM	A-2-4(0)
□ Wet medium dense orange fine to coarse sand w/some silt.	SM	A-2-4(0)
△ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
◇ Wet medium dense orange fine to coarse sand w/trace silt.	SP	A-3
▽ Wet medium dense brown fine to coarse sand w/trace silt.	SP	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-1 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** BHW-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** BHW-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** BHW-1 **Depth:** 6.0 **Sample Number:** 4

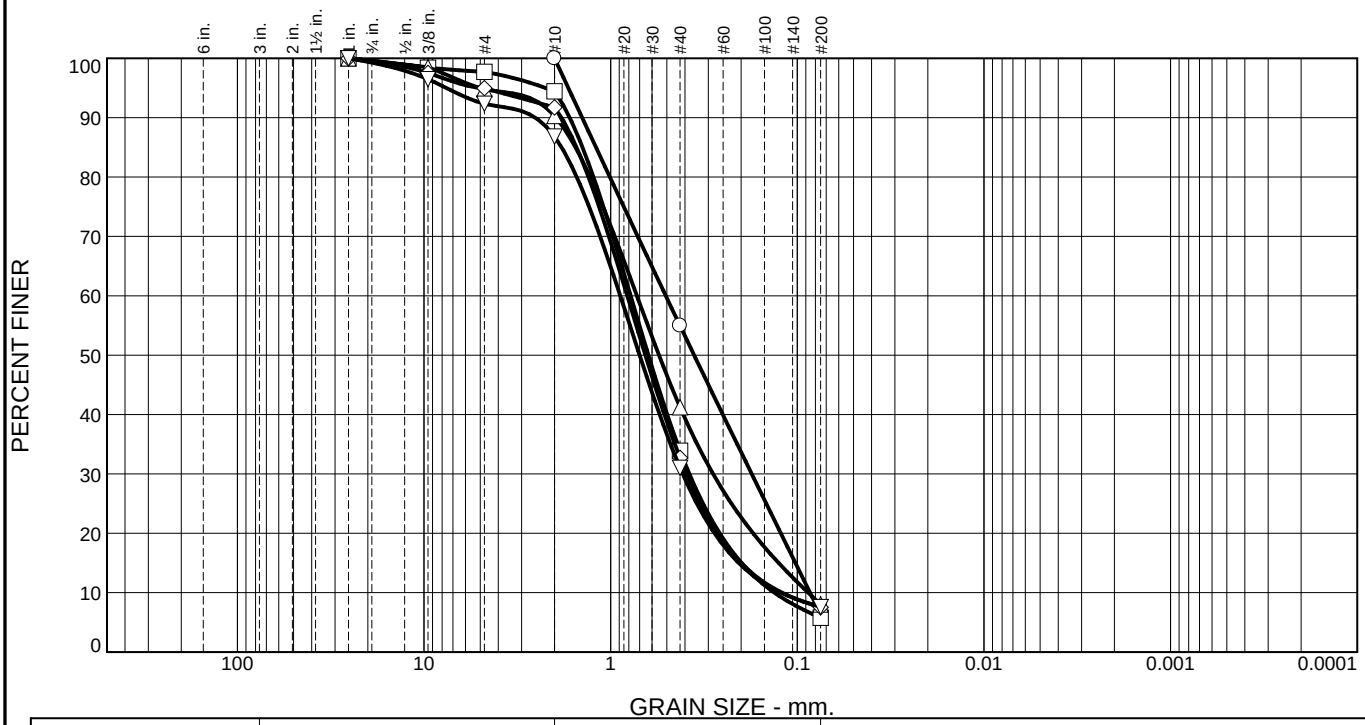
▽ **Source of Sample:** BHW-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	45.0	48.6	6.4	
□	0.0	5.6	60.5	28.1	5.8	
△	0.0	9.7	49.1	33.2	8.0	
◇	0.0	8.3	59.0	25.2	7.5	
▽	0.0	13.2	55.8	23.4	7.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.1986	0.5066	0.3570	0.1755	0.1024	0.0855	0.71	5.93
□	NV	NP	1.4151	0.7815	0.6279	0.3790	0.1991	0.1329	1.38	5.88
△	NV	NP	1.5430	0.7234	0.5507	0.2826	0.1259	0.0875	1.26	8.27
◇	NV	NP	1.5237	0.8147	0.6519	0.3919	0.1998	0.1210	1.56	6.73
▽	NV	NP	1.8317	0.8881	0.6997	0.4115	0.2060	0.1226	1.55	7.24

Material Description	USCS	AASHTO
○ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
□ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet loose brown coarse to fine sand w/some fine gravel, trace of silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** BHW-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** BHW-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** BHW-1 **Depth:** 16.0 **Sample Number:** 9

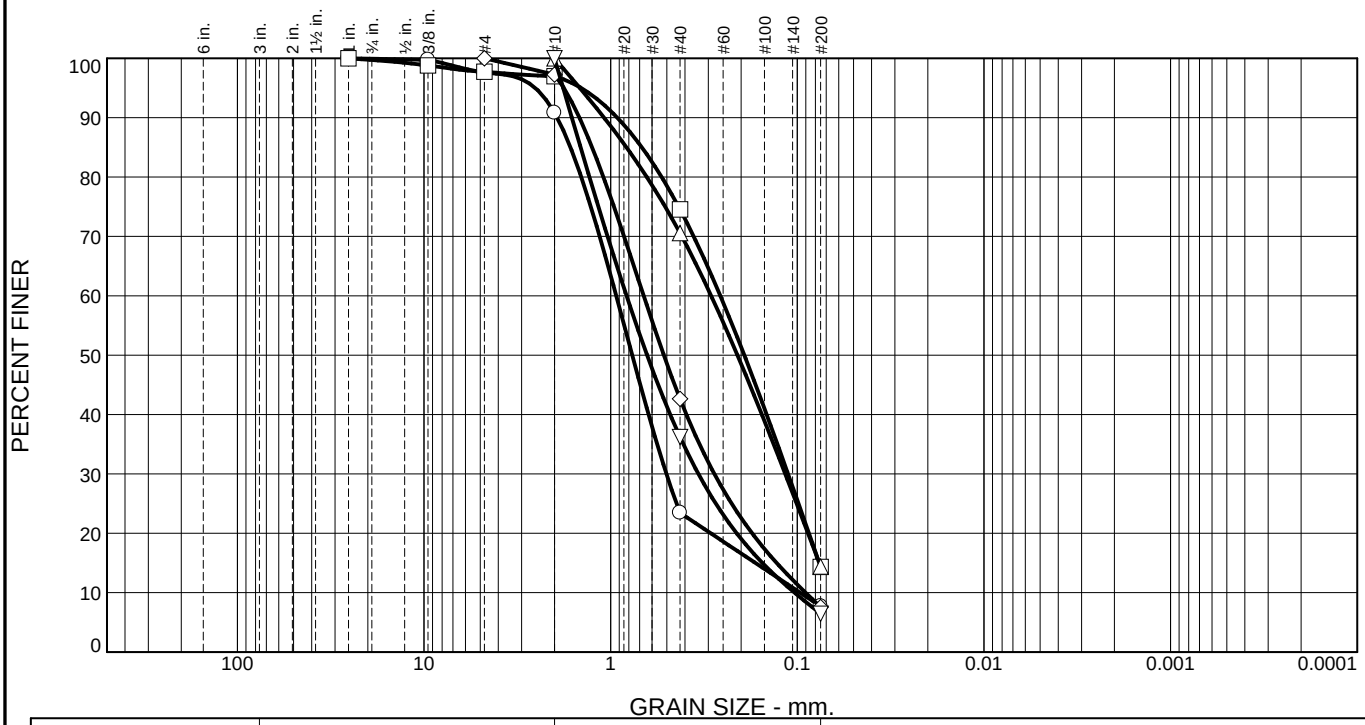
▽ **Source of Sample:** BHW-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.2	67.4	15.7	7.7	
□	0.0	3.0	22.5	60.2	14.3	
△	0.0	0.0	29.4	56.2	14.4	
◇	0.0	2.7	54.7	35.0	7.6	
▽	0.0	0.0	63.8	29.7	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.6424	0.9338	0.7664	0.5027	0.1676	0.0966	2.80	9.67
□	NV	NP	0.6806	0.2585	0.1924	0.1122	0.0763			
△	NV	NP	0.8228	0.2894	0.2094	0.1161	0.0763			
◇	NV	NP	1.2575	0.6652	0.5188	0.2781	0.1291	0.0903	1.29	7.36
▽	NV	NP	1.4495	0.8218	0.6380	0.3389	0.1538	0.1034	1.35	7.94

Material Description	USCS	AASHTO
○ Wet loose brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
□ Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet medium dense brown fine to coarse sand w/some silt.	SM	A-2-4(0)
◇ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet dense brown coarse to fine sand w/trace silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-1 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** BHW-1 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** BHW-1 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** BHW-1 **Depth:** 38.0 **Sample Number:** 14

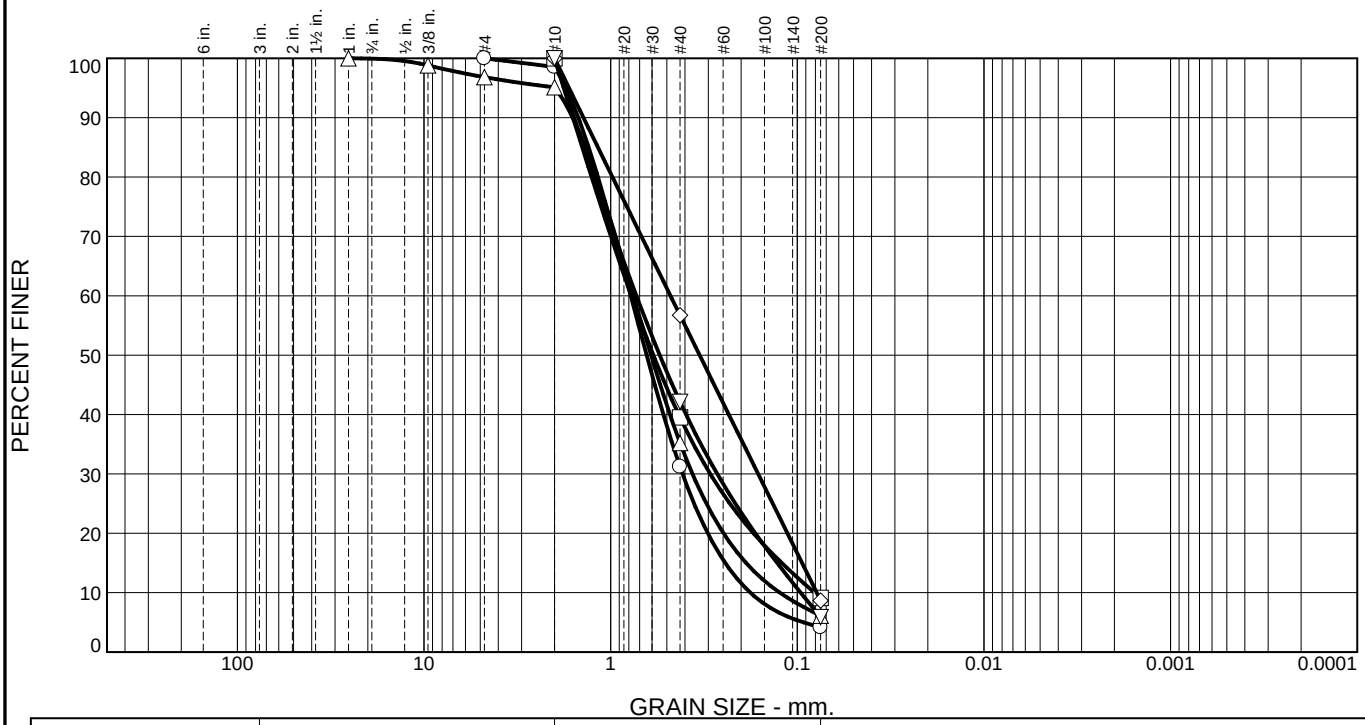
▽ **Source of Sample:** BHW-1 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.4	67.4	27.0	4.2	
□	0.0	0.0	60.5	30.4	9.1	
△	0.0	4.9	59.9	29.1	6.1	
◇	0.0	0.0	43.3	48.0	8.7	
▽	0.0	0.0	57.8	36.3	5.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3118	0.7804	0.6415	0.4121	0.2433	0.1785	1.22	4.37
□	NV	NP	1.4209	0.7756	0.5904	0.2926	0.1212	0.0808	1.37	9.60
△	NV	NP	1.3645	0.7561	0.6076	0.3646	0.1881	0.1241	1.42	6.09
◇	NV	NP	1.1702	0.4780	0.3336	0.1622	0.0943	0.0787	0.70	6.07
▽	NV	NP	1.3874	0.7280	0.5458	0.2684	0.1282	0.0960	1.03	7.59

Material Description	USCS	AASHTO
○ Wet very dense brown coarse to fine sand w/trace silt.	SP	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace silt.	SW-SM	A-1-b
△ Wet dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Wet medium dense brown fine to coarse sand w/trace silt.	SP-SM	A-3
▽ Wet dense brown coarse to fine sand w/trace silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-1 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** BHW-1 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** BHW-1 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** BHW-1 **Depth:** 63.0 **Sample Number:** 19

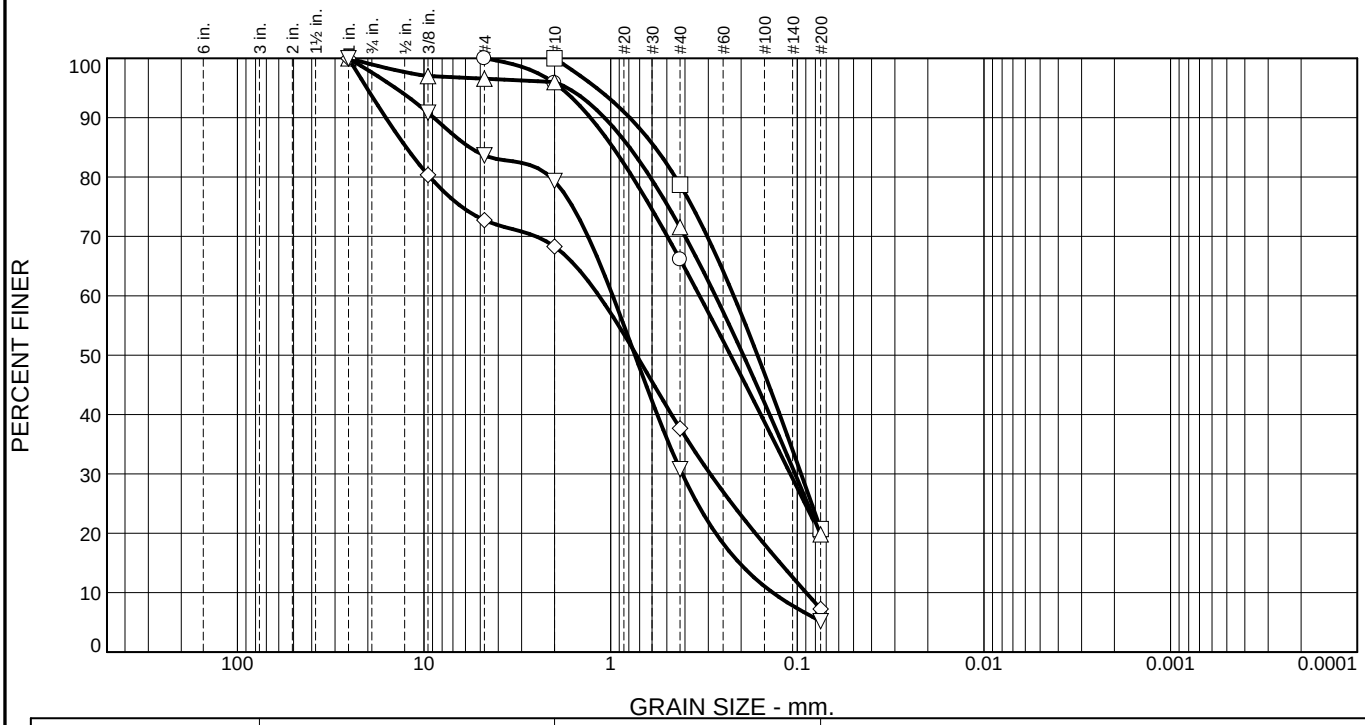
▽ **Source of Sample:** BHW-1 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	4.2	29.7	46.4	19.7	
□	0.0	0.0	21.3	58.0	20.7	
△	0.0	4.0	24.4	51.8	19.8	
◇	0.0	31.7	30.6	30.4	7.3	
▽	0.0	20.7	48.5	25.6	5.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.9722	0.3339	0.2279	0.1090				
□	NV	NP	0.5783	0.2191	0.1635	0.0954				
△	NV	NP	0.7926	0.2745	0.1947	0.1028				
◇	NV	NP	12.4532	1.1548	0.7272	0.2927	0.1235	0.0897	0.83	12.88
▽	NV	NP	5.6972	0.9751	0.7410	0.4135	0.2044	0.1353	1.30	7.21

Material Description	USCS	AASHTO
○ Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
□ Moist medium dense brown silty fine to coarse sand.	SM	A-2-4(0)
△ Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet medium dense brown coarse to fine sand and fine gravel w/trace silt.	SP-SM	A-1-b
▽ Wet loose brown fine gravelly coarse to fine sand w/trace silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-2 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** BHW-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** BHW-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** BHW-2 **Depth:** 6.0 **Sample Number:** 4

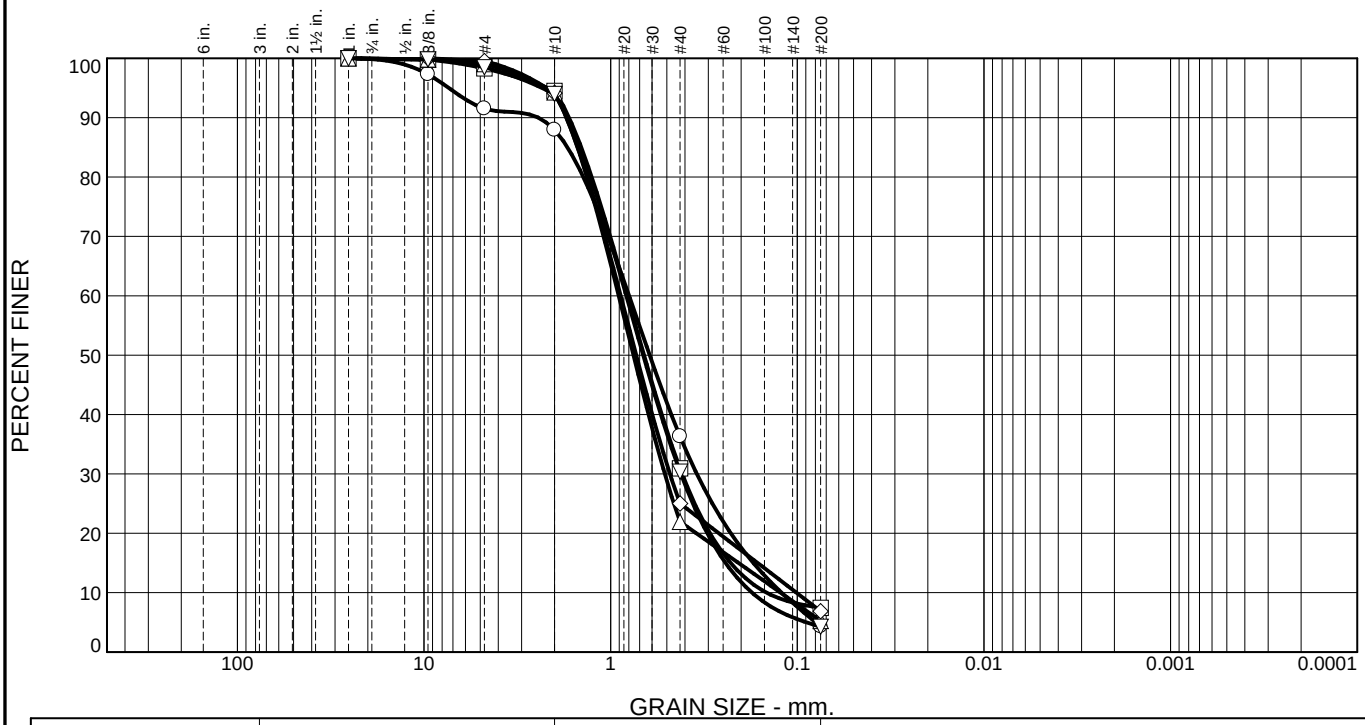
▽ **Source of Sample:** BHW-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	12.1	51.6	32.0	4.3	
□	0.0	5.5	63.6	23.5	7.4	
△	0.0	5.7	72.4	16.6	5.3	
◇	0.0	5.9	69.1	18.1	6.9	
▽	0.0	6.0	63.6	26.2	4.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.7041	0.7965	0.6180	0.3454	0.1721	0.1216	1.23	6.55
□	NV	NP	1.4374	0.8154	0.6624	0.4141	0.2276	0.1462	1.44	5.58
△	NV	NP	1.5057	0.9056	0.7548	0.5128	0.2066	0.1229	2.36	7.37
◇	NV	NP	1.5008	0.8836	0.7294	0.4815	0.1631	0.1012	2.59	8.73
▽	NV	NP	1.4620	0.8245	0.6694	0.4207	0.2424	0.1750	1.23	4.71

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SW	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
◇ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
▽ Wet loose brown coarse to fine sand w/trace fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** BHW-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** BHW-2 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** BHW-2 **Depth:** 16.0 **Sample Number:** 9

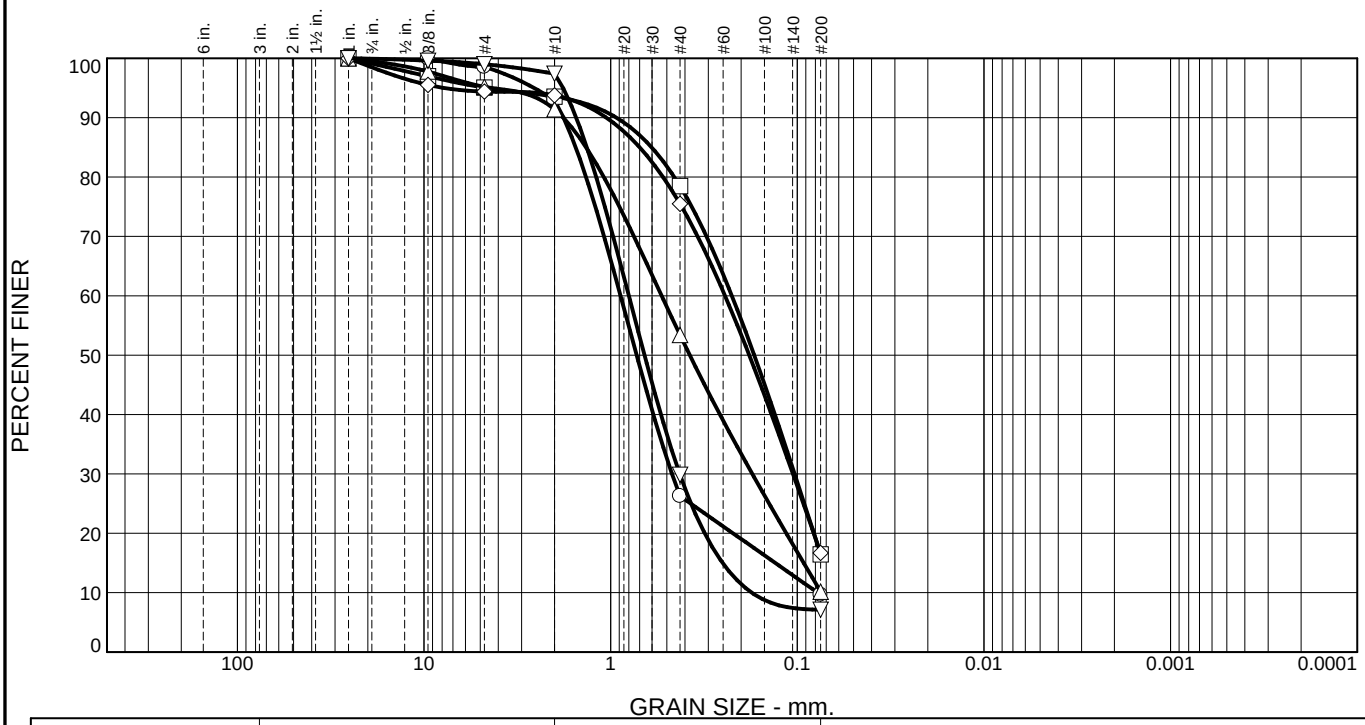
▽ **Source of Sample:** BHW-2 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	7.1	66.6	16.7	9.6	
□	0.0	6.5	15.0	62.1	16.4	
△	0.0	8.6	38.0	43.2	10.2	
◇	0.0	6.2	18.3	58.8	16.7	
▽	0.0	2.6	67.6	22.7	7.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5394	0.8852	0.7255	0.4692	0.1312	0.0778	3.20	11.37
□	NV	NP	0.6030	0.2242	0.1702	0.1034				
△	NV	NP	1.3546	0.5330	0.3768	0.1743	0.0924			
◇	NV	NP	0.6990	0.2439	0.1810	0.1056				
▽	NV	NP	1.3424	0.7989	0.6585	0.4267	0.2512	0.1755	1.30	4.55

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP-SM	A-1-b
□ Wet medium dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
△ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet dense orange coarse to fine sand w trace fine gravel and silt.	SP-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-2 **Depth:** 23.0 **Sample Number:** 11

□ **Source of Sample:** BHW-2 **Depth:** 28.0 **Sample Number:** 12

△ **Source of Sample:** BHW-2 **Depth:** 33.0 **Sample Number:** 13

◇ **Source of Sample:** BHW-2 **Depth:** 38.0 **Sample Number:** 14

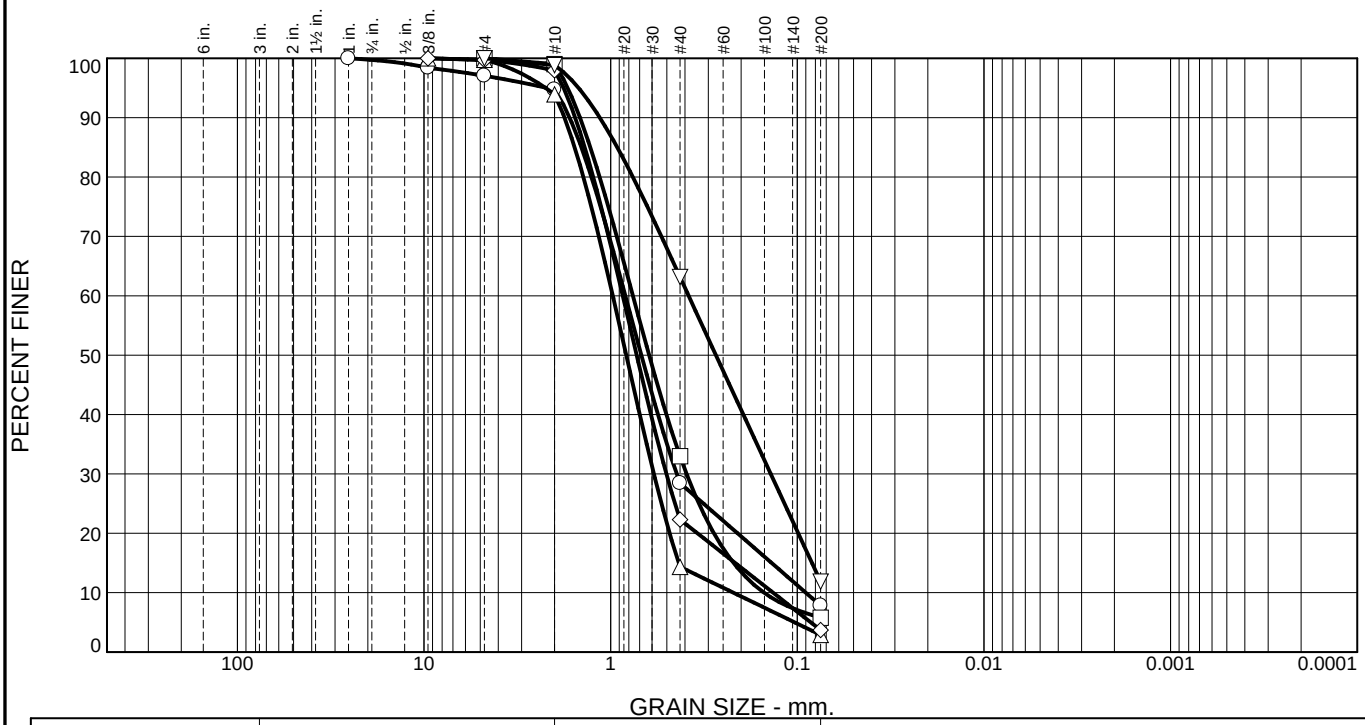
▽ **Source of Sample:** BHW-2 **Depth:** 43.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	5.3	66.3	20.6	7.8	
□	0.0	1.0	66.0	27.2	5.8	
△	0.0	6.1	79.6	11.4	2.9	
◇	0.0	2.0	75.7	18.6	3.7	
▽	0.0	1.2	35.6	51.3	11.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4351	0.8340	0.6849	0.4426	0.1372	0.0901	2.61	9.25
□	NV	NP	1.2855	0.7600	0.6222	0.3922	0.2195	0.1508	1.34	5.04
△	NV	NP	1.5596	0.9742	0.8250	0.5866	0.4319	0.2202	1.60	4.42
◇	NV	NP	1.3769	0.8614	0.7254	0.5030	0.2151	0.1349	2.18	6.38
▽	NV	NP	0.9219	0.3822	0.2730	0.1388	0.0834			

Material Description	USCS	AASHTO
○ Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
□ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
△ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b
◇ Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW	A-1-b
▽ Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SP-SM	A-2-4(0)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** BHW-2 **Depth:** 48.0 **Sample Number:** 16

□ **Source of Sample:** BHW-2 **Depth:** 53.0 **Sample Number:** 17

△ **Source of Sample:** BHW-2 **Depth:** 58.0 **Sample Number:** 18

◇ **Source of Sample:** BHW-2 **Depth:** 63.0 **Sample Number:** 19

▽ **Source of Sample:** BHW-2 **Depth:** 68.0 **Sample Number:** 20

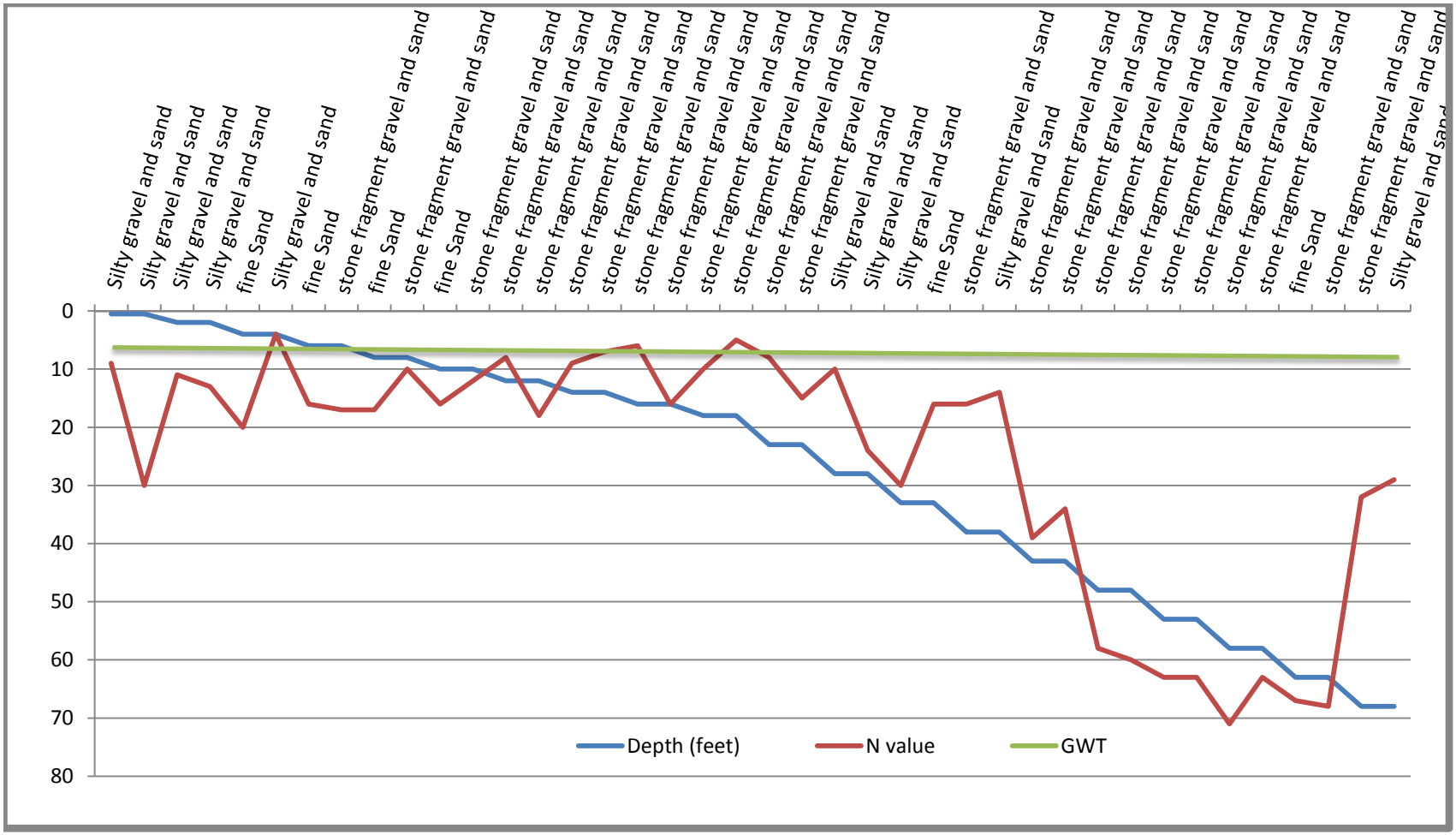
Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
CL-1	1	0.5	Moist loose brown fine to coarse sand w/some silt.	NV	NP	9	SM	A-2-4(0)	100	17.7	2	4	5	
	2	2	Wet medium dense orange fine to coarse sand w/some silt.	NV	NP	15.8	SM	A-2-4(0)	100	12.6	3	4	7	11
	3	4	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	17.9	SP-SM	A-3	100	7.5	5	8	12	12
	4	6	Wet medium dense orange fine to coarse sand w/trace silt.	NV	NP	19.2	SP	A-3	100	1.8	6	6	10	12
	5	8	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	20.6	SP	A-3	100	1.5	2	7	10	12
	6	10	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	18.6	SP-SM	A-3	100	6.4	7	8	8	9
	7	12	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.7	SP-SM	A-1-b	94.4	5.8	3	4	4	4
	8	14	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	17.6	SW-SM	A-1-b	90.3	8	4	4	5	6
	9	16	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.5	SW-SM	A-1-b	91.7	7.5	3	3	3	3
	10	18	Wet loose brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	20.3	SW-SM	A-1-b	86.8	7.6	2	4	6	8
	11	23	Wet loose brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.3	SW-SM	A-1-b	90.8	7.7	3	3	5	5
	12	28	Wet loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	18.2	SM	A-2-4(0)	97	14.3	2	5	5	6
	13	33	Wet medium dense brown fine to coarse sand w/some silt.	NV	NP	17.4	SM	A-2-4(0)	100	14.4	8	10	20	21
	14	38	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.6	SW-SM	A-1-b	97.3	7.6	5	5	11	13
	15	43	Wet dense brown coarse to fine sand w/trace silt.	NV	NP	17	SW-SM	A-1-b	100	6.5	13	19	20	23
	16	48	Wet very dense brown coarse to fine sand w/trace silt.	NV	NP	15.2	SP	A-1-b	98.6	4.2	20	28	30	32
	17	53	Wet medium dense brown coarse to fine sand w/trace silt.	NV	NP	13.3	SW-SM	A-1-b	100	9.1	10	13	13	16
	18	58	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	13.4	SW-SM	A-1-b	95.1	6.1	11	17	21	24
	19	63	Wet medium dense brown fine to coarse sand w/trace silt.	NV	NP	15.3	SP-SM	A-3	100	8.7	10	12	17	18
	20	68	Wet dense brown coarse to fine sand w/trace silt.	NV	NP	15.9	SW-SM	A-1-b	100	5.9	11	15	17	22
		70	End Boring											
CL-2	1	0.5	Moist medium dense brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	9.1	SM	A-2-4(0)	95.8	19.7	6	14	16	
	2	2	Moist medium dense brown silty fine to coarse sand.	NV	NP	12.8	SM	A-2-4(0)	100	20.7	6	6	7	6
	3	4	Wet very loose brown fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	15.4	SM	A-2-4(0)	96	19.8	1	2	2	3
	4	6	Wet medium dense brown coarse to fine sand and fine gravel w/trace silt.	NV	NP	22.3	SP-SM	A-1-b	68.3	7.3	5	10	7	5
	5	8	Wet loose brown fine gravelly coarse to fine sand w/trace silt.	NV	NP	16.5	SW-SM	A-1-b	79.3	5.2	5	5	5	6
	6	10	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	13.1	SW	A-1-b	87.9	4.3	5	6	6	8
	7	12	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	19.7	SP-SM	A-1-b	94.5	7.4	6	8	10	10
	8	14	Wet loose orange coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	18.1	SW-SM	A-1-b	94.3	5.3	2	3	4	5
	9	16	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	21.5	SW-SM	A-1-b	94.1	6.9	6	8	8	9
	10	18	Wet loose brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.7	SP	A-1-b	94	4.2	2	2	3	5
	11	23	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	13.3	SP-SM	A-1-b	92.9	9.6	5	6	9	11
	12	28	Wet medium dense gray fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	23.2	SM	A-2-4(0)	93.5	16.4	7	11	13	13
	13	33	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	18	SP-SM	A-3	91.4	10.2	5	6	10	12
	14	38	Wet medium dense brown fine sand w/some coarse sand and silt, trace of fine gravel.	NV	NP	20.6	SM	A-2-4(0)	93.8	16.7	4	6	8	8
	15	43	Wet dense orange coarse to fine sand w trace fine gravel and silt.	NV	NP	19	SP-SM	A-1-b	97.4	7.1	12	16	18	22
	16	48	Wet very dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	12.8	SW-SM	A-1-b	94.7	7.8	32	35	25	25
	17	53	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	20	SP-SM	A-1-b	99	5.8	7	11	13	13
	18	58	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	23.6	SP	A-1-b	93.9	2.9	9	12	13	15
	19	63	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	17.4	SW	A-1-b	98	3.7	10	15	18	25
	20	68	Wet medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	17.5	SP-SM	A-2-4(0)	98.8	11.9	9	13	16	18
		70	End Boring											

DATE : **3-16-2016**
PROJECT NUMBER : **T201407003**
PROJECT NAME : **BR3-914 Ellendale, DE**



DATE : **3-16-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-914 Ellendale, DE**

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

TO:	**Jason Hasting** Design Engineer Bridge Section
FROM:	**Hany Fekry, P.E.** Geotechnical Engineer Material & Research
DATE	**: 4-27-2016**
PROJECT NUMBER	**: T201407003**
PROJECT NAME	**: BR3-923 Fleatown Rd, Lincoln, DE**
SUBJECT	**: Geotechnical Data Report**

1. Introduction

The subsurface exploration for this Task was completed on 2-11-2016. Walton Corporation-Newark, Delaware drilled two Standard Penetration Test borings that were scheduled to depths of 70 feet below the existing ground surface elevation. Walton provided a Truck Rig Mounted model CME 45 and 55 with Safety Hammer 140- pound. The Boring locations were laid out in the filed by Walton using the drawing provide from the bridge section then Walton recorded the exact borings location were drilling using a *Global Positioning System* (*GPS*) .The site location coordinate is shown on the Map figure in Appendix- A.

2. Area Geology Background

The geological background of this area was found using the Geologic Map Ellendale and Milton Quadrangles, Delaware According to Geologic Map Series No. 11 by Ramsey, K.W 2001. The area is situated LYNCH HEIGHTS FORMATION as, Light gray to brown to light yellowish brown, medium to fine sand to very fine sand with discontinuous beds of course sand, gravel silt, and organic- rich clayey silt to silty sand.

3. Ground Water Background

3.1 According to The Water-Table, Surface-Drainage, and Engineering Soils Map of The Ellendale Area, Delaware by John Adam, and Durward H. Boggess (1964) Atlas HA- 101. The nearest well to this site the groundwater historically had been measured as 17 feet on October 1960 and between the years of 1950 to 1960 appeared from 14 to 20 feet below the existing elevation. The historical borings indicate the soil AASHTO classification is from the surface to 20 feet down is fine sand (A-3), from 20 to 52 feet down is Silty or Clayey gravel and sand (A-2-4) and from 52 to 72 feet down is Silty soils (A-4).

3.2 According to Delaware Geologic Information Resource (DGIR) the Depth to Water, Surface-Drainage for normal condition had been measured and encounter less of 3 feet below the existing surface. In addition, the Water Table elevation for normal condition had been measured and encounters less of 10 feet below the existing elevation.

4. Hydrologic Background

According to Delaware Geological Survey Geohydrology Sussex County Delaware; Map Series, No. 12, by A. Scott Andres June 2003 the recharge potential for this area is situated is in a Fair Category.

5. Ground Cover

The ground cover for site is 4 8 inches of asphalt top of 4 inches of stone. More detail show in Appendix- B

6. Groundwater

The depth to groundwater below the ground surface elevation was noted during the drilling operations is 4 and 5 feet, noted at the completion of the drilling is 4 feet and caved at 5 and 9.7 feet. More detail show in Appendix- B

7. Laboratory Testing

The laboratory Index testing from the split spoon appeared the natural moisture content was in the range of the 7.1 to 25.8 percent. The Atterberg limit is 18 percent, Liquid limits is range from 25 to 40.2 percent and Plasticity Index is range from 8.1 to 16 also the organic matter was not encounter for the entire sample more detail show in Appendix- D

8. Recommendations

Our findings indicate that the subsurface condition at this site in general is in a good condition. In addition all the sample from the depth of 2 to 12 feet from the surface had been met all the borrow material according to Del-DOT standard specification with good amount to reuse Except Borrow type "B".

9. Limitations

The borings indicate the soil condition only at specific locations and weather conditions and only to the depth penetrated; these samples do not reflect the strata variation that may exist between the test locations.
This report has been prepared for the exclusive use of DelDOT in accordance with generally accepted engineering practice. No warranty, express or implied, is made.
This Report is part of the Boring Log and the soil Description.

APPENDIX A

- GPS Boring Plan (1- sheet)

APPENDIX B

- AASHTO Soil Classification System AND Borings Log (11- sheets)

APPENDIX C

- Grain Size Distribution Result (8- sheets)

APPENDIX D

- Summary of the Borings (1- sheet)

APPENDIX E

- Chat N- Value Vs. Depth (1- sheet)

DATE : 4-27-2016
PROJECT NUMBER : T201407003
PROJECT NAME : BR3-923 Fleatown Rd, Lincoln, DE

Reference	State Plane		Geographic	
	Northing	Easting	Latitude	Longitude
FT-1	316001.706	667488.795	38.8676861	-75.3769028
FT-2	316068.507	667555.995	38.8678694	-75.3766667

- **Table B-1 AASHTO SOIL CLASSIFICATION SYSTEM**

The American Association of State Highway and Transportation Officials developed the AASHTO Soil Classification System, and it is used as a guide for the classification of soils and soil-aggregate mixtures for highway construction purposes. AASHTO M-57-2, M-145-7											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6 Note 1
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

Note (2): The AASHTO classification include the Group Index (GI) need to be lees 20, more than 20 indicates

very poor subgrade.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING FT-1

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 316001.706
Easting: 667488.795
Boring Surface Elev.:
Reference:
Date Started: 2/11/16
Date Completed: 2/11/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 66.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/11/16	4.0	
2/11/16	4.0	5.0

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 45 Trailer Rig
Driller: Jason Truver
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.0' 1.7'		Moist gray silty fine to coarse sand w some fine gravel. 20" RECOVERY	A-2-4(0)	Hot-mix 4"
2.53		2	2.0' 4.0'	5 6 7 4	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	14 8 6 7	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 18" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	5 2 2 2	Wet very loose gray fine to coarse sand w/ some silt, trace of fine gravel. 24" RECOVERY	A-2-4(0)	
10.12		5	8.0' 10.0'	3 3 6 6	Wet stiff gray clayey fine sandy silt w/some coarse sand, trace of fine gravel. 17" RECOVERY	A-4(1)	
		6	10.0' 12.0'	4 8 6 7	Wet stiff gray clayey silt w/some fine to coarse sand. 23" RECOVERY	A-4(5)	
12.65		7	12.0'	3 6 7 11	Wet stiff gray silty clay w/some fine to coarse sand w/trace fine gravel.	A-6(5)	

Remarks: Hole collapsed, unable to obtain the last sample.

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
			14.0'		24" RECOVERY		
15.18		8	14.0' 16.0'	2 2 3 3	Wet loose gray clayey coarse to fine sand w/ some silt, trace of fine gravel. 8" RECOVERY	A-2-4(0)	
17.71		9	16.0' 18.0'	2 6 9 10	Wet medium dense brown coarse sand w/ some fine gravel and fine sand, trace of silt. 24" RECOVERY	A-1-b	
20.24		10	18.0' 20.0'	9 10 10 9	Wet medium dense brown coarse sand w/ some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	20 42 25 14	Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt. 24" RECOVERY	A-1-b	
30.36		12	29.0' 31.0'	12 20 19 36	Wet dense brown fine gravelly coarse sand w/trace fine sand and silt. 7" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	11 17 17 32	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt. 9" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	10 12 14 13	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt. 16" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	8 9 10 14	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 24" RECOVERY	A-3	
48.07							
50.6		16	49.0' 51.0'	4 6 12 19	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt. 18" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	14 19 32 38	Wet very dense brown fine to coarse sand w/ trace fine gravel and silt. 24" RECOVERY	A-3	
58.19							
				28			

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-1
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
60.72		18	59.0' 61.0'	26 38 36	Wet very dense brown fine to coarse sand w/ trace fine gravel and silt. 10" RECOVERY	A-3	
63.25		19	64.0' 66.0'	25 32 34 41	Wet very dense brown fine to coarse sand w/ trace fine gravel and silt. 10" RECOVERY	A-3	
65.78					End Boring		
68.31							
70.84							
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Silty soils
	Plastic clays
	Well graded gravels and sands
	Clean sand & gravelly sand
Misc. Symbols	
	Description not given for: "WATER2"

Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

BORING FT-2

Project Name: Bridge Concept Design
Location: Sussex County, DE
State Contract #: T201407003
Federal Contract #:
Station/Offset:
Northing: 316068.507
Easting: 667555.995
Boring Surface Elev.:
Reference:
Date Started: 2/11/16
Date Completed: 2/11/16

Wt. of Sample Hammer: 140 **Lbs.**
Type of: **D-Sampler:** Split Barrel **O.D.**
S-Sampler: **O.D.**
U-Sampler: **O.D.**
Core Bit: **O.D.**

Average Fall: 30 **IN.**
O.D. of Sampler: 2 **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Samp. Tube: **IN.**
O.D. of Rock Core: **IN.**

Hollow Stem Auger Diameter: 3 1/4" **Inches**
Mud Rotary:

From Depth of: 0.0 **To:** 70.0
From Depth of: **To:**

Water Level Readings

Date	Depth to Water (ft)	Caved Depth (ft)
2/11/16	5.0	
2/11/16	4.0	9.7

Boring Contractor: Walton Corporation
Equipment/Rig Type: CME 55 Truck Rig
Driller: Dave Burt
Logged By: Randy Ferguson

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
		1	0.5'		Moist gray fine to coarse sand w/some fine gravel and silt.	A-2-4(0)	Hot-mix 4"
2.53		2	2.0' 2.2' 4.0'	8 10 11 13	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 20" RECOVERY 18" RECOVERY	A-2-4(0)	
5.06		3	4.0' 6.0'	7 8 10 12	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel. 13" RECOVERY	A-2-4(0)	
7.59		4	6.0' 8.0'	5 5 5 5	Wet loose gray fine to coarse sand w/trace fine gravel and silt. 19" RECOVERY	A-3	
10.12		5	8.0' 10.0'	3 3 3 3	Wet firm gray silty clay w/some coarse to fine sand w/trace fine gravel. 10" RECOVERY	A-6(5)	
		6	10.0' 12.0'	5 7 9 11	Wet very stiff brown clayey coarse to fine sandy silt. 22" RECOVERY	A-4(1)	
12.65		7	12.0' 14.0'	3 5 6 9	Wet stiff brown silty clay w/trace coarse to fine sand. 11" RECOVERY	A-6(13)	

Remarks:

Reviewed By: Hany Fekry
Soils Supervisor: Aaron Wieczorek

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
15.18		U-1	14.0' 16.0'		No Recovery NR" RECOVERY		Shelby Tube - Press Sample
17.71		9	16.0' 18.0'	4 6 7 9	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt. 12" RECOVERY	A-3	
20.24		10	18.0' 20.0'	8 9 9 11	Wet medium dense gray coarse to fine w some fine gravel, trace of silt. 18" RECOVERY	A-1-b	
25.3		11	24.0' 26.0'	8 21 18 16	Wet dense brown coarse sandy fine gravel w/ trace fine sand and silt. 17" RECOVERY	A-1-b	
30.36		12	29.0' 31.0'	25 17 13 15	Wet medium dense brown fine gravelly coarse sand w/trace fine sand and silt. 15" RECOVERY	A-1-b	
35.42		13	34.0' 36.0'	19 17 15 18	Wet dense brown fine to coarse sand w/some fine gravel, trace of silt. 10" RECOVERY	A-1-b	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
37.95							
40.48		14	39.0' 41.0'	40 27 23 17	Wet very dense brown coarse to fine sand w/ some fine gravel and silt. 17" RECOVERY	A-1-b	
43.01							
45.54		15	44.0' 46.0'	17 19 25 24	Wet dense brown coarse to fine sand w/trace fine gravel and silt. 10" RECOVERY	A-1-b	
48.07							
50.6		16	49.0' 51.0'	10 12 11 17	Wet dense brown coarse to fine sand w/trace fine gravel and silt. 11" RECOVERY	A-1-b	
53.13							
55.66		17	54.0' 56.0'	15 18 20 23	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt. 16" RECOVERY	A-1-b	
58.19							
		18	59.0'	11 15 17	Wet dense brown coarse to fine sand w/some	A-3	

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

Project Name: Bridge Concept Design **Boring No.:** FT-2
State Contract: T201407003

Depth (ft.)	Water Level	No.	Sample Depth	Blows/6"	Sample Description	AASHTO Class.	Remarks
				22	silt, trace of fine gravel.		
60.72			61.0'		7" RECOVERY		
63.25							
		19	64.0'	19 20 23 29	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	A-1-b	
65.78			66.0'		9" RECOVERY		
68.31		20	68.0'	21 28 34 39	Wet very dense brown fine to coarse sand w/ trace fine gravel and silt.	A-3	
			70.0'		11" RECOVERY		
70.84					End Boring		
73.37							
75.9							
78.43							
80.96							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Poorly graded, silty or clayey sands and gravel
	Clean sand & gravelly sand
	Plastic clays
	Silty soils
	Well graded gravels and sands
Misc. Symbols	
	Description not given for: "WATER2"

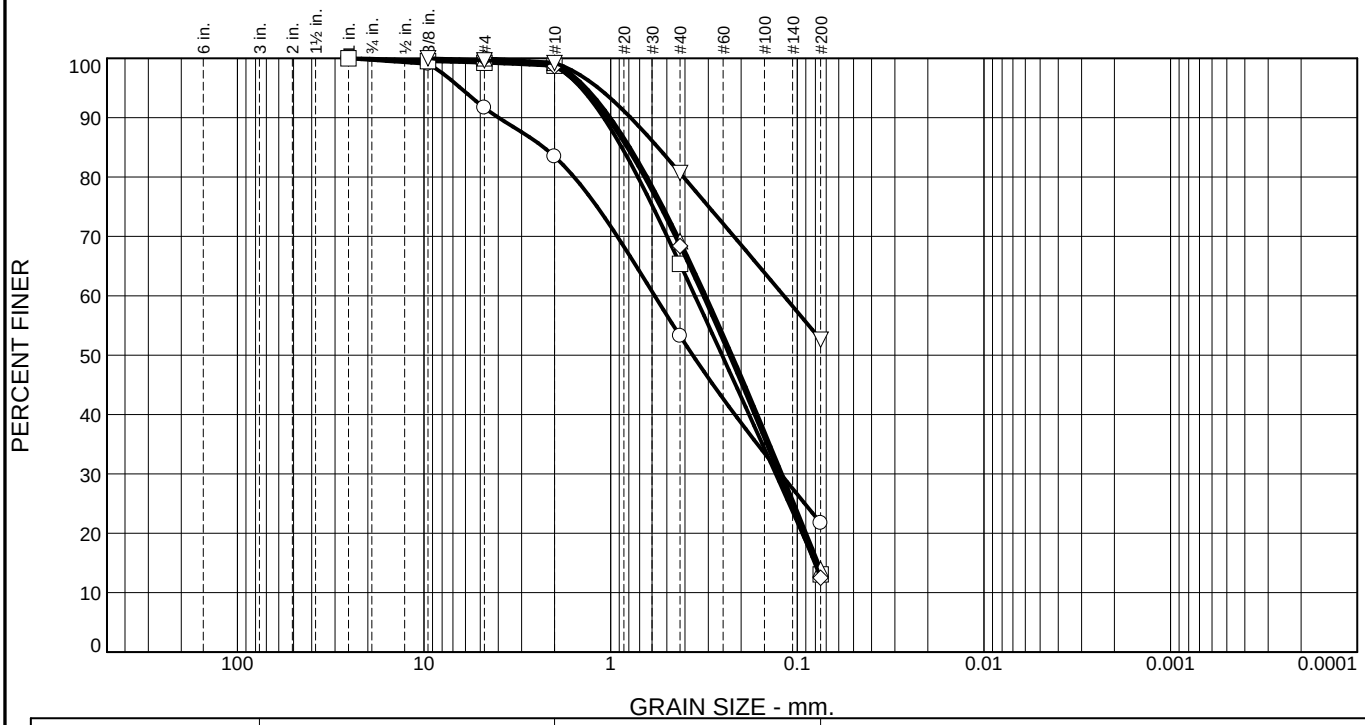
Notes:

1. Exploratory borings were drilled using a 3 1/4 - inch diameter hollow stem auger.

2. These logs are subject to the limitations, conclusions, and recommendations in this report.

3. All blow counts are uncorrected.

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	16.5	30.3	31.5	21.7	
□	0.0	1.3	33.3	52.3	13.1	
△	0.0	0.8	30.0	55.3	13.9	
◇	0.0	1.3	30.3	55.9	12.5	
▽	0.0	0.8	18.5	28.1	52.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	2.2840	0.5808	0.3633	0.1226				
□	NV	NP	0.8718	0.3539	0.2529	0.1305	0.0799			
△	NV	NP	0.7892	0.3097	0.2238	0.1210	0.0774			
◇	NV	NP	0.8164	0.3190	0.2308	0.1255	0.0807			
▽	25.0	16.9	0.5585	0.1181						

Material Description	USCS	AASHTO
○ Moist gray silty fine to coarse sand w some fine gravel.	SM	A-2-4(0)
□ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
▽ Wet stiff gray clayey fine sandy silt w/some coarse sand, trace of fine gravel.	CL	A-4(1)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-1 **Depth:** 0.0 **Sample Number:** 1

□ **Source of Sample:** FT-1 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** FT-1 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** FT-1 **Depth:** 6.0 **Sample Number:** 4

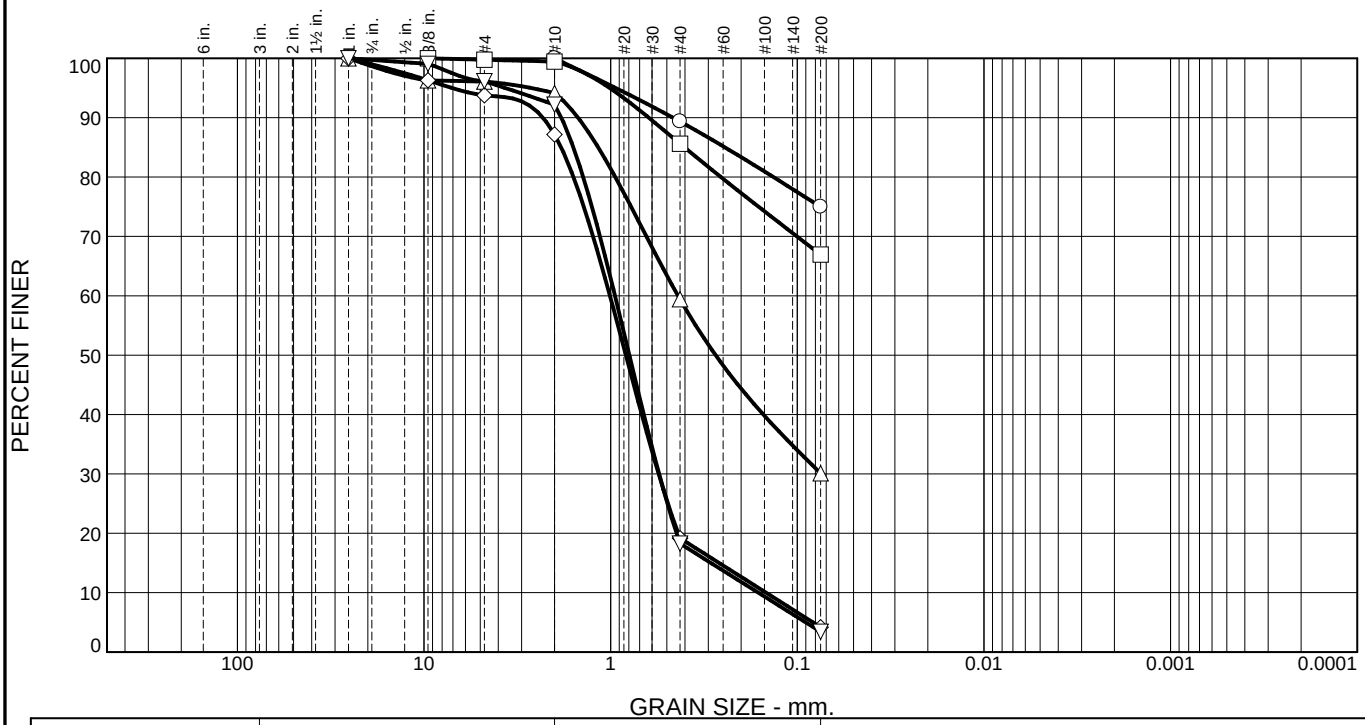
▽ **Source of Sample:** FT-1 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	10.6	14.4	75.0	
□	0.0	0.6	13.8	18.7	66.9	
△	0.0	5.9	34.7	29.3	30.1	
◇	0.0	12.8	68.0	15.0	4.2	
▽	0.0	7.8	73.9	14.9	3.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27.5	19.3	0.2443							
□	30.2	19.2	0.4026							
△	26.5	17.1	1.1668	0.4356	0.2739					
◇	NV	NP	1.8427	1.0093	0.8291	0.5532	0.2623	0.1471	2.06	6.86
▽	NV	NP	1.5847	0.9483	0.7942	0.5503	0.2902	0.1619	1.97	5.86

