GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing ASFE Member Firm

June 30, 2000

Terrabrook
c/o DSS, Inc.
P.O. Box 287
Clarksburg, MD 20871

Attn: Mr. Jim Richmond

Re: Proposed Embankment for Stormwater Management Pond No.1
Clarksburg Town Center
Montgomery County, Maryland

Dear Mr. Richmond:

As requested, Geo-Technology Associates, Inc. (GTA) has performed additional evaluation to assess seepage related concerns for the proposed embankment as recently requested by MCDPS. This letter provides a summary of the background information and results of our evaluation.

Based on plans entitled Clarksburg Town Center, Stormwater Management Pond #1, by Montgomery Kontgias Enterprises, (MKE), the site civil engineer, the facility is planned as a wet pond. Excavation ranging from 1 to 8 feet, and fills of approximately 1 foot, will be required to establish the proposed pond bottom elevation of 610 feet above Mean Sea Level (MSL). Maximum fills of approximately 19 feet will be required to achieve the proposed embankment top elevation of 626.2 MSL. The pond is to be constructed to meet State requirements for stormwater management facilities (MD 378). A concrete riser and principal spillway will be utilized to control releases. The stormwater facility is planned as a wet pond with a permanent pool elevation of 616.5 MSL. Based on our review of the existing subsurface data, the foundation soils are anticipated to be clayey sand (SC) or low plasticity silt mixed with varying proportion of rock fragments. Groundwater was observed at elevations ranging from 599.5 to 606 MSL, on the order of 4 to 10 feet below the proposed bottom of the pond.

GTA has evaluated the potential for piping of foundation soils and erosion of the downstream slope due to seepage. The exit gradients were estimated assuming the pond at permanent pool and steady state seepage occurring through the foundation soils. Due to the significant (180 to 200 feet) width of the embankment, the exit gradients near the downstream toe of the embankment will be relatively small and well below the critical gradient that are needed to cause piping. In consideration of the proposed core trench, the significant width of the embankment, and anticipated subsurface conditions, it is GTA's opinion that significant seepage emerging in the vicinity of the toe of the embankment is not likely. Therefore, increased cutoff trench depth, toe drains or other down stream

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seepage control measures are not recommended at this time. GTA recommends that, after construction, the down stream face of the embankment be monitored, particularly in wet seasons. In the unanticipated event that signs of seepage are observed on the down stream slope of the embankment, installation of toe drain or drainage blanket to prevent erosion and migration of fines should be considered.

This report has been prepared for the exclusive use of Terrabrook, in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made. This report should be considered as a supplement to our previous report entitled "Report of Subsurface Exploration, Clarksburg Town Center - Phase 1B, Stormwater Management Pond," dated June 13, 2000. It is subjected to the limitations outlined in the aforementioned report.

Thank you for this opportunity to assist you. Should you have any questions or require additional information, please do not hesitate to contact our office.

Very truly yours,

GO-TECHNOLOGY ASSOCIATES, INC.

Ravi Malviya, P.E.
Associates

J. Patrick Klima, P.E.
Vice President

STATE OF MARYLAND
JAMES PATRICK KLIMA, III
No. 18538
REGISTERED
PROFESSIONAL ENGINEER

JPK/jeb(F:\DOCS\KLIMA\CLKSBGTC\seepage.ltr.wpd)
J.O# 99530

cc: Mr. Richard Gee (Montgomery County)
Ms. Irene Carrato (M/K)
Mr. Mike Knicely (Terrabrook)

I-6

SEDIMENT CONTROL/STORMWATER MANAGEMENT DESIGN PLAN INFORMATION FORM (IF-1)

I. PROJECT INFORMATION:

PROJECT NAME: CLARKSBURG TOWN CENTER SUBDIVISION: PHASE 1B

LOT/BLOCK: N/A PARCEL: N/A PRELIMINARY PLAN #: 1-95042

SITE PLAN #/APPROVAL DATE: 8-98001, 1-14-98 (If a site plan is not required enter N/A.)

RECORD PLAT #(s): N/A ZONE: N/A DISTURBED AREA (AC): N/A

BUILDING PERMIT APPLICATION #(s): N/A

WATERSHED: LITTLE SENECA CREEK Is this a Special Protection Area? /✓/YES / /NO (check one).
*

NOTE: Special Protection Area Stream Monitoring Fees are due prior to plan approval.

I. STORMWATER MANAGEMENT STATUS: Enter information in the appropriate blanks for each form of control. The stormwater management concept letter must be shown on the detailed plans.

		QUANTITY CONTROL	QUALITY CONTROL
A.	On-site facility proposed. State type and number of facility(ies). Complete Section V of this form.	1 WET POND - 2YR POST-TO 2YR PRE w/ 10 & 10YR SAFE CONVEYANCE	PERMANENT POOL, FUTURE SAND FILTERS & INF.
B.	On-site, Central or Regional Facility(ies) previously approved. Provide name and original Sediment Control Permit Number. Include statement of such on plan.	N/A	N/A
C.	Waiver - Provide approval date.	N/A	N/A
D.	Phasing - Provide approval date - (Include approved phasing letter on plans).	6-18-99	6-18-99
E.	Exempt	N/A	N/A

SOILS INFORMATION: Provide Soil Survey Sheet Number and soil list symbols within property.

SHEET 7, SOILS 4B, 5B, 9B, 9C, 16B, 16C, 16D, 17B, 17C, 54A,

ENGINEER

Firm: M/K ENGINEERING, INC.

Address: 2900 LINDEN LANE, SUITE 200 SILVER SPRING MD 20910

Project Engineer: IRENE CARRATO Phone (301) 588-5896

Prepared By: PATRICK GERVAIS Date 7-27-99

OFFICIAL USE ONLY

Reviewer: RJS Number of Reviews: 4 Approval Date: 7/3/00

Revision #: — Plan Type: PD WT QN SF, INF

Sediment Control # 9980400005 Stormwater Management # 1-95042

enm:IF-1X:08/31/98

REPORT OF
Subsurface Exploration

CLARKSBURG TOWN CENTER - PHASE IB

Stormwater Management Pond No. 1
Montgomery County, Maryland

June 13, 2000

Prepared For:

Terrabrook
c/o DSS, Inc.
P.O. Box 287
Clarksburg, Maryland 20871

GTA Job Number: 99530

Prepared By:

Geo-Technology Associates, Inc.
9090 Junction Drive
Suite 9
Annapolis Junction, Maryland 20701
(410) 792-9446 or (301) 470-4470
Facsimile (410) 792-7395

GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing ASFE Member Firm

June 13, 2000

Terrabrook
c/o DSS, Inc.
P.O. Box 287
Clarksburg, Maryland 20871

Attn: Mr. Jim Richmond

Re: ***Clarksburg Town Center, Phase 1B***
Stormwater Management Pond No. 1
Montgomery County, Maryland

Gentlemen:

In accordance with your request, Geo-Technology Associates, Inc. (GTA) has performed an exploration to characterize subsurface conditions in the vicinity of proposed Stormwater Management Pond No. 1 on the referenced property in Montgomery County, Maryland. GTA's work was performed under the geotechnical services proposal dated May 12, 2000.

