One Cambridge Place, 50 Hampshire Street
Cambridge, Massachusetts 02139
tel: 617 452-6000
fax: 617 452-8000

August 14, 2008

Ms. Kristin Hilberg, Chair
Water Resources Committee
Town Hall
29 Middle Road
Boxborough, Massachusetts 01719-1402

Subject: Summary of Final Bedrock Test Well Installation at Steele Farm
Groundwater Exploration Program
Town of Boxborough, Massachusetts

Dear Ms. Hilberg:

In fulfillment of our contract amendment dated July 5, 2007, Camp Dresser & McKee Inc. (CDM) is pleased to present this final letter report on the bedrock test well installation at the Steele Farm site off Middle Road. This work has been performed jointly by CDM and Boart Longyear Company for the Town of Boxborough, as part of the Groundwater Exploration Program.

Project Background

In 2001, the Town undertook a Water Resources Analysis Study to identify and prioritize potential sites for municipal groundwater supply testing in both unconsolidated deposits (i.e., sand and gravel) and bedrock. In order to identify potentially favorable sites for bedrock well testing, a bedrock fracture-trace analysis was performed by Boart Longyear. The results were presented in the Final Report Water Resources Analysis Study prepared by the CDM/Boart Longyear Team (December 2002).

The bedrock fracture-trace analysis identified fourteen sites for bedrock well exploration (Sites A through N), prioritized in order of geological preference. The report recommended that the Town re-prioritize these sites in consideration of such factors as legal/physical access conditions, ownership, and proximity to a future water service area. At the Town's request, initial bedrock test well exploration proceeded at Wolf Swamp (Site C), with the results presented in CDM's letter report of November 16, 2006.

Subsequently, the Town expressed interest in performing additional bedrock test well exploration at Steele Farm (Site B). The CDM/Boart Longyear Team assisted in this testing program, with the results presented below.

Steele Farm Bedrock Test Well Program

One bedrock test well (referred to as bedrock well no. 3) was installed by Boart Longyear at Steele Farm. Test well installation proceeded following receipt of Conservation Commission approval and site access preparation by the Town's Highway Department. In addition, efforts relative to selection and physical access to the well site were closely coordinated with the Steele Farm Advisory Committee.

The location of the test well is shown on the attached figure. Also attached is Boart Longyear correspondence describing the well installation, a well drilling log and a well completion report.

To select the bedrock test well site, field staking was conducted by Boart Longyear at several locations based on the presence of converging bedrock fractures, as identified by review of aerial photography and satellite images. Sites were then correlated in the field by inspection. The Town provided input on each staked location based upon such institutional concerns as land ownership, distance to abutting properties, surrounding land uses, wetland proximity, physical access requirements, and considerations relative to historical site preservation/uses.

Based on these criteria, the Town identified its preferred location at Steele Farm. Drilling at the site proceed on March 4 - 12, 2008. The 6-inch diameter test well was drilled to 603 feet. Several small bedrock fractures were encountered at various depths, with an estimated well yield of 40 gpm. A two hour short-duration pumping test was conducted at a pumping rate of 37.5 gpm. One water quality sample was collected at the conclusion of the pumping test. Laboratory results (attached) indicate favorable water quality.

Conclusions and Recommendations

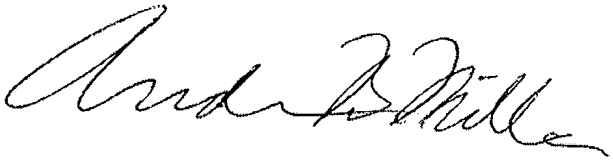
Further assessment of this site would be necessary to confirm its viability as a municipal water supply source. The recommended approach would be to ream out the 6-inch test well to a diameter of 8-inches, and then conduct further surging and pumping of the test well. This would help establish the site's potential well yield. In addition, further water quality sampling would be required to confirm the favorable results obtained to date. Assuming the yield and water quality appear suitable for municipal water supply development, the Town could then consider additional testing (i.e., more test wells and an extended duration pumping test) in accordance with the MassDEP New Source Approval Process.

Prior to initiating any further assessment at this site, the Town might wish to review the bedrock fracture-trace analysis map presented in the *Final Report Water Resources Analysis*

Study (CDM, December 2002). Consideration might be given to conducting bedrock test well exploration at some of the other recommended sites. Identifying several potential sources throughout town would provide options for future water supply development and preservation relative to any future municipal water system.

