

Mr. Allan G. Palmer
Eversource Energy
P.O. Box 330
Manchester, NH 03105-0330

January 14, 2016
File No. 2025.03

Re: Groundwater Monitoring Well Network Verification
Merrimack Station Coal Ash Landfill
Bow, New Hampshire

Dear Mr. Palmer:

Sanborn, Head & Associates, Inc. (Sanborn Head) prepared this letter to summarize our review of the hydrogeologic conditions at the Merrimack Station Coal Ash Landfill (landfill) and the existing New Hampshire Department of Environmental Services (NHDES)-approved monitoring well network to verify that it meets the requirements for groundwater monitoring systems provided in the Coal Combustion Residual (CCR) Rules (40 CFR Part 257, Subpart D).

SITE DESCRIPTION & HISTORY

The landfill, which began operating in 1978, was constructed in an abandoned sand and gravel quarry on a property adjacent to the Merrimack Station electric power generation facility in Bow, New Hampshire. The original clay-lined landfill was approved for disposal of fly ash and other wastes (e.g., dewatered wastewater treatment facility sludge, slag, and ash pond dredging material) resulting from electric power generation at coal-fired power plants in New Hampshire.

In 1981, environmental concerns prompted a series of hydrogeologic investigations of the facility. Investigators concluded that site operations were impacting groundwater quality in the immediate vicinity of the landfill. As a result, 2,000 cubic yards of previously disposed ash sludge were removed from the landfill, and future site use was restricted to the disposal of dry coal fly ash from Merrimack Station. In addition, the New Hampshire Water Supply and Pollution Control Commission mandated extensive groundwater quality monitoring pursuant to a facility groundwater permit, which was first issued in 1985. A number of facility upgrades/improvements were also implemented by 1986, including:

- Excavating all pre-existing ash materials and relocating the materials into disposal cells lined with a 36-mil thick chlorosulfonated polyethylene synthetic rubber liner (i.e., Hypalon);
- Installing a leachate collection system within the Hypalon-lined cells, including perforated collection pipe, non-perforated drainage pipe and a sump; and

- Constructing a final cover system over the portions of the landfill brought to final grade.

Also, new lined disposal areas would be constructed as needed.

We understand that the landfill operations have not materially changed since 1986. The construction of additional lined cells, installation of the final cover in select areas, and groundwater monitoring activities have been ongoing. Eversource plans to continue to deliver dry coal fly ash to the landfill until final grades are achieved throughout the permitted area. Based on incoming ash quantities, it is anticipated that the landfill has enough capacity to operate for about 15 more years.

SUMMARY OF HYDROGEOLOGIC CONDITIONS

In support of our verification of the current monitoring well network with respect to the requirements for groundwater monitoring systems provided in the CCR Rules (40 CFR §257.91), Sanborn Head reviewed publically-available physical setting resources, as well as historical site investigation reports. A summary of geologic/hydrogeologic information obtained from these sources is provided in this section.

Statewide geographic information system (GIS) resources¹ classify overburden soils in the vicinity of the site as Windsor loamy fine sand, with a sandy outwash parent material derived mainly from granite, gneiss, and schist. Bedrock in the site vicinity is mapped as the lower part of Rangeley Formation, which is described as variably metamorphosed sedimentary and volcanic rocks of greenschist to granulite facies.² Previous investigators provided a more detailed overview of regional geology,³ reporting that the site is located within a kame delta characterized by 10 to 15 feet of top set strata (sand and gravel) underlain successively by fore set beds (sand and gravel) and bottom set beds (silt and fine sand). Locally, ice contact structures interrupt the otherwise relatively uniform deltaic structure, which forms a significant valley fill with widely scattered planar surfaces at an elevation of about 340 feet. These surfaces are marked by numerous kettle holes; one such kettlehole occurs northeast of the landfill. Also, the primary deltaic topography was extensively dissected by post glacial erosion by the Merrimack River and its tributaries, and by gravel excavation/mining.

The regional characterization is generally consistent with observations made by previous site investigators, who predominately classified soils encountered during subsurface investigations at the site as medium dense to dense sand and/or sand and gravel.⁴ A relatively thin layer of dense till-like material was reported to be present below the sandy deposits at a few of the investigation locations. Bedrock was encountered during site investigations at varying depths, suggesting an overburden thickness ranging from about

¹ New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT): <http://granitviewii.unh.edu/>, as accessed on November 10, 2015.