Material Description	USCS	AASHTO
○ Wet stiff gray clayey silt w/some fine to coarse sand.	CL	A-4(5)
□ Wet stiff gray silty clay w/some fine to coarse sand w/trace fine gravel.	CL	A-6(5)
△ Wet loose gray clayey coarse to fine sand w/some silt, trace of fine gravel.	SC	A-2-4(0)
◇ Wet medium dense brown coarse sand w/some fine gravel and fine sand, trace of silt.	SW	A-1-b
▽ Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-1 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** FT-1 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** FT-1 **Depth:** 14.0 **Sample Number:** 8

◇ **Source of Sample:** FT-1 **Depth:** 16.0 **Sample Number:** 9

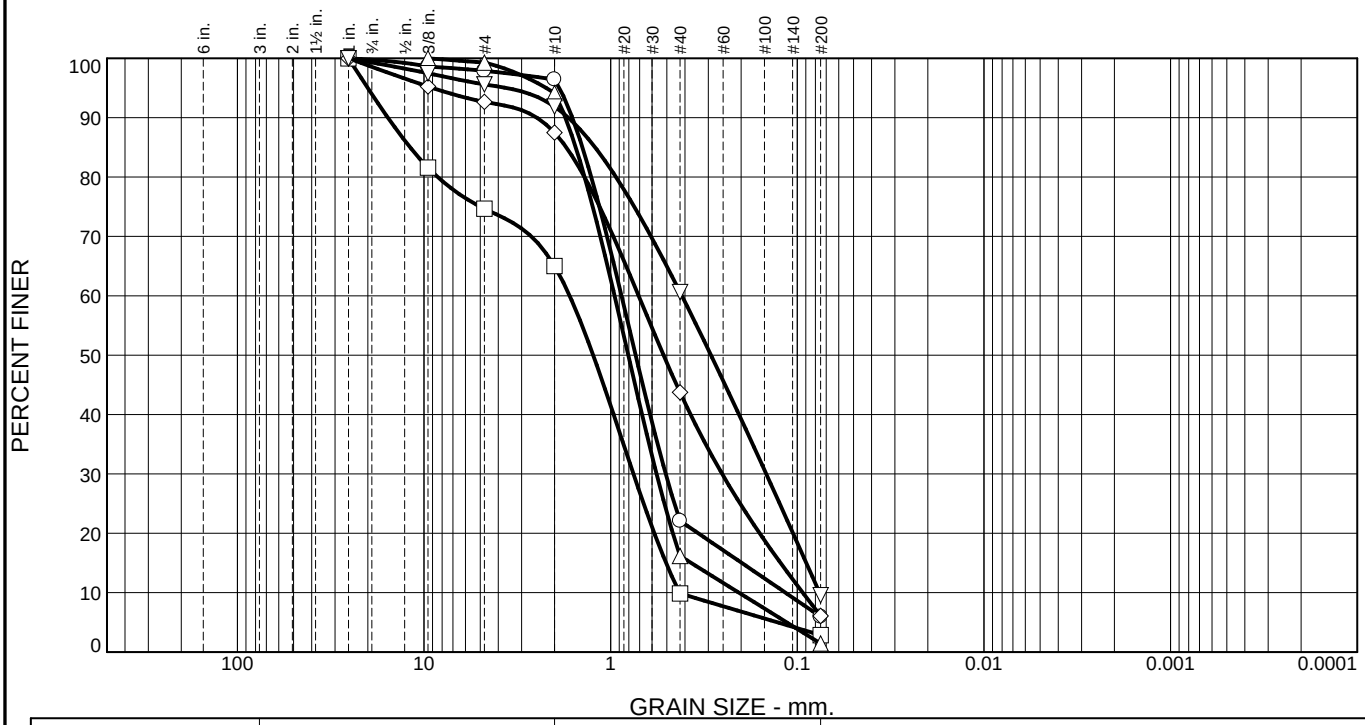
▽ **Source of Sample:** FT-1 **Depth:** 18.0 **Sample Number:** 10

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	3.6	74.3	16.1	6.0	
□	0.0	35.0	55.1	7.1	2.8	
△	0.0	5.9	77.9	14.8	1.4	
◇	0.0	12.5	43.8	37.6	6.1	
▽	0.0	8.1	31.3	51.0	9.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.4168	0.8749	0.7349	0.5071	0.1983	0.1158	2.54	7.55
□	NV	NP	11.8680	1.6588	1.2408	0.7549	0.5048	0.4272	0.80	3.88
△	NV	NP	1.5385	0.9533	0.8049	0.5677	0.3703	0.2055	1.64	4.64
◇	NV	NP	1.7292	0.7081	0.5206	0.2527	0.1229	0.0935	0.96	7.58
▽	NV	NP	1.2123	0.4154	0.2901	0.1468	0.0895	0.0760	0.68	5.46

Material Description	USCS	AASHTO
○ Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SW-SM	A-1-b
□ Wet dense brown fine gravelly coarse sand w/trace fine sand and silt.	SP	A-1-b
△ Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b
◇ Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
▽ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-1 **Depth:** 24.0 **Sample Number:** 11

□ **Source of Sample:** FT-1 **Depth:** 29.0 **Sample Number:** 12

△ **Source of Sample:** FT-1 **Depth:** 34.0 **Sample Number:** 13

◇ **Source of Sample:** FT-1 **Depth:** 39.0 **Sample Number:** 14

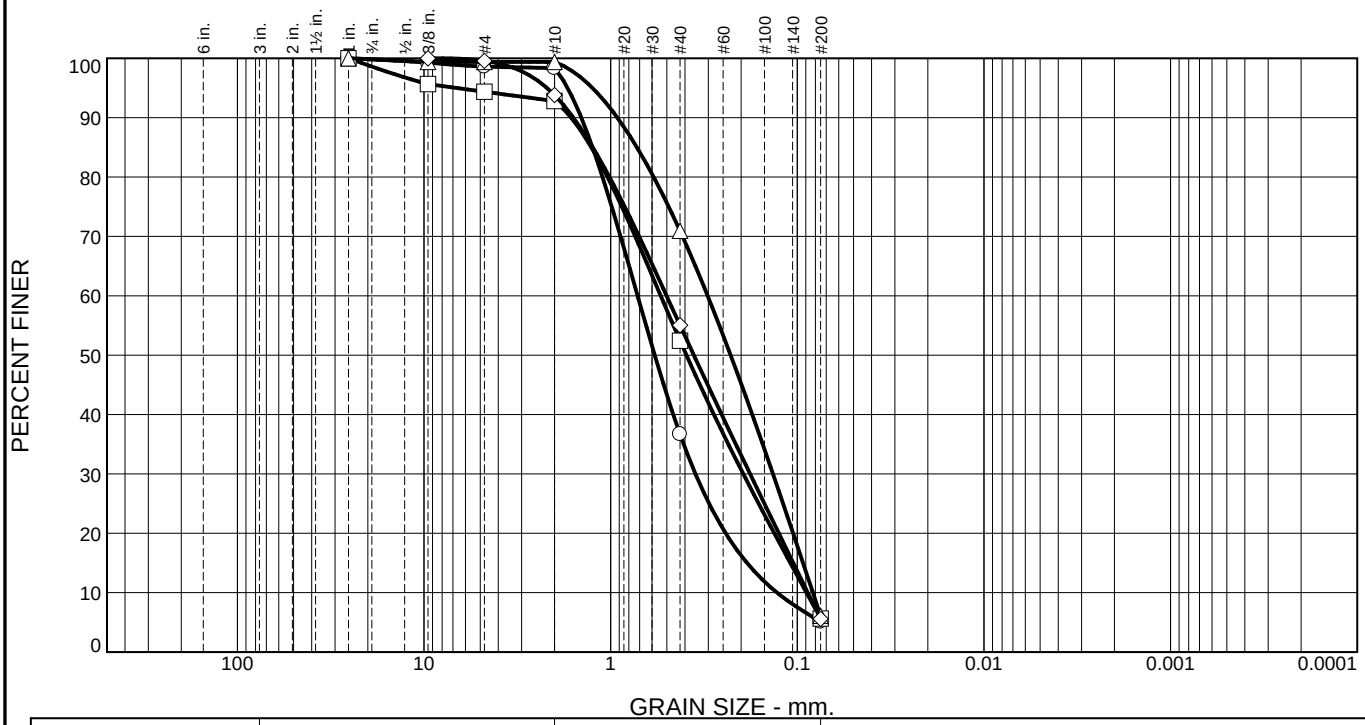
▽ **Source of Sample:** FT-1 **Depth:** 44.0 **Sample Number:** 15

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	1.6	61.7	31.6	5.1	
□	0.0	7.2	40.4	46.8	5.6	
△	0.0	0.6	28.5	64.8	6.1	
◇	0.0	6.2	38.8	49.4	5.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.2511	0.7174	0.5805	0.3515	0.1860	0.1284	1.34	5.59
□	NV	NP	1.2689	0.5393	0.3927	0.1947	0.1091	0.0893	0.79	6.04
△	NV	NP	0.7236	0.3022	0.2276	0.1351	0.0932	0.0825	0.73	3.66
◇	NV	NP	1.2472	0.5017	0.3583	0.1791	0.1051	0.0879	0.73	5.71

Material Description	USCS	AASHTO
○ Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	SP-SM	A-1-b
□ Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
△ Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-1 **Depth:** 49.0 **Sample Number:** 16

□ **Source of Sample:** FT-1 **Depth:** 54.0 **Sample Number:** 17

△ **Source of Sample:** FT-1 **Depth:** 59.0 **Sample Number:** 18

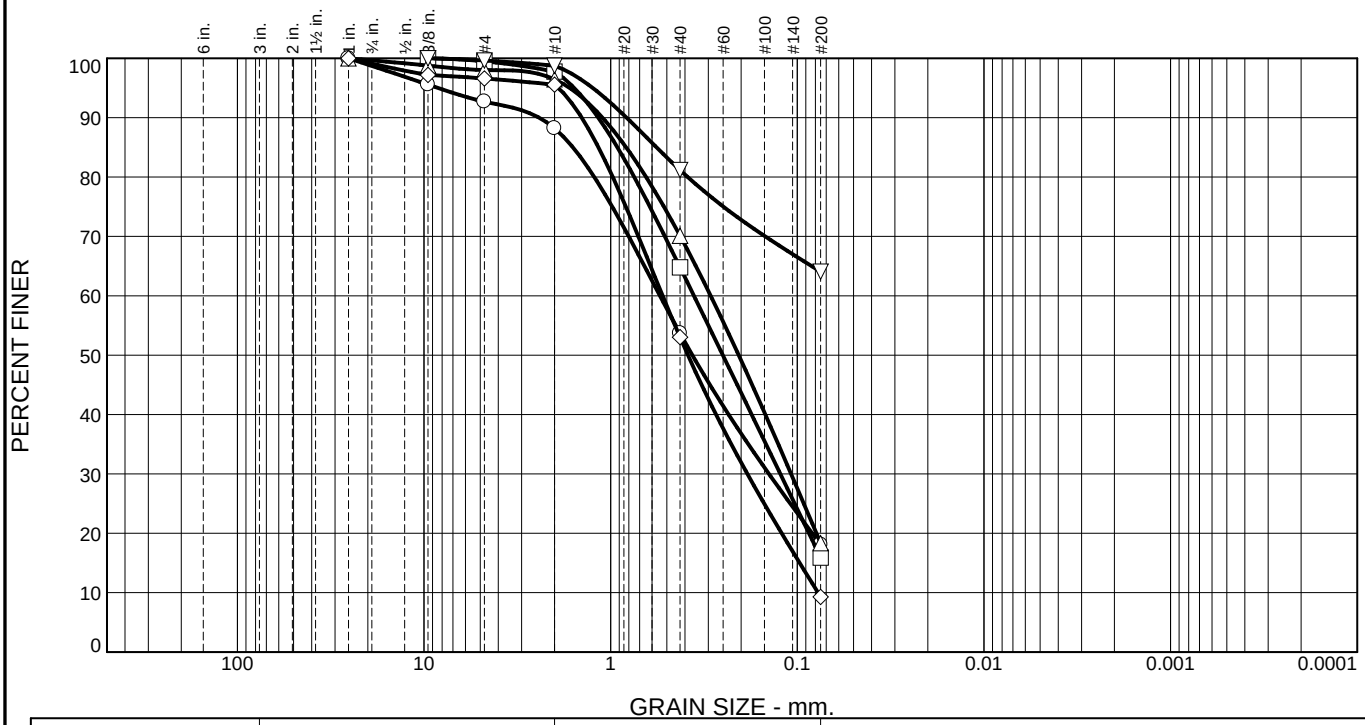
◇ **Source of Sample:** FT-1 **Depth:** 64.0 **Sample Number:** 19

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	11.8	34.5	35.6	18.1	
□	0.0	2.2	33.0	48.9	15.9	
△	0.0	3.5	26.4	51.8	18.3	
◇	0.0	4.4	42.6	43.7	9.3	
▽	0.0	1.3	17.5	17.1	64.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.5939	0.5443	0.3650	0.1420				
□	NV	NP	0.9206	0.3580	0.2506	0.1233				
△	NV	NP	0.8262	0.2912	0.2061	0.1080				
◇	NV	NP	1.1629	0.5266	0.3854	0.1852	0.0971	0.0775	0.84	6.80
▽	30.3	19.4	0.5675							

Material Description	USCS	AASHTO
○ Moist gray fine to coarse sand w/some fine gravel and silt.	SM	A-2-4(0)
□ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
△ Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	SM	A-2-4(0)
◇ Wet loose gray fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
▽ Wet firm gray silty clay w/some coarse to fine sand w/trace fine gravel.	CL	A-6(5)

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-2 **Depth:** 0.5 **Sample Number:** 1

□ **Source of Sample:** FT-2 **Depth:** 2.0 **Sample Number:** 2

△ **Source of Sample:** FT-2 **Depth:** 4.0 **Sample Number:** 3

◇ **Source of Sample:** FT-2 **Depth:** 6.0 **Sample Number:** 4

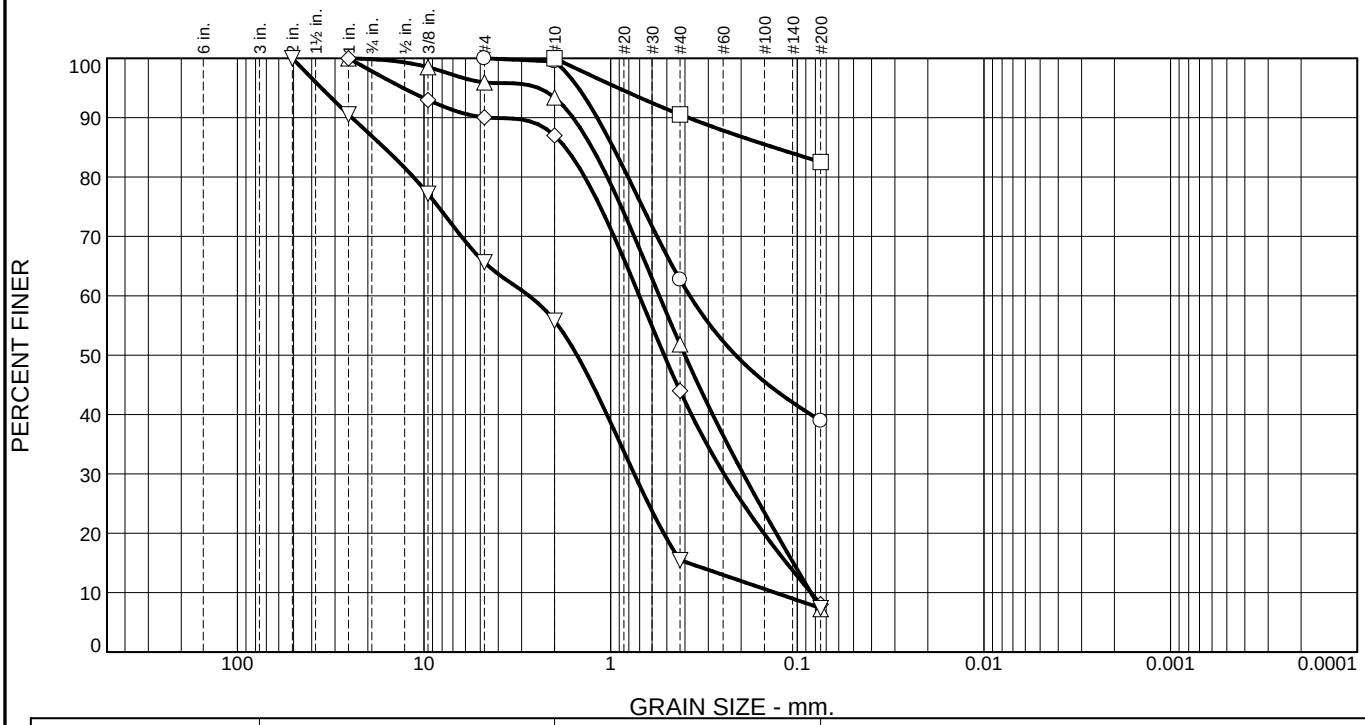
▽ **Source of Sample:** FT-2 **Depth:** 8.0 **Sample Number:** 5

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.5	36.8	23.8	38.9	
□	0.0	0.0	9.5	8.0	82.5	
△	0.0	6.6	41.6	44.6	7.2	
◇	0.0	13.0	43.0	36.0	8.0	
▽	0.0	44.2	40.3	8.1	7.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	28.5	17.6	0.9697	0.3768	0.2139					
□	40.2	24.2	0.1338							
△	NV	NP	1.2613	0.5489	0.4005	0.1949	0.1049	0.0846	0.82	6.49
◇	NV	NP	1.7499	0.7022	0.5167	0.2471	0.1141	0.0845	1.03	8.31
▽	NV	NP	16.4028	2.7384	1.5152	0.7478	0.3844	0.1314	1.55	20.84

Material Description	USCS	AASHTO
○ Wet very stiff brown clayey coarse to fine sandy silt.	SC	A-4(1)
□ Wet stiff brown silty clay w/trace coarse to fine sand.	CL	A-6(13)
△ Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3
◇ Wet medium dense gray coarse to fine w some fine gravel, trace of silt.	SW-SM	A-1-b
▽ Wet dense brown coarse sandy fine gravel w/trace fine sand and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-2 **Depth:** 10.0 **Sample Number:** 6

□ **Source of Sample:** FT-2 **Depth:** 12.0 **Sample Number:** 7

△ **Source of Sample:** FT-2 **Depth:** 16.0 **Sample Number:** 9

◇ **Source of Sample:** FT-2 **Depth:** 18.0 **Sample Number:** 10

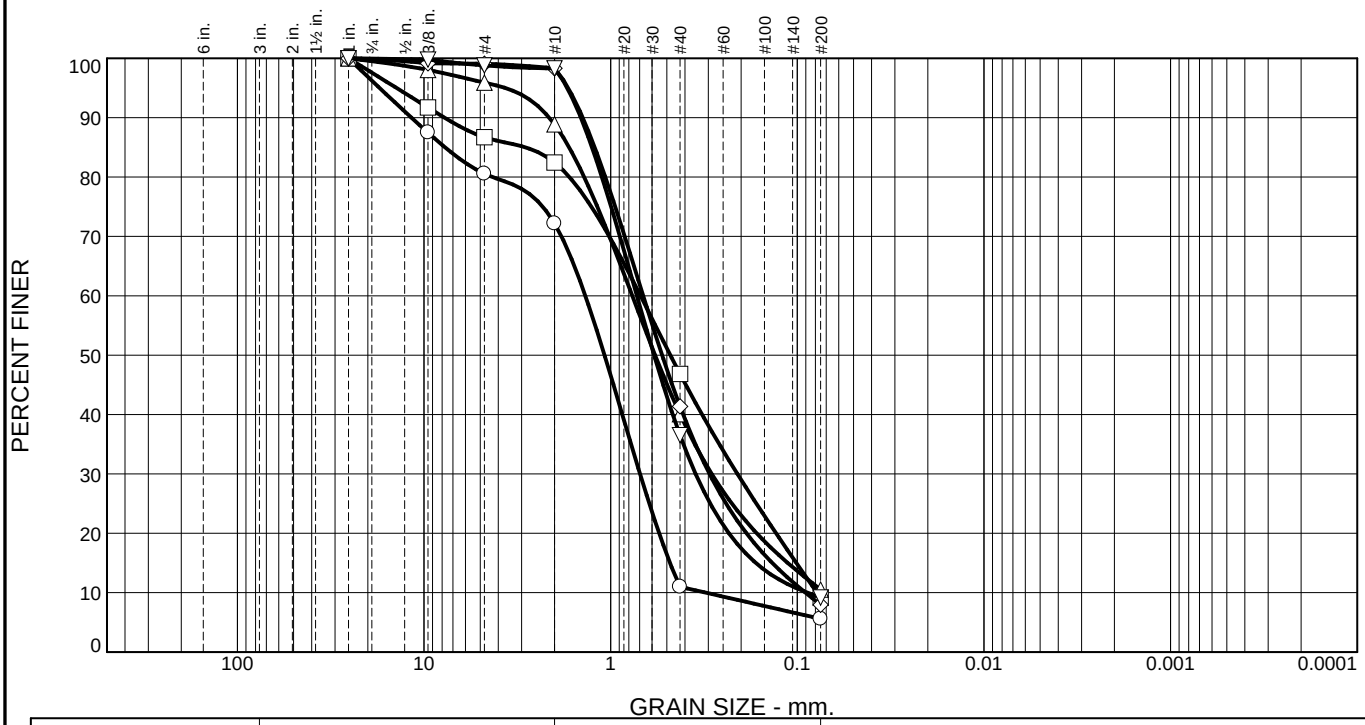
▽ **Source of Sample:** FT-2 **Depth:** 24.0 **Sample Number:** 11

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	27.8	61.2	5.4	5.6	
□	0.0	17.5	35.7	37.7	9.1	
△	0.0	11.1	48.8	29.6	10.5	
◇	0.0	1.7	56.9	33.4	8.0	
▽	0.0	1.7	61.8	27.3	9.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	7.7154	1.3672	1.0789	0.6960	0.4808	0.3090	1.15	4.42
□	NV	NP	2.8618	0.6915	0.4789	0.2094	0.1012	0.0784	0.81	8.82
△	NV	NP	1.6700	0.7658	0.5778	0.2874	0.1125			
◇	NV	NP	1.2184	0.6695	0.5302	0.2954	0.1363	0.0904	1.44	7.40
▽	NV	NP	1.2592	0.7235	0.5851	0.3505	0.1669	0.0882	1.93	8.21

Material Description	USCS	AASHTO
○ Wet medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	SP-SM	A-1-b
□ Wet dense brown fine to coarse sand w/some fine gravel, trace of silt.	SP-SM	A-1-b
△ Wet very dense brown coarse to fine sand w/some fine gravel and silt.	SP-SM	A-1-b
◇ Wet dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
▽ Wet dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-2 **Depth:** 29.0 **Sample Number:** 12

□ **Source of Sample:** FT-2 **Depth:** 34.0 **Sample Number:** 13

△ **Source of Sample:** FT-2 **Depth:** 39.0 **Sample Number:** 14

◇ **Source of Sample:** FT-2 **Depth:** 44.0 **Sample Number:** 15

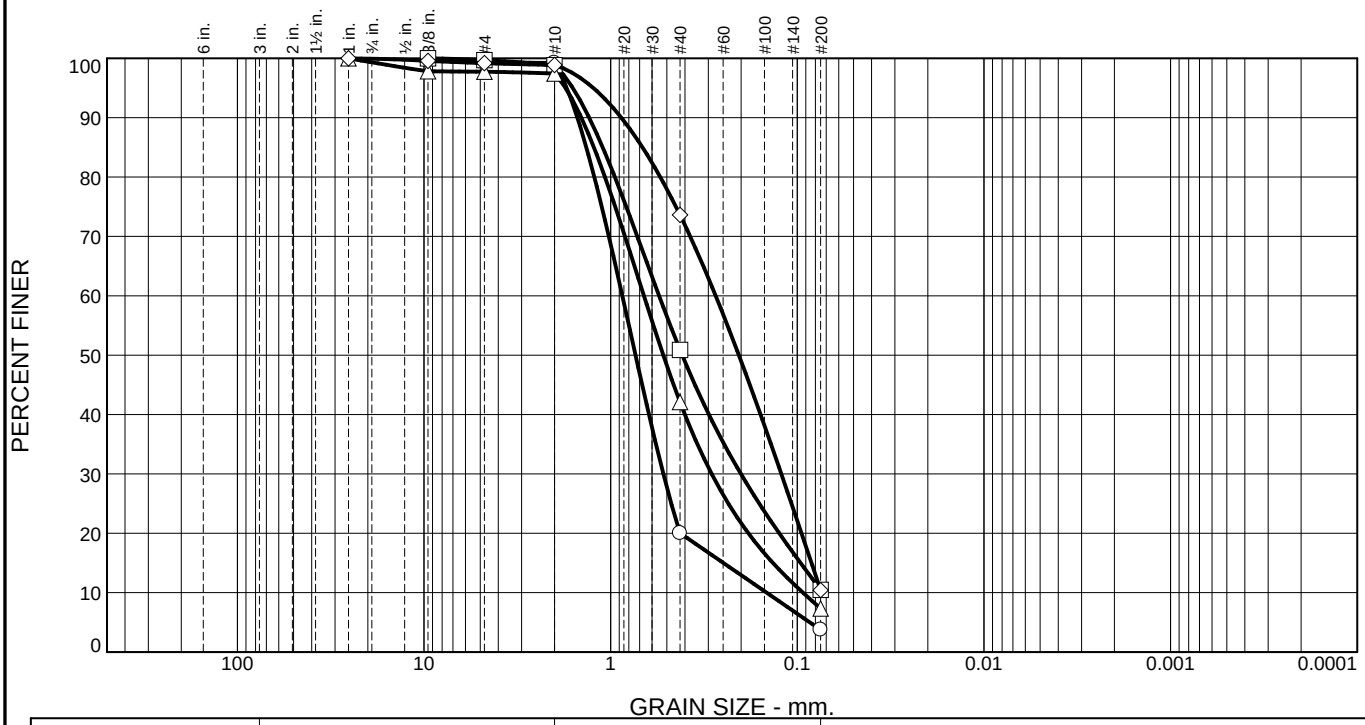
▽ **Source of Sample:** FT-2 **Depth:** 49.0 **Sample Number:** 16

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.8	79.2	16.2	3.8	
□	0.0	1.2	47.9	40.4	10.5	
△	0.0	2.6	55.3	34.8	7.3	
◇	0.0	1.1	25.3	63.2	10.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	1.3501	0.8661	0.7360	0.5219	0.2489	0.1460	2.15	5.93
□	NV	NP	1.1036	0.5501	0.4138	0.2006	0.0960			
△	NV	NP	1.2300	0.6634	0.5224	0.2875	0.1351	0.0933	1.34	7.11
◇	NV	NP	0.6754	0.2737	0.2057	0.1219	0.0839			

Material Description	USCS	AASHTO
○ Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	SP	A-1-b
□ Wet dense brown coarse to fine sand w/some silt, trace of fine gravel.	SP-SM	A-3
△ Wet dense brown coarse to fine sand w/trace fine gravel and silt.	SW-SM	A-1-b
◇ Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	SP-SM	A-3

Project No. T201407003 **Client:**

Project: Bridge Concept Design

○ **Source of Sample:** FT-2 **Depth:** 54.0 **Sample Number:** 17

□ **Source of Sample:** FT-2 **Depth:** 59.0 **Sample Number:** 18

△ **Source of Sample:** FT-2 **Depth:** 64.0 **Sample Number:** 19

◇ **Source of Sample:** FT-2 **Depth:** 68.0 **Sample Number:** 20

Remarks:

Delaware Department of Transportation
Materials and Research Laboratory

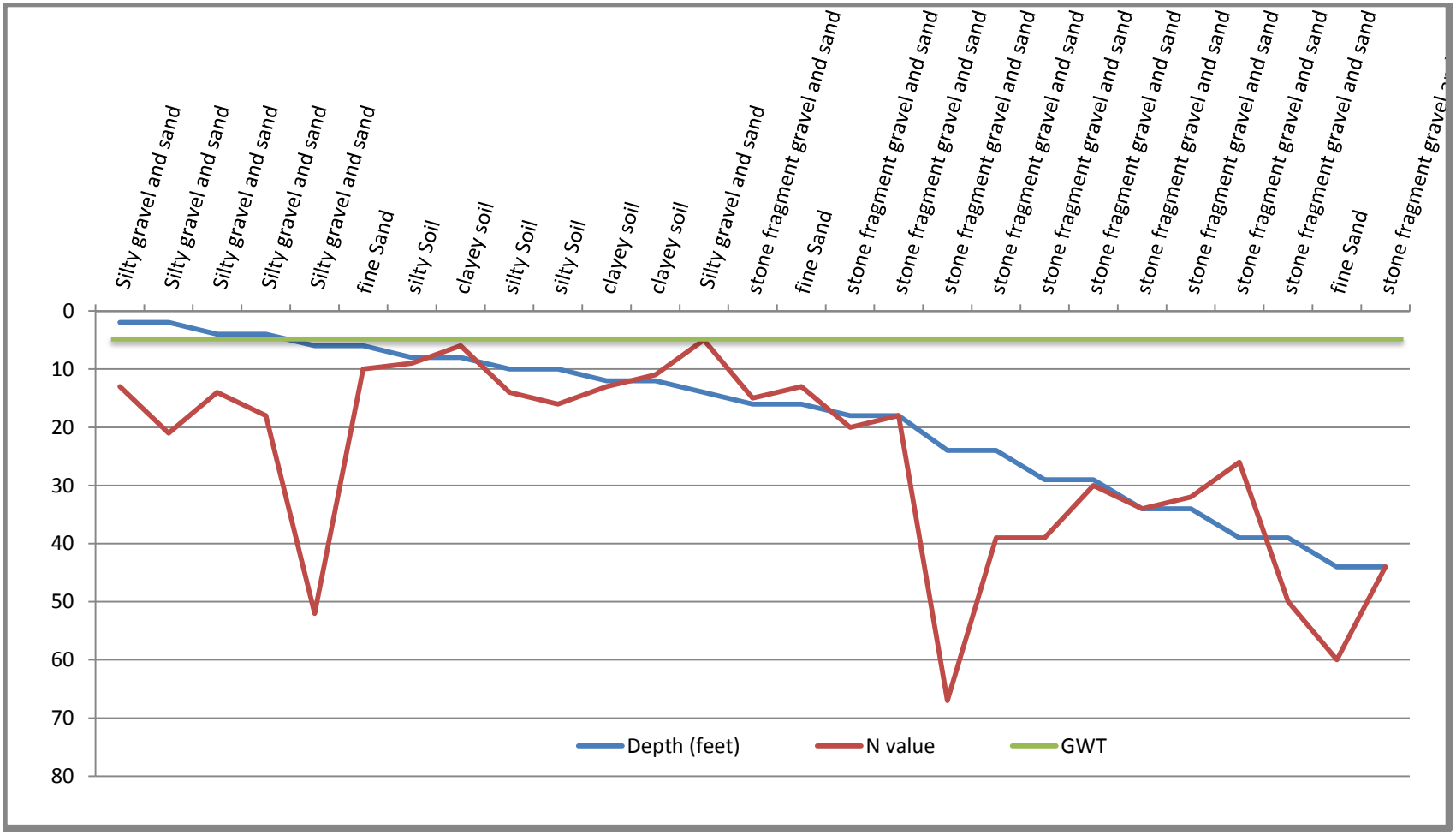
Figure

Boring Test number	Sample Number	Depth (feet)	Material description	Liquid limit	Plasticity index	Natural moisture %	USCS	AASHTO classification	Percent < than the #10 sieve	Percent < than the #200 sieve	Blow count #1	Blow count #2	Blow count #3	Blow count #4
FT-1	1		Moist gray silty fine to coarse sand w some fine gravel.	NV	NP	7.1	SM	A-2-4(0)	83.5	21.7				
	2	2	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	11.6	SM	A-2-4(0)	98.7	13.1	5	6	7	4
	3	4	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	14.6	SM	A-2-4(0)	99.2	13.9	14	8	6	7
	4	6	Wet very loose gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	15.3	SM	A-2-4(0)	98.7	12.5	5	2	2	2
	5	8	Wet stiff gray clayey fine sandy silt w/some coarse sand, trace of fine gravel.	25	8.1	18.9	CL	A-4(1)	99.2	52.6	3	3	6	6
	6	10	Wet stiff gray clayey silt w/some fine to coarse sand.	27.5	8.2	21.2	CL	A-4(5)	100	75	4	8	6	7
	7	12	Wet stiff gray silty clay w/some fine to coarse sand w/trace fine gravel.	30.2	11	22.6	CL	A-6(5)	99.4	66.9	3	6	7	11
	8	14	Wet loose gray clayey coarse to fine sand w/some silt, trace of fine gravel.	26.5	9.4	18	SC	A-2-4(0)	94.1	30.1	2	2	3	3
	9	16	Wet medium dense brown coarse sand w/some fine gravel and fine sand, trace of silt.	NV	NP	15.6	SW	A-1-b	87.2	4.2	2	6	9	10
	10	18	Wet medium dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	16.2	SP	A-1-b	92.2	3.4	9	10	10	9
	11	24	Wet very dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	18.6	SW-SM	A-1-b	96.4	6	20	42	25	14
	12	29	Wet dense brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	10	SP	A-1-b	65	2.8	12	20	19	36
	13	34	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	21.9	SP	A-1-b	94.1	1.4	11	17	17	32
	14	39	Wet medium dense brown coarse to fine sand w/some fine gravel, trace of silt.	NV	NP	20	SP-SM	A-1-b	87.5	6.1	10	12	14	13
	15	44	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	17.9	SP-SM	A-3	91.9	9.6	8	9	10	14
	16	49	Wet medium dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.8	SP-SM	A-1-b	98.4	5.1	4	6	12	19
	17	54	Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	20.4	SP-SM	A-3	92.8	5.6	14	19	32	38
	18	59	Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.9	SP-SM	A-3	99.4	6.1	28	26	38	36
	19	64	Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	19.3	SP-SM	A-3	93.8	5.6	25	32	34	41
		66	End Boring											
FT-2	1	0.5	Moist gray fine to coarse sand w/some fine gravel and silt.	NV	NP	7.3	SM	A-2-4(0)	88.2	18.1				
	2	2	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	9.7	SM	A-2-4(0)	97.8	15.9	8	10	11	13
	3	4	Moist medium dense gray fine to coarse sand w/some silt, trace of fine gravel.	NV	NP	12	SM	A-2-4(0)	96.5	18.3	7	8	10	12
	4	6	Wet loose gray fine to coarse sand w/trace fine gravel and silt.	NV	NP	16.8	SP-SM	A-3	95.6	9.3	5	5	5	5
	5	8	Wet firm gray silty clay w/some coarse to fine sand w/trace fine gravel.	30.3	10.9	21.1	CL	A-6(5)	98.7	64.1	3	3	3	3
	6	10	Wet very stiff brown clayey coarse to fine sandy silt.	28.5	10.9	18.1	SC	A-4(1)	99.5	38.9	5	7	9	11
	7	12	Wet stiff brown silty clay w/trace coarse to fine sand.	40.2	16	25.8	CL	A-6(13)	100	82.5	3	5	6	9
	U-1	14	No Recovery											
	9	16	Wet medium dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	18	SP-SM	A-3	93.4	7.2	4	6	7	9
	10	18	Wet medium dense gray coarse to fine w some fine gravel, trace of silt.	NV	NP	15.2	SW-SM	A-1-b	87	8	8	9	9	11
	11	24	Wet dense brown coarse sandy fine gravel w/trace fine sand and silt.	NV	NP	10.8	SW-SM	A-1-b	55.8	7.4	8	21	18	16
	12	29	Wet medium dense brown fine gravelly coarse sand w/trace fine sand and silt.	NV	NP	12.7	SP-SM	A-1-b	72.2	5.6	25	17	13	15
	13	34	Wet dense brown fine to coarse sand w/some fine gravel, trace of silt.	NV	NP	14.4	SP-SM	A-1-b	82.5	9.1	19	17	15	18
	14	39	Wet very dense brown coarse to fine sand w/some fine gravel and silt.	NV	NP	14	SP-SM	A-1-b	88.9	10.5	40	27	23	17
	15	44	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.9	SW-SM	A-1-b	98.3	8	17	19	25	24
	16	49	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	21.9	SW-SM	A-1-b	98.3	9.2	10	12	11	17
	17	54	Wet dense brown coarse sand w/some fine sand, trace of fine gravel and silt.	NV	NP	20.9	SP	A-1-b	99.2	3.8	15	18	20	23
	18	59	Wet dense brown coarse to fine sand w/some silt, trace of fine gravel.	NV	NP	18.7	SP-SM	A-3	98.8	10.5	11	15	17	22
	19	64	Wet dense brown coarse to fine sand w/trace fine gravel and silt.	NV	NP	18.5	SW-SM	A-1-b	97.4	7.3	19	20	23	29
	20	68	Wet very dense brown fine to coarse sand w/trace fine gravel and silt.	NV	NP	17.7	SP-SM	A-3	98.9	10.4	21	28	34	39
		70	End Boring											

DATE : **4-14-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR2-066A on White Oak Rd over Little River - Dover, DE**



DATE : **4-27-2016**

PROJECT NUMBER : **T201407003**

PROJECT NAME : **BR3-923 Fleatown Rd, Lincoln, DE**

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX F

UTILITY DOCUMENTS

Project Utilities																																	
Bridge ID	Road Facility	Delaware Electric Co-Op	Delmarva Power NCC	Delmarva Power K&S	Delmarva Power - Gas	Eastern Shore Natural Gas	Chesapeake Utilities	AERO Energy	SUEZ (United) Water	Tidewater Utilities	Artesian Water Company	Verizon	Comcast NCC	Comcast Kent	Comcast Sussex	AT & T Corporation	MCI Worldcom	WINDSTREAM (Caviler)	Sunesys LLC	Fibertech	Mediacom	Zayo	Quest	Atlantic Broadband	Level 3 Communications	New Castle County	Kent County Public Works	Sussex County	DEL DOT	City of Milford	Town of Bridgeville	Town of Georgetown	City of Dover	DNREC
1178 282	MILL CREEK RD.																																	
1183 276	MCKENNAN'S CHURCH																																	
1420 461	MARYLAND LINE RD.																																	
1449 456	UNION CHURCH RD.																																	
1454 465	EAGLES NEST LNDG RD.																																	
1455 466	DEER RUN RD.																																	
1615 021	NEWPORT GAP PIKE																																	
1616 021	NEWPORT GAP PIKE																																	
2066A 066	WHITE OAK RD.																																	
2113B 113	CATTAIL BRANCH RD.																																	
2303A 303	HIGH STUMP RD.																																	
2371B 371	BARRATTS CHAPEL RD.																																	
2384C 384	KILLENS POND RD.																																	
2442A 442	ABBOTTS POND RD.																																	
3132 565	SUNNYSIDE RD.																																	
3139 597	TUCKERS RD.																																	
3236 046	ELKS RD.																																	
3317 024	SR 24 / LAUREL RD.																																	
3323 447	JOHNSON RD.																																	
3335 515	BACONS RD.																																	
3441 382	ARMORY RD.																																	
3564 413	FIREMANS RD.																																	
3576 064	WHITESVILLE RD.																																	
3626 608	ELLENDALE FOREST RD.																																	
3627 606	SAMMONS RD.																																	
3630 593	MAPLE BRANCH RD.																																	
3681 318	CEDAR LANE																																	
3913 016	BEACH HGWY / SR16																																	
3914 016	BEACH HGWY / SR16																																	
3914A 016	BEACH HGWY / SR16																																	
3923 224	FLEATOWN RD.																																	

Transportation Solutions, Engineering Support, Utilities

UTILITY RELOCATION CHECKLIST

September 6, 2016

To: Eric C. Cimo
Utility Engineer, Engineering Support
Via: {Name}
Utility Coordinator, Engineering Support
From: {Name}
Project Manager, {Section}

Utility Company Information

(to be completed by Utility Coordinator)

Name:
Address:
Contact Person:

Project Information

State Contract No.:
Project I.D. No.:
F.A.P. No.:
Location:
County:
Maintenance Road No.:
Construction District:

Excerpt for Reference

Provisions of 17 Del. C. §132, General powers and duties (b)(5):

- **(b)(5)** Reimburse the owner thereof for the expense (as hereinafter defined) of the relocation of public utility facilities necessitated by any project where the State is to be reimbursed by at least 90% of the cost of such project from federal funds or by the federal government or any agency thereof, such expense to be the amount paid by such owner properly attributable to such relocation after deducting therefrom any increase in the value of the new facilities and any salvage value derived from the old facilities;

Provisions of 17 Del. C. §143 Expenses of alteration or relocation of facilities or structures of public utilities (g)(1)c:

- **(g)(1)** The Department shall reimburse a nonmunicipal or other non-governmental public utility for the cost of altering or relocating its facility due to a highway construction, reconstruction, relocation, repair, or maintenance project under each of the following circumstances:
    - **a.** The Department requires a second alteration or relocation of the same public utility facility

SAMPLE

Transportation Solutions, Engineering Support, Utilities

UTILITY RELOCATION CHECKLIST

DATE

To: Eric C. Cimo
Utility Engineer, Engineering Support
Via: {Name}
Utility Coordinator, Engineering Support
From: {Name}
Project Manager, {Section}

Utility Company Information

(to be completed by Utility Coordinator)

Name:
Address:
Contact Person:

Project Information

State Contract No.:
Project I.D. No.:
F.A.P. No.:
Location:
County:
Maintenance Road No.:
Construction District:

Excerpt for Reference

Provisions of 17 Del. C. §132, General powers and duties (b)(5):

- **(b)(5)** Reimburse the owner thereof for the expense (as hereinafter defined) of the relocation of public utility facilities necessitated by any project where the State is to be reimbursed by at least 90% of the cost of such project from federal funds or by the federal government or any agency thereof, such expense to be the amount paid by such owner properly attributable to such relocation after deducting therefrom any increase in the value of the new facilities and any salvage value derived from the old facilities;

Provisions of 17 Del. C. §143 Expenses of alteration or relocation of facilities or structures of public utilities (g)(1)c:

- **(g)(1)** The Department shall reimburse a nonmunicipal or other non-governmental public utility for the cost of altering or relocating its facility due to a highway construction, reconstruction, relocation, repair, or maintenance project under each of the following circumstances:
    - **a.** The Department requires a second alteration or relocation of the same public utility facility within 10 years from the date of completion of the initial alteration or relocation;
    - **b.** The Department alters its plan of construction for the project at any time before its completion,

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

UTILITY STATEMENT
STATE CONTRACT #T201000701
HSIP NCC SR 71, OLD PORTER ROAD TO SR 7
FEDERAL AID PROJECT #ESTP-NO35(4)
PROJECT I.D. No. 10-44332
NEW CASTLE COUNTY

The following Utility Companies may own and/or maintain facilities within the project limits:

Delmarva Power – Electric Distribution
Comcast Cable Communications
Verizon Delaware LLC – Communications
Delmarva Power – Gas
United Water Corporation
New Castle County Department of Special Services

The following is a breakdown of the Utilities involved, adjustments and/or relocations as required:

Delmarva Power – Electric Distribution

Delmarva Power maintains primary 12kv & 25kv aerial facilities on both Delmarva and Verizon owned poles throughout the project limits.

Red Lion Road (SR71): Delmarva has facilities along the easterly side of Red Lion Road from the beginning of the project limits to the intersection with SR7. The facilities then continue along the westerly side of Red Lion Road to the project limits at approximate Station 31+50.

Bear Corbitt Road (SR7) Delmarva has facilities along the westerly side of the road throughout the limits of the project.

Old Porter Road Delmarva has facilities along the southerly side of Old Porter Road from the westerly limits of the project on Old Porter Road until Red Lion Road (SR71) where they cross over and tie into pole 45264/38336.

SAMPLE

Church Road Delmarva has facilities along the southerly side of Church Road from the westerly limits of the project until Bear Corbitt Road (SR7) where they cross over and tie into pole 45293/38380.

Bidders are advised that Delmarva aerial circuits are also located on Verizon-owned poles on Bear Corbitt Road (SR7) at Sta. 223+50 RT and also Sta. 225+25 RT.

PROPOSED RELOCATION

NOTE: It is anticipated that Delmarva will complete its proposed work in advance of this contract. The bidders are to determine the extent completion of the advanced utility work and predicated their bid prices on the extent of utility work completed and anticipated to be completed prior to the start of construction.

Red Lion Road (SR71): Delmarva proposes to set new poles and relocate their 25kv aerial facilities farther back off the easterly side of Red Lion Road to be out of the clear zone and proposed construction from approximate Sta. 9+50 to approximate Sta. 23+00, the intersection with Bear Corbitt Road (SR7).

From the intersection with Bear Corbitt Road, Delmarva proposes to relocate their 3-phase, 12kv aerial circuits and poles farther back off the western side of Red Lion Road to be out of the clear zone and proposed construction from approximate Sta. 24+00 to approximate Sta. 29+00.

Delmarva plans to install new service and/or guy poles at the following approximate locations.

Sta. 8+00 LT
Sta. 21+20 LT
Sta. 28+70 RT

Bear Corbitt Road (SR7) Delmarva proposes to set new poles and relocate their aerial facilities farther back off the western side of Bear Corbitt Road to be out of the clear zone and proposed construction from approximate Sta. 209+25 to approximate Sta. 222+40.

The following poles are maintained by Delmarva. Delmarva plans to remove, install new service and/or install guy poles at the following approximate locations.

Sta. 210+80 LT – Remove Pole
Sta. 211+40 LT – New Pole
Sta. 212+30 LT – New Pole
Sta. 214+00 RT & LT – New Pole
Sta. 215+40 LT – New Pole
Sta. 216+60 RT – New Pole
Sta. 216+95 LT – Remove Pole
Sta. 219+25 RT – Remove Pole
Sta. 223+80 LT – New Pole
Sta. 225+25 LT – New Pole

SAMPLE

Old Porter Road Delmarva proposes to relocate one pole (49253/38333) at the southeast corner of Old Porter and Red Lion Roads. The pole will be reset behind the proposed curb and clear zone at approximate Sta. 302+90 RT. Aerial facilities will be attached to the new pole and run across Red Lion Road to tie into the proposed pole at approximate Sta. 13+48.

Church Road Delmarva proposes to relocate the existing pole line back behind the proposed construction and clear zones. They will be adding additional facilities on the northern side (offset left) of Church Road at approximate Sta. 408+00 and Sta. 406+70. Delmarva will also be installing two new poles along the southern (offset right) to provide services to the houses. The poles will be at approximate Sta. 409+10 and 408+05, within the proposed permanent easement. A new pole will be set at Sta. 410+00 to reconnect services to the existing houses.

General: Verizon will add place additional anchors and guys at location shown on the plans as required to support the Aerial relocation work. Delmarva will replace, transfer and/or relocate aerial and underground services as necessary in conjunction with the proposed work.

Delmarva estimates that the proposed work will take one hundred (100) calendar days to complete following thirty (30) calendar days advance notice by DelDOT (for the advance work) to start relocation work after the project area is made ready by DelDOT's contractor, including completion of clearing and grubbing.

Delmarva states that no existing facilities can be taken out of service until the replacement facilities are installed and in operation.

Should any additional conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utility's existing facilities, the necessary relocation work shall be accomplished by the respective company's forces, as directed by the Engineer.

Comcast Cablevision Communications:

The company has communications facilities attached to both Delmarva Power and Verizon poles which must be relocated to the new Delmarva Power and Verizon poles as described in the relocations schemes of the respective Companies. Comcast crews will start their relocations after the new poles are set and Delmarva Power company crews have transferred aerial facilities to the new poles. There are also underground facilities to be relocated and connected to the new pole lines. It is estimated that thirty (30) calendar days will be required to relocate their facilities following fourteen (14) days advance notice from DelDOT (for the advanced work).

PROPOSED RELOCATION

NOTE: It is anticipated that Comcast will complete its proposed work in advance of this contract. The bidders are to determine the extent completion of the advanced utility work and predicated their bid prices on the extent of utility work completed and anticipated to be completed prior to the start of construction.

SAMPLE

Should any additional conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utility's existing facilities, the necessary relocation work shall be accomplished by the respective company's forces, as directed by the Engineer.

Verizon Delaware L.L.C.:

The Company maintains both aerial and underground communication facilities within the project limits.

Red Lion Road (SR71):
Verizon maintains aerial facilities along the eastern side of Red Lion Road from the southerly project limits extending northerly to Delmarva pole 45318/38407 at approximate Sta. 23+00 at the intersection with SR7. From here, Verizon crosses Red Lion Road and the west side of Red Lion Road to Delmarva Pole 45327/38427. The aerial facilities continue on the western/norther side (offset left) of Red Lion Road to the project limits.

Verizon maintains underground facilities on the east side of Red Lion Road that extend from Pole #45293/38380 at northeast corner of the intersection with Church Road to approximate Sta. 22+40 where they cross diagonally under Red Lion Road to Pole #45327/38427 at the northwest corner of the intersection with Bear Corbitt Road.

Bear Corbitt Road (SR7)
Verizon maintains aerial communication facilities along the east side of Bear Corbitt Road between approximate Sta. 209+20 and Sta. 214+00. At the intersection with Red Lion Road Verizon's aerial facilities begin at approximate Sta. 23+00, Delmarva pole 45318/38407, and extend along the western (offset left) side of Bear Corbitt Road to the project limits.
Verizon maintains an underground conduit facility along the western (offset left) side of Bear Corbitt Road within the entire project limits.

Verizon also maintains buried facilities from existing Verizon pole No. 32, approximate Sta. 219+90, along the eastern (offset right) side of Bear Corbitt Road to the project limits.

Old Porter Road
Verizon maintains aerial communication facilities along the south side of Old Porter Road that extend from the project limit, across Red Lion Road to Delmarva Pole 45264/38336.

Church Road
Verizon maintains aerial communication facilities along the south side of Church Road that extend from the project limit to Delmarva Pole 45283/38382 on the southwest corner at the intersection with Red Lion Road. From there the facilities cross Red Lion Road to pole 45293/38380.

Verizon maintains a conduit run and underground facilities along Church Road. The facilities extend from the manholes at the intersection of Bear Corbitt Road to the intersection of Red Lion Road. The facilities begin offset left, cross into the roadway at approximate Sta. 402+85 and

SAMPLE

runs under the existing roadway to the manhole at Sta. 402+80. The conduit crosses Red Lion Road and continues along the westerly (offset left) side of Church Road.

PROPOSED RELOCATION

NOTE: With the exception of the adjustments to their manholes it is anticipated that Verizon will complete its proposed work in advance of this contract. The bidders are to determine the extent completion of the advanced utility work and predicated their bid prices on the extent of utility work completed and anticipated to be completed prior to the start of construction.

Red Lion Road (SR71):

Verizon proposes to transfer aerial cables on the southeastern side (offset right) of Red Lion Road from existing pole 45231/39284 at approximate Sta. 7+80 to relocated Delmarva pole 45318/38407 at approximate Sta. 23+00.

Verizon proposes to transfer aerial cables on the north side of Red Lion Road beginning from existing pole 45362/38442 at approximate Sta. 28+65, across Bear Corbitt Road, to relocated pole 45327/38427.

Verizon proposes to relocate or place new conduit between their manhole at Church Road Sta. 405+80 and relocated pole 45293/38380 at Sta. 19+50 RT. The existing pedestal at Sta 19+50 RT will be removed. Verizon will also replace the buried cable that runs from this manhole to pole 45327/38427 (Sta. 219+00 Bear Corbitt Road) with an aerial cable from relocated Pole 45318/38407 (Sta. 23+00) to relocated pole 45293/38380 (Sta. 19+50).

Bear Corbitt Road (SR7)

Verizon proposes to relocate poles along the east side of Bear Corbitt Road beginning at approximate Sta. 210+25 through approximate Sta. 214+00. Aerial facilities will be transferred on the west side of Bear Corbitt Road from pole 45318/38407 at approximate Sta. 23+00, to existing pole 45338/38505 at approximate Sta. 226+85. The overhead guy wire across Bear Corbitt Road from pole 45318/38407 at approximate Sta. 216+90 will be relocated to the new poles.

Verizon will relocate the pedestal at approximate Sta 210+50 to approximate Sta 209+25. The buried cable that feeds this pedestal will be cut and terminated at the new pedestal location. The remaining cable to the north of this cut location will be retired. The cable dip and aerial cable attached to pole 45306/38341, approximate Sta 210+80 will be removed.

In the area of Sta 210+25 Verizon proposes to adjust the 16-way duct bank by fanning out the conduit to provided required vertical clearance at the proposed pipe P30. **The contractor shall use care when installing this pipe since there will be minimal cover over Verizon's lines**.

Verizon proposes to relocate or place new conduit between their manhole at Sta. 216+60 and relocated pole 45318/38407 (Sta. 23+00 Red Lion Road). Verizon will also replace the buried cable that runs from this manhole to pole 45327/38427 with aerial cables between relocated pole

SAMPLE

45318/38407 (Sta. 23+00 Red Lion Road) and relocated pole 45327/38427 (Sta. 219+00). The conduit dip and remaining two fiber cables will be relocated to the new poles.

Verizon will cut the buried cable on the east side of Bear Corbitt Road at the pedestal at Sta. 225+25. The remaining portion of this cable and the 4 Pedestals between Sta 225+30 and 219+90 will be removed/retired.

The following poles are maintained by Verizon. Verizon plans to remove, install new service and/or install guy poles at the following approximate locations

Sta. 212+20 RT – New Pole
Sta. 219+90 RT – Remove Pole
Sta. 220+75 RT– New Pole
Sta. 221+80 – Remove Pole
Sta. 223+50 RT– New Pole
Sta. 225+30 RT– New Pole

Old Porter Road

Verizon proposes to relocate aerial cables and a fiber hub on the south side of Old Porter Road to relocated Pole 45253/38333 (approximate Sta. 303+15). An anchor and guy will be placed at pole 45264/38336 (approximate Sta. 13+25 Red Lion Road). Aerial cable from relocated Pole 45253/38333 to relocated pole 45238/38330 will be a slack span and require anchor guys on both poles.

Church Road

Verizon proposes to relocate aerial cables from the southwest side of Church Road to the proposed poles on the northeast side of the road, crossing to the unnumbered Delmarva pole near Sta. 410+00. Anchor guys will be added as shown on the construction plans.

General: Verizon will add place additional anchors and guys at location shown on the plans as required. Aerial and underground services will be replaced, transferred and/or relocated as necessary.

Verizon estimates that the above proposed work (anticipated to be completed in advance) will take one hundred (90) calendar days to complete following thirty (30) calendar days advance notice by DelDOT (for the advance work) to start relocation work after the project area is made ready by DelDOT's contractor, including completion of clearing.

Verizon will adjust manhole covers as required to meet the proposed grades. It is expected that the following manholes will require adjustment. Adjustments will be performed during the appropriate construction phase.

Sta. 209+55 LT Bear Corbitt Road
Sta. 216+65 LT Bear Corbitt Road
Sta. 223+55 LT Bear Corbitt Road
Sta. 405+80 RT Church Road

SAMPLE

Verizon estimates that the proposed work to adjust the manholes will take Ten (10) calendar days to complete following thirty (30) calendar days advance notice by the State's Contractor.

Should any additional conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utility's existing facilities, the necessary relocation work shall be accomplished by the respective company's forces, as directed by the Engineer.

Delmarva Power – Gas:

The Company maintains gas facilities along the southerly side of Red Lion Road (Rte.71) from Old Porter Road to the intersection with Church Road. The main then turns and extends northerly along the easterly side of Church Road to the northerly project limits.

Delmarva Power intends to perform the following relocations:

Red Lion Road

At Sta. 13+82 RT, the Company proposes to relocate approximately 50 LF of 6" gas main to avoid conflict with the proposed inlet DI10.

At Sta.17+00 RT, the Company proposes to relocate approximately 50 LF of 6" gas main to avoid conflict with proposed DI12 & P12.

Delmarva estimates that this work can be completed in fourteen (14) calendar days after fourteen (14) calendar days of advance notice and will require approximately 20 CY of borrow type C. Work is to be coordinated with DelDOT's construction contractor's work schedule and is anticipated to occur in Phase 2 once the drainage has been laid out and notice to proceed given by the State's Contractor.

In addition, all valves will be adjusted vertically to meet proposed finished grade. The valve at Sta 18+40 RT will require adjustment. Delmarva estimates that this work can be completed in one (1) calendar days after seven (7) calendar days of advance notice. Work is to be coordinated with DelDOT's construction contractor's work and notice to proceed given by the State's Contractor.

Should any additional conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utility's existing facilities, the necessary relocation work shall be accomplished by the respective company's forces, as directed by the Engineer.

United Water Company:

United Water maintains a water main along the western side of Red Lion Road (offset left) throughout the project limits. The main is a 12" plastic line within these limits with the exception of the section between Church Road and Bear Corbitt Road where it becomes an 8" AC pipe.

United Water maintains a 16" cast iron water main on the western side of Bear Corbitt Road (offset left) throughout the project limits.

SAMPLE

United Water maintains a 12” PVC water main on the northern side of Old Porter Road (offset left) throughout the project limits.

The Company also maintains an 8” AC pipe along the northern side of Church Road (offset right) beginning at approximate Sta. 406+50 and continuing to the project limits.

The Company maintains services throughout the project limits.

