PRELIMINARY GEOTECHNICAL ENGINEERING STUDIES
DOVER COMMUNITY CENTER
4 SPRINGDALE AVENUE
DOVER, MASSACHUSETTS

Prepared For:
Mills Whitaker Architects LLC
Arlington, Massachusetts

Prepared By:
The Geotechnical Group, Inc.
Needham, Massachusetts

File No. Y1963
August 2006

The Geotechnical Group Inc.
CONSULTING GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS

August 14, 2006
File No. Y1963

Mills Whitaker Architects LLC
PO Box 750089
Arlington, MA 02475

Attention: Mr. Don Mills

RE: Preliminary Geotechnical Engineering Studies
Dover Community Center
4 Springdale Avenue
Dover, MA

Dear Don:

The Geotechnical Group, Inc. (TGG) is pleased to present the results of our preliminary geotechnical engineering studies performed for the proposed Dover Community Center located at 4 Springdale Avenue in Dover, Massachusetts. Our objective has been to assess the subsurface conditions across the site and provide preliminary recommendations for use by the project team in design of foundations and the ground level floor slab, as well as for use in seismic design of the building. We have also provided recommendations for use during earthwork construction activities. Our studies have been performed in accordance with our proposal to Mills Whitaker Architects LLC (MWA), dated May 30, 2006 and are subject to the Statement of Limitations attached as Appendix A.

BACKGROUND

Several plans were forwarded to us and reviewed for use in our studies. They include:

- A plan entitled "Existing Conditions Plan", sheet no. EX-1, dated December 20, 2005, scale 1"=30', prepared by Harry R. Feldman, Inc.;
- A plan entitled "Conceptual Site Plan", sheet no. CP.01, dated June 14, 2006, prepared by H.K. Dodge Associates, Inc.;
- A plan entitled "Site Analysis – Site Context", sheet no. SP.00, dated June 7, 2007, prepared by H.K. Dodge Associates, Inc.; and
- Two plans entitled "Concept Plans – New Construction", sheet nos. A-05 and A-06, dated June 12, 2006 and July 10, 2006, respectively, and prepared by MWA.

The site of the proposed new Community Center at 4 Springdale Avenue is located on the southwest corner of Springdale Avenue and Centre Street. An entrance to the site is also located off of Whiting Road to the west. The site is currently developed with an existing one to two story brick school building (Caryl School) with a footprint area of about 20,000 square feet. Existing pavement and gravel parking areas, grassy areas and play areas occupy the remainder of the site. Underground utilities including a leach field are present on the site. The approximate 3-acre site is relatively flat with existing grades between about Elevation 163 to 158. The finish floor Elevation of the existing school building varies from about 153± in the southern portion to about 158± in the northern and eastern portions.

Our understanding of the project at this time, according to the plans we reviewed, is that the existing school building will be demolished and a new Community Center building will be constructed in about the same area. The proposed footprint is shown to extend beyond the existing building limits in some areas. The new Community Center building will have 2 floors and a partial basement in the eastern portion of the building. A gymnasium is shown to occupy the western portion of the building. The basement and first floor finish elevations have been preliminarily set at 150 and 162.25, respectively. Proposed site grading was not provided, however we anticipate the grades surrounding the building will be set just below the first floor elevation. Modifications to the existing leach field or replacement with a new field may be required.

PRELIMINARY SUBSURFACE EXPLORATIONS

A preliminary subsurface exploration program consisting of five soil test borings (B-1 through B-5) and two deep observation holes (A and B) was performed at the site to assess the subsurface conditions. The locations of the explorations were provided by MWA. Soil Exploration Corporation of Leominster, MA performed the borings on July 27, 2006 using a truck mounted drill rig. The borings were advanced to depths of between 20± and 32± feet below the existing ground surface using hollow stem augers. Standard Penetration Testing was generally conducted at about five foot intervals during advancement of the borings.

The Standard Penetration Tests (SPT) were performed by driving a standard two-inch outside diameter split spoon sampler a distance of twenty-four inches (or to refusal) with a 140-pound safety hammer falling a distance of thirty inches at each sampling depth. The number of blows required to drive the sampler in six-inch increments is recorded on the boring logs attached in Appendix B. The sum of the blows required to drive the sampler from the 6 to 12 and 12 to 18 inch increments, which is defined as the Standard Penetration Resistance of the soil, is used as a measure of soil density and strength based upon empirically derived correlations.

Soil samples retrieved during the SPTs were described in general accordance with the Burmister soil descriptions. Note that the soil descriptions are representative of the 1.4± inch minus size soil fraction of the overall deposits sampled. The soil descriptions, blow counts, and other information are shown on the boring logs, which are attached in Appendix B of this report.

The deep observation holes were excavated by the Town of Dover on July 27, 2006 using a rubber tire backhoe in the areas of potential new leach fields. The holes reached depths of 120± to 124± inches below existing ground surface. The soils encountered in the holes were described in general accordance with the USDA system of classification. The soil descriptions, and other information are shown on the deep observation hole and on-site assessment logs, which are attached in Appendix C of this report.

The boring and deep observation hole locations are shown approximately on the Exploration Location Plan, attached as Figure No. 1. These locations were determined by pacing and line of sight from the existing site features and should be considered approximate.

LABORATORY SOIL TESTING AND FIELD PERCOLATION TESTING

A laboratory soil testing program consisting of natural water contents and grain size analyses was conducted on samples of soil encountered during the borings. Again, it should be noted that the samples retrieved and tested represent the 1.4± inch minus size soil fraction of the sampled soil deposits. The purpose of the laboratory testing was to aid in describing the soil composition and to evaluate engineering behavior. The testing was performed in general accordance with the testing requirements of ASTM and the results are discussed in the next section. The laboratory testing results are included in Appendix D of this report.

Percolation tests were performed at depths of 50± to 64± inches below ground surface in each of the two deep observation holes. The percolation tests were performed in general accordance with the requirements of Title 5 of the Massachusetts Environmental Code. The percolation test results indicated percolation rates of less than 1 minute per inch at each hole location. Percolation test results are shown on the percolation test form, which is included in Appendix C of this report.

SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

Our understanding of the subsurface conditions at the site is based on our site reconnaissance and our review of the results of the borings, deep observation holes and laboratory analyses. The general subsurface profile encountered at the site beneath the surficial pavement and topsoil fill consists of a granular fill deposit extending to depths of about 2± to 5± feet below existing grades that is underlain by natural sandy soils to the depths explored.

