

Environmental Engineering Geotechnical Engineering Water Resources Hydrogeology

October 5, 2011 Project No. 4707

Board of Selectmen c/o: Dina Cutting, Administrative Assistant Town of Lyme Office of the Selectmen P. O. Box 126 Lyme, N. H. 03768

RE: Report of Performing Design Phase Geotechnical Engineering Services River Road Riverbank Failure Area Lyme, New Hampshire

Dear Board of Selectmen:

Submitted is the HTE Northeast, Inc. (HTE) analysis of the Connecticut riverbank failure located along a $1,000^{\circ}\pm$ section of River Road in the northwest part of Lyme, New Hampshire. This work was performed in accordance with HTE Proposal No. 9372.1 dated August 8, 2011. This report is subject to the Limitations in Appendix A.

I) <u>Introduction</u>

It is HTE's understanding that substantial river bank slope failures occurred on or about April 30 to May 1, 2011 along the west side of River Road where it is adjacent to the Connecticut River. The slope failures occurred in several areas over a $1,000\pm$ feet distance for a portion of River Road just south of North Thetford Road On June 22^{nd} , the undersigned observed that portions of the southbound (west) lane of River Road were in danger of further failure being imminent.

It is understood that the flood level rose to within a few feet of the road level (the grade of River Road varies from about EL $398\pm$ to EL $400\pm$), and that the river level receded relatively quickly. The failure occurred in the interior (and straight) portion of an obtuse bend (southeast, the south, then southwest flow) in the river.

It is understood that consideration is being given to re-constructing the affected portion of River Road along a new alignment that would be shifted to the east of the current alignment. The establishment of this new alignment would be based on constructing permanent stable new slopes along the adjacent Connecticut River shoreline to the west.

Holden Engineering & Surveying, Inc. (Holden) obtained topographic survey information of the failure area, including topographic data for the easterly $50^{2}\pm$ of the river (at normal level), and also $50^{2}\pm$ east of the present road, such that accurate cross-sections of slope failure areas could be developed for use



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in our work. The area has a preliminary surficial geologic mapping as stratified sand & silt outwash, often overlying varved clays. The subsurface explorations performed for this study indicates that the pertinent soil stratigraphy consists of loose to medium dense non-cohesive fine sand/silt alluvium overlying dense granular ice-contact deposits. The presence of varved deposits was not in evidence. Bedrock was not encountered to the depths explored.

Based on our observations, chronology of events, and results of subsurface explorations presented subsequently, it appears that the failed riverbank section of concern was been caused by the following general conditions:

- 1) Long term erosion and undermining of the riverbank due to flow action. Erosion and undermining alone are responsible for depletion of the alluvium riverbank along the east side of the Connecticut River in the area of concern. The frequent raising and lowering of the water level by downstream dam management (Wilder Dam), over time, is a contributing factor. As the soil mass is slowly removed from the bottom of the slope, the overall stability is reduced by the decrease in resisting forces until such time that the slope or a portion of the slope either sloughs or rotates to a more stable condition classical rotational type failure surface). This situation repeats itself over a long period of time being exacerbated during floods.
- 2) <u>Existence of water in the riverbank soils.</u> The high groundwater levels within the slope cross section at the time of the flood increased the driving forces thus tending to destabilize or reduce overall stability, particularly as the flood receded. The saturation of the relatively slow-draining alluvial soils resulted in an unbalanced hydrostatic condition in the slope. Surface runoff from the east is not considered to have been a significant factor in the riverbank failure. Wave action is not considered to have been a factor in the riverbank failure.

It is anticipated that the failure of the subject riverbank was a result of both of these phenomenon in concert. It can be anticipated that future long term riverbank instability will occur, as evidenced by the steepness of the post-flood riverbank and the 'tension cracks' still present along portions of the west side of River Road. Remedial actions will need to consider reconstruction of the affected riverbank and contiguous upstream and downstream sections to a stable configuration (in-part to reduce groundwater impacts), including appropriate riverbank slope surface protection.

It should be noted that the current riverbank configuration is considered unstable and we do not recommend re-opening of the road until a stable re-construction is implemented.

II) <u>Subsurface Explorations</u>

HTE observed the drilling of four test borings, designated as HTE-1 to HTE-4 at approximate stations Sta $18+75\pm$, $16+75\pm$, $14+45\pm$ and $13+00\pm$ along River Road, per the Holden survey. The explorations were performed in general accordance with ASTM D 1452 by New Hampshire Boring, Inc. (NHB), of



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Derry, N. H., on August 15 and 16, 2011. The logs of the test borings and observation wells, prepared by HTE, are attached as Appendix B. The approximate as-drilled exploration locations are shown on the project plans developed by Holden.

The test boring was drilled using standard dive & wash test boring drilling techniques to depths ranging from $31^{2}\pm$ to $41^{2}\pm$. Standard Penetration Tests (SPTs) were performed in each test boring in general accordance with ASTM D 1586. The SPT consists of driving a 1-3/8 inch I.D. split spoon sampler with a 140 pound hammer falling 30 inches. The blows for each 6 inches of penetration are recorded for a total of 18 to 24 inches. The sum of the blows required to drive the sampler from 6 inches to 18 inches penetration is referred to as the Standard Penetration Resistance, or N-value, which is an index measure of in-situ soil density or consistency.

In addition to the split spoon samples obtained at 5' depth increments, selected additional split-spoon samples were obtained at anticipated general slip-circle depths. The test borings were performed under the observation of a HTE geotechnical engineer. Soil samples from the test borings were classified in the field by HTE in general accordance with the Burmister Soil Classification System.

Groundwater level measurement observation wells were installed in borings HTE-1 and HTE-3.

III) <u>Subsurface Conditions</u>

Based on the results of HTE's test boring observations, the existing overburden soils encountered in the test boring consist generally of loose to medium dense natural fine sand and silt alluvial deposits, underlain at least locally at boring HTE- 3, by dense granular ice-contact deposits at a depth of about $34\frac{1}{2}$ '± and continuing to the termination depth of 41'. A more detailed discussion of soil conditions encountered is outlined below. The non-cohesive alluvial deposits were encountered in each test boring to below depths considered of importance for this study. Significant clay deposits were noted not to be present.

IV) <u>Slope Stability Analyses – Stone Slope Configuration Initial Option</u>

Based on the results of the test boring program, the survey data provided by Holden and HTE's observations, cross sections of the subject Connecticut River riverbank were developed by Holden (refer to separate Holden plan set). Using the cross sectional slope geometry (1.5 horizontal to 1 vertical – 1.5H:1V slope), and the soil and rock fill parameters determined from literature review, slope stability analyses were performed to assess existing slope conditions with regard to potential slope failure. The analyses were performed using GSLOPE, a slope modeling software package, developed by Mitre Software Corporation. The GSLOPE program utilizes Bishop's Modified Method of limit equilibrium slope stability analysis.