United Water proposes to relocate 550’ of its 12” main along Red Lion Road beginning at approximate Sta. 12+25 LT to approximate Sta. 19+75 LT, just north of Church Road. The new pipe will be 12” DI and will be placed under the existing auxiliary lane/shoulder. A new 8” DI line will also be installed from this main to tie in to the existing main on Church Road to avoid conflicts with DI15 & P15. Existing service will be replaced to be from the new main. It is anticipated that this work will take thirty (30) calendar days to complete after fourteen (14) calendar days of advance notice and the location of the proposed drainage is staked.

United Water will remove any section of abandon AC main that is in conflict with the State’s proposed work for proper disposal. It is anticipated that this will occur in the area of Road at proposed pipe P15 and between Church Road and Bear Corbitt Road.

United water proposes to lower in place a portion of their 12” PVC water main beginning at approximate Sta. 27+00 LT to Sta. 27+70 LT to avoid conflict with proposed pipe P20. The Company will also relocate the existing fire hydrant near Sta. 27+70 LT back to the proposed right of way line. It is anticipated that this work will take five (5) calendar days to complete after fourteen (14) calendar days of advance notice and the location of the proposed drainage is staked. It is anticipated that this work will occur in Phase 1.

NOTE: It is anticipated that United Water will complete this proposed work in advance of this contract. The bidders are to determine the extent completion of the advanced utility work and predicated their bid prices on the extent of utility work completed and anticipated to be completed prior to the start of construction.

United Water will also vertically adjust the existing fire hydrant near Sta. 9+73 LT as needed to match proposed grades. It is anticipated that this work will take one (1) calendar days to complete after fourteen (14) calendar days of advance notice is provided by the State’s Contractor. It is anticipated that this work will occur in Phase 1.

It is anticipated that the water valves at the following locations will be adjusted to match the proposed grades. This work will be completed by the United Water’s contractor during the appropriate phase.

<u>Bear Corbitt Road Stations:</u>

208+62 LT	214+00 LT	218+38 LT	219+03 LT
220+40 LT	220+50 LT	221+00 RT	221+09 LT
222+65 LT	223+44 RT	223+93 RT	225+30 RT

SAMPLE

Red Lion Road Stations:

9+73 LT	12+75 RT	13+32 LT	19+55 LT	29+15 LT

The water meter at Church Road Sta. 408+40 LT will need to be relocated out of right of way. The State's Contractor shall relocate the meter per United Water's standards and coordinate with the property owner regarding the timing of the work. United Water will reconnect the service once the meter has been installed. It is anticipated that this work will take one (5) calendar days to complete after fourteen (14) calendar days of advance notice is provided by the State's Contractor.

Should any additional conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utility's existing facilities, the necessary relocation work shall be accomplished by the respective company's forces, as directed by the Engineer.

New Castle County Department of Special Services:

The County maintains sewer facilities throughout the project limits with no apparent conflicts.

The State's contractor will adjust manhole covers as required to meet the proposed grades. It is expected that the following manholes will require adjustment:

Sta. 18+52 LT Red Lion Road
Sta. 24+50 RT Red Lion Road
Sta. 209+55 LT Bear Corbitt Road
Sta. 405+65 RT Church Road
Sta. 405+50 Church Road

Please note that on Bear Corbitt Road at Sta. 209+88 RT, proposed drainage inlet DI32 and pipe P17 are in close proximity to the existing 16" PVC force main. **The contractor shall use care when excavating in this area and may be required to support or protect the force main as directed by the Engineer**.

Should any conflicts be encountered during construction requiring adjustment and/or relocation to the aforementioned utilities existing facilities, the necessary relocation work shall be accomplished by the State's Contractor, in accordance with the utility's specifications, as directed by the Engineer.

General Notes

1. The contractor's attention is directed to Section 105.09 Utilities, Delaware Standard Specifications, August 2001.The Contractor shall contact Miss Utility (1-800-282-8555) three (3) working days prior to any excavation. The Contractor is responsible for the support and protection of all utilities when excavating. The Contractor is responsible for ensuring proper clearances, including safety clearances, from overhead utilities for construction equipment. The contractor is advised to check the

SAMPLE

site for access purposes for their equipment and, if necessary, make arrangements directly with utility companies for field adjustments for adequate clearances.

2. The information shown in the Contract Documents, including the Utility Statement and the Utility Schedule contained herein, concerning the location, type and size of existing and proposed utilities, their location, and construction timing has been compiled by the preparer based on information furnished by each of the involved Utility Companies. It shall be the responsibility of the State's Contractor to verify all information and coordinate with the Utility Companies prior to and during construction, as specified in Section 105.09 of the Standard Specifications.

3. It is understood and agreed that the contractor has considered in his bid all permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans or described in the utility statement and/or are readily discernible and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him/her to any interference from the utility facilities and appurtenances or the operation of moving the, except that the contractor may be granted an equitable extension of time.

4. Utility companies are required to restore any areas disturbed in conjunction with their relocation work. If an area is disturbed by a utility company and is not properly restored, the Department may have the highway contractor perform the necessary restoration. Any additional costs incurred as a result will be forwarded to the utility company.

5. The Contractor shall follow all requirements of the Delaware Code, Title 26, Chapter 8. Underground Utility Damage Prevention And Safety. Chapter 8 includes, among other requirements, Section 806. Duties of Excavators which contains the requirement for the Contractor to excavate prudently and carefully and to take all reasonable steps necessary to properly protect, support and backfill underground utility lines. This protection shall include but may not be limited to hand digging, within the limits of the planned excavation or demolition, starting 2 feet of either side of the extremities of the underground utility line for other than parallel type excavations and at reasonable distances along the line of excavation for parallel type excavations.

6. As outlined in Chapter 3 of the DelDOT Utilities Manual, utilities are responsible for obtaining all required permits from municipal, State and federal government agencies and railroads. This includes but is not limited to water quality permits/DNREC Water Quality Certification, DNREC Subaqueous Lands/Wetlands permits, DNREC Coastal Zone Consistency Certification, County Floodplain permits (New Castle County only), U.S. Coast Guard permits, US Army Corps 404 permits, sediment and erosion permits, and railroad crossing permits

7. The Contractor shall note that the Delaware Code, Chapter 74B, Section 7405B requires notification to and mutually agreeable measures from the public utility for

SAMPLE

any person intending to carry on any function, activity work or operation within dangerous proximity of any high voltage overhead lines.

NOTE: **Coordination and cooperation among the utilities and the State's Contractor are of prime importance, therefore, the Contractor is directed to contact the following Utility Representatives with any questions in regard to this work prior to submitting bids and work schedules. Proposed work schedules should reflect the Utility Companies' proposed relocations.**

Mr. Jacob Barlow	Delmarva Power, Electric Dist.	302-283-5869
Mr. Ted Waugh	Delmarva Power, Gas	302-429-3706
Mr. David Clark	New Castle County Sewer	302-395-5705
Mr. John Licht	United Water of Delaware	302-633-5905
Mr. George Zang	Verizon Delaware LLC	302-422-1238
Mr. Steve Mosher	Comcast Communications	302-661-4434

PREPARED AND RECOMMENDED BY:

_____ _____

Century Engineering, Inc. DATE

APPROVED AS TO FORM BY:

_____ _____

Utilities Section, DelDOT DATE

SAMPLE

in a manner that requires the public utility to alter or relocate its facility that has already been fully or partially altered or relocated in connection with the project;

c. The Department cancels or does not commence a highway construction, reconstruction, relocation, repair, or maintenance project within a period of 2 years from the date of authorization;

d. The Department requests a temporary alteration or relocation of the public utility facility.

✓	Please answer the following questions	Resp. Party	Y	N	Additional Comments
	Project Information				
	Is this project sponsored administered (mostly for TA projects)? If yes, then please provide Division/Section/Contact that has the agreement?	PM			
	Is there an anticipated construction start date, or bid date? If so, please provide and identify which date is provided.	PM			
	Has the project been advertised? If not, when is the anticipated advertisement date?	PM			
	Design				
	Are final grades shown in construction plan set in the areas where utilities are located and/or impacted?	PM			
	Have all mark-ups or comments supplied by the utility company been incorporated into the construction plan set?	PM			
	Was SUE designation and/or test holes obtained for the project and is the information shown in the construction plan set?	PM			
	Environmental Coordination				
	Has the NEPA document been approved?	PM			
	Have the environmental permits been received? If not, when are they anticipated to be received? *Note: Advanced relocations are not covered by permits.*	PM			
	Right-of-Way Coordination				
	Have all right-of-way acquisitions been completed (TCE, PE, FEE) in the area of the advanced utility relocation? If not, please provide the date when rights-of-entry are anticipated.	PM			
	Construction Coordination				
	Has DelDOT Construction been involved with discussions on construction phasing and do they agree with how the utility relocation will be incorporated into the project? (provide confirmation from construction in writing)	PM			

	Based on coordination between Construction, Design and DelDOT Utilities, is the preference that utility relocation work occur in advance of the project? (provide confirmation from in writing)	PM			
	If to be done in advance, will inspection of utility relocations be handled by Construction? (provide confirmation from construction in writing)	PM			
	Survey Stake-out				
	Has the necessary survey layout/stakeout been coordinated? (provide copy of internal stakeout request/email or email from utility co. confirming they will provide stakeout)	UC			
	Has the stakeout been completed? If yes, who completed the survey and when? (provide email confirmation of completion if available)	UC			
	Funding				
	Is the project being paid for with 100% state funds or federal funds? If yes, comment on whether state or federal. If no, please provide funding split.	PM			
	If using federal funds, is the state match for the **entire project** 10% or less?	PM			
	If using federal funds, are the project estimates shown in the current CTP correct?	PM			
	Has Primavera been updated to show reimbursable utility relocation costs based on estimates received from utility companies?	PM			
	Utility Coordination				
	Do we have a final utility relocation design from the company?	UC			
	Do we have an executed Utility Statement? If yes, please provide execution date and attach statement.	UC			
	Is utility relocation work required to meet the provisions of **Buy America**? (dependent upon scope of work, funding of project and if company is receiving any form of reimbursement from DelDOT)	UC			
	Have we received a **Buy America** submission from the utility company?	UC			
	Has an estimated cost of non-reimbursable utility work been obtained? If so, please provide. (needed for Buy America documentation purposes)	UC			
	Utility Relocations				
	Is utility relocation work reimbursable? If yes, please explain what/why.	UC			
	Have any property interests been identified and has the required documentation (i.e. easements) been supplied by the utility company?	UC			

	If reimbursable, has a cost estimate been received from the utility company? If so, please provide the estimated cost & attach a hard copy of the estimate?	UC			
	If reimbursable, has funding been set up to cover utility relocation	UC			
	Is clearing and grubbing required for utility work? If so, has DelDOT construction and the utility co. agreed upon how it will be accomplished (state contractor, utility company, etc.)?	UC			
	Is MOT required for utility work? If so, who will provide (state contractor, utility company, etc.)?	UC			
	Is MOT reimbursement being sought by utility company? If so, what is the estimated cost & has a hard copy of the estimate been obtained?	UC			
	What is the anticipated start date for the Utility company to begin their relocation?	UC			
	Has the Department been communicating with the Utility Owner regarding the utility going in advance of the State Project?	UC			
	If so, please provide the following information:	UC			
	By whom? Date?	UC			
	Utility Company Representative:	UC			
	Department Representative and/or Consultant:	UC			

✓	**Resp. Party**	Provide justification for **ADVANCED** utility relocations, including benefits to the Department and the traveling public.
	PM	

I concur with this recommendation:

_____ _____

Project Manager Date

_____ _____

Utility Coordinator Date

_____ _____

Eric C. Cimo Date
Utility Engineer

<u>BELOW SIGNATURES REQUIRED FOR ADVANCE RELOCATION WORK</u>

RECOMMENDED: _____ _____

Robert Cunningham Date
Assistant Director of Right-of-way

APPROVED: _____ _____

Robert B. McCleary Date
Chief Engineer

within 10 years from the date of completion of the initial alteration or relocation;

b. The Department alters its plan of construction for the project at any time before its completion, in a manner that requires the public utility to alter or relocate its facility that has already been fully or partially altered or relocated in connection with the project;

c. The Department cancels or does not commence a highway construction, reconstruction, relocation, repair, or maintenance project within a period of 2 years from the date of authorization;

d. The Department requests a temporary alteration or relocation of the public utility facility.

✓	Please answer the following questions	Resp. Party	Y	N	Additional Comments
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	Have all right-of-way acquisitions been completed (TCE, PE, FEE) in the area of the advanced utility relocation? If not, please provide the date when rights-of-entry are anticipated.	PM			
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SAMPLE

	Has DelDOT Construction been involved with discussions on construction phasing and do they agree with how the utility relocation will be incorporated into the project? (provide confirmation from construction in writing)	PM			
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SAMPLE

	Utility Relocations				
	Is utility relocation work reimbursable? If yes, please explain what/why.	UC			
	Have any property interests been identified and has the required documentation (i.e. easements) been supplied by the utility company?	UC			
	If reimbursable, has a cost estimate been received from the utility company? If so, please provide the estimated cost & attach a hard copy of the estimate?	UC			
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	If so, please provide the following information:	UC			
	By whom? Date?	UC			
	Utility Company Representative:	UC			
	Department Representative and/or Consultant:	UC			

✓	Resp. Party	Provide justification for **ADVANCED** utility relocations, including benefits to the Department and the traveling public.
	PM	

I concur with this recommendation:

_____ _____
Project Manager Date

_____ _____
Utility Coordinator Date

_____ _____
Eric C. Cimo Date
Utility Engineer

<u>BELOW SIGNATURES REQUIRED FOR ADVANCE RELOCATION WORK</u>

RECOMMENDED: _____ _____
Robert Cunningham Date
Assistant Director of Right-of-way

APPROVED: _____ _____
Robert B. McCleary Date
Chief Engineer

SAMPLE

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

DESIGN-BUILD STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX G

RIGHT-OF-WAY DOCUMENTS

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX H

ENVIRONMENTAL DOCUMENTS

STATE OF DELAWARE

DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

STATEWIDE PIPE REPLACEMENTS

State Contract # T201607002
Federal Contract # EBROS-2016(26)

RFP PART 3

APPENDIX I

BRIDGE INSPECTION REPORTS

STRUCTURAL DATA RECORD

Sufficiency Rating: 95.7

IDENTIFICATION

Bridge ID: 1178 282 **(2) District:** 01 **(3) County:** 3
Inventory Route: **(4) Place Code:** 28830
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00282 **(E) Direction:** 0
6A) Features Intersected: TRIB. OF MILL CREEK **6B) Critical:**
(7) Facility Carried: MILL CREEK RD.
(9) Location: SOUTH OF HOCKESSIN **11) Km. Point:** 4.630 mi
16) Latitude: 39^46'39.39" **17) Longitude:** 75^41'40.78"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1989
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** NA
29) ADT: 2037 **30) Year of ADT:** 2012
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: NA **109) % Truck ADT:** 3

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 17 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 4/25/2006
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 2555 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: -1 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 4/11/2014 **91) Frequency:** 48 months **Next Inspection:** 4/11/2018
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 48 months **Elem. Insp. Date:** 4/11/2014 **Next Elem Insp.:** 4/11/2018
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 04
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 5 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 5 **72) Approach Rdwy Alignment:** 7
113) Scour Critical Evaluation: 6 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 3.00 ft **49) Structure Length:** 13.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 0.00 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 4/11/2014 **Type:** 1 **Inspector:** GMILLER

INSPECTION NOTES

INSPECTED BY: G.MILLER(TL,I,P) /
M.SCHLITTER(S,R) REQUESTED MAXIMO BRIDGE
MAINTENANCE: B055-V1A REMOVE DEBRIS AT
INLET - WORK ORDER #632839

BRIDGE NOTES

NBI DONE BY: RICK MOORE ....NOTE: SCALE FACTOR ENTERED BY GRD ON 07/31/07,
DO NOT CHANGE OR ERASE... NOTE: SINCE THE FEW FEET OF CS3 WAS DUE TO DAMAGE
ATT HE ENDS OF THE PIPES AND NOT CORROSION, THE BIE KEPT THE CULVERT AS A
NBI '6' WITH A 48 MONTH INSPECTION FREQUENCY.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	120.00	0.00	116.00	4.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	1,033.64	1,033.64	0.00	0.00	0.00

1. NORTH APPROACH

2. EAST ELEVATION

3. GENERAL VIEW FACING WEST THROUGH CENTER PIPE

4. UPSTREAM WEST

5. DOWNSTREAM EAST

6. WEARING SURFACE LOOKING EAST

7. DEBRIS & SEDIMENT CLOGGING INLET

8. BENT & DAMAGED EAST END OF SOUTH PIPE

SCOUR RELATED DATA

For
Bridge: *1178 282*

Bridge ID: 1178 282
Inspection Date: 4/11/2014
Region: Urban
Waterway Name: TRIB. TOO MILL CREEK
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Silt/Clay
Streambed Mtrl Penetration: Loose 1-3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 2.00 ft
Depth of Flow: 0.50 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Unknown
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: P
Comments: DEBRIS & SEDIMENT BLOCKING INLET w/ MINOR BANK EROSION BETWEEN CELLS 2 & 3
Streambed: G
Comments:
Embankment: F
Comments:
Fender System:
Comments:

CHANNEL INFORMATION

Debris in Channel: Yes
Sediment in Channel: Yes
Cap. of Chnl: Moderate
Chance of Overtopping: 3-10 Years
Upstream Bank Condition: Bank Failure
Downstream Bank Condition: Bank Failure
Rdwy Overflow: Significant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

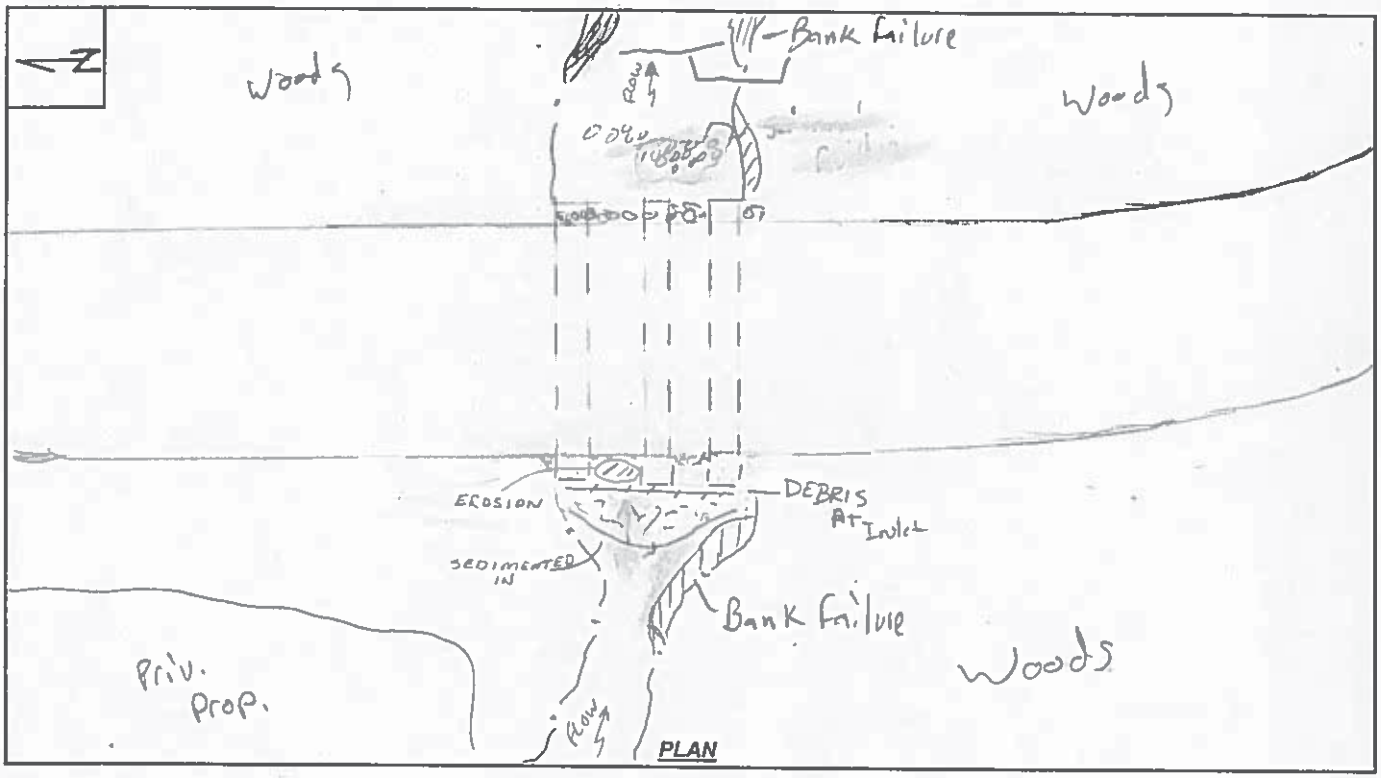
WATERWAY SKETCH SHEET

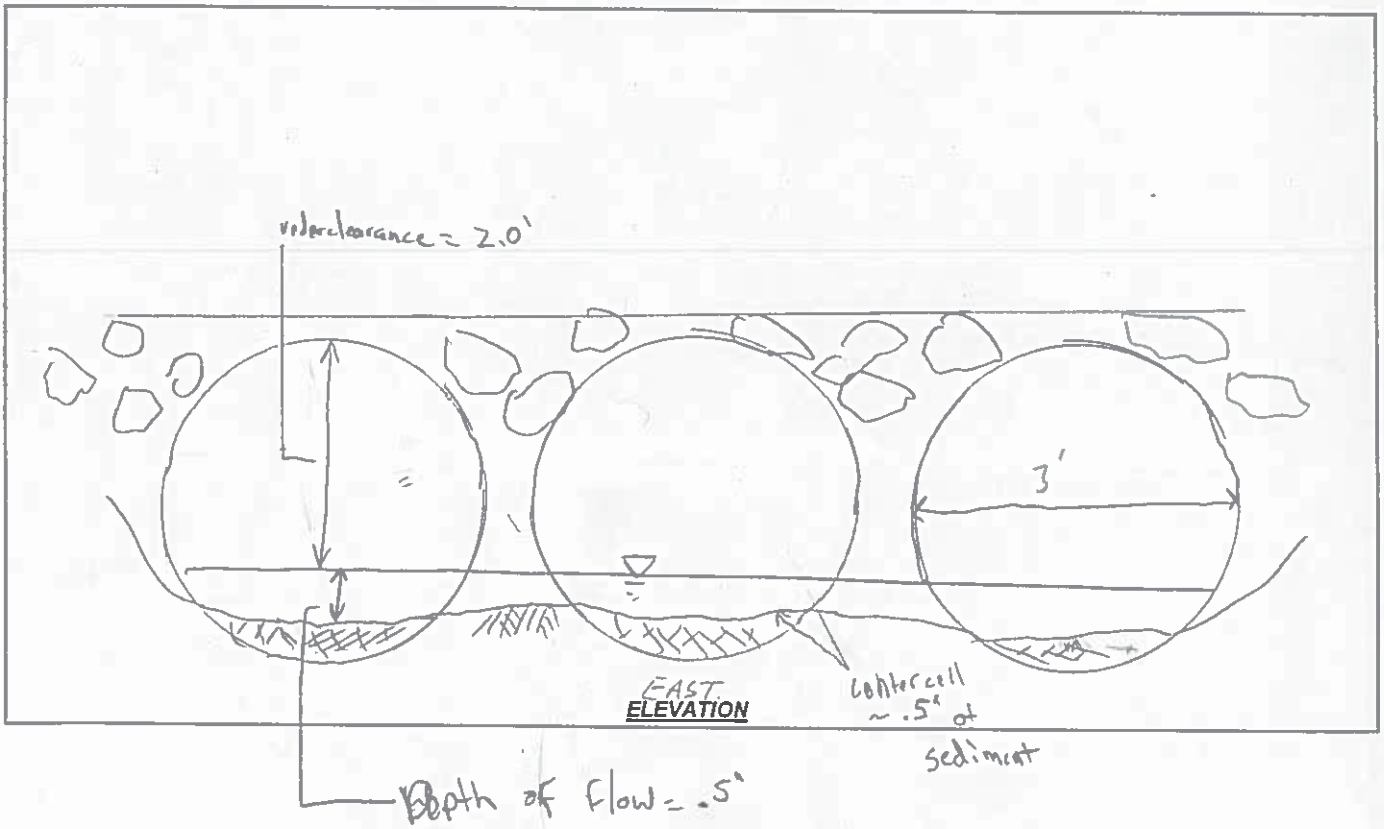
BR. I.D.: 1 -178 -252

WATERWAY NAME: Trib. of Mill Creek

DATE: 4 / 11 / 14

INSPECTED BY: MS / GM / / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 98.7

IDENTIFICATION

Bridge ID: 1183 276
(2) District: 01
(3) County: 3
Inventory Route:
(4) Place Code: 78980
(A) On/Under: 1
(B) Highway Type: 4
(C) Service Lvl: 0
(D) Route No: 00276
(E) Direction: 0
6A) Features Intersected: HYDE RUN
6B) Critical:
(7) Facility Carried: MCKENNAN'S CHURCH
(9) Location: N. OF DELCASTLE
11) Km. Point: 2.090 mi
16) Latitude: 39^45'37.19"
17) Longitude: 75^39'43.34"
98) Border Bridge Code: NA
99) Border Br. Str. No.: NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3
43B) DESIGN TYPE: 19
44A) APPR. SPAN MATERIAL: NA
44B) DESIGN TYPE: NA
45) Main Spans: 2
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108A) Wearing Surface: N
108B) Membrane: N
108C) Deck Protection: N
Pier 1: NA
Pier 2: NA
Pier Ftg. 1: NA
Pier Ftg. 2: NA
Abut 1: NA
Abut 2: NA
Abut Ftg. 1: NA
Abut Ftg. 2: NA

NAVIGATION DATA

38) Navigational Control: 0
39) Vertical Clearance: 0.0 ft
40) Horizontal Clearance: 0.0 ft
111) Pier Protection: !
116) Lift Br. Vert. Clr: 0.0 ft

AGE AND SERVICE

19) Detour Length: 3 mi
27) Year Built: 1970
28) No. of Lanes:
A) On Bridge: 2
B) Under Bridge: NA
29) ADT: 6299
30) Year of ADT: 2012
42) Type of Service:
A) On Bridge: 1
B) Under Bridge: 5
106) Year Reconst.: NA
109) % Truck ADT: 7

CLASSIFICATION

12) Base Hwy. Network: 0
13A) LRS Inv. Rte: NA
13B) LRS Subroute No.: NA
20) Toll Facility: 3
21) Maintenance: 1
22) Owner: 1
26) Functional Class: 16
37) Historical: 5
100) Defense Highway: 0
101) Parallel Str.: N
102) Direction: 2
103) Temp. Str.:
104) NHS: 0
105) Fed. Lands Highway: 0
110) Nat. Truck Network: 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5
41) Oper. Status: A
Rating Date: 4/27/2006
63) Oper. Rating Method: 5
64) Operating Rating: 60.0
65) Inv. Rating Method: 5
66) Inv. Rating: 36.0
70) Bridge Posting: 5
Reason of Posting: NA
Date of Resolution: NA
Rating Analysis Req'd: NA
S335: NA
S437: NA
T330: NA
T435: NA
T540: NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA
76) Length of Imp.: NA
94) Bridge Cost: NA
95) Roadway Cost: NA
96) Total Cost: NA
97) Year of Cost Est.: NA
114) Future ADT: 7903
115) Year of Future ADT: 2036

CONTRACT INFORMATION

Contract 1: -1
Contract 2: -1
Contract 3: -1
Contract 4: -1
Contract 5: -1
Contract 6: -1

INSPECTION RECORD

90) Inspection Date: 4/28/2014 **91) Frequency:** 48 months **Next Inspection:** 4/28/2018
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 48 months **Elem. Insp. Date:** 4/28/2014 **Next Elem Insp.:** 4/28/2018
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 04
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 44.50 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.00 ft **49) Structure Length:** 15.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 0.00 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 4/28/2014 **Type:** 1 **Inspector:** GMILLER

INSPECTION NOTES

INSPECTED BY: M.SCHLITTER(I) / G.MILLER
(TL,S,R) / P.ERONY(P) REQUESTED MAXIMO
BRIDGE MAINTENANCE: B055-V1A REMOVE
VEGETATION AT INLET AND OUTLET - WORK
ORDER #363285

BRIDGE NOTES

NBI DONE BY: RICK MOORE ....NOTE: SCALE FACTOR ENTERED BY GRD ON 02/22/07,
DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/1	Steel Culvert	ft	116.00	0.00	116.00	0.00	0.00
817/1	Galvanizing Steel Protection	sq.ft	999.18	999.18	0.00	0.00	0.00

1. NORTH APPROACH

2. EAST ELEVATION

3. GENERAL VIEW FACING WEST THROUGH SOUTH PIPE

4. UPSTREAM WEST

5. DOWNSTREAM EAST

6. WEARING SURFACE FACING WEST

SCOUR RELATED DATA

For
Bridge: *1183 276*

Bridge ID: 1183 276 **Inspection Date:** 4/28/2014 **Region:** Urban
Waterway Name: HYDE RUN **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 3.41 ft **Depth of Flow:** 0.33 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Unknown
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: F **Comments:** SEDIMENT UP & DOWNSTREAM
Embankment: F **Comments:** SEDIMENT UP & DOWNSTREAM
Fender System: **Comments:** SEDIMENT UP & DOWNSTREAM

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** Moderate
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

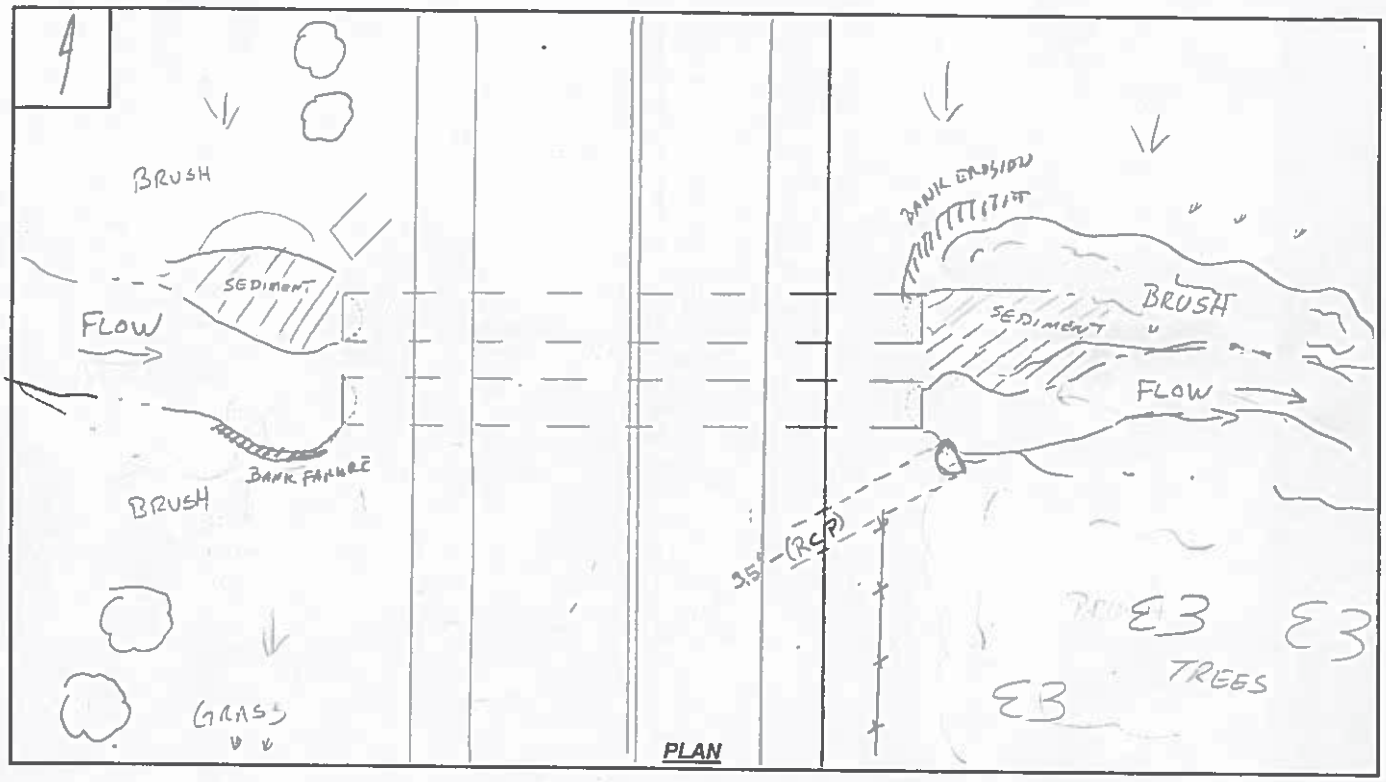
WATERWAY SKETCH SHEET

BR. I.D.: 1 - 183 - 276

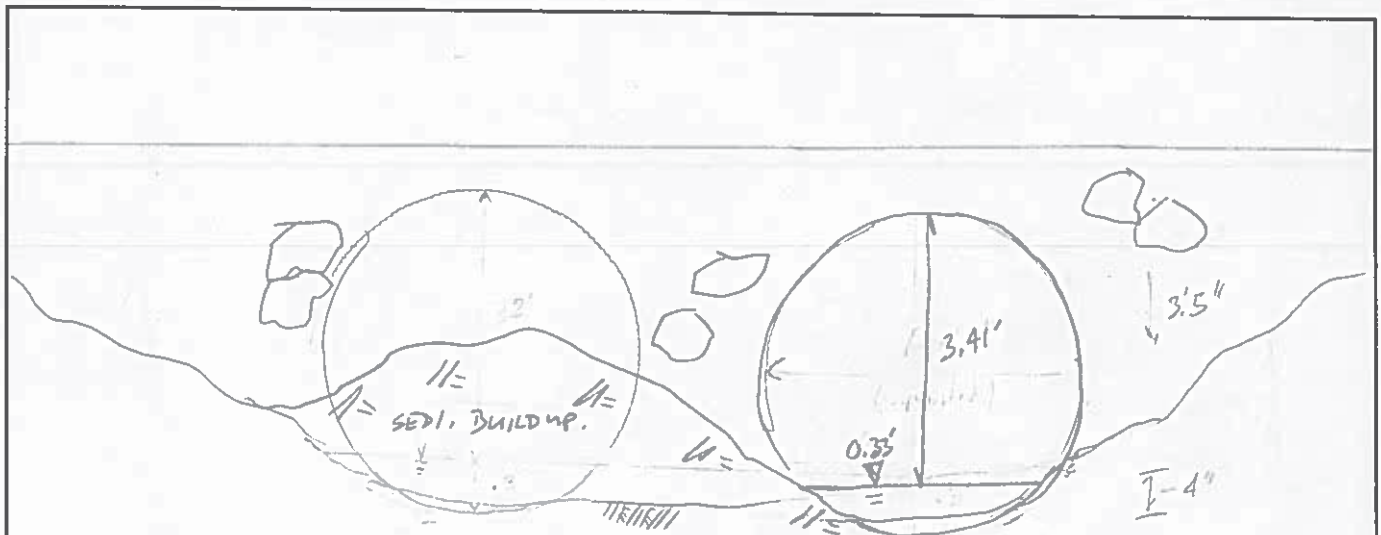
WATERWAY NAME: HYDE RUN

DATE: 4 / 28 / 14

INSPECTED BY: GM / MS / P. ERINY



PLAN



WEST

ELEVATION

INLET

STRUCTURAL DATA RECORD

Sufficiency Rating: 86.0

IDENTIFICATION

Bridge ID: 1420 461 **(2) District:** 05 **(3) County:** 3
Inventory Route: **(4) Place Code:** 72510
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00461 **(E) Direction:** 0
6A) Features Intersected: TRIB OF SASSAFRAS RIVER **6B) Critical:**
(7) Facility Carried: MARYLAND LINE RD.
(9) Location: WEST OF TOWNSEND **11) Km. Point:** 1.200 mi
16) Latitude: 39^22'39.17" **17) Longitude:** 75^45'59.58"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1965
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 208 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 10/19/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 260 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 6404016 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 4/6/2015 **91) Frequency:** 24 months **Next Inspection:** 4/6/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 4/11/2013 **Next Elem Insp.:** 4/6/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 06
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 5 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 18.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 10.67 ft **49) Structure Length:** 24.58 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 4/6/2015 **Type:** 1 **Inspector:** -1

INSPECTION NOTES

INSPECTED BY: G.GARCIA (I,P) / J.MASTEN (TL,S,R) ADDITIONAL MAXIMO MAINTENANCE: B055-V1A: REMOVE TREES, DEBRIS AND SEDIMENT UPSTREAM (EAST OF BRIDGE).WO#424576 B054-S6D: REPAIR EROSION HOLE IN THE NORTH EAST SHOULDER AT NORTH END OF GUIDERAIL. WO# 690207

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 9/21/05, DO NOT CHANGE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
848/2	Alum Culvert-Major	(LF)	124.00	119.00	0.00	0.00	5.00
1000/2	Corrosion	(LF)	5.00	0.00	0.00	0.00	5.00

1. NORTH APPROACH

2. WEST ELEVATION

3. GENERAL VIEW LOOKING EAST SPAN#1

4. UPSTREAM LOOKING EAST

5. DOWNSTREAM LOOKING WEST

6. WEARING SURFACE LOOKING EAST

7. SPAN#1 CORROSION HOLE NEAR EAST END

8. SPAN#1 NORTH WALL FAILED REPAIR w/LOSS OF FILL

SCOUR RELATED DATA

For
Bridge: *1420 461*

Bridge ID: 1420 461
Inspection Date: 4/11/2013
Region: Rural
Waterway Name: TRIB SASSAFRAS RIVER
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Silt/Clay
Streambed Mtrl Penetration: Loose 1-3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 16.40 ft
Depth of Flow: 3.28 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Soil
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: P
Comments: POOR ALIIGNMENT

Streambed: F
Comments: SEDIMENT UPSTREAM/SEDIMENT UP AND DOWNSTREAM.

Embankment: F
Comments: SEDIMENT UPSTREAM/SEDIMENT UP AND DOWNSTREAM.

Fender System:
Comments: SEDIMENT UPSTREAM/SEDIMENT UP AND DOWNSTREAM.

CHANNEL INFORMATION

Debris in Channel: No
Sediment in Channel: Yes
Cap. of Chnl: High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Failure
Downstream Bank Condition: Bank Failure
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

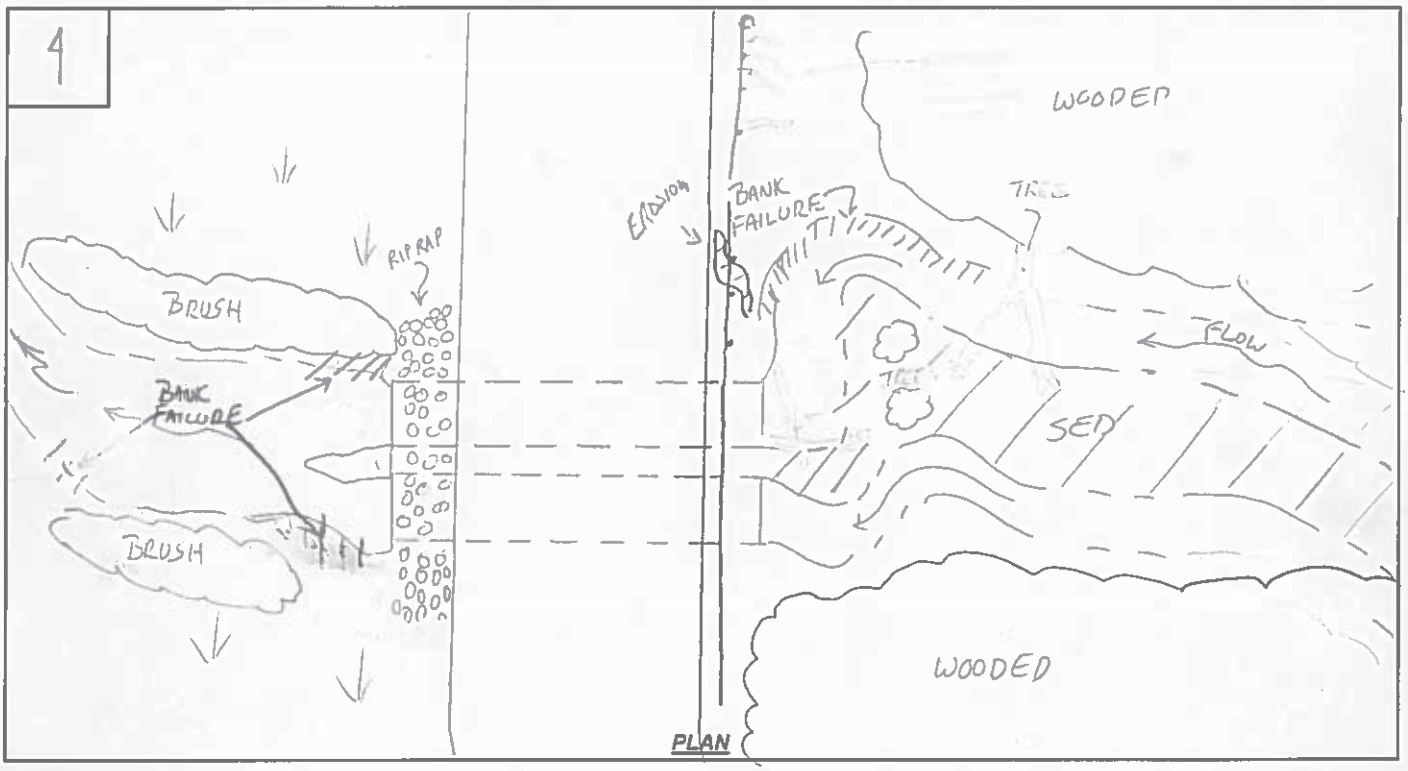
WATERWAY SKETCH SHEET

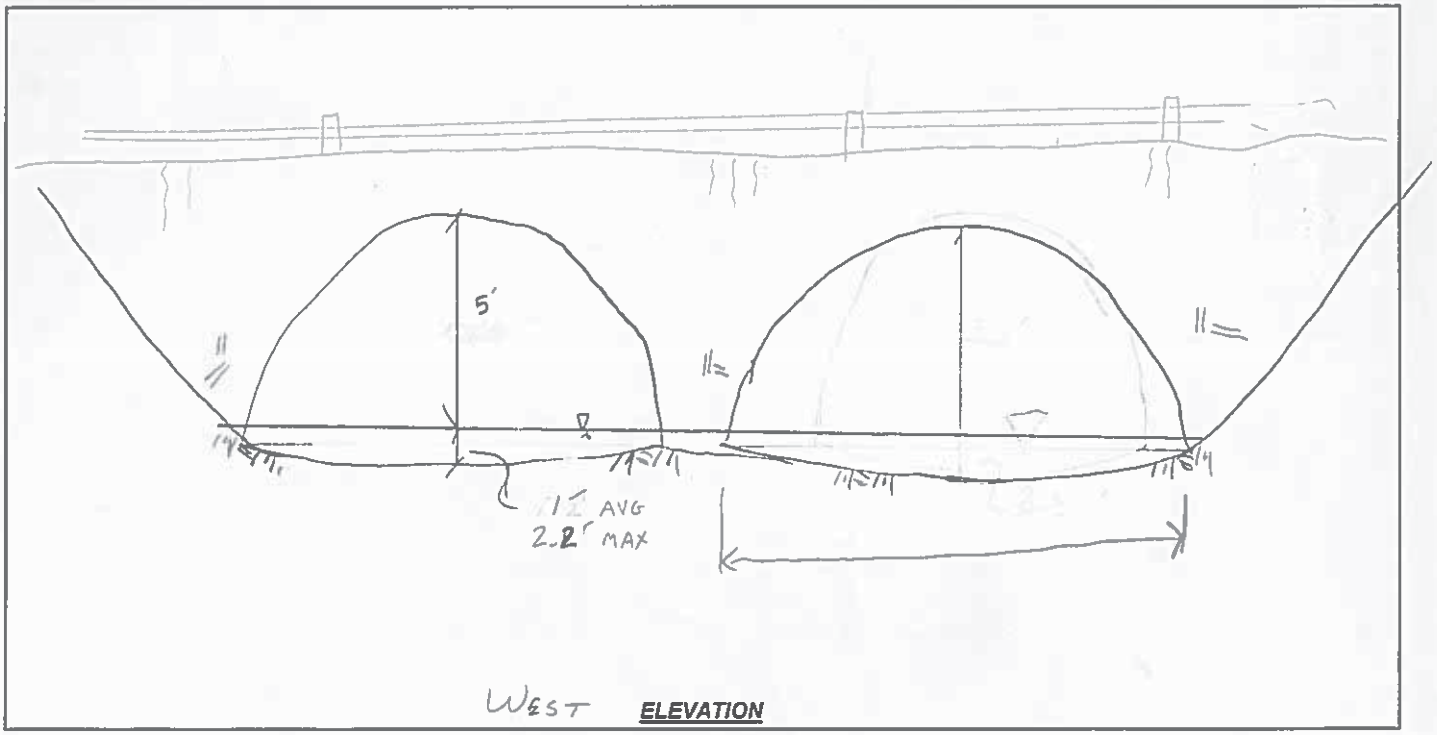
BR. I.D.: 1 -420 - 461

WATERWAY NAME: TRIB. OF SASSAFRAS RIVER

DATE: 4 / 16 / 15

INSPECTED BY: JM / GG / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 86.0

IDENTIFICATION

Bridge ID: 1449 456
(2) District: 05
(3) County: 3
Inventory Route:
(4) Place Code: 06470
(A) On/Under: 1
(B) Highway Type: 4
(C) Service Lvl: 1
(D) Route No: 00456
(E) Direction: 0
6A) Features Intersected: TRIB. TO BLACKBIRD CREEK
6B) Critical:
(7) Facility Carried: UNION CHURCH RD
(9) Location: EAST OF TOWNSEND
11) Km. Point: 1.320 mi
16) Latitude: 39^23'17.93"
17) Longitude: 75^38'57.01"
98) Border Bridge Code: NA
99) Border Br. Str. No.: NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9
43B) DESIGN TYPE: 19
44A) APPR. SPAN MATERIAL: NA
44B) DESIGN TYPE: NA
45) Main Spans: 2
46) Approach Spans: 0
107) Deck Type: N
108A) Wearing Surface: N
108B) Membrane: N
108C) Deck Protection: N
Pier 1: NA
Pier 2: NA
Pier Ftg. 1: NA
Pier Ftg. 2: NA
Abut 1: NA
Abut 2: NA
Abut Ftg. 1: NA
Abut Ftg. 2: NA

NAVIGATION DATA

38) Navigational Control: 0
39) Vertical Clearance: 0.0 ft
40) Horizontal Clearance: 0.0 ft
111) Pier Protection: !
116) Lift Br. Vert. Clr: 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi
27) Year Built: 1968
28) No. of Lanes:
A) On Bridge: 2
B) Under Bridge: 0
29) ADT: 242
30) Year of ADT: 2012
42) Type of Service:
A) On Bridge: 1
B) Under Bridge: 5
106) Year Reconst.: -4
109) % Truck ADT: 6

CLASSIFICATION

12) Base Hwy. Network: 0
13A) LRS Inv. Rte: NA
13B) LRS Subroute No.: NA
20) Toll Facility: 3
21) Maintenance: 1
22) Owner: 1
26) Functional Class: 09
37) Historical: 5
100) Defense Highway: 0
101) Parallel Str.: N
102) Direction: 2
103) Temp. Str.:
104) NHS: 0
105) Fed. Lands Highway: 0
110) Nat. Truck Network: 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5
41) Oper. Status: A
Rating Date: 4/13/2016
63) Oper. Rating Method: 0
64) Operating Rating: 60.0
65) Inv. Rating Method: 0
66) Inv. Rating: 36.0
70) Bridge Posting: 5
Reason of Posting: NA
Date of Resolution: NA
Rating Analysis Req'd: NA
S335: 0
S437: 0
T330: 0
T435: 0
T540: 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA
76) Length of Imp.: NA
94) Bridge Cost: NA
95) Roadway Cost: NA
96) Total Cost: NA
97) Year of Cost Est.: NA
114) Future ADT: 303
115) Year of Future ADT: 2036

CONTRACT INFORMATION

Contract 1: 6803002
Contract 2: -1
Contract 3: -1
Contract 4: -1
Contract 5: -1
Contract 6: -1

INSPECTION RECORD

90) Inspection Date: 7/14/2014 **91) Frequency:** 24 months **Next Inspection:** 7/14/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 7/14/2014 **Next Elem Insp.:** 7/14/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 06
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.50 ft **33) Median:** 0
34) Skew: 15^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 8.17 ft **49) Structure Length:** 22.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 7/14/2014 **Type:** 1 **Inspector:** MSCHLITTER

INSPECTION NOTES

INSPECTED BY: N.DRAPER(I,P) M.SCHLITTER (TL,S,R) ADDITIONAL MAXIMIO MAINTENANCE REQUESTS: 504902 B054-S6D: REPAIR LARGE EROSION HOLE ~ 55FT X 10FT X 3FT DEEP DOWNSTREAM. 504903 B055-V1A: REMOVE RAILROAD TIE & DEBRIS UPSTREAM.

BRIDGE NOTES

NBI DONE BY: JASON BAUER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 01/22/07, DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/2	Maj Mtl Culv	(LF)	150.00	142.00	0.00	0.00	8.00
817/2	Galvanizing Steel Protection	sq.ft	10,372.27	10,372.27	0.00	0.00	0.00

1. EAST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW SOUTH IN WEST CELL

4. UPSTREAM NORTH

5. DOWNSTREAM SOUTH

6. A/C OVERLAY LOOKING SOUTH

7. EXISTING PERF. IN SPAN 1.

8. EROSION HOLE B/T PIPES ON DOWNSTREAM SLOPE.

SCOUR RELATED DATA

For
Bridge: *1449 456*

Bridge ID: 1449 456
Inspection Date: 7/14/2014
Region: Rural
Waterway Name: TRIB. TO BLACKBIRD CREEK
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Sand
Streambed Mtrl Penetration: Loose 1-3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 5.60 ft
Depth of Flow: 0.75 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Soil
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: G
Comments:
Streambed: F
Comments: MINOR SEDIMENT IN WEST CULVERT
Embankment: P
Comments: MINOR SEDIMENT IN WEST CULVERT
Fender System:
Comments: MINOR SEDIMENT IN WEST CULVERT

CHANNEL INFORMATION

Debris in Channel: Yes
Sediment in Channel: Yes
Cap. of Chnl: High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Erosion
Downstream Bank Condition: Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

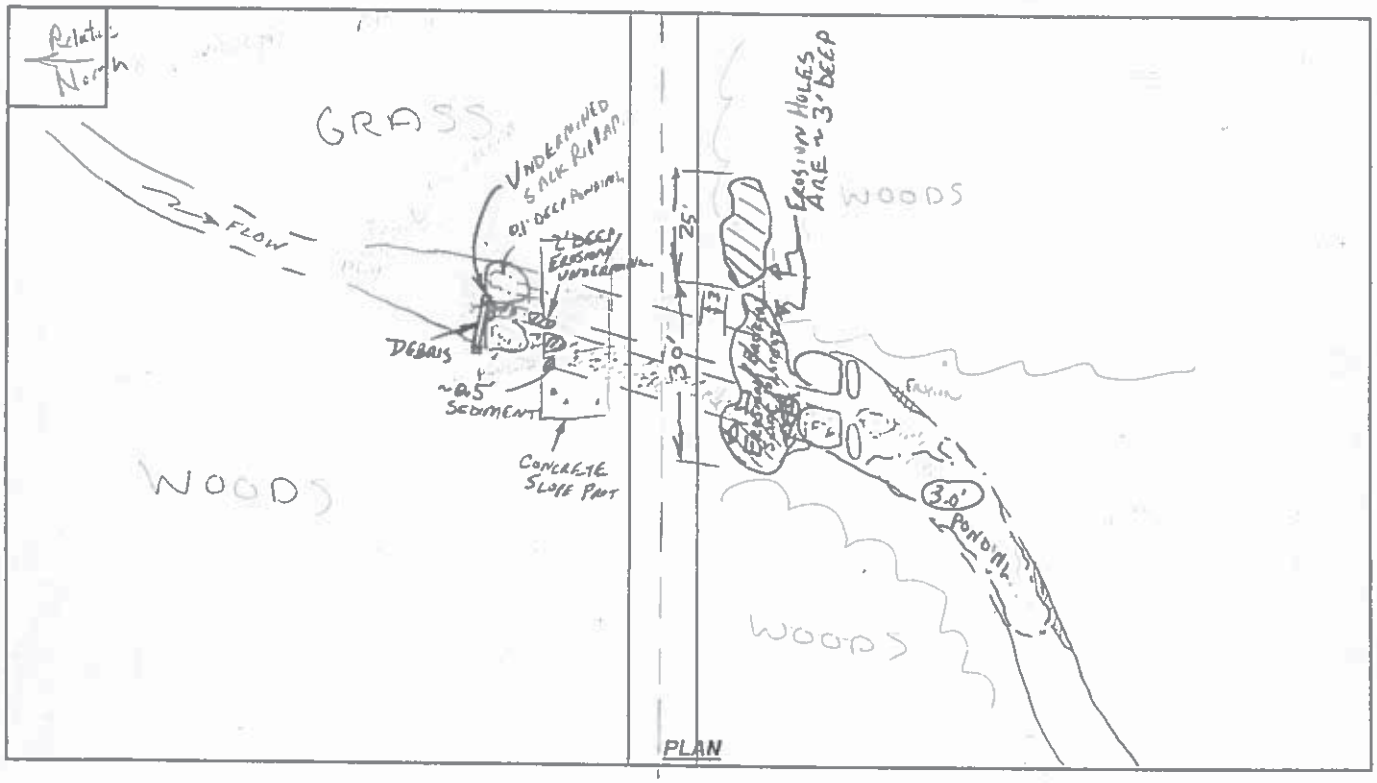
WATERWAY SKETCH SHEET

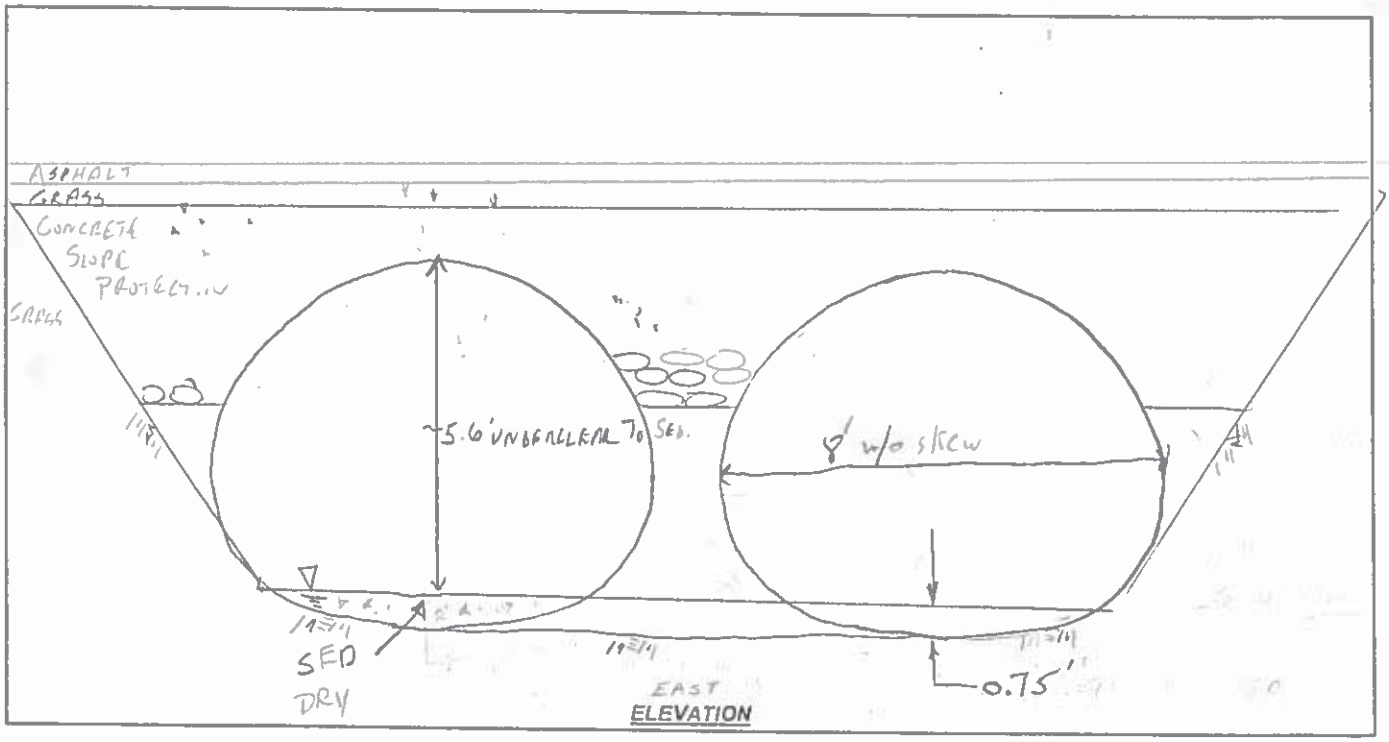
BR. I.D.: 1 -449-456

WATERWAY NAME: Trib. to Blackbird Creek

DATE: 7 / 14 / 14

INSPECTED BY: MS / ND / / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 100.0

IDENTIFICATION

Bridge ID: 1454 465 **(2) District:** 05 **(3) County:** 3
Inventory Route: **(4) Place Code:** 06470
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00465 **(E) Direction:** 0
6A) Features Intersected: SAW MILL BRANCH **6B) Critical:**
(7) Facility Carried: EAGLES NEST LNDG R
(9) Location: S/E OF BLACKBIRD **11) Km. Point:** 1.780 mi
16) Latitude: 39^21'38.40" **17) Longitude:** 75^37'18.30"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: 1 **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1968
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 335 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 10/27/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 420 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 6401038 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 5/12/2015 **91) Frequency:** 24 months **Next Inspection:** 5/12/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: 48 months **93B) UW Insp. Date:** 5/17/2013 **Next UW Insp.:** 5/17/2017
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 5/17/2013 **Next Elem Insp.:** 5/12/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 06
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 6 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 1 **B) Transition:** N **C) Approach Rail:** 1
D) Approach Rail Ends: 1
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.00 ft **33) Median:** 0
34) Skew: 15^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 10.60 ft **49) Structure Length:** 24.80 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 5/12/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: J.MASTEN (TL,I,P) /
N.DRAPER (S,R) NOTES: -IN WEST APPROACH,
WESTBOUND LANE 3' WEST OF BARREL 1 HAS A
5' LONG X 2' WIDE X 2" DEEP DEPRESSION
AT THE EDGE OF PAVEMENT. -THE CONCRETE
SLOPE PROTECTION ABOVE BARREL 1 AT THE
INLET HAS UP TO 1-1/2" SETTLEMENT.
MAXIMO MAINTENANCE: NONE

