GEOTECHNICAL INVESTIGATION AND EVALUATION
TOWN OF PETERBOROUGH LIBRARY REDEVELOPMENT
PETERBOROUGH, NEW HAMPSHIRE

Prepared for:

Peterborough Town Library Trustees
2 Concord Street
Peterborough, New Hampshire 03458

Prepared by:

GeoInsight, Inc.
25 Sundial Avenue, Suite 515 West
Manchester, New Hampshire 03103
Tel: (603) 314-0820
Fax: (603) 314-0821
info@geoinc.com
www.geoinsightinc.com

August 24, 2007

GeoInsight Project 5178-000

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GeoInsight®
Environmental Strategy & Engineering
Practical in Nature

August 24, 2007 GeoInsight Project 5178-000

Michael Price
Peterborough Town Library
2 Concord Street
Peterborough, New Hampshire 03458

Re: Geotechnical Investigation and Evaluation
Town of Peterborough Library Redevelopment
2 Concord Street
Peterborough, New Hampshire

Dear Mr. Price:

In accordance with your request, GeoInsight, Inc. (GeoInsight) prepared this letter report for the Peterborough Town Library (the Library) to provide geotechnical information associated with potential redevelopment of the Peterborough Library in Peterborough, New Hampshire (the Site). The work performed was described in a Scope of Work dated July 10, 2007 and submitted by GeoInsight to the Library Trustees. The proposed development addressed by this geotechnical report includes the razing and rebuilding of approximately 6,200 square feet of the existing Library. Proposed redevelopment building elements are likely to include masonry block walls with a stone or brick veneer, of potentially three building stories. GeoInsight obtained limited information regarding existing Site conditions and the proposed redevelopment of the Site based upon discussions with Tennant/Wallace Architects, PC (TW Architects) and our review of the "Library Potential Borings Locations" aerial photo prepared by TW Architects.

The purpose of GeoInsight's involvement with the project was to develop a geotechnical soil boring investigation program for the Site, oversee the investigation and characterize subsurface conditions, and provide soil engineering analysis and recommendations regarding foundation support for the new building addition, earthwork, and other construction relying on or interacting with soil for support.

GeoInsight, Inc.
25 Sundial Ave., Suite 515 West
Manchester, NH 03103-7244
Tel (603) 314-0820
Fax (603) 314-0821
www.geoinsightinc.com

GeoInsight, Inc.
5 Lan Drive, Suite 200
Westford, MA 01886-3538
Tel (978) 692-1114
Fax (978) 692-1115

GeoInsight, Inc.
Corporate Ten Center
1781 Highland Ave., Suite 207
Cheshire, CT 06410-1254
Tel (203) 271-8036
Fax (203) 271-8038

1.0 SITE DESCRIPTION AND BACKGROUND

The Site is situated in a predominantly urban area of mixed residential and commercial use in Peterborough, New Hampshire. The Site is bordered to the north by a neighboring property boundary, to the east by Concord Street (Route 202), to the south by Main Street, and to the west by the Nubanusit River. The Site currently includes a two-story masonry library building and an associated parking lot. It is GeoInsight's understanding that the current Library is founded on standard spread footing and has not experienced noticeable settlement and related damages. The topography of the Site slopes gently towards the Nubanusit River, then drops steeply approximately 10 feet at the river bank. A Site Locus based upon the United States Geological Survey Peterborough North, New Hampshire topographic quadrangle map is included as Figure 1.

2.0 INVESTIGATION ACTIVITIES

To assess subsurface conditions relative to the new development, GeoInsight coordinated a focused geotechnical drilling program at the Site. Prior to initiating the subsurface investigation, Dig Safe Systems, Inc. was notified to mark public utilities on the Site. GeoInsight was present during the investigation to observe subsurface conditions present at the locations of the borings. Boring locations were designed to preliminarily evaluate subsurface conditions beneath the proposed new building footprint as referenced by TW Architects, but were also partially dictated by existing Site use and access restrictions.

On July 23, 2007, GeoInsight oversaw the advancement of four geotechnical borings in the area being evaluated for the proposed new building section. The borings were conducted to assess soil characteristics and provide definable soil strength data pertinent to the new development. The investigation was performed using a truck-mounted hollow-stem auger drill rig operated by GeoSearch, Inc., of Fitchburg, Massachusetts. GeoInsight observed subsurface conditions at the locations of the four borings and used the information as it was recovered to continually assess the objectives of the boring program. Drilling depths ranged from approximately 20.3 to 22 feet below ground surface (bgs). Locations of the borings are indicated on Figure 2, as measured from existing Site features.

The soil borings were installed using 4.25-inch inside diameter hollow stem augers to advance the boreholes through the soil and provide an open hole for sampling. Soil samples were recovered in accordance with the American Society for Testing and Materials (ASTM) specifications for the Standard Penetration Test (SPT). A 24-inch long split spoon sampler was used to recover the samples. The sampler was advanced by blows from a 140-pound weight free falling from a height of 30 inches, with the number of blows needed to advance the sampler in 6-inch increments of penetration being recorded for each 24-inch sample interval. The summation of the blows necessary to drive the second and third increments is called the Standard Penetration Number, which is used as an indicator of the soil's inherent bearing capacity and *in situ* density. The soil samples retrieved in the split spoon sampler during each SPT were visually classified in general accordance with the Burmister Soil

Classification System. Following the soil boring activities, the borings were backfilled with native material and capped with an asphalt patch. Soil boring logs prepared by GeoInsight to describe conditions encountered during the investigation are included in Attachment A. A representative sample of soil was collected from boring B-1 at a depth of 5 to 7 feet and tested for gradation characteristics by GeoInsight in accordance with ASTM D-422. The resulting sieve curve for the sample is included in Attachment B.