HTE considered the following in-situ index property average values:

Silty Sand In-Situ Moist Density (γ_m):

120 pounds per cubic foot (pcf)



Geotechnical Services Report River Road Riverbank Failure Area Lyme, New Hampshire	October 5, 2011 HTE Project No. 4707 Page No. 4
Silty Sand Effective Friction Angle (ϕ):	32°
HTE considered the following Bank-run Gravel index pro	perty average values:
Bank-run Gravel In-Situ Moist Density (γ_m): Bank-run Gravel Effective Friction Angle (ϕ):	125 pounds per cubic foot (pcf) 34°
HTE considered the following Class A Stone Fill index pr	operty average values:
Class A Stone In-Situ Moist Density (γ_m): Class A Stone Effective Friction Angle (φ): 34°	140 pounds per cubic foot (pcf)
HTE considered the following Class C Rip-Rap index pro	perty average values:
Class C Rip-Rap In-Situ Moist Density (γ_m): Class C Rip-Rap Effective Friction Angle (ϕ):	135 pounds per cubic foot (pcf) 34°

Stability analyses were performed, in order to investigate a proposed stone slope concept for permanent riverbank/slope stabilization. The intent of these analyses was to determine the slope and materials necessary to achieve a minimum factor of safety against failure of 1.5 for a 10-year flood event (EL 386.5). Analyses were performed for minimum 4' thickness rock slope configuration with a slope of no steeper than 1.5H:1V. This configuration considers that the failed soil mass is removed. Analytical results indicate that a factor of safety of approximately 1.5 can be achieved by utilizing more-dense NHDOT Class A Stone Fill for the lower portion and less dense Class C Rip-Rap for construction of the upper portion.

The use of NHDOT Bank-run Gravel is considered for the balance of the necessary replacement backfill, beneath the stone/rock fills, for the construction phase excavation, assuming a cut-back slope of no steeper than 2H:1V. All new soil backfill, to beneath roadway subgrade, should be compacted to at least 93% of the optimum dry density per ASTM D-1557. Re-use of the native silty sand for backfill is not recommended.

Copies of the stability analysis results for the proposed stone slope, showing the existing/proposed slope profiles, input material properties and resultant minimum factors of safety, are attached as Appendix C.

V) <u>Slope Stability Analyses – Alternate Stone/Soil Slope Configuration</u>

Based on September 2011 discussions with the Town of Lyme, Holden developed an alternate stone/soil slope configuration, with a 3H:1V slope. Based on the results of the test boring program, the survey data provided by Holden and HTE's observations, cross sections of the subject Connecticut River riverbank were developed by Holden (refer to separate October 2011 Holden plan set). Using the cross sectional slope geometry (3H:1V slope), and the soil and rock fill parameters determined from



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literature review, slope stability analyses were performed to assess existing slope conditions with regard to potential slope failure. The analyses were performed using GSLOPE, a slope modeling software package, developed by Mitre Software Corporation. The GSLOPE program utilizes Bishop's Modified Method of limit equilibrium slope stability analysis.

HTE considered the following in-situ index property average values:

Silty Sand In-Situ Moist Density (γ_m):	120 pounds per cubic foot (pcf)
Silty Sand Effective Friction Angle (ϕ) :	32°

HTE considered the following Bank-run Gravel index property average values:

Bank-run Gravel In-Situ Moist Density (γ_m):125 pounds per cubic foot (pcf)Bank-run Gravel Effective Friction Angle (ϕ):34°

HTE considered the following Class A Stone Fill index property average values:

Class A Stone In-Situ Moist Density (γ_m): 140 pounds per cubic foot (pcf) Class A Stone Effective Friction Angle (ϕ): 34°

Stability analyses were performed, in order to investigate a proposed stone/soil slope concept for permanent riverbank/slope stabilization. The intent of these analyses was to determine the slope and materials necessary to achieve a minimum factor of safety against failure of 1.5 for a 10-year flood event (EL 386.5). Analyses were performed for minimum 3' thickness Class A Stone toe slope configuration to 1' above the 10-year flood level, and with soil above, with a slope of no steeper than 3H:1V. This configuration also considers that the failed soil mass is removed. Analytical results indicate that a factor of safety of approximately 1.5 can be achieved by utilizing more-dense NHDOT Class A Stone for the toe section, with in-place soil cut to a 3H:1V slope (with topsoil cover) for construction of the upper portion.

The use of NHDOT Bank-run Gravel is considered for the balance of the necessary replacement backfill, beneath the stone/rock fills, for the construction phase excavation, assuming a cut-back slope of no steeper than 2H:1V. All new soil backfill, to beneath roadway subgrade, should be compacted to at least 93% of the optimum dry density per ASTM D-1557. Re-use of the native silty sand for backfill is not recommended.

Copies of the stability analysis results for the proposed stone slope, showing the existing/proposed slope profiles, input material properties and resultant minimum factors of safety, are attached as Appendix D (pending).

VI) <u>Other Components</u>



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The new stone slope or stone/soil slope section should be underlain by a course of heavy-grade nonwoven geotextile. The geotextile should be non-woven heavy grade product meeting the requirements of NHDOT 593.411, and should be installed per the Section 593 requirements for 'permanent erosion control'. Further, for the 1.5H:1V stone slope configuration, the Class C Rip-Rap course for the stone slope option should be underlain by a 1' thickness of NHDOT Class C Stone.

Specifically related to the 3H:1V stone/soil slope configuration, the installation of EnvirogridTM (or similar) cellular units for topsoil surface stabilization between 1' above the 10-year and to 1' above the 50-year flood level (EL 390.75±) is recommended (this is depicted on the updated Holden cross-section).

VII) <u>Recommended Typical Sections</u>

As one alternative, a recommended typical 1.5H:1V stone slope cross-section for the riverbank reconstruction, as prepared by Holden, is attached. It is our opinion that proper re-construction of the subject riverbank area with the depicted material configuration and underlying Bank-run Gravel replacement fill for excavation cut will have a factor of safety of greater than 1 relative to the flood event of May 2011.

As a second alternative, a recommended typical 3H:1V stone/soil slope cross-section for the riverbank re-construction, as prepared by Holden, is also attached. It is our opinion that proper re-construction of the subject riverbank area with the depicted Class A stone (toe section) and upper soil material configuration at excavation cut will have a factor of safety of greater than 1 relative to the flood event of May 2011.

VIII) Construction Considerations

For construction of either alternative, it is recommended: 1) that the work be conducted in $100'\pm$ wide sections, with complete section construction to at least the 50-year flood level over this width, prior to advancing to the next section; 2) that work on a new section should not be initiated unless the two week advance forecast is favorable; 3) that about 100 cu. yds of NHDOT Class C Stone be kept available at the site for temporary slope stabilization as necessary and 4) that a HTE geotechnical engineer observe the construction of the first re-construction section, in order to be able to comment on the progress of the method chosen for implementation.

IX) <u>Closing</u>

HTE trusts that this submittal will meet your current requirements for assistance to Holden Engineering & Surveying, Inc. with final design of slope stabilization. Please do not hesitate to contact this office should you have any questions.

Very truly yours,



HTE NORTHEAST, INC.

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Roger B. Keilig, PE, PG Sr. Project Manager

Cc: Peter Holden, Holden Engineering & Surveying, Inc.

Attachments: Table 1 – Summary of Explorations Typical Reconstruction Cross-Section: Stone Slope Typical Reconstruction Cross-Section: Stone/Soil Slope Appendix A – Limitations Appendix B – Test Boring Logs Appendix C – Stability Analysis Calculations – Stone Slope Appendix D – Stability Analysis Calculations – Stone/Soil Slope

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APPENDIX A LIMITATIONS ON WORK PRODUCT

Site Observations

- 1. The analyses and recommendations submitted in this report are based in part upon the data obtained from limited subsurface observations. The nature and extent of subsurface variations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.
- 2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of limited observations (no engineering subsurface samples were obtained; actual soil and bedrock transitions are probably more erratic.
- 3. Water level readings have been made under conditions stated. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature and other factors occurring since the time observations were made.
- 4. In the event that any changes in the proposed general project development are planned (e.g., floor slab on grade elevations, column and wall loads, building footprint size and location, etc.), 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 by HTE Northeast, Inc. It is recommended that this firm be provided the opportunity to review the final design plans and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented.