A 1.5± to 4.5± foot thick layer of existing granular fill was observed at each boring and deep observation hole location below the, less than 6± inch thick, surficial topsoil fill or pavement. The fill can generally be described as a loose to medium dense, brown, fine to medium or fine to coarse sand with between about 10 to 30 percent silt and up to about 20 percent fine to coarse gravel. Due to its variable nature and the unknown manner in which it was placed, the existing fill is not considered suitable for support of structural building loads in its current condition. The fill could be densified in-place for pavement support however.

Natural sandy soils consisting of either sand and gravel, sand or sandy silt layers were observed beneath the fill deposit to depths of up to 32± feet below ground surface. The surface of this deposit was observed at about elevations ranging from 153± to 160±. These soils were deposited as outwash from glacial runoff during or following glacial retreat. The deposit was assessed to be loose to very dense but primarily medium dense based upon the results of the SPTs. The tan sand and gravel generally consisted of fine to coarse sand with between about 15 to more than 50 percent fine to coarse gravel and about 5 to 15 percent silt. The tan sand generally consisted of either fine or fine to medium sand with about 5 to 30 percent silt. A 12± inch thick layer of wet silt with fine sand (sandy silt) was observed during boring B-1 at a depth of 15± feet. These soils are considered to be firm, natural ground and should be the strata upon which the foundations are constructed. The sandy silt and the fine sand with a significant percentage of silt are considered moisture sensitive. Care should be taken by the earthwork contractor when handling these soils during wet weather or below the groundwater table.

Refusal to the drill augers and split spoon sampler occurred during boring B-4 at a depth of about 20.3 feet below ground surface. The refusal condition was not determined but may be the result of a boulder or encountering the bedrock surface. The refusal condition is not expected to impact the proposed development unless deep excavations are planned.

Groundwater was encountered during three of the five borings (B-2, B-4 and B-5) at depths of about 15± to 30± feet below the existing ground surface. These depths correspond to Elevations between 133± and 143±. In addition, TGG personnel utilized five existing wells to measure the depth to groundwater at the site on June 7, 2006. The wells were installed by others as part of previous environmental studies. These depths correspond to Elevations between 132± and 147±. Based on our observations, groundwater may become an issue during and following the construction of a basement level set at Elevation 150. It should be noted that the groundwater level at the site will fluctuate due to varying climatic, surface and subsurface conditions. Therefore, groundwater levels encountered during construction and thereafter may differ from those reported herein.

PRELIMINARY GEOTECHNICAL ENGINEERING RECOMMENDATIONS

At the time of this report, a new Community Center building is proposed for construction at the approximate location of the existing school building. Given that the redevelopment of the site into a new Community Center is in a preliminary stage, we respectfully request the opportunity to review updated plans and make additional recommendations or modify the recommendations discussed herein if necessary.

Based on the conceptual plans we reviewed, we anticipate the gymnasium portion of the new building will be constructed as a slab on grade at the first floor elevation of 162±. The area of the proposed gymnasium is located approximately within the western portion of the existing school building where the existing finish floor elevations appear to range from about 153± to 158±. The remaining areas of the Community Center are shown to overlap the eastern portion of the existing school and have a basement level slab preliminarily set at Elevation 150. The existing school building appears to have a finish floor elevation of about 158± in this area.

Given this information, a fill in the western half and a cut in the eastern half of the new building will be required to achieve the proposed subgrade elevations.

The existing granular fill soils at this site are considered unsuitable for building support due to their erratic density, composition, and the unknown manner in which they were placed. The new building loads should be transferred to the underlying firm, natural ground. It is our opinion that a foundation system consisting of conventional shallow spread footings bearing on firm, natural ground could be utilized to support the new building foundation loads. To accomplish this, excavation and replacement of the existing fill may be required below foundations depending on the proposed foundation subgrade elevations.

The proximity of groundwater to the building is of concern should a basement level be constructed at Elevation 150. Groundwater levels were measured at the site in the vicinity of the new building's basement at elevations up to 147±. Additional design and construction measures regarding bearing capacity, waterproofing, foundation underdrains, and dewatering may be required due to this vertical separation distance of about 3 feet. If possible, we recommend the basement level be raised to about Elevation 153.

Our preliminary recommendations pertaining to earthwork, foundations and allowable bearing capacity, seismic design criteria, floor slab on grade, building retaining walls, and materials are presented under the following subheadings.

General Earthwork Recommendations

The existing building's foundations and subsurface utilities should be removed in their entirety from the proposed building area. Excavation should then proceed to remove the existing fill or to reach the proposed subgrade elevations, whichever is lower. The excavation to remove the existing fill should extend beyond the exterior building lines to accommodate the stress zone of the building's perimeter foundations. The stress zone of a foundation is defined by a line sloping downward and outward from the outside bottom edge of the foundation to firm, natural ground on a one horizontal to one vertical slope.

Once exposed, portions of the natural subgrade may be susceptible to disturbance especially during wet weather. The sandy soils containing significant amounts of silt are of particular concern. Careful excavation procedures will be critical to maintaining the integrity of the subgrade and the subsequent lifts of structural fill to be placed above.

After the natural subgrade is cleaned and recompacted, structural fill should be placed in controlled, compacted 12-inch maximum thick lifts up to the slab subgrade elevations (if necessary) under appropriate observation by a qualified geotechnical engineer. Each lift should be compacted to a firm and stable condition and to at least 95 percent of the soil's maximum dry density as determined by ASTM D-1557 for subsequent support of the foundations and slab on grade.

Suitable structural fill is anticipated to include some of the on-site existing fill, as well as sand and gravel and structural fill from off-site sources. Structural fill, sand and gravel and crushed stone from off-site sources should meet the recommendations contained under the subheading Materials on page 8 of this report. Some of the existing fill deposit may be reusable on-site as structural fill from a geotechnical engineering perspective provided the fill intended for reuse is excavated and maintained at a suitable moisture content for compaction to a firm and stable condition, and oversize boulders and deleterious materials are removed. The on-site geotechnical engineer should assess the suitability of the excavated on-site materials for reuse as structural fill on this project during construction.

Some of the existing fill encountered during the test borings contains a relatively high percentage of silt. Consequently these silty fill soils will be difficult to work with during wet weather. The fill material should be placed and compacted to a firm and stable condition and its required density the same day it is excavated. Stockpiling increases exposure to saturation by rain.