3.0 SUBSURFACE CONDITIONS

Based upon evaluation of the boring data collected by GeoInsight, subsurface conditions at the Site generally included a surficial deposition of sand fill underlain by native sand. This soil profile was generally consistent for the entire boring program.

The fill layer encountered in the boring program was generally found to be approximately 3 to 8 feet thick. The fill was observed to be very loose to medium dense and comprised of medium to coarse sand with fine gravel in the matrix. The fill was most likely placed during the original Site development and most likely included disturbed native material regraded and/or material from off-site placed during historic development activities. GeoInsight is not aware of records that might indicate whether existing fill materials were placed in a controlled manner (i.e., compacted in lifts under quality control circumstances); however, based upon blow count data, it appeared the fill was subjected to some manner of historic compaction effort at some locations (B-1, B-2, and B-4). The fill observed at B-3 was very loose and comprised of fine sand with silt. This boring was located on the lawn in front of the historic building located just north of the Library and most likely did not have a compaction effort applied to the area.

At each location investigated, the fill layer was underlain by a medium dense to dense sand layer. The undisturbed sand deposits were observed to consist of medium to coarse sand with fine to coarse gravel throughout the soil profile extending into the water table. The top of this natural deposit was observed between 3 to 8 feet bgs. GeoInsight obtained limited representative samples of natural soil for grain size analysis for the purpose of developing a reuse of on-site material scheme. The beginning of a loose to very loose layer of river-valley deposition material was encountered at approximately 15 feet bgs at the investigation locations. Due to project scope limitations, GeoInsight did not evaluate the extent of this layer and depth to refusal. Shallow refusals did not occur during the drilling program and bedrock outcrops and large boulders were not present within the immediate vicinity of the Site.

Ground water was generally encountered at a depth of approximately 10.5 to 16 feet bgs based upon observations of soil moisture or standing water in the borehole upon completion of drilling. This depth appeared to be relatively close to the level of the water in the adjacent Nubanusit River. The differences in observed ground water depths appeared to be in direct relation to the topography changes at the Site. It should be noted that the static range of ground water elevation fluctuation is affected by many factors including season, recent

precipitation, and topography. Therefore, levels observed during future subsurface construction may differ from the data indicated in this report.

4.0 RECOMMENDATIONS

4.1 Foundation Support Method

Based upon the subsurface conditions observed by GeoInsight, undisturbed, inorganic soil is prevalent at the Site at relatively shallow depths and will be considered readily suitable for the proposed construction, depending upon desired final grades and improvements to the soil (i.e., excavation and replacement or densification) that might be required. Standard cast-in-place spread footings are an appropriate foundation support approach for new structures bearing in natural, undisturbed soil. Where ground-level slabs will be constructed, a standard slab-on-grade surface can be constructed following proper preparation of the subgrade.

4.2 Acceptable Bearing Surfaces

The acceptable bearing surface for shallow footings and slabs will be either prepared and approved inorganic natural subgrades (densified sand) or structural borrow placed on top of natural subgrades after removal of disturbed soil and/or topsoil. GeoInsight recommends that the natural subgrade acceptable as a bearing surface be limited to undisturbed inorganic materials that exhibit at least medium dense consistency, and that at least 8 feet of natural soil be maintained between the bottom of new foundation units and the top of the loose sand layer. Existing weak fill materials, any organic soil, and weak or disturbed natural soil are unacceptable for support of new construction loads because of their potential for load-induced settlement. Existing fill, weak natural materials, and disturbed soil are present at the Site and must be anticipated by the Sitework contractor. These conditions, although variable, should be straightforward to manage because of their relatively shallow influence.

4.3 Bearing Capacity

Based upon the density information obtained from the soil boring program described herein, compacted natural soil existing at the likely depths of new footings or structural borrow placed above the approved natural soil and 8 feet above the loose to very loose layer can be assigned an allowable bearing capacity of not more than 2 tons per square foot. This recommendation is based upon an average N values observed in the field during standard penetration testing in the sand layer. This bearing capacity is also recommended based upon our experience with similar soil conditions, our understanding of the intended Site use, and the assumption that proper subgrade preparation techniques will be applied. Excavation and replacement of shallow unsuitable material will be required at isolated locations within the new structure footprint to support perimeter and internal footings, but in many areas, acceptable subgrade will be exposed simply because of the process of excavating the footings to their normal design depth. Backfill of all areas below proposed concrete slabs, such as

foundation wall trench excavations, must include proper compaction of the backfill soil for proper slab support.