Construction

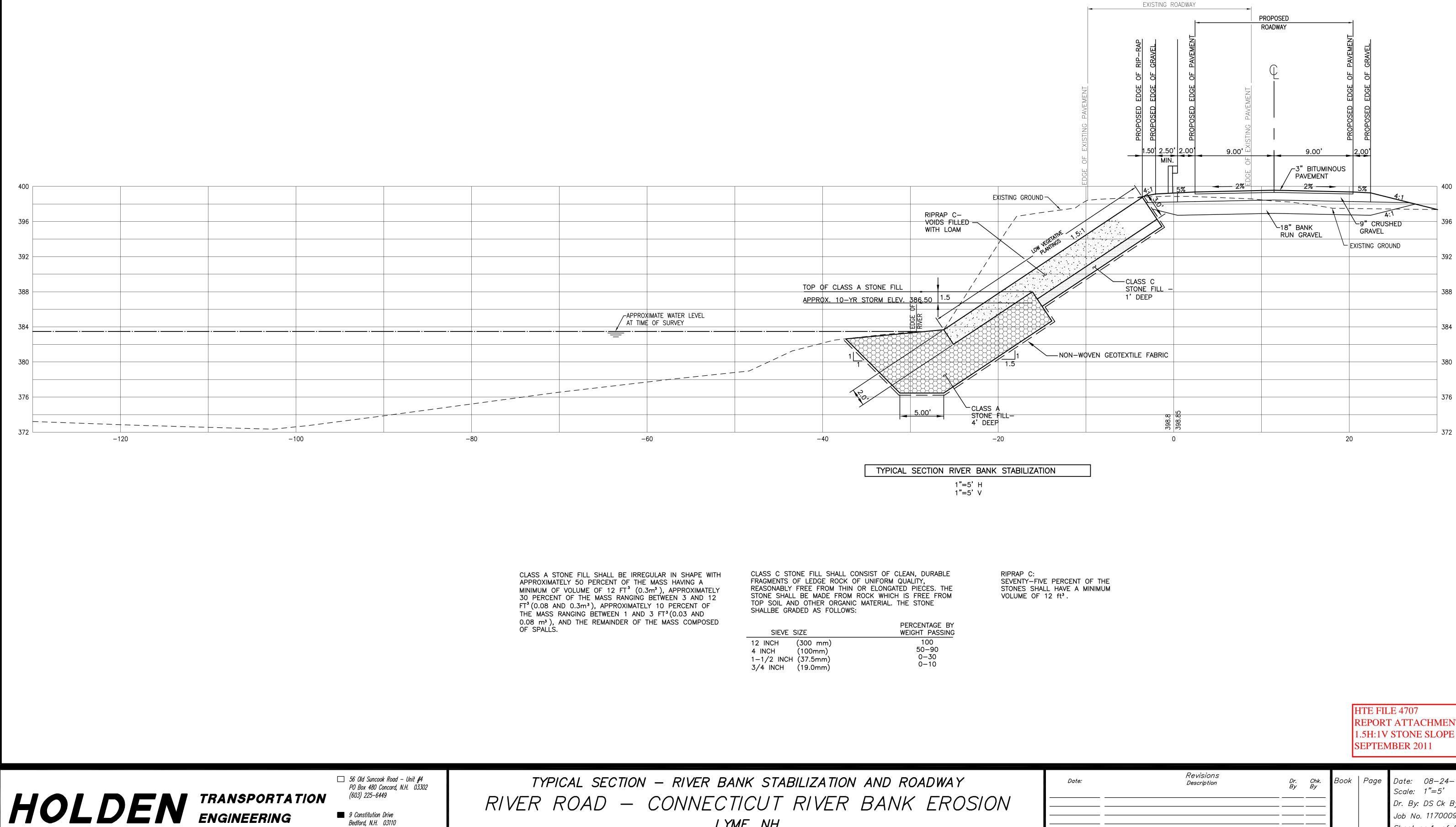
5. It is also recommended that this firm be provided the opportunity to perform the recommended construction phase monitoring services to verify that the intent of our recommendations is being properly implemented in the field during construction. The recommendations given in this report shall not be considered valid unless we are given the opportunity to perform in this capacity.

Topographic Data

6. This report is based on topographic data developed by Holden Engineering & Surveying, Inc.

Use of Report

- 7. This Geotechnical Engineering Report has been prepared for the exclusive use of Town of Lyme and for use by Holden Engineering & Surveying, Inc., in reference to the Proposed River Road Riverbank Re-construction project located at River Road (between N. Thetford Road and E. Thetford Road) in Lyme, NH and is intended to be in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied is made.
- 8. This soil and foundation engineering report has been prepared for this project by HTE Northeast, Inc. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it only with the authorization of the owner and then with the understanding that its scope is limited to design considerations only.



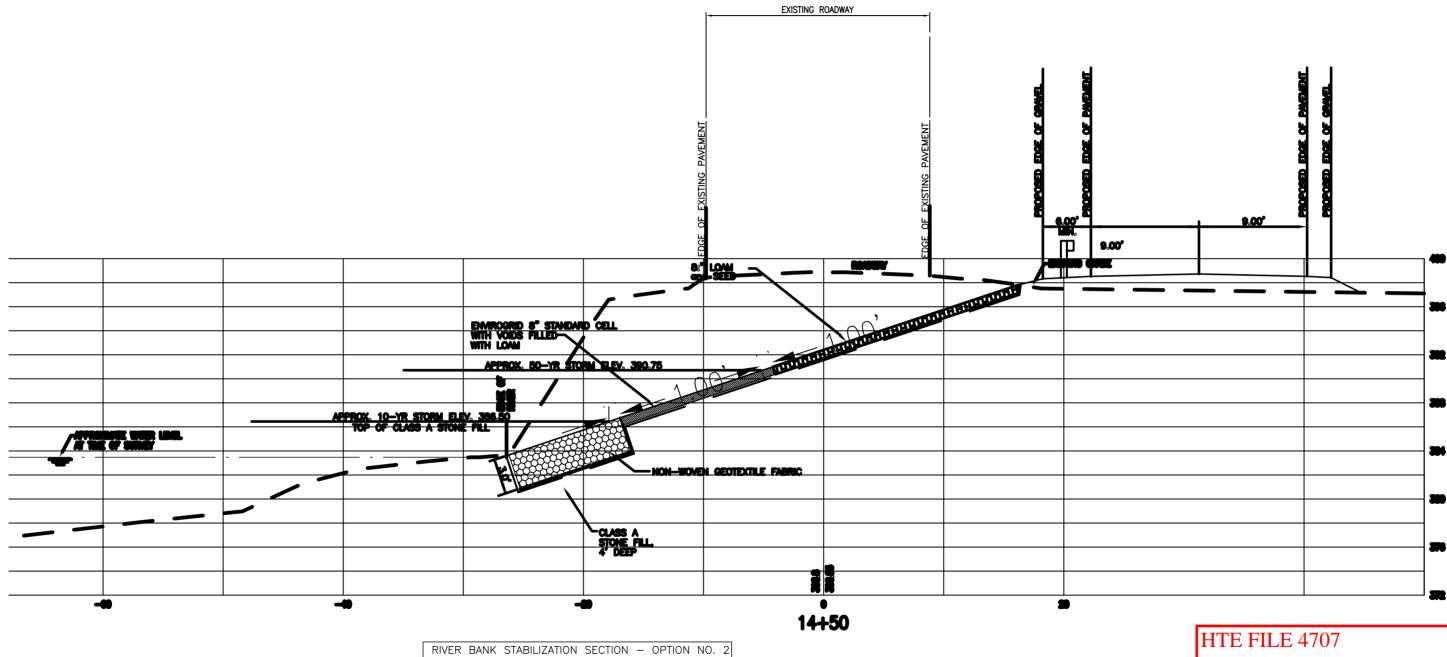
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(603) 472–2078