GTA's exploration included a series of hand auger borings in the pond and outfall area, review of a previous boring by GTA in the same area, laboratory analysis of recovered samples, and review of the Stormwater Management Facilities Report, prepared by Schnabel Engineering, dated July 29, 1997. The intent of this review was to evaluate the proposed cutoff trench design and address comments regarding the proposed construction, from reviewers employed by Montgomery County and the National Resource Conservation Service (NRCS).

Conversations with MCDPS officials indicate that a primary concern with regard to pond embankment construction is the presence of loose soils at the cutoff trench location. We understand from these conversations that NRCS is concerned with soils characterized as loose to depths of 4 feet that may impact the stability of the proposed embankment.

PROPOSED CONSTRUCTION

Based on plans entitled Clarksburg Town Center, Stormwater Management Pond #1, by Montgomery Kontgias Enterprises, (MKE), the site civil engineer, the facility is planned as a wet pond. Excavation ranging from 1 to 8 feet, and fills of approximately 1 foot, will be required to establish the proposed pond bottom elevation of 610 feet above Mean Sea Level (MSL). Maximum fills of approximately 19 feet will be required to achieve the proposed embankment top elevation of 626.2 MSL. The pond is to be constructed to meet State requirements for stormwater management facilities (MD 378). A concrete riser and outfall pipe will be utilized to control releases.

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SUBSURFACE EXPLORATION

In conjunction with a submittal to Montgomery County Department of Permitting Services (MCDPS), dated June 2, 2000, GTA drilled one test boring, labeled B-6, in the proposed pond embankment area, to a depth of 8.0 feet below existing grade. Materials encountered varied from loose clay and silt with rock fragments to medium dense weathered rock. Approximately six inches of topsoil was encountered at the boring location. Groundwater was not observed while drilling, but was observed after 24 hours at a depth of 7.7 feet (equivalent to elevation 599.5). Please refer to the boring log presented in Appendix B for further information.

A series of shallow hand auger probes was performed in the pond basin, embankment and outfall areas in an effort to locate materials suitable for use in cutoff trench and core construction. Limited laboratory testing, including Unified Soil Classification System (USCS) classification was performed on selected, representative specimens. The USCS classification was determined to identify soils available for use in cutoff trench and embankment construction in accordance with the controlling specification, Soil Conservation Service of Maryland (SCS) MD 378. A summary of the index property testing is provided in the following table. Please see the laboratory test data sheets in Appendix C for further details.

INDEX PROPERTIES TESTING RESULTS

Test Boring/ Hand Auger #	Depth (ft)	Liquid Limit	Plasticity Index	Unified Classification
B-6	2.5 - 4.0	39	15	CL, Low Plasticity Clay
T-2	1.0	37	13	CL, Low Plasticity Clay
T-2A	1.0	36	14	CL, Low Plasticity Clay
T-3	3.0	40	16	CL, Low Plasticity Clay
T-3B	1.0	37	14	CL, Low Plasticity Clay
'Basin2'	3.0 - 5.0	41	28	SC, clayey Sand

CONCLUSIONS AND RECOMMENDATIONS

Based on GTA's SPT and hand auger test borings and laboratory test data, construction of the proposed pond is feasible. The following recommendations regarding pond construction are based on laboratory analysis and interpolation of boring data. GTA's preliminary recommendations are provided in the following paragraphs.

- **Cutoff Trench and Embankment**

Plans indicate that the minimum cutoff trench subgrade elevation of 602.5 MSL will occur at the outfall. Based on boring data, excavation of the cutoff trench may be accomplished by ordinary means. Boring data indicates that the embankment will be supported on medium stiff and medium dense natural soils, referencing SPT 'N' values ranging from 6 to 13 bpf. While we have not been able to speak to NRCS directly, GTA understands that the NRCS reviewer considers 6 to 10 bpf material unstable and requests that the cutoff trench be extended through those materials exhibiting an SPT 'N' value less than 10 bpf. The reviewer further suggests that the cutoff trench be extended to a maximum depth of approximately 12 feet below existing surface grade, a depth equivalent to the inverse of the height of the pond 10-year storm water level. GTA infers from this recommendation that the reviewer may consider that one of the functions of the cutoff trench is to provide stability to the embankment by means of "keying" the embankment into natural materials.

GTA understands the reviewer's comment, but differs in our conception of the function of the cutoff trench. In GTA's opinion, the function of the cutoff trench is to provide a barrier to increase the seepage path of water traveling through the soil. As the seepage path is increased, the velocity of the water is slowed, which decreases the gradient, and therefore, the likelihood of piping. Furthermore, the cutoff trench serves to interrupt more permeable layers beneath the embankment. Such permeable layers may include fluviated gravels in a stream bed or organic soils which would readily transmit water beneath the embankment. The excavation of these deposits and replacement with relatively impermeable materials would interrupt any seepage paths through the depth of the cutoff trench.

GTA does not agree with the reviewer's apparent assumption that the purpose of the cutoff trench is to increase stability of the embankment. The increase in frictional or cohesive resistance to sliding provided at the top of the cutoff trench as a result of the newly placed impermeable soils is negligible as compared to the frictional resistance along the base of the embankment at the natural ground interface.

It is GTA's opinion that the cutoff trench need not be overexcavated to more dense materials. Based on the boring data, the soils at approximate cutoff trench subgrade will consist of medium stiff to medium dense silty and sandy soils. These materials are anticipated to provide a suitable trench subgrade. Since the pond location is a cultivated field, and no concentrated surface flow or stream is evidenced in the basin or embankment area, GTA does not anticipate that fluviated gravel layers are present which would conduct water much more readily than the residual silt. GTA will observe the cutoff trench subgrade, and in the unanticipated event that field conditions warrant, we will recommend deepening the trench in localized areas as required to maintain the seepage control qualities of the cutoff trench.

GTA recommends that the cutoff trench be excavated four feet below stripped surface grades and the invert of proposed structures as indicated on the drawings. Prior to the placement of structural fill, the embankment subgrade should be proof rolled. Soft areas exposed in this manner may be undercut to a stable bearing layer. USCS CL soils thus removed should be stockpiled for later use. Soil placed adjacent to the principal spillway should consist of USCS designated CL materials or other materials approved by GTA. In accordance with referenced project plans and specifications, the embankment clay core should be constructed to the 10 year storm elevation (10YR WSEL) of 621.7, minimum.

- **On-site Materials for Pond Construction**

GTA understands that SCS, MD 378 governs design and construction of the proposed stormwater management facility. MD 378 specifies that the soils for use in cutoff trench construction meet USCS Classification CL (low plasticity clay), CH (high plasticity clay), SC (clayey sand), or GC (clayey gravel). Furthermore, GTA recommends that similar materials be used for backfill adjacent to the outfall structure and conduit. The use of the fine-grained or plastic material adjacent to the pond outfall structures should decrease the potential for embankment failure induced by "piping" erosional processes.