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 9/26/05,
DO NOT CHANGE.... NOTE: THIS BRIDGE IS ON THE LOW-CLEARANCE INSPECTION LIST

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/2	Maj Mtl Culv	(LF)	138.00	0.00	138.00	0.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	2,999.99	1,499.99	1,499.99	0.00	0.00
1000/2	Corrosion	(LF)	138.00	0.00	138.00	0.00	0.00

1. EAST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW LOOKING NORTH SPAN#1

4. UPSTREAM LOOKING NORTH

5. DOWNSTREAM LOOKING SOUTH

6. AC OVERLAY LOOKING NORTH

SCOUR RELATED DATA

For
Bridge: *1454 465*

Bridge ID: 1454 465 **Inspection Date:** 5/17/2013 **Region:** Rural
Waterway Name: SAW MILL BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 13.12 ft **Depth of Flow:** 10.17 ft

ARMORING
Abutment: N/A **Piers:** No Armoring
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** MINOR ATTACK ANGLE
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

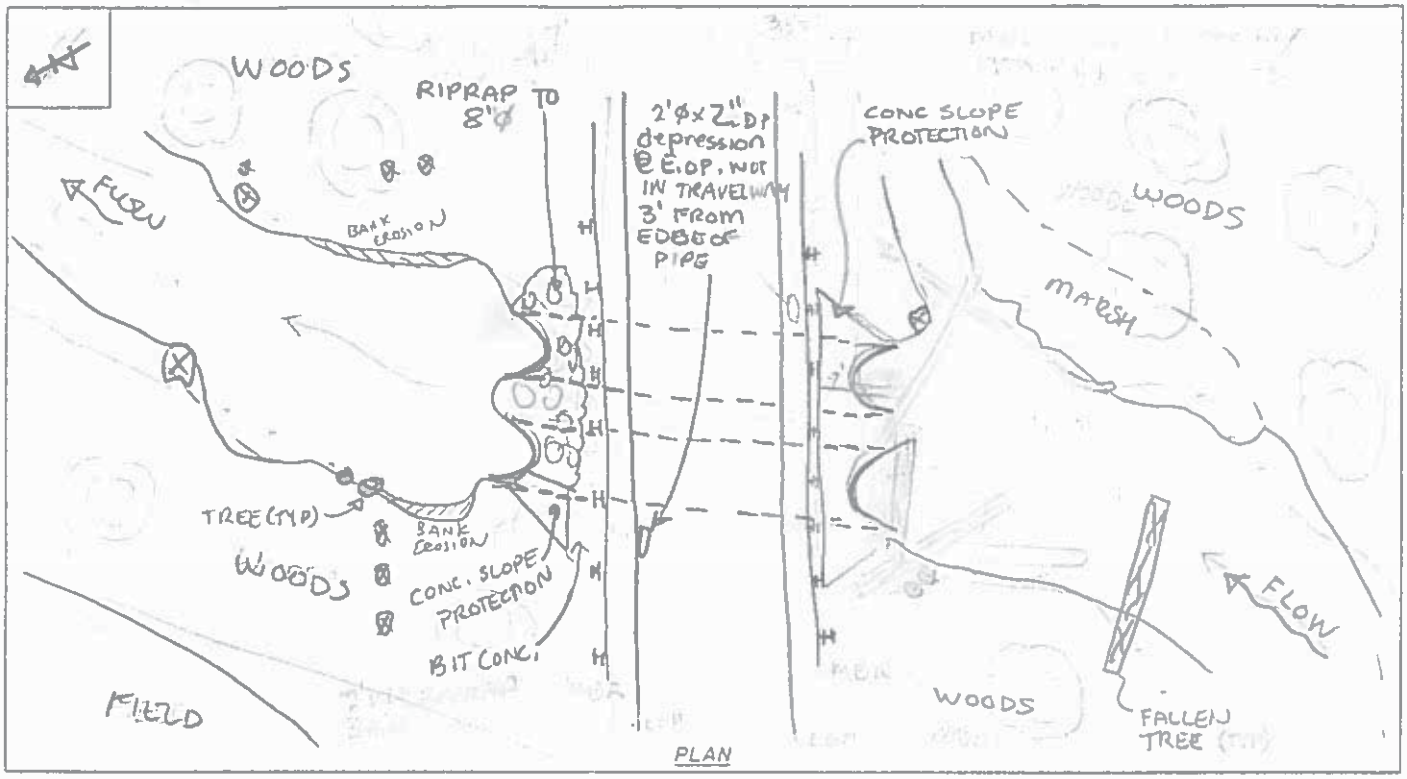
WATERWAY SKETCH SHEET

BR ID : 1 -454-465

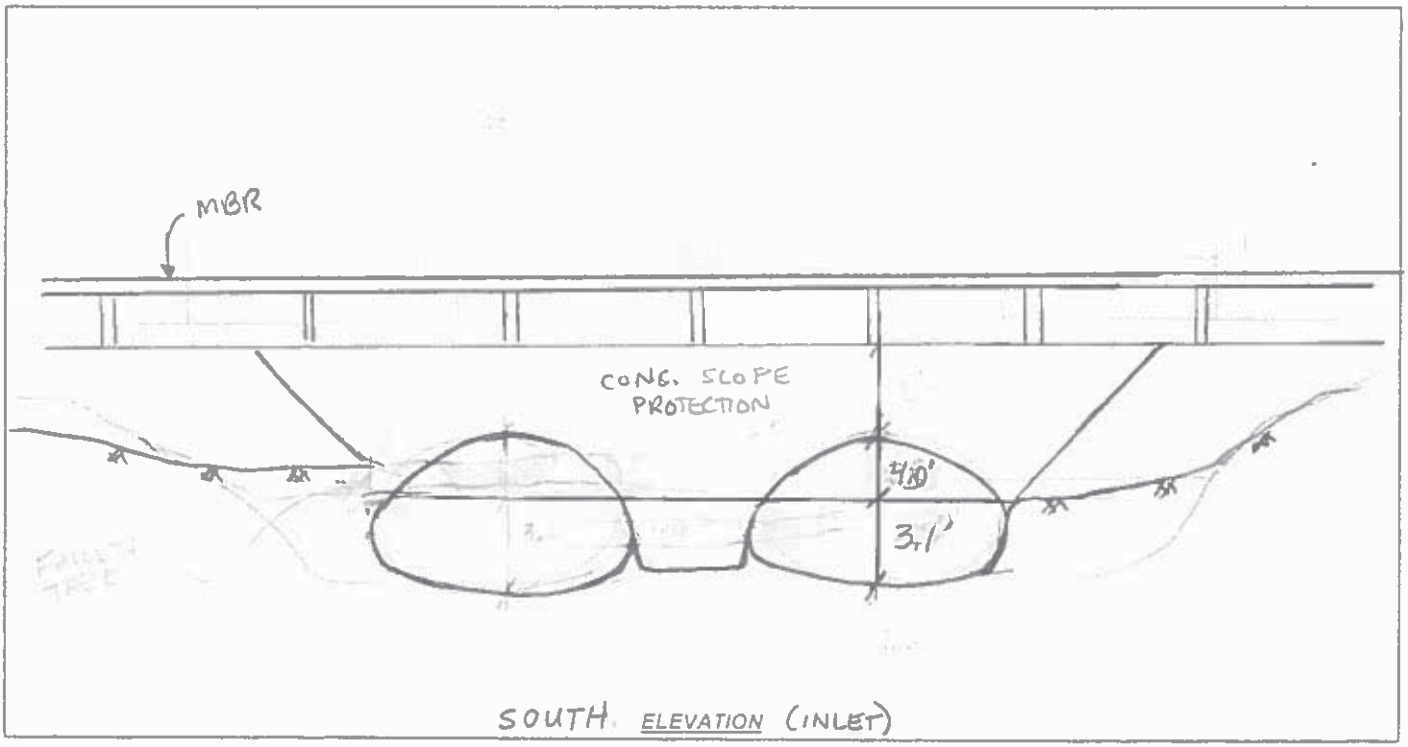
WATERWAY NAME: SAWMILL BRANCH

DATE: 05 / 12 / 15

INSPECTED BY: ND / JM / / /



PLAN



SOUTH ELEVATION (INLET)

STRUCTURAL DATA RECORD

Sufficiency Rating: 97.0

IDENTIFICATION

Bridge ID: 1455 466 **(2) District:** 05 **(3) County:** 3
Inventory Route: **(4) Place Code:** 06470
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00466 **(E) Direction:** 0
6A) Features Intersected: SAW MILL BRANCH **6B) Critical:**
(7) Facility Carried: DEER RUN RD
(9) Location: EAST OF BLACKBIRD **11) Km. Point:** 0.578 mi
16) Latitude: 39^22'2.76" **17) Longitude:** 75^36'46.66"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1975
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 106 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 10/27/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 133 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 7411002 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 5/12/2015 **91) Frequency:** 24 months **Next Inspection:** 5/12/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 5/20/2013 **Next Elem Insp.:** 5/12/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 06
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** X
62) Culvert: 6 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 10.00 ft **49) Structure Length:** 21.66 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 5/12/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: N.DRAPER (TL,I,P) /
J.MASTEN (S,R) ADDITIONAL MAXIMO
MAXINTENANCE: NONE AT THIS TIME

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 9/26/05,
DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
848/1	Alum Culvert-Major	(LF)	98.00	95.00	3.00	0.00	0.00
1000/1	Corrosion	(LF)	1.00	0.00	1.00	0.00	0.00
7000/1	Damage	(LF)	3.00	0.00	3.00	0.00	0.00

1. NORTH APPROACH

2. EAST ELEVATION

3. GENERAL VIEW WEST IN SPAN 1

4. UPSTREAM WEST

5. DOWNSTREAM EAST

6. AC OVERLAY LOOKING WEST

SCOUR RELATED DATA

For
Bridge: *1455 466*

Bridge ID: 1455 466 **Inspection Date:** 5/20/2013 **Region:** Rural
Waterway Name: SAWMILL BRANCH **Fathometer Req'd:** Yes

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Muck > 3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 15.42 ft **Depth of Flow:** 9.19 ft

ARMORING
Abutment: No Armoring **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:**
Embankment: F **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Failure
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

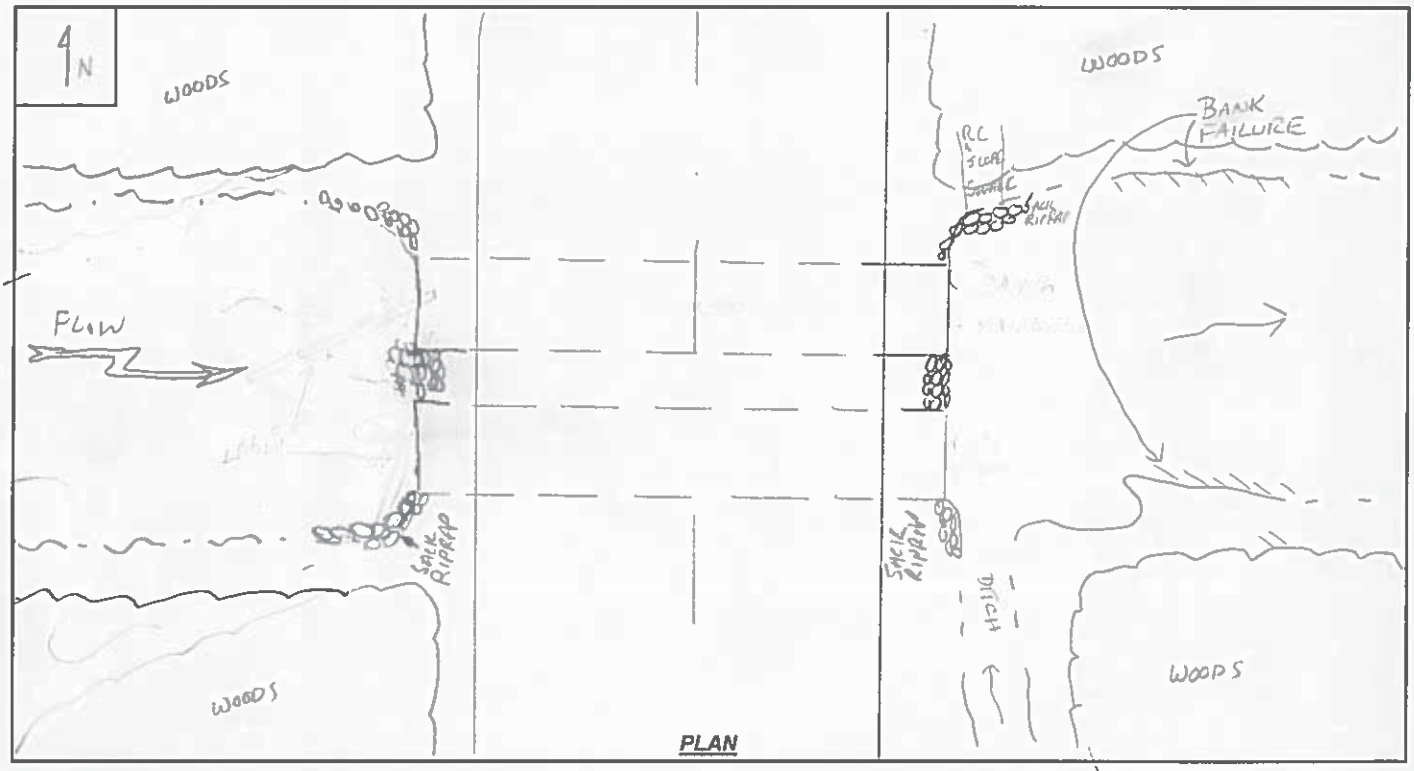
WATERWAY SKETCH SHEET

BR. I.D.: 1 - 455 - 466

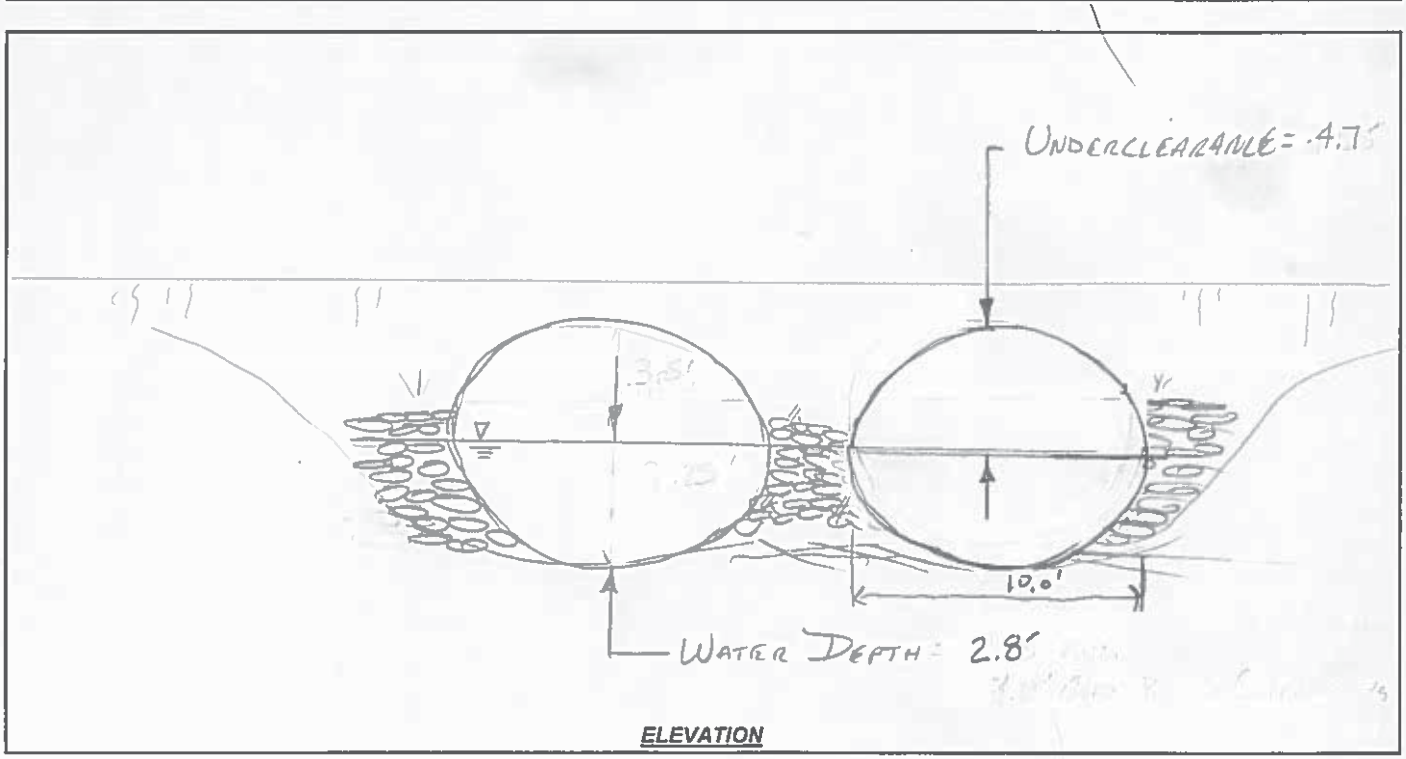
WATERWAY NAME: SAWMILL BRANCH

DATE: 5 / 12 / 15

INSPECTED BY: JM / ND / /



PLAN



ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 96.6

IDENTIFICATION

Bridge ID: 1615 021 **(2) District:** 01 **(3) County:** 3
Inventory Route: **(4) Place Code:** 02050
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00041 **(E) Direction:** 0
6A) Features Intersected: HYDE RUN **6B) Critical:**
(7) Facility Carried: NEWPORT GAP PIKE
(9) Location: S/E OF HOCKESSIN **11) Km. Point:** 3.230 mi
16) Latitude: 39^45'33.84" **17) Longitude:** 75^39'31.74"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 0 mi **27) Year Built:** 1981
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 10278 **30) Year of ADT:** 2015
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 1 **13A) LRS Inv. Rte:** 0000000021 **13B) LRS Subroute No.:** 00
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 14 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 1 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 4/8/2008
63) Oper. Rating Method: 5 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 5 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 16098 **115) Year of Future ADT:** 2030

CONTRACT INFORMATION

Contract 1: 7906101 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 4/14/2016 **91) Frequency:** 48 months **Next Inspection:** 4/14/2020
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 48 months **Elem. Insp. Date:** 4/12/2012 **Next Elem Insp.:** 4/14/2020
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 04
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** NA
62) Culvert: 5 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 6 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 44.30 ft **33) Median:** 0
34) Skew: 20^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.83 ft **49) Structure Length:** 15.79 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 4/14/2016 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,S,R) / G.MILLER
(I,P) MAXIMO REQUESTS: NONE

BRIDGE NOTES

NBI DONE BY: GLEN MILLER .....SCALE FACTORS ENTERED BY J.E.A. ON 4/09/08 -
DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/1	Steel Culvert	ft	152.00	0.00	99.00	39.00	14.00
817/1	Galvanizing Steel Protection	sq.ft	2,148.00	1,432.01	0.00	0.00	715.99
3440/1	Eff (Stl Protect Coat)	ft	218.23	0.00	0.00	0.00	218.23
1000/1	Corrosion	ft	152.00	0.00	99.00	39.00	14.00

1. SOUTH APPROACH

2. EAST ELEVATION

3. SPAN#1 GENERAL VIEW LOOKING WEST

4. DOWNSTREAM LOOKING EAST

5. UPSTREAM LOOKING WEST

6. A/C WEARING SURFACE

7. SPAN#1 EASILY PERFORATED W/ PICK HAMMER AT EAST END

8. SPAN#2 EXISTING PERFORATIONS AT WEST END OF PIPE

SCOUR RELATED DATA

For
Bridge: *1615 021*

Bridge ID: 1615 021 **Inspection Date:** 4/12/2012 **Region:** Urban
Waterway Name: HYDE RUN **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 9.84 ft **Depth of Flow:** 1.64 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: N/A **Wingwalls:** N/A
Dwnstrm Channel: R-5(AVG = 9 in) **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** MODERATE ANGLE OF ATTACK
Streambed: F **Comments:** MINOR SED. BULDUP IN N. PIPE
Embankment: G **Comments:** MINOR SED. BULDUP IN N. PIPE
Fender System: **Comments:** MINOR SED. BULDUP IN N. PIPE

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

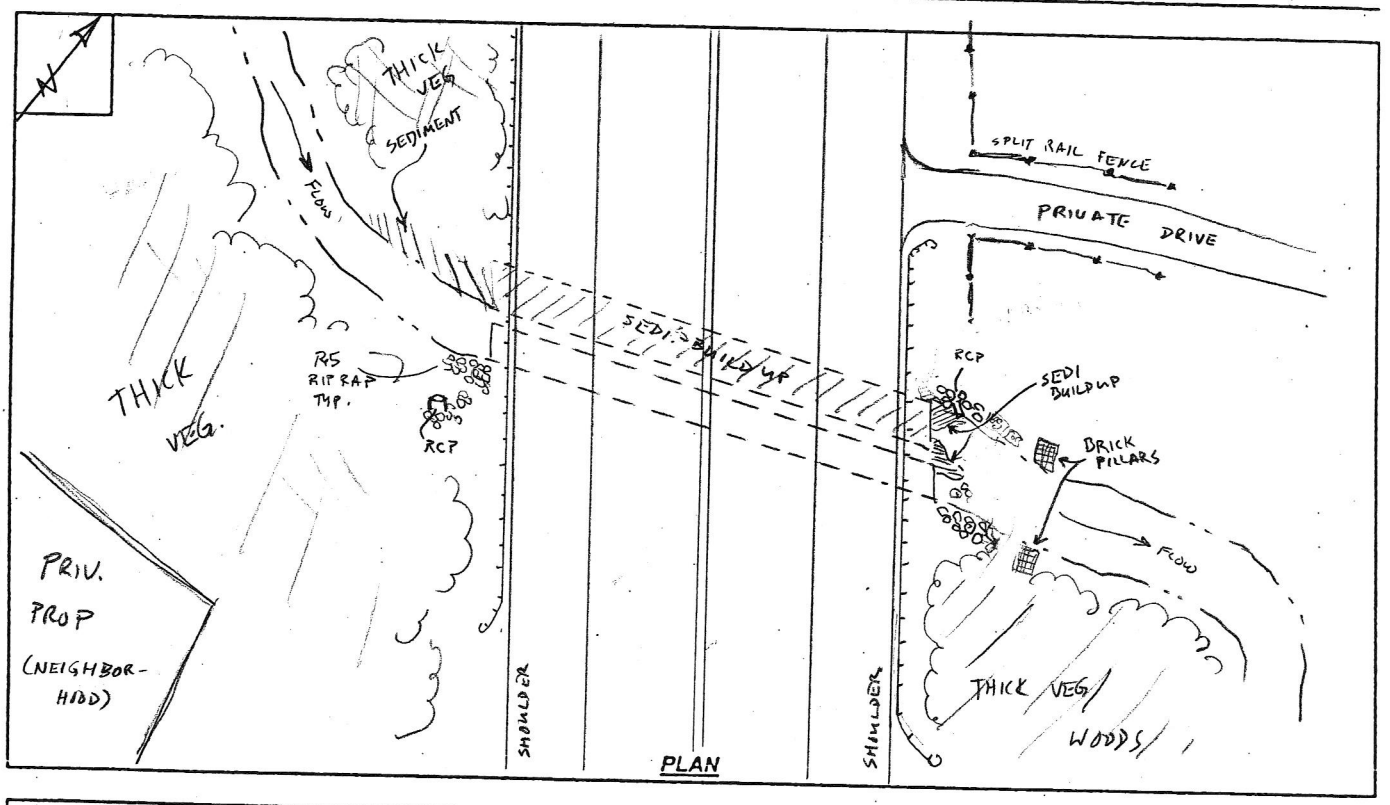
WATERWAY SKETCH SHEET

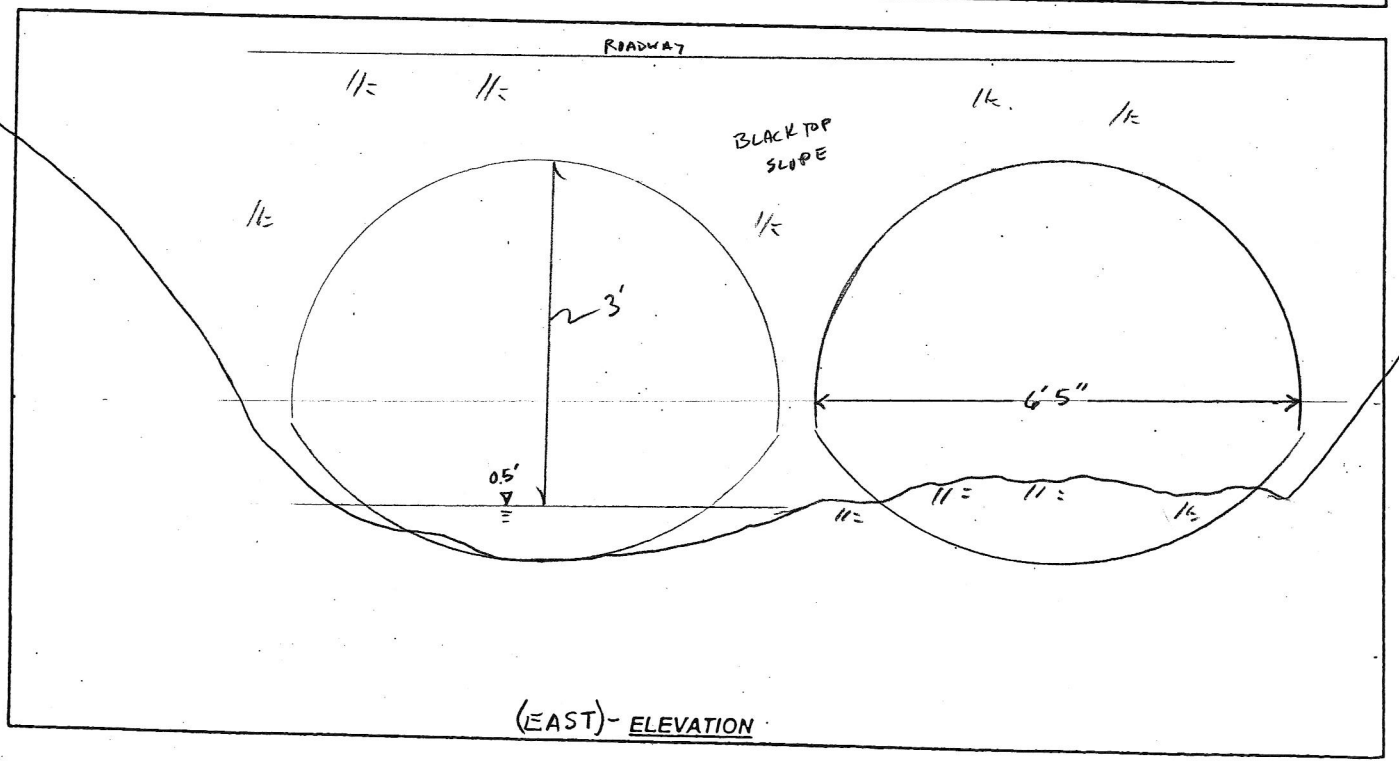
BR. I.D.: 1-615-021

WATERWAY NAME: HYDE RUN

DATE: 4/12/2012

INSPECTED BY: MMI RM / /





SCOUR RELATED DATA

For
Bridge: *1616 021*

Bridge ID: 1616 021 **Inspection Date:** 4/9/2012 **Region:** Urban
Waterway Name: HYDE RUN **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 4.25 ft **Depth of Flow:** 0.08 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** MINOR ANGLE OF ATTACK
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

STRUCTURAL DATA RECORD

Sufficiency Rating: 100.0

IDENTIFICATION

Bridge ID: 1616 021 **(2) District:** 01 **(3) County:** 3
Inventory Route: **(4) Place Code:** 02050
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00041 **(E) Direction:** 0
6A) Features Intersected: HYDE RUN **6B) Critical:**
(7) Facility Carried: NEWPORT GAP PIKE
(9) Location: S/E OF HOCKESSIN **11) Km. Point:** 3.610 mi
16) Latitude: 39^45'49.50" **17) Longitude:** 75^39'47.95"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 1 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 0 mi **27) Year Built:** 1982
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 13407 **30) Year of ADT:** 2015
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 1 **13A) LRS Inv. Rte:** 0000000021 **13B) LRS Subroute No.:** 00
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 14 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 1 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 4/9/2008
63) Oper. Rating Method: 5 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 5 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 19238 **115) Year of Future ADT:** 2030

CONTRACT INFORMATION

Contract 1: UNKNOWN **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 4/14/2016 **91) Frequency:** 48 months **Next Inspection:** 4/14/2020
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 48 months **Elem. Insp. Date:** 4/9/2012 **Next Elem Insp.:** 4/14/2020
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 04
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 6 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 77.00 ft **33) Median:** 0
34) Skew: 25^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 7.90 ft **49) Structure Length:** 7.90 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 4/14/2016 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,I,P) / G.MILLER
(S,R) MAXIMO REQUESTS: NONE

BRIDGE NOTES

NBI DONE BY: MATTHEW MORTENSEN ...SCALE FACTORS ENTERED BY J.E.A. ON 4/09/08
- DO NOT CHANGE OR ERASE...

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	154.00	132.00	15.00	0.00	7.00
817/1	Galvanizing Steel Protection	sq.ft	2,553.00	2,503.00	0.00	0.00	50.00
1000/1	Corrosion	(LF)	21.00	0.00	15.00	0.00	6.00
7000/1	Damage	(LF)	1.00	0.00	0.00	0.00	1.00

1. NORTH APPROACH

2. WEST ELEVATION

3. GENERAL VIEW LOOKING WEST

4. UPSTREAM LOOKING EAST

5. DOWNSTREAM LOOKING WEST

6. A/C RIDING SURFACE

7. HOLE NEAR TOP OF CULVERT SECOND JOINT FROM WEST EXPOSING FILL

8. LOSS OF FILL UNDER HOLE NEAR TOP OF CULVERT

9. PERFORATION IN CULVERT FLOOR AT WEST END.

10. CORE BORING'S OVER APPROX. LOCATION OF HOLE IN CULV. PIPE

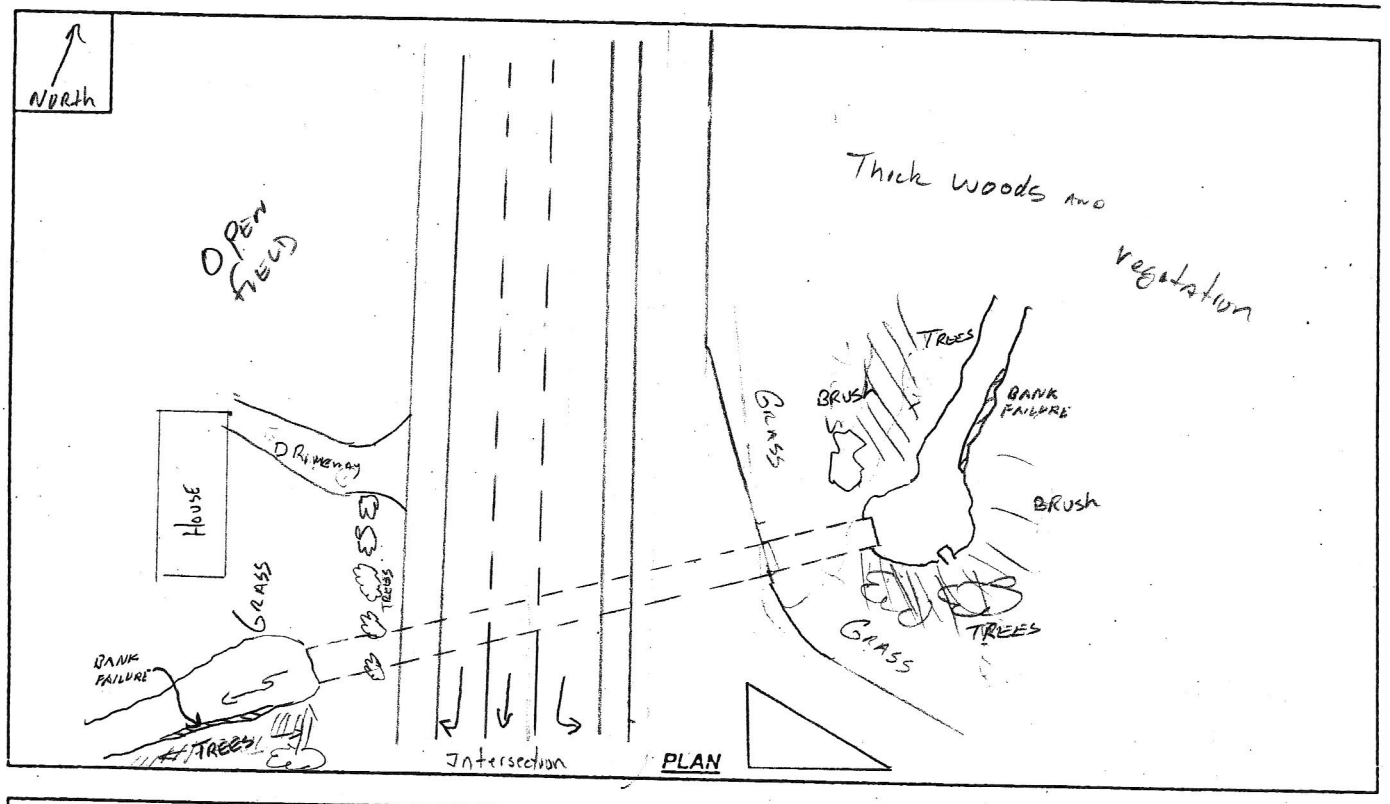
WATERWAY SKETCH SHEET

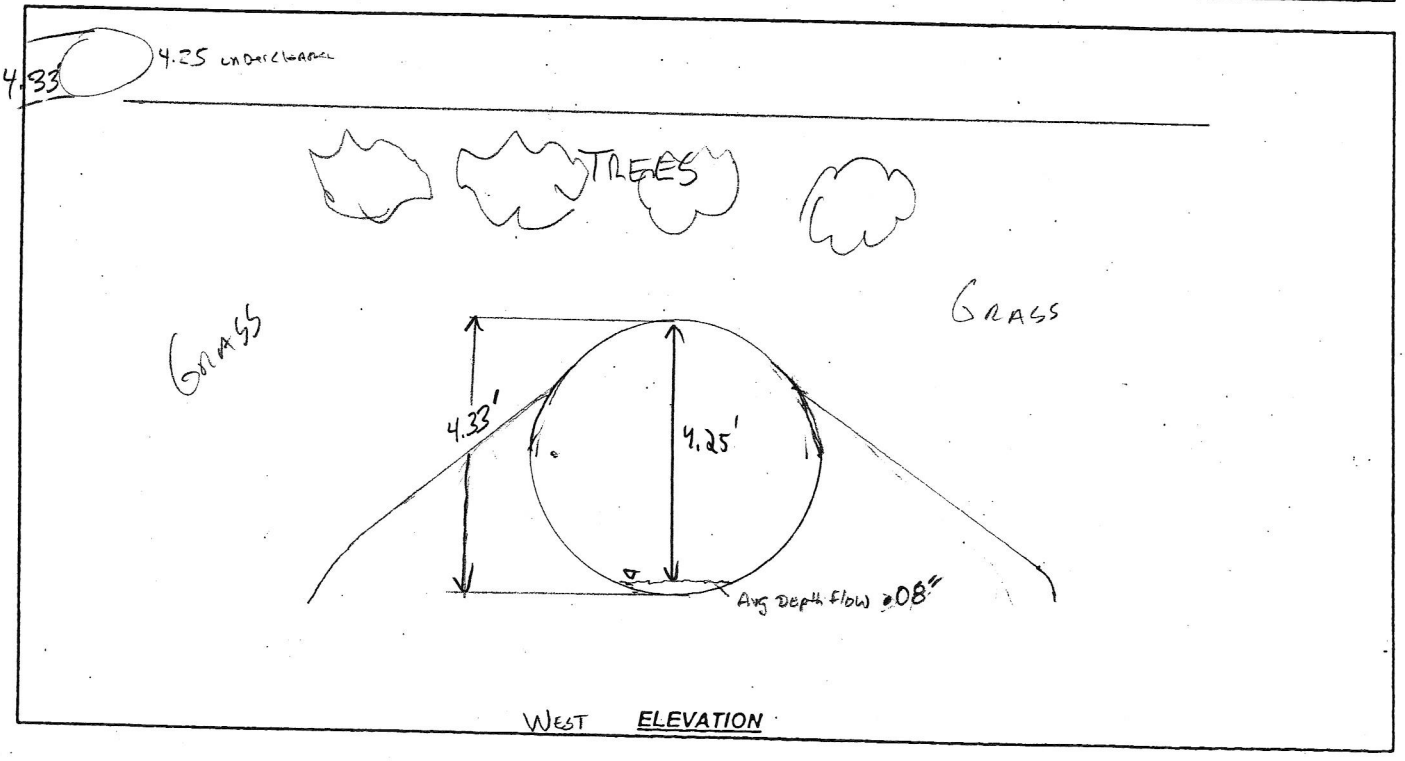
BR. I.D.: 1 -616 -021

WATERWAY NAME: Hyde Run

DATE: 4 19 1 12

INSPECTED BY: MM 1 RM 1 1





STRUCTURAL DATA RECORD

Sufficiency Rating: 69.7

IDENTIFICATION

Bridge ID: 2066A066 **(2) District:** 02 **(3) County:** 1
Inventory Route: **(4) Place Code:** 21200
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00066 **(E) Direction:** 0
6A) Features Intersected: LITTLE RIVER **6B) Critical:**
(7) Facility Carried: WHITE OAK RD
(9) Location: EAST DOVER **11) Km. Point:** 1.680 mi
16) Latitude: 39^10'42.02" **17) Longitude:** 75^29'50.89"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 4 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1967
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 1175 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 19 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 3/4/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 1460 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 9/30/2015 **91) Frequency:** 24 months **Next Inspection:** 9/30/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 10/4/2013 **Next Elem Insp.:** 9/30/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 08
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 4 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 4 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 23.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 5.50 ft **49) Structure Length:** 25.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/30/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: C,BUGHER (I,P) / N.DRAPER
(R) / J.MASTEN (S) ADDITIONAL MAXIMO
MAINTENANCE: B055-V1A...REMOVE
VEGETATION FROM AROUND ALL
WINGWALLS...WO#725064

BRIDGE NOTES

NBI DONE BY: DSOBOTA ....NOTE: SCALE FACTORS ENTERED BY GRD ON 12/15/05, DO
NOT CHANGE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	212.00	0.00	148.00	51.00	13.00
817/2	Galvanizing Steel Protection	sq.ft	3,164.03	1,582.01	0.00	0.00	1,582.01
3440/2	Eff (Stl Protect Coat)	ft	482.20	0.00	0.00	0.00	482.20
1000/2	Corrosion	ft	211.00	0.00	148.00	51.00	12.00
1900/2	Distortion	ft	1.00	0.00	0.00	0.00	1.00
895/2	Grouted or Sacked Ri	(SF)	550.00	548.00	0.00	2.00	0.00
1640/2	Masonry Displacement	(SF)	2.00	0.00	0.00	2.00	0.00

1. WEST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW LOOKING SOUTH IN SPAN 2

4. UPSTREAM NORTH

5. DOWNSTREAM SOUTH

6. AC OVERLAY LOOKING SOUTH

7. SPAN 1, EASILY PERFORATED w/ PICK HAMMER NEAR NORTH END

8. SPAN 1, JOINT SEPARATION AT 1ST JOINT FORM NORTH w/ VOID UP TO 2.0'

9. SPAN 1, EXISTING PERFORATIONS AT SOUTH END

10. SPAN 4, MISSING SACKED RIPRAP BELOW PIPE AT NORTH END.

SCOUR RELATED DATA

For
Bridge: *2066A066*

Bridge ID: 2066A066 **Inspection Date:** 10/4/2013 **Region:** Urban
Waterway Name: LITTLE RIVER **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 14.76 ft **Depth of Flow:** 1.64 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** No Armoring
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:** PONDING DOWNSTREAM.
Embankment: G **Comments:** PONDING DOWNSTREAM.
Fender System: **Comments:** PONDING DOWNSTREAM.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

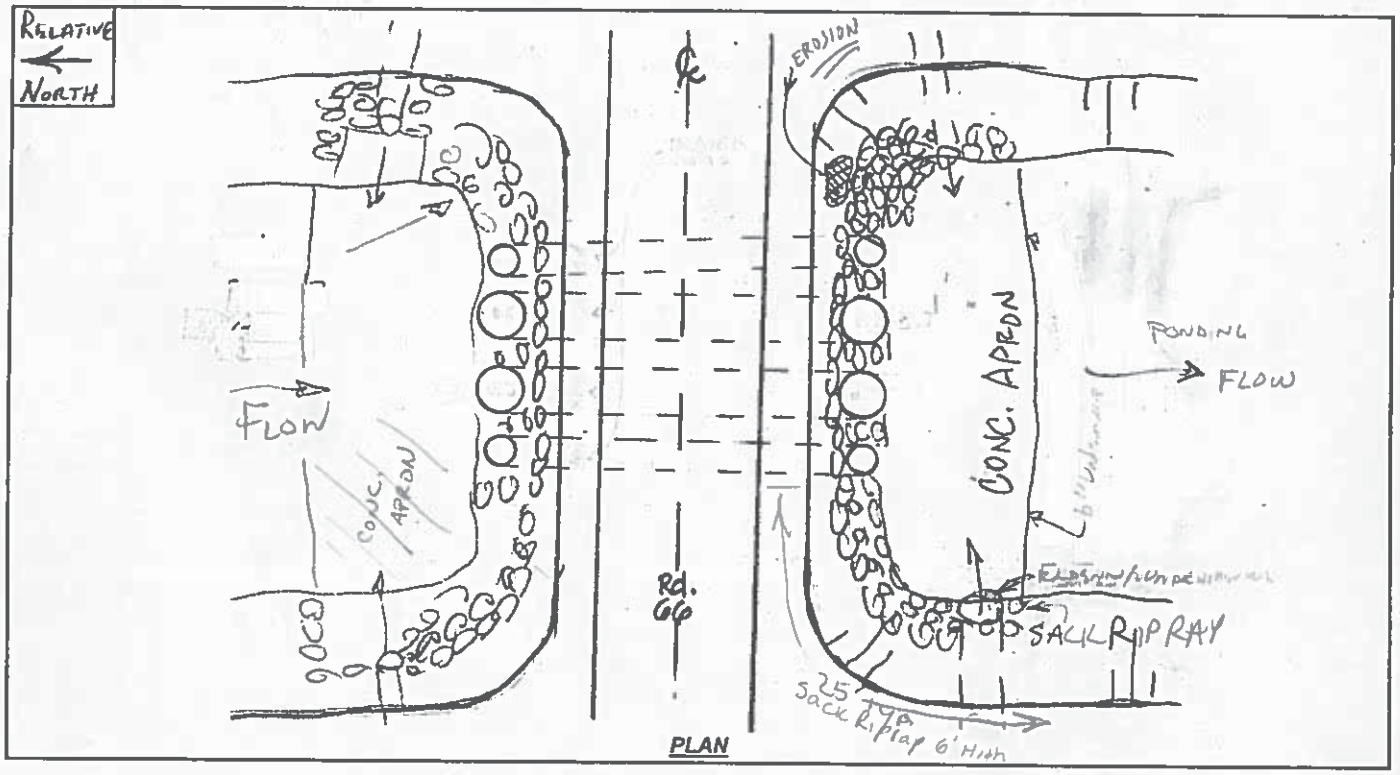
WATERWAY SKETCH SHEET (LITTLE RIVER)

BR. I.D.: 2-066A-066

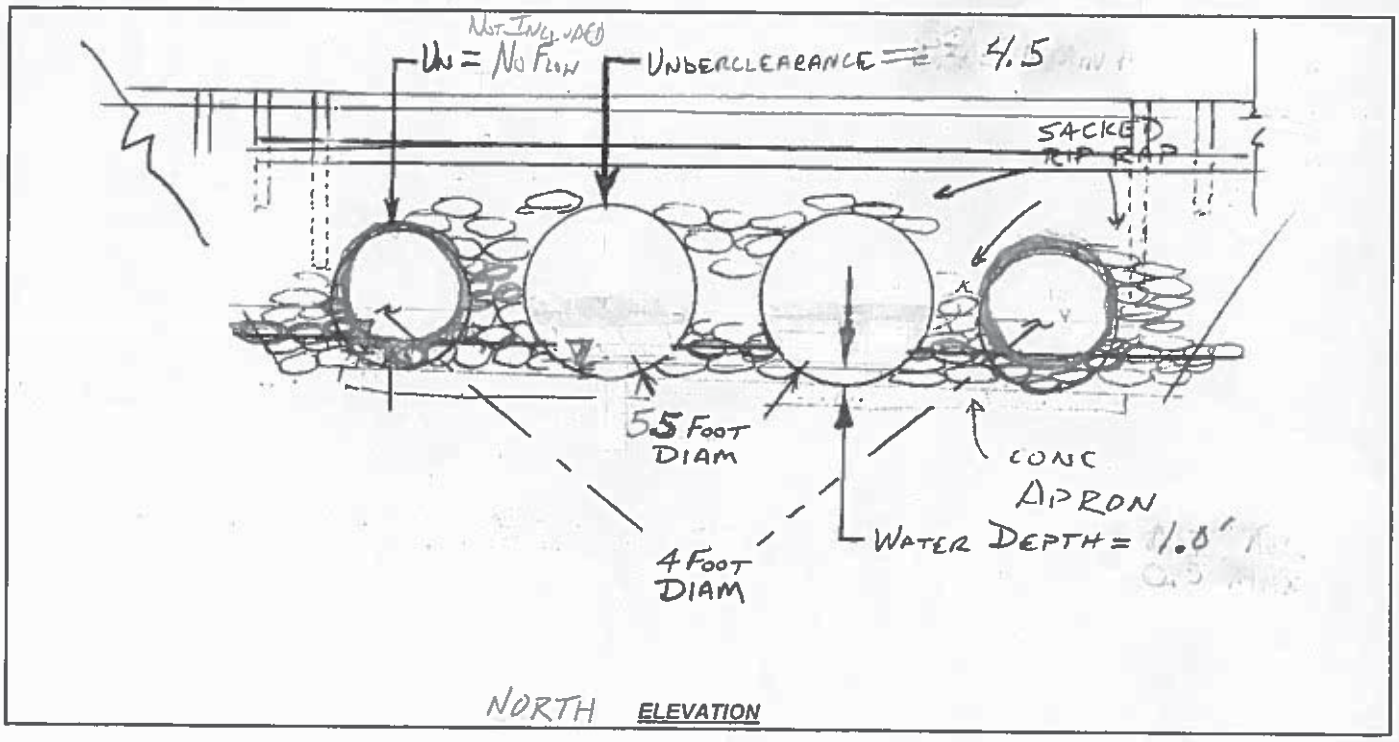
WATERWAY NAME: ~~WHITE OAK TRI. DITCH~~

DATE: 9/30/15

INSPECTED BY: JM / ND / CB /



PLAN



ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 86.0

IDENTIFICATION

Bridge ID: 2113B113 **(2) District:** 02 **(3) County:** 1
Inventory Route: **(4) Place Code:** 25840
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00113 **(E) Direction:** 0
6A) Features Intersected: SAULSBURY CREEK **6B) Critical:**
(7) Facility Carried: CATTAIL BRANCH RD.
(9) Location: WEST OF FARMINGTON **11) Km. Point:** 2.090 mi
16) Latitude: 38^51'0.32" **17) Longitude:** 75^42'11.15"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 2004
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 41 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 10/31/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 50 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 10/8/2014 **91) Frequency:** 24 months **Next Inspection:** 10/8/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 10/8/2014 **Next Elem Insp.:** 10/8/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 09
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 8 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.50 ft **33) Median:** 0
34) Skew: 28^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 8.60 ft **49) Structure Length:** 24.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 10/8/2014 **Type:** 1 **Inspector:** GMILLER

INSPECTION NOTES

INSPECTED BY: C.KURSINSKY(I,P) /
G.MILLER(TL,S,R) MAXIMO MAINTENANCE:
NONE AT THIS TIME.

BRIDGE NOTES

NBI DONE BY: DARREN SOBOTA ....NOTE: SCALE FACTORS ENTERED BY GRD ON 01/17/07, DO NOT CHANGE OR ERASE.... NOTE: PIPES ARE STEEL CMP'S THAT WERE GALVINIZED AND THEN HAD SOME SORT OF ALUMINUM COATING.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	202.00	200.00	0.00	2.00	0.00
817/1	Galvanizing Steel Protection	sq.ft	13,967.99	13,967.99	0.00	0.00	0.00
895/2	Grouted or Sacked Ri	(SF)	480.00	480.00	0.00	0.00	0.00

1. WEST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW LOOKING NORTH THROUGH EAST PIPE

4. UPSTREAM NORTH

5. DOWNSTREAM SOUTH

6. WEARING SURFACE FACING EAST

7. MOWER DAMAGE TO NORTH END OF WEST PIPE

SCOUR RELATED DATA

For
Bridge: *2113B113*

Bridge ID: 2113B113 **Inspection Date:** 10/8/2014 **Region:** Rural
Waterway Name: SAULSBURY CREEK **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 5.00 ft **Depth of Flow:** 1.25 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: R-5(AVG = 9 in) **Wingwalls:** N/A
Dwnstrm Channel: Sacked Conc Riprap **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: F **Comments:** SEDIMENT BUILD UP @ INLET & OUTLET.
Embankment: F **Comments:** SEDIMENT BUILD UP @ INLET & OUTLET.
Fender System: **Comments:** SEDIMENT BUILD UP @ INLET & OUTLET.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Erosion **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

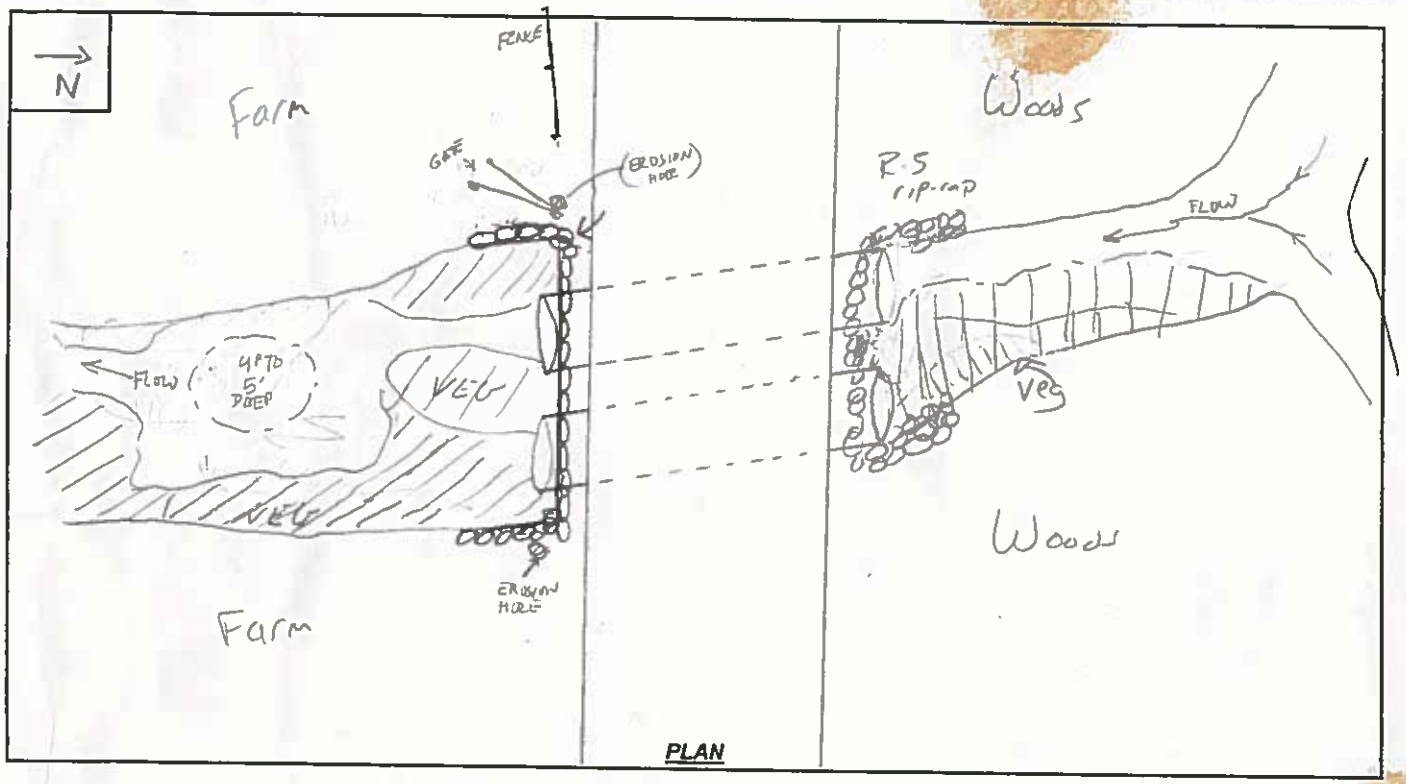
WATERWAY SKETCH SHEET

BR. I.D.: 2 -113B 113

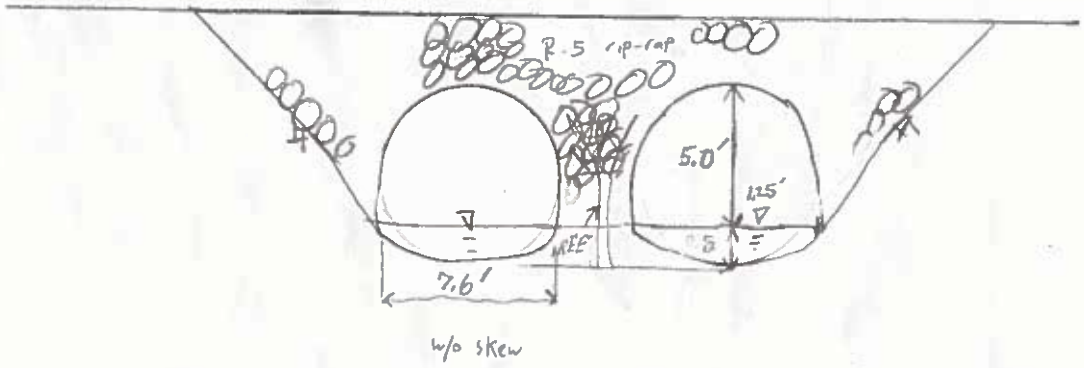
WATERWAY NAME: Saulsbury Creek

DATE: 10 / 8 / 2014

INSPECTED BY: GM / CK / /



PLAN



North ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 100.0

IDENTIFICATION

Bridge ID: 2303A303
(2) District: 02
(3) County: 1
Inventory Route:
(4) Place Code: 31420
(A) On/Under: 1
(B) Highway Type: 4
(C) Service Lvl: 1
(D) Route No: 00303
(E) Direction: 0
6A) Features Intersected: CATTAIL BRANCH
6B) Critical:
(7) Facility Carried: HIGH STUMP RD.
(9) Location: W. OF FARMINGTON
11) Km. Point: 0.980 mi
16) Latitude: 38^52'29.35"
17) Longitude: 75^41'32.85"
98) Border Bridge Code: NA
99) Border Br. Str. No.: NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 1
43B) DESIGN TYPE: 19
44A) APPR. SPAN MATERIAL: NA
44B) DESIGN TYPE: NA
45) Main Spans: 3
46) Approach Spans: 0
107) Deck Type: N
108A) Wearing Surface: N
108B) Membrane: N
108C) Deck Protection: N

Pier 1: NA	Pier 2: NA	Pier Ftg. 1: NA	Pier Ftg. 2: NA
Abut 1: NA	Abut 2: NA	Abut Ftg. 1: NA	Abut Ftg. 2: NA

NAVIGATION DATA

38) Navigational Control: 0
39) Vertical Clearance: 0.0 ft
40) Horizontal Clearance: 0.0 ft
111) Pier Protection: !
116) Lift Br. Vert. Clr: 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi
27) Year Built: 1969
28) No. of Lanes:
A) On Bridge: 2
B) Under Bridge: 0
29) ADT: 42
30) Year of ADT: 2014
42) Type of Service:
A) On Bridge: 1
B) Under Bridge: 5
106) Year Reconst.: NA
109) % Truck ADT: 8

CLASSIFICATION

12) Base Hwy. Network: 0
13A) LRS Inv. Rte: NA
13B) LRS Subroute No.: NA
20) Toll Facility: 3
21) Maintenance: 1
22) Owner: 1
26) Functional Class: 09
37) Historical: 5
100) Defense Highway: 0
101) Parallel Str.: N
102) Direction: 2
103) Temp. Str.:
104) NHS: 0
105) Fed. Lands Highway: 0
110) Nat. Truck Network: 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5
41) Oper. Status: A
Rating Date: 9/13/2007
63) Oper. Rating Method: 5
64) Operating Rating: 60.0
65) Inv. Rating Method: 5
66) Inv. Rating: 36.0
70) Bridge Posting: 5
Reason of Posting: NA
Date of Resolution: NA
Rating Analysis Req'd: NA
S335: NA
S437: NA
T330: NA
T435: NA
T540: NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA
76) Length of Imp.: NA
94) Bridge Cost: NA
95) Roadway Cost: NA
96) Total Cost: NA
97) Year of Cost Est.: NA
114) Future ADT: 52
115) Year of Future ADT: 2037

CONTRACT INFORMATION

Contract 1: UNKNOWN
Contract 2: -1
Contract 3: -1
Contract 4: -1
Contract 5: -1
Contract 6: -1