SIEVE SIZE	PERCENTAGE BY WEIGHT PASSING
12 INCH (300 mm)	100
4 INCH (100mm)	50-90
1–1/2 INCH (37.5mm)	0-30
3/4 INCH (19.0mm)	0-10

LYME, NH

]	REPOR 1.5H:1V	LE 4707 F ATTACHMENT STONE SLOPE //BER 2011
Date:	Revisions Description	Dr. By	Chk. By	Book	Page	Date: 08–24–11 Scale: 1"=5' Dr. By: DS Ck By: BT
						Job No. 1170009 Sheet no 1 of 2



HTE FILE 4707 REPORT ATTACHMENT 3H:1V STONE/SOIL SLOPE OCTOBER 2011



TABLE 1 SUMMARY OF SUBSURFACE EXPLORATIONS RIVER ROAD STREAMBANK FAILURE LYME, NEW HAMPSHIRE PROJECT NO. 4707

TEST BORING DESIGNATION	GROUND SURFACE ELEVATION	BOTTOM OF FILL	BOTTOM OF ALLUVIUM	BOTTOM OF ICE-CONTACT DEPOSIT	BOTTOM OF EXPLORATION DEPTH	OBSERVED GROUNDWATER LEVELS DURING DRILLING OPERATIONS
		DEPTH (FT)	DEPTH (FT)	DEPTH (FT)	DEPTH (FT)	DEPTH (FT)
HTE-1	398.5 ±	<u>+2</u>	>36 ±	>36 ±	36 ±	15 ±
HTE-2	398 ±	±1	>31 ±	>31 ±	31 ±	N.M. ±
HTE-3	399 ±	±2	34.5 ±	>41 ±	41 ±	15 ±
HTE-4	400 ±	±1	>36 ±	>36 ±	36 ±	N.M. ±

Notes: 1) Borings HTE-1 to 4 were performed on August 15 and 16, 2011 by N. H. Boring, Inc. under HTE observation.

2) Groundwater levels were NOT measured during WASH BORING exploration advancement and therefore are not indicative of stabilized groundwater conditions. Groundwater depths for 08/23/11 for HTE-1 and 3 are shown.

3) Approx. locations of borings: HTE-1 at Sta 18+75; HTE-2 at Sta 16+75; HTE-3 at Sta 14+45; HTE-4 at Sta 13+00.

V:\4000\47\4707.Table 1.1

								00				
1	H	- -	PROJECT:	River R	load Fai	lure Inves	tigation	BORING	NO.:	HTE-1	SHEET:	1 of 2
	TE		LOCATION:	Lyme, Ne	ew Hamps	hire		CONTRA	CTOR: New	Hampshire	Boring, Inc	
	NORTHEA	ST INC	PROJ. NO:	4707				FOREMA	N: Roge	er Burn		
Bedfor	2 Cote Lane, S rd, New Hampsl		CLIENT:	Holden E	Ingineering	g & Surveyir	ng	INSPECT	or: Erich	Adler		
Dedio	(603) 668-16		DATE:	August 1	5, 2011			GROUND	SURFACE EL	EVATION:	398.5	±
EQUIPMEN	NT:	AUGER	CASING	SAMPLER	COREBRL.		GROUNDWATER OBSE	RVATIONS		FIELD TE	STING	
TYPE			HW	SS		ELAPSED TIME	(HR)	175			TORY TESTING	
SIZE ID (IN	-		4	13⁄8		CASING AT (FT)		well			RING WELL INSTAI	LLED
HAMMER	, ,		300	140		DEPTH (FT)	-	15		PID SCRE	EENING	
HAMMER	FALL (IN)		24	30			NO GROUNDW/					
Depth	SAMPLE	RECOVERY	BLOWS	STRATUM		SOIL A	ND ROCK CLASSIFICA	TION-DESCI	RIPTION		STRATUM CHANGE	PID
(FT)	NUMBER	(IN)	PER 6"	SYMBOL	E	BURMISTER SYSTE	M (SOIL) U.S. CORPS (OF ENGINEE	RS SYSTEM (R	OCK)	DESCRIPTION	(PPM)
	S1	11			Asphalt						0.33	
1	51		15				rly-graded coars		SAND, tra	ce fine		
'			17		Gravel, tra	ace Silt, no st	ructure, no odor	, moist.				
2			13									
2			14									
3												
Ŭ												
4				_			<i>"</i> • • • • • • •	1.011				
	S2	12	6	_			own fine SAND a	and Silt,	no structur	e, no	ALLUVIUM	
5	02		6	_	odor, mois	st.						
_			5	_								
6			5									
				_								
7				-								
				_								
8												
				-								
9		-	6	-	Medium d	ense, similar	to above				ALLUVIUM	
	S3	8	5		inicalani a	onoo, ommar					ALLOVION	
10			5									
			6									
11												
40												
12												
12												
13												
14											14	
	S4	9	9				oorly-graded co	arse to f	ine SAND,	trace		
15	04	5	10		Gravel, no	o structure, no	odor, wet.					
10			9	_								
16			10	_								
				_							ALLUVIUM	
17												
18				-								
											19	
19			9		Medium d	ense olive-bro	own SILT, some	fine Sar	nd no struc	ture no	19	
	S5	9	9	-	odor, wet.		Swill OIL1, Sollie			ture, no		
20			9									
			9									
21											ALLUVIUM	
22												
Notes:						NLESS SOILS	COHESIVE SO			E TYPE	PROPORTI	
'		drich D-50: Tru				= VERY LOOSE	N = 0-2 = VERY		C = ROCK CO		trace = 0% -	
,		PE: Safety / C				= LOOSE	1 - 4 = SOFT		S = SPLIT SP		little = 10% -	
	-	stalled at 30' b	ogs.			= MEDIUM	3 - 8 = MEDI		UP = UNDISTU		some = 20% - and = 35% -	
-	8+73, 1LT.			01 00 · · · · · · · · · ·								
FILE:	:\4000\47\4707	Lyme\Boring Lo	gs\[4707BORIN	GLOG.xls]HTE 3	50 +	= VERY DENSE	30 + = HARE	J				