Additionally, some areas of the site may have existing fill that contains deleterious material consisting of: organic matter, construction debris (wood, concrete, brick, metal, plastic, etc.), and oversize boulders and therefore may not be readily reusable. Oversized boulders are defined as boulders that are greater than 2/3's of the loose lift thickness. For instance, a 12-inch thick loose lift may contain boulders up to about 8 inches in diameter. Efforts should be made to reuse as much fill as possible by removing oversize boulders and other deleterious materials from the fill. Organic matter, deleterious materials and oversize boulders should be properly disposed of off-site.

If a winter earthwork construction schedule is anticipated, provisions should be made to protect against frost penetration. Lifts of fill shall not be placed over frozen soils. Frozen soils should be removed and/or thawed and recompacted.

Foundations and Allowable Bearing Capacity

Conventional spread footings are recommended for support of the proposed building. Excavation for the foundations are anticipated to proceed through previously placed and compacted structural fill (as described in the preceding section), and/or firm, natural sandy soils to reach the proposed bottom of footing elevation.

If a silty, moisture sensitive natural soil (i.e. sandy silt or silty fine sands) is encountered at the foundation subgrade, the foundation should be constructed on a 6-inch minimum thick layer of compacted crushed stone. Therefore excavation for the footings in these areas should extend an additional six inches below the proposed bottom of footing elevation. The intent of the crushed stone is to provide a working mat to protect the bearing soils from disturbance and to provide a media from which dewatering operations (if required) can be performed to allow foundation construction to occur in the dry.

If the basement level is set at Elevation 150, the foundation subgrade elevations will most likely be set one or two feet below this elevation. Groundwater may then be encountered during foundation excavations. The contractor should be prepared to dewater foundation excavations so that foundation subgrade preparation and construction can proceed in the dry. To reduce the amount of dewatering and for ease of construction, we recommend that the basement level be set no lower than about Elevation 153.

If the basement level is established at Elevation 150, we recommend designing the foundations according to a preliminary maximum allowable bearing pressure of one and one-quarter tons per square foot (1.25 tsf). A larger bearing pressure may be possible if the basement level is established at a higher elevation. We recommend designing the foundations in the gymnasium area according to a preliminary maximum allowable bearing pressure of one and one-half tons per square foot (1.5 tsf).

Regardless of the recommended allowable bearing capacity, continuous strip footings should be at least 24 inches wide and column footings should be no less than 36 inches wide in least lateral dimension. Footings should be founded at least 4 feet below exterior finish grade for frost protection. In addition, where new or existing utilities to remain are located, footings should be dropped so that no pipe is within the stress zone of any footing. Another option is to move utilities to satisfy this recommendation.

If a winter earthwork construction schedule is anticipated, interim frost protection may be required. Prepared foundation subgrades should be continuously protected against frost penetration from the time of excavation until the foundations can be properly backfilled to a depth of 4 feet. Additional frost protection measures such as the use of insulation blankets and tenting and heating may be required prior to backfilling operations to protect the foundation bearing soils.

Seismic Design Considerations

Provided that foundations are designed and constructed as recommended herein, the proposed building site should be considered an S_2 soil site in accordance with Section 1612.4.2 of The Code. Accordingly, an S factor of 1.2 should be utilized for calculating minimum total lateral seismic forces in accordance with Section 1612.4.2 of The Code.

Floor Slab on Grade

Slab on grade construction is recommended for the basement and first floor (gymnasium) slabs provided the existing fill soils are excavated and replaced with compacted structural fill as described previously. The slab should bear directly on a 6-inch minimum thick base course sand and gravel layer, compacted to at least 95 percent of the soil's maximum dry density as determined by ASTM D-1557. The sand and gravel should meet the gradation specifications contained in Table 1 below.

Building Retaining Walls

Proposed finish grading outside the building is not shown on the referenced plans. However, based on the proposed first floor elevation, the basement walls of the building are anticipated to retain up to about 12 feet of soil. It these walls are formed and backfilled independent of one another and are free to deflect at the top (a wall movement of approximately 0.001 to 0.01 x H) prior to placement of the first floor structural members, the full "active" earth pressures behind the walls will be mobilized. Under these conditions, the walls should be designed to resist a static lateral earth pressure taken as an equivalent fluid pressure of 45 pounds per cubic foot per foot height of wall.

However, if these walls are braced and prohibited from movement during backfilling, they would be considered sufficiently rigid so that "at rest" earth pressure conditions would apply. In the "at rest" condition, the walls should be designed to resist a static lateral earth pressure taken as an equivalent fluid pressure of 65 pounds per cubic foot per foot height of wall.

Only hand operated vibratory plate or drum compactors should be used when compacting within 5 feet from the backside of these walls and the "rigid" basement walls should not be backfilled to a level higher than 4 feet above bottom of footing grade until the upper floor beams are in place to act as top bracing or until temporary bracing is in place. Bracing requirements prior to backfilling should be reviewed by the project structural engineer.

The recommended earth pressures are valid assuming that the backfill is horizontal and well drained. In order to promote drainage of water that may accumulate behind the walls, they should be backfilled to a minimum distance of three feet with a "clean" (less than 8 percent passing the number 200 sieve) granular material. Some of the sandy soils at the site meet this requirement. The on-site geotechnical engineer will be able to assist in assessing which on-site soils meet his requirement. Fill obtained from off-site sources for this purpose should meet the recommended gradation criteria in Table 1 below. Ground surfaces immediately around the building should be sloping downward away from the structure and surface runoff should be diverted away from the building.

In an effort to control groundwater levels, a foundation perimeter drain consisting of a perforated 6 inch PVC pipe, surrounded in at least 6 inches of ¾ inch crushed stone and wrapped in filter fabric should be provided at the base of each basement wall adjacent to the footing. The pipe should be located below the finish floor elevation of the basement level and connected in a loop around the entire basement level. The pipe should be laid flat and outlet by gravity to an appropriate drainage structure or to a sump pump system that has backup emergency power. Waterproofing the basement walls should be considered as an additional measure to mitigate water from seeping into the basement particularly if the basement level is set at Elevation 150. Additional underdrains beneath the basement slab may also be prudent in this case.

Materials

As discussed earlier, on-site fill considered for reuse as structural fill within the building area should be unfrozen soil and free of organic matter, deleterious materials and oversize boulders. The fill should also be at a suitable moisture content to allow for proper placement and compaction to a firm and stable condition. Off-site structural fill and base course sand and gravel should be unfrozen, free of organic matter and deleterious materials, at a suitable moisture content for proper placement and compaction to a firm and stable state and meet the gradation criteria contained in the table below. Crushed stone should conform to the Massachusetts Highway Department specifications for ¾-inch crushed stone (M2.01.4).