We are available at your convenience to further discuss these recommendations. We look forward to continue assisting the Town of Boxborough in its efforts to identify and protect available groundwater supply sources. As always, please feel free to call me at (617) 452-6532 if you have any questions or require any additional information.

Very truly yours,



Andrew B. Miller, P.E.
Associate
Camp Dresser & McKee Inc.

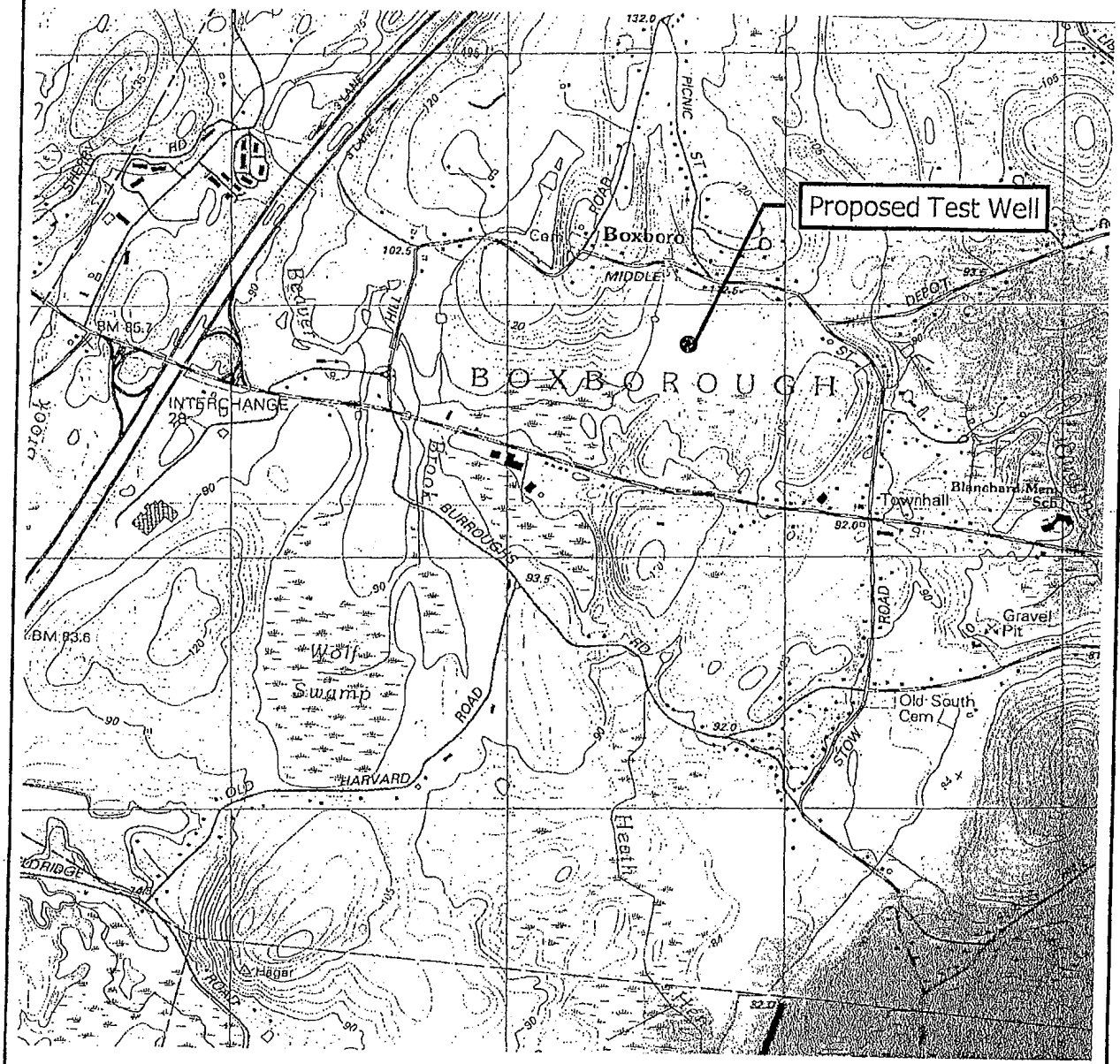
Attachments

cc: Michael Willis, Former Chair Water Resources Committee
Selina Shaw, Town Administrator
Ted Morine, Boart Longyear
William Pauk, CDM