Laboratory testing indicates that the majority of near-surface materials sampled from the basin and outfall areas are classified as USCS CL (low plasticity clay). It is GTA's opinion that on-site USCS CL soils are suitable for both cutoff trench and embankment construction. Due to the limited availability of the clay soils elsewhere on site, efforts should be made during site grading to conserve these materials for use in the cut-off trench and embankment core, as well as for lining of the basin, where required. These materials were present at the locations indicated on the chart below, and on the attached boring location plan.

Boring #	Approximate Thickness of Clay Soil Layer
B-6	4.0
T-2	3.0
T-3	4.0
Basin 2	5.0

The approximate areal extent of the clay soils is indicated by the hatched area on the attached location plan. If an average usable thickness of 3 feet is assumed for the clay layer outside the basin area, then approximately 2000 to 2500 cubic yards of suitable core and cutoff trench fill is available. GTA performed a rough estimate of suitable materials needed to

construct the embankment. The quantity of clay soils required to construct the 4-foot deep cutoff trench indicated on the pond plan will approach 600 cubic yards. The quantity required for the embankment core will approach 1,000 cubic yards. Accordingly, if subsurface conditions do not vary greatly from those observed in the borings, and the contractor makes efforts to conserve these materials, it is likely that a sufficient quantity of materials will be available on site.

This estimate is considered to be generally accurate. If a more precise estimate is required, then this can be accomplished by an exhaustive sampling effort or during review of the geotechnical conditions subsequent to the commencement of mass grading. Clay soils may be present elsewhere on site, and variations of materials as indicated in this report may occur. Soils suitable for core and cut-off construction should be approved on site during the borrow process by GTA. If off-site borrow soils are required, they should be approved by GTA prior to import.

- **Basin**

The stormwater management facility is planned as a wet pond with a normal pool elevation of 617 MSL. Plans provided by MKE indicate that maximum excavations to establish the basin occur at the eastern end of the facility, and approach a depth of 8 feet. Cuts deeper than two feet may have the effect of removing the less permeable surface soils identified in the borings, negatively impacting the basin's capacity to hold water. Plastic, low permeability soils excavated from the basin should be stockpiled for later reuse as cut-off trench, embankment core, or basin liner material, as needed. It should be noted that GTA did not perform a water balance or geohydrologic assessment of the pond to evaluate if a permanent pool is attainable, and therefore cannot accurately predict the long-term condition of the water level. GTA can provide these services at your request.

Boring data indicates that excavations to pond bottom can be accomplished by ordinary means, i.e. scraping or ripping, at the locations explored. Groundwater was observed in Boring B-6, and in borings drilled by Schnabel. Groundwater was observed at elevations ranging from 599.5 to 606 MSL, on the order of 4 to 10 feet below the proposed basin bottom. Groundwater will not likely be encountered during excavation of the basin, however, the contractor should be prepared to implement a dewatering scheme as needed to facilitate construction.

LIMITATIONS

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

The analysis and recommendations contained in this report are based on the data obtained from limited observation and testing of the recovered materials. The test pits indicate soil conditions only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between the test pit locations. Consequently, the analysis and recommendations must be considered preliminary until the subsurface conditions can be verified by direct observation at the time of construction. If variations in subsurface conditions from those described are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are verified in writing. Geo-Technology Associates, Inc. is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis without the express written authorization of Geo-Technology Associates, Inc.

In accordance with the guidelines of ASFE/The Association of Engineering firms Practicing in the Geosciences, it is recommended that Geo-Technology Associates, Inc. be retained to provide continuous soils engineering services for this project. Participation of GTA will facilitate compliance with GTA's recommendations, and allow changes to be made in these recommendations, in the event that subsurface conditions are found to vary from those anticipated prior to construction.

This report and the attached logs are instruments of service. If certain conditions or items are noted during our exploration, Geo-Technology Associates, Inc. may be required by prevailing statutes to notify and provide information to regulatory or enforcement agencies. Geo-Technology Associates, Inc. will notify our Client should a required disclosure condition exist.

This report was prepared by Geo-Technology Associates, Inc. (GTA) for the sole and exclusive use of Geo-Technology Associates, Inc. and Terrabrook Use and reproduction of this report by any other person without the expressed written permission of GTA and Terrabrook is unauthorized and such use is at the sole risk of the user.

We thank you for the opportunity to be of assistance to you on this project. If you have any questions or require additional information, please do not hesitate to contact this office.

Very truly yours,

GEO-TECHNOLOGY ASSOCIATES, INC.

Scott C. Rowe
Staff Engineer

J. Patrick Klima, III
Vice President

STATE OF MARYLAND
JAMES PATRICK KLIMA, III
No. 18538
REGISTERED
PROFESSIONAL ENGINEER

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J.O# 99530

cc: Irene Carotta (M/K)
Mike Knicely (Terrabrook)

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you*—should apply the report for any purpose or project except the one originally contemplated.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