TABLE 1 – MATERIAL GRADATION CRITERIA

Percent Finer by Weight

Sieve Size	Sand and Gravel	Off-site Structural Fill
8-inch		100
4-inch	100	
½-inch	50 – 85	
No. 4	40 – 75	30 – 95
No. 10	30 – 60	
No. 40	10 – 35	10 – 70
No. 100	5 – 20	
No. 200	2 – 8	0 – 15*

* Reduced to 0 – 8 for backfill within 3 feet of retaining walls.

REVIEW AND EARTHWORK OBSERVATION

The project is in a preliminary stage at this point. We respectfully request the opportunity to review updated plans to assess that the recommendations contained in this preliminary report have been properly interpreted and to modify our recommendations or to provide additional recommendations.

Once the project is under construction, we also recommend that TGG be retained to provide construction observation and soil testing services during the earthwork phase of the project. Our continued involvement will allow us the opportunity to assess the chosen contractors' compliance with the intent of this report and subsequent recommendations. Should questions or unanticipated/changed conditions present themselves, we will be available to provide timely geotechnical engineering input.

Thank you very much for the opportunity to assist you on this project. We look forward to continued involvement with Mills Whitaker Architects. Please do not hesitate to contact us if you have any questions or comments.

Very truly yours,

THE GEOTECHNICAL GROUP, INC.

James M. Handanyan, P.E.
Vice President

Jeremy A. Haugh, P.E.
Project Engineer

JAH/JMH/jah

Attachments: Figure 1 – Exploration Location Plan
Appendix A – Statement of Limitations
Appendix B – Test Boring Logs
Appendix C – Deep Observation Hole Logs and Percolation Test Form
Appendix D – Laboratory Test Results

NOTES:

1. BASE MAP DEVELOPED FROM CADD FILES PROVIDED BY HARRY R. FELDMAN, INC. ENTITLED ``EXISTING CONDITIONS PLAN", DATED 12/20/05, ORIGINAL SCALE 1"=30', DRAWING NO. EX-1.
2. THE LOCATIONS OF THE BORINGS WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT AND PACING FROM EXISTING TOPOGRAPHIC FEATURES. THIS DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED.

LEGEND:

- BORINGS PERFORMED BY SOIL EXPLORATION CORPORATION ON 7/27/06. OBSERVED AND LOGGED BY TGG PERSONNEL.
- DEEP OBSERVATION HOLES PERFORMED BY TOWN OF DOVER ON 7/27/06. OBSERVED AND LOGGED BY TGG PERSONNEL.

REV No.	DATE	INT.	- DESCRIPTION -

DRAWN BY: JJP | REVIEWED BY: JAH

DATE: 8/14/06 | SCALE: 1"=60' | JOB No. Y1963.00

DOVER COMMUNITY CENTER — DOVER, MASSACHUSETTS

EXPLORATION LOCATION PLAN

TGG®

FIGURE No. 1

STATEMENT OF LIMITATIONS

Explorations

The analysis and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

The stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

Water level readings have been made in the explorations at the time and under the conditions stated on the logs. This data has been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors that are different from the time the measurements were made.

Review

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

It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork recommendations may be properly interpreted and implemented in the design and specifications.

Construction

It is recommended that this firm be retained to provide soil engineering services during the construction phase of the work. This is to observe compliance with design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Use of Report

This report has been prepared for the exclusive use of Mills Whitaker Architects LLC for specific application to the proposed Dover Community Center at 4 Springdale Avenue in Dover, Massachusetts, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No.	B-1
	Sheet 1 of 1
File No.	Y1963
Review by:	James Handanyan

Boring Co.	Soil Exploration Corporation
Foreman	George
TGG Observer	Michael Clement
Boring Location:	See Exploration Location Plan
Ground Elev.	159±
Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	22'±	–	3

Sample Data

No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem	Strata Change	Sample Description
S-1	0-2	2-4-6-5	24	10		Topsoil Fill 0.5	Dark brown, SILT and fine to medium SAND, trace fine Gravel, Organics.
						Fill 5.0	Loose, brown, fine to coarse SAND, little fine Gravel, little Silt.
S-2	5-7	3-2-4-6	24	12		Sand & Gravel 15.0	Loose, tan, fine to coarse SAND, some fine Gravel, trace Silt.
S-3	10-12	11-15-15-17	24	0			No Recovery.
S-4A	15-16	9-12	12	8	1	Sandy Silt 16.0	Wet, gray to tan, SILT, little fine Sand.
S-4B	16-17	11-12	12	8		Sand 22.0	Tan, fine to medium SAND, trace Silt.
S-5	20-22	6-9-10-9	24	12	2		Medium dense, tan, fine SAND, trace fine Gravel, trace Silt.
							Bottom of Boring at 22.0± feet.

Remarks:
1. Apparent perched groundwater at about 15 to 16 feet.
2. The boring was terminated at 22± feet.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No. B-2
Sheet 1 of 2
File No. Y1963
Review by: James Handanyan

Boring Co.	Soil Exploration Corporation
Foreman	George
TGG Observer	Michael Clement
Boring Location:	See Exploration Location Plan
Ground Elev.	163±
Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	32'±	30'±	2

Sample Data						Strata Change	Sample Description
	No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem	
	S-1	1-3	8-6-4-2	24	12		Asphalt 0.3
							Fill — Loose to medium dense brown, fine to coarse SAND, little fine Gravel, little (-) Silt.
	S-2	3-5	5-7-9-9	24	8		3.0
							Medium dense, tan, fine to coarse SAND, some (-) fine Gravel, trace Silt.
5	S-3	5-7	7-6-6-7	24	14	1	Medium dense, tan, fine to coarse SAND, some fine Gravel, trace Silt.
							Sand & Gravel
10	S-4	10-12	4-5-5-6	24	14		Loose to medium dense, tan, fine to coarse SAND, some fine Gravel, trace Silt.
							15.0
15	S-5	15-17	4-5-6-7	24	20		Medium dense, tan, fine SAND, some Silt.
20	S-6	20-22	7-11-11-15	24	20		Sand — Medium dense, tan, fine SAND, little (+) Silt.
25	S-7	25-27	6-10-12-13	24	18		Medium dense, tan, fine SAND, little (+) Silt.