INSPECTION RECORD

90) Inspection Date: 9/11/2015 **91) Frequency:** 24 months **Next Inspection:** 9/11/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 9/14/2011 **Next Elem Insp.:** 9/11/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 09
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 17.50 ft **33) Median:** 0
34) Skew: 3^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 5.01 ft **49) Structure Length:** 21.53 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/11/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE (TL,I) / C.BUGHER (P,R) / J.MASTEN (S) ADDITIONAL MAXIMO MAINTENANCE: B055-V1A: REMOVE DEBRIS AT INLET. WO#

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 12/20/07, DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	49.00	0.00	49.00	0.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	1,384.99	355.99	0.00	0.00	1,029.00
1000/2	Corrosion	ft	49.00	0.00	49.00	0.00	0.00
241/2	Re Conc Culvert	ft	98.00	95.00	0.00	3.00	0.00
1090/2	Exposed Rebar	ft	3.00	0.00	0.00	3.00	0.00
895/2	Grouted or Sacked Ri	(SF)	724.00	689.00	30.00	0.00	5.00
1640/2	Masonry Displacement	(SF)	35.00	0.00	30.00	0.00	5.00

1. WEST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW SPAN#1 LOOKING SOUTH

4. DOWNSTREAM LOOKING SOUTH

5. UPSTREAM LOOKING NORTH

6. TAR AND CHIP RIDING SURFACE

7. SPAN#2 EXPOSED REINFORCEMENT AT NORTH END

8. EROSION HOLE BEHIND SOUTH EAST WINGWALL

9. SPAN#2 MISSING SACK RIP RAP AT SOUTH END OVER PIPE

SCOUR RELATED DATA

For
Bridge: *2303A303*

Bridge ID: 2303A303 **Inspection Date:** 9/14/2011 **Region:** Rural
Waterway Name: CATTAIL BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Firm < 1 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 10.83 ft **Depth of Flow:** 4.27 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: P **Comments:** DEBRIS UPSTREAM AT INLET OF SPAN#3
Streambed: G **Comments:**
Embankment: F **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: Yes **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit **Downstream Bank Condition:** Bank Slumping
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

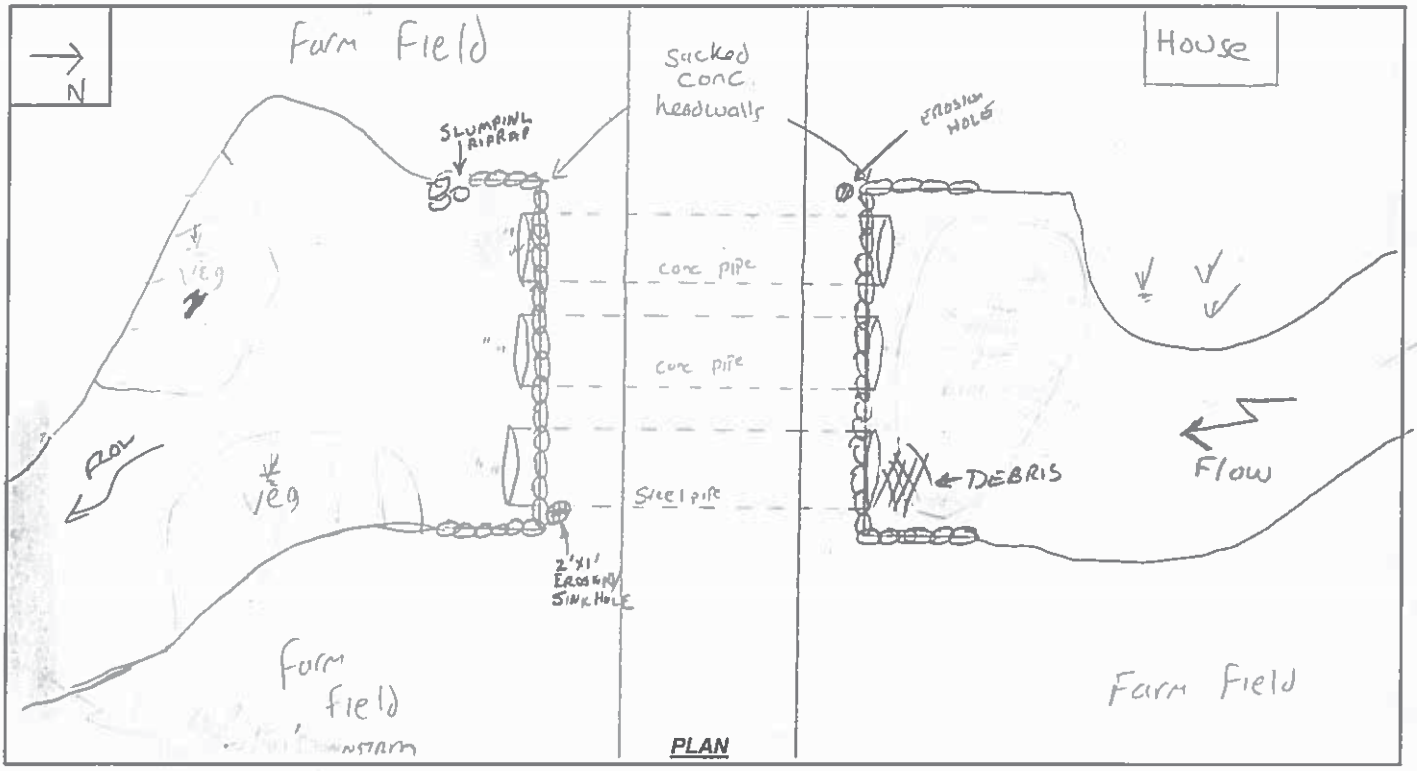
WATERWAY SKETCH SHEET

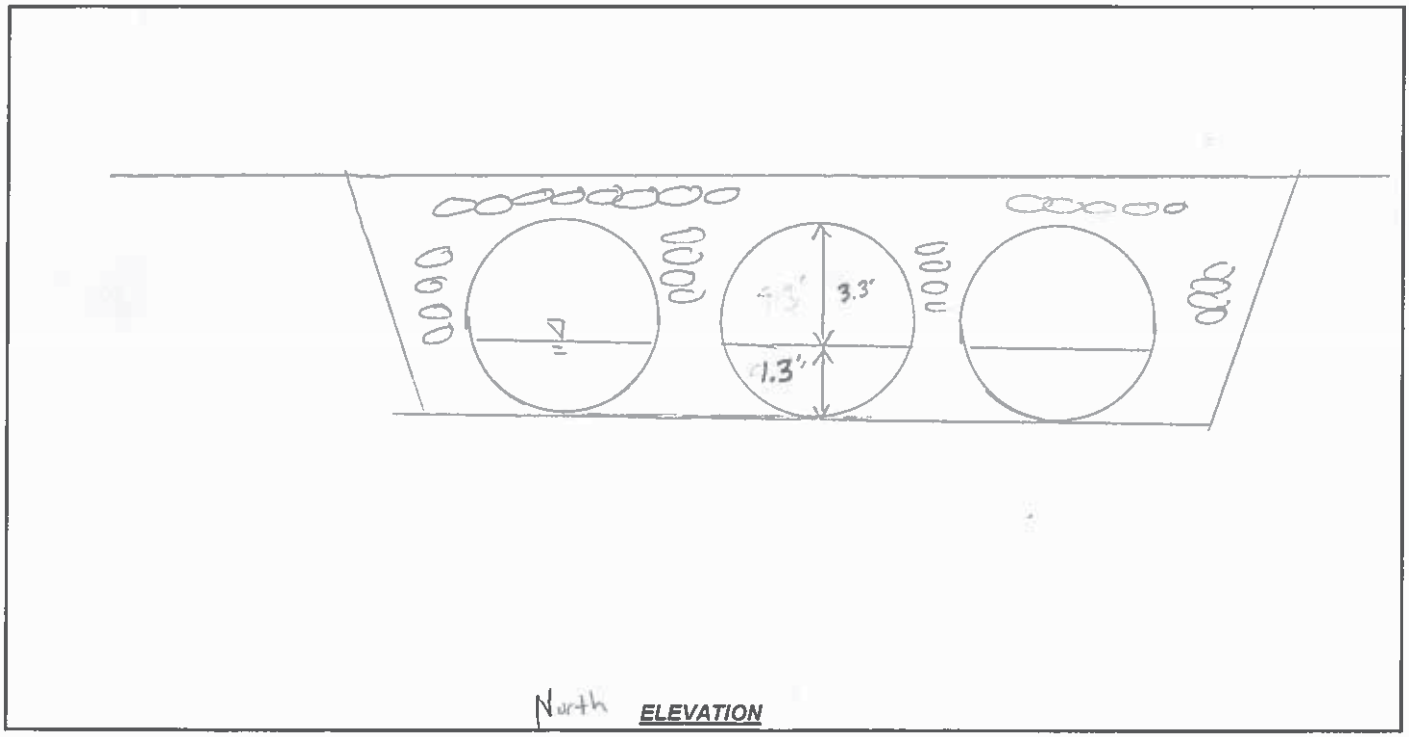
BR. ID.: 2-303A-303

WATERWAY NAME: Cattail Branch

DATE: 9/1/15

INSPECTED BY: JM / RM / CB /





STRUCTURAL DATA RECORD

Sufficiency Rating: 85.8

IDENTIFICATION

Bridge ID: 2371B371 **(2) District:** 02 **(3) County:** 1
Inventory Route: **(4) Place Code:** 42040
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00371 **(E) Direction:** 0
6A) Features Intersected: TRIB. TO MCGINNIS POND **6B) Critical:**
(7) Facility Carried: BARRATTS CHAPEL RD
(9) Location: SOUTH OF MAGNOLIA **11) Km. Point:** 2.540 mi
16) Latitude: 39^2'23.70" **17) Longitude:** 75^30'55.70"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 1 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1970
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 1479 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 17 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 9/17/2009
63) Oper. Rating Method: 5 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 5 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 1838 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: UNKNOWN **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 9/11/2015 **91) Frequency:** 24 months **Next Inspection:** 9/11/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 9/11/2013 **Next Elem Insp.:** 9/11/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 09
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** NA
62) Culvert: 5 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.90 ft **33) Median:** 0
34) Skew: 15^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.21 ft **49) Structure Length:** 6.21 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/11/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: J.MASTEN (I) / R.MOORE (S,R) / C.BUGAR (P) ADDITIONAL MAXIMO MAINTENANCE: 583862 B055-V1A REMOVE DEBRIS/DOWNED TREES FROM INLET.

BRIDGE NOTES

NBI DONE BY: DAREN SOBOTA ....SCALE FACTORS ENTERED BY JEA ON 9/17/09 -- DO NOT CHANGE OR ERASE.... NOTE: THIS WAS A FOUND BRIDGE THAT WAS INVENTORIED & INSPECTED IN DECEMBER OF 2008, BUT WASN'T ENTERED INTO PONTIS UNTIL SEPTEMBER 2009.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	50.00	18.00	0.00	32.00	0.00
1000/1	Corrosion	(LF)	28.00	0.00	0.00	28.00	0.00
1900/1	Distortion	(LF)	4.00	0.00	0.00	4.00	0.00

1. WEST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW LOOKING NORTH

4. DOWNSTREAM LOOKING SOUTH

5. UPSTREAM LOOKING NORTH

6. A/C RIDING SURFACE

7. CORROSION TYPICAL NEAR NORTH END

8. DISTORTION AT NORTH END

SCOUR RELATED DATA

For
Bridge: *2371B371*

Bridge ID: 2371B371 **Inspection Date:** 9/11/2013 **Region:** Rural
Waterway Name: TRIB. TO MCGINNIS POND **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 8.20 ft **Depth of Flow:** 11.48 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** LARGE TREE DEBRIS UPSTREAM
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: Yes **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit **Downstream Bank Condition:** Bank Prot/Vegit
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

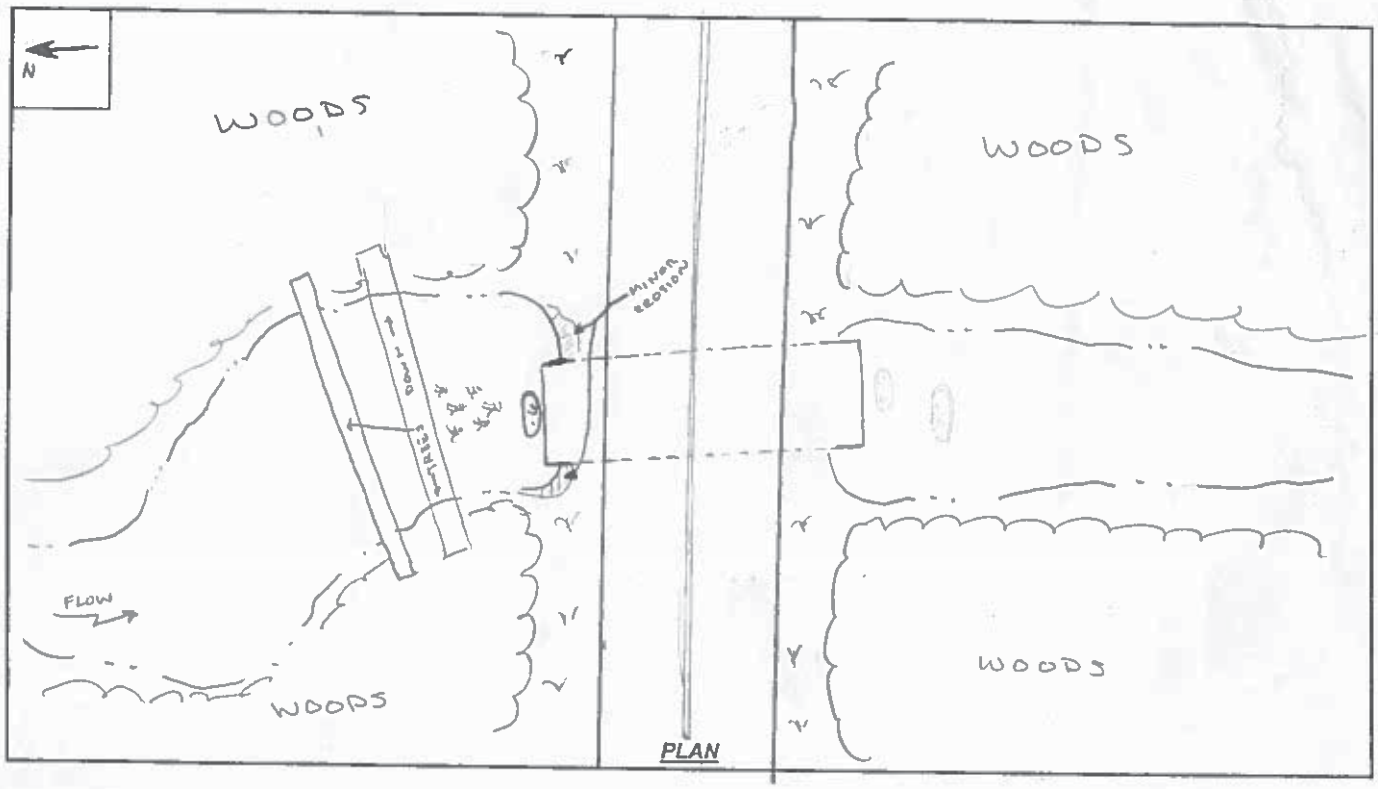
WATERWAY SKETCH SHEET

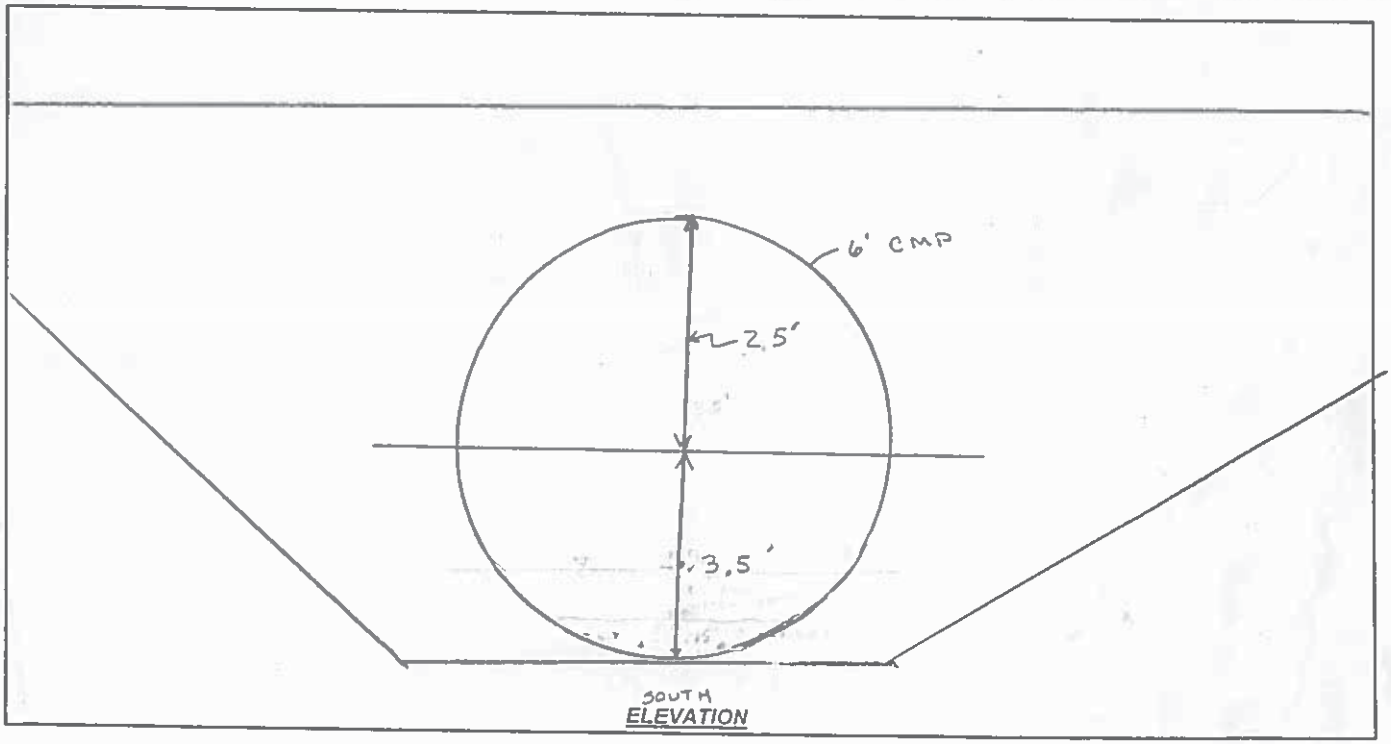
BR. I.D.: 2 - 371B-371

WATERWAY NAME: Trib. to McGinnis Pond

DATE: 09 / 10 / 15

INSPECTED BY: RM / JM / CB /





STRUCTURAL DATA RECORD

Sufficiency Rating: 98.9

IDENTIFICATION

Bridge ID: 2384C384 **(2) District:** 02 **(3) County:** 1
Inventory Route: **(4) Place Code:** 46700
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00384 **(E) Direction:** 0
6A) Features Intersected: BROWNS BRANCH **6B) Critical:**
(7) Facility Carried: KILLENS POND RD
(9) Location: N. OF MELVINS CROSSROADS **11) Km. Point:** 6.310 mi
16) Latitude: 38^57'7.02" **17) Longitude:** 75^31'21.37"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi **27) Year Built:** 1987
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 1244 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 3/9/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** N
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 1546 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 8607201 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 9/18/2015 **91) Frequency:** 24 months **Next Inspection:** 9/18/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 9/16/2013 **Next Elem Insp.:** 9/18/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 09
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 6 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 1
D) Approach Rail Ends: 1
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 7
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.75 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 8.17 ft **49) Structure Length:** 30.51 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/18/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: C.BUGHER(I,P) / R.MOORE
(TL) / G.GARCIA(S,R) ADDITIONAL MAXIMO
MAINTENANCE: WO#583311... B055-V1A
REMOVE TIRE FROM CENTER SPAN.

BRIDGE NOTES

NBI DONE BY: JBAUER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 12/07/05, DO
NOT CHANGE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/2	Maj Mtl Culv	(LF)	225.00	0.00	225.00	0.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	9,935.97	0.00	4,967.99	0.00	4,967.99
3440/2	Eff (Stl Protect Coat)	(LF)	3,028.48	0.00	1,514.24	0.00	1,514.24
1000/2	Corrosion	(LF)	223.00	0.00	223.00	0.00	0.00
1900/2	Distortion	(LF)	2.00	0.00	2.00	0.00	0.00
7000/2	Damage	(LF)	2.00	0.00	2.00	0.00	0.00

1. NORTH APPROACH

2. WEST ELEVATION

3. GENERAL VIEW SPAN#2 LOOKING EAST

4. UPSTREAM LOOKING WEST

5. DOWNSTREAM LOOKING EAST

6. A/C RIDING SURFACE

7. SPAN#2 GALVANIC PROTECTION FAILURE

8. SPAN#2 HANDLING DAMAGE AT WEST END

SCOUR RELATED DATA

For
Bridge: *2384C384*

Bridge ID: 2384C384 **Inspection Date:** 9/16/2013 **Region:** Rural
Waterway Name: BROWNS BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Firm < 1 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 14.76 ft **Depth of Flow:** 4.59 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** TIRE IN SPAN 2
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: Yes **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Need Minor Repr **Downstream Bank Condition:** Need Minor Repr
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

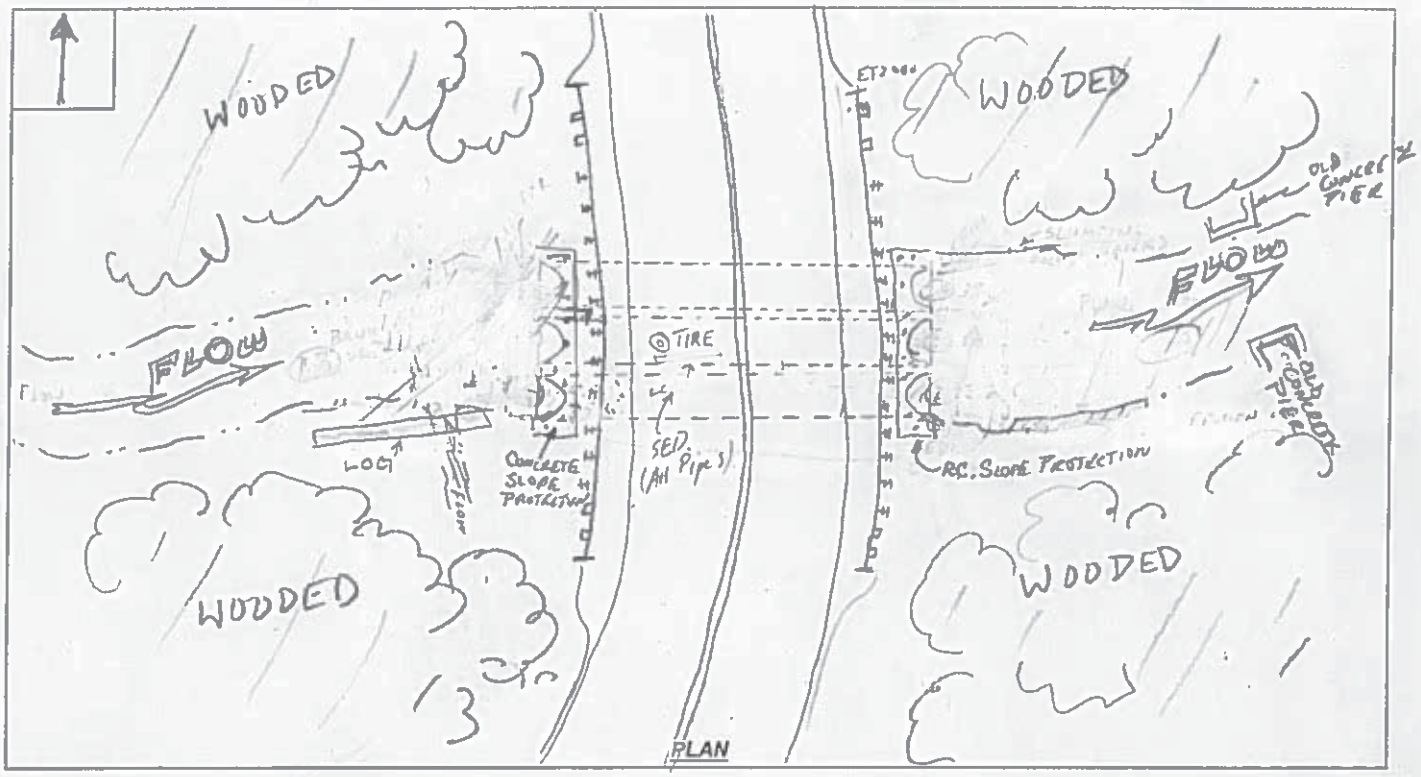
WATERWAY SKETCH SHEET

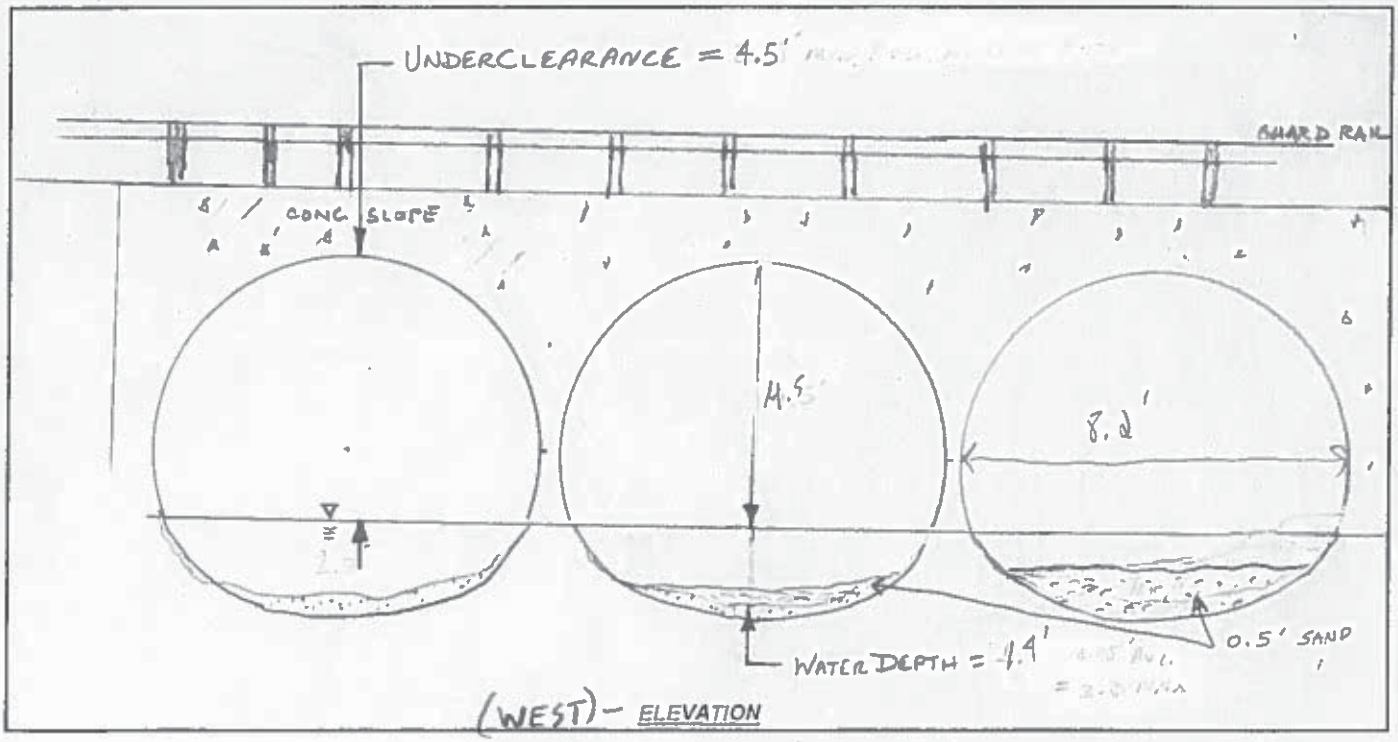
BR. I.D.: 2-38AC-38A

WATERWAY NAME: BROWN'S BRANCH

DATE 09 18 15

INSPECTED BY IGG / EB / RM





5.75
1.50
4.25

3.75
1.50
5.25

6.0
1.5
4.5

STRUCTURAL DATA RECORD

Sufficiency Rating: 94.9

IDENTIFICATION

Bridge ID: 2442A442 **(2) District:** 02 **(3) County:** 3
Inventory Route: **(4) Place Code:** 77060
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00442 **(E) Direction:** 0
6A) Features Intersected: TANTROUGH BRANCH **6B) Critical:**
(7) Facility Carried: ABBOTTS POND RD
(9) Location: SW OF MILFORD **11) Km. Point:** 1.080 mi
16) Latitude: 38^53'22.70" **17) Longitude:** 75^29'25.70"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** 0 **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 4 mi **27) Year Built:** 1970
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 1071 **30) Year of ADT:** 2012
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 4 **41) Oper. Status:** A **Rating Date:** 1/1/1901
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** 0
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 1343 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: -1 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 7/22/2014 **91) Frequency:** 24 months **Next Inspection:** 7/22/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: 48 months **93B) UW Insp. Date:** 7/22/2014 **Next UW Insp.:** 7/22/2018
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 7/22/2014 **Next Elem Insp.:** 7/22/2016
UBIV Required: NA **UBIV Days:** NA **Inspection Zone:** 09
Boat: NA **Tidal:** N **GPS:** NA

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 6 **68) Deck Geometry:** 5 **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 30.00 ft **33) Median:** 0
34) Skew: 30^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.00 ft **49) Structure Length:** 22.30 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 7/22/2014 **Type:** E **Inspector:** PENNONI

INSPECTION NOTES

INSPECTED BY: N. WARD(TL,I,R), M. SCORPA (S), A. FULTON(P) UNDERWATER INSPECTION PERFORMED BY: PENNONI (2014) THE BITUMINOUS PAVEMENT IS IN FAIR CONDITION WITH TRANSVERSE AND LONGITUDINATL CRACKS UP TO 1/4-INCH WIDE. THE EAST SHOULDER BETWEEN CELLS 1 AND 2 HAS A 2-FOOT DIAMETER BITUMINOUS PATCH. PER EMAIL CORRESPONDENCE WITH M. MORTENSEN ON 07/01/2014, THE 2014 INSPECTION IS A ROUTINE/INVENTORY INSPECTION WITH A SUBSEQUENT INVENTORY INSPECTION TO OCCUR AT A LATER DATE BY THE DEPARTMENT TO VERIFY DATA. WHEREVER POSSIBLE, DATA HAS BEEN ENTERED IN ACCORDANCE WITH THE DELDOT BRIDGE INSPECTION MANUAL AND THE FHWA RECORDING AND CODING GUIDE.

BRIDGE NOTES

NBI DONE BY: M.MORTENSEN / PENNONI

PONTIS DATA

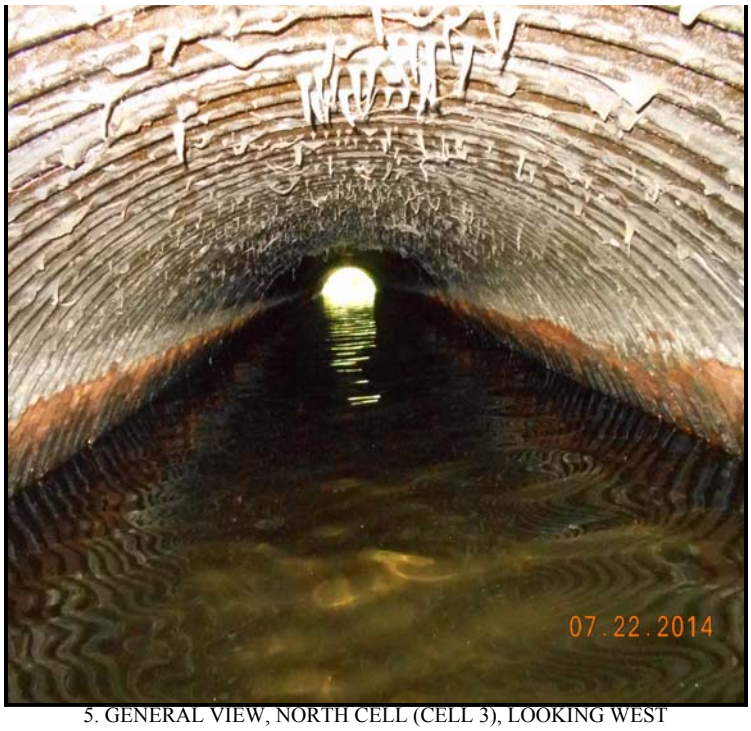
Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/1	Steel Culvert	ft	186.00	0.00	186.00	0.00	0.00
817/1	Galvanizing Steel Protection	sq.ft	1,602.14	1,602.14	0.00	0.00	0.00

1. NORTH APPROACH

2. SOUTH APPROACH

3. WEST ELEVATION

4. EAST ELEVATION



5. GENERAL VIEW, NORTH CELL (CELL 3), LOOKING WEST

6. VIEW UPSTREAM, LOOKING WEST

7. VIEW DOWNSTREAM, LOOKING EAST

8. GENERAL VIEW OF BITUMINOUS PAVEMENT, LOOKING SOUTH

9. SOUTH CELL (CELL 1), WEST END - TYPICAL SURFACE CORROSION

10. EAST SHOULDER, BETWEEN CELLS 1 AND 2 - 2-FOOT DIAMETER PATCH

SCOUR RELATED DATA

For
Bridge: *2442A442*

Bridge ID: 2442A442 **Inspection Date:** 7/23/2014 **Region:** Rural
Waterway Name: TANTROUGH BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Firm < 1 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 1.92 ft **Depth of Flow:** 1.20 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: **Fnd. Mtrl:**
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:** WATERWAY IS CLEAR.
Streambed: G **Comments:** STREAMBED IS COMPACT.
Embankment: G **Comments:** STREAMBED IS COMPACT.
Fender System: N **Comments:** STREAMBED IS COMPACT.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** Moderate
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Need Minor Repr **Downstream Bank Condition:** Need Minor Repr
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

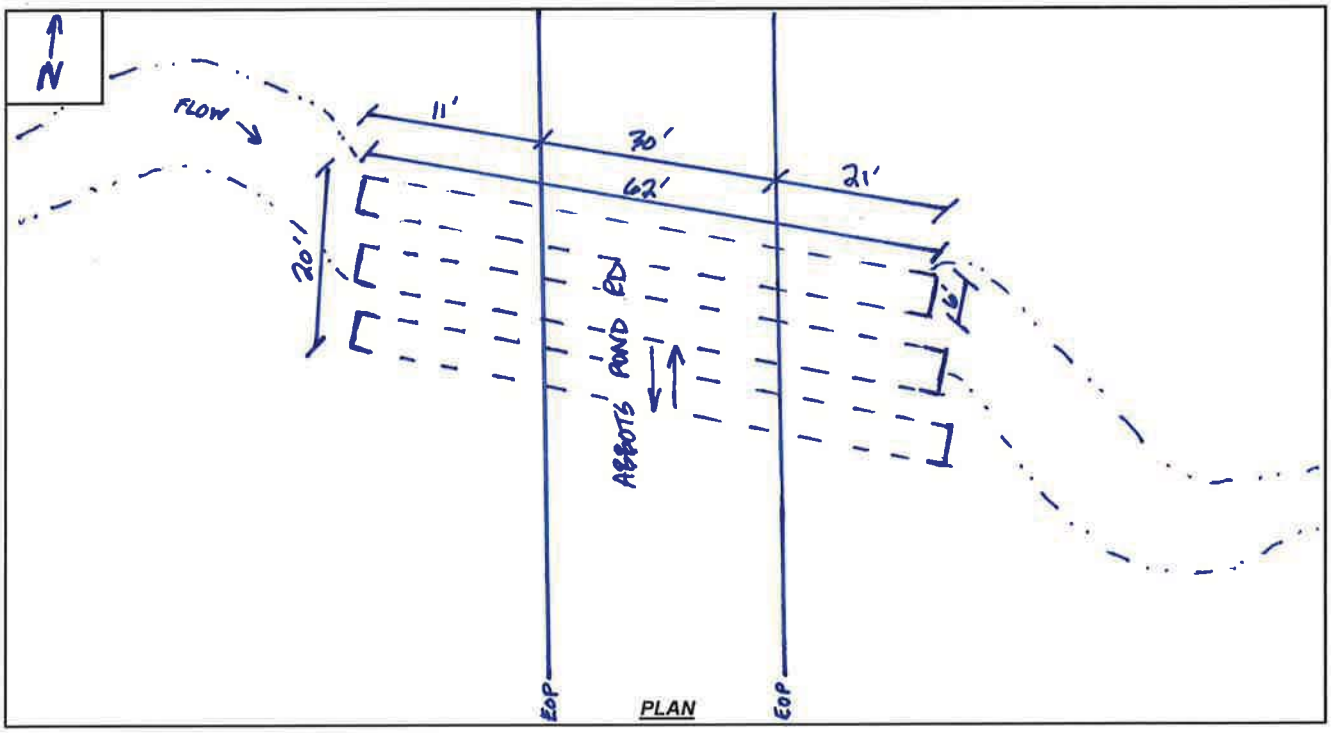
WATERWAY SKETCH SHEET

BR. I.D.: 2 - 442 - A

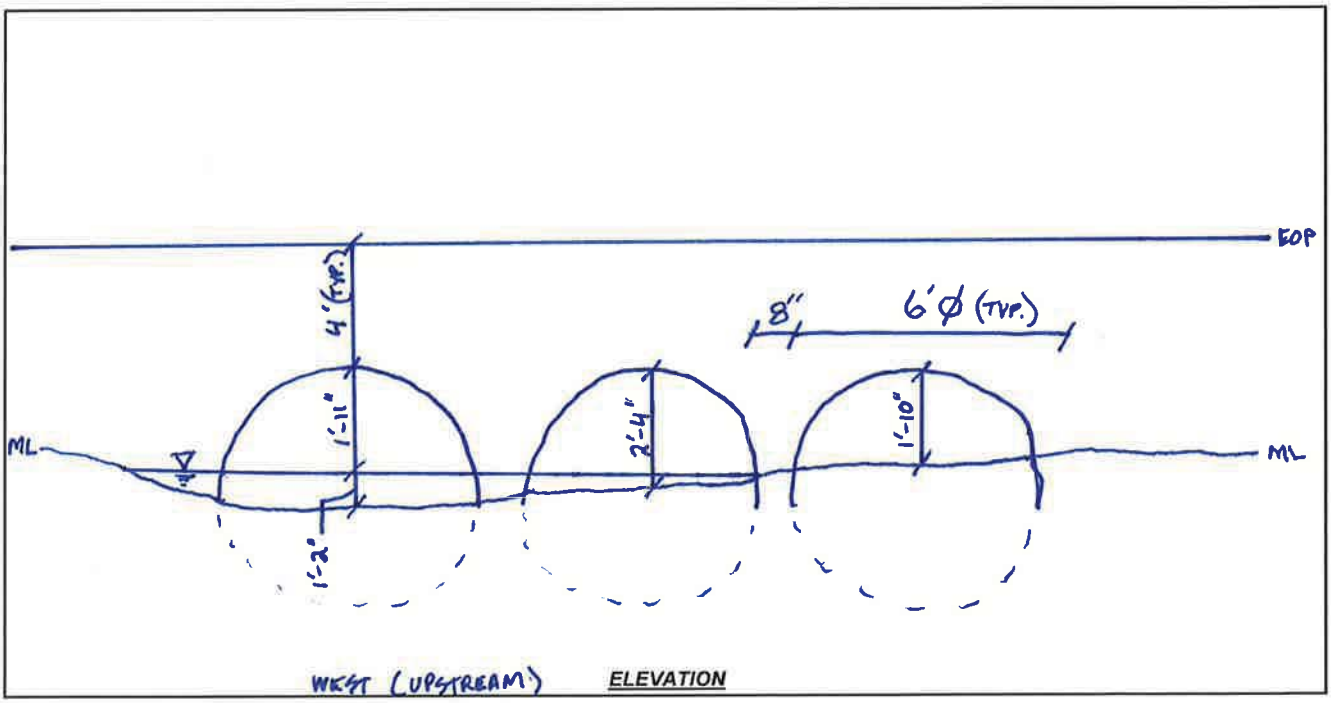
WATERWAY NAME: TANYROUGH BRANCH

DATE: 7 / 22 / 2014

INSPECTED BY: NRW / ATF / MJS /



PLAN



WEST (UPSTREAM) ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 69.9

IDENTIFICATION

Bridge ID: 3132 565
(2) District: 03
(3) County: 5
Inventory Route:
(4) Place Code: 17910
(A) On/Under: 1
(B) Highway Type: 4
(C) Service Lvl: 1
(D) Route No: 00565
(E) Direction: 0
6A) Features Intersected: GUM BRANCH
6B) Critical:
(7) Facility Carried: SUNNYSIDE RD.
(9) Location: EAST OF BRIDGEVILLE
11) Km. Point: 1.850 mi
16) Latitude: 38^45'6.96"
17) Longitude: 75^33'9.56"
98) Border Bridge Code: NA
99) Border Br. Str. No.: NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3
43B) DESIGN TYPE: 19
44A) APPR. SPAN MATERIAL: NA
44B) DESIGN TYPE: NA
45) Main Spans: 3
46) Approach Spans: 0
107) Deck Type: N
108A) Wearing Surface: N
108B) Membrane: N
108C) Deck Protection: N

Pier 1:	NA	**Pier 2:**	NA	**Pier Ftg. 1:**	NA	**Pier Ftg. 2:**	NA
Abut 1:	NA	**Abut 2:**	NA	**Abut Ftg. 1:**	NA	**Abut Ftg. 2:**	NA

NAVIGATION DATA

38) Navigational Control: 0
39) Vertical Clearance: 0.0 ft
40) Horizontal Clearance: 0.0 ft
111) Pier Protection: !
116) Lift Br. Vert. Clr: 0.0 ft

AGE AND SERVICE

19) Detour Length: 4 mi
27) Year Built: 1987
28) No. of Lanes:
A) On Bridge: 2
B) Under Bridge: 0
29) ADT: 328
30) Year of ADT: 2014
42) Type of Service:
A) On Bridge: 1
B) Under Bridge: 5
106) Year Reconst.:
109) % Truck ADT: 8

CLASSIFICATION

12) Base Hwy. Network: 0
13A) LRS Inv. Rte: NA
13B) LRS Subroute No.: NA
20) Toll Facility: 3
21) Maintenance: 1
22) Owner: 1
26) Functional Class: 09
37) Historical: 5
100) Defense Highway: 0
101) Parallel Str.: N
102) Direction: 2
103) Temp. Str.:
104) NHS: 0
105) Fed. Lands Highway: 0
110) Nat. Truck Network: 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5
41) Oper. Status: A
Rating Date: 3/9/2016
63) Oper. Rating Method: 0
64) Operating Rating: 60.0
65) Inv. Rating Method: 0
66) Inv. Rating: 36.0
70) Bridge Posting: 5
Reason of Posting: NA
Date of Resolution: NA
Rating Analysis Req'd: NA
S335: 0
S437: 0
T330: 0
T435: 0
T540: 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA
76) Length of Imp.: NA
94) Bridge Cost: NA
95) Roadway Cost: NA
96) Total Cost: NA
97) Year of Cost Est.: NA
114) Future ADT: 407
115) Year of Future ADT: 2037

CONTRACT INFORMATION

Contract 1: 8707305
Contract 2: -1
Contract 3: -1
Contract 4: -1
Contract 5: -1
Contract 6: -1

INSPECTION RECORD

90) Inspection Date: 8/5/2015 **91) Frequency:** 12 months **Next Inspection:** 8/5/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 12 months **Elem. Insp. Date:** 8/7/2013 **Next Elem Insp.:** 8/5/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 11
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 4 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 4 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 9.80 ft **49) Structure Length:** 35.25 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/5/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE (TL,S,R) /
J.MASTEN(I,P) ADDITIONAL MAXIMO
MAINTENANCE: B055-V1A: REMOVE DEBRIS AT
INLET OF SPAN#2.WO#

BRIDGE NOTES

NBI DONE BY: RMOORE ....NOTE: SCALE FACTOR ENTERED BY GRD ON 10/5/05, DO NOT CHANGE.... NOTE: A FIELD VISIT WAS MADE BY MJM & JEA ON 8/11/15 TO VERIFY PIPE CONDITION AND NBI CULVERT RATING. IT WAS DECIDED THAT THE NBI RATING IS NOW A 4, NOT A 3 AS RECOMMENDED BY THE INSPECTOR. THIS BRIDGE IS NOW ON A 12 MONTH INSPECTION FREQUENCY.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	264.00	0.00	164.00	85.00	15.00
817/1	Galvanizing Steel Protection	sq.ft	18,255.00	0.00	0.00	17,905.00	350.00
3440/1	Eff (Stl Protect Coat)	(LF)	5,564.12	0.00	0.00	5,457.44	106.68
1000/1	Corrosion	(LF)	262.00	0.00	162.00	85.00	15.00
1010/1	Cracking	(LF)	2.00	0.00	2.00	0.00	0.00

1. WEST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW SPAN#2 LOOKING SOUTH

4. UPSTREAM LOOKING NORTH

5. DOWNSTREAM LOOKING SOUTH

6. A/C WEARING SURFACE

7. SPAN#3 EXISTING HOLE AT NORTH END OF PIPE

8. SPAN#3 EASILY PERFORATED AT NORTH END

9. SPAN#2 CRACK / TEAR AT NORTH END OF PIPE

SCOUR RELATED DATA

For
Bridge: *3132 565*

Bridge ID: 3132 565 **Inspection Date:** 8/7/2013 **Region:** Rural
Waterway Name: GUM BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 7.55 ft **Depth of Flow:** 12.14 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** DERIS AT INLET OF SPAN#2
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: Yes **Sediment in Channel:** No **Cap. of Chnl:** Moderate
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

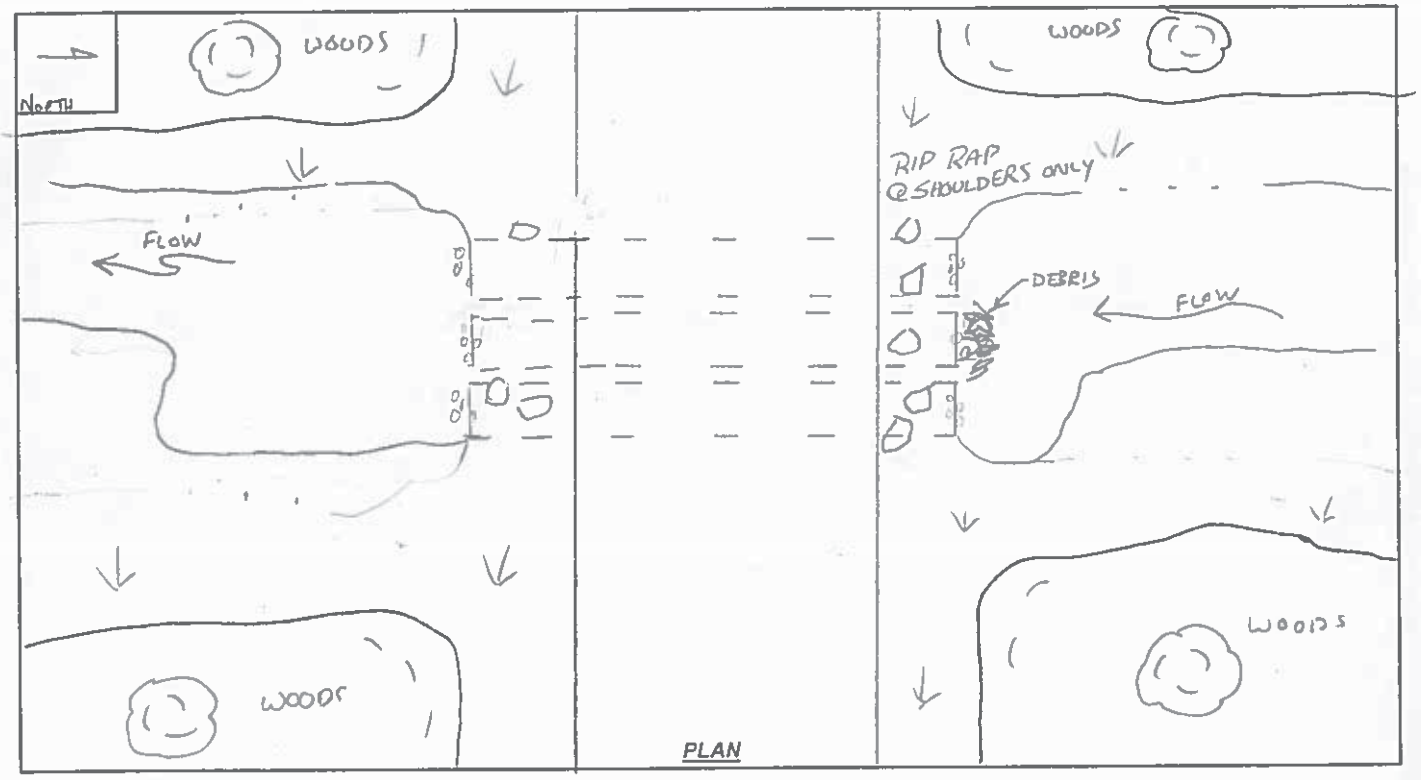
WATERWAY SKETCH SHEET

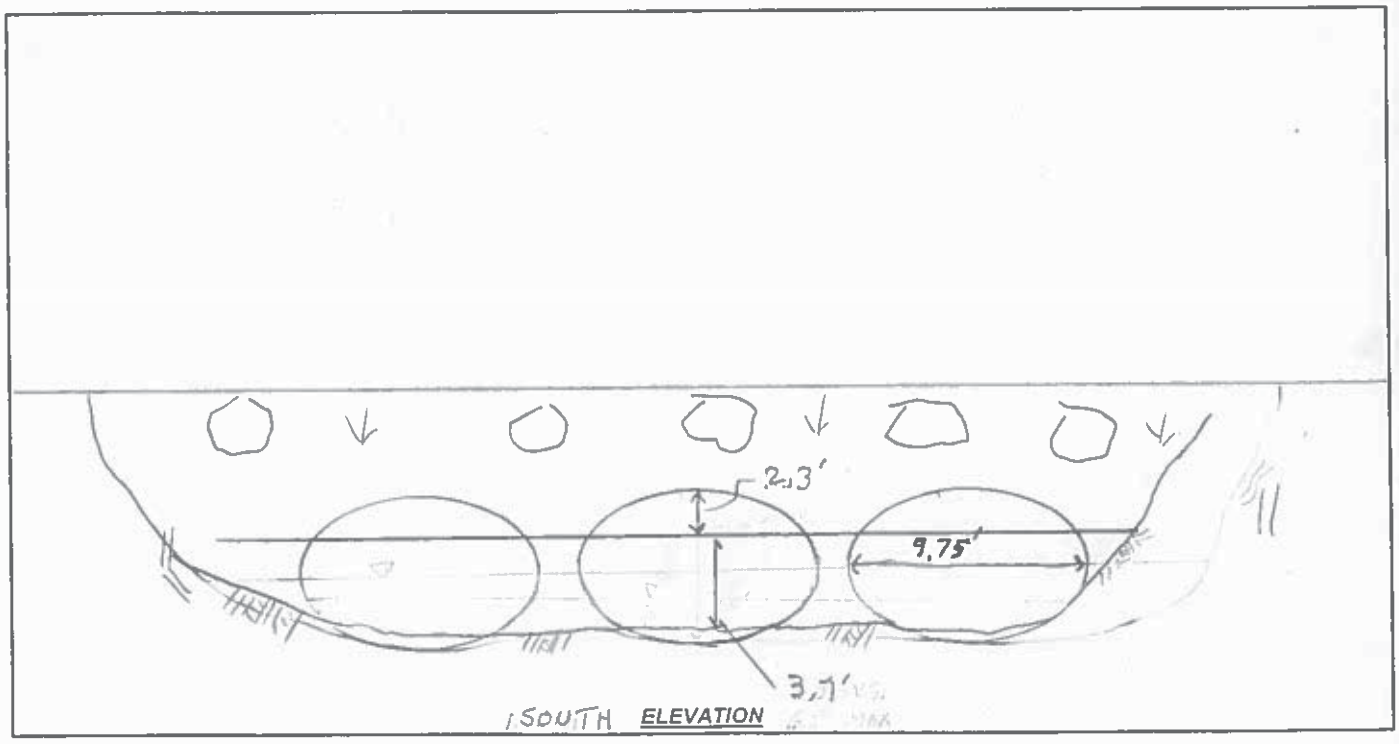
BR. ID.: 3 -132 -565

WATERWAY NAME: GUM BRANCH

DATE: 08 / 05 / 2015

INSPECTED BY: RM / JM / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 89.0

IDENTIFICATION

Bridge ID: 3139 597
(2) District: 03
(3) County: 5
Inventory Route:
(4) Place Code: 54800
(A) On/Under: 1
(B) Highway Type: 4
(C) Service Lvl: 1
(D) Route No: 00597
(E) Direction: 0
6A) Features Intersected: WEST BRANCH
6B) Critical:
(7) Facility Carried: TUCKERS RD.
(9) Location: NE OF BRIDGEVILLE
11) Km. Point: 1.951 mi
16) Latitude: 38^46'25.41"
17) Longitude: 75^31'37.62"
98) Border Bridge Code: NA
99) Border Br. Str. No.: NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3
43B) DESIGN TYPE: 19
44A) APPR. SPAN MATERIAL: NA
44B) DESIGN TYPE: NA
45) Main Spans: 3
46) Approach Spans: 0
107) Deck Type: N
108A) Wearing Surface: N
108B) Membrane: N
108C) Deck Protection: N
Pier 1: NA
Pier 2: NA
Pier Ftg. 1: NA
Pier Ftg. 2: NA
Abut 1: NA
Abut 2: NA
Abut Ftg. 1: NA
Abut Ftg. 2: NA

NAVIGATION DATA

38) Navigational Control: 0
39) Vertical Clearance: 0.0 ft
40) Horizontal Clearance: 0.0 ft
111) Pier Protection: !
116) Lift Br. Vert. Clr: 0.0 ft

AGE AND SERVICE

19) Detour Length: 3 mi
27) Year Built: 1970
28) No. of Lanes:
A) On Bridge: 2
B) Under Bridge: 0
29) ADT: 121
30) Year of ADT: 2014
42) Type of Service:
A) On Bridge: 1
B) Under Bridge: 5
106) Year Reconst.: -4
109) % Truck ADT: 8

CLASSIFICATION

12) Base Hwy. Network: 0
13A) LRS Inv. Rte: NA
13B) LRS Subroute No.: NA
20) Toll Facility: 3
21) Maintenance: 1
22) Owner: 1
26) Functional Class: 09
37) Historical: 5
100) Defense Highway: 0
101) Parallel Str.: N
102) Direction: 2
103) Temp. Str.:
104) NHS: 0
105) Fed. Lands Highway: 0
110) Nat. Truck Network: 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5
41) Oper. Status: A
Rating Date: 11/2/2005
63) Oper. Rating Method: 0
64) Operating Rating: 60.0
65) Inv. Rating Method: 0
66) Inv. Rating: 36.0
70) Bridge Posting: 5
Reason of Posting: NA
Date of Resolution: NA
Rating Analysis Req'd: NA
S335: 0
S437: 0
T330: 0
T435: 0
T540: 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA
76) Length of Imp.: NA
94) Bridge Cost: NA
95) Roadway Cost: NA
96) Total Cost: NA
97) Year of Cost Est.: NA
114) Future ADT: 150
115) Year of Future ADT: 2037

CONTRACT INFORMATION

Contract 1: N/A
Contract 2: -1
Contract 3: -1
Contract 4: -1
Contract 5: -1
Contract 6: -1

INSPECTION RECORD

90) Inspection Date: 8/14/2015 **91) Frequency:** 24 months **Next Inspection:** 8/14/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 8/15/2013 **Next Elem Insp.:** 8/14/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 11
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 18.00 ft **33) Median:** 0
34) Skew: 56^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 8.94 ft **49) Structure Length:** 30.82 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/14/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: G.MILLER(I,P) & R.MOORE
(TL,S,R) ADDITIONAL MAXIMO MAINTENANCE:
B054-S6D: REPAIR EROSION BEHIND
SOUTHWEST RIP RAP WALL. (WO#: 583387)

BRIDGE NOTES

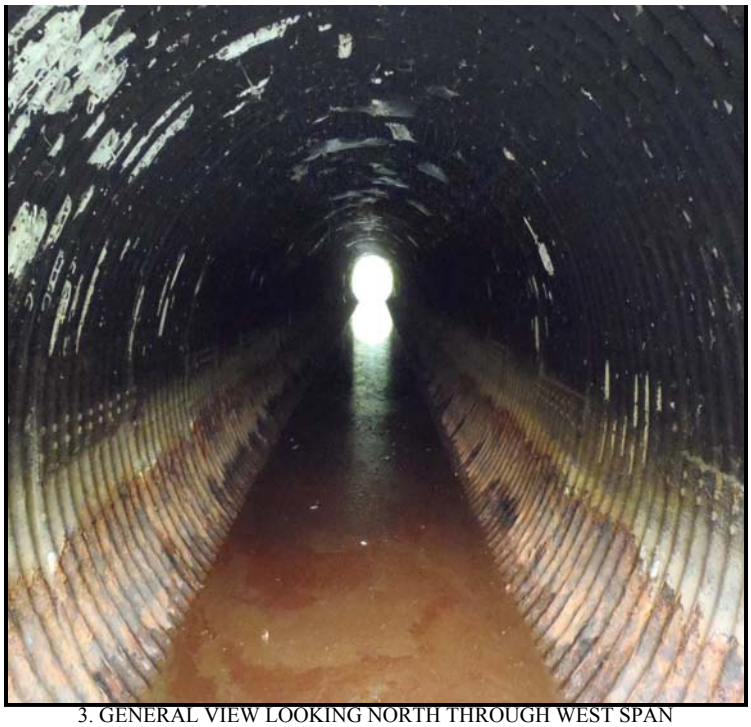
NBI DONE BY: DSOBOTA ....NOTE: SCALE FACTORS ENTERED BY GRD ON 10/5/05, DO
NOT CHANGE...