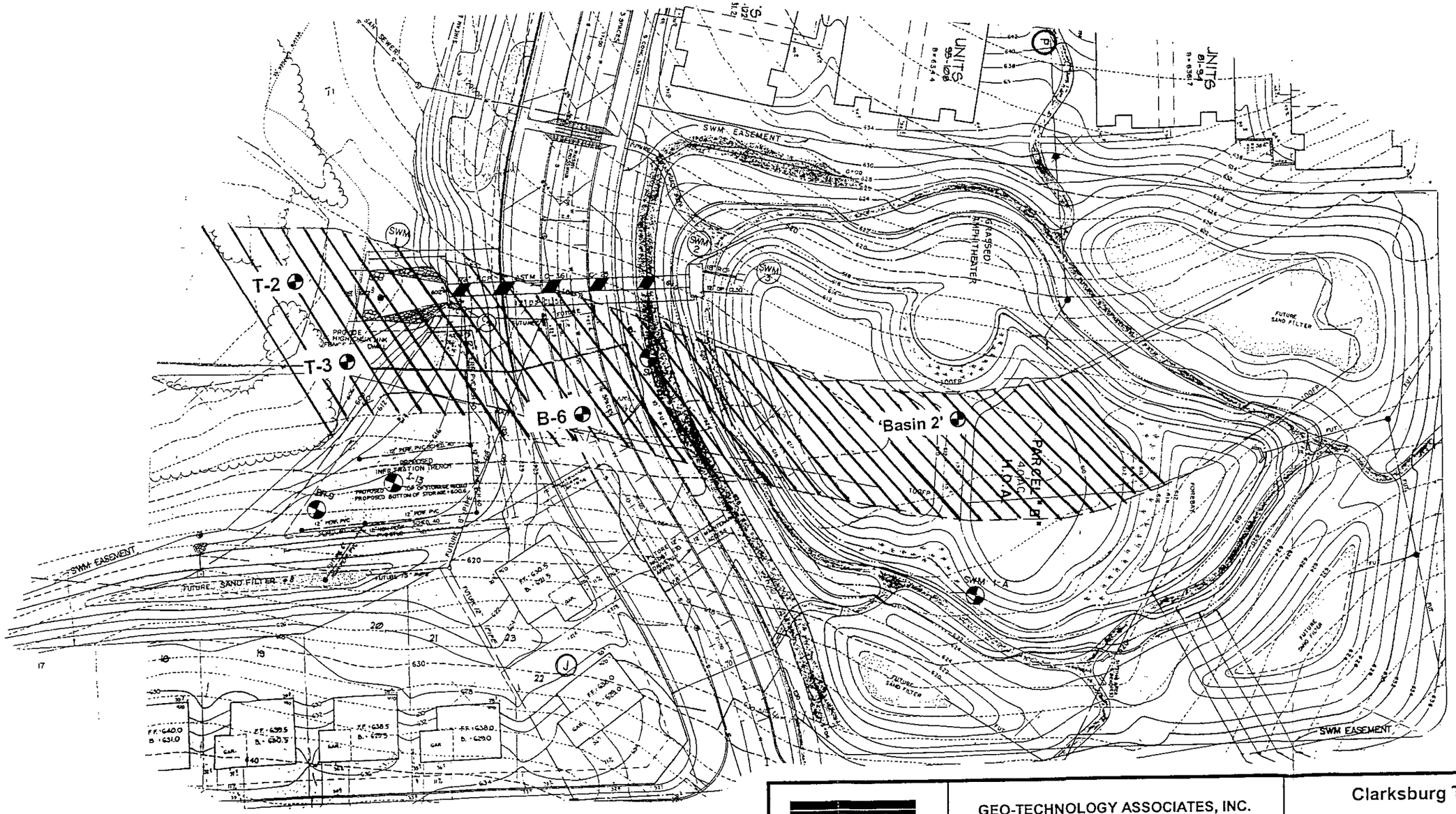
ASFE PROFESSIONAL FIRMS PRACTICING IN THE GEOSCIENCES

8811 Colesville Road Suite G106 Silver Spring, MD 20910
Telephone: 301-565-2733 Facsimile: 301-589-2017
email: info@asfe.org www.asfe.org

IIGER06983.5M

APPENDIX A

FIGURES



GTA	GEO-TECHNOLOGY ASSOCIATES, INC. *Geotechnical and Environmental Consultants* 9090 Junction Drive, Suite 9 Annapolis Junction, MD 20701 (410) 792-9446 or (301) 470-4470 Fax: (410) 792-7395		Clarksburg Town Center - Pond #1 BORING LOCATION PLAN Montgomery County, Maryland		
SCALE: NTS	DATE: 06/12/00	DRAWN BY: ---	DESIGN BY: ---	REVIEWED BY: JPK	JOB NO.: 99530

APPENDIX B

SOIL BORING LOGS

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Proportions

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders		- 8-inch diameter or more
Cobbles		- 3- to 8-inch diameter
Gravel	- Coarse	- 1 to 3 inch
	- Medium	- 1/2 to 1 inch
	- Fine	- 1/4 to 1/2 inch
Sand	- Coarse	- 0.6mm to 1/4 inch
	- Medium	- 0.2 mm to 0.6 mm
	- Fine	- 0.05 mm to 0.2 mm
		- 0.06 mm to 0.002 mm

COHESIVE SOILS
(Clay and Silt Combinations)

Consistency

Very Soft	- 3 blow/ft.
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

Plasticity

Degree of Plasticity	Plasticity Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 50
High to Very High	Over 50

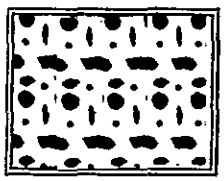
Classification on logs are made by visual inspection.

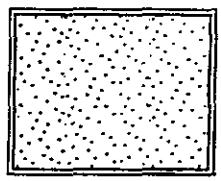
Standard Penetration Test - Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of one foot into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log. The standard penetration test results can be obtained by adding at last two figures.

Strata Changes - In the column "Soil Descriptions" on the drill log, the horizontal lines represent approximate strata changes.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

Graphic Legend:


Gravel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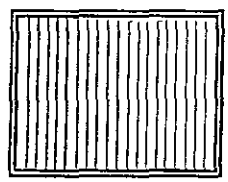
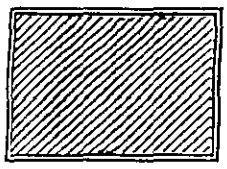
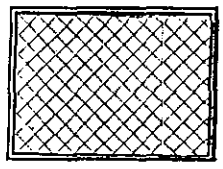
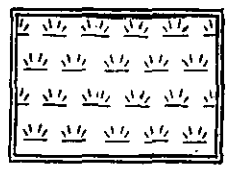

Silt


Clay


Fill


Topsoil

LOG OF BORING NO. B-6

PROJECT: Clarksburg Town Center
PROJECT NO: 99530
PROJECT LOCATION: Montgomery County, Maryland

WATER LEVEL: ▽ Dry ▼ 7.7 ▼
DATE: 5/18/00 5/19/00
CAVED (ft.): 8.1 8.1

DATE STARTED: May 18, 2000
DATE COMPLETED: May 18, 2000
DRILLING CONTRACTOR: Geo-Technology Associates
DRILLER: JP/TC
DRILLING METHOD: HSA
SAMPLING METHOD: Split Spoon

GROUND SURFACE ELEVATION: 607.2
DATUM: MSL
WEATHER Partly Sunny
GEOLOGIST:
CHECKED BY: S. Rowe
BACKGROUND OVA (PPM):

SAMPLE NUMBER	SAMPLE ADVANCE (ft.)	SAMPLE RECOVERY (ft.)	SAMPLE BLOWS/6 in.	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
S-1	2.0	1.2	4-4-5-5	9	607.2	0	SC		Brown, moist, medium stiff to stiff, CLAY & SILT and coarse to fine ROCK FRAGMENTS. (SC) AASHTO: A-6	Topsoil: 6 in.
S-2	2.0		2-2-4-5	6						
S-3	2.0		2-4-7-5	11	601.2	5				Water Not Encountered While Drilling.
S-4	2.0		4-4-8-8	12	599.2		SM		Brown, moist, medium dense, coarse to fine ROCK FRAGMENTS and SILT. (SM) AASHTO: A-4	Bag Sample: 1.0 - 6.0 ft. ▼
									Bottom of Hole at 8.0 ft.	

Boring Location: Clarks Crossing Drive, CL Sta. 19+45, 5 ft. Left

Coordinates:
N: 128922.0
E: -73818.0

NOTES:

GEO-TECHNOLOGY ASSOCIATES, INC.
9090 JUNCTION DRIVE, SUITE 9
ANNAPOLIS JUNCTION, MARYLAND 20701

LOG OF BORING B-6

LOBG 99530 6/1/00

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** Clarksburg Town Center Clarksburg, Maryland	**Contract Number:** 972166 **Boring Number:** SWM-1 **Sheet:** 1 of 1

Boring Contractor: STEVENS DRILLING, INC.