Attachments

- Figure – Steele Farm Bedrock Test Well Location
- Boart Longyear, May 12, 2008. Correspondence RE: Well No. 3 / Steele Farm
- Well No. 3 - Drilling Log
- Well No. 3 Well Completion Report
- Water Quality Laboratory Results – Nashoba Analytical, LLC

Figure – Steele Farm Bedrock Test Well Location



Steele Farm - Bedrock Well No. 3

North Scale: 1" = 2000'	**Proposed Test Well** Boxborough Water Resources Committee	**Figure 1** **Location Map**

Boart Longyear, May 12, 2008
Correspondence RE: Well No. 3 / Steele Farm

BOART LONGYEAR

Boart Longyear Company
Drilling Services
71 Concord Street, North Reading, MA 01864
Tel: 781-933-3210 / Fax: 978-664-3299
www.boartlongyear.com

May 12, 2008

Mr. Andrew Miller, P.E.
Camp, Dresser & McKee, Inc.
One Cambridge Place
50 Hampshire Street
Cambridge, MA 02139

RE: Rock Well No. 3 / Steele Farm
Boxborough, MA

Dear Sir:

From March 4, to March 12, 2008, drillers from our firm constructed Rock Well No. 3 in the southeastern part of a parcel abutting the Steele Farm. This location had been selected after a Fracture Trace and Lineament Study had indicated a convergence of linear features at this site. After the installation of hay bales and silt fence, in accordance with the Conservation Commission directions, the drill rig accessed the site and set up to commence drilling. A 14 inch diameter hole was mudded through the overburden to bedrock at 20 feet below existing grade. This hole was then advanced into bedrock to a depth of 52 feet. Massachusetts D.E.P. regulations for a bedrock well stipulates that well casing must be set 15 feet into competent bedrock. Eight inch diameter well casing was set into the 14 inch socket hole and then grouted in place to insure no leakage of surface water into the borehole.

A six inch diameter pilot hole was now drilled to a depth of 603 feet below grade. Small fractures were noted at various depths with the estimated total yield to be in access of 40 GPM. To gather a water sample for various water quality parameters, the driller used a 1½ centrifugal suction lift pump. The yield was 37.5 GPM with a pumping level of less than 20 feet. The enclosed results of the chemical analysis show that the water quality is excellent for Secondary Contaminants, Volatile Organic Compounds and Inorganic Compounds.

Based upon the results of this effort, it is our opinion that this well might meet some of the projected water needs for the Town of Boxborough as a public water supply. We believe that if this source is surged and pumped by a cable tool drilling machine and reamed from 6 to 8 inches in diameter, the safe yield will be increased.

If we may offer any additional information, please contact us.