	H	-	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING	NO.:	ITE-1	SHEET:	2 of 2		
	TA		LOCATION:	Lyme, No	ew Hamps	shire		CONTRA	CTOR: New I	Hampshire	Boring, Inc			
		ST INC	PROJ. NO:	4707				FOREMA	N: Roge	r Burn				
	2 Cote Lane, S rd, New Hampsl		CLIENT:	Holden E	ngineering	g & Surveyir	ng	INSPECT	OR: Erich	Adler				
	(603) 668-16		DATE:	8/15/201	1			GROUNE	SURFACE EL	EVATION:				
EQUIPMEN	NT:	AUGER	CASING	SAMPLER	COREBRL.		GROUNDWATER OBSE			FIELD TE				
TYPE			HW	SS		ELAPSED TIME	(HR)	175			TORY TESTING			
SIZE ID (IN HAMMER \			4	1 <mark>⅔</mark> 140		CASING AT (FT)		well 15			RING WELL INSTAI	LLED		
HAMMER I			300 24	30		DEPTH (FT)	NO GROUNDWA				EENING			
						SOIL A	ND ROCK CLASSIFICAT				STRATUM			
Depth (FT)	SAMPLE NUMBER	RECOVERY (IN)	BLOWS PER 6"	STRATUM SYMBOL	В		M (SOIL) U.S. CORPS C			CK)	CHANGE DESCRIPTION	PID (PPM)		
23				-										
24	56	11	11		Medium d	ense olive-bro	own fine SAND, I	little to t	race Silt, no		ALLUVIUM			
25	S6	11	7			no odor, wet.								
23			8											
26			8	_										
				_										
27				_										
				4										
28				-										
29	S7	17	5	1	Loose oliv	e-brown SILT	and fine Sand,	no struc	cture, no odc	or, wet.				
30	57	17	3											
50			2											
31			3											
				4										
32				_										
				4										
33														
24														
34	S8	14	10		Dense oliv	e-brown fine	SAND, trace me	dium S	and, trace Si	lt, no	ALLUVIUM			
35	30	14	14		structure,	no odor, wet.								
			16	4										
36			15		Dettern of	-					2.01	.		
				_	Bottom of	Exploration a	11 30				36'			
37				4										
				1										
38														
39														
39				4										
40				4										
-				-										
41														
				-										
42														
43														
43]										
44				_										
				4										
Notes:					CONEGIO	NLESS SOILS	COHESIVE SOI	15	SAMPL		PROPORTI	ONS		
		Irich D-50: Tru	uck Mounted			VERY LOOSE	N = 0-2 = VERY		C = ROCK CO		trace = 0% -			
·		PE: Safety / C				= LOOSE	1 - 4 = SOFT		S = SPLIT SPC		little = 10% -			
		stalled at 30' b				= MEDIUM	3-8 = MEDI		UP = UNDISTUR		some = 20% ·			
					30-50 -	= DENSE	7 -15 = STIFF	-	UT = UNDISTUR	BED THINWALL	and = 35% -	- 50%		
FILE:	:\4000\47\4707	Lyme\Boring Lo	gs\[4707BORIN	GLOG.xls]HTE 3	50 + =	= VERY DENSE	30 + = HARE)						

	HT	- -	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING	3 NO.:	H	ITE	-2	SHEET:	1 of 2
	FR		LOCATION:	Lyme, Ne	ew Hamps	hire		CONTR	ACTOR:	New H	lam	npshire	Boring, Inc	
		ST INC	PROJ. NO:	4707				FOREM	AN:	Roger	r Bu	ırn		
Bodfor			CLIENT:	Holden E	g & Surveyir	g	INSPEC	TOR:	Erich	Adl	er			
Bedio			CLIENT: Holden Engineering & Surveying DATE: August 16, 2011 CASING SAMPLER COREBRL. GROUNDWATER 0 HW SS ELAPSED TIME (HR) 4 1% CASING AT (FT) 300 140 DEPTH (FT) 24 30 Image: No ground state of the symbol. BLOWS STRATUM SOIL AND ROCK CLASS PER 6" SYMBOL. BURMISTER SYSTEM (SOIL) U.S. COI Asphalt Loose Olive-grey medium to fine S/ 5 Structure, no odor, moist. 4 5 Medium dense brown fine SAND, so 6 B Image: Note of the system (SOIL) u.s. coil of the system (SOIL)					GROUN	ID SURF	ACE ELE	VAT	ION:	398±	E
EQUIPMEN	NT:	ALTON: Lyme, New Hampshire PROJ. NO: 4707 CLIENT: Holden Engineering & Surveying Date: August 16, 2011 Auger Casing Auger Casing HW SS ELAPSED TIME (HR) 4 1% CASING AT (FT) 30 140 DEPTH (FT) NI 24 300 140 DEPTH (FT) NI 24 SOL AND ROCK CLASSIN BURMISTER SYSTEM (SOL) U.S. COR SOL AND ROCK CLASSIN BURM						RVATION	IS			FIELD TES	STING	
TYPE		LOCATION: Lyme, New Hampshire PROJ. NO: 4707 CLIENT: Holden Engineering & Surveying DATE: August 16, 2011 AUGER CASING HW SS ELAPSED TIME (HR) 4 4 1% CLIENT: Holden Engineering & Surveying DATE: August 16, 2011 AUGER CASING AT (FT) 300 140 DEPTH (FT) NO RECOVERY BLOWS STRATUM SOUL AND ROCK (DIL) U 8 5 10 5 11 4 13 7 11 4 12 5 4 10 11 4 12 5 10 8 10 8 10 4 10 4 10 4 10 4 10 4 10 4 10 4 10					(HR)				, Ľ			
	,	LOCATION: Lyme, New Hampshire CONTR. VORTHEAST INC PROJ. NO: 4707 FOREM Date Lake, Suite 1 (BS) Biochean On TE: August 16, 2011 GROUNDWATER DESERVATION Date: August 16, 2011 GROUNDWATER DESERVATION GROUNDWATER DESERVATION LIN) August 16, 2011 DEPRINTING SOLAN PROCI CLASSIFICATION DES SUBLER PER S' STRATUM SOLAN PROC CLASSIFICATION DES SUBLER PER S' STRATUM SOLAN PROC CLASSIFICATION DES SUBLER PER S' STRATUM SOLAN PROC CLASSIFICATION DES SUBLER RECOVERY BUGNISTER SOLAND PROC CLASSIFICATION DES SUBLER RECOVERY BUGNISTER SOLAND PROC CLASSIFICATION DES SIL T Asphalt Loose Drown fine SAND, Intitle C SS1 S SUB DES <td< td=""><td></td><td></td><td>Ļ</td><td></td><td></td><td>LLED</td></td<>				Ļ			LLED					
		Cocation: Lyme, New Hampshire PROJ. No: 4707 CLIENT: Holden Engineering & Surveying Date: August 16, 2011 Auger Casino HW SS Bested Consol at (cf) Auger Casino at (cf) HW SS Bested Consol at (cf) Auger Casino at (cf) HW SS SS ELAPSED TIME (HR) Auger Casino at (cf) Auger Casino at (cf) With Engineering Summister system (sold) u.s. SS SYMBOL Burkinster system (sold) u.s. SS SYMBOL Burkinster system (sold) u.s. SS SYMBOL Asphalt SS SS Asphalt SS SS Medium dense brown fine SAND and Silt, SS 20 12 SS 20 12 SS 20 14 SS 10 Medium dense poorly-graded mere trace Silt, no structure, n							¦ ¦	PID SCRE	ENING			
	NORTHEAST INC LOCATION: Lyme, New Hampshire RROJ. NO: 4707 CLENT: Holden Engineering & Surveying DATE: August 16, 2011 T: Auger CASING HWV SS ELAPSED Time (HR) T(LIE) 300 140 HWV SS ELAPSED Time (HR) ALL (N) 24 30 SAMPLE COREBRIL CASING ATTERT NUMBER RECOVERY BUGNS NUMBER RECOVERY BUGNS STATUM SOLAND ROCK OF SYMBOL BURMISTER SYSTEM (SOLIL) IS S1 8 5 LOSSE Olive-grey medium to fine structure, no odor, moist. Structure, no odor, moist. S2 13 7 S3 11 4 S4 12 5 S5 20 14 S5 20 14 Medium dense poorly-graded m trace Silt, no structure, no odor, mory or regravel, trace Silt, no structure, no odor, mory ory regravel, trace Silt, no structure, no odor, mory									STRATUM				
Depth (FT)					E						CK)		CHANGE DESCRIPTION	PID (PPM)
Control Lyme, New Hampshire Control Contro Contro Control			0.33											
Stat B Contraction Lyme, Naw Hampshire Contraction: New Hampshire Boring, Inc. 2 Optimized in the fill Audet Audet Audet Audet Audet Same														
State Control Lyme, New Hampshire Control Control <thcontrol< th=""> Contro Contro</thcontrol<>														
2	DOUTION: Lyme, New Hampshire CONTRACTOR: New Hampshire Boding, Inc. PROLING: 2.00 tates, aut (2000000000000000000000000000000000000													
			5											
3														
4	<u>S2</u>	13	LocATton: Lyme, New Hampshire Contractor: New Hampshire Boring, Inc. PRoJ. No: 4707 FOREMAR: Roger Burn cLiewr: Holden Engineering & Surveying INSPECTOR: Erich Adler DATE: August 16, 2011 OROUND SURFACE ELEVATION: 398± R CASING Samuelik Contents: 198± HW SS ELEVEND THE (MR) INSPECTOR: Erich Testing 4 1% Contents: Inspector 398± 300 140 DEPID Testing Inspector Oronobace Visiting 24 30 Inspector No anountere encountered Inspector 140 DEPID Testing Inspector Inspector Inspector 25 Loose Olive-grey medium to fine SAND, little Gravel, trace Silt, no structure, no odor, moist. Inspector Inspector 26 Loose brown fine SAND and Silt, no structure, no odor, wet. Inspector Inspector Inspector 37 Inspector Medium dense poorly-graded medium to fine SAND, little Gravel, trace Silt, no structure, no odor, wet.											
5	02	15												
				_										
6			8											
				-										
7														
8														
٩														
3	53	11			Loose bro	wn fine SANE	and Silt, no str	ucture,	no od	or, moi	st.			
10	00													
-				-										
11			4											
10				-										
12														
13														
13														
14			_											
	S4	12		-	Medium d	ense noorly-a	raded medium t	o fino (little C	rove	al.		
15									SAND,	intie O	lave	<i>.</i> ,	ALLOVION	
40					in alloc enti,									
16	<u>۹</u> 5	20	14						fine S	AND, lit	ttle			
17	55	20			Gravel, tra	ace Silt, no st	ructure, no odor	, wet.						
18			11											
19	00	40	8		Medium d	ense. similar	to above.						19.5	
20	56	10						ine Sar	nd, varv	ved, no	odo	or, wet.		1
20			7											
21														
	S7	24		_	Medium de	ense, similar	to above.							
22	0.			-										
				-										
Notes:		1	14	1	COHESIO	NLESS SOILS	COHESIVE SO	ILS		SAMPLE	TYP	Έ	PROPORTI	ONS
1) TYPE (OF RIG: Died	drich D-50: Tru	ick Mounted		N = 0 - 4 =	= VERY LOOSE	N = 0-2 = VERY	(SOFT	C = F	ROCK COF	₹E		trace = 0% -	10%
2) HAMM	ER/HOIST TY	/PE: Safety / C	Cathead		4-10 :	= LOOSE							little = 10% ·	- 20%
	-													
,		Luma Derita d							UT = U	INDISTURI	3ED T	THINWALL	and = 35%	- 50%
FILE:	.\4000\47\4707	Lyme\Boring Lo	ys\[4/U/BORIN(JLUG.XISJHTE 3	50+:	- VLIVI DENGE	эu + = ПАКІ				_			