² U.S. Geologic Survey Mineral Resources On-line Spatial Data by State: <https://mrddata.usgs.gov/geology/state/map.html>, as accessed on November 11, 2015.

³ *Phase II – Hydrogeological Investigation and Phase III - Water Quality Analysis, Merrimack Station Landfill Site for Public Service Company of New Hampshire*, DuBois & King, Inc., April 1982.

⁴ *Ibid.*

35 to 100 feet. The variation in overburden thickness is attributed in part to variations in surface topography associated with gravel excavation, and in part to variation in the bedrock surface elevation.

Although depths to groundwater range from less than 10 feet to greater than 60 feet below the ground surface (bgs) at the landfill site, the historical elevation data indicate the groundwater table is relatively flat (i.e., hydraulic gradients on the order of 0.001 feet per foot [ft/ft]). The direction of overburden groundwater flow has been interpreted to be to the northeast, consistent with surface water hydrology, which indicates regional groundwater flow toward the Merrimack River, located less than a mile to the north and east of the landfill.

With regard to groundwater flow rates, NHDES GIS data⁵ suggest regional aquifer transmissivity in the landfill vicinity on the order of 1,000 to 2,000 square feet per day (ft²/day). Based on hydraulic conductivity testing performed at the landfill site, previous site investigators estimated a groundwater flow rate (seepage velocity) through subsurface soil in the landfill area of about 0.6 feet/day.⁶ This value is generally consistent with our understanding of subsurface conditions (i.e., a granular aquifer with a relatively low hydraulic gradient) and consistent with the published regional transmissivity values.

CURRENT GROUNDWATER MONITORING PROGRAM & NETWORK

As indicated above, groundwater quality at the facility has been routinely monitored for the past 30 years. The current groundwater monitoring program, as prescribed in the NHDES Groundwater Release Detection Permit No. GWP-198400065-B-005, dated February 12, 2012 (Permit), includes the collection of static groundwater level measurements and laboratory analyses of groundwater samples from five (5) overburden monitoring wells (i.e., SB-1, SB-4, SB-6, SB-13, and SB-14) on a semi-annual basis; the monitoring program and associated network have been generally consistent since the mid-1990s. A summary of key monitoring well details is provided in the table below; additional information may be obtained from copies of the soil boring/monitoring well logs enclosed with this letter. The locations of the monitoring wells in relation to the landfill are shown on Figure 1.

⁵ New Hampshire Department of Environmental Services (NHDES) Onestop Program Web GIS: <http://www2.des.state.nh.us/gis/onestop/>, as accessed on November 10, 2015.

⁶ *Phase II – Hydrogeological Investigation and Phase III - Water Quality Analysis, Merrimack Station Landfill Site for Public Service Company of New Hampshire*, DuBois & King, Inc., April 1982.

Exhibit 1: Key Monitoring Well Details

	SB-1	SB-4	SB-6	SB-13	SB-14
Date Installed	9/23/81	9/21/81	10/8/81	10/12/81	10/4/93
Hydrologic Location	Downgradient/ Crossgradient	Downgradient	Downgradient/ Crossgradient	Upgradient	Upgradient/ Crossgradient
Reference Point Elevation (ft)	240.85	274.26	268.77	216.93	242.70
Depth of Exploration (ft)	74.5 - Refusal Encountered	99.2 - Refusal Encountered	80.6 - Refusal Encountered	37 - Refusal Encountered	45 - Refusal Not Reported
Construction Materials	1.5" PVC	1.5" PVC	1.5" PVC	1.5" PVC	2" PVC
Top of Screen (ft)	29.5	59	Not Reported	10	30
Bottom of Screen (ft)	74.5	99	Not Reported	35	45
DTW ¹ - Average (ft)	31.31	64.84	59.32	8.11	32.09
DTW ¹ - High (ft)	27.59	61.34	55.41	1.99	27.60
DTW ¹ - Low (ft)	34.79	68.11	62.76	13.22	35.91

Notes:

1. Average, low, and high depth to water (DTW) values are based on groundwater gauging data reported from April 2008 and November 2014.

Initially, the groundwater monitoring network at the landfill included as many as 13 monitoring wells. However, due to logistical access constraints related to topography (i.e., kettle holes) and the growing body of environmental data, the NHDES approved a reduced network reflective of the currently monitored wells.