Remarks:
1. Performed continuous sampling through apparent fill material.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No. B-2
Sheet 2 of 2
File No. Y1963
Review by: James Handanyan

Boring Co.	Soil Exploration Corporation
Foreman	George
TGG Observer	Michael Clement
Boring Location:	See Exploration Location Plan
Ground Elev.	163±
Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	32'±	30'±	2

Sample Data

No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem	Strata Change	Sample Description
S-8	30-32	6-8-9-12	24	18	2	Sand	Medium dense, wet, fine SAND, some (-) Silt.
					3	32.0	
							Bottom of Boring at 32.0± feet.

Remarks:
2. Groundwater encountered at about 30± feet below ground surface during drilling.
3. The boring was terminated at 32± feet.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No. B-3
Sheet 1 of 1
File No. Y1963
Review by: James Handanyan

Boring Co.	Soil Exploration Corporation
Foreman	George
TGG Observer	Michael Clement
Boring Location:	See Exploration Location Plan
Ground Elev.	163±
Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	22'±	–	2

	Sample Data						Strata Change	Sample Description
	No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem		
	S-1	0-2	1-2-3-4	24	12		Topsoil Fill 0.5	Dark brown, fine to medium SAND and SILT, trace Organics.
							Fill	Loose, brown, fine to medium SAND, some Silt, trace (+) fine Gravel.
5							5.0	
	S-2	5-7	8-15-15-17	24	18		Sand & Gravel	Dense, tan, fine to coarse SAND, some (-) fine Gravel, trace Silt.
10	S-3	10-12	8-7-6-8	24	12			Medium dense, tan, fine to coarse SAND, some (-) fine Gravel, trace Silt.
15							15.0	
	S-4	15-17	7-10-12-15	24	16		Sand	Medium dense, tan, fine to medium SAND, little Silt.
20	S-5	20-22	8-9-9-10	24	20	1	22.0	Medium dense, tan, fine to medium SAND, little Silt.
								Bottom of Boring at 22.0± feet.
25								

Remarks:
1. The boring was terminated at 22± feet.
2. Groundwater was not encountered at the time of the test boring.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No. B-4
Sheet 1 of 1
File No. Y1963
Review by: James Handanyan

Boring Co.	Soil Exploration Corporation
Foreman	George
TGG Observer	Michael Clement
Boring Location:	See Exploration Location Plan
Ground Elev.	159±
Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	20.3'±	19'±	4

Sample Data						Strata Change	Sample Description
No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem		
S-1	0-2	2-4-6-10	24	10		Topsoil Fill 0.5	Dark brown, fine to medium SAND and SILT, trace Organics.
					1, 2	Fill 2.0	Loose to medium dense, brown, fine to coarse SAND, some Silt.
S-2	2-4	5-4-3-3	24	12			Loose, tan, fine to medium SAND, little (+) Silt.
S-3	4-6	4-5-5-8	24	20			Loose to medium dense, tan, fine SAND, little Silt.
S-4	10-12	7-9-8-12	24	20		Sand	Medium dense, tan, fine to medium SAND, little (-) Silt.
						15.0	
S-5	15-17	12-25-31-36	24	18		Sand & Gravel	Very dense, tan, fine to coarse SAND, some fine Gravel, trace (+) Silt.
						20.3	Wet, tan, fine to coarse SAND, some fine Gravel, little Silt.
S-6	20-20.3	50/3"	3	3	3	Refusal	Auger and split spoon refusal at 20.3± feet.

Remarks:
1. Performed continuous sampling through apparent fill material.
2. Drilled through brick at about 2± feet.
3. Refusal to auger and split spoon at 20.3± feet.
4. Groundwater encountered at about 19± feet below ground surface at the time of the boring.

THE GEOTECHNICAL GROUP, INC.

Test Boring Log

- PROJECT -

Proposed Dover Community Center
Dover, MA

Boring No. B-5
Sheet 1 of 1
File No. Y1963
Review by: James Handanyan

Boring Co.	Soil Exploration Corporation	Boring Location:	See Exploration Location Plan
Foreman	George	Ground Elev.	158±
TGG Observer	Michael Clement	Date Start > End	7/27/06

Sampling Protocol

Unless otherwise noted, borings were accomplished using 4-inch inside diameter hollow stem augers. Samples were recovered using a 2-inch I.D. split spoon sampler, driven by blows of a 140 lb. safety hammer falling 30 inches.

Ground Water Readings (See Notes)

Date	Time	Depth to Bottom	Depth to Water	Rem.
7/27	Drilling	22'±	15'±	3

Sample Data

No.	Depth	Blows per 6 in.	Pen.	Rec.	Rem	Strata Change	Sample Description
S-1	0-2	2-6-7-6	24	8		Topsoil Fill 0.5	Dark brown, fine to medium SAND and SILT, trace (-) Roots.
						Fill	Medium dense, brown, fine to medium SAND, some Silt, trace fine Gravel.
						5.0	
S-2	5-7	11-50/5"	11	6	1	Sand & Gravel	Tan, fine to coarse GRAVEL and fine to coarse SAND, trace Silt.
						10.0	
S-3	10-12	13-13-9-20	24	14		Sand	Moist, medium dense, tan, fine SAND, little (+) Silt.
						15.0	
S-4	15-17	10-28-33-45	24	6		Sand & Gravel	Very dense, wet, gray, fine to coarse SAND and fine GRAVEL, trace Silt.
S-5	20-22	23-12-12-9	24	12			Medium dense, wet, gray, fine to coarse SAND and fine GRAVEL, little Silt.
					2	22.0	
							Bottom of Boring at 22.0± feet.

Remarks:
1. Refusal to split spoon at 6± feet.
2. The boring terminated at 22± feet.
3. Groundwater encountered at about 15± feet at the time of the test boring.

THE GEOTECHNICAL GROUP, INC.