									٦					
. 1	H	- -	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING	NO.:	HT	「E-2	SHEET:	2 of 2	
	TAL		LOCATION:	Lyme, Ne	ew Hamps	shire		CONTRA	стоя: Ne	w Ha	ampshire	Boring, Inc		
		ST INC	PROJ. NO:	4707				FOREMA	N: Ro	ger E	Burn			
	2 Cote Lane, S d, New Hampsl		CLIENT:	Holden E	ngineering	g & Surveyir	ng	INSPECT	or: Eri	ch A	dler			
Dealor	(603) 668-16		DATE:	8/16/201	1			GROUND	SURFACE	ELEV	ATION:			
EQUIPMEN	NT:	AUGER	CASING	SAMPLER	COREBRL.		GROUNDWATER OBSE	RVATIONS	_		FIELD TES	STING		
TYPE			HW	SS		ORY TESTING								
SIZE ID (IN)		4	1¾		CASING AT (FT) DEPTH (FT)						ING WELL INSTAL	LED.	
			300	140		PID SCRE	ENING							
HAMMER F			24		30 NO GROUNDWATER ENCOUNTERED STRATI IM SOIL AND ROCK CLASSIFICATION-DESCRIPTION									
Depth (FT)	SAMPLE NUMBER	RECOVERY (IN)	BLOWS PER 6"	STRATUM SYMBOL							2	STRATUM CHANGE	PID (PPM)	
()	Hombert	(. 2.00	0111202	E	ORMISTER SYSTE	M (SOIL) U.S. CORPS (JF ENGINE	EKS SYSTEM	ROCK	.)	DESCRIPTION	()	
				_										
23														
24														
	S8	16	7				own poorly-grad		um to fine	3 SAN	ND,	ALLUVIUM		
25			8 11	-	trace Silt,	oxidation laye	ering, no odor, w	vet.						
			11	_										
26														
27														
21														
28				_										
29	<u> </u>	4.4	9		Medium d	ense similar t	o above.					ALLUVIUM		
30	S9	14	10											
50			12	_										
31			13		Pottom of	Exploration a	+ 21'					041		
				_	BOLLOITI OI							31'		
32														
33														
34				_										
				-										
35														
36														
37				-										
38														
39				_										
40				-										
44														
41														
42														
				-										
43				-										
4.4														
44														
Notes:					0005010		CONFORME				VDE	DDODODT	ONE	
	OF RIG: Dier	lrich D-50: Tru	uck Mounted			NLESS SOILS	COHESIVE SOI N = 0 -2 = VERY		C = ROCK	CORE		PROPORTIO trace = 0% -		
'		PE: Safety / C				= LOOSE	1 - 4 = SOFT		S = SPLIT			little = 10% -		
		-				= MEDIUM	3-8 = MEDI	IUM	UP = UNDIS			some = 20% -		
						= DENSE	7 -15 = STIFF		UT = UNDIS	TURBE	D THINWALL	and = 35% -	50%	
FILE:	4000\47\4707	Lyme\Boring Lo	gs\[4707BORIN	GLOG.xls]HTE 3	50 + -	= VERY DENSE	30 + = HARI	D						