CERTIFICATION

Based on our review of hydrogeologic conditions at the landfill and the site's current monitoring well network as summarized herein, it appears that the current well network meets the requirements of the performance standard specified in 40 CFR §257.91(a) based on the following:

- The monitoring well network consists of a sufficient number of wells meeting the minimum number of wells required by 40 CFR §257.91(c)(1). The wells were installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer.
- The network includes well locations that are representative of both groundwater passing the waste boundary (i.e., downgradient the landfill) and background water quality (i.e., upgradient of the landfill).
- The groundwater monitoring network was approved by the NHDES based on approximately 30 years of historical environmental data/information.

LIMITATIONS

- In preparing this letter, Sanborn Head relied on information available from state and federal environmental resources and other parties referenced herein. Although there may be some degree of overlap in the information obtained from these various sources, we did not attempt to independently verify the accuracy or completeness of all information reviewed or received as part of this assessment.

- The conclusions and recommendations contained in this report are based in part upon various types of environmental data, as well as historical and hydrogeologic information developed by previous investigators. While Sanborn Head reviewed that data and information as stated in this report, Sanborn Head's interpretations, conclusions, and recommendations that rely on that information is contingent on its validity. Should additional environmental data, historical information, or hydrogeologic information become available in the future, such information should be brought to Sanborn Head's attention. We will evaluate the information and, on the based on our evaluation, may modify the conclusions stated herein.
- This letter was prepared for the exclusive use of Eversource for specific application to the Merrimack Station Coal Ash Landfill in Bow, New Hampshire, in accordance with generally accepted hydrogeologic practices. No other warranty, express or implied, is made.

Thank you for the opportunity to be of service to Eversource. Please contact us should you require additional information or would like to discuss this summary.

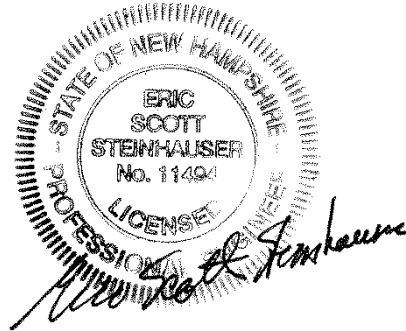
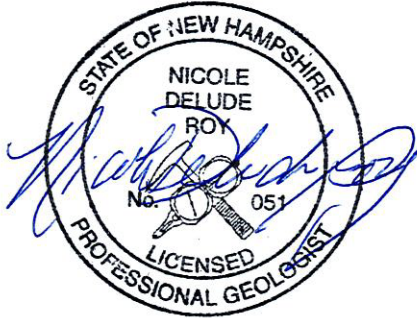
Very truly yours,
SANBORN, HEAD & ASSOCIATES, INC.



Nikki Delude Roy, PG
Senior Project Manager



Eric S. Steinhauser, P.E., CPESC, CPSWQ
Senior Project Director



REN/NDR/ESS:ren

Enclosures Figure 1 – Monitoring Well Location Plan
Soil Boring/Monitoring Well Logs