DEEP OBSERVATION HOLE AND ON-SITE ASSESSMENT LOG

Project:	Dover Community Center	**Client:**	Mills Whitaker Architects	**Soil Evaluator:**	Jeremy Haugh
Project Location:	4 Springdale Avenue Dover, MA	**Owner:**	Town of Dover	**Witness:**	None
				Date:	7/27/06
Deep Hole Number:	A	**Contractor:**	Town of Dover	**Weather:**	80 Degrees F, Sunny
Project/File Number:	Y1963	**Deep Hole Location/ Lot Number:**	See Exploration Location Plan	**Ground Elevation at Surface of Deep Hole:**	160±

Depth (inches)	Soil Horizon or Layer	Soil Matrix: Color–Moist (Munsell)	Redoximorphic Features (Mottles)			Soil Texture (USDA)	Coarse Fragments (% by volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth (inches)	Color	Percent		Gravel	Cobbles & Stones			
0-24	Fill	---	---	---	---	---	---	---	---	---	
24-40	B	2.5YR 5/8	---	---	---	Sandy Loam	5	<2	Subangular Blocky	Friable	
40-120	C	10YR 6/2	---	---	---	Gravelly Sandy Loam	20	5	Single Grain	Very Friable	

Additional Notes:

Land use: Developed **Surface Stones:** None **Slope (%):** 2± **Vegetation:** Grass
Landform: Outwash Plain **Position on Landscape:** Shoulder **Parent Material:** Proglacial Outwash
Approximate Distance (feet) from: Open Water: --- **Drainage:** --- **Wetlands:** --- **Property Line:** 50'±

Groundwater Observed: No **If yes: Depth Weeping from Pit Face:** _____ **Depth Standing Water in the Hole:** ____
Estimated Depth (inches) to Seasonal High Ground Water: >120

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes
If yes, between what depths was it observed? 40 **inches and** 88 **inches**

THE GEOTECHNICAL GROUP, INC.

DEEP OBSERVATION HOLE AND ON-SITE ASSESSMENT LOG

Project:	Dover Community Center	**Client:**	Mills Whitaker Architects	**Soil Evaluator:**	Jeremy Haugh
Project Location:	4 Springdale Avenue Dover, MA	**Owner:**	Town of Dover	**Witness:**	None
				Date:	7/27/06
Deep Hole Number:	B	**Contractor:**	Town of Dover	**Weather:**	80 Degrees F, Sunny
Project/File Number:	Y1963	**Deep Hole Location/ Lot Number:**	See Exploration Location Plan	**Ground Elevation at Surface of Deep Hole:**	160±

Depth (inches)	Soil Horizon or Layer	Soil Matrix: Color–Moist (Munsell)	Redoximorphic Features (Mottles)			Soil Texture (USDA)	Coarse Fragments (% by volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth (inches)	Color	Percent		Gravel	Cobbles & Stones			
0-50	Fill	---	---	---	---	---	---	---	---	---	
50-64	B	2.5YR 5/6	---	---	---	Gravelly Sandy Loam	1	<1	Subangular Blocky	Friable	
64-124	C	10YR 6/3	---	---	---	Gravelly Sand	20	<5	Single Grain	Loose	

Additional Notes:

Land use: Developed **Surface Stones:** None **Slope (%):** 0± **Vegetation:** Grass
Landform: Outwash Plain **Position on Landscape:** Shoulder **Parent Material:** Proglacial Outwash
Approximate Distance (feet) from: Open Water: --- **Drainage:** --- **Wetlands:** --- **Property Line:** 50'±

Groundwater Observed: No **If yes: Depth Weeping from Pit Face:** _____ **Depth Standing Water in the Hole:** ____
Estimated Depth (inches) to Seasonal High Ground Water: >124

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes
If yes, between what depths was it observed? 64 **inches and** 112 **inches**

THE GEOTECHNICAL GROUP, INC.
PERCOLATION TEST FORM

Project:	Dover Community Center	**Client:**	Mills Whitaker Architects
Project Location:	4 Springdale Avenue Dover, MA	**Owner:**	Town of Dover
Project/ File Number :	Y1963	**Deep Hole Location/ Lot Number:**	See Exploration Location Plan

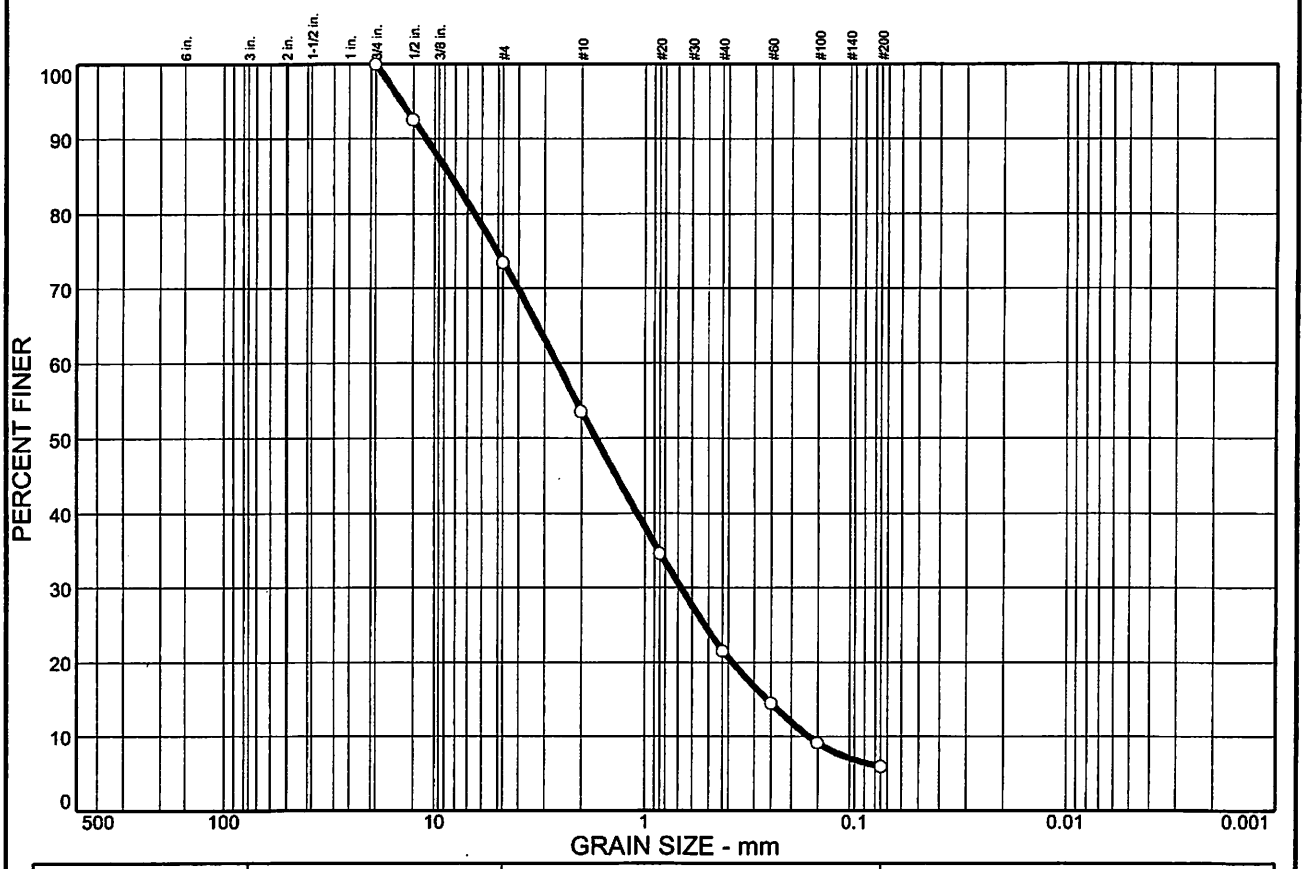
Deep Hole Number:	A	**Deep Hole Number:**	B	**Deep Hole Number:**		**Deep Hole Number:**	
Date	7/27/06	Date	7/27/06	Date		Date	
Time	0930	Time	1100	Time		Time	
Depth of Perc hole shelf	50"	Depth of Perc hole shelf	64"	Depth of Perc hole shelf		Depth of Perc hole shelf	
Start of Pre-soak	0930	Start of Pre-soak	1100	Start of Pre-soak		Start of Pre-soak	
End of Pre-soak	0945	End of Pre-soak	1110	End of Pre-soak		End of Pre-soak	
Time at 12"	0945	Time at 12"	---	Time at 12"		Time at 12"	
Time at 9"	0947	Time at 9"	---	Time at 9"		Time at 9"	
Time at 6"	0949	Time at 6"	---	Time at 6"		Time at 6"	
Time (9" – 6")	2	Time (9" – 6")	---	Time (9" – 6")		Time (9" – 6"	
Rate (Min./Inch)	<1	Rate (Min./Inch)	<1	Rate (Min./Inch)		Rate (Min./Inch)	
Passed or Failed	Passed	Passed or Failed	Passed	Passed or Failed		Passed or Failed	