Boring Foreman: Martin
Drilling Method: 2-1/4" HOLLOW STEM AUGER
Drilling Equipment:
SEA Representative: K. White
Dates Started: 4-19-97 **Finished:** 4-19-97
Location: SEE BORING LOCATION PLAN; COORD: N128934.5 - E73872.1
Ground Surface Elevation: 606.5 ±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4-19		13.5		
Completion	4-19		DRY		
Casing Pulled	4-19		DRY		12.2
	4-20		5.5		10.5

DEPTH (ft)	STRATA DESCRIPTION	CLASS	ELEV. (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	SILT, with sand, mica, and rock fragments, moist, brown	ML				3+3+4		
	orangish brown below 3.5			A	5	5+7+9		
						12+12+14		
8.5	DISINTEGRATED ROCK, dry, brown and orangish-brown		598.0	B	10	14+100/11		
14.0	Bottom of Boring @ 14.0		592.5			100/6		

Comments:

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** Clarksburg Town Center Clarksburg, Maryland	**Contract Number:** 972166 **Boring Number:** SWM-1A **Sheet:** 1 of 1

Boring Contractor: STEVENS DRILLING, INC.

Boring Foreman: Martin

Drilling Method: 2-1/4" HOLLOW STEM AUGER

Drilling Equipment:

SEA Representative: K. White

Dates Started: 4-19-97 **Finished:** 4-19-97

Location: SEE BORING LOCATION PLAN; COORD: N129020.9 - E73551.6

Ground Surface Elevation: 618.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4-19		13.5		
Completion	4-19		12.9		
Casing Pulled	4-19		13.1		13.3
	4-20		12.5		13.0

DEPTH (ft)	STRATA DESCRIPTION	CLASS	ELEV. (ft)	STRATUM	SAMPLING DATA	W (%)	REMARKS
	sandy SILT, with quartz, moist, orangish-brown	ML			4+6+5		
	trace rock fragments @ 3.5				9+6+11		
6.0	SILT, with sand and rock fragments, moist, brown, orangish-brown and gray	ML	612.0	A	12+11+12		
					10+7+7		
	wet below 13.5				6+5+5		
15.0	Bottom of Boring @ 15.0		603.0				

Comments:

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	Project: Clarksburg Town Center Clarksburg, Maryland	Contract Number: 972188 Boring Number: BR-9 Sheet: 1 of 1

Boring Contractor: STEVENS DRILLING, INC.

Boring Foreman: Martin

Drilling Method: 2-1/4" HOLLOW STEM AUGER

Drilling Equipment:

SEA Representative: K. White

Dates Started: 4-17-97 Finished: 4-17-97

Location: SEE BORING LOCATION PLAN; COORD:
N128764.0 - E73882.9

Ground Surface Elevation: 615.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4-17		NONE		
Completion	4-17		DRY		
Casing Pulled	4-17		DRY		5.8

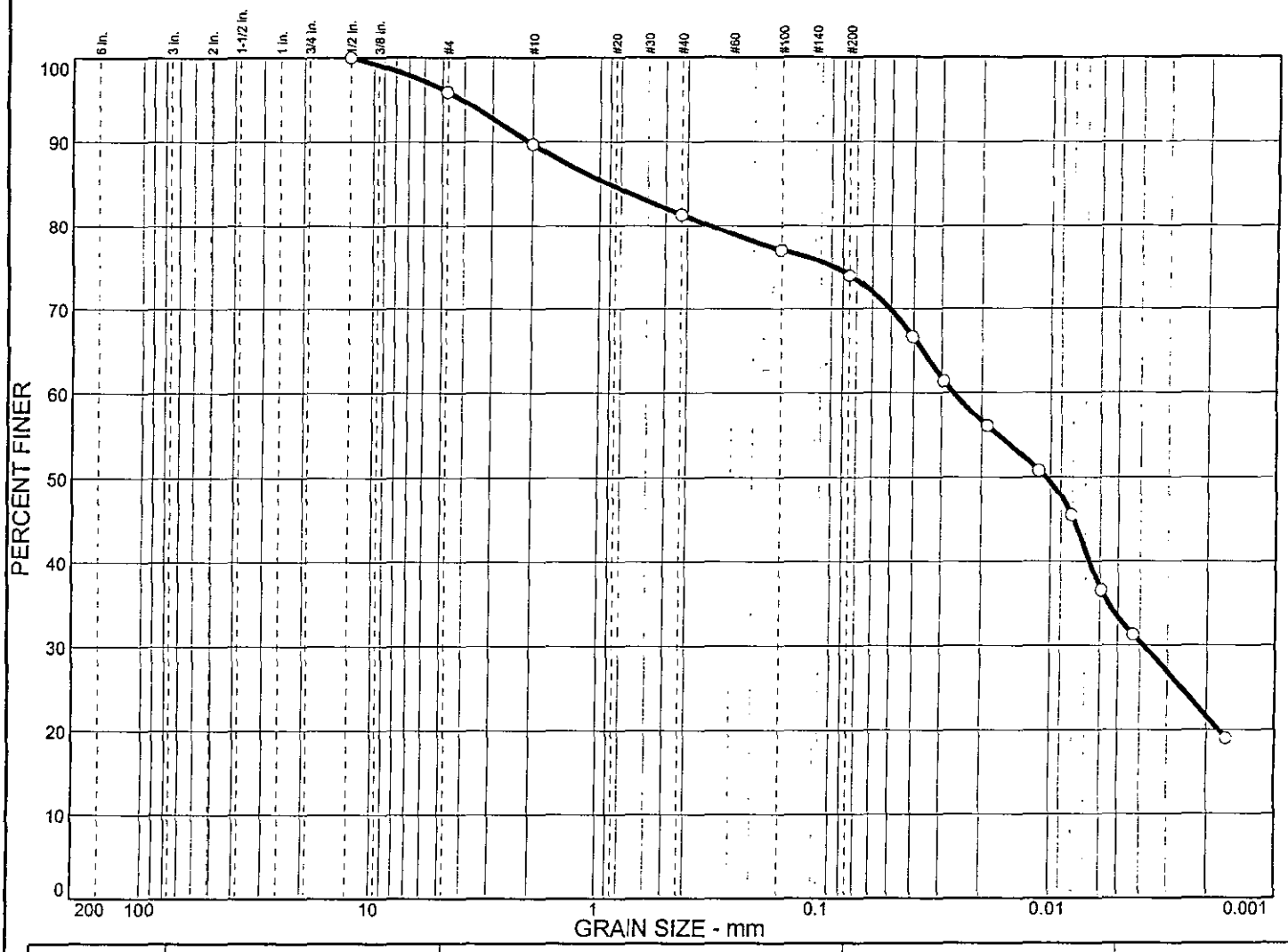
DEPTH (ft)	STRATA DESCRIPTION	CLASS	ELEV. (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	sandy SILT, with mica and rock fragments, moist, orangish-brown	ML		A		5+6+7		
					5	15+14+12		
6.0	Bottom of Boring @ 6.0		609.0					

Comments:

APPENDIX C

LABORATORY TEST RESULTS

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	4.1	21.9	40.7	33.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	39	15	0.918	0.0266	0.0105	0.0038				

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown CLAY & SILT, some coarse to fine Sand, trace fine Gravel.	CL	A-6(11)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** B-6 **Sample No.:** S-1 **Elev./Depth:** 2.5'-4.0'

Remarks:

○ Natural Moisture: 23.1%

May 26, 2000

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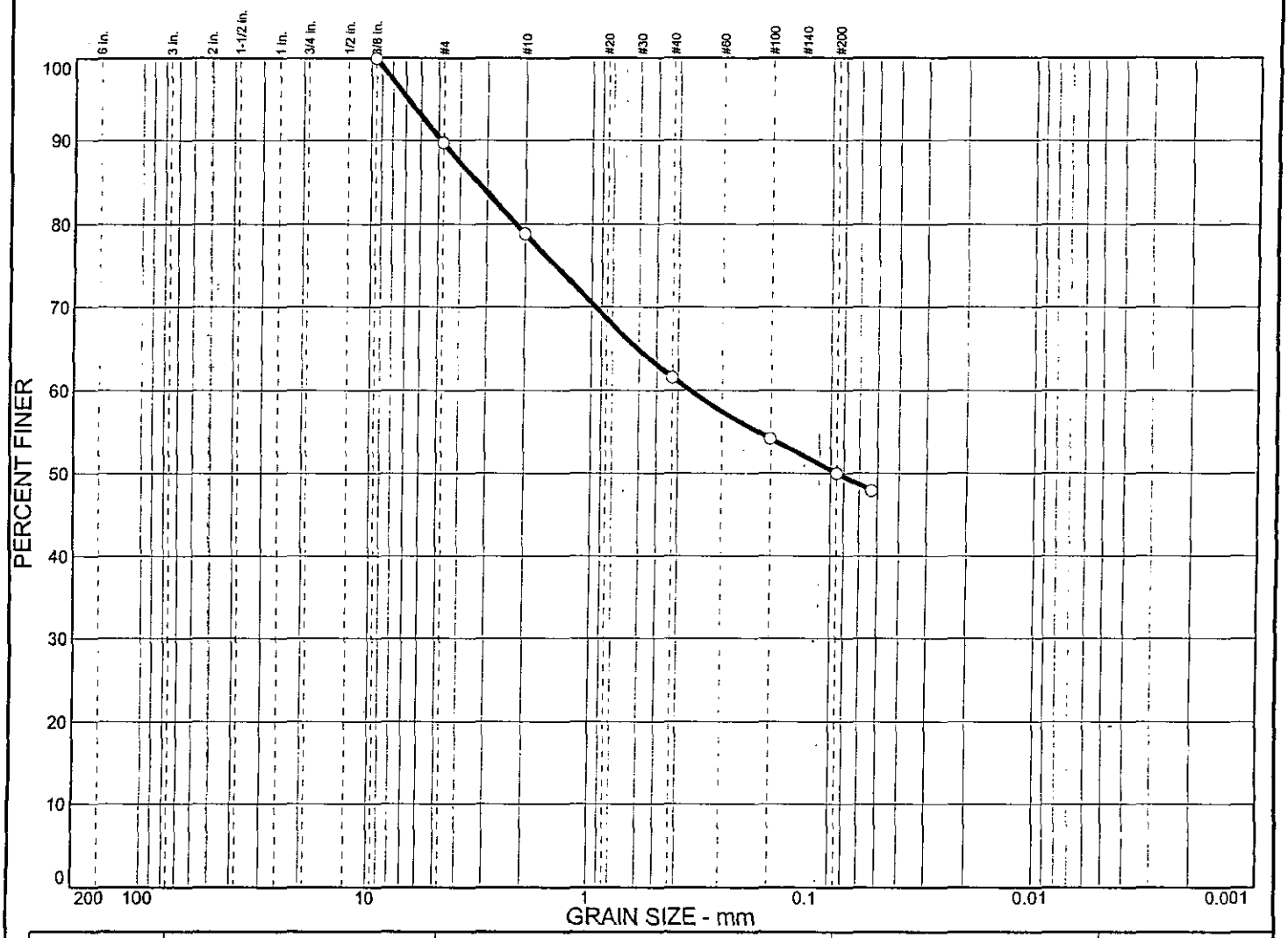
PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	10.3	39.7	50.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	13	3.32	0.351	0.0750					

MATERIAL DESCRIPTION	USCS	AASHTO
○ Dark brown CLAY & SILT and coarse to fine SAND, little fine Gravel.	CL	A-6(4)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** T-2 **Sample No.:** S-1 **Elev./Depth:** 1.0'

Remarks:

○ Natural Moisture: 23.0%

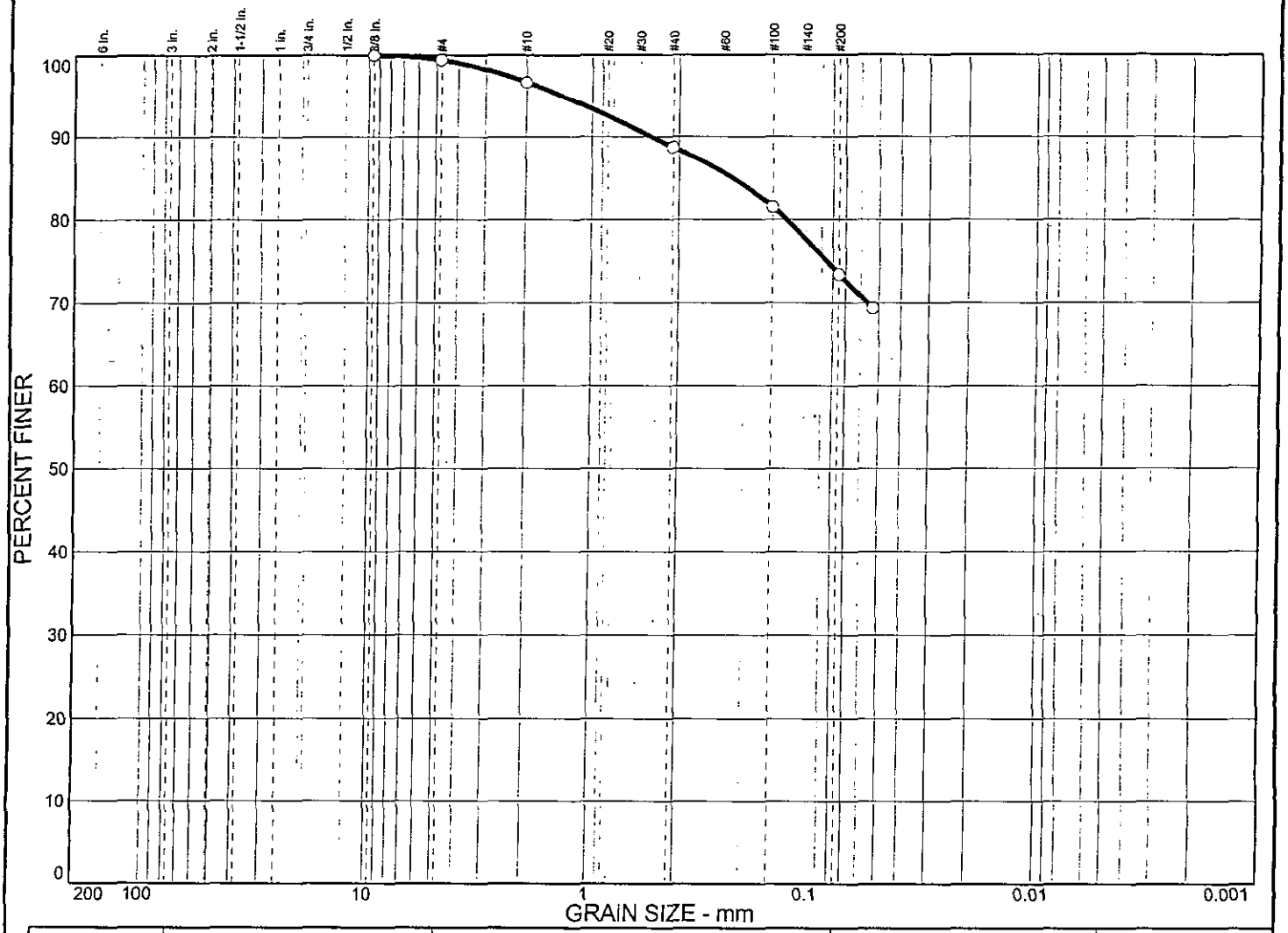
June 7, 2000

PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.6	26.0	73.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	36	14	0.228							