Figure 1

Monitoring Well Location Plan








Merrimack Station
Coal Ash Landfill
Bow, New Hampshire

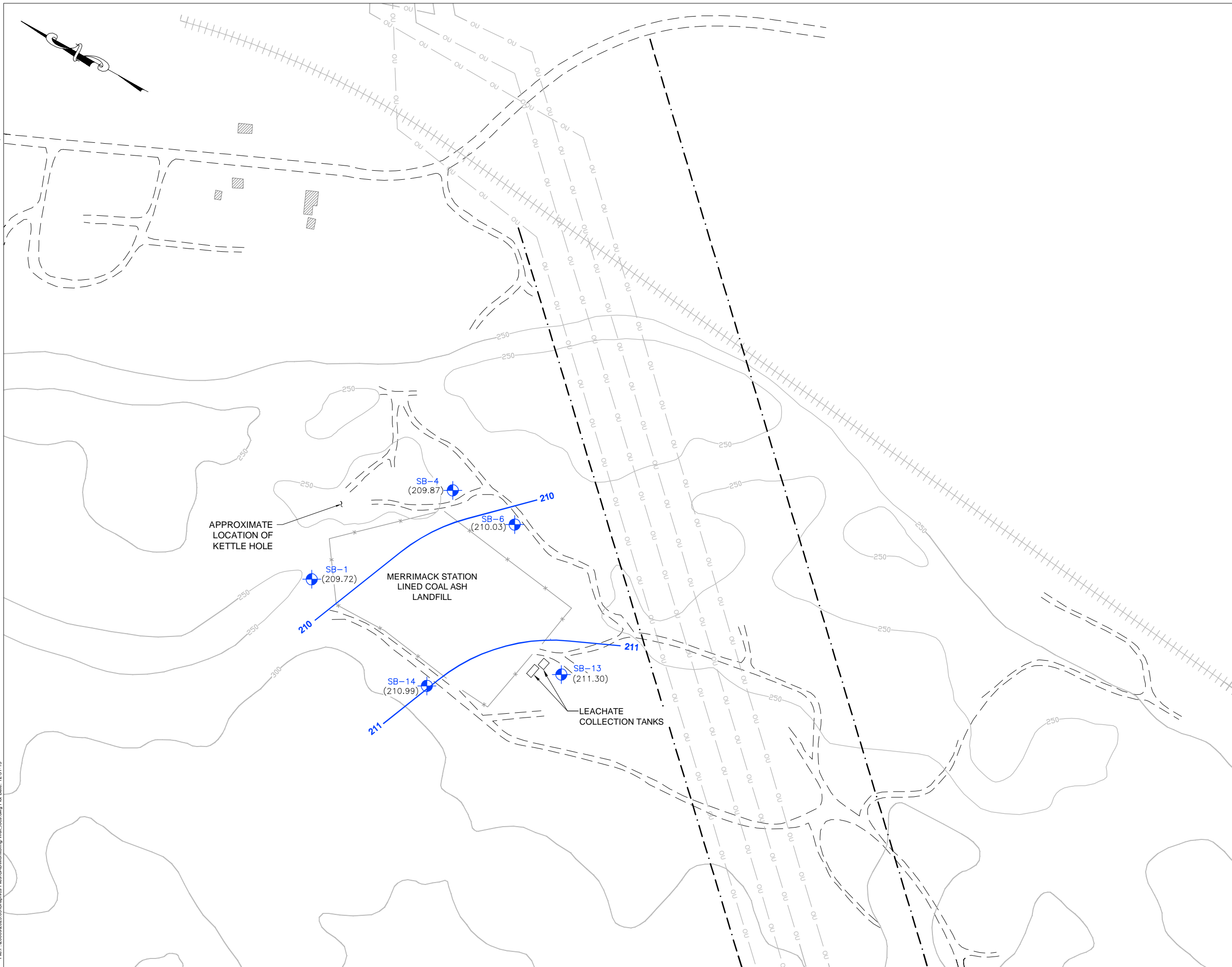
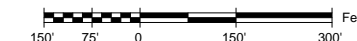
Drawn By: L. Teal
Designed By: L. Damiano/L. Teal
Reviewed By: N. Roy / R. Nahlik
Project No: 2025.03
Date: December 2015

Notes

1. The base map was developed from a drawing prepared by Public Service Company of New Hampshire's Engineering Division entitled, "Area Plan, Merrimack Station, Bow, N.H." The drawing was dated 5/1/90 and was last revised on 6/28/95.
2. The location of site and site features shown should be considered approximate only.
3. Groundwater contours shown on this plan were developed based on groundwater level measurements in the monitoring wells made on April 30, 2014.

Legend

-  SB-4 Monitoring Well
-  (210.5) Groundwater Elevation Measured on April 30, 2014
-  Right-Of-Way
-  Fence
-  Overhead Utilities
-  Elevation Contour
-  Groundwater Contour (dashed where less constrained)



SOIL BORING/MONITORING WELL LOGS

Soils Engineering Inc.

Main St. Charlestown, N. H. 03603

TO Dubois & King Inc ADDRESS Concord, New Hampshire
 PROJECT NAME PSNH - Merrimack Sta LOCATION Bow, New Hampshire
 REPORT SENT TO Phil Wagner PROJ. NO. _____
 SAMPLE SENT TO _____ OUR JOB NO. 1370-81

SHEET 1 OF 2
 DATE 9-22-81
 HOLE NO. SB-1
 LINE & STA. _____
 OFFSET _____

GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR	SURFACE ELEV.
At <u>32'-8"</u>	at <u>18+</u>	Hours	Type <u>H.S.A.</u>	<u>2"</u>		DATE STARTED <u>9/22/81</u>
			Size I. D. <u>2 3/4"</u>	<u>1 1/2"</u>		DATE COMPL. <u>9/23/81</u>
At <u>31'11"</u>	at <u>10/13/81</u>	Hours	Hammer Wt. _____	<u>140#</u>	BIT	BORING FOREMAN <u>Myron Domingue</u>
			Hammer Fall _____	<u>30"</u>		INSPECTOR _____
						SOILS ENGR. _____

LOCATION OF BORING _____

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Const.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From	To					No.	Pen	Rec.
				0-6	6-12	12-18						
								No topsoil - Removed Loose lt.br.sandy silt (fill)				
5'		5' 6.5'	ss	5	9	7		4'3"				
								M/den.br.silty fine sand, bags, concrete, cinders (fill)				
10'		10' 11.5'	ss	11	5	8		11.0'	Old Ground			
								Loose lt.br.coarse sand				
15'		15' 16.5'	ss	3	2	4		18'3"				
								Stiff grey clayey silty fine gravel				
20'		20' 21.5'	ss	6	9	11		23'10"				
								33.0' WATER				
25'		25' 26.5'	ss	2	2	2		M/den.br.fine to coarse sandy gravel				
30'		30' 31.5'	ss	32	33	41						
35'		35' 36.5'	ss	6	7	10	Wet					
40'		40' 41.5'	ss	7	9	11						

GROUND SURFACE TO 41.5'

USED 41.5' CASING THEN _____

Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston

Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%

140 lb. Wt. x 30" fall on 2" O. D. Sampler
 Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense
 Cohesive Consistency
 0-4 Soft 30 + Hard
 4-8 M/Stiff

SUMMARY
 Earth Boring 41.5'
 Rock Coring _____
 Samples 8

Jois Engineering Inc.

Main St. Charlestown, N. H. 03603

SHEET 2 OF 2
DATE 9-23-81
HOLE NO. SB-1
LINE & STA.
OFFSET

TO Dubois & King Inc ADDRESS Concord, New Hampshire
PROJECT NAME PSNH - Merrimack Sta LOCATION Bow, New Hampshire
REPORT SENT TO Phil Wagner PROJ. NO.
SAMPLE SENT TO OUR JOB NO. 1370-81

GROUND WATER OBSERVATIONS				CASING	SAMPLER	CORE BAR	SURFACE ELEV.
At	at	Hours	Type	H.S.A.	2"		9-22-81
			Size I. D.	2 3/4"	1 1/2"		DATE COMPL 9-23-81
At	at	Hours	Hammer Wt.		140#	BIT	BORING FOREMAN Myron Doming
			Hammer Fall		30"		INSPECTOR
							SOILS ENGR.

LOCATION OF BORING.....

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From	To					No.	Pen	Rec.
				0-6	6-12	12-18						
45'		45' 46.5'	ss	17	19	21	Wet	M/den.br.fine to coarse sandy gravel	9	18"	16"	
50'		50' 51.5'	ss	29	14	16	Wet	M/den.br.fine sand, trace of silt and fine gravel	10	18"	18"	
55'		55' 56.5'	ss	19	28	31			11	18"	8"	
60'		60' 61.5'	ss	9	11	13			12	18"	18"	
65'		65' 66.5'	ss	12	18	21			13	18"	18"	
70'		70' 71.5'	ss	20	21	23			14	18"	18"	
								Den.br.coarse sandy gravel & decayed ledge				
								Refusal - Ledge				
								Set 74.5' of 1 1/2" PVC pipe in ground. Slotted last 45'. covered with filter cloth 3' River wrap above grid				

GROUND SURFACE TO 74.5

USED 74.5' CASING, THEN

Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston
 TP—Test Pit A—Auger V—Vane Test

Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%

140 lb. Wt. x 30 3/4 fall an 2" O. D. Sampler
 Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense
 Cohesive Consistency
 0-4 Soft 30 + Hard
 4-8 M/SHff
 8-16

SUMMARY
 Earth Boring 74.5
 Rock Coring
 Samples 14

SEP 26 1981 17:04

Main St.

Charlestown, N. H. 03603

SHEET 1 OF 3

TO Dubois & King, Inc. ADDRESS Concord, New Hampshire

PROJECT NAME PSM1 Merrimack Sta. LOCATION Bow, New Hampshire

REPORT SENT TO P. Wagner PROJ. NO.

SAMPLE SENT TO OUR JOB NO. 1370-81

DATE 9-18-81

MOLE NO. SB-4

LINE & STA.

OFFSET

GROUND WATER OBSERVATIONS

At 67'1" at 10/13/81 Hours

Type

CASING HSA

SAMPLER 2"

CORE BAR.

SURFACE ELEV. 9-18-81
DATE STARTED

Size I. D. 2 3/4"

1 1/2"

DATE COMPL. 9-21-81

Hammer Wt.

140

BORING FOREMAN Myron Dominique

Hammer Fall

30

BIT

INSPECTOR

SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				0-6	6-12	12-18				No.	Pen	Rec.
									Topsoil removed			
5		5.0' - 6.5'	SS	5	5	5				1	18	14
10		10 - 11.5'	SS	6	4	5				2	18	18
15		15 - 16.5'	SS	4	5	5				3	18	12
20		20' - 21.5'	SS	4	8	9			M/dense light brown Med to coarse sand with occasional layers of fine gravel	4	18	14
25		25 - 26.5'	SS	5	8	10				5	18	18
30		30' - 31.5'	SS	6	12	14		30'4"		6	18	18
35		35' - 36.5'	SS	6	8	9			M/dense to dense light brown fine sand, trace of silt	7	18	18
40		40' - 41.5'	SS	8	16	18				8	18	18

GROUND SURFACE TO 41.5'

USED 41.5' CASING THEN

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test
UT-Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb. Wt. x 30" fall on 2" O. D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense
Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/SHF
8-15 SHF

SUMMARY

Earth Boring 41.5'
Rock Coring 8'
Samples

Soils Engineering Inc.

Main St. Charlestown, N. H. 03603

TO Dubois & King, Inc. ADDRESS Concord, New Hampshire
 PROJECT NAME PSNH Merrimack Sta LOCATION Bow, New Hampshire
 REPORT SENT TO P. Wagner PROJ. NO. _____
 SAMPLE SENT TO _____ OUR JOB NO. 1370-81

SHEET 2 OF 3
 DATE 9-18-81
 HOLE NO. SB-4
 LINE & STA. _____
 OFFSET _____

GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR	SURFACE ELEV.
At _____	at _____	Hours _____	Type <u>HSA</u>	<u>2"</u>	_____	DATE STARTED <u>9-18-81</u>
			Size I. D. <u>2-3/4"</u>	<u>1 1/2"</u>	_____	DATE COMPL. <u>9-21-81</u>
At _____	at _____	Hours _____	Hammer Wt. _____	<u>140</u>	BIT _____	BORING FOREMAN <u>Myron Dominique</u>
			Hammer Fall _____	<u>30"</u>	_____	INSPECTOR <u>P. Wagner</u>
						SOILS ENGR. _____

LOCATION OF BORING: _____

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Constat.	Smoat Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From To						No.	Pen	Rec.
				0-6	6-12	12-18						
45		45' - 46.5'	ss	10	14	16				9	18	18
50		50' - 51.5'	ss	15	22	24				10	18	18
55		55' - 56.5'	ss	9	10	13				11	18	18
60		60' - 61.5'	ss	9	13	20			Med/dense to dense light brown fine sand, trace of silt	12	18	18
65		65' - 66.5'	ss	12	15	18				13	18	18
70		70' - 71.5'	ss	13	18	21				14	18	18
75		75' - 76.5'	ss	8	9	8			Med/den. to dense light brown fine sand, trace of silt	15	18	18
80		80' - 81.5'	ss	5	7	9				16	18	18

GROUND SURFACE TO 81.5'

USED 81.5' "CASING: THEN _____

Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston
 TP—Test Pit A—Auger V—Vane Test

Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%

140 lb. Wt. x 30% fall on 2" O. D. Sampler
 Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense

Cohesive Consistency
 0-4 Soft 30 + Hard
 4-8 M/Stiff

SUMMARY
 Earth Boring _____
 Rock Coring _____
 Samples _____

UNIVERSITY MICROFILMS 40-107 53728-2

Main St. Charlestown, N. H. 03603

TO Dubois & King, Inc ADDRESS Concord, New Hampshire
 PROJECT NAME PSNH Merrimack Sta. LOCATION