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/1	Steel Culvert	ft	240.00	0.00	238.00	0.00	2.00
817/1	Galvanizing Steel Protection	sq.ft	3,771.00	2,525.99	0.00	0.00	1,245.01
1000/1	Corrosion	ft	240.00	0.00	238.00	0.00	2.00
895/1	Grouted or Sacked Ri	(SF)	580.00	530.00	50.00	0.00	0.00
4000/1	Settlement	(SF)	50.00	0.00	50.00	0.00	0.00

1. WEST APPROACH

2. NORTH ELEVATION



3. GENERAL VIEW LOOKING NORTH THROUGH WEST SPAN

4. DOWNSTREAM LOOKING SOUTH

5. UPSTREAM LOOKING NORTH

6. TAR AND CHIP RIDING SURFACE

7. PERFORATION AT SOUTH END OF WEST PIPE

8. ELEVATION VIEW OF ROTATED RIPRAP AT SOUTHWEST

9. TOP VIEW OF SOUTHWEST RIPRAP ROTATION

SCOUR RELATED DATA

For
Bridge: *3139 597*

Bridge ID: 3139 597 **Inspection Date:** 8/15/2013 **Region:** Rural
Waterway Name: West Branch **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 13.78 ft **Depth of Flow:** 2.62 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:** HEAVY VEG.
Streambed: G **Comments:**
Embankment: F **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: None **Abutment:** None **Bents:** None

SCOUR SHEET

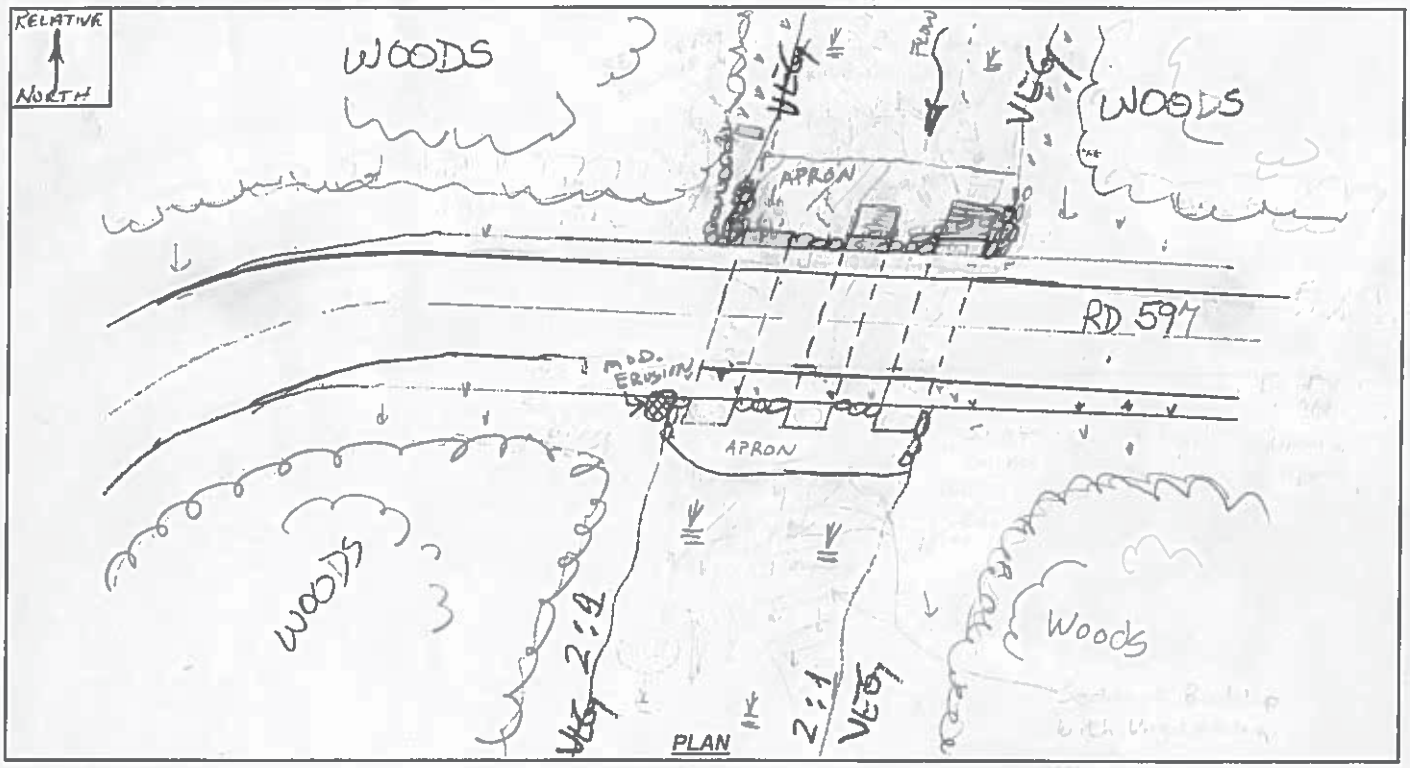
WATERWAY SKETCH SHEET

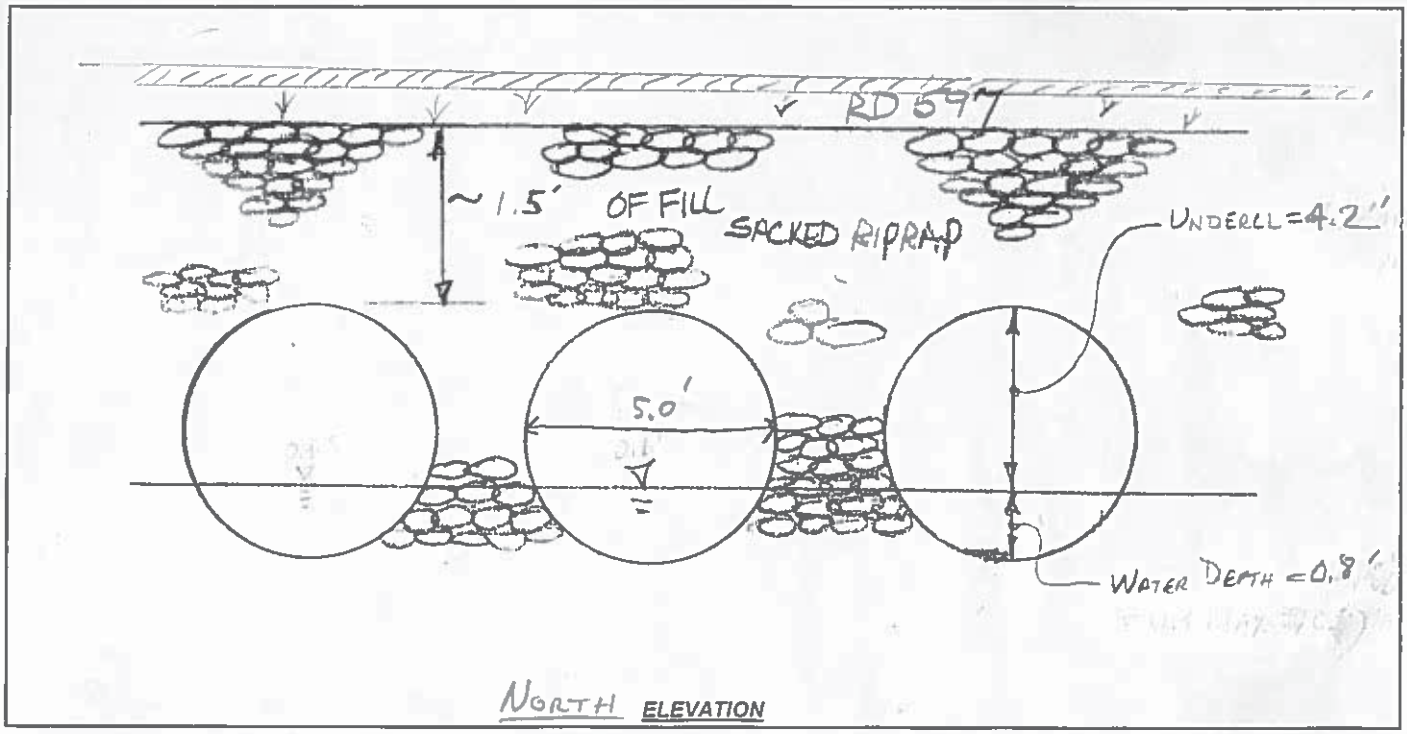
BR. I.D.: 3-139-597

WATERWAY NAME: WEST BRANCH.

DATE: 08/14/2015

INSPECTED BY: RM / GM / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 96.6

IDENTIFICATION

Bridge ID: 3236 046 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 40295
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00046 **(E) Direction:** 0
6A) Features Intersected: CLEAR BROOK **6B) Critical:**
(7) Facility Carried: ELKS RD.
(9) Location: NORTH OF SEAFORD **11) Km. Point:** 0.379 mi
16) Latitude: 38^41'29.70" **17) Longitude:** 75^35'58.78"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi **27) Year Built:** 1982
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 5773 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 3/14/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 7175 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 8207304 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 7/7/2015 **91) Frequency:** 24 months **Next Inspection:** 7/7/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: 48 months **93B) UW Insp. Date:** 6/27/2013 **Next UW Insp.:** 6/27/2017
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 6/27/2013 **Next Elem Insp.:** 7/7/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 11
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** N
62) Culvert: 6 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.30 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 9.75 ft **49) Structure Length:** 35.25 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 7/7/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,I,P) G.MILLER (S,R) ALLIGATOR CRACKING WAS TYPICAL IN BOTH LANES OF THE ROADWAY, GENERALLY 1/16 INCH WIDE, 1/8 INCH WIDE MAX. A 7 FEET BY 6 FEET AREA OF PATCHED CONCRETE HAD FAILED AT THE SOUTHEAST CORNER OF THE ROADWAY. A 3 FOOT DIAMETER AREA OF ASPHALT FAILURE CAUSED BY EROSION WAS LOCATED AT THE SOUTHWEST CORNER OF THE ROADWAY. THE 5TH AND 6TH SOUTH GUARDRAIL POSTS FROM THE WEST WERE TWISTED. THE SOUTH GUARDRAIL EXHIBITED MINOR ISOLATED IMPACT DAMAGE (SEE PHOTOS 10 THROUGH 14). MAINTENANCE: IT IS RECOMMENDED THAT THE 7 FEET BY 6 FEET AREA OF SETTLED ASPHALT IN THE SOUTHEAST CORNER OF THE ROADWAY BE REPAIRED.

BRIDGE NOTES

NBI DONE BY: DSOBOTA ....NOTE: SCALE FACTORS ENTERED BY GRD ON 10/6/05, DO NOT CHANGE..... NOTE: BRIDGE IS MARKED AS UNDERWATER DUE TO LOW-CLEARANCE INSPECTION.

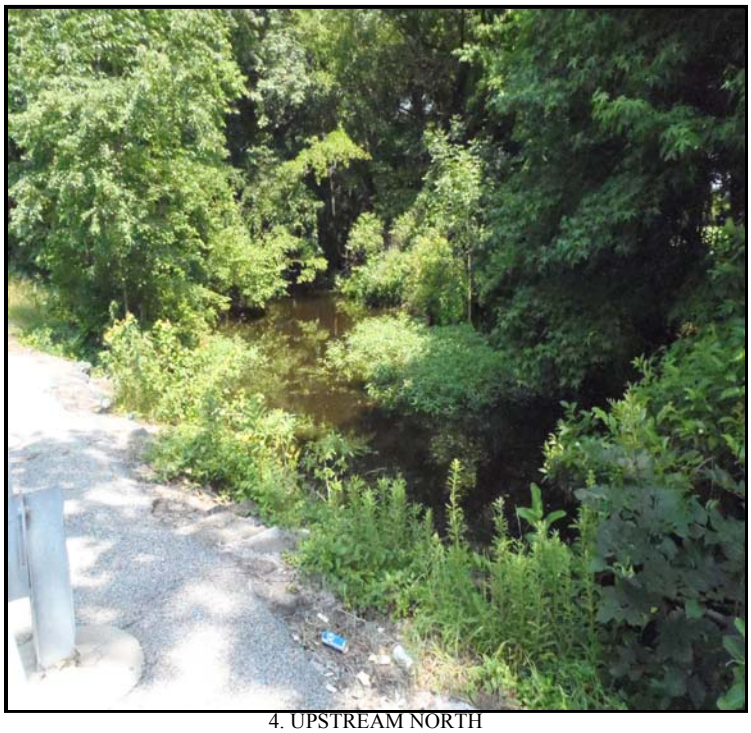
PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	207.00	0.00	207.00	0.00	0.00
817/1	Galvanizing Steel Protection	sq.ft	14,312.99	13,712.99	0.00	0.00	600.00
1000/1	Corrosion	(LF)	69.00	0.00	69.00	0.00	0.00

1. EAST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW SPAN-3 LOOKING SOUTH



4. UPSTREAM NORTH

5. DOWNSTREAM SOUTH

6. A/C WEARING SURFACE

SCOUR RELATED DATA

For
Bridge: *3236 046*

Bridge ID: 3236 046 **Inspection Date:** 6/27/2013 **Region:** Rural
Waterway Name: TRIB. TO HEARNS POND **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 8.20 ft **Depth of Flow:** 13.45 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: F **Comments:** SOFT SEDIMENT IN CELLS ~0.5 FEET AVG.
Embankment: G **Comments:** SOFT SEDIMENT IN CELLS ~0.5 FEET AVG.
Fender System: **Comments:** SOFT SEDIMENT IN CELLS ~0.5 FEET AVG.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

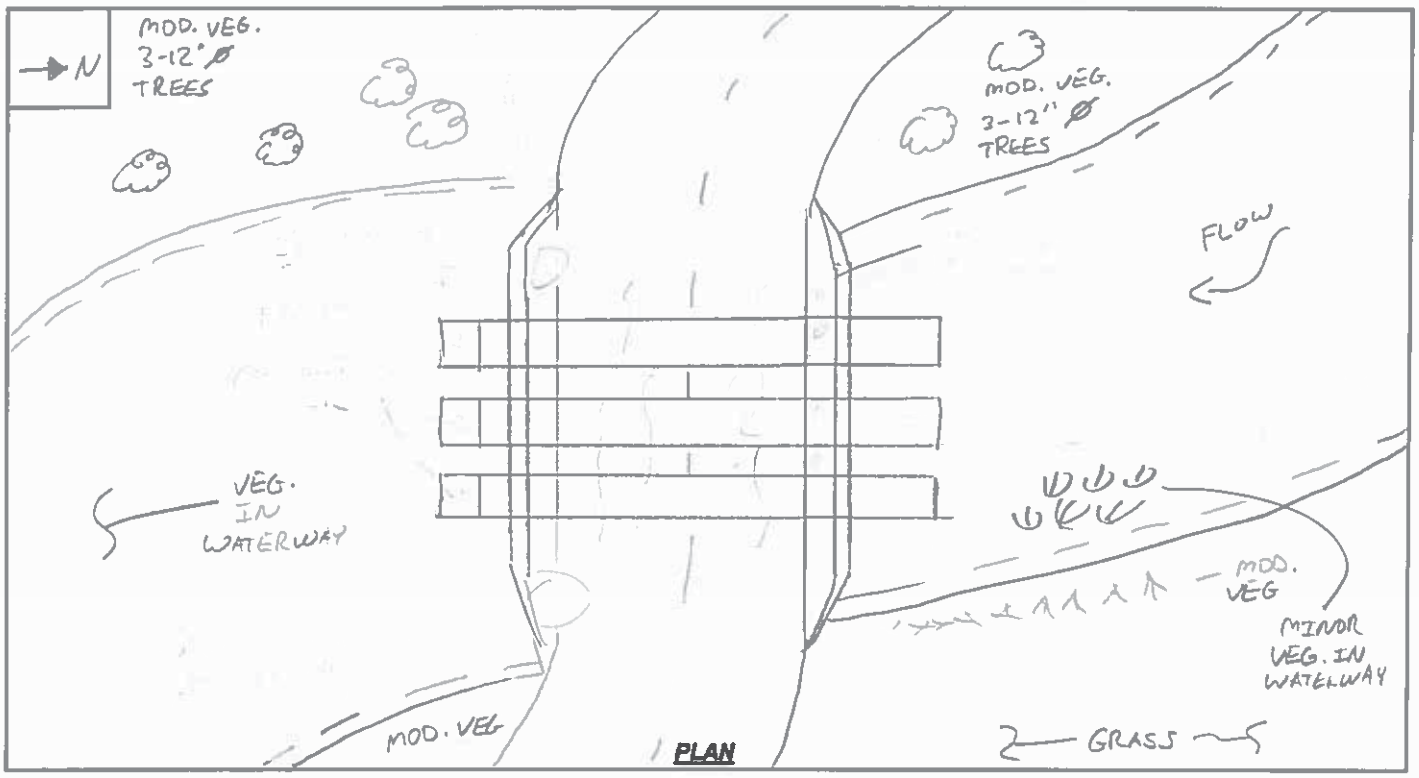
LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

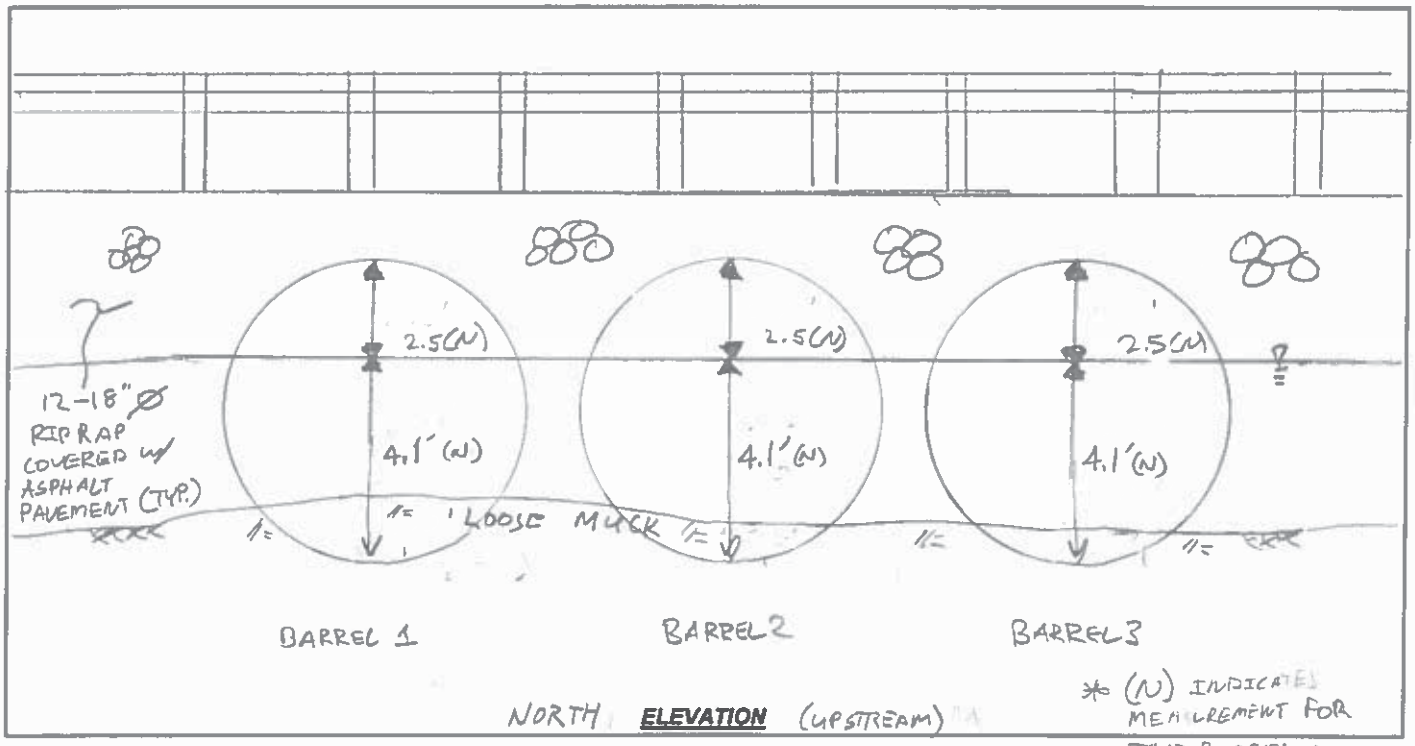
WATERWAY SKETCH SHEET

BR. I.D.: 3-236-046 **WATERWAY NAME:** SWAIN & TRUITT DITCH

DATE: 7/7/2015 **INSPECTED BY:** GM / RM / /



PLAN



NORTH **ELEVATION** (UPSTREAM)

* (N) INDICATES MEASUREMENT FOR THAT BARREL AT NORTH END

STRUCTURAL DATA RECORD

Sufficiency Rating: 88.6

IDENTIFICATION

Bridge ID: 3317 024 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 76585
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00024 **(E) Direction:** 0
6A) Features Intersected: TRIB. TO TRAP POND **6B) Critical:**
(7) Facility Carried: SR 24 / LAUREL RD
(9) Location: N/E OF TRAP POND **11) Km. Point:** 14.600 mi
16) Latitude: 38^32'5.87" **17) Longitude:** 75^27'29.31"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: 1 **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi **27) Year Built:** 2001
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 5147 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 07 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 11/7/2005
63) Oper. Rating Method: 1 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 1 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 6397 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: CS 25 **Contract 2:** 1001 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 11/3/2014 **91) Frequency:** 24 months **Next Inspection:** 11/3/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 11/3/2014 **Next Elem Insp.:** 11/3/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 15
Boat: N **Tidal:** N **GPS:** N

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** X
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 8 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 38.50 ft **33) Median:** 0
34) Skew: 35^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 5.50 ft **49) Structure Length:** 12.20 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 11/3/2014 **Type:** 1 **Inspector:** GMILLER

INSPECTION NOTES

INSPECTED BY: GMILLER(TL,I,P) &
CKURSINSKY(S,R) MAXIMO REQ.: B054-
S6D...REPAIR EROSION HOLES IN SHOULDER
AREAS, PRIMARILLY IN SOUTH SHOULDER AREA
DUE TO LOSS OF FILL WITHIN BOTH PIPES.
(WO#: 665679) B055-V1A...REMOVE
DEBRIS/TIRE FROM INLET. (WO#:399990)
[WAPPR]

BRIDGE NOTES

NBI DONE BY: RICK MOORE ....NOTE: SCALE FACTORS ENTERED BY GRD ON 11/08/05,
DO NOT CHANGE....

PONTIS DATA

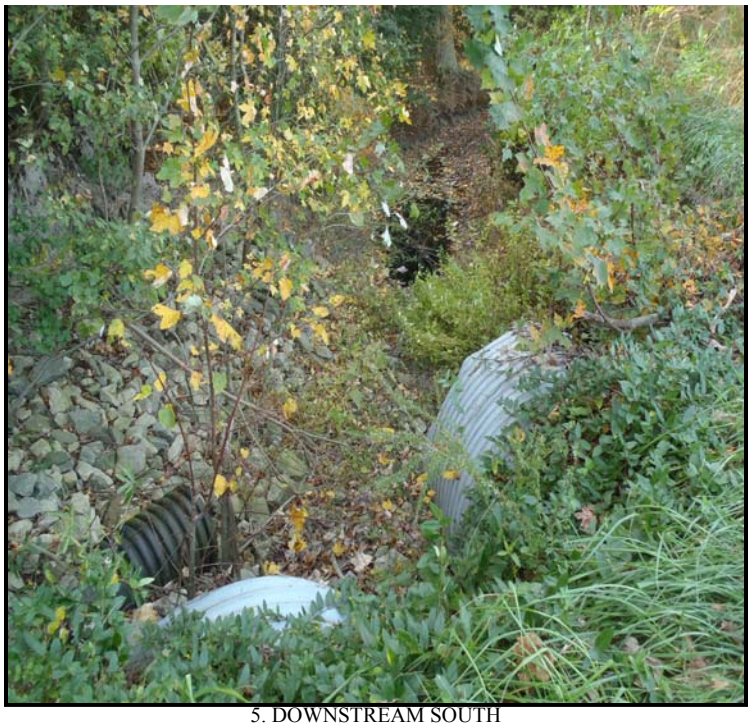
Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	150.00	116.00	7.00	25.00	2.00
817/2	Galvanizing Steel Protection	sq.ft	1,292.05	1,292.05	0.00	0.00	0.00

1. WEST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW FACING SOUTH THROUGH EAST SPAN

4. UPSTREAM NORTH



5. DOWNSTREAM SOUTH

6. WEARING SURFACE FACING NORTH

7. PRE-EXISTING PERFORATIONS @ 10' IN FROM SOUTH END OF EAST SPAN

8. ACTIVE CORROSION EASILY PERFORATED w/ PICK HAMMER @ SOUTH END OF EAST SPAN

9. EVIDENCE OF FILL LOSS @ SOUTH END OF EAST PIPE @ JOINT

10. EROSION/ SINK HOLE OVER JOINT w/ FILL LOSS WITHIN EAST SPAN, SOUTH END

SCOUR RELATED DATA

For
Bridge: *3317 024*

Bridge ID: 3317 024 **Inspection Date:** 11/3/2014 **Region:** Rural
Waterway Name: TRIB. TO TRAP POND **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 3.40 ft **Depth of Flow:** 0.60 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

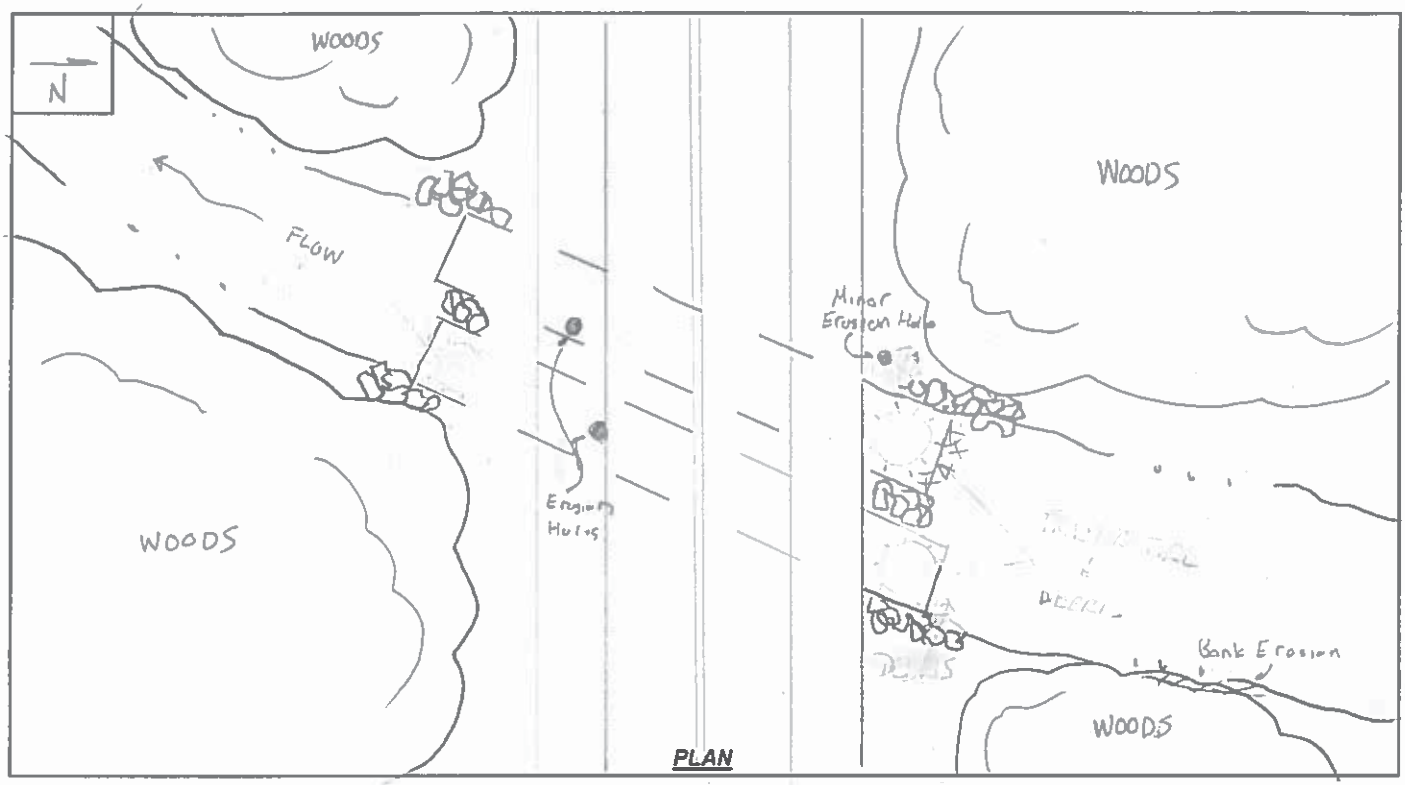
WATERWAY SKETCH SHEET

BR. ID.: 3 - 317 - 024

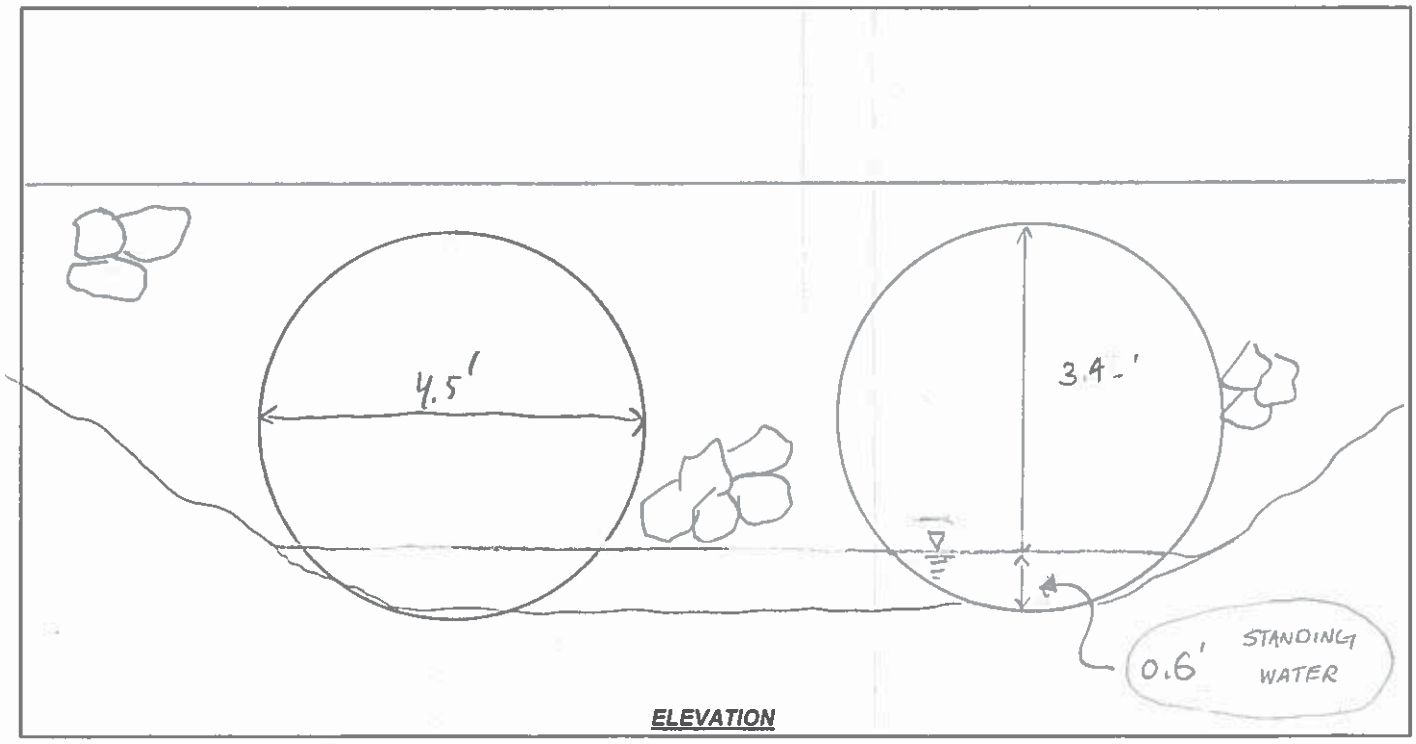
WATERWAY NAME: Trib. to Trap Pond

DATE: 11 / 03 / 14

INSPECTED BY: CK / GM / /



PLAN



ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 85.9

IDENTIFICATION

Bridge ID: 3323 447 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 47090
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00447 **(E) Direction:** 0
6A) Features Intersected: WILEYS POND **6B) Critical:**
(7) Facility Carried: JOHNSON RD.
(9) Location: EAST OF LAUREL **11) Km. Point:** 3.580 mi
16) Latitude: 38^34'27.05" **17) Longitude:** 75^31'10.98"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 1 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: 1 **Abut 2:** NA **Abut Ftg. 1:** G **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 5 mi **27) Year Built:** 1987
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 184 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 6 **41) Oper. Status:** A **Rating Date:** 3/14/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 230 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 8507302 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 5/26/2015 **91) Frequency:** 24 months **Next Inspection:** 5/26/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 5/29/2013 **Next Elem Insp.:** 5/26/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 14
Boat: Y **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 4 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 6
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.00 ft **33) Median:** 0
34) Skew: 9^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 22.00 ft **49) Structure Length:** 22.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 5/26/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,I,P) / N.DRAPER (S,R) NOTES: TALKED TO CALVIN WEBER ON 5/29/13 AND HE STATED THAT DISTRICT WAS INFORMED TO REPAIR SCOUR BUT THEY WERE UNABLE TO DUE TO WATER DEPTHS. THERE WAS A MINOR SINK HOLE IN THE PATCH FROM LAST INSPECTION. THIS SHOULD BE MONITORED FOR THE TIME BEING. *NOTE: MONITOR PATCHED AREA IN ROADWAY 2015 ADDITIONAL MAXIMO MAINTENANCE: NONE

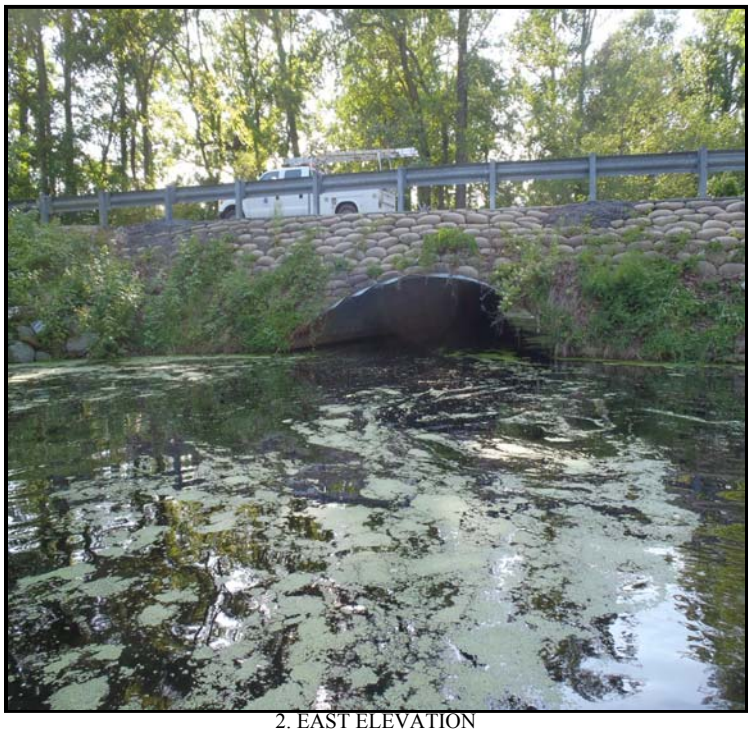
BRIDGE NOTES

NBI DONE BY: NICK WARD ....SCALE FACTORS ENTERED BY GRD -- DO NOT CHANGE OR ERASE.... NOTE: CALVIN IS WORKING WITH ENVIRONTAL SECTION AND THE DISTRICT TO SEE WHAT CAN BE DONE TO REPAIR THE SCOUR.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
220/2	Re Conc Pile Cap/Ftg	ft	112.00	0.00	82.00	30.00	0.00
6000/2	Scour	ft	112.00	0.00	82.00	30.00	0.00
844/2	Maj Mtl Culv	(LF)	56.00	0.00	56.00	0.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	12,705.00	6,352.00	6,353.00	0.00	0.00
1000/2	Corrosion	(LF)	56.00	0.00	56.00	0.00	0.00
895/2	Grouted or Sacked Ri	(SF)	400.00	400.00	0.00	0.00	0.00

1. SOUTH APPROACH



2. EAST ELEVATION

3. GENERAL VIEW LOOKING WEST

4. DOWNSTREAM LOOKING WEST

5. UPSTREAM LOOKING EAST

6. A/C WEARING SURFACE W/ PATCH OVER S. APPROACH

SCOUR RELATED DATA

For
Bridge: *3323 447*

Bridge ID: 3323 447 **Inspection Date:** 5/29/2013 **Region:** Rural
Waterway Name: WILEYS POND **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 11.48 ft **Depth of Flow:** 16.67 ft

ARMORING
Abutment: No Armoring **Piers:** No Armoring
Upstream Channel: No Armoring **Wingwalls:** No Armoring
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Piles > 20 ft **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:** SMALL BEAVER DAM AT OUTLET BUT BEYOND ONE SPAN LENGTH
Streambed: P **Comments:** MODERATE SCOUR EXPOSING BOTH FOOTINGS WITH UNDERMINING.
Embankment: G **Comments:** MODERATE SCOUR EXPOSING BOTH FOOTINGS WITH UNDERMINING.
Fender System: **Comments:** MODERATE SCOUR EXPOSING BOTH FOOTINGS WITH UNDERMINING.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** Moderate **Bents:**

SCOUR SHEET

SOUNDING SHEET

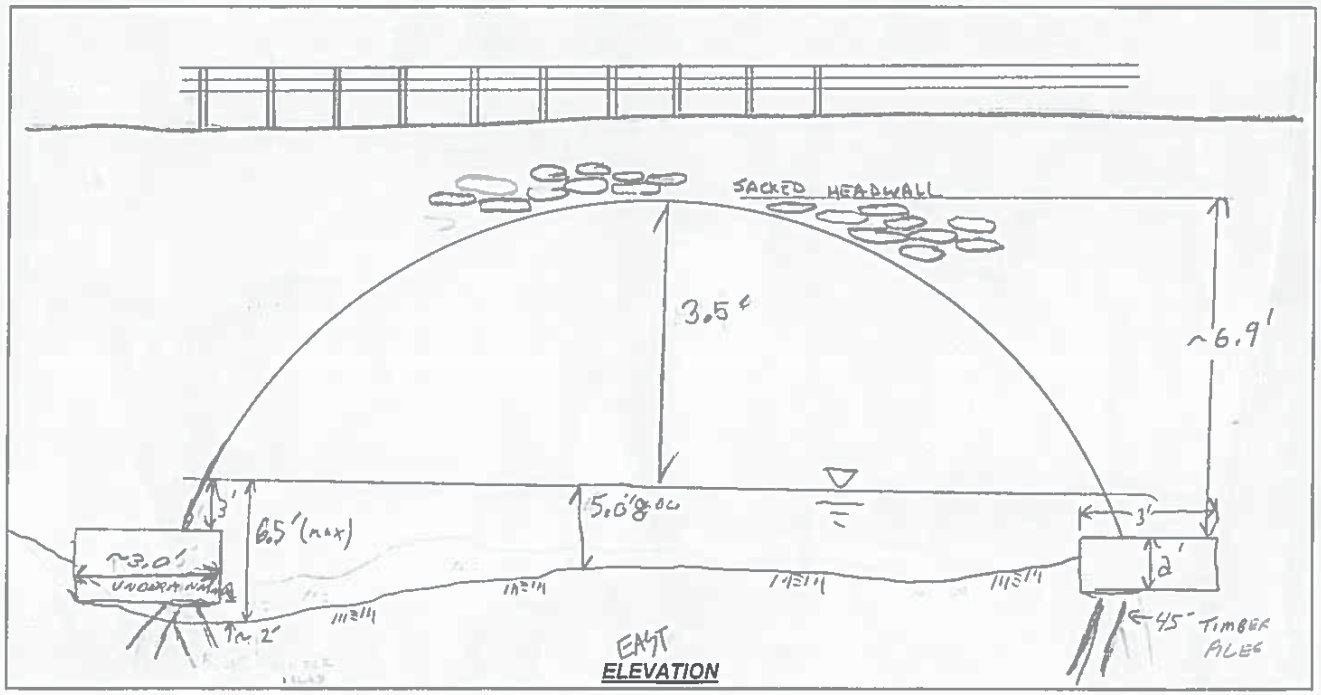
WATERWAY SKETCH SHEET

BR. I.D.: 3 - 323 - 447

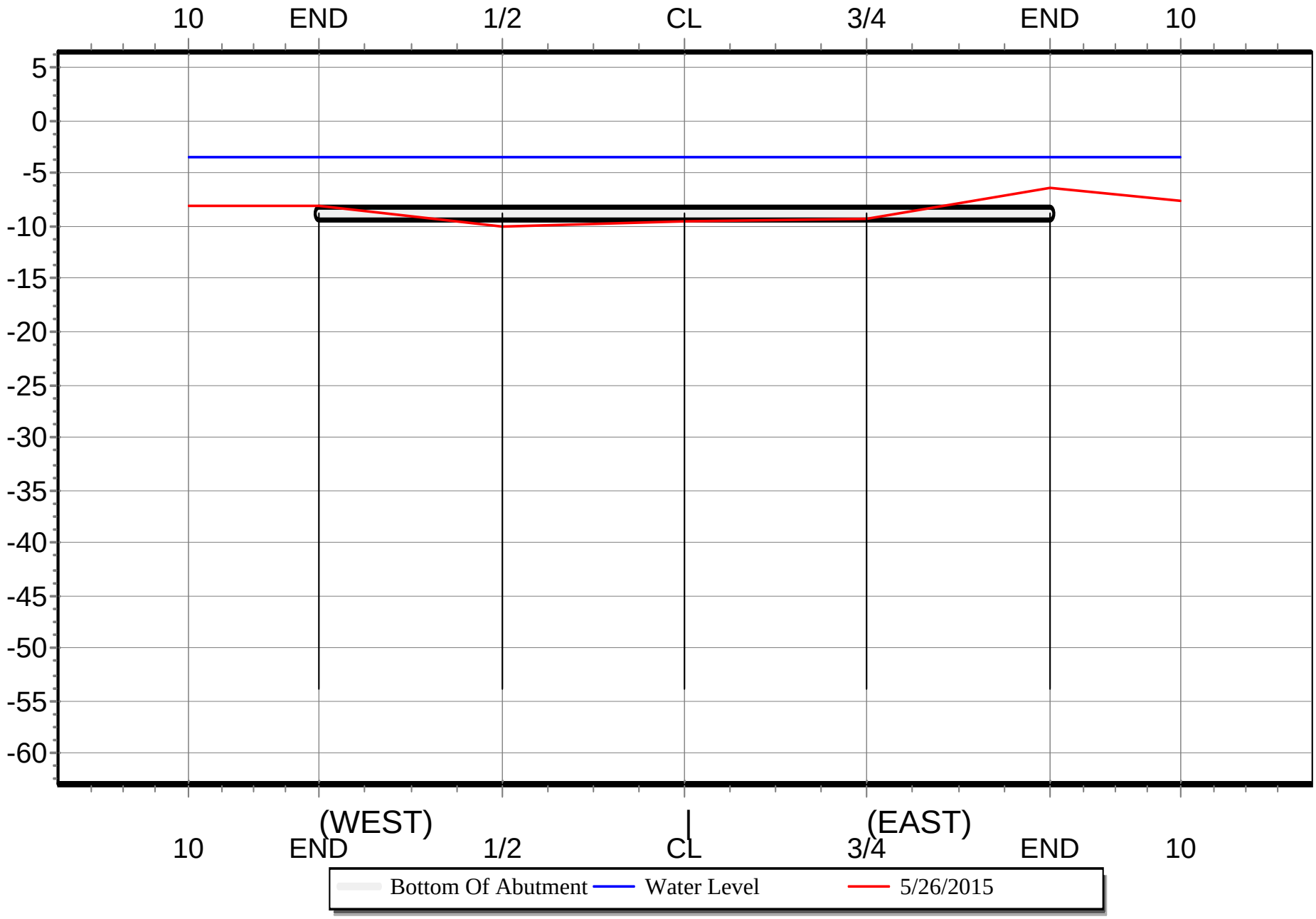
WATERWAY NAME: WILEYS POND

DATE: 5 / 26 / 2015

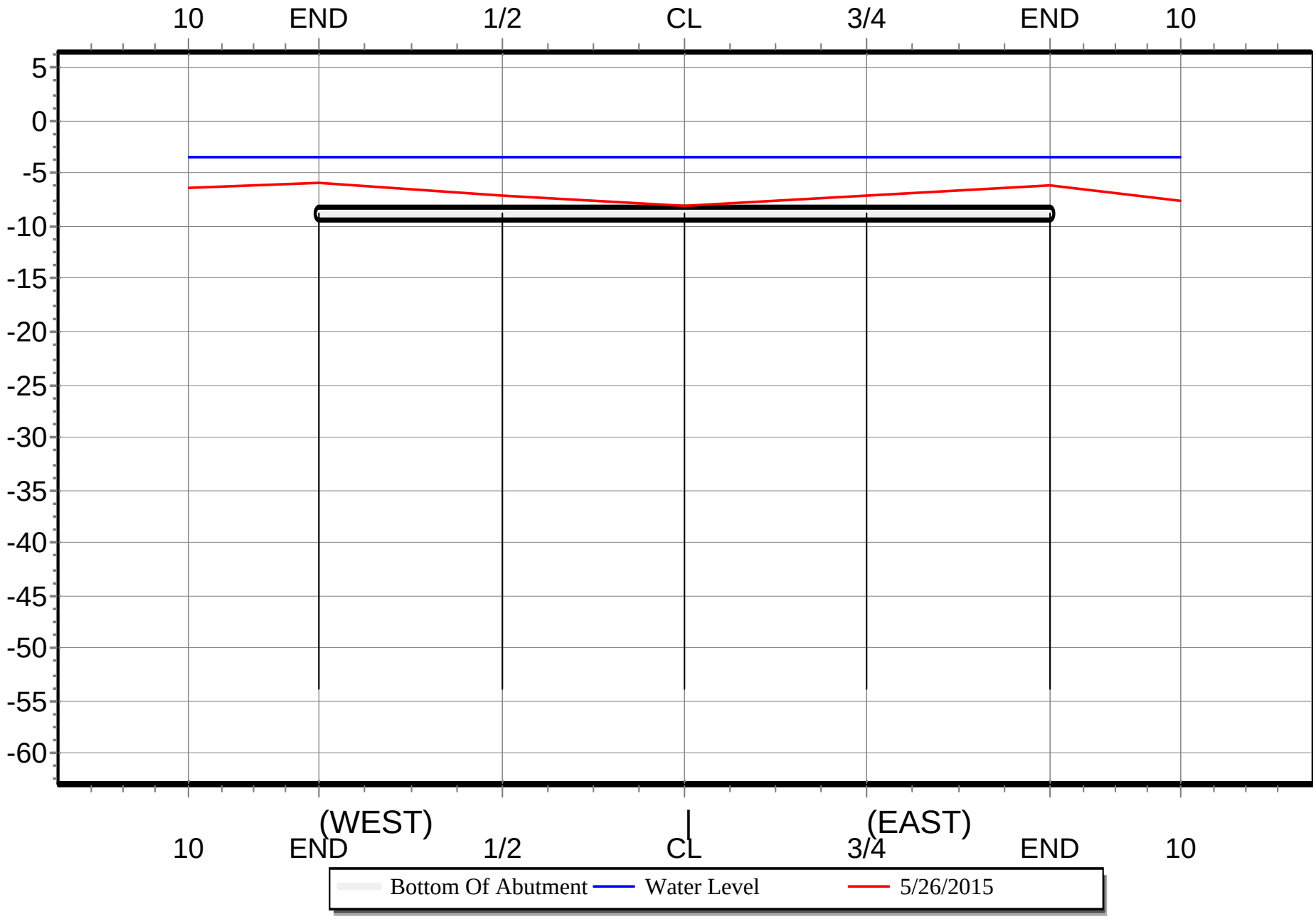
INSPECTED BY: ND / RM



ile Along Unit # 1 - SOUTH ABUTMENT For Bridge No.3323

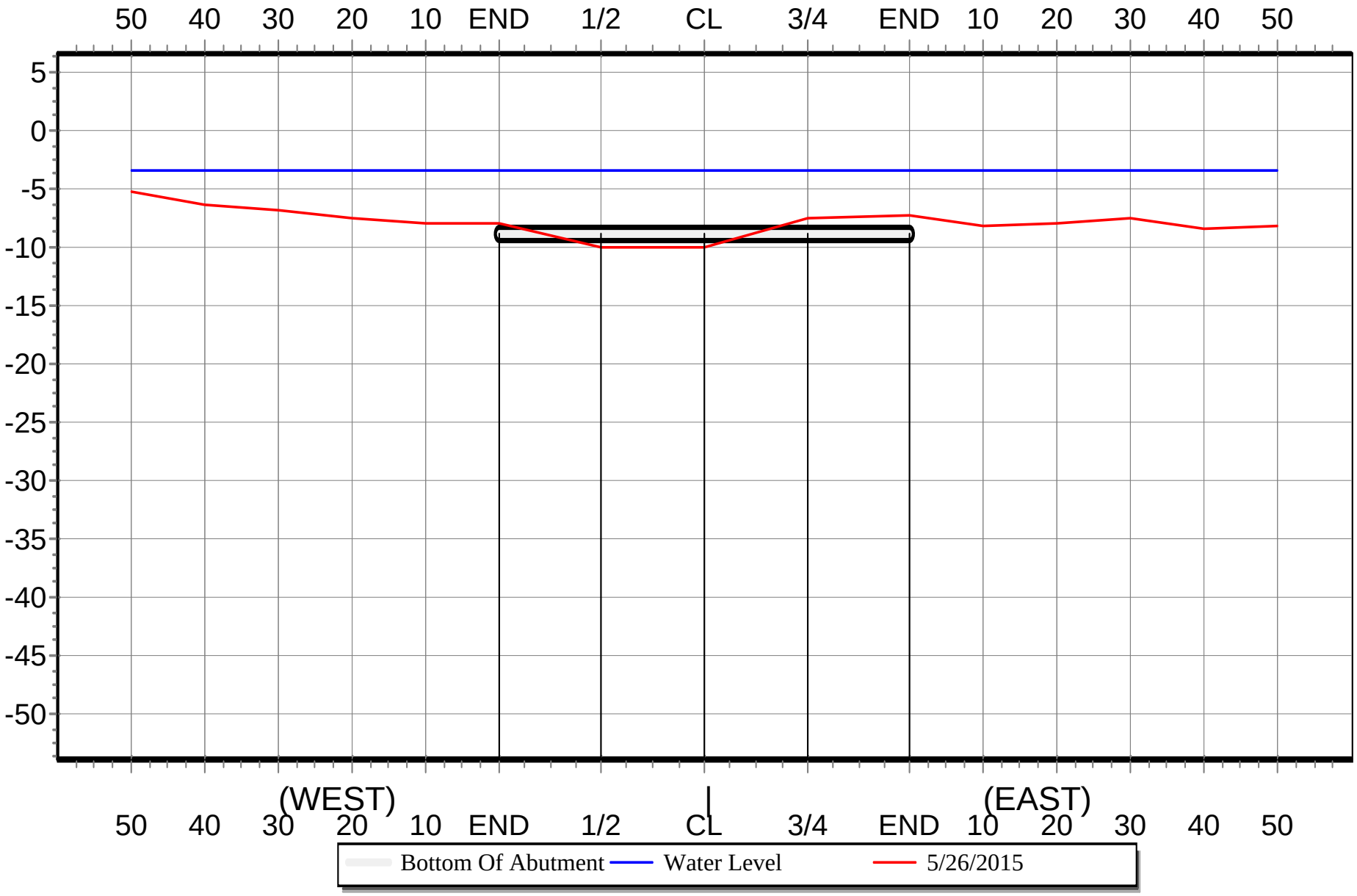


ile Along Unit # 4 - NORTH ABUTMENT For Bridge No.3323



Thalweg Profile for 3323 447

Thalweg is in Span No. 1



STRUCTURAL DATA RECORD

Sufficiency Rating: 88.9

IDENTIFICATION

Bridge ID: 3335 515 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 03350
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00515 **(E) Direction:** 0
6A) Features Intersected: MEADOW BRANCH **6B) Critical:**
(7) Facility Carried: BACONS RD
(9) Location: N. OF DELMAR **11) Km. Point:** 2.672 mi
16) Latitude: 38^30'22.91" **17) Longitude:** 75^34'38.41"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1989
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 291 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 11/7/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: 31 **76) Length of Imp.:** NA
94) Bridge Cost: 800000 **95) Roadway Cost:** 200000
96) Total Cost: 1000000 **97) Year of Cost Est.:** 2005
114) Future ADT: 361 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: 301 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 9/18/2014 **91) Frequency:** 24 months **Next Inspection:** 9/18/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 9/18/2014 **Next Elem Insp.:** 9/18/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 14
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 5 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.00 ft **49) Structure Length:** 22.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/18/2014 **Type:** 1 **Inspector:** RMOORE

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,I,P)
M.SCHLITTER(S,R) W.MULHERN ADDITIONAL
MAXIMO MAINTENANCE: NONE

BRIDGE NOTES

NBI DONE BY: ANDY CONKLIN ....NOTE: SCALE FACTORS ENTERED BY GRD ON 02/21/07, DO NOT CHANGE OR ERASE....