Tests Performed By: Jeremy Haugh **Witnessed By:** None

Comments:

1. Perc test hole at B accepted 25 gallons in less than 15 minutes.

PARTICLE SIZE DISTRIBUTION REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	26.5	20.0	32.0	15.6	5.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
1/2 in.	92.5		
#4	73.5		
#10	53.5		
#20	34.6		
#40	21.5		
#60	14.4		
#100	9.1		
#200	5.9		

* (no specification provided)

Soil Description

Well-graded sand with silt and gravel

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 8.46 D_{60}= 2.64 D_{50}= 1.72
D_{30}= 0.679 D_{15}= 0.263 D_{10}= 0.167
C_u= 15.81 C_c= 1.05

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

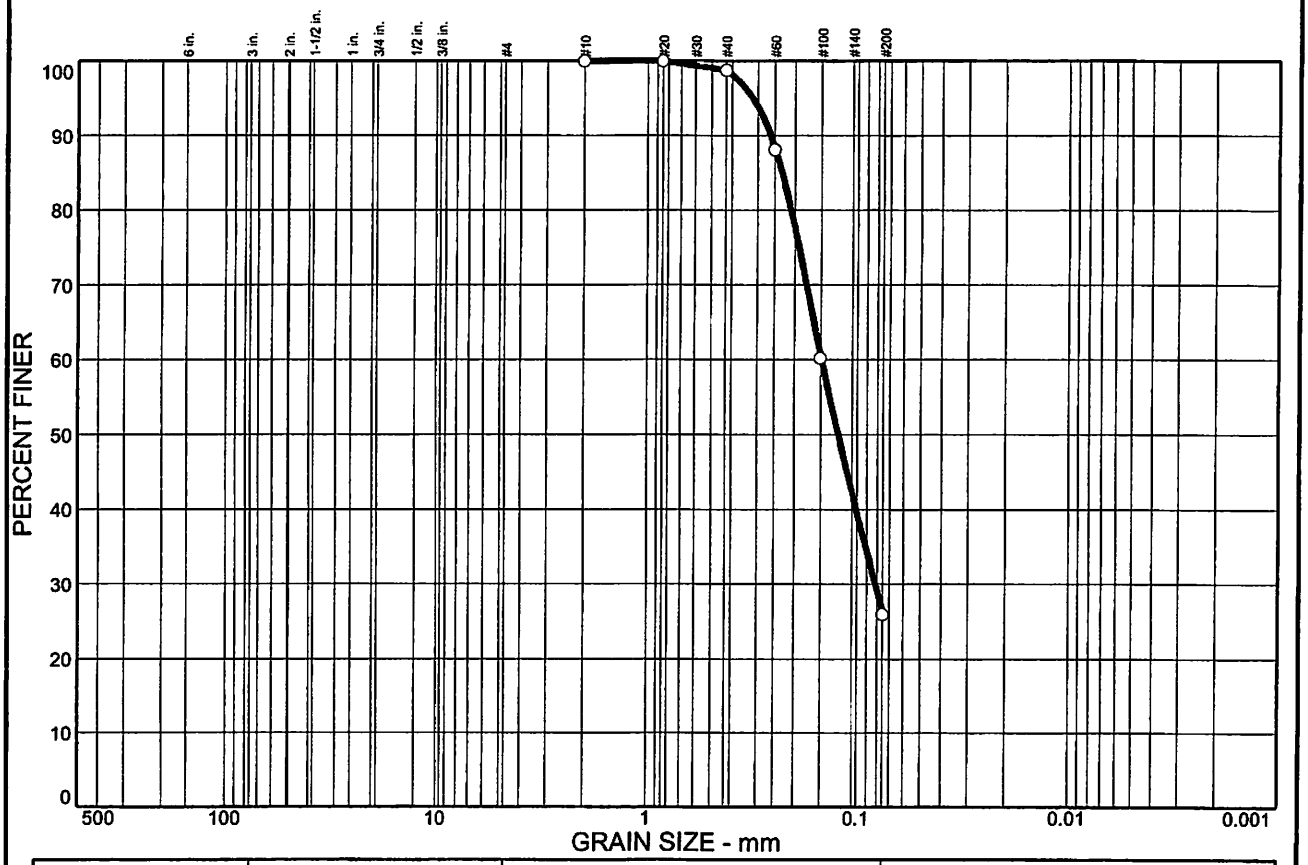
as rec'd w% = 6.2

Sample No.: S-2 **Source of Sample:** Boring B-1 **Date:** 8/4/06
Location: **Elev./Depth:** 5-7'

THE GEOTECHNICAL GROUP, INC.