MATERIAL DESCRIPTION	USCS	AASHTO
○ Dark brown CLAY & SILT, some coarse to fine Sand, trace fine Gravel.	CL	A-6(9)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** T-2A **Sample No.:** S-1 **Elev./Depth:** 1.0'

Remarks:

○ Natural Moisture: 28.5%

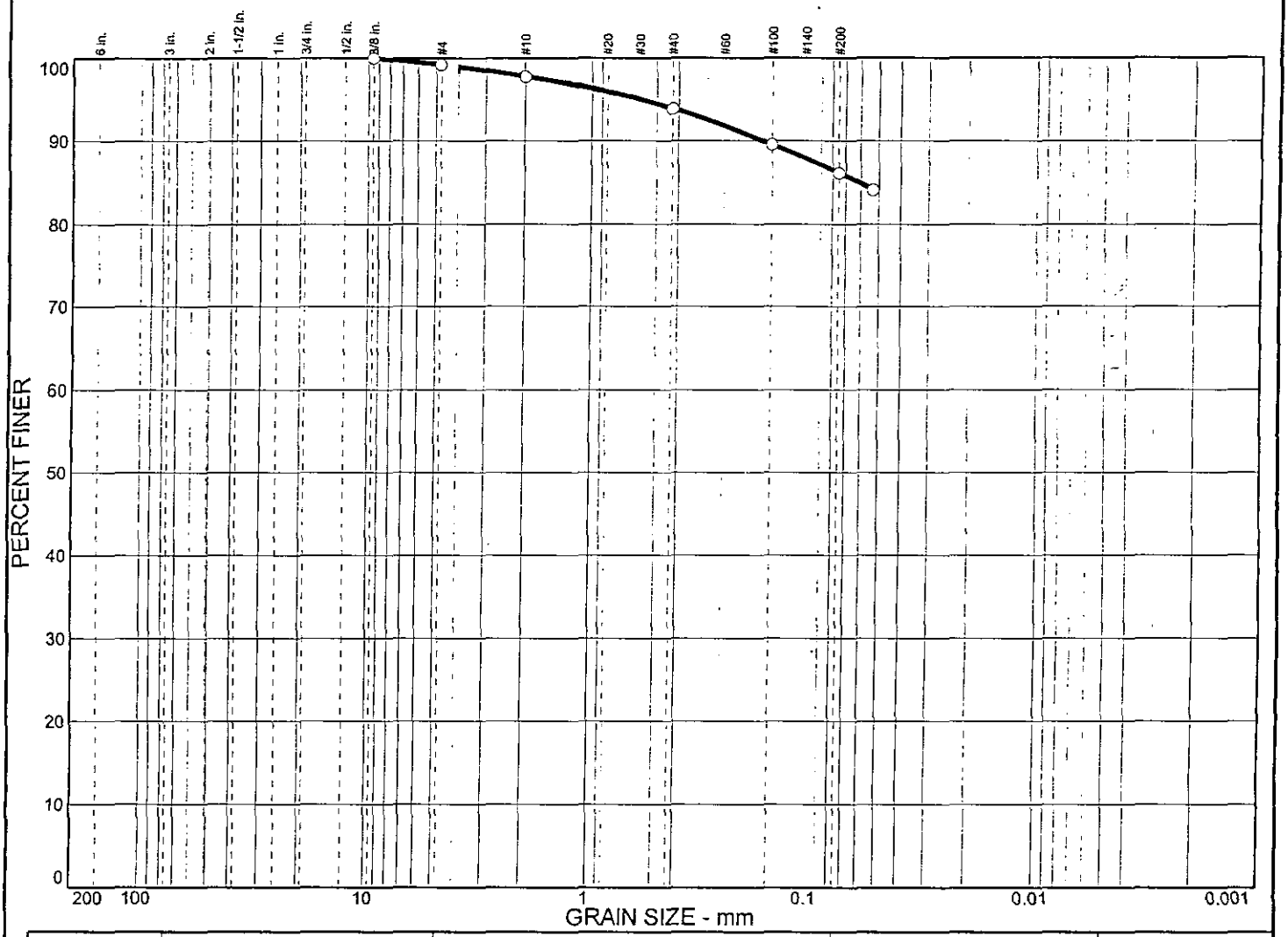
June 7, 2000

PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.8	13.1	86.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40	16	0.0618							

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown CLAY & SILT, little coarse to fine Sand, trace fine Gravel.	CL	A-6(14)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** T-3 **Sample No.:** S-3 **Elev./Depth:** 3.0'

Remarks:

○ Natural Moisture: 29.8%

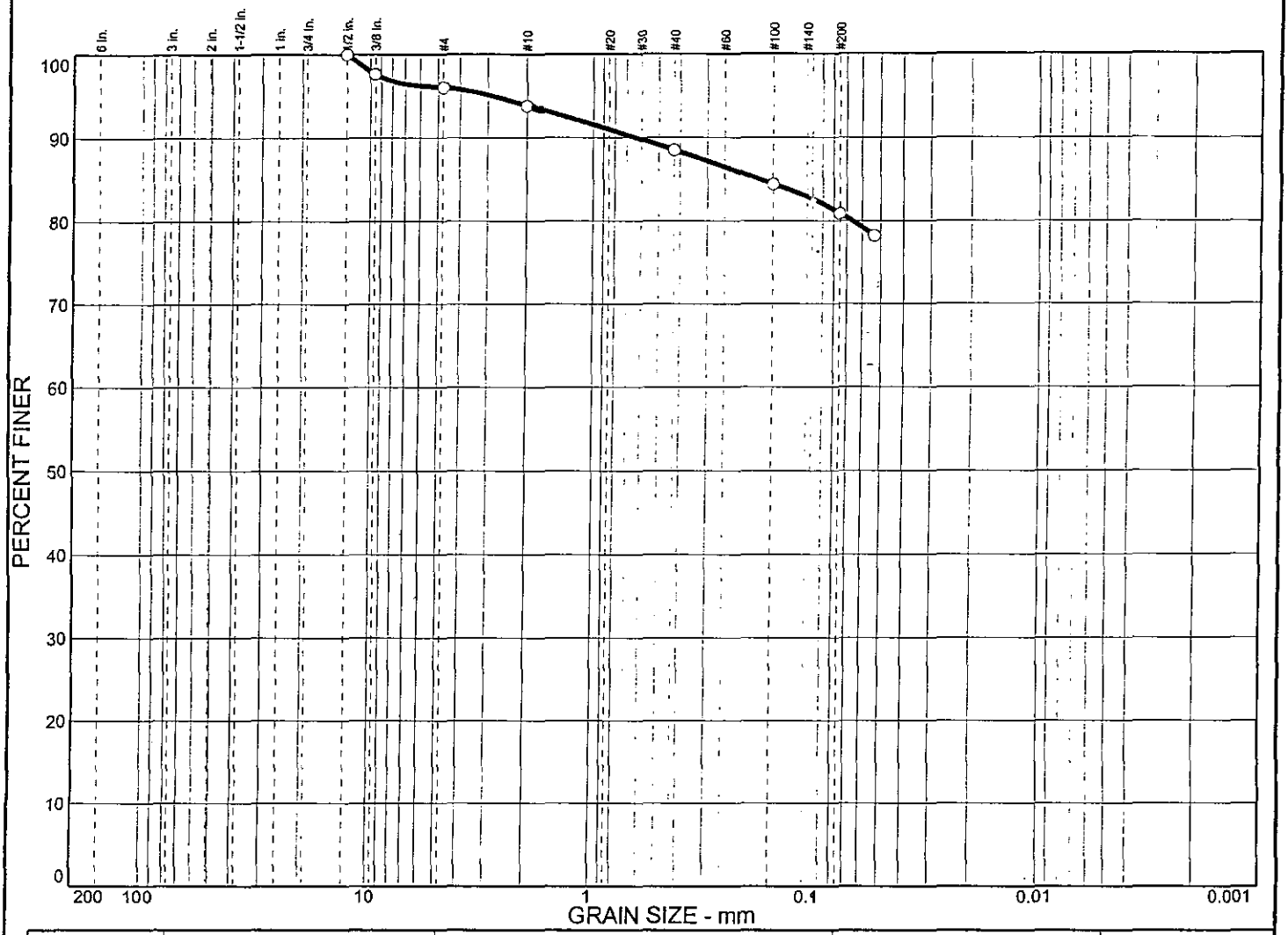
June 7, 2000

PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	4.0	15.1	80.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	14	0.174							

MATERIAL DESCRIPTION	USCS	AASHTO
○ Dark brown CLAY & SILT, little coarse to fine Sand, trace fine Gravel.	CL	A-6(11)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** T-3B **Sample No.:** S-1 **Elev./Depth:** 1.0'

Remarks:

○ Natural Moisture: 30.3%

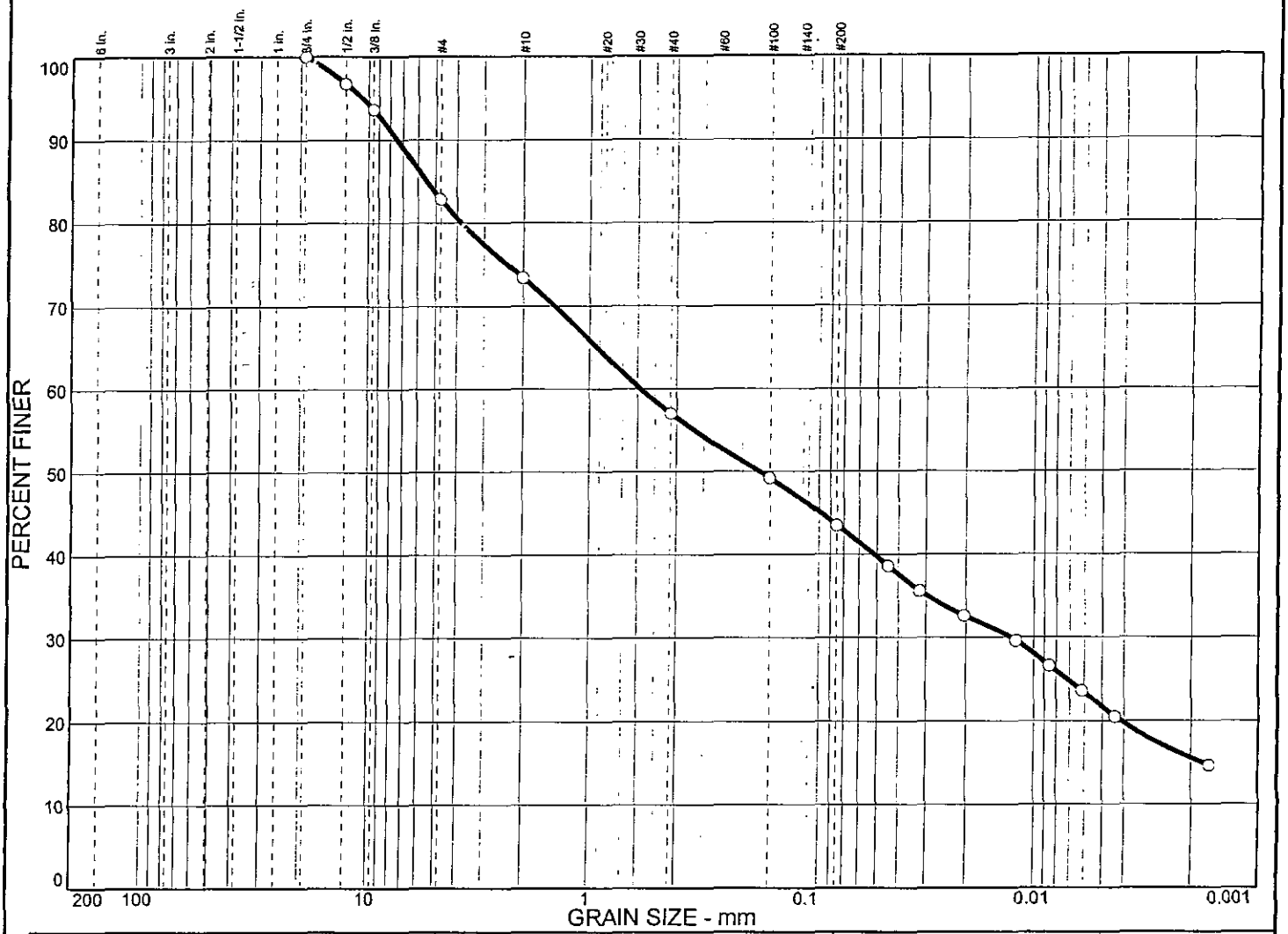
June 7, 2000

PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	17.2	39.3	21.8	21.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	41	28	5.49	0.581	0.167	0.0126	0.0018			

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown CLAY & SILT and coarse to fine SAND, little fine Gravel.	SC	A-7-6(7)

Project No. 99530 **Client:** Terrabrook

Project: Clarksburg Town Center

○ **Source:** Basin 2 **Sample No.:** S-1 **Elev./Depth:** 3.0'-5.0'

Remarks:

○ Natural Moisture: 21.2%

May 26, 2000

PARTICLE SIZE DISTRIBUTION TEST REPORT

GEO-TECHNOLOGY ASSOCIATES, INC.

Plate