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	186.00	0.00	125.00	25.00	36.00
817/2	Galvanizing Steel Protection	sq.ft	1,602.14	1,602.14	0.00	0.00	0.00

1. WEST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW SPAN#2 LOOKING NORTH

4. UPSTREAM LOOKING SOUTH

5. DOWNSTREAM LOOKING NORTH

6. A/C WEARING SURFACE

7. EXISTING PERFORATIONS AT SOUTH END

8. SPAN#2 EASILY PERFORATED AT WATERLINE W/ PICK HAMMER

SCOUR RELATED DATA

For
Bridge: *3335 515*

Bridge ID: 3335 515 **Inspection Date:** 9/18/2014 **Region:** Rural
Waterway Name: MEADOW BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 4.30 ft **Depth of Flow:** 1.70 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:** SLIGHT SEDIMENT UPSTREAM AND DOWNSTREAM IN THE CHANNEL.
Embankment: F **Comments:** SLIGHT SEDIMENT UPSTREAM AND DOWNSTREAM IN THE CHANNEL.
Fender System: **Comments:** SLIGHT SEDIMENT UPSTREAM AND DOWNSTREAM IN THE CHANNEL.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Failure **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

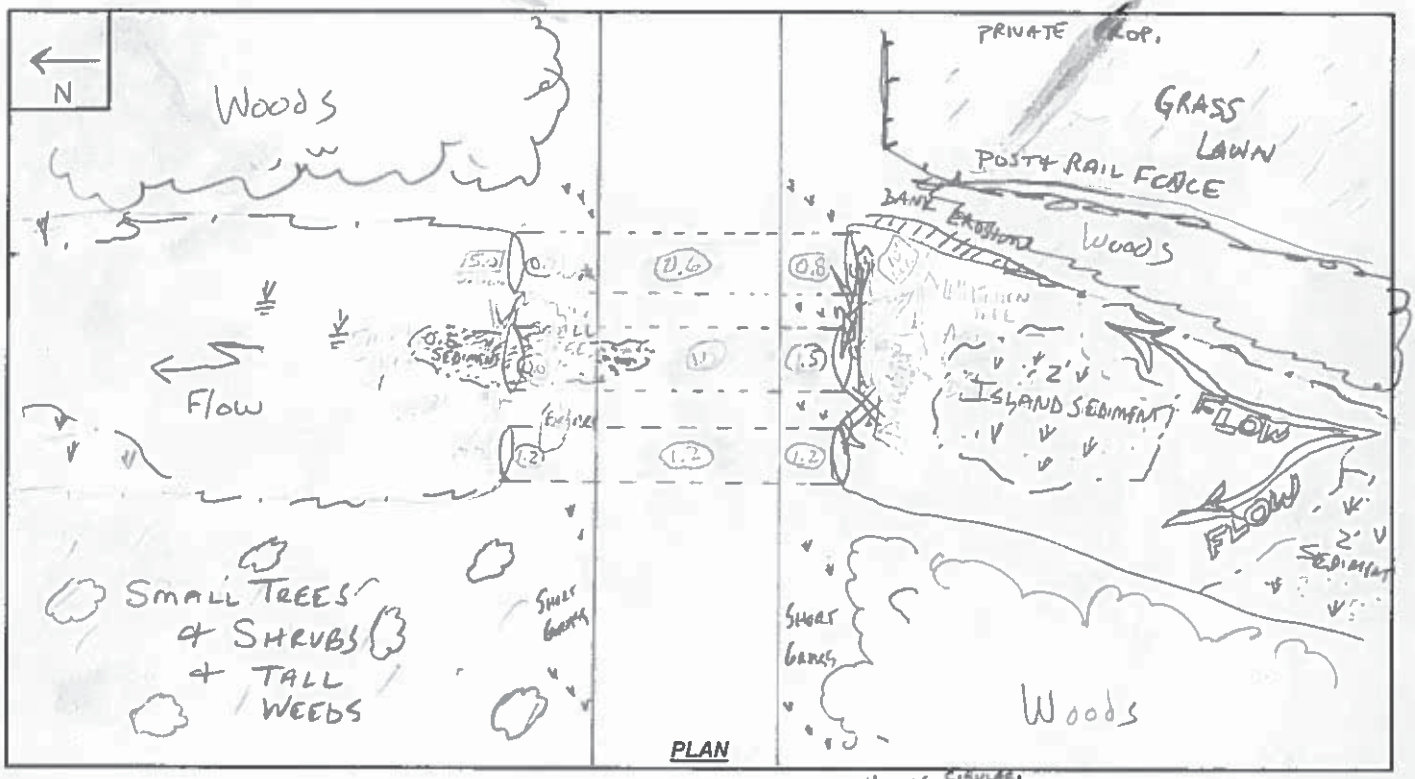
WATERWAY SKETCH SHEET

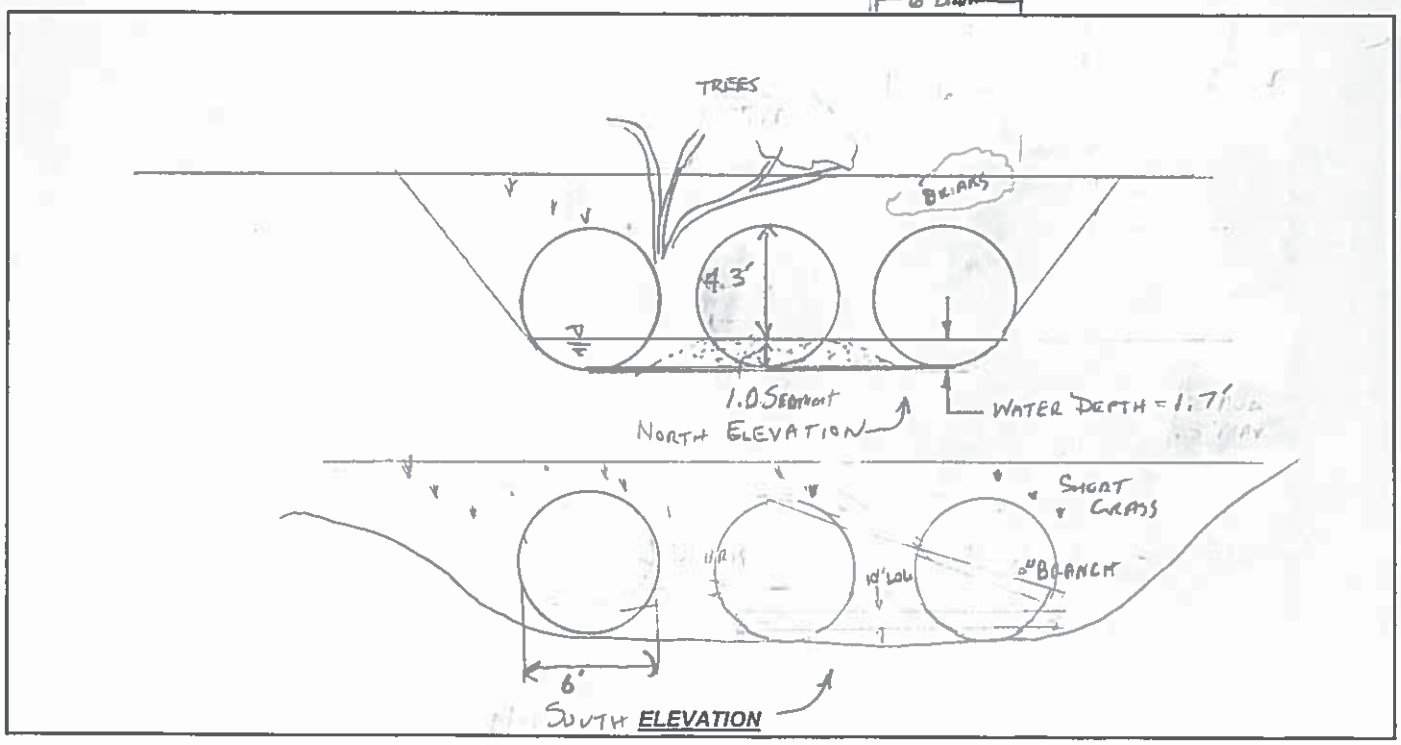
BR. ID.: 3 - 335 - 515

WATERWAY NAME: Meadow Branch

DATE: 09 / 18 / 14

INSPECTED BY: MS / RM / WM /





STRUCTURAL DATA RECORD

Sufficiency Rating: 85.2

IDENTIFICATION

Bridge ID: 3441 382 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 54440
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00020 **(E) Direction:** 0
6A) Features Intersected: HERRING BRANCH **6B) Critical:**
(7) Facility Carried: ARMORY RD.
(9) Location: E. OF DAGSBORO **11) Km. Point:** 8.020 mi
16) Latitude: 38^32'27.33" **17) Longitude:** 75^13'17.50"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1969
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 5913 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 07 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 6/15/2009
63) Oper. Rating Method: 5 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 5 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 7419 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: UNKNOWN **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 6/11/2015 **91) Frequency:** 24 months **Next Inspection:** 6/11/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 6/11/2013 **Next Elem Insp.:** 6/11/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 16
Boat: N **Tidal:** Y **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 5 **Paint Condition:** NA
62) Culvert: 5 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 6 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 35.50 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 5.30 ft **49) Structure Length:** 12.70 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 6/11/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,S,R) / G.GARCIA
(I,P) ADDITIONAL MAXIMO MAINTENANCE:
B055-V1A: REMOVE DEBRIS & VEGETATION
GROWING AT INLET AND OUTLET. WO# 702961
INSPECTION NOTE: DUE TO VEGETATION
GROUTED WALL WAS PARTIALLY VISIBLE AT
THE TIME OF INSPECTION. (2015)

BRIDGE NOTES

NBI DONE BY: DARREN SOBOTA ....SCALE FACTORS ENTERED BY JEA ON 6/15/09 -- DO NOT CHANGE OR ERASE.... NOTE: BRIDGE WAS INVENTORIED & INSPECTED IN DECEMBER OF 2008, BUT WASN'T CREATED IN THE SYSTEM UNTIL JUNE OF 2009.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
847/1	Alum Culvert - Minor	(LF)	102.00	30.00	7.00	64.00	1.00
1000/1	Corrosion	(LF)	63.00	0.00	0.00	62.00	1.00
1900/1	Distortion	(LF)	5.00	0.00	5.00	0.00	0.00
7000/1	Damage	(LF)	4.00	0.00	2.00	2.00	0.00
895/1	Grouted or Sacked Ri	(SF)	199.99	30.00	140.00	30.00	0.00
1640/1	Masonry Displacement	(SF)	169.99	0.00	140.00	30.00	0.00

1. SOUTH APPROACH

2. EAST ELEVATION

3. GENERAL VIEW SPAN#2 LOOKING WEST

4. UPSTREAM LOOKING WEST

5. DOWNSTREAM LOOKING EAST

6. A/C WEARING SURFACE

7. SPAN#1 MISSING STONE AT TOP OF EAST HEADWALL

8. SPAN#2 ACTIVE CORROSION TO ALUMINUM AT TOP OF PIPE CULVERT

9. SPAN#1 DAMAGED / TORN AT BOTTOM OF EAST END

10. SPAN#1 HOLE IN CEILING OF ALUMINUM PIPE CULVERT

SCOUR RELATED DATA

For
Bridge: *3441 382*

Bridge ID: 3441 382 **Inspection Date:** 6/11/2013 **Region:** Rural
Waterway Name: HERRING BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: Y **Underclearance:** 11.48 ft **Depth of Flow:** 1.64 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** DEBRIS IN CHANNEL
Streambed: F **Comments:** MINOR PONDING/SCOUR DOWNSTREAM w/ UNDERMINING OF PIPE OUTLETS
Embankment: F **Comments:** MINOR PONDING/SCOUR DOWNSTREAM w/ UNDERMINING OF PIPE OUTLETS
Fender System: **Comments:** MINOR PONDING/SCOUR DOWNSTREAM w/ UNDERMINING OF PIPE OUTLETS

CHANNEL INFORMATION
Debris in Channel: Yes **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

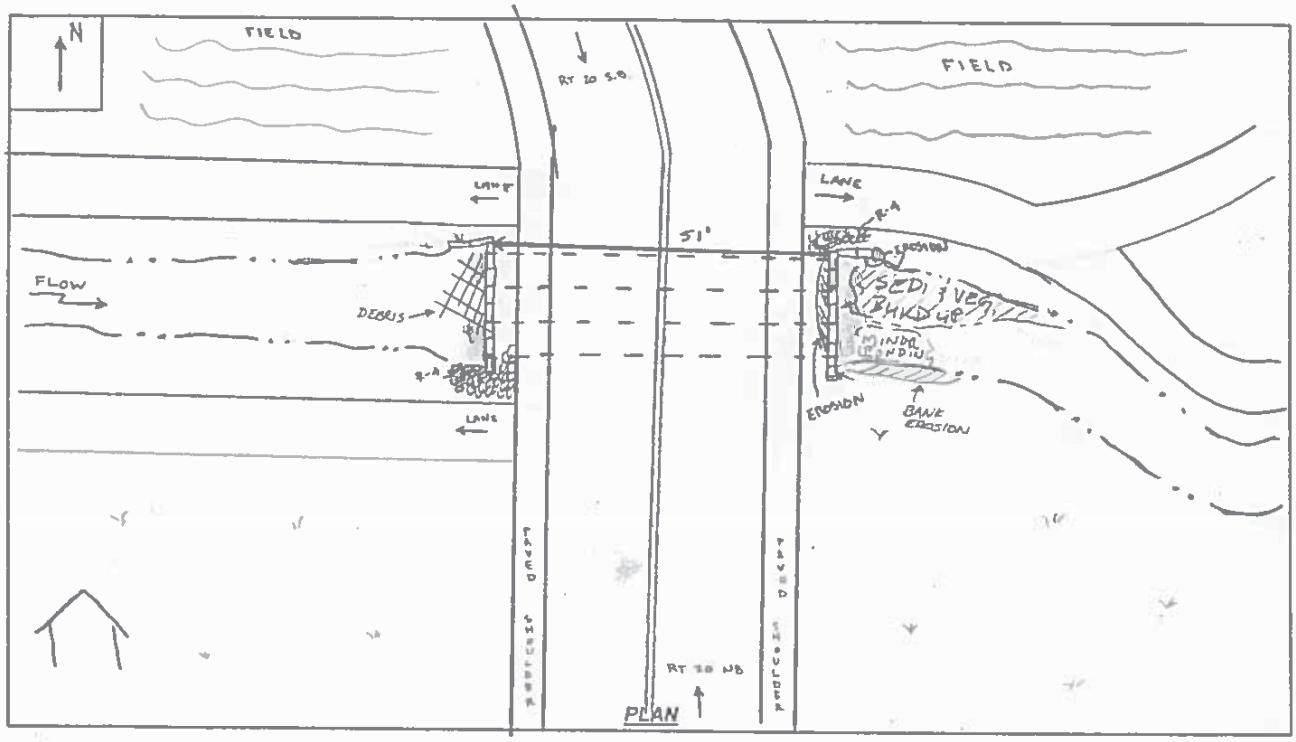
WATERWAY SKETCH SHEET

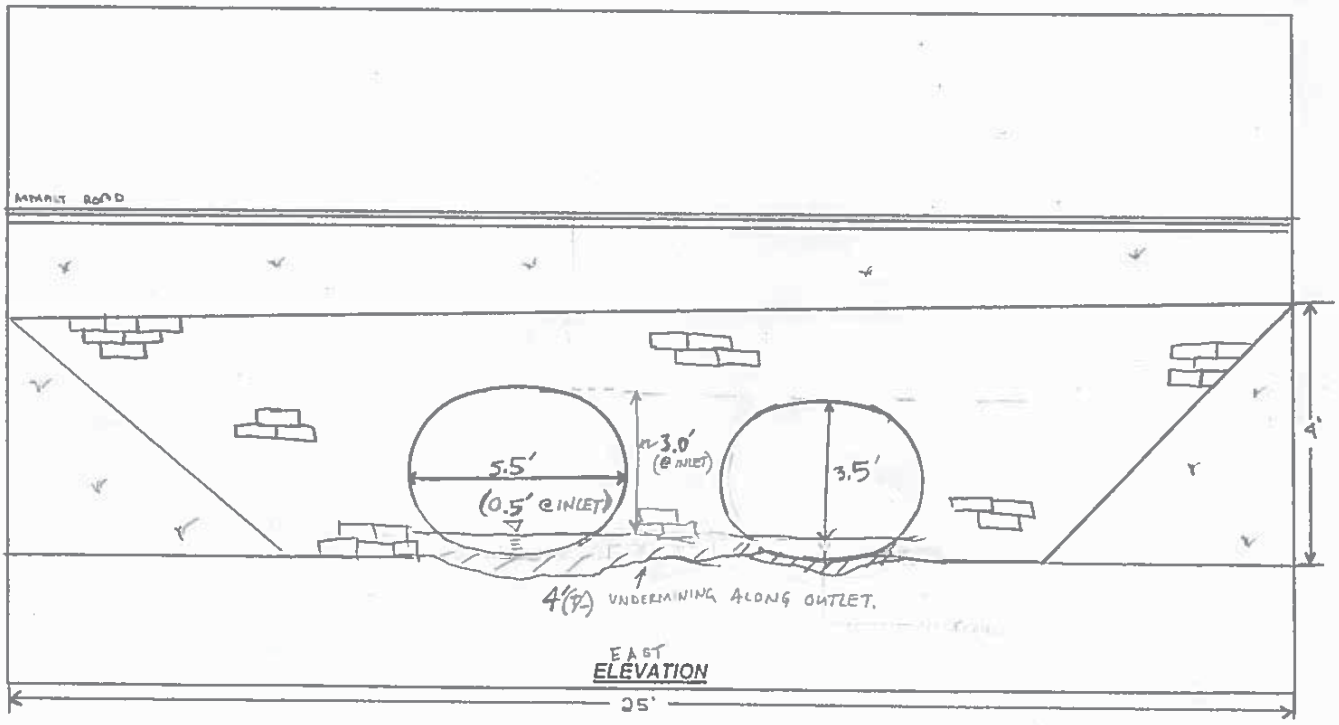
BR. I.D.: 3-441-302

WATERWAY NAME: HERRING BRANCH

DATE: 6 / 11 / 2015

INSPECTED BY: RM / GG / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 89.0

IDENTIFICATION

Bridge ID: 3564 413 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 31690
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00413 **(E) Direction:** 0
6A) Features Intersected: GUM BRANCH **6B) Critical:**
(7) Facility Carried: FIREMANS RD
(9) Location: GUMBORO **11) Km. Point:** 1.120 mi
16) Latitude: 38^28'17.79" **17) Longitude:** 75^21'56.17"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 0 mi **27) Year Built:** 1990
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 316 **30) Year of ADT:** 2012
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 6

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 11/29/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 396 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 8/22/2014 **91) Frequency:** 24 months **Next Inspection:** 8/22/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 8/22/2014 **Next Elem Insp.:** 8/22/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 15
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 5.50 ft **49) Structure Length:** 26.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/22/2014 **Type:** 1 **Inspector:** MSCHLITTER

INSPECTION NOTES

INSPECTED BY: N.DRAPER(I,P), M.SCHLITTER
(TL,S,R) ADDITIONAL MAXIMO MAINTENANCE:
NONE

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 01/10/07,
DO NOT CHANGE OR ERASE...

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	180.00	0.00	161.00	0.00	19.00
817/2	Galvanizing Steel Protection	sq.ft	1,550.46	1,550.46	0.00	0.00	0.00

1. SOUTH APPROACH

2. WEST ELEVATION

3. GENERAL VIEW EAST IN SPAN 1.

4. UPSTREAM WEST

5. DOWNSTREAM EAST

6. A/C OVERLAY LOOKING WEST

7. EXISTING PERF. @ W. END OF SPAN 1.

SCOUR RELATED DATA

For
Bridge: *3564 413*

Bridge ID: 3564 413 **Inspection Date:** 8/22/2014 **Region:** Rural
Waterway Name: GUM BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Muck > 3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 4.50 ft **Depth of Flow:** 1.00 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: F **Comments:** SLIGHT SEDIMENT BUILD UP IN CENTER AND SOUTH PIPES
Embankment: G **Comments:** SLIGHT SEDIMENT BUILD UP IN CENTER AND SOUTH PIPES
Fender System: **Comments:** SLIGHT SEDIMENT BUILD UP IN CENTER AND SOUTH PIPES

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

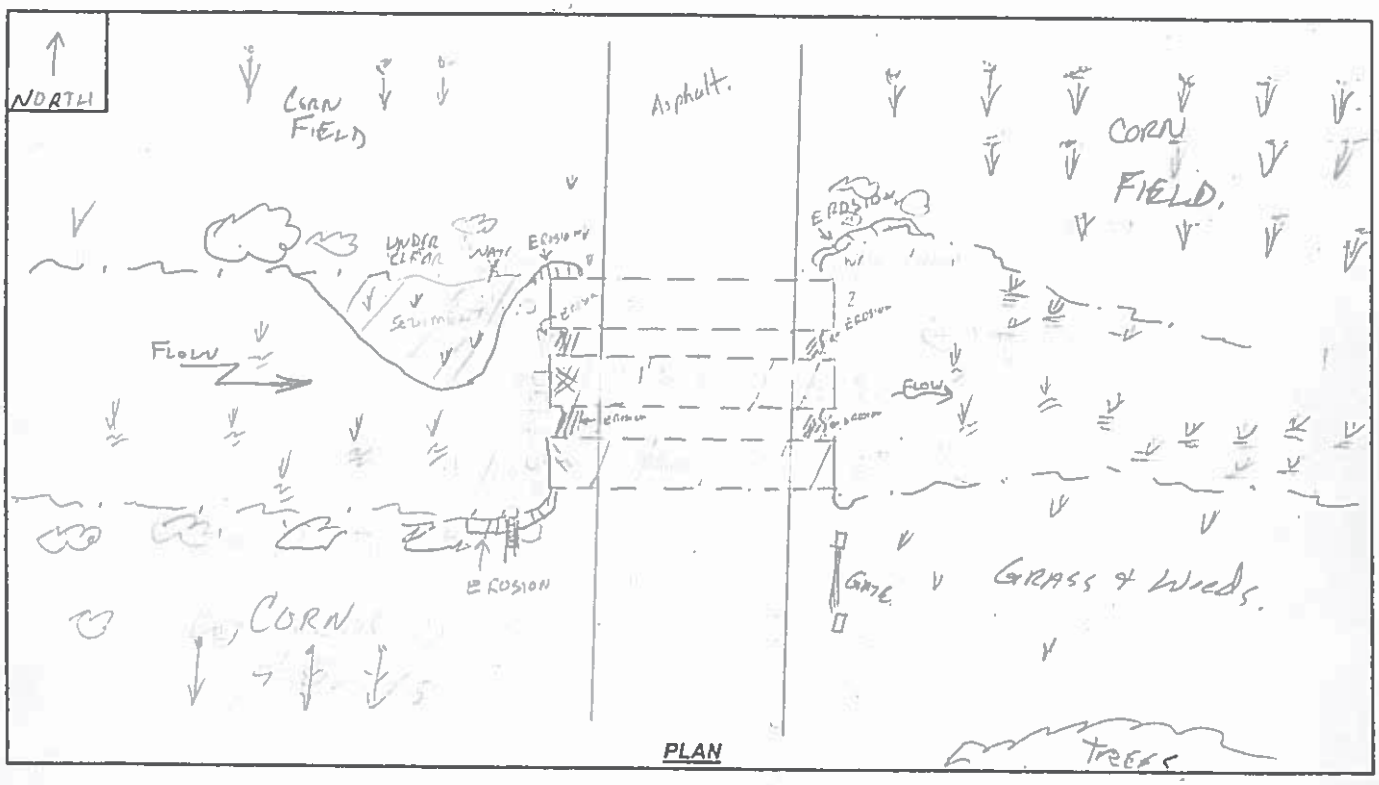
WATERWAY SKETCH SHEET

BR. I.D.: 3 -564 - 413

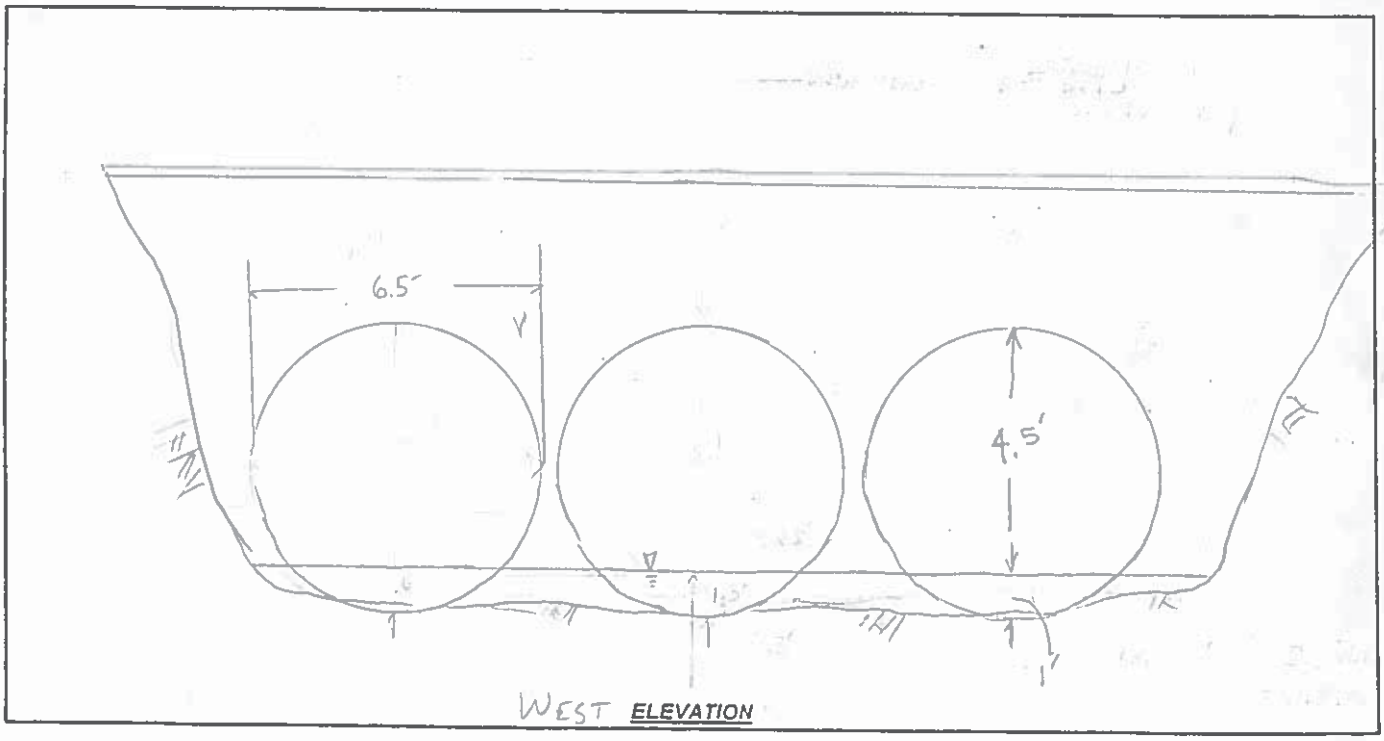
WATERWAY NAME: GUM BRANCH

DATE: 8 / 22 / 2014

INSPECTED BY: MS / ND / [illegible] /



PLAN



WEST ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 97.8

IDENTIFICATION

Bridge ID: 3576 064 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 76930
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00064 **(E) Direction:** 0
6A) Features Intersected: NORTH FORK GREEN RUN **6B) Critical:**
(7) Facility Carried: WHITESVILLE RD.
(9) Location: WEST OF GUMBORO **11) Km. Point:** 8.520 mi
16) Latitude: 38^28'13.28" **17) Longitude:** 75^24'41.85"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 1 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 4 mi **27) Year Built:** 1974
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 889 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 07 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 11/29/2005
63) Oper. Rating Method: 1 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 1 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 1104 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 7311007 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 6/20/2015 **91) Frequency:** 24 months **Next Inspection:** 6/20/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 6/21/2013 **Next Elem Insp.:** 6/20/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 15
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** X
62) Culvert: 6 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 1
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 23.00 ft **33) Median:** 0
34) Skew: 45^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 11.80 ft **49) Structure Length:** 11.80 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 6/20/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE(TL,S,R)/ G.GARCIA
(I,P) ADDITIONAL MAXIMO MAINTENANCE:
NONE AT THIS TIME

BRIDGE NOTES

NBI DONE BY: DARREN SOBOTA ....NOTE: SCALE FACTOR ENTERED BY GRD ON 11/09/05, DO NOT CHANGE.... NOTE: BIE RAISED THE CULVERT CONDITION RATING TO A 6 FROM A 5 SINCE THE ONLY CS3 IS DUE TO MOWER DAMAGE AT THE END, NOT CORROSION.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/2	Maj Mtl Culv	(LF)	106.00	95.00	10.00	1.00	0.00
817/2	Galvanizing Steel Protection	sq.ft	24,048.00	24,027.00	0.00	0.00	21.00
1000/2	Corrosion	(LF)	10.00	0.00	10.00	0.00	0.00
1900/2	Distortion	(LF)	1.00	0.00	0.00	1.00	0.00
7000/2	Damage	(LF)	1.00	0.00	0.00	1.00	0.00

1. EAST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW LOOKING NORTH

4. UPSTREAM LOOKING NORTH

5. DOWNSTREAM LOOKING SOUTH

6. A/C WEARING SURFACE

7. SURFACE RUST AND MINOR PITTING AT S/E END OF PIPE

8. DAMAGE AT NORTH END OF PIPE

SCOUR RELATED DATA

For
Bridge: *3576 064*

Bridge ID: 3576 064 **Inspection Date:** 6/21/2013 **Region:** Rural
Waterway Name: NORTH FORK GREEN RUN **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 11.65 ft **Depth of Flow:** 7.22 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: F **Comments:** TWO FEET OF MUCK THRU STRUCTURE
Embankment: G **Comments:** TWO FEET OF MUCK THRU STRUCTURE
Fender System: **Comments:** TWO FEET OF MUCK THRU STRUCTURE

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit **Downstream Bank Condition:** Bank Prot/Vegit
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

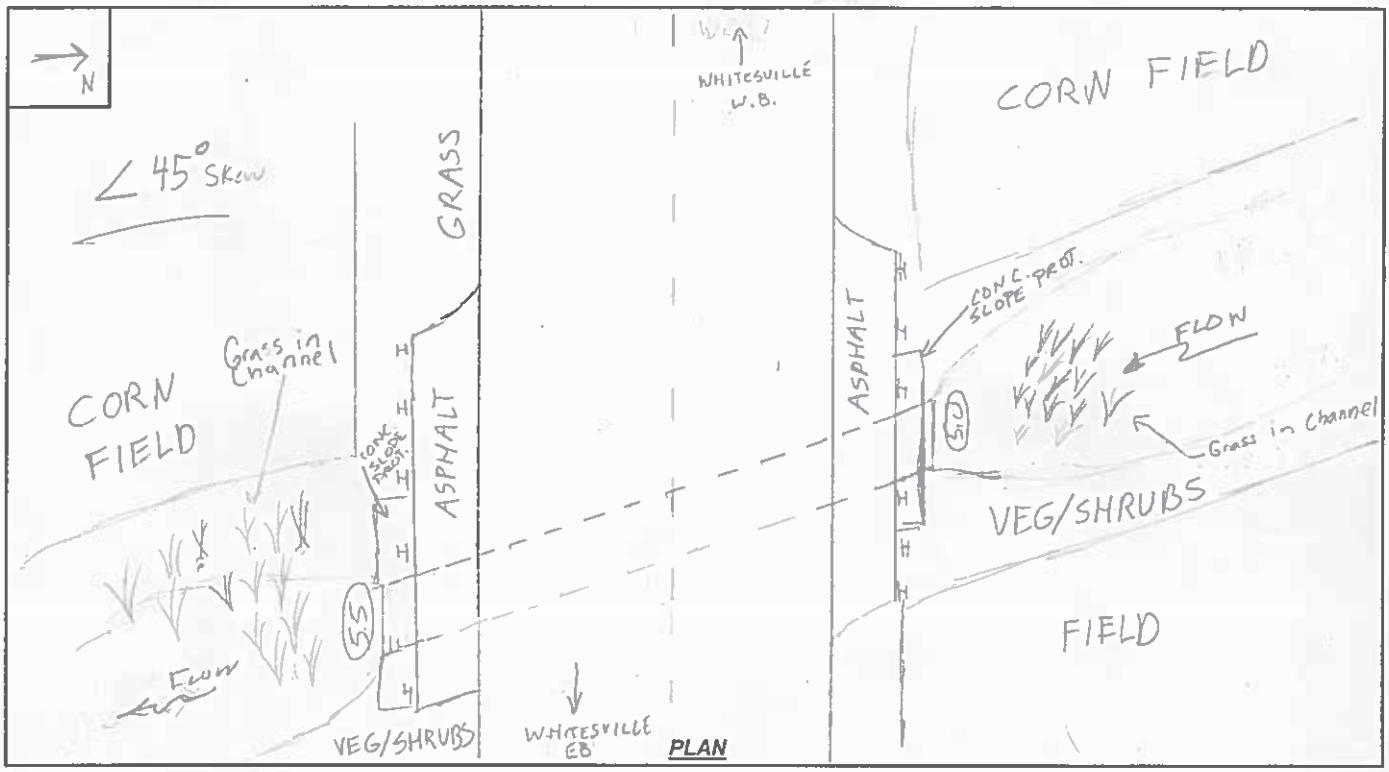
WATERWAY SKETCH SHEET

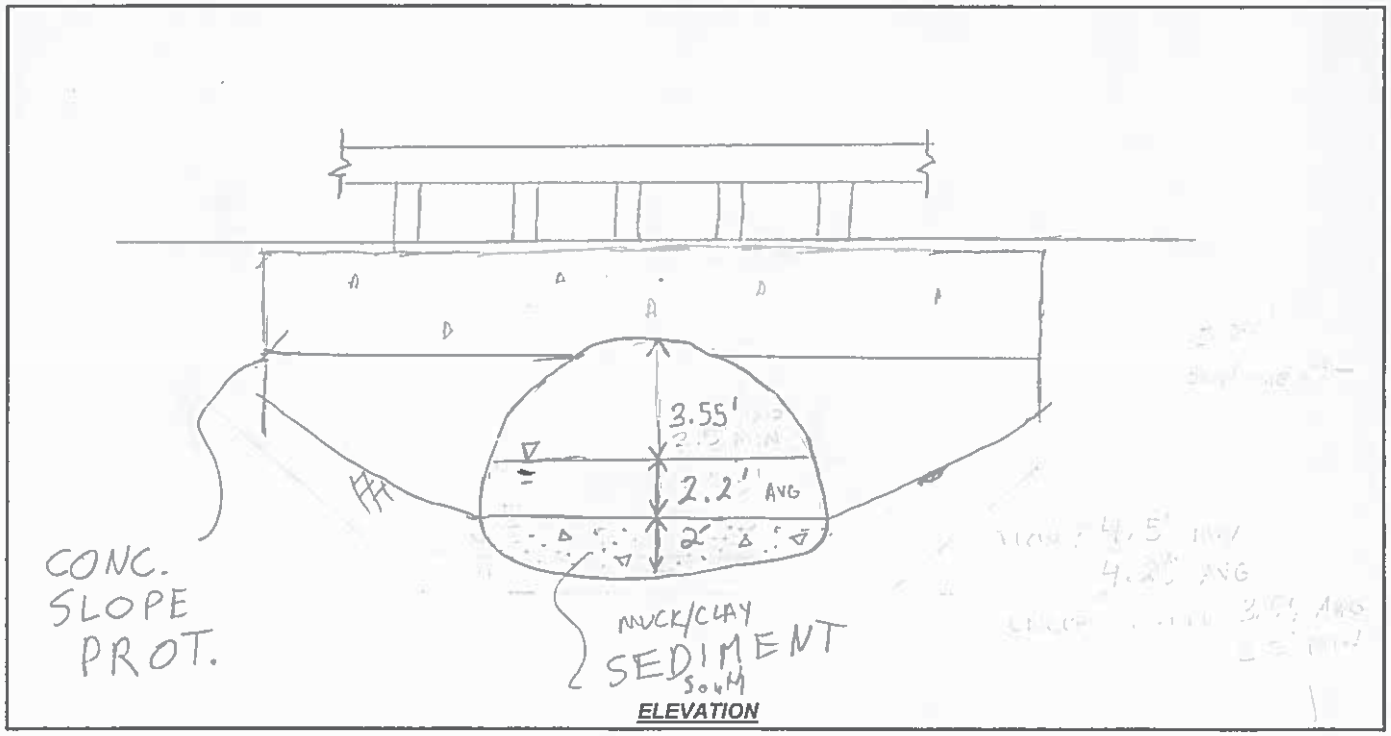
BR. I.D.: 3 - 576 - 064

WATERWAY NAME: NORTH FORK GREEN RUN

DATE: 06 / 20 / 15

INSPECTED BY: RM / GG / / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 89.0

IDENTIFICATION

Bridge ID: 3626 608 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 24020
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00608 **(E) Direction:** 0
6A) Features Intersected: MAPLE MARSH/BEAVER DAM B **6B) Critical:**
(7) Facility Carried: ELLENDALE FOREST R
(9) Location: S.W. OF ELLENDALE **11) Km. Point:** 0.220 mi
16) Latitude: 38^47'14.31" **17) Longitude:** 75^27'20.45"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1975
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 69 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 12/9/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 85 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 6/25/2015 **91) Frequency:** 24 months **Next Inspection:** 6/25/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 6/25/2013 **Next Elem Insp.:** 6/25/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 12
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 8 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 18.30 ft **33) Median:** 0
34) Skew: 20^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 9.84 ft **49) Structure Length:** 23.50 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 6/25/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: DSOBOTA(TL,S,R) GGARCIA (I,P), SCABALLERO(S) ADDITIONAL MAXIMO REQUESTS: B055-V1A: REMOVE VEGETATION NEAR GROUTED SACKED RI-RAP. WO#..

BRIDGE NOTES

NBI DONE BY: DARREN SOBOTA ....NOTE: SCALE FACTOR ENTERED BY GRD ON 11/10/05, DO NOT CHANGE.... NOTE: THE INSPECTION TEAM RECOMMENDED A NBI CULVERT RATING OF 4. THIS NBI CULVERT RATING WAS INCREASED TO A 5 BASED ON THE SMALL QUANTITY AND SIZE OF PERFORATIONS AND THE FACT THAT IT IS AN ALUMINUM PIPE.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
848/1	Alum Culvert-Major	(LF)	74.00	61.00	10.00	3.00	0.00
848/2	Alum Culvert-Major	(LF)	64.00	38.00	20.00	6.00	0.00
1000/1	Corrosion	(LF)	13.00	0.00	10.00	3.00	0.00
1000/2	Corrosion	(LF)	26.00	0.00	20.00	6.00	0.00
895/2	Grouted or Sacked Ri	(SF)	199.99	199.99	0.00	0.00	0.00

1. EAST APPROACH LOOKING WEST

2. NORTH ELEVATION LOOKING SOUTHWEST

3. GENERAL VIEW OF SPAN 1, WEST CELL, LOOKING SOUTH

4. UPSTREAM LOOKING NORTH

5. DOWNSTREAM LOOKING SOUTH

6. ASPHALT (TAR & CHIP) WEARING SURFACE LOOKING NORTH

7. SPAN 1, WEST CELL, WHITE CORROSION SPOTS IN N HALF OF W WALL LOOKING W

8. SPAN 1, W CELL, CORROSION SPOTS & DEEP PITTING UNDER TRAVEL LANES LOOK W

9. SPAN 1, WEST CELL MISSING SECTION, EXPOSED BARS AT SOUTH END, LOOKING SE

SCOUR RELATED DATA

For
Bridge: *3626 608*

Bridge ID: 3626 608
Inspection Date: 6/25/2013
Region: Rural
Waterway Name: MAPLE MARSH & BEAVER DAM BRANCH
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Sand
Streambed Mtrl Penetration: Muck > 3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 16.40 ft
Depth of Flow: 3.94 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Soil
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: G
Comments:
Streambed: G
Comments:
Embankment: G
Comments:
Fender System:
Comments:

CHANNEL INFORMATION

Debris in Channel: No
Sediment in Channel: Yes
Cap. of Chnl: High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit
Downstream Bank Condition: Bank Prot/Vegit
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

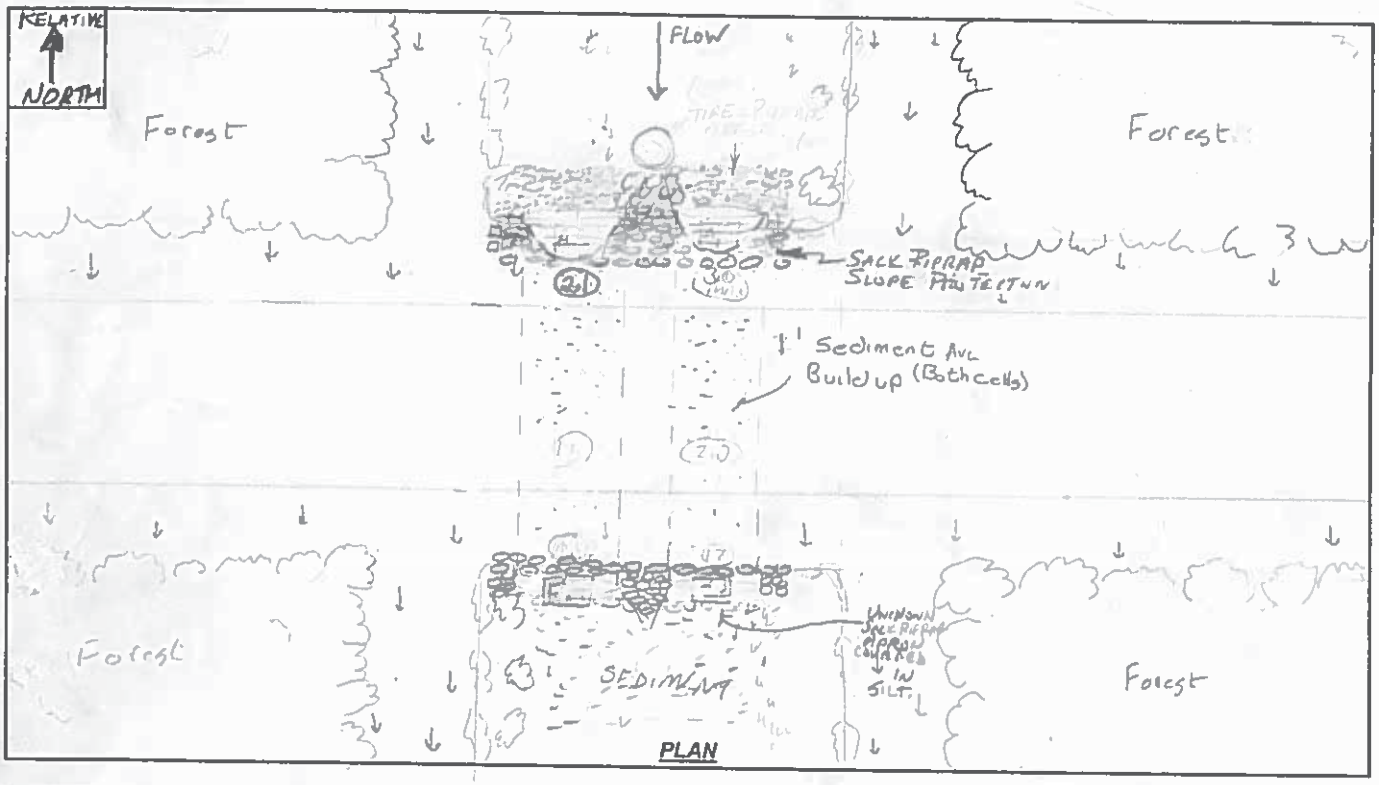
WATERWAY SKETCH SHEET

BR. I.D.: 3-626-608

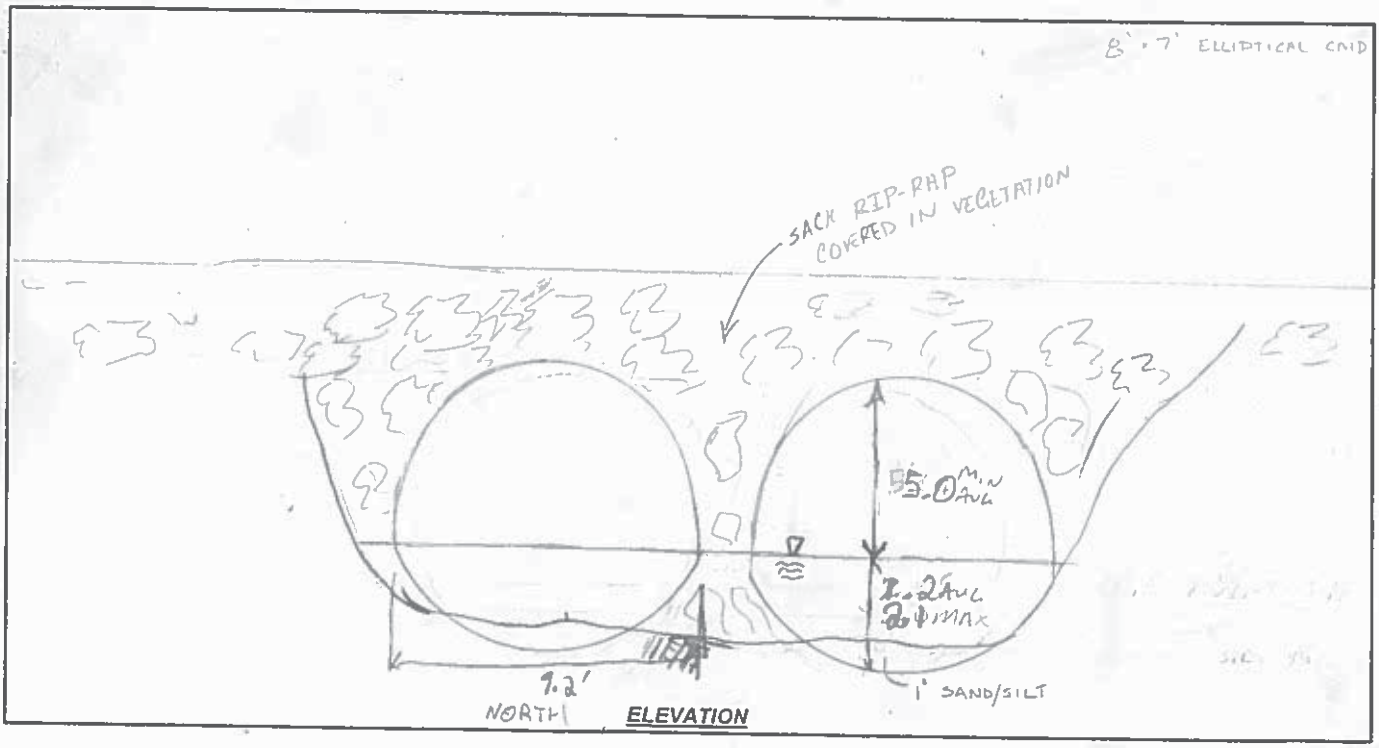
WATERWAY NAME: MAPLE MARSH & BEAVER DAM BRANCH.

DATE: 06/25/2015

INSPECTED BY: SC / DS / GG /



PLAN



ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 88.9

IDENTIFICATION

Bridge ID: 3627 606 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 39520
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00606 **(E) Direction:** 0
6A) Features Intersected: MAPLE MARSH&BEAVER DAM B **6B) Critical:**
(7) Facility Carried: SAMMONS RD.
(9) Location: S.W. OF ELLENDALE **11) Km. Point:** 1.448 mi
16) Latitude: 38^46'22.14" **17) Longitude:** 75^27'40.59"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 9 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 3 mi **27) Year Built:** 1974
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 203 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 8

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 12/9/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 252 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 6/25/2015 **91) Frequency:** 24 months **Next Inspection:** 6/25/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 6/25/2013 **Next Elem Insp.:** 6/25/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 12
Boat: Y **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 8 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: N **B) Transition:** N **C) Approach Rail:** N
D) Approach Rail Ends: N
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 20.00 ft **33) Median:** 0
34) Skew: 25^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 13.00 ft **49) Structure Length:** 30.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 6/25/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: DSOBOTA(TL,I,P) GMILLER
(S,R) ADDITIONAL MAXIMO MAINTENANCE:
B054-S6D: REPAIR EROSION & UNDERMINING
BEHIND NORTH SACK RIPRAP HEADWALL
BETWEEN THE TWO CULVERTS

BRIDGE NOTES

NBI DONE BY: DARREN SOBOTA ....NOTE: SCALE FACTOR ENTERED BY GRD ON
11/10/05, DO NOT CHANGE...

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
848/2	Alum Culvert-Major	(LF)	134.00	29.00	96.00	9.00	0.00
1000/2	Corrosion	(LF)	97.00	0.00	88.00	9.00	0.00
1020/2	Connection	(LF)	8.00	0.00	8.00	0.00	0.00
895/2	Grouted or Sacked Ri	(SF)	239.99	239.99	0.00	0.00	0.00

1. EAST APPROACH ROADWAY LOOKING WEST

2. NORTH ELEVATION LOOKING SOUTH

3. GENERAL VIEW OF WEST CELL LOOKING SOUTH

4. UPSTREAM LOOKING NORTH (BOOK)

5. DOWNSTREAM LOOKING SOUTH

6. ASPHALT OVERLAY WEARING SURFACE LOOKING NORTH

7. SPAN 1, WEST CELL, LARGE ~1 INCH DIAMETER BLISTER AT 29 FT FROM N LOOK E

8. SPAN 1, W CELL, SMALL CORROSION BLISTERS & PITTING ON FASTENERS LOOK E

9. EROSION BETWEEN SPANS 1 & 2 IN THE NORTH SACK RIPRAP HEADWALL LOOK N

10. SPAN 2, E CELL, FASTENER SECTION LOSS AT 13 FEET FROM N END, LOOKING EAST

SCOUR RELATED DATA

For
Bridge: *3627 606*

Bridge ID: 3627 606
Inspection Date: 6/25/2013
Region: Rural
Waterway Name: MAPLE MARSH & BEAVER DAM BRANCH
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Silt/Clay
Streambed Mtrl Penetration: Muck > 3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 12.14 ft
Depth of Flow: 10.50 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Soil
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: G
Comments:

Streambed: F
Comments: SLIGHT SEDIMENT BUILDUP AT SOUTH ENDS OF PIPES

Embankment: G
Comments: SLIGHT SEDIMENT BUILDUP AT SOUTH ENDS OF PIPES

Fender System:
Comments: SLIGHT SEDIMENT BUILDUP AT SOUTH ENDS OF PIPES

CHANNEL INFORMATION

Debris in Channel: No
Sediment in Channel: Yes
Cap. of Chnl: High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit
Downstream Bank Condition: Bank Prot/Vegit
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

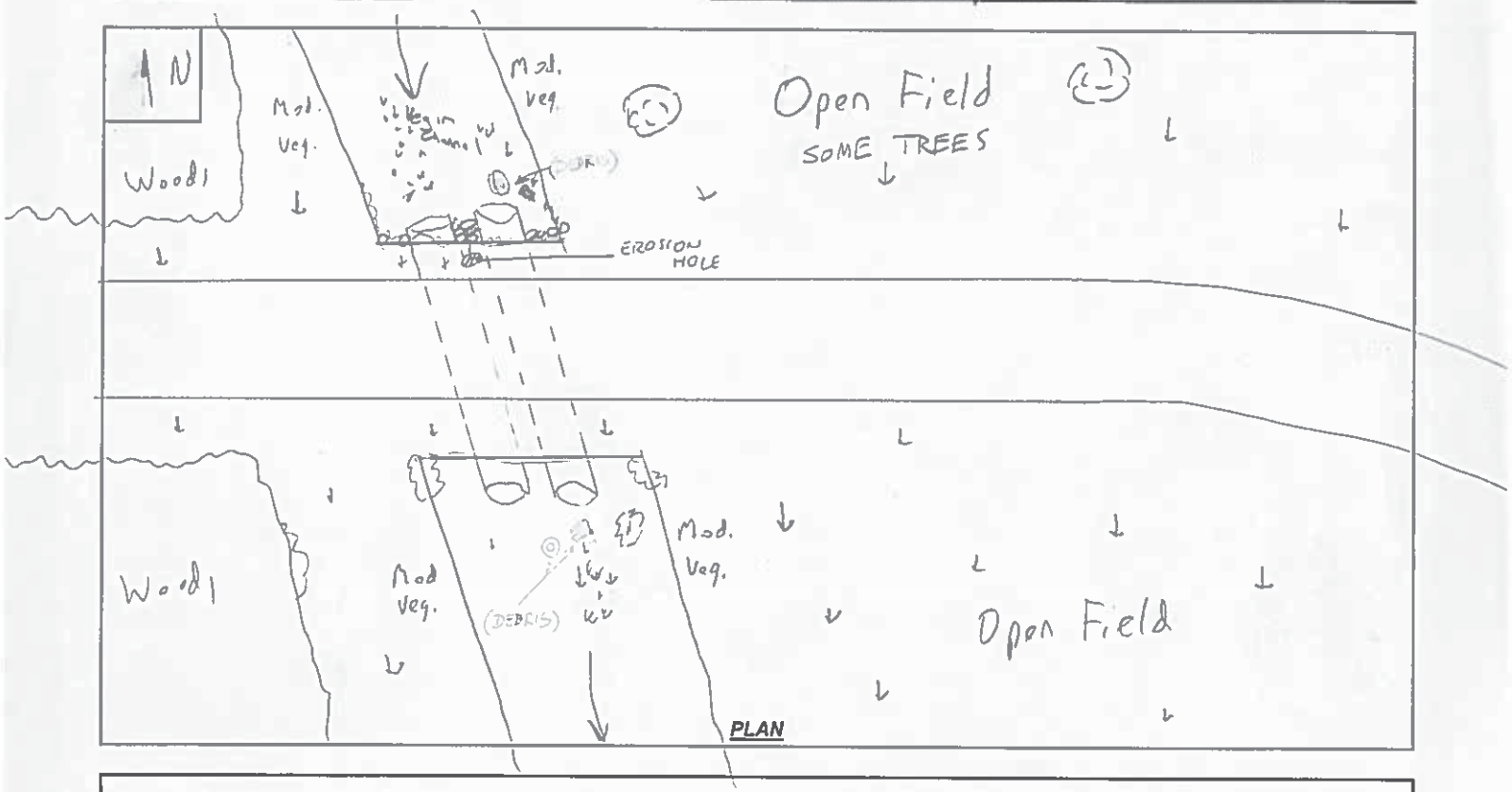
WATERWAY SKETCH SHEET

BR. I.D.: 3 -627-606

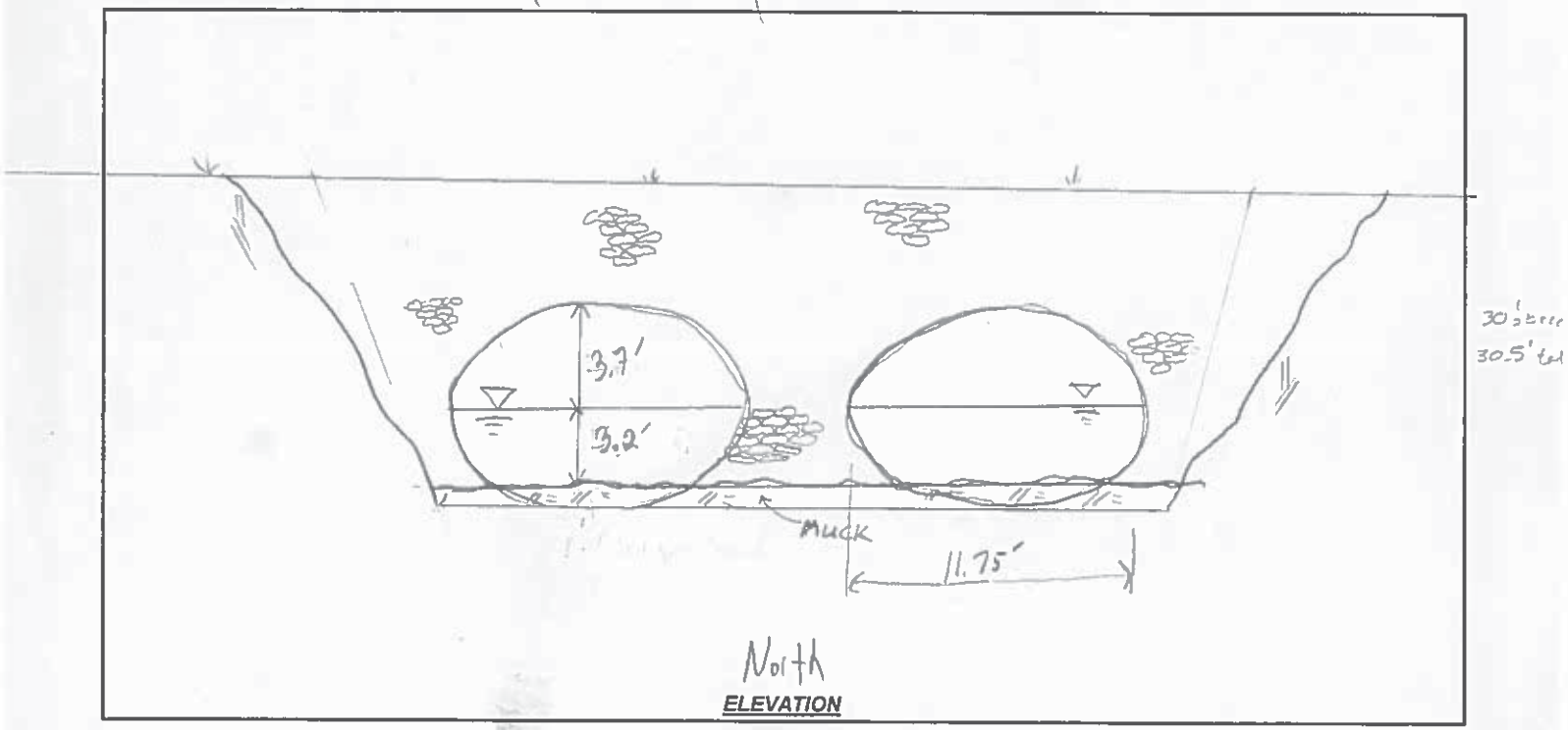
WATERWAY NAME: Maple Marsh Ditch

DATE: 06/25/15

INSPECTED BY: GG / DS / CB /



PLAN



ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 86.0

IDENTIFICATION

Bridge ID: 3630 593 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 39520
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00593 **(E) Direction:** 0
6A) Features Intersected: MAPLE MARSH & BEAVER DAM **6B) Critical:**
(7) Facility Carried: MAPLE BRANCH RD.
(9) Location: N/W OF GEORGETOWN **11) Km. Point:** 0.690 mi
16) Latitude: 38^45'22.79" **17) Longitude:** 75^27'42.67"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 0 mi **27) Year Built:** 1983
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 99 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 12

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 4/22/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 123 **115) Year of Future ADT:** 2036

CONTRACT INFORMATION

Contract 1: 8305301 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 9/4/2014 **91) Frequency:** 24 months **Next Inspection:** 9/4/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 9/4/2014 **Next Elem Insp.:** 9/4/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 12
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 19.00 ft **33) Median:** 0
34) Skew: 15^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 12.00 ft **49) Structure Length:** 25.00 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 9/4/2014 **Type:** 1 **Inspector:** MSCHLITTER

INSPECTION NOTES

INSPECTED BY: M.SCHLITTER(TL,I,P) /
N.DRAPER(S,R) MAXIMO REQUESTS: NONE

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 01/16/07,
DO NOT CHANGE OR ERASE...

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	144.00	0.00	143.00	0.00	1.00
817/1	Galvanizing Steel Protection	sq.ft	9,957.38	9,957.38	0.00	0.00	0.00
895/1	Grouted or Sacked Ri	(SF)	520.00	520.00	0.00	0.00	0.00

1. SOUTH APPROACH

2. WEST ELEVATION

3. GENERAL VIEW EAST IN SOUTH CELL

4. UPSTREAM WEST

5. DOWNSTREAM EAST

6. A/C OVERLAY WEST

7. EXISTING PERF. @ W. END OF S. CELL.

SCOUR RELATED DATA

For
Bridge: *3630 593*

Bridge ID: 3630 593
Inspection Date: 9/4/2014
Region: Rural
Waterway Name: MAPLE MARSH AND BEAVER DAM BRANCH
Fathometer Req'd: No

STREAMBED CHARACTERISTICS

Streambed Mtrl: Sand
Streambed Mtrl Penetration: Loose 1-3 in

WATERWAY INFORMATION

Tidal: N
Underclearance: 5.60 ft
Depth of Flow: 2.00 ft

ARMORING

Abutment: N/A
Piers: N/A
Upstream Channel: No Armoring
Wingwalls: N/A
Dwnstrm Channel: No Armoring
Channel Bottom: No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS

Foundation Type: Culvert
Fnd. Mtrl: Soil
Pier:
Cap Shape:
Shape of Piles:

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)

Waterway: F
Comments: DEBRIS IN N. CELL
Streambed: F
Comments: SEDIMENT BUILDUP @ INLET, OUTLET & THROUGH NORTH CELL.
Embankment: F
Comments: SEDIMENT BUILDUP @ INLET, OUTLET & THROUGH NORTH CELL.
Fender System:
Comments: SEDIMENT BUILDUP @ INLET, OUTLET & THROUGH NORTH CELL.