Very truly yours,

J. Theodore Morine

J. Theodore Morine, P.G.
Senior Hydrogeologist

Boart Longyear Company
Environmental & Infrastructure

Well No. 3 - Drilling Log

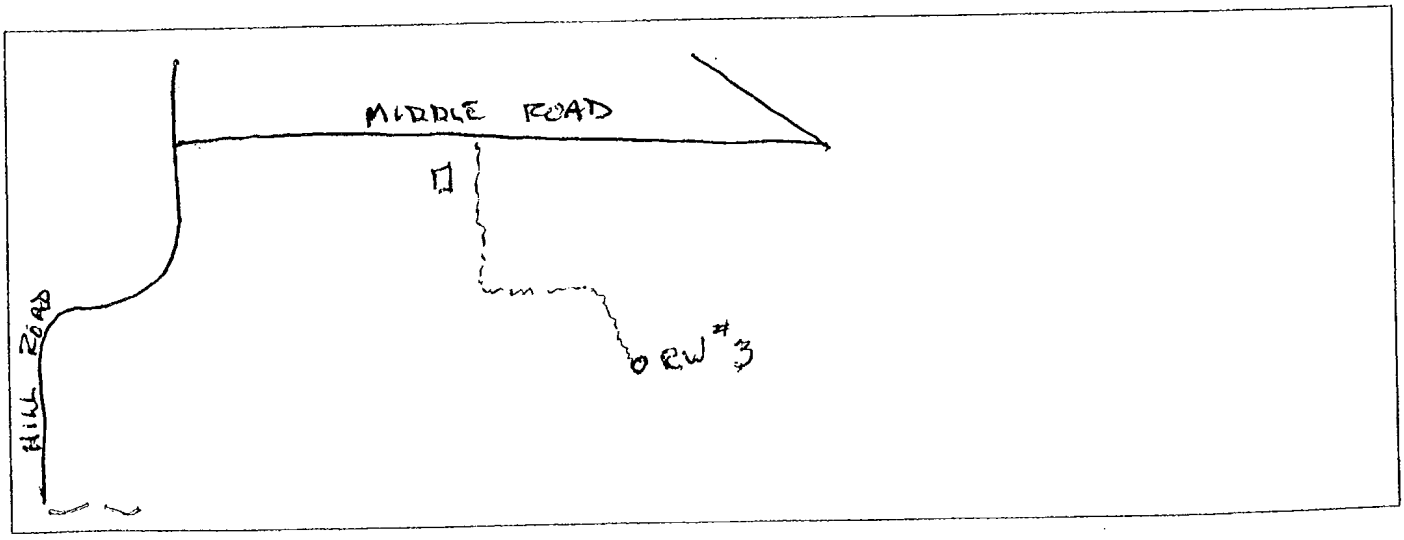
DRILLING LOG

JOB INFORMATION	
Job Name: BOXBORO MA	Job Number: 3465 - 0018
Driller: TOM REID	Rig Number: 01 - 01
Customer: CDM	
Contact: MIKE WILLIS	Phone: 1 - 339 - 368 - 0107

WELL INFORMATION	
Well Location: STEELE FARM	
Longitude: 71° 31.333 W	Latitude: 42° 29.269 N
Date Started: 03/04/08	Date Completed: 03/12/08
Depth of Well: 603	Depth to Ledge: 20'
Feet of Pipe: 51 ft	Grouted: YES
Static Water Level: 1.0 ft ABOVE GROUND	Est. Gallons per Minute: 40 GPM

MAP

Location of job by street names or route number and show location of well on property.



DRILLING LOG	Job Name: 0 STEELE FARM							Job No. 0 3465T0018	
Location: 0	BOXBORO, MASS							Date: 3/14/08	

Feet Drilled	Total Feet Drilled	Total Drilling Time	Eng. RPM	Drilling Pressure	Drillability Soft/Med/Hard	Water Injection GPM	Hole Making Water GPM	Formation	Remarks
12	12	35	1800	500	HARD	MUD	0	GR	2 BOULDERS 6' 10'
8	20		"	"	MED	MUD		CL	
32	52		"	"	"	"			WEATHERED BEDROCK 20'-40' COMPETENT 40'-52'
11	63	4				3			
20	83	7.5							
	103	8							
	123	8					10		SOFT ZONE 110-115
	143	10							
	163	12							
	183	9							
	203	12							
	223	10							
	243	12							
	263	11							
	283	12							
	303	12							
	323	13							

BIT S/N: _____ BIT SIZE: 6"

DRILLING LOG

Job Name: 0 STEELE FARM

Job No. 0 34650018

Location: 0 BOXBORO, MASS

Date: 3/14/08

Feet Drilled	Total Feet Drilled	Total Drilling Time	Eng. RPM	Drilling Pressure	Drillability Soft/Med/Hard	Water Injection GPM	Hole Making Water GPM	Formation	Remarks
20	343	13	1800	500	MD	3	0		
	363	15							
	383	15							
	403	15							
	423	16					20		5M FRAC @ 425'
	443	15							
	463	16							SOFT ZONE 475'-480'
	483	17							
	503	17							SOFT ZONE 510-513'
	523	18							
	543	19							SOFT ZONE 545-550
	563	18							
	583	19					40+		CLEAN HOLE AND RATE 40 GPM.
	603	19							

BIT S/N:_____ BIT SIZE:_____

Well No. 3 Well Completion Report

Massachusetts Department of Conservation and Recreation
Office of Water Resources

152225

TYPE OR PRINT ONLY

Well Completion Report

1. WELL LOCATION GPS (Required) North 42° 29.265 West 71° 31.330

Address at Well Location: 419 MIDDLE ROAD
Property Owner/Client: TOWN OF BOXBOROUGH
Subdivision Name: STEELE FARM
Mailing Address: 29 MIDDLE ROAD
City/Town: BOXBOROUGH
City/Town: BOXBOROUGH MA
Assessors Map 7-3 Assessors Lot #: 128.0.0 NOTE: Assessors Map and Lot # mandatory if no street address available
Board of Health permit obtained: Yes ☐ Not Required ☒ Permit Number _____ Date Issued _____

2. WORK PERFORMED: N W

3. WELL TYPE: P B W S

4. DRILLING METHOD

Overburden	Bedrock
M R	A R

6. CASING

From (ft)	To (ft)	Type	Thickness	Diameter
+2	52	S T L	SCH 40	8"

7. SCREEN

From (ft)	To (ft)	Type	Slot Size	Diameter

8. ANNULAR SEAL/FILTER PACK/ABANDONMENT MTL.

From (ft)	To (ft)	Material Description	Purpose
0	52	C B	A S

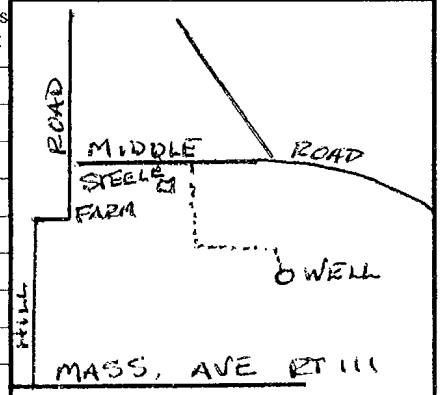
5. WELL LOG — OVERBURDEN LITHOLOGY

From (ft)	To (ft)	Code	Color	Comment	Water Bearing Zone	Loss or Addition of Fluid	Drop in Drill Stem	Extra Fast or Slow Drill Rate
0	4	FS	BR	SOME LOAM		Y / N	Y / N	F / S
4	20	T	BR			Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S
						Y / N	Y / N	F / S

WELL LOG — BEDROCK LITHOLOGY

From (ft)	To (ft)	Code	Comment	Water Bearing Zone	Drop in Drill Stem	Extra Large Chips	Extra Fast or Slow Drill Rate	Visible Rust Staining	Loss or Addition of Fluid	# of Fractures per foot
20	40	AM	SOFT		Y / N	Y / N	(F) / S	Y / N	Y / N	
40	52	AM	HARD		Y / N	Y / N	F / (S)	Y / N	Y / N	
52	110	AM	"		Y / N	Y / N	F / S	Y / N	Y / N	
110	115	AM	FRACTURE	10	Y / N	Y / N	F / S	Y / N	Y / N	
115	425	AM	SMALL FRACTURE	20	Y / N	Y / N	F / S	Y / N	Y / N	
425	475	AM	HARD		Y / N	Y / N	F / S	Y / N	Y / N	
475	480	AM	SOFT		Y / N	Y / N	F / S	Y / N	Y / N	
480	545	AM	HARD		Y / N	Y / N	F / S	Y / N	Y / N	
545	550	AM	SMALL FRACTURE	40	Y / N	Y / N	F / S	Y / N	Y / N	
550	603	AM		40+	Y / N	Y / N	F / S	Y / N	Y / N	

9. SITE SKETCH



10. WELL TEST DATA (ALL SECTIONS MANDATORY FOR PRODUCTION WELLS)

Date	Method	Yield (GPM)	Time Pumped (hrs & min)	Pumping Level (Ft. BGS)	Time to Recover (hrs & min)	Recovery (Ft. BGS)
3/12/08	PUMP	37.5	2:00	18.5	0:30	+1.00

11. STATIC WATER LEVEL (ALL WELLS)

Date Measured	Depth Below Ground Surface (ft)
3/12/08	+1.0

12. PERMANENT PUMP (IF AVAILABLE)

Pump Description _____ Horsepower _____
Pump Intake Depth _____ (ft) Nominal Pump Capacity _____ (gpm)

13. ADDITIONAL WELL INFORMATION

Developed Y / (N) Fracture Enhancement Y / (N)
Disinfected Y / (N) Surface Seal Type C B
Total Well Depth 603 Depth to Bedrock 20

14. COMMENTS TEST WELL AT PRESENT TIME

15. WELL DRILLER'S STATEMENT

This well was drilled, altered, and/or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge.

Driller: ROBERT THOMAS REID Supervising Driller Signature: _____ Registration #: 624
Firm: BOART LONGYEAR E & I Date Complete: 3/12/08 Rig Permit #: 253

NOTE: Well Completion Reports must be filed by the registered well driller within 30 days of well completion.

Water Quality Laboratory Results - Nashoba Analytical, LLC

Nashoba Analytical, LLC Tel: 978-486-3316 Fax: 978-486-3319 LabNumber: 100895
29 King Street, Littleton MA 01460 Website: http://www.NashobaAnalytical.com Use this number with all correspondence

Client:
Boart Longyear E & I
71 Concord Street
North Reading, MA 01864

ReportDate: 3/20/2008

Certificate of Analysis

Parameter	Method	Result	MCL	MRL	Date of Analysis	Analyst
Steele Farm, Boxborough MA, Rockwell #3						
Sampled: 3/12/2008 11:15:00 AM by T. Morine						
Aluminum, MG/L	EPA 200.8	ND	0.2	0.01	3/14/2008	M-CT008
Antimony, MG/L	EPA 200.8	ND	0.006	0.001	3/14/2008	M-CT008
Arsenic, MG/L	EPA 200.8	ND	0.01	0.005	3/14/2008	M-CT008
Barium, MG/L	EPA 200.8	ND	2	0.005	3/14/2008	M-CT008
Beryllium, MG/L	EPA 200.8	ND	0.004	0.001	3/14/2008	M-CT008
Cadmium, MG/L	EPA 200.8	ND	0.005	0.001	3/14/2008	M-CT008
Calcium, MG/L	SM 3500-CA-B	25.7	Not Spec	1	3/14/2008	M-MA1118
Chromium, MG/L	EPA 200.8	ND	0.1	0.001	3/14/2008	M-CT008
Copper, MG/L	EPA 200.8	ND	1.3	0.001	3/14/2008	M-CT008
Iron, MG/L	EPA 200.7	ND	0.3	0.05	3/13/2008	M-CT008
Magnesium, MG/L	SM 3500-MG-B	8.7	Not Spec	1	3/14/2008	M-MA1118
Manganese, MG/L	EPA 200.7	0.006	0.05	0.002	3/13/2008	M-CT008
Mercury, MG/L	EPA 245.2	ND	0.002	0.0002	3/14/2008	M-CT008
Nickel, MG/L	EPA 200.8	ND	0.1	0.001	3/14/2008	M-CT008
Potassium, MG/L	EPA 200.7	2.4	Not Spec	0.20	3/13/2008	M-CT008
Selenium, MG/L	EPA 200.8	ND	0.05	0.005	3/14/2008	M-CT008
Silver, MG/L	EPA 200.8	ND	0.1	0.001	3/14/2008	M-CT008
Sodium, MG/L	EPA 200.7	23	See Note	0.050	3/13/2008	M-CT008
Thallium, MG/L	EPA 200.8	ND	0.002	0.001	3/14/2008	M-CT008
Zinc, MG/L	EPA 200.8	0.007	5	0.005	3/14/2008	M-CT008
Alkalinity, MG/L	SM 2320B	107	Not Spec	2	3/13/2008	M-MA1118
Chloride, MG/L	EPA 300.0	1.9	250	1	3/12/2008	M-MA1118
Color Apparent, CU	SM 2120B	ND	15	1	3/12/2008	M-MA1118
Cyanide, MG/L	SM 4500-CN-C,E	ND	0.2	0.010	3/17/2008	M-CT008
Fluoride, MG/L	EPA 300.0	1	4	0.1	3/12/2008	M-MA1118
Hardness total, MG/L	SM 2340C	100	Not Spec	2	3/14/2008	M-MA1118
Nitrate as N, MG/L	EPA 300.0	ND	10	0.05	3/12/2008	M-MA1118
Nitrite as N, MG/L	EPA 300.0	ND	1	0.01	3/12/2008	M-MA1118
Odor, TON	SM 2150B	0	3	0	3/12/2008	PN
pH, PH AT 25C	SM 4500-H-B	8	6.5 - 8.5	NA	3/12/2008	M-MA1118
Sulfate, MG/L	EPA 300.0	24	250	1	3/12/2008	M-MA1118

MCL=Maximum Contaminant Level (EPA Limit), MRL = Minimum Reporting Level
Sodium Guidelines- Mass 20, EPA 250, # = Result Exceeds Limit or Guideline
ND = None Detected (<MRL), * = Background Bacteria Noted

Massachusetts Certified Laboratory #MA1118
New Hampshire Laboratory ID #2977

David L. Knowlton
Laboratory Director

Nashoba Analytical, LLC Tel: 978-486-3316 Fax: 978-486-3319
29 King Street, Littleton MA 01460 Website: http://www.NashobaAnalytical.com

LabNumber: **100895**

Use this number with all correspondence

Client:

Boart Longyear E & I
71 Concord Street
North Reading, MA 01864

ReportDate: 3/20/2008

Certificate of Analysis

Parameter	Method	Result	MCL	MRL	Date of Analysis	Analyst
Total Dissolved Solids, MG/L	SM 2540C	154	500	1	3/14/2008	M-MA1118
Turbidity, NTU	EPA 180.1	0.35	Not Spec	0.10	3/12/2008	M-MA1118

MCL=Maximum Contaminant Level (EPA Limit), MRL = Minimum Reporting Level
Sodium Guidelines- Mass 20, EPA 250, # = Result Exceeds Limit or Guideline
ND = None Detected (<MRL), * = Background Bacteria Noted

Massachusetts Certified Laboratory #MA1118
New Hampshire Laboratory ID #2977

David L. Knowlton
Laboratory Director

Nashoba Analytical, LLC
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Lab/Invoice Number: **100895**
Use this number with all correspondence

Client:

Boart Longyear E & I

71 Concord Street

North Reading, MA 01864

Report Date: 3/20/2008

Location: Steele Farm, Boxborough MA, Rockwell #3

Sampled: 3/12/2008 11:15:00 AM by T. Morine

EPA 524.2

PARAMETER	MCL	RESULT
Benzene	5.0	ND
Carbon Tetrachloride	5.0	ND
1,1-Dichloroethylene	7.0	ND
1,2-Dichloroethane	5.0	ND
p-DichloroBenzene	5.0	ND
Trichloroethene	5.0	ND
1,1,1-Trichloroethane	200.0	ND
Vinyl Chloride	2.0	ND
Monochlorobenzene	100.0	ND
ortho-Dichlorobenzene	600.0	ND
trans-1,2-Dichloroethylene	100.0	ND
cis-1,2-Dichloroethylene	70.0	ND
1,2-Dichloropropane	5.0	ND
Ethylbenzene	700.0	ND
Styrene	100.0	ND
Tetrachloroethylene	5.0	ND
Toluene	1000.0	ND
Xylenes(Total)	10000.0	ND
Dichloromethane	5.0	ND
1,2,4-Trichlorobenzene	70.0	ND
1,1,2-Trichloroethane	5.0	ND
Chloroform	--	ND
Bromodichloromethane	--	ND
Chlorodibromomethane	--	ND
Bromoform	--	ND
m-Dichlorobenzene	--	ND
Dibromomethane	--	ND
1,1-Dichloropropene	--	ND
1,1-Dichloroethane	--	ND

PARAMETER	MCL	RESULT
1,1,2,2-Tetrachloroethane	--	ND
1,3-Dichloropropane	--	ND
Chloromethane	--	ND
Bromomethane	--	ND
1,2,3-Trichloropropane	--	ND
1,1,1,2-Tetrachloroethane	--	ND
Chloroethane	--	ND
2,2-Dichloropropane	--	ND
o-Chlorotoluene	--	ND
p-Chlorotoluene	--	ND
Bromobenzene	--	ND
1,3-Dichloropropene	--	ND
1,2,3-Trimethylbenzene	--	ND
1,2,4-Trimethylbenzene	--	ND
1,3,5-Trimethylbenzene	--	ND
n-Propylbenzene	--	ND
n-Butylbenzene	--	ND
Naphthalene	--	ND
Hexachlorobutadiene	--	ND
1,2,3-Trichlorobenzene	--	ND
p-Isopropyltoluene	--	ND
Isopropylbenzene	--	ND
t-Butylbenzene	--	ND
sec-Butylbenzene	--	ND
FluoroTrichloromethane	--	ND
Dichlorodifluoromethane	--	ND
Bromochloromethane	--	ND
*MethylTertiaryButylEther	*70	ND

ND=None Detected

MCL= Maximum Contaminant Level

*MTBE (Optional) Mass Advisory Limit

% Recovery of Internal Standards:

4-Bromofluorobenzene	104
1,2-Dichlorobenzene-d	103

Detection Limit: 0.5 ug/L

This analysis was performed at DEP Certified Laboratory #M-CT008

Date of analysis: 3/14/08

David L. Knowlton

Laboratory Director