4.4 Foundation and Slab Performance Criteria

Lowest level slabs may be cast using standard slab-on-grade techniques bearing on either: 1) proof-rolled approved natural soils (where they are free draining); or 2) compacted structural borrow placed above approved natural soil after removal of fill, organics, and/or very loose natural soil. The slab subgrades should include at least 12 inches of free-draining, compacted material (either natural soil or structural borrow) to improve sub-slab moisture management. The slab concrete should be underlain by a vapor barrier (depending on the slab concrete curing techniques used), reinforced at least with heavy gauge welded wire fabric, and proper construction jointed to control the occurrence of shrinkage cracks. Where the potential exists for localized heavy floor loads, it is advisable that anticipated loading conditions be addressed with the use of additional steel reinforcement within the slab; the use of haunched slab areas below zones of anticipated concentrated floor loads to distribute the weight; the addition of fibers into the concrete mix; and/or slab subgrade strengthening, such as the use of geosynthetics.

4.5 Subgrade Preparation

To prepare subgrades for new construction, excavation and removal of fill, organic material, and loose natural soil must first occur. These materials are not reliable as stable media capable of supporting new loads. After excavation of unsuitable material is completed and acceptable bearing surfaces are reached and verified by qualified personnel, heavy proof-rolling of the exposed surfaces should occur using heavy-tired or vibratory equipment. The proof-rolling will be an important component of subgrade preparation for the natural Site soil. In particular, it will be important to densify potential localized zones of material that exhibit low density upon being exposed by excavation. Vibratory equipment should not be used if subgrades are saturated or if ground water is closer than 18 inches to the subgrade; however, this exception should not be applicable at this Site based upon observed conditions.

The proposed building area subgrades should be densified by compacting the surface of the in-place material with a vibratory drum-roller weighing at least 20,000 pounds, rubber-tired equipment having a minimum body weight of 60,000 pounds, or other specialized devices delivering energy sufficient to compact disturbed soil, with the densification occurring under observation by a qualified geotechnical engineer. This effort is intended to densify natural materials for subsequent support of new loads. Weak or unstable areas detected during the densification operation should be explored and deficient materials should be excavated and replaced with compacted structural borrow, with each lift compacted as described in Section 4.8.

To minimize disturbance to natural subgrades during excavation, particularly in areas of localized fine sand, it may be advisable to equip excavation equipment with straight-edged

buckets. The exception to this recommendation includes locations where a significant percentage of gravel, cobbles, and boulders are encountered, which will likely require toothed-buckets to remove obstructions efficiently.

Where excavation is being conducted within the proposed building footprint, unsuitable material should be removed laterally to at least 10 feet beyond the proposed building limits, or within the area bounded by a line sloping downward and outward at a 1 horizontal to 1 vertical slope from the proposed bottom of the exterior footings and intersecting the approved natural ground, whichever is greater. The minimum 10-foot extension promotes proper support of perimeter structures such as sidewalks and entranceways where potential differential settlement at the building could otherwise be obvious and/or problematic.

4.6 Frost Protection

The Site soils are likely to be only slightly frost susceptible due to depth to ground water and the relatively low presence of fine-grained material in the soil matrix. However, exterior footings should be set at least 4 feet below the finished exterior grade to provide frost protection. It will be important to institute proper Site grading, take advantage of primarily well-draining natural soil where possible, and use well-draining soil as foundation backfill to minimize frost action for the new construction without implementation of other special techniques such as insulation.

4.7 Refusal Surfaces and Obstructions

Based upon observations encountered in the boring program it is does not seem likely that rock will interfere with new shallow footing placement. Where boulders are encountered at the proposed footing or slab elevations, the rock must be overexcavated by at least 12 inches and replaced with structural borrow material. Existing foundations and/or slabs associated with demolition activities should be completely removed or broken away at least 12 inches below any new structures and also replaced with structural borrow. This structural cushion of structural material will help minimize stresses otherwise resulting from the different elastic properties inherent in rock and soil. Boulders should typically be removed (when possible and practicable) and replaced with structural borrow when they interfere with proposed footing or slab grades. All rock below the building slab or footing that is loosened by any removal process (such as ripping, hoe ramming or blasting) must be densified afterward to reduce void spaces or excavated until more intact rock is reached. Once the refusal surface is prepared and approved by qualified personnel, structural borrow may be placed and compacted to form the bearing surface for the footings and slab.

All existing utilities and subgrade building structures within the area proposed for the new building should be accurately located and assessed prior to construction. Based upon this assessment, decisions can be made regarding whether existing utilities and structures can remain below or near to the footprint of the new structure. Utilities/structures should be allowed to remain below a new building footprint only if information exists documenting that

they will not be impacted by the new construction, and proposed foundation plans include spanning over utilities, utility trenches, and subgrade structures to avoid imparting any new loads to the utilities or new building slabs. Otherwise, the utilities/structures should be relocated, updated, removed, and/or abandoned if they might interfere with the proposed new structures. The Sitework contractor should be made aware of these conditions during the bidding phase of the project.

4.8 Installation of Structural Soil

Based upon the presence of fill, disturbed materials, and potential zones of weak natural soil, excavation of unsuitable material and replacement with structural borrow will likely be required for some areas of the proposed construction. Structural borrow used for this purpose should be a well-graded, granular soil that compacts efficiently and is from a location that yields a material of consistent quality. Soil used for structural purposes should meet the gradation criteria listed below.

STRUCTURAL BORROW

SIEVE SIZE	PERCENT PASSING	
	Minimum	Maximum
6 inches	100	---
1 inch	60	100
#4	35	85
#10	25	75
#20	15	60
#40	10	45
#100	5	25
#200	3	10

Structural borrow should be installed under conditions of quality control testing and inspection, with maximum loose lift thicknesses of 12 inches (depending upon the method of compaction) being placed in horizontal layers under dry conditions. Each lift must be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557, Method D. For non-structural areas, each lift must be compacted to at least 90 percent of its maximum dry density as determined by ASTM D-1557, Method D.

4.9 Reuse of On-Site Soil

It may be permissible to reuse certain on-site materials as structural soil based upon geotechnical investigation data. A significant proportion of the on-site material (natural soil) that will be excavated by the proposed construction is generally well graded granular soil (although too fine grained overall), based upon limited grain size analysis testing (Attachment B). Should this material be chosen as a structural material during construction,

coarser particles will have to be blended into the matrix in order to create a suitable construction material.

Provided the quality of existing fill material is acceptable and practical to segregate from unsuitables, it could be replaced in compacted lifts as structural material below footings, slabs, and new pavement. The challenge with reusing existing soil from the Site will likely focus on culling unsuitable soil, organics, and poorly graded material (such as rock larger than two-thirds of any lift height). It will be very important to provide on-site observation of the excavation process by qualified personnel to further evaluate the possibility of reuse of on-site soil. A practical approach to existing soil reuse will likely involve blending and stockpiling soil (after segregation of unacceptable material) and collecting representative samples for laboratory sieve analyses to compare to the gradation criteria described in the previous section.

4.10 Verification of Approved Surfaces

We recommend that GeoInsight be retained to provide construction observation and soil testing services during the earthwork phases of construction. The purpose of our participation will be to verify our design assumptions in the field, particularly those regarding bearing surface identification, confirmation of proper subgrade preparation, removal and replacement of existing unsuitables, and potential reuse of on-site materials. Our understanding of Site conditions and construction objectives will allow engineering input in a timely manner if subsurface conditions are found to vary from those anticipated and a design change or a change in earthwork procedures is required.

4.11 Seismic Criteria

Based upon GeoInsight's knowledge of the geology of the area encompassing the Site and the information obtained during the geotechnical investigation, the Site soil is not considered liquefaction susceptible above the water table and is highly susceptible below the water table. Using the 2006 International Building Code, which refers to the spectral response accelerations as provided by the United States Geological Survey, the Site meets the Site Class C criteria based upon blow count data. The maximum considered earthquake spectral response accelerations for short periods and 1-second periods were $S_{MS} = 0.49$ and $S_{M1} = 0.19$, respectively. The calculated design spectral response acceleration parameters for short periods and 1-second periods were $S_{DS} = 0.33$ and $S_{D1} = 0.13$, respectively.

4.12 Foundation Backfilling

For cast-in-place walls and piers not designed to resist horizontal loads, backfilling against opposite sides of the structure should be performed simultaneously to avoid unbalanced loads. Backfilling against walls and piers should not occur until the concrete is sufficiently cured and braced against the horizontal load imparted by the backfill. Where applicable, at-rest, short-term soil pressure against buried structures should be calculated based upon a

fluid pressure of 55 pounds per cubic foot acting against the structure in a triangular distribution.

Backfill must be sufficiently compacted on both sides of the foundation walls and all sides of piers to support surface loads such as pavement, floor slabs, and other surface structures. Proper backfilling of perimeter exterior areas with granular material will also be important to achieve and transfer lateral resistance from surrounding soil to the new foundations.

4.13 Water Management During Construction

Care must be taken during subgrade preparation to maintain the moisture content of natural subgrades and newly placed structural borrow at or near optimum levels. If subgrades become over-saturated, work should be delayed until the moisture content decreases as the result of dewatering or air-drying. Otherwise, removal of material weakened by over-saturation must occur through over-excavation to expose a stable subgrade and allow work to progress. All subgrade preparation activities must be conducted using approaches that manage potential water infiltration along with surface water run-on and precipitation.

Provisions must be made for dewatering, if and as necessary, to allow foundation preparation work, including structural borrow placement, to occur in unsaturated conditions. Relatively granular subgrades are expected to be exposed after removal of unsuitable soil and organic materials. The natural materials are generally expected to be relatively well draining but may be subject to weakening from the combination of water and disturbance. The proximity of the Nubanusit River as a sensitive area will require proper management of construction dewatering fluids.

4.14 Erosion and Sediment Control

The gradation of the deposits at the Site will be potentially erodible by wind and water, requiring a well-devised Erosion and Sedimentation Control Plan for the Site that details criteria for protecting surface water quality during the proposed work. The Nubanusit River is a Class B surface water body located immediately to the west of the Site and needs to be protected from sediment-laden runoff during construction activities.

4.14 Building Envelope Water Management

Where the proposed construction will include space below the exterior grade, the exterior face of those walls set below grade should be thoroughly waterproofed with a bituminous membrane applied to the surface to minimize moisture from infiltrating the concrete. A perimeter drain system should be constructed around below grade areas at the footing level using perforated pipe surrounded by clean stone enveloped in filter fabric. The perimeter drain system should slope such that it collects water then drains it by gravity to an approved receptors or discharge location. Water-stops should be used at all footing to wall joints

around the below grade spaces, and at all slab to wall joints, depending upon the potential water head differential between high ground water levels and the slab.

While it does not appear that a slab underdrain system will be necessary in combination with the perimeter drain, the slab system should be constructed to prevent the build up of soil moisture below the slab such that an excess moisture gradient results and adversely affects the below grade space. This may be accomplished by connecting the free-draining material below the slab to the perimeter drain, using waterproofing below the slab, using low permeability concrete, and/or treating the slab surface with a finish that minimizes moisture migration. The potential need for an underdrain system should be evaluated further after the elevation and final configuration of the new building footprint are determined.

5.0 LIMITATIONS

GeoInsight provided the information and recommendations contained within this letter report based upon an evaluation of subsurface conditions observed and their relation to proposed construction, as documented in the letter report text and attached materials. The evaluation described and recommendations made in this letter report pertain to the specific areas investigated. The findings of this letter report are less likely to apply to areas not investigated as a function of increased distance away from the specific investigation locations. GeoInsight believes the investigation and evaluation described herein were performed in a manner consistent with the services that would have been provided by other geotechnical professionals under similar circumstances. However, given the variable nature of natural soil deposits and rock formations, we cannot represent that the subsurface conditions identified in the boring logs and described in this letter report are exact, nor can we guarantee that our interpolation between or extrapolation from investigation locations is completely representative of actual conditions. Variations in subsurface conditions are possible laterally and with depth that are not identified on the boring logs or otherwise in this letter report.

Should additional information become available regarding the proposed Site development that is significantly different from that described in this letter report, or should subsurface conditions be found during construction that vary significantly from those observed during previous investigations and summarized in this letter report, GeoInsight should be given the opportunity to evaluate the data and modify its recommendations, if warranted.

This letter report has been prepared for specific application to the Site described as the Peterborough Town Library in Peterborough, New Hampshire. No other warranty, expressed, or implied, is made. In addition, this letter report was prepared exclusively for the Library Trustees, and the use of this letter report by other parties without written consent from GeoInsight is hereby prohibited. In preparing this letter report, GeoInsight relied upon certain verbal information or representations provided by personnel from the Library Director and TW Architects. To the extent that the interpretations, findings, and recommendations presented in this letter report are based in whole or in part upon such details, they are contingent on the validity of the information.

We trust the above and attached information is acceptable for your use. Please contact us at (603) 314-0820 with questions.

Sincerely,
GEOINSIGHT, INC.

Marc R. Fyrberg
Staff Engineer

Michael J. Redding, P.E., CPESC
Senior Engineer

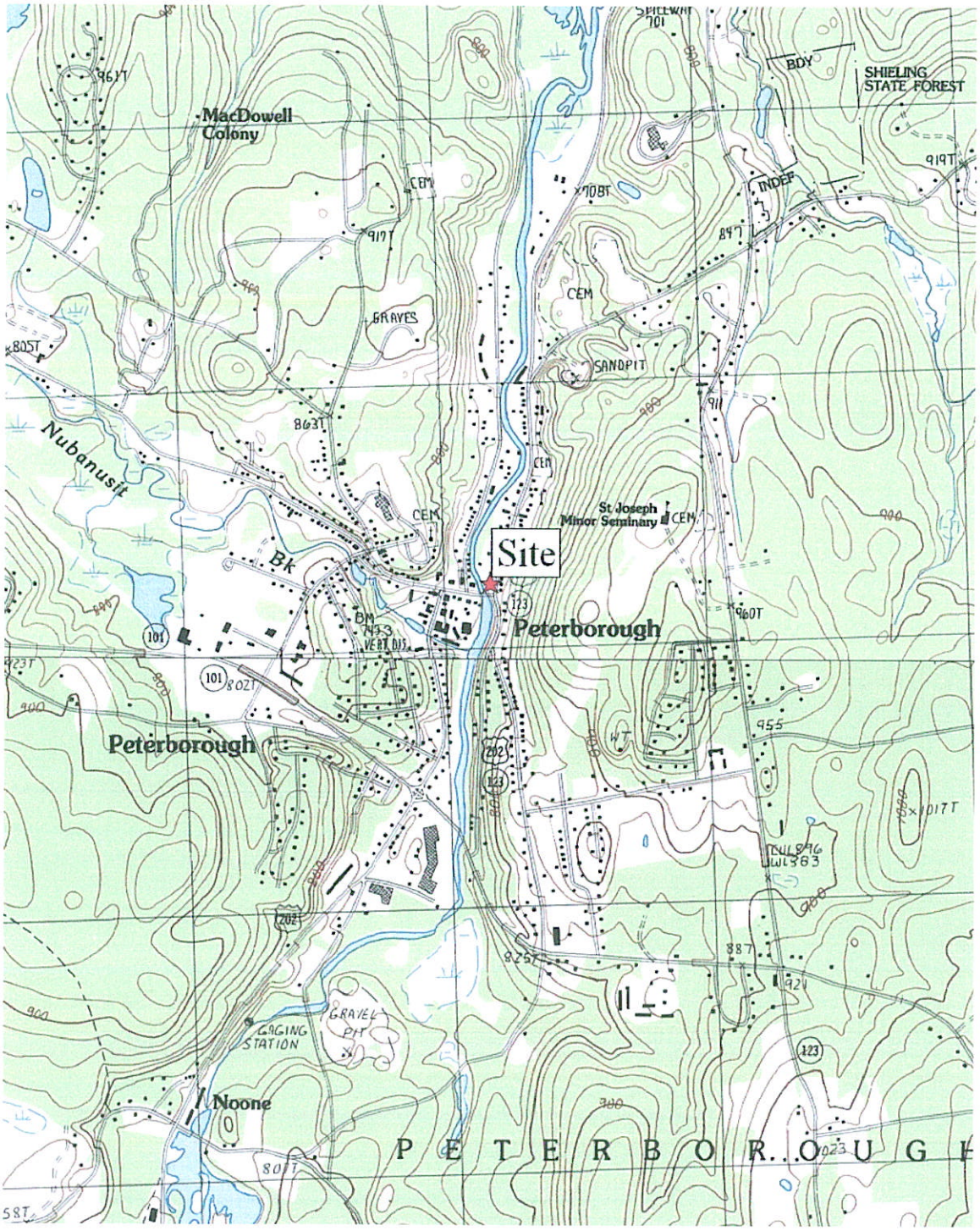
Michael C. Penney, P.E., L.S.P.
Senior Associate/Senior Engineer

STATE OF NEW HAMPSHIRE
MICHAEL C. PENNEY
No. 7608
LICENSED PROFESSIONAL ENGINEER

Attachments

P:\5178 Peterborough Library\5178 Geotech Report.doc

FIGURES



SOURCE:

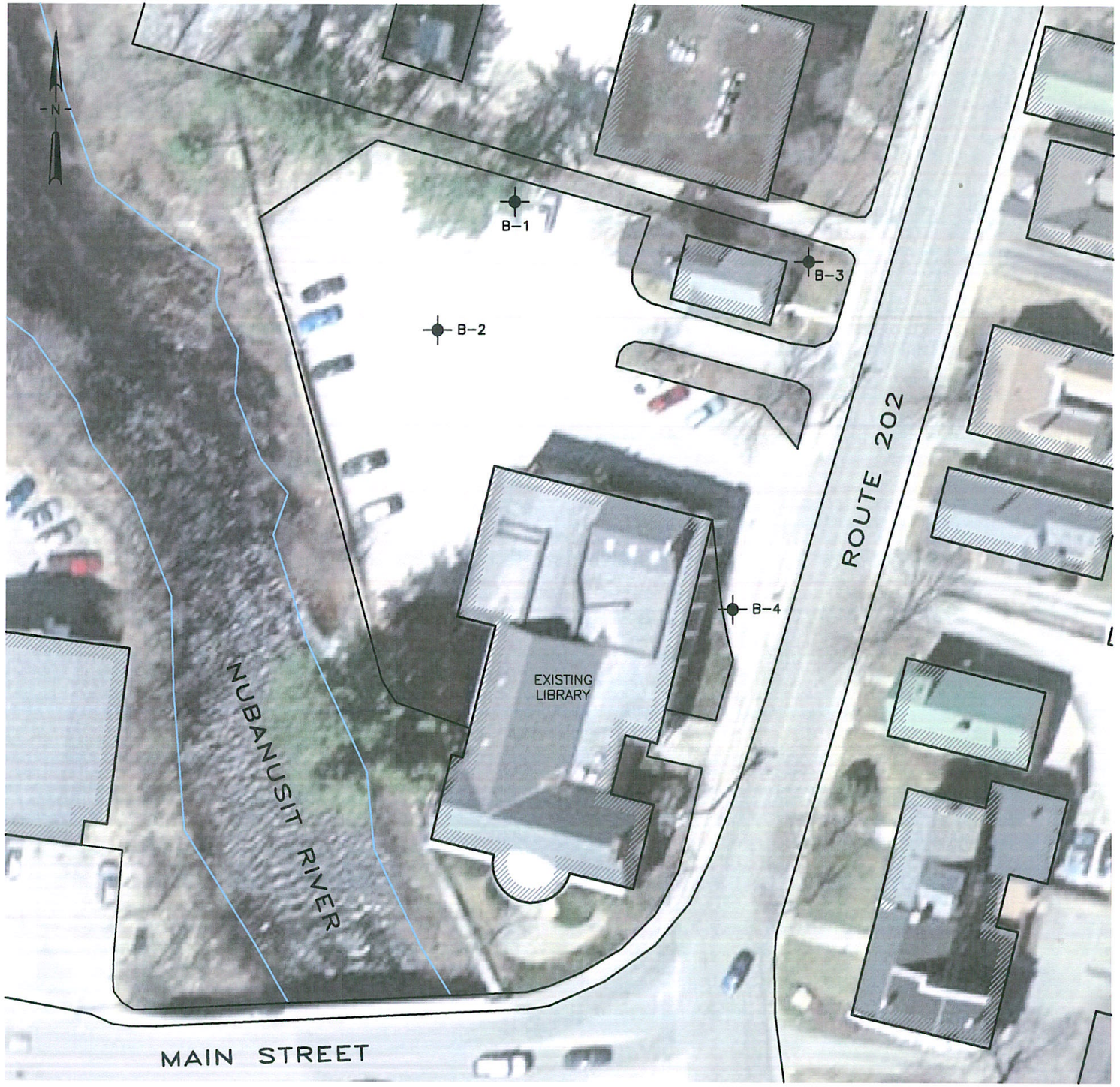
USGS PETERBOROUGH NORTH, NH QUADRANGLE

0 2000 4000

APPROX. SCALE IN FEET

CLIENT: PETERBOROUGH LIBRARY				
PROJECT: 2 CONCORD STREET PETERBOROUGH, NEW HAMPSHIRE				
TITLE: SITE LOCUS				
DESIGNED: MRF	DRAWN: STM	CHECKED: MJR	APPROVED: MCP	GeoInsight Practical in Nature
SCALE: 1" = 2000'	DATE: 08/02/07	FILE NO.: 5178-LOCUS	PROJECT NO.: 5178-000	FIGURE NO.: 1

PLOT DATE: 8-2-07
FILE: I:\5178\5178-LOCUS.dwg



LEGEND

B-1 TEST BORING LOCATION (7/23/07)

NOTES:

1. THIS FIGURE WAS BASED UPON AN AERIAL PHOTOGRAPH TITLED "PETERBOROUGH TOWN LIBRARY POTENTIAL TEST BORING LOCATIONS MAY 11, 2007" PROVIDED BY TENNANT/WALLACE ARCHITECTS, PC.

0 40 80

APPROX. SCALE IN FEET

CLIENT: PETERBOROUGH LIBRARY				GeoInsight *Practical in Nature*
PROJECT: 2 CONCORD STREET PETERBOROUGH, NEW HAMPSHIRE				
TITLE: SITE PLAN				
DESIGNED: MRF	DRAWN: STM	CHECKED: MJR	APPROVED: MCP	
SCALE: 1" = 40'	DATE: 08/02/07	FILE NO.: 5178D001	PROJECT NO.: 5178-000	FIGURE NO.: 2

PLOT DATE: 8-24-07
FILE: I:\5178\5178D001.dwg

ATTACHMENT A

GEOINSIGHT SOIL BORING LOGS

GeoInsight
Practical in Nature

SOIL BORING LOG

Location:	Peterborough Town Library	Boring No.:	B-1
Project:	Library Redevelopment	Sheet:	1 Of: 2
Drilling Co.:	Geosearch, Inc.	Project Number:	5178-000
Foreman:	Jason Morgan	Chkd. By:	MRF
GeoInsight Eng./Geol:	Joshua Funk	Boring Location:	Refer to Site Plan
		Ground Surface Elevation:	Not Surveyed Datum: N/A
		Date Started: 7/23/07	Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	10.5'	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
0					ASPHALT 4".	ASPHALT		
	1	20/24	0.3'-2.3'	12	Medium dense, tan, fine SAND, some medium Sand, trace Silt, trace			
				10	coarse Sand, dry.			
				12		SAND FILL		
				12				
	2	24/24	2.3'-4.3'	21	Dense, tan, fine to medium SAND, trace Silt, trace coarse Sand, dry.			
				20				
				17				
				12				1
	3	20/24	4.3'-6.3'	4	Medium dense, orange, fine SAND, dry.			
5				5				
				10				
				23	Brown, medium to coarse SAND, some Gravel, dry.			
	4	18/24	6.3'-8.3'	16	Very dense, brown, medium SAND, some fine to coarse Gravel,			
				23	dry.			
				31				
				49				
	5	20/24	8.3'-10.3'	17	Dense, brown, medium SAND, some fine Gravel, moist.			
				21				
				28				
10				23				
	6	6/24	10.3'-12.3'	25	Very dense, brown, medium SAND, trace Silt, some coarse Gravel,			
				39	moist.			
				16		SAND		
				14				
	7	10/24	12.3'-14.3'	10	Dense, brown, fine to medium SAND, some coarse Sand, some Silt,			
				19	some fine to coarse Gravel, wet.			
				22				
				15				
	8	12/24	14.3'-16.3'	4	Loose, brown, medium SAND, trace coarse Sand, trace fine Gravel,			
15				4	wet.			
				3				
				3				
	9	18/24	16.3'-18.3'	4	Loose, brown, medium SAND, some coarse Sand, trace fine Sand,			
				5	wet.			
				5				
				6				
	10	24'24	18.3'-20.3'	6	Very loose, brown, fine to medium SAND, trace coarse Sand, wet.			
				1				
				1				

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

NOTES:

1. Stratum changed based upon drill rig behavior.

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-1
Sheet: 2 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	10.5'	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	SAMPLE REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
20				1		SAND		
					Boring terminated at 20.3' bgs.			
					Refusal not encountered.			
25								
30								
35								

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY	
0-4	V. LOOSE	<2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
>50	V. DENSE	15-30	V. STIFF	
		>30	HARD	

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-2
Sheet: 1 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	11.5'	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
0					ASPHALT 4".	ASPHALT		
	1	12/24	0.3'-2.3'	12	Medium dense, light brown/tan, medium SAND, some fine Sand,			
				7	some coarse Sand, dry.			
				6		SAND FILL		
				7				
								1
5	2	18/24	5'-7'	15	Medium dense, orange, fine to medium SAND, trace coarse Sand,			
				7	dry.			
				6				
				15				
10	3	18/24	10'-12'	19	Dense, brown, medium SAND, some coarse Sand, some coarse			
				24	Gravel, moist.			
				18				
				14		SAND		
15	4	10'24	15'-17'	4	Medium dense, brown, medium to coarse SAND, some coarse			
				7	Gravel, wet.			
				7				
				10				

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

NOTES:

1. Stratum changed based upon drill rig behavior.

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-2
Sheet: 2 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	11.5'	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
20	5	10'24	20'-22'	5	Very loose, brown, medium to coarse SAND, trace coarse Gravel,	SAND		
				1	wet.			
				1				
				1				
					Boring terminated at 22' bgs.			
					Refusal not encountered.			
25								
30								
35								

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

NOTES:

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-3
Sheet: 1 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER	
Vehicle:	Truck Mount	Type:	2' Split Spoon
Model:	CME	Hammer(lb):	140
Method:	Hollow Stem Auger	Fall (in):	30

GROUND WATER READINGS			
DATE	DEPTH	REFERENCE	STABILIZATION
7/23/2007	16.5'	Ground Surface	Upon Completion

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
0	1	24/24	0-2'	1	Very loose, dark brown, fine SAND, some Silt, little Roots, dry.	TOPSOIL		
				1	Tan, fine to medium SAND, trace coarse Sand, dry.	SAND FILL		
				1				
				1				
5	2	20/24	5'-7'	1	Very loose, tan, fine to medium SAND, trace coarse Sand, dry.			
				1				
				1				
				1				
								1
10	3	12/24	10'-12'	8	Medium dense, tan, fine to medium SAND, dry.	SAND		
				9				
				8				
				6				
15	4	12/24	15'-17'	3	Loose, tan, medium to coarse SAND, some fine SAND, moist.			
				4				
				4				
				4				

GRANULAR SOILS	
BLOWS/ft.	DENSITY
0-4	V. LOOSE
4-10	LOOSE
10-30	M. DENSE
30-50	DENSE
>50	V. DENSE

COHESIVE SOILS	
BLOWS/ft.	CONSISTENCY
<2	V. SOFT
2-4	SOFT
4-8	M. STIFF
8-15	STIFF
15-30	V. STIFF
>30	HARD

NOTES:
1. Stratum changed based upon drill rig behavior.

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-3
Sheet: 2 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	16.5'	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
20	5	12	20'-22'	1	Very loose, tan, medium to coarse SAND, wet.	SAND		
				1				
				1				
				1				
					Boring terminated at 22' bgs.			
					Refusal not encountered.			
25								
30								
35								

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

NOTES:

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment
Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-4
Sheet: 1 Of: 2
Project Number: 5178-000
Chkd. By: MRF
Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER	
Vehicle:	Truck Mount	Type:	2' Split Spoon
Model:	CME	Hammer(lb):	140
Method:	Hollow Stem Auger	Fall (in):	30

GROUND WATER READINGS			
DATE	DEPTH	REFERENCE	STABILIZATION
7/23/2007	Not Observed	Ground Surface	Upon Completion

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
0					ASPHALT 4".	ASPHALT		
	1	10/24	0.3'-2.3'	5	Medium dense, light brown, medium to coarse SAND, dry.	SAND FILL		
				9				
				10				
				10				
								1
5	2	12/24	5'-7'	12	Dense, light brown, medium to coarse SAND, some fine Sand, some fine Gravel, dry.			
				15				
				32				
				23				
10	3	8/24	10'-12'	28	Very dense, light brown, medium to coarse SAND, dry (top 3" rock in bottom spoon).	SAND		
				43				
				20				
				19				
15	4	20/24	15'-17'	5	Medium dense, light brown, medium SAND, some coarse Sand, dry.			
				7				
				8				
				6				

GRANULAR SOILS	
BLOWS/ft.	DENSITY
0-4	V. LOOSE
4-10	LOOSE
10-30	M. DENSE
30-50	DENSE
>50	V. DENSE

COHESIVE SOILS	
BLOWS/ft.	CONSISTENCY
<2	V. SOFT
2-4	SOFT
4-8	M. STIFF
8-15	STIFF
15-30	V. STIFF
>30	HARD

NOTES:
1. Stratum changed based upon drill rig behavior.

GeoInsight
Practical in Nature

SOIL BORING LOG

Location: Peterborough Town Library
Project: Library Redevelopment

Drilling Co.: Geosearch, Inc.
Foreman: Jason Morgan
GeoInsight Eng./Geol: Joshua Funk

Boring No.: B-4
Sheet: 2 Of: 2
Project Number: 5178-000
Chkd. By: MRF

Boring Location: Refer to Site Plan
Ground Surface Elevation: Not Surveyed Datum: N/A
Date Started: 7/23/07 Date Completed: 7/23/07

DRILLING METHOD		SAMPLER		GROUND WATER READINGS			
Vehicle:	Truck Mount	Type:	2' Split Spoon	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	CME	Hammer(lb):	140	7/23/2007	Not Observed	Ground Surface	Upon Completion
Method:	Hollow Stem Auger	Fall (in):	30				

DEPTH (ft)	SAMPLE NO.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	SAMPLE DESCRIPTION	STRATUM DESCRIPTION	FIELD SCREENING (ppm)	NOTE
20	5	18/24	20'-22'	1	Very loose, brown, medium to coarse SAND, wet.	SAND		
				1				
				1				
				1				
					Boring terminated at 22' bgs.			
					Refusal not encountered.			
25								
30								
35								

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

NOTES:

ATTACHMENT B

GRAIN SIZE RESULTS

GRAIN SIZE DISTIBUTION - SAMPLE 1
TOWN OF PETERBOROUGH LIBRARY REDEVELOPMENT
PETERBOROUGH, NEW HAMPSHIRE