CHANNEL INFORMATION

Debris in Channel: Yes
Sediment in Channel: Yes
Cap. of Chnl: High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency
Downstream Bank Condition: Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113

Piers:
Abutment:
Bents:

SCOUR SHEET

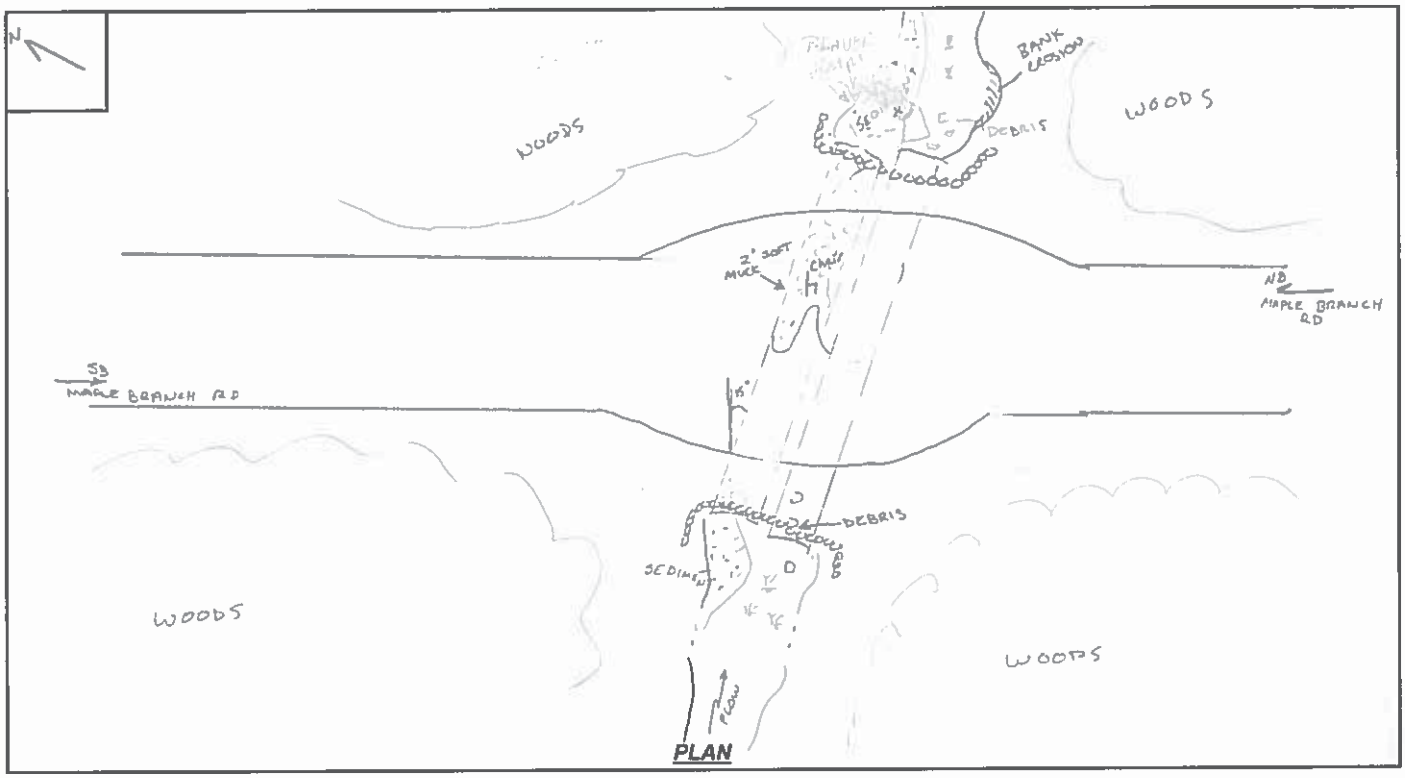
WATERWAY SKETCH SHEET

BR. I.D.: 3 - 630 - 593

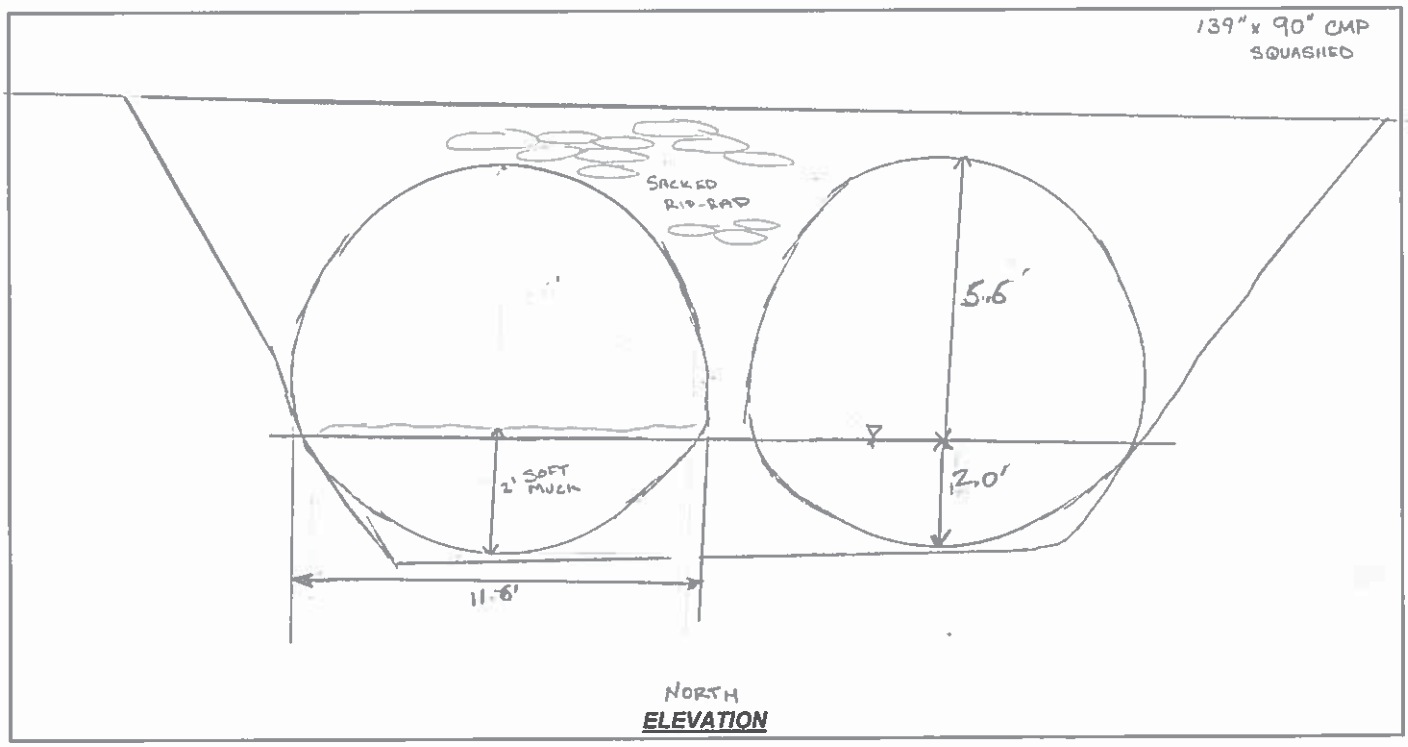
WATERWAY NAME: MAPLE MARSH + BEAVER DAM BRANCH

DATE: 09 / 04 / 14

INSPECTED BY: ND / MS / / /



PLAN



NORTH
ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 68.8

IDENTIFICATION

Bridge ID: 3681 318 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 79240
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00318 **(E) Direction:** 0
6A) Features Intersected: ELI WALLS DITCH **6B) Critical:**
(7) Facility Carried: CEDAR LANE
(9) Location: S.E. OF GEORGETOWN **11) Km. Point:** 4.240 mi
16) Latitude: 38^39'46.48" **17) Longitude:** 75^20'25.36"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi **27) Year Built:** 1985
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 2124 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: **109) % Truck ADT:** 5

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 12/9/2005
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 2639 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: N/A **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 8/5/2015 **91) Frequency:** 12 months **Next Inspection:** 8/5/2016
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: 12 months **93B) UW Insp. Date:** 8/5/2015 **Next UW Insp.:** 8/5/2016
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 12 months **Elem. Insp. Date:** 8/5/2015 **Next Elem Insp.:** 8/5/2016
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 15
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 6 **Paint Condition:** N
62) Culvert: 4 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 4 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 5 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 22.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.50 ft **49) Structure Length:** 21.50 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/5/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: KCI TECHNOLOGIES, INC.:
K.GRAVATT (TL,P,I), M.SUCHAN (S,I),
M.MCDORMAN (I) NOTES: CITIZEN INSTALLED
A DAM ~20' FROM OUTLET. THIS IS CAUSING
SEDIMENT BUILDUP IN PIPES. THERE WAS NO
FLOW THROUGH PIPE 3 DUE TO SEDIMENT
BUILDUP. THE WEST (U/S) SACKED WALL HAD
MISSING BAGS AND WAS UNDERMINED SOUTH OF
PIPE 1, BETWEEN PIPES 1 & 2, AND BETWEEN
PIPES 2 & 3, WITH UP TO 3 FEET OF
PENETRATION. REQUESTED MAXIMO
MAINTENANCE: NONE RECOMMENDED
MAINTENANCE: RECOMMEND TO DELDOT TO LOOK
INTO WHETHER OR NOT THE DAM PLACEMENT
WAS AUTHORIZED. IF NOT, RECOMMEND
REMOVAL OF THE DAM. IF THE DAM IS TO
REMAIN IN PLACE, RECOMMEND CLOSE
MONITORING OF SEDIMENT LEVELS IN PIPES
AND IN WATERWAY TO AVOID OVERTOPPING OF
THE ROADWAY.

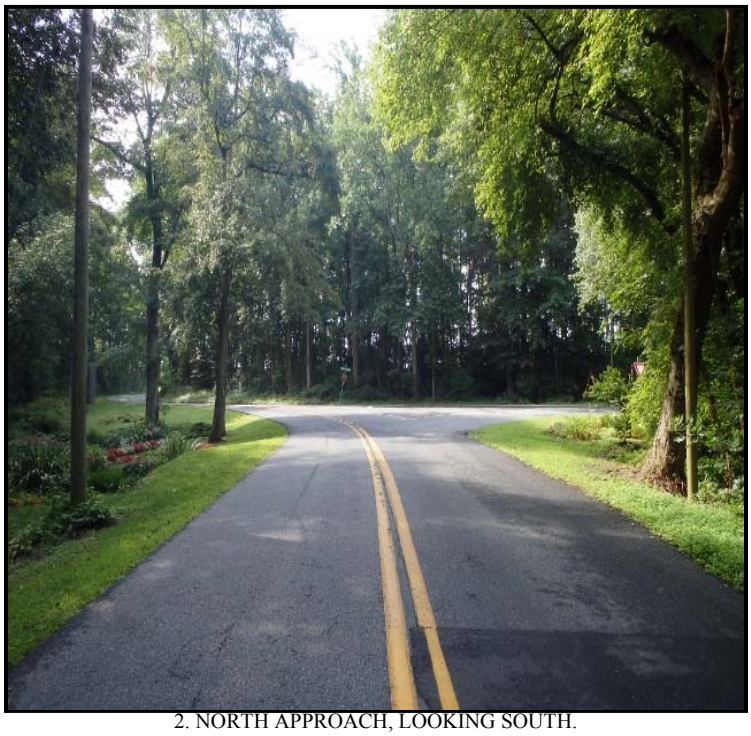
BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....NOTE: SCALE FACTORS ENTERED BY GRD ON 11/10/05,
DO NOT CHANGE... NOTE: BRIDGE IS MARKED AS UNDERWATER DUE TO LOW-CLEARANCE
INSPECTION. NOTE: MJM AND JEA MADE A FIELD VISIT ON 9/18/15 TO VERIFY PIPE
CONDITION AND NBI CULVERT RATING. IT WAS DETERMINED THAT THE NBI RATING IS
NOW A 4 AND THE INSPECTION FREQUENCY HAS BEEN REDUCED TO 12 MONTHS.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	150.00	0.00	0.00	145.00	5.00
817/2	Galvanizing Steel Protection	sq.ft	1,884.01	634.01	0.00	309.00	941.00
1000/2	Corrosion	ft	100.00	0.00	0.00	97.00	3.00
895/2	Grouted or Sacked Ri	(SF)	168.00	157.00	0.00	11.00	0.00
1640/2	Masonry Displacement	(SF)	11.00	0.00	0.00	11.00	0.00

1. SOUTH APPROACH, LOOKING NORTH.



2. NORTH APPROACH, LOOKING SOUTH.

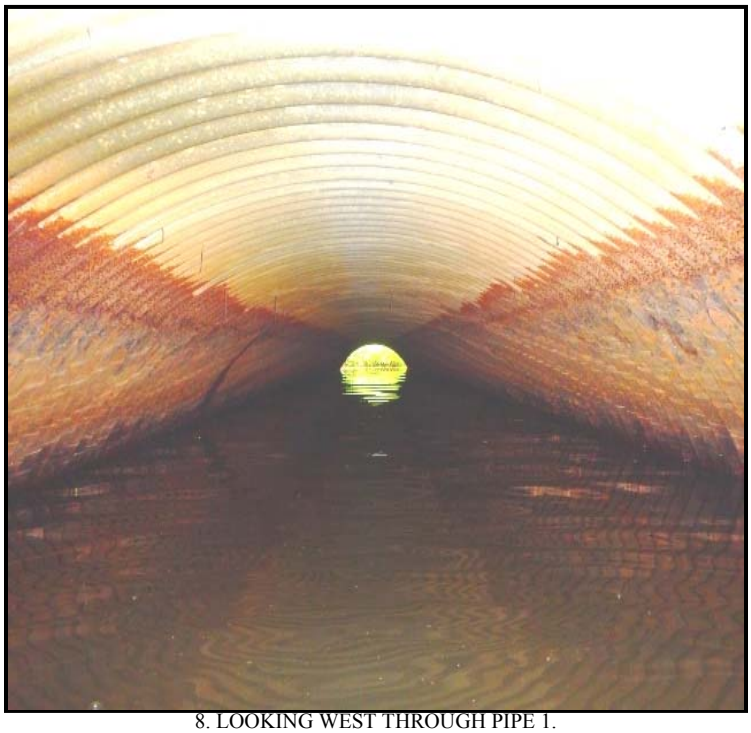
3. ROADWAY OVER STRUCTURE, LOOKING NORTH.

4. WEST (U/S) ELEVATION, LOOKING NORTHEAST.

5. EAST (D/S) ELEVATION, LOOKING WEST.

6. U/S (WEST) CHANNEL, LOOKING NORTHWEST.

7. D/S (EAST) CHANNEL, LOOKING SE. NOTE AESTHETIC WALL D/S.



8. LOOKING WEST THROUGH PIPE 1.

9. PIPE 1 EAST END, SECTION LOSS ON NORTH SIDE.

10. UNDERMINING OF SACKED WALL BETWEEN WEST END OF PIPES 1 & 2.

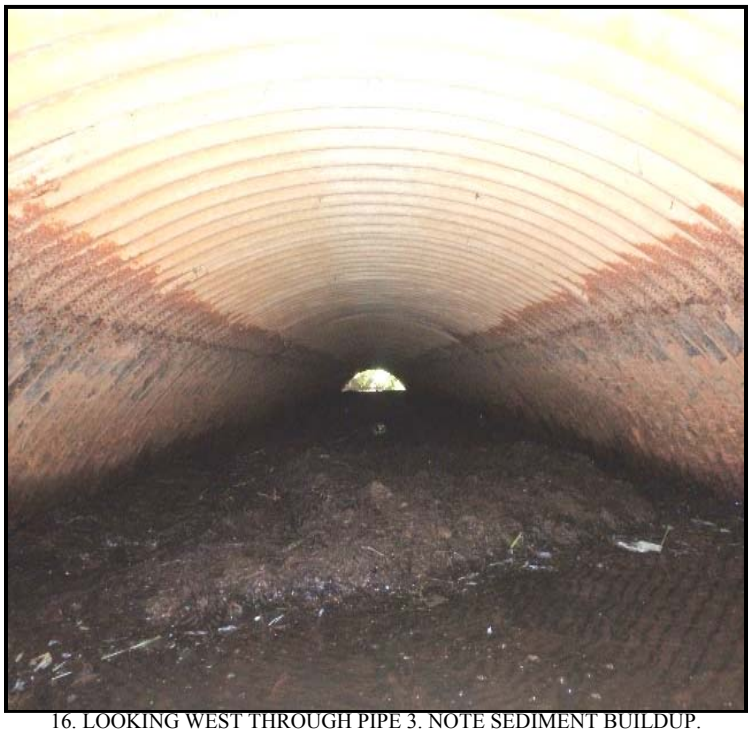
11. LOOKING WEST THROUGH PIPE 2.

12. PIPE 2 EAST END, SECTION LOSS ON NORTH SIDE.

13. PIPE 2 EAST END, SECTION LOSS ON SOUTH SIDE.

14. PIPE 2 WEST END, SECTION LOSS ON NORTH SIDE.

15. PIPE 2 WEST END, SECTION LOSS ON SOUTH SIDE.



16. LOOKING WEST THROUGH PIPE 3. NOTE SEDIMENT BUILDUP.

17. PIPE 3 EAST END, SECTION LOSS ON SOUTH SIDE.

18. PIPE 3 WEST END, SECTION LOSS ON SOUTH SIDE. NOTE SEDIMENT AT INLET.

SCOUR RELATED DATA

For
Bridge: *3681 318*

Bridge ID: 3681 318 **Inspection Date:** 8/9/2013 **Region:** Rural
Waterway Name: ELI WALLS DITCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Silt/Clay **Streambed Mtrl Penetration:** Muck > 3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 4.92 ft **Depth of Flow:** 7.22 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** No Armoring

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: F **Comments:** MANMADE DAM 20' D/S OF OUTLET.
Streambed: F **Comments:** UNDERMINING AT W.END; SEDIMENT IN PIPE 3.
Embankment: F **Comments:** UNDERMINING AT W.END; SEDIMENT IN PIPE 3.
Fender System: **Comments:** UNDERMINING AT W.END; SEDIMENT IN PIPE 3.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** Moderate
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Erosion **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

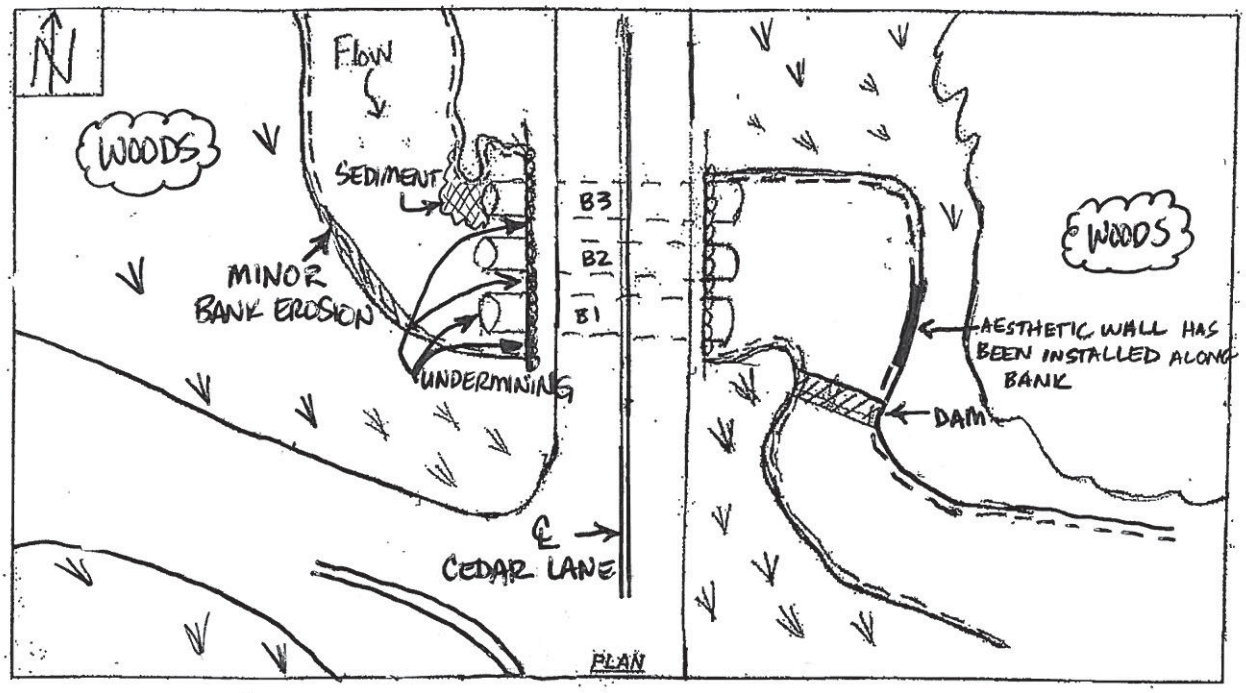
LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

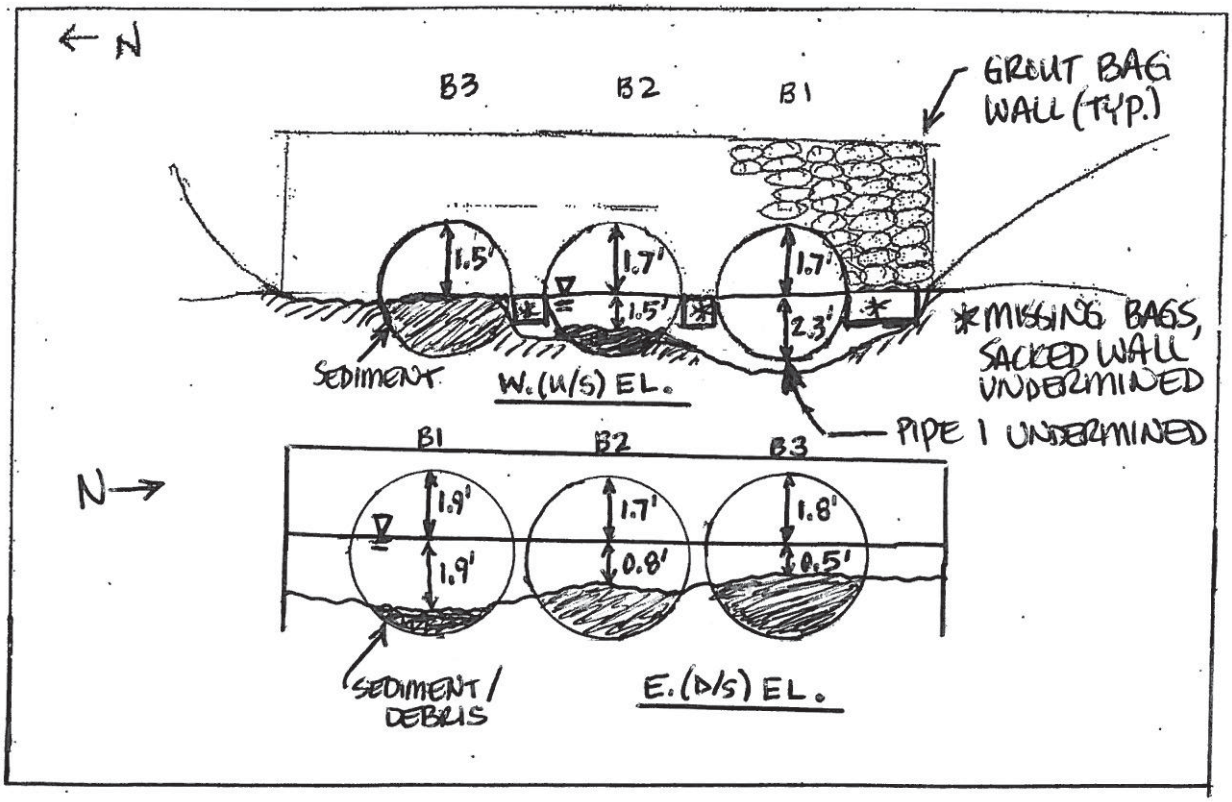
SCOUR SHEET

WATERWAY SKETCH SHEET

BR. I.D.: 3-681-318 WATERWAY NAME: ELI WALLS DITCH

DATE: 8/5/15 INSPECTED BY: KMG / MAS / MSM





STRUCTURAL DATA RECORD

Sufficiency Rating: 85.5

IDENTIFICATION

Bridge ID: 3913 016 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 54800
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00016 **(E) Direction:** 0
6A) Features Intersected: WEST BRANCH **6B) Critical:**
(7) Facility Carried: BEACH HGWY / SR16
(9) Location: W. OF ELLENDALE **11) Km. Point:** 9.864 mi
16) Latitude: 38^48'22.04" **17) Longitude:** 75^30'38.19"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 1 mi **27) Year Built:** 1969
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 5556 **30) Year of ADT:** 2014
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 9

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 07 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 8/11/2009
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 6905 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: UNKNOWN **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 8/19/2015 **91) Frequency:** 24 months **Next Inspection:** 8/19/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 8/16/2013 **Next Elem Insp.:** 8/19/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 11
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 5 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 6 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 40.00 ft **33) Median:** 0
34) Skew: 30^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.93 ft **49) Structure Length:** 16.16 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/19/2015 **Type:** 1 **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: R.MOORE (TL,I,P) /
J.MASTEN (S,R) ADDITIONAL MAXIMO
MAINTENANCE: NONE AT THIS TIME

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....SCALE FACTORS ENTERED BY JEA ON 8/11/09 -- DO
NOT CHANGE OR ERASE.... NOTE: BRIDGE WAS INVENTORIED IN DECEMBER OF 2008,
BUT WASN'T CREATED IN THE SYSTEM UNTIL AUGUST OF 2009.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	156.00	0.00	148.00	2.00	6.00
817/1	Galvanizing Steel Protection	sq.ft	10,787.98	5,393.99	0.00	0.00	5,393.99
3440/1	Eff (Stl Protect Coat)	(LF)	1,644.09	0.00	0.00	0.00	1,644.09
1000/1	Corrosion	(LF)	8.00	0.00	0.00	2.00	6.00

1. EAST APPROACH

2. SOUTH ELEVATION

3. GENERAL VIEW SPAN#1 LOOKING SOUTH

4. UPSTREAM LOOKING NORTH

5. DOWNSTREAM LOOKING SOUTH

6. A/C WEARING SURFACE

7. EASILY PERFORATED W/ PICK HAMMER NEAR NORTH END

8. SPAN#1 EXISTING HOLE IN PIPE AT NORTH END

SCOUR RELATED DATA

For
Bridge: *3913 016*

Bridge ID: 3913 016 **Inspection Date:** 8/16/2013 **Region:** Rural
Waterway Name: WEST BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 11.48 ft **Depth of Flow:** 0.00 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:** HEAVY VEGETATION
Streambed: F **Comments:** SED IN BOTH PIPES
Embankment: F **Comments:** SED IN BOTH PIPES
Fender System: **Comments:** SED IN BOTH PIPES

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** Bank Erosion
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

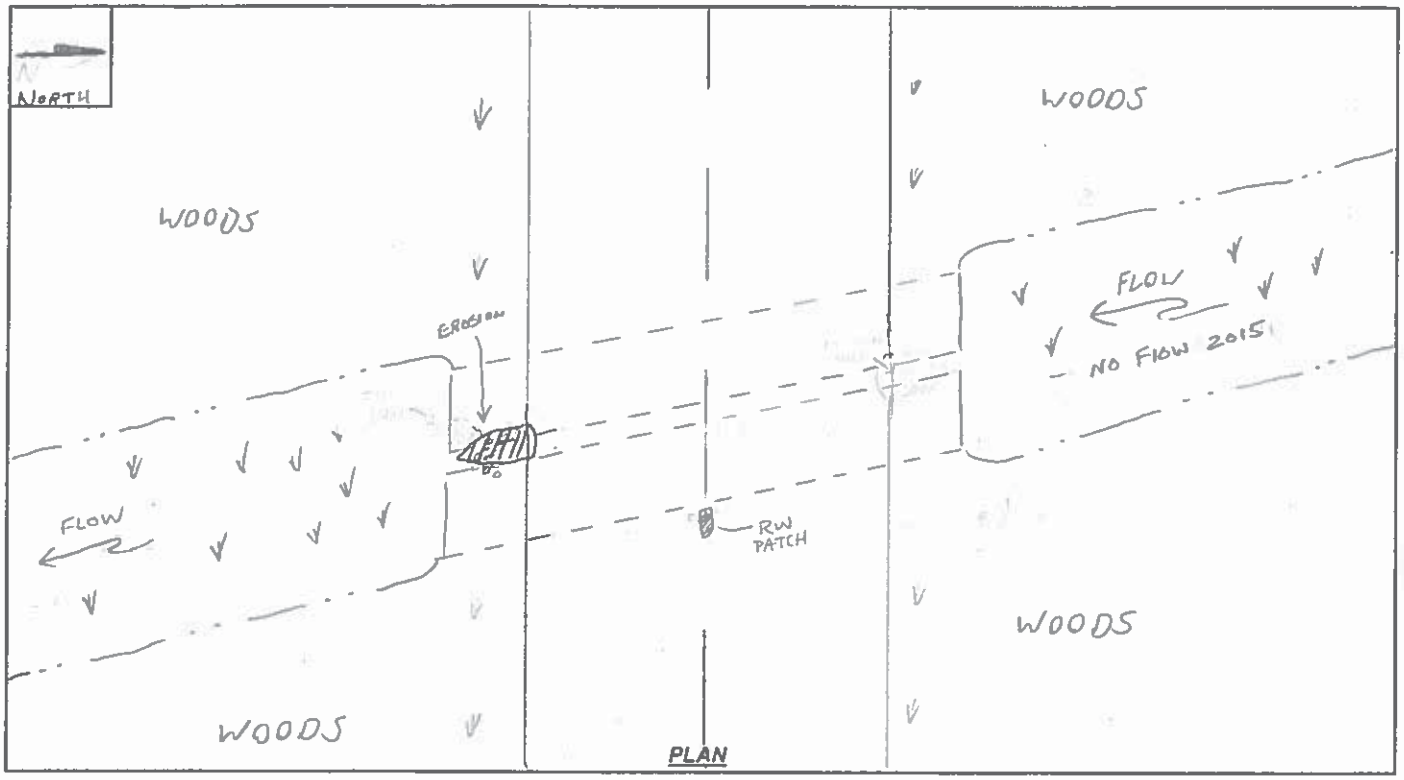
WATERWAY SKETCH SHEET

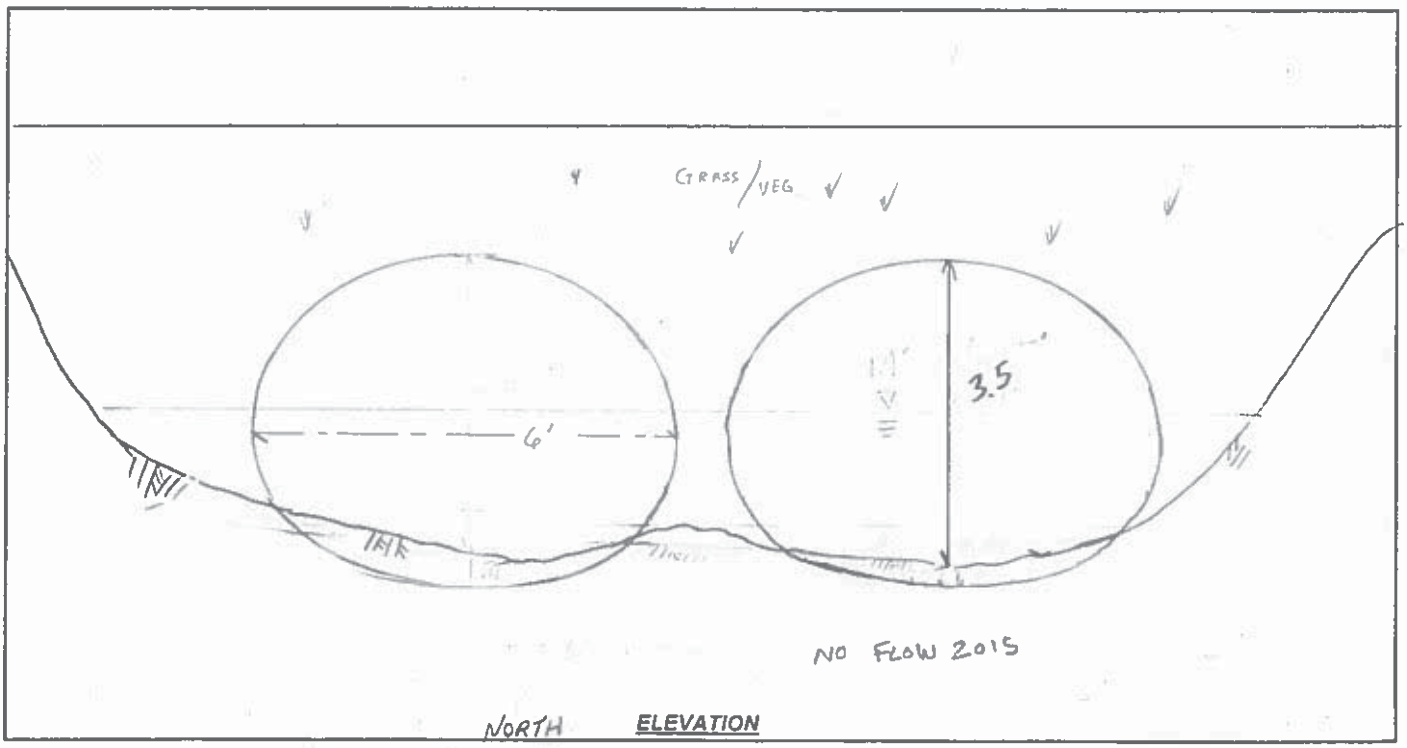
BR. ID.: 3 - 913 - 016

WATERWAY NAME: WEST BRANCH

DATE: 8 / 19 / 15

INSPECTED BY: JM / RM / /





STRUCTURAL DATA RECORD

Sufficiency Rating: 95.5

IDENTIFICATION

Bridge ID: 3914 016 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 53560
(A) On/Under: 1 **(B) Highway Type:** 3 **(C) Service Lvl:** 1
(D) Route No: 00016 **(E) Direction:** 0
6A) Features Intersected: STALLION HEAD BRANCH **6B) Critical:**
(7) Facility Carried: BEACH HGWY / SR16
(9) Location: W. OF ELLENDALE **11) Km. Point:** 10.990 mi
16) Latitude: 38^48'23.59" **17) Longitude:** 75^29'21.59"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 2 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 4 mi **27) Year Built:** 1988
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 5376 **30) Year of ADT:** 2012
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 5

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** NA **13B) LRS Subroute No.:** NA
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 07 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: N

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 8/11/2009
63) Oper. Rating Method: 5 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 5 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: NA **S437:** NA **T330:** NA
T435: NA **T540:** NA

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 5768 **115) Year of Future ADT:** 2031

CONTRACT INFORMATION

Contract 1: 8606311 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 8/16/2013 **91) Frequency:** 48 months **Next Inspection:** 8/16/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: NA **93B) UW Insp. Date:** NA **Next UW Insp.:** NA
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 48 months **Elem. Insp. Date:** 8/16/2013 **Next Elem Insp.:** 8/16/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 11
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 7 **Paint Condition:** NA
62) Culvert: 6 **Paint Priority:** NA

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 0 **B) Transition:** 0 **C) Approach Rail:** 0
D) Approach Rail Ends: 0
67) Structure Evaluation: 6 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 6 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 40.00 ft **33) Median:** 0
34) Skew: 40^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 7.83 ft **49) Structure Length:** 19.58 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 8/16/2013 **Type:** 1 **Inspector:** GMILLER

INSPECTION NOTES

INSPECTED BY: G.MILLER(TL,I,P) / R.MOORE
(S,R) REQUESTED MAXIMO: B054-
S6D...REPAIR EROSION BEHIND BOTH NW & NE
GROUTED RIPRAP WINGWALL EXTENTIONS.
(WO#: 583366)

BRIDGE NOTES

NBI DONE BY: GLEN MILLER ....SCALE FACTORS ENTERED BY JEA ON 8/11/09 -- DO NOT CHANGE OR ERASE... NOTE: BRIDGE WAS INVENTORIED IN DECEMBER OF 2008, BUT WASN'T CREATED IN THE SYSTEM UNTIL AUGUST OF 2009.

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
844/1	Maj Mtl Culv	(LF)	200.00	0.00	200.00	0.00	0.00
817/1	Galvanizing Steel Protection	sq.ft	13,829.69	13,829.69	0.00	0.00	0.00
895/1	Grouted or Sacked Ri	(SF)	474.00	454.00	0.00	0.00	20.00

1. WEST APPROACH

2. NORTH ELEVATION

3. GENERAL VIEW SOUTH THROUGH WEST CELL

4. UPSTREAM NORTH

5. DOWNSTREAM SOUTH

6. WEARING SURFACE FACING NORTH

7. FAILED SACKED HEADWALL/WINGWALL @ NORTHWEST CORNER

SCOUR RELATED DATA

For
Bridge: *3914 016*

Bridge ID: 3914 016 **Inspection Date:** 8/16/2013 **Region:** Rural
Waterway Name: STALLION HEAD BRANCH **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 1.40 ft **Depth of Flow:** 2.70 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:**
Embankment: G **Comments:**
Fender System: **Comments:**

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** No **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: Bank Prot/Vegit **Downstream Bank Condition:** Bank Prot/Vegit
Rdwy Overflow: Insignificant

LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

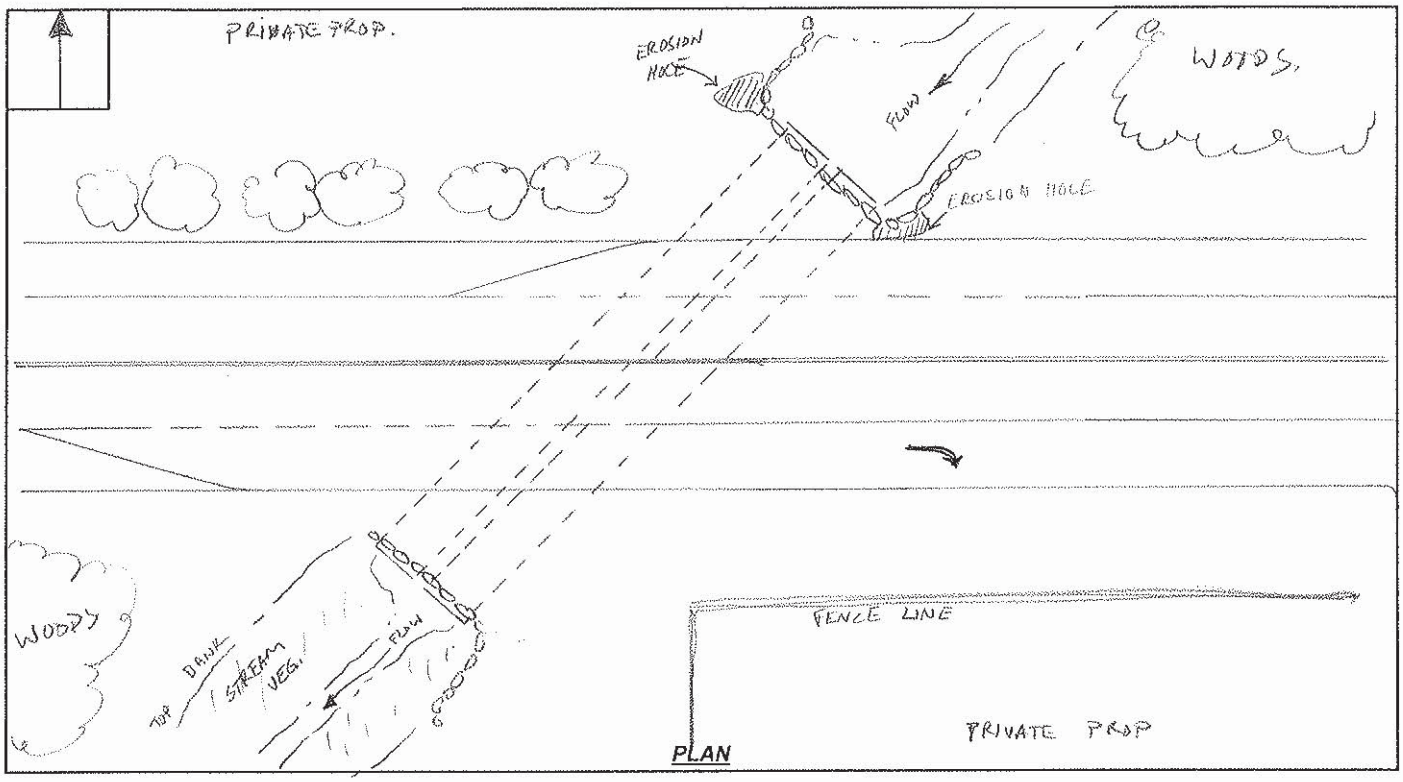
WATERWAY SKETCH SHEET

BR. ID.: 3-919-016

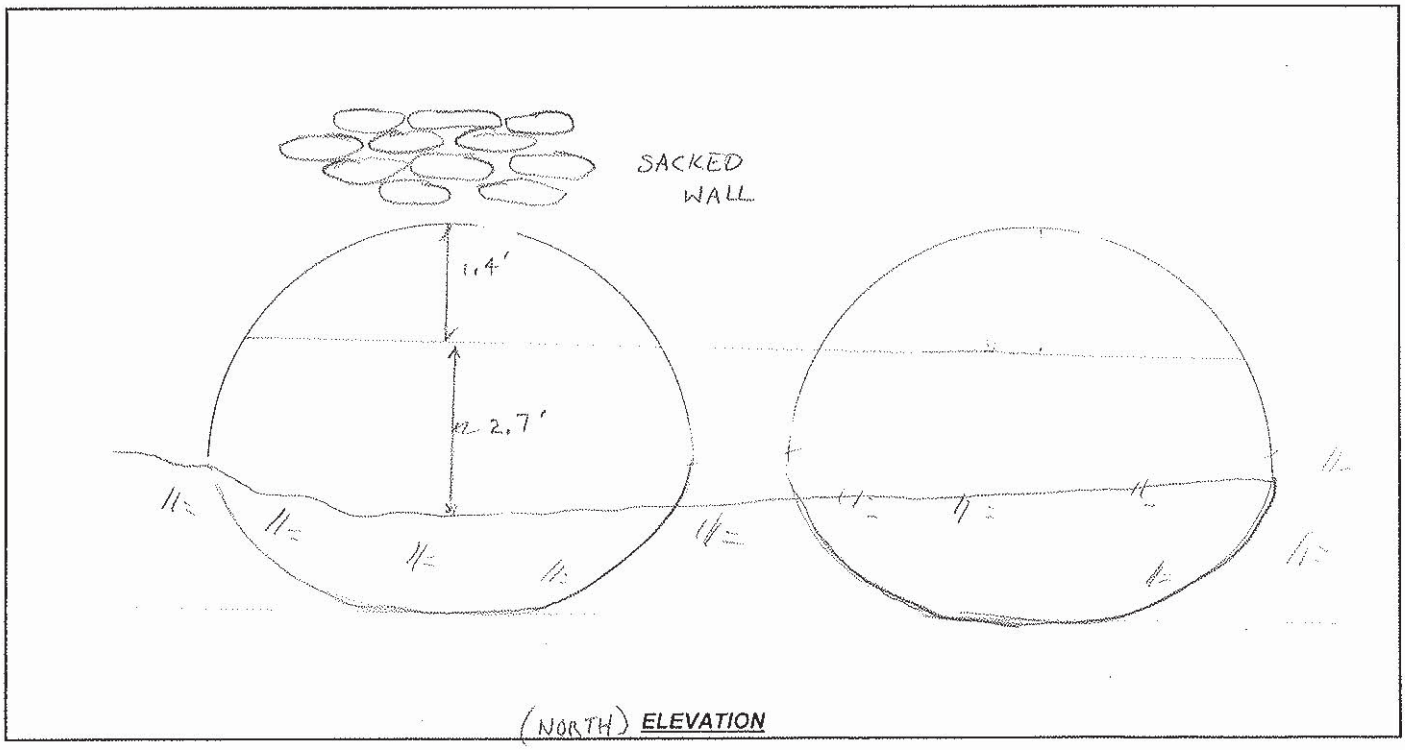
WATERWAY NAME: STALLION HEAD BRANCH

DATE: 08 / 16 / 13

INSPECTED BY: RM / GM / /



PLAN



(NORTH) ELEVATION

STRUCTURAL DATA RECORD

Sufficiency Rating: 88.7

IDENTIFICATION

Bridge ID: 3923 224 **(2) District:** 03 **(3) County:** 5
Inventory Route: **(4) Place Code:** 00850
(A) On/Under: 1 **(B) Highway Type:** 4 **(C) Service Lvl:** 1
(D) Route No: 00224 **(E) Direction:** 0
6A) Features Intersected: SWIGGETS POND **6B) Critical:**
(7) Facility Carried: FLEATOWN ROAD
(9) Location: S.E. OF MILFORD **11) Km. Point:** 10.270 mi
16) Latitude: 38^52'2.82" **17) Longitude:** 75^22'37.42"
98) Border Bridge Code: NA **99) Border Br. Str. No.:** NA

STRUCTURE TYPE AND MATERIAL

43A) MAIN SPAN MATERIAL: 3 **43B) DESIGN TYPE:** 19
44A) APPR. SPAN MATERIAL: NA **44B) DESIGN TYPE:** NA
45) Main Spans: 3 **46) Approach Spans:** 0
107) Deck Type: N
108A) Wearing Surface: N **108B) Membrane:** N **108C) Deck Protection:** N
Pier 1: NA **Pier 2:** NA **Pier Ftg. 1:** NA **Pier Ftg. 2:** NA
Abut 1: NA **Abut 2:** NA **Abut Ftg. 1:** NA **Abut Ftg. 2:** NA

NAVIGATION DATA

38) Navigational Control: 0 **39) Vertical Clearance:** 0.0 ft **40) Horizontal Clearance:** 0.0 ft
111) Pier Protection: ! **116) Lift Br. Vert. Clr:** 0.0 ft

AGE AND SERVICE

19) Detour Length: 2 mi **27) Year Built:** 1979
28) No. of Lanes: **A) On Bridge:** 2 **B) Under Bridge:** 0
29) ADT: 2026 **30) Year of ADT:** 2013
42) Type of Service: **A) On Bridge:** 1 **B) Under Bridge:** 5
106) Year Reconst.: -4 **109) % Truck ADT:** 5

CLASSIFICATION

12) Base Hwy. Network: 0 **13A) LRS Inv. Rte:** **13B) LRS Subroute No.:**
20) Toll Facility: 3 **21) Maintenance:** 1 **22) Owner:** 1
26) Functional Class: 09 **37) Historical:** 5 **100) Defense Highway:** 0
101) Parallel Str.: N **102) Direction:** 2 **103) Temp. Str.:**
104) NHS: 0 **105) Fed. Lands Highway:** 0 **110) Nat. Truck Network:** 0
112) NBIS Length: Y

LOAD RATING AND POSTING

31) Design Load: 5 **41) Oper. Status:** A **Rating Date:** 3/14/2016
63) Oper. Rating Method: 0 **64) Operating Rating:** 60.0
65) Inv. Rating Method: 0 **66) Inv. Rating:** 36.0 **70) Bridge Posting:** 5
Reason of Posting: NA **Date of Resolution:** NA **Rating Analysis Req'd:** NA
S335: 0 **S437:** 0 **T330:** 0
T435: 0 **T540:** 0

PROPOSED IMPROVEMENTS

75) Type of Work: NA **76) Length of Imp.:** NA
94) Bridge Cost: NA **95) Roadway Cost:** NA
96) Total Cost: NA **97) Year of Cost Est.:** NA
114) Future ADT: 2542 **115) Year of Future ADT:** 2037

CONTRACT INFORMATION

Contract 1: 7802303 **Contract 2:** -1 **Contract 3:** -1
Contract 4: -1 **Contract 5:** -1 **Contract 6:** -1

INSPECTION RECORD

90) Inspection Date: 5/19/2015 **91) Frequency:** 24 months **Next Inspection:** 5/19/2017
92A) FC Frequency: NA **93A) FC. Insp. Date:** NA **Next FC Insp.:** NA
92B) UW Frequency: 24 months **93B) UW Insp. Date:** 5/19/2015 **Next UW Insp.:** 5/19/2017
92C) SI Frequency: NA **93C) SI Date:** NA **Next SI:** NA
Element Frequency: 24 months **Elem. Insp. Date:** 5/19/2015 **Next Elem Insp.:** 5/19/2017
UBIV Required: N **UBIV Days:** NA **Inspection Zone:** 12
Boat: N **Tidal:** N **GPS:** Y

CONDITION

58) Deck: N **59) Superstructure:** N **60) Substructure:** N
61) Channel: 8 **Paint Condition:** N
62) Culvert: 5 **Paint Priority:** 9999

APPRAISAL

36) Traffic Sfty Feat.:
A) Bridge Rail: 1 **B) Transition:** N **C) Approach Rail:** 1
D) Approach Rail Ends: 1
67) Structure Evaluation: 5 **68) Deck Geometry:** N **69) Underclearance:** N
71) Waterway Adequacy: 7 **72) Approach Rdwy Alignment:** 8
113) Scour Critical Evaluation: 8 **Scour Analysis Date:** NA

GEOMETRIC DATA

32) Appr. Rdwy Width (w/ Shldrs): 22.00 ft **33) Median:** 0
34) Skew: 0^ 0' 0" **35) Structure Flared:** 0
48) Length Maximum Span: 6.10 ft **49) Structure Length:** 24.30 ft
50) Curb or Sidewalk: **A) Left:** 0.00 ft **B) Right:** 0.00 ft
51) Width Curb to Curb: 0.00 ft **52) Deck Width o/o:** 0.00 ft
53) Minimum Vertical Clearance Over Bridge Roadway: 99.9 ft
54) Vertical Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
55) Lateral Underclearance: **A) Reference:** N **B) Minimum:** 0.00 ft
56) Lateral Underclearance - Minimum Left: 0.00 ft

PAST INSPECTION

Inspection Date: 5/19/2015 **Type:** E **Inspector:** Pontis, Pontis

INSPECTION NOTES

INSPECTED BY: NRW (TL,I,R), ATF (I), MJA (I,S), WBC (I,P) PENNONI PERFORMED AN UNDERWATER INSPECTION ON 5/19/2015 NOTE: THE NORTHEAST GUARDRAIL IS MISSING TWO (2) CONNECTION BOLTS AT THE TOP ADJACENT TO FIRE HOOK-UP. MAINTENANCE REQUESTS: NONE AT THIS TIME

BRIDGE NOTES

NBI DONE BY: BMORGAN ....NOTE: SCALE FACTOR ENTERED BY GRD ON 11/14/05, DO NOT CHANGE.... NOTE: BRIDGE IS MARKED UNDERWATER DUE TO LOW-CLEARANCE INSPECTION

PONTIS DATA

Elem/Env	Description	Unit	Total Qty	Qty. St. 1	Qty. St. 2	Qty. St. 3	Qty. St. 4
240/2	Steel Culvert	ft	165.00	0.00	162.00	0.00	3.00
817/2	Galvanizing Steel Protection	sq.ft	1,422.00	0.00	168.01	0.00	1,253.98
3440/2	Eff (Stl Protect Coat)	ft	433.43	0.00	51.21	0.00	382.21
1000/2	Corrosion	ft	165.00	0.00	162.00	0.00	3.00

1. WEST APPROACH LOOKING EAST

2. NORTH ELEVATION LOOKING SOUTH

3. GENERAL VIEW, LOOKING SOUTH (CELL 2 SHOWN)

4. UPSTREAM CHANNEL LOOKING SOUTH

5. DOWNSTREAM CHANNEL LOOKING NORTH

6. TYPICAL BITUMINOUS PAVEMENT

7. CELL 1, N. END, E. SIDE - 10" L x 6" H AREA OF 100% SECTION LOSS.

SCOUR RELATED DATA

For
Bridge: *3923 224*

Bridge ID: 3923 224 **Inspection Date:** 5/19/2013 **Region:** Rural
Waterway Name: SWIGGETS POND **Fathometer Req'd:** No

STREAMBED CHARACTERISTICS
Streambed Mtrl: Sand **Streambed Mtrl Penetration:** Loose 1-3 in

WATERWAY INFORMATION
Tidal: N **Underclearance:** 1.20 ft **Depth of Flow:** 3.90 ft

ARMORING
Abutment: N/A **Piers:** N/A
Upstream Channel: No Armoring **Wingwalls:** N/A
Dwnstrm Channel: No Armoring **Channel Bottom:** N/A

TYPE OF FOUNDATION AND SUBSTRUCTURE ELEMENTS
Foundation Type: Culvert **Fnd. Mtrl:** Soil
Pier: **Cap Shape:** **Shape of Piles:**

CHANNEL AND CHANNEL PROTECTION (NBI ITEM # 61)
Waterway: G **Comments:**
Streambed: G **Comments:** PIPES WITH UP TO 10-INCHES OF SEDIMENT IN THEM.
Embankment: G **Comments:** PIPES WITH UP TO 10-INCHES OF SEDIMENT IN THEM.
Fender System: **Comments:** PIPES WITH UP TO 10-INCHES OF SEDIMENT IN THEM.

CHANNEL INFORMATION
Debris in Channel: No **Sediment in Channel:** Yes **Cap. of Chnl:** High
Chance of Overtopping: Slight (11-100 Yrs)
Upstream Bank Condition: No Deficiency **Downstream Bank Condition:** No Deficiency
Rdwy Overflow: Insignificant

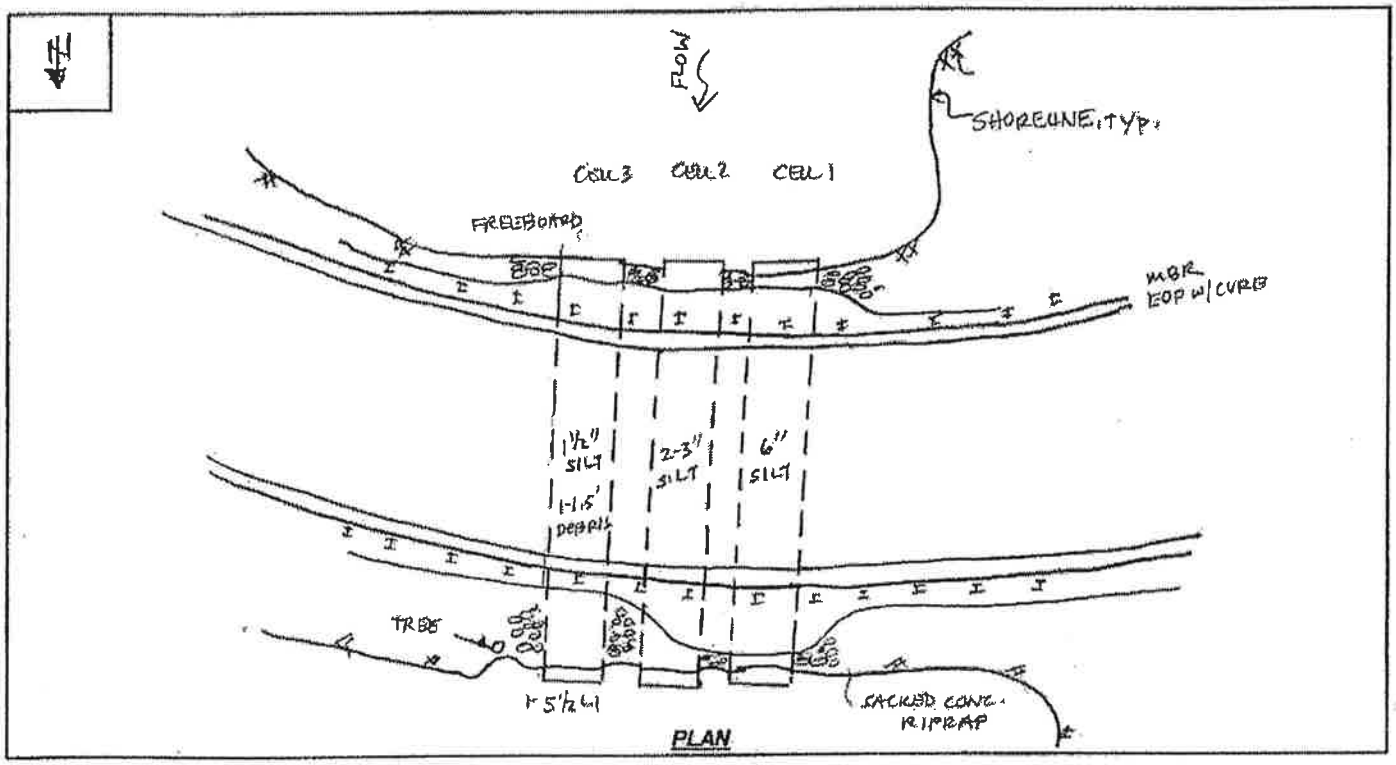
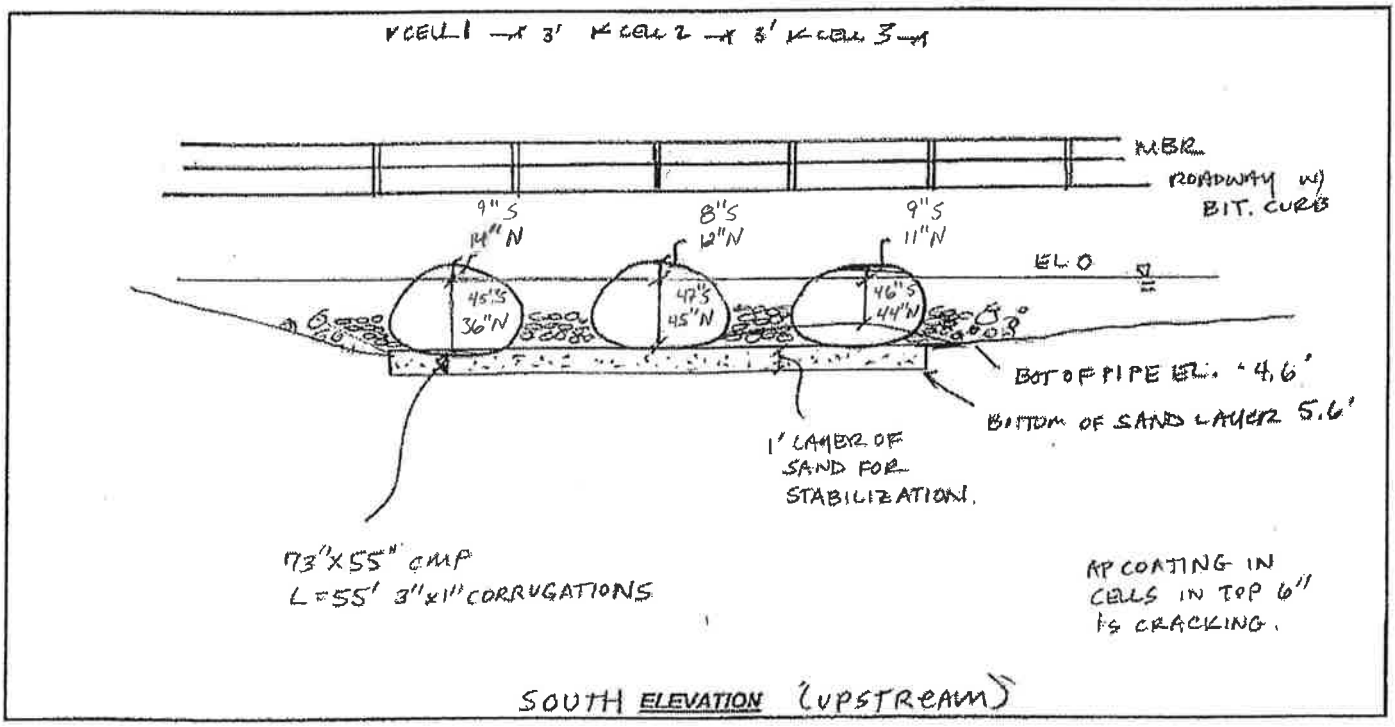
LOCAL SCOUR (OBSERVED) NBI ITEM # 113
Piers: **Abutment:** **Bents:**

SCOUR SHEET

WATERWAY SKETCH SHEET

BR. I.D.: 3 . 923 . 224

WATERWAY NAME: SWIGGETS POND

DATE: 5/19/2015

INSPECTED BY: NRW / WBC / ATF / MJA