Client: Mills Whitaker Architects LLC
Project: Dover Community Center
Dover, MA
Project No: Y1963 **Lab. No.** SL-1271

PARTICLE SIZE DISTRIBUTION REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	1.2	72.9	25.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	98.8		
#60	88.1		
#100	60.2		
#200	25.9		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.233 D_{60}= 0.149 D_{50}= 0.124
D_{30}= 0.0821 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

as rec'd w% = 8.7

Sample No.: S-5 **Source of Sample:** Boring B-2 **Date:** 8/4/06
Location: **Elev./Depth:** 15-17'

THE GEOTECHNICAL GROUP, INC.

Client: Mills Whitaker Architects LLC
Project: Dover Community Center
Dover, MA
Project No: Y1963 **Lab. No.** SL-1271

PARTICLE SIZE DISTRIBUTION REPORT

% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	9.3	3.7	25.1	32.8	29.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
1/2 in.	95.1		
#4	90.7		
#10	87.0		
#20	77.9		
#40	61.9		
#60	47.2		
#100	36.9		
#200	29.1		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 1.51 D_{60}= 0.397 D_{50}= 0.278
D_{30}= 0.0827 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

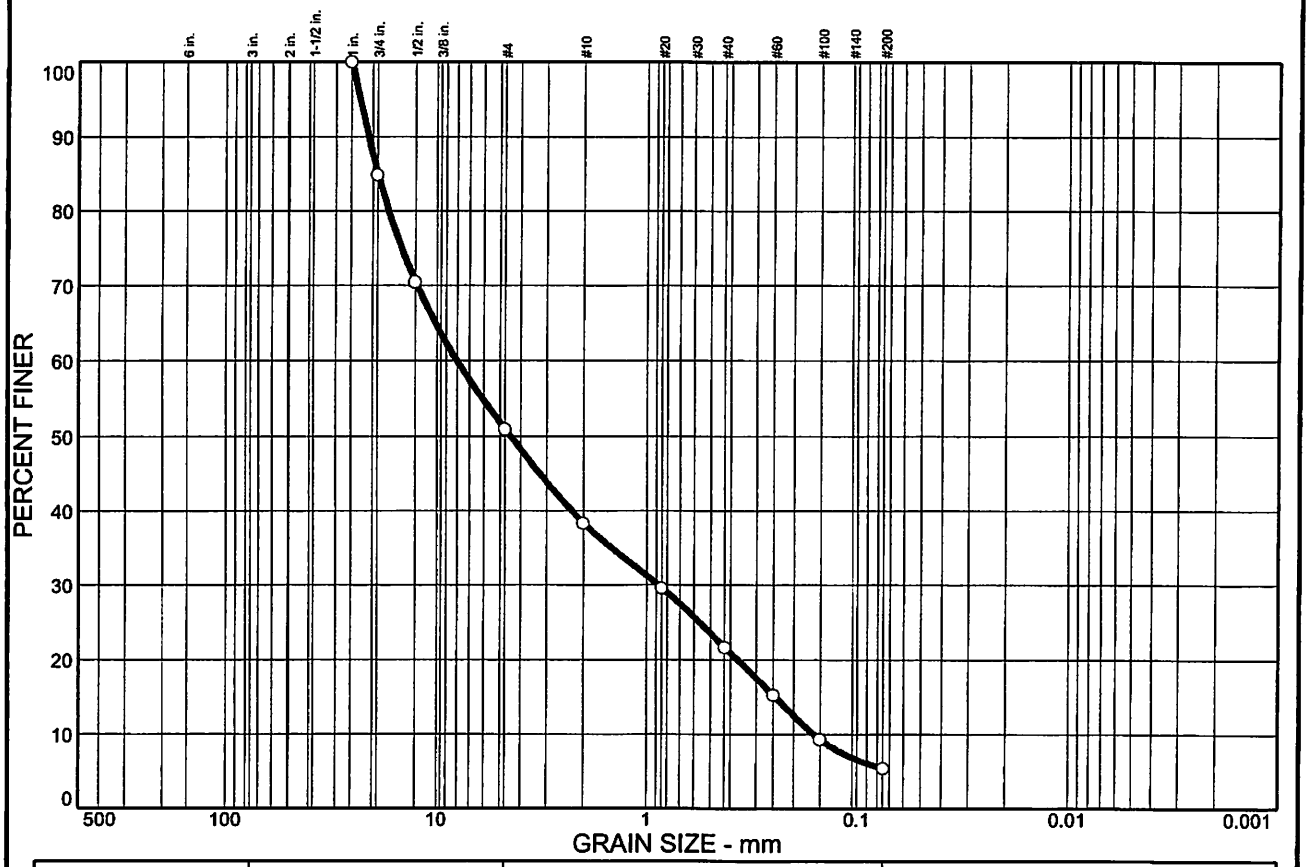
as rec'd w% = 19.3

Sample No.: S-1 **Source of Sample:** Boring B-3 **Date:** 8/4/06
Location: **Elev./Depth:** 0-2'

THE GEOTECHNICAL GROUP, INC.

Client: Mills Whitaker Architects LLC
Project: Dover Community Center
Dover, MA
Project No: Y1963 **Lab. No.** SL-1271

PARTICLE SIZE DISTRIBUTION REPORT



% + 3"	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	15.2	33.9	12.6	16.7	16.2	5.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
3/4 in.	84.8		
1/2 in.	70.5		
#4	50.9		
#10	38.3		
#20	29.6		
#40	21.6		
#60	15.2		
#100	9.3		
#200	5.4		

* (no specification provided)

Soil Description

Poorly graded gravel with silt and sand

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 19.1 D_{60}= 8.06 D_{50}= 4.49
D_{30}= 0.884 D_{15}= 0.246 D_{10}= 0.161
C_u= 49.99 C_c= 0.60

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

as rec'd w% = 2.6

Sample No.: S-2 **Source of Sample:** Boring B-5 **Date:** 8/4/06
Location: **Elev./Depth:** 5-7'

THE GEOTECHNICAL GROUP, INC.

Client: Mills Whitaker Architects LLC
Project: Dover Community Center
Dover, MA
Project No: Y1963 **Lab. No.** SL-1271