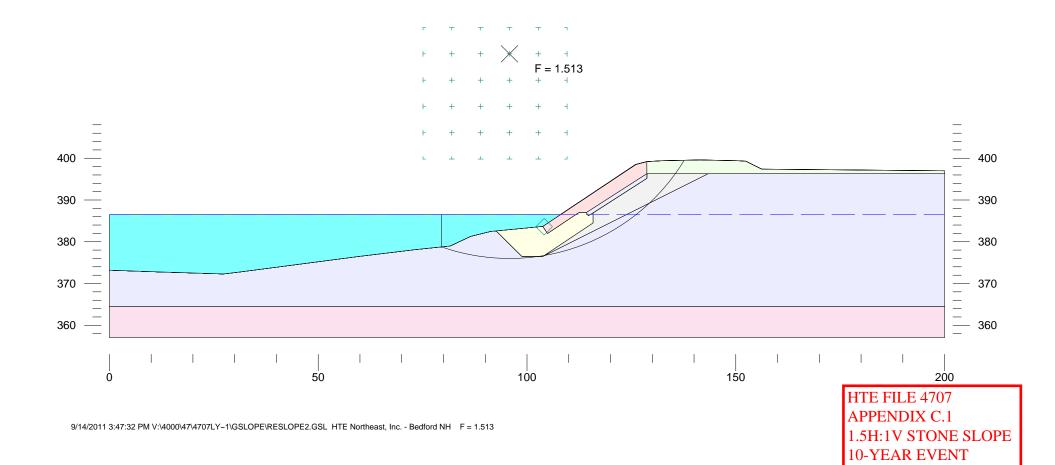
									~				
	H	-	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING	6 NO.:	Н	TE-3	SHEET:	1 of 2
	TA		LOCATION:	Lyme, Ne	ew Hamps	hire		CONTRA	ACTOR:	New H	lampshii	re Boring, Inc	
		ST INC	PROJ. NO:	4707				FOREM	AN:	Roger	Burn		
	2 Cote Lane, S rd, New Hampsl		CLIENT:	Holden E	ngineering	g & Surveyir	ng	INSPEC	TOR:	Erich	Adler		
Deuloi	(603) 668-16		DATE:	August 1	6, 2011			GROUN	D SURF	ACE ELE	VATION:	399 1	E
EQUIPMEN	NT:	AUGER	CASING	SAMPLER	COREBRL.		GROUNDWATER OBSE	RVATION	S		FIELD	TESTING	
TYPE			HW	SS		ELAPSED TIME	(HR)	175			LABO	RATORY TESTING	
SIZE ID (IN	-		4	1¾		CASING AT (FT)		well				FORING WELL INSTAI	LLED
HAMMER \	; ;		300	140		DEPTH (FT)	7	15			PID SO	CREENING	
HAMMER F	FALL (IN)		24	30			NO GROUNDW			ED			
Depth	SAMPLE	RECOVERY	BLOWS	STRATUM		SOIL A	ND ROCK CLASSIFICA	TION-DES	CRIPTION			STRATUM CHANGE	PID
(FT)	NUMBER	(IN)	PER 6"	SYMBOL	В	URMISTER SYSTE	M (SOIL) U.S. CORPS	OF ENGINE	EERS SYS	TEM (ROC	CK)	DESCRIPTION	(PPM)
					Asphalt							0.25	
1													Ī
	S1	18	9				boorly-graded co			AND ar	nd	FILL	
2	51	10	7				ructure, no odor					2	
-			7		Medium de	ense brown fi	ne SAND and S	ilt, laye	red, no	odor, ı	noist.		
3			8										
4				4		ana krawa fi			مما بمم				
	S2	12	7		iviealum a	ense brown n	ne SAND and S	nit, laye	rea, no	odor, i	noist.	ALLUVIUM	
5			5	-									
			5 5	-									
6			5	4									
7													
				-									
8				1									
9	00	4.4	4		Medium de	ense brown fi	ne SAND, some	e Silt, la	vered.	no odo	r, moist.	ALLUVIUM	
10	S3	14	5										
10			6										
11			5										
	S4	12	4		Loose, sim	nilar to above							
12	5	12	4										
			6										
13			7										
_				4									
14			0		Modium d	onco brown n	oorly graded my	odium t	o fino (rooo Silt	14	
	S5	11	8	-		re, no odor, v	oorly-graded me	ealum to	o nne s	SAND, I	nace Sin,		
15			9 11				vel.						
			11										
16		4.0	10		Medium de	ense brown p	oorly-graded co	arse to	fine SA	AND. tra	ace Silt.	ALLUVIUM	
	S6	16	10			re, no odor, v						/	
17			11			-,,.							
40			9										
18			-										
19												19	
19	S7	18	7]	Medium de	ense olive-bro	own fine SAND a	and Silt	, layere	ed, no c	odor, wet.		
20	31	10	5										
20			6										
21			9										
22													
Notes:				I	COLLESIO	NLESS SOILS	COHESIVE SO			SAMPLE	TVPE	PROPORTI	ONS
		Irich D-50: Tru	ick Mounted			VERY LOOSE	N = 0.2 = VER		C - P	OCK COR		trace = 0% -	
'		PE: Safety / C				= LOOSE	1 - 4 = SOF			PLIT SPO		little = 10% -	
,		stalled at 30' b				= MEDIUM	3-8 = MED				BED PISTON	some = 20%	
-	4+46, 2LT.					= DENSE	7 -15 = STIFF				ED THINWAL		
		Lyme\Boring Lo	gs\[4707BORING	GLOG.xls]HTE 3		= VERY DENSE	30 + = HARI						

									A				
1.	H	-	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING	NO.:	Н	TE-3	SHEET:	2 of 2
H	TA	ł	LOCATION:	Lyme, No	ew Hamps	shire		CONTRA	ACTOR:	New H	lampshire	Boring, Inc	
	NORTHEA	ST INC	PROJ. NO:	4707				FOREMA	AN: F	Roger	Burn		
	2 Cote Lane, S d, New Hampsh		CLIENT:	Holden E	ngineering	g & Surveyir	ng	INSPECT	FOR:	Erich /	Adler		
	(603) 668-16	54	DATE:	8/16/201	-				D SURFA	CE ELE			
	IT:	AUGER	CASING	SAMPLER	COREBRL.				\$ 		FIELD TES		
TYPE SIZE ID (IN	\ \		HW 4	SS 1¾		ELAPSED TIME CASING AT (FT)	(HR)	175 well				ORY TESTING	
HAMMER V			300	1/8		DEPTH (FT)		15			PID SCRE		
HAMMER F			24	30			NO GROUNDW	-	OUNTERE	D			
Depth (FT)	SAMPLE NUMBER	RECOVERY (IN)	BLOWS PER 6"	STRATUM SYMBOL	В		ND ROCK CLASSIFICA M (SOIL) U.S. CORPS (EM (ROC	K)	STRATUM CHANGE DESCRIPTION	PID (PPM)
23				-									
				-									
24	00	40	7		Medium de	ense olive-bro	own fine SAND a	and Silt.	lavered	d, no c	dor.	ALLUVIUM	
25	S8	18	7		wet.			,	, j	,	,		
25			10										
26			12	-									
07													
27													
28													
				-									
29	60	10	7		Medium de	ense olive-bro	own fine SAND a	and Silt,	layere	d, no c	dor,	ALLUVIUM	
30	S9	16	6		wet.			-			·		
			9										
31			13										
22													
32													
33				-									
34	S10	16	13		Dense oliv	e-brown fine	SAND and Silt,	layered	, no odo	or, wet		34.5	
35	310	10	13			y poorly-grad	led fine SAND, t	race Sil	t, no str	ructure	, no		
			17 17		odor, wet.								
36			17										
37												GLACIO	
57												FLUVIAL	
38	-											DEPOSIT	
39	S11	14	14			y poorly-grad	led fine SAND, t	race Silf	t, no str	ucture	, no		
40	511	17	16		odor, wet.								
41			20 22										
42					Bottom of	Exploration a	at 41'					41'	
43													
44													
Notes:					COLLEGIO	NLESS SOILS	COHESIVE SO			SAMPLE	TVPF	PROPORTI	ONS
	OF RIG: Died	Irich D-50: Tru	uck Mounted			VERY LOOSE	N = 0.2 = VERY			DCK COR		trace = 0% -	
2) HAMM	ER/HOIST TY	PE: Safety / C	Cathead			= LOOSE	1 - 4 = SOFT			LIT SPOO		little = 10% -	
		stalled at 30' b	ogs.			= MEDIUM	3 - 8 = MED				ED PISTON	some = 20% -	
4) Sta. 14 FILE:		Lyme\Boring Lo	ogs\[4707BORIN	GLOG.xls]HTE 3		= DENSE = VERY DENSE	7 -15 = STIFF 30 + = HARI		UT = UN	DISTURB	ED THINWALL	and = 35% -	- 50%

1	HH	-	PROJECT:	River R	oad Fai	lure Inves	tigation	BORING NO.	: H	TE-	4	SHEET:	1 of 2		
H	PAC		LOCATION:	Lyme, Ne	ew Hamps	hire	(CONTRACTO	DR: New H	lamp	shire I	Boring, Inc			
	NORTHEA	ST INC	PROJ. NO:	4707				FOREMAN:	DREMAN: Roger Burn						
	2 Cote Lane, S	uite 1	CLIENT:	Holden E	ingineering	g & Surveyir	ig i	INSPECTOR: Erich Adler							
Bedfor	d, New Hampsh (603) 668-16		DATE:	August 1	6, 2011		(GROUND SURFACE ELEVATION: 400±							
	IT:	AUGER	CASING	SAMPLER	COREBRL.		FIELD TESTING								
PE ZE ID (IN)			HW 4	SS 1¾		ELAPSED TIME CASING AT (FT)	(HR)					ORY TESTING ING WELL INSTAL			
			300	178		DEPTH (FT)					PID SCRE		LED		
MMER F	ALL (IN)		24	30			NO GROUNDWA		TERED						
Depth (FT)	SAMPLE NUMBER	RECOVERY (IN)	BLOWS PER 6"	STRATUM SYMBOL			ND ROCK CLASSIFICAT M (SOIL) U.S. CORPS OI			:К)		STRATUM CHANGE DESCRIPTION	PIE (PPI		
	S1	19	16		Asphalt Medium d	ense light hro	wn fine SAND, lit	ttle Silt no	structure	no		0.25			
1			6	1	odor, mois					,					
2			5 3	4											
			3	-											
3]											
4		4.0	5		Loose oliv	e-brown poor	ly-graded fine SA	ND. trace	to little Si	lt. no		ALLUVIUM			
5	S2	16	5			no odor, moi				,		/			
Ŭ			<u>4</u> 5	-											
6			5	-											
7				1											
				-											
8															
9	• •		6	-	l oose oliv	e-arev to oliv	e-brown poorly-g	raded fine	SAND tra	ace S	ilt				
10	S3	6	4			re, no odor, n			0, 110, 110		int,				
10			4	-											
11	S4	13	6				own poorly-grade	d fine SAN	ND, trace to	o little	е				
12	34	13	6		Silt, no str	ucture, no od	or, moist.								
10			6 6	-											
13															
14			6	-	Medium d	ense noorlv-c	raded coarse to f	fine SAND	trace Silt	no		ALLUVIUM			
15	S5	12	7			no odor, moi			, trace ent	., 110		ALLOVION			
15			<u>8</u> 12	-											
16	56	1.1	9	-	Medium d	ense, similar	to above except v	wet.							
17	S6	14	10	1			·								
			11 12	4											
18				1											
19			10	4	Medium d	ense, similar	to above								
20	S7	9	10	1		, on mar									
			<u>13</u> 11	4											
21				1											
22				-											
				<u> </u>											
otes: TYPE (Irich D-50: Tru	uck Mounted			NLESS SOILS	COHESIVE SOIL N = 0-2 = VERY		SAMPLE = ROCK COR			PROPORTIOn trace = 0% -			
		PE: Safety / C				= LOOSE	1 - 4 = SOFT		= SPLIT SPOC			little = 10% -			
o. :-						= MEDIUM	3 - 8 = MEDIU					some = 20% -			
	2+98, 5LT.	Lymo\Poring Lo		GLOG.xls]HTE 3		= DENSE = VERY DENSE	7 -15 = STIFF 30 + = HARD		= UNDISTURB	ED THI	NWALL	and = 35% -	· 50%		

PROJECT: River				River R	Road Failure Investigation			BORING N	NO.:	HTE-	SHEET:	2 of 2	
			LOCATION:	DCATION: Lyme, New Hampshire					CONTRACTOR: New Hampshire Boring, Inc				
NORTHEAST INC			PROJ. NO:	4707 F				FOREMAN: Roger Burn					
	2 Cote Lane, S rd, New Hampsl		CLIENT:	Holden Engineering & Surveying				INSPECTOR: Erich Adler					
	(603) 668-16	54	DATE:	8/16/2011					GROUND SURFACE ELEVATION:				
EQUIPMENT: AUGER			CASING	SAMPLER	COREBRL.		GROUNDWATER OBSE	RVATIONS		FIELD TE			
TYPE		HW	SS		ELAPSED TIME	(HR)				ORY TESTING			
SIZE ID (IN)			4	13⁄8		CASING AT (FT)					ING WELL INSTAL	LED	
	HAMMER WT (LB)		300	140		DEPTH (FT)				PID SCRE	ENING		
HAMMER F	-ALL (IN)		24	30			NO GROUNDWA				STRATUM		
Depth	SAMPLE	RECOVERY	BLOWS	STRATUM		SOIL A	ND ROCK CLASSIFICA	TION-DESCF	RIPTION		CHANGE	PID (PPM)	
(FT)	NUMBER	(IN)	PER 6"	SYMBOL	B	BURMISTER SYSTE	M (SOIL) U.S. CORPS C	S OF ENGINEERS SYSTEM (ROCK) DESCRIPTION					
23				-									
24	S8	11	6		Medium dense olive-brown SILT, some fine Sand, no structure, no ALLUVIUM								
25			5 9	-	odor, wet.								
26			11	-									
27				1									
28				-									
29													
29	S9	16	8	Medium dense olive-brown medium to fine SAND, little Silt, no							ALLUVIUM		
30			8 8	structrue, no odor, wet.									
31			16		Bottom of Exploration at 31'								
32				-	Dottoin or						31'		
33				-									
				-									
34													
35													
36													
37													
38				-									
39													
40													
41				-									
42													
43				-									
44													
Notes:		1	I	I	COHESIO	NLESS SOILS	COHESIVE SOI	LS	SAMPLE	ETYPE	PROPORTI	ONS	
1) TYPE OF RIG: Diedrich D-50: Truck Mounted						= VERY LOOSE	N = 0.2 = VERY		C = ROCK COR		trace = 0% -		
2) HAMMER/HOIST TYPE: Safety / Cathead						= LOOSE	1 - 4 = SOFT		S = SPLIT SPC		little = 10% -		
4) Sta. 12+98, 5LT.					10-30 = MEDIUM 3 - 8 = MEDIUM UP = UNDISTURBED PISTON some = 20% - 35% 30-50 = DENSE 7 - 15 = STIFF UT = UNDISTURBED THINWALL and = 35% - 50%								
FILE: :\4000\47\4707 Lyme\Boring Logs\[4707BORINGLOG.xls]HTE 3					50 + :	= VERY DENSE	30 + = HARE)					

	Gamma	аС	Phi	Piezo	HTE Northeast, Inc Bedfor
	pcf	psf	deg	Surf.	
Water	62.4	0	0	0	River Road Slope Fai
Road Fill	125	0	35	1	September
RipRap C	120	0	40	1	10 year flood
Class C Stone	135	0	45	1	
Class A Stone	140	0	45	1	
Fill	125	0	34	1	
Silty Sand	120	0	32	1	
Dense SAND	130	0	34	1	



	Gamma	С	Phi	Piezo
	pcf	psf	deg	Surf.
Water	62.4	0	0	0
Road Fill	125	0	35	1
RipRap C	120	0	40	1
Class C Stone	135	0	45	1
Class A Stone	140	0	45	1
Fill	125	0	34	1
Silty Sand	120	0	32	1
Dense SAND	130	0	34	1
Seismic coefficient = 0.14				

HTE Northeast, Inc. - Bedford NH 4707 River Road Slope Failures September 2011 10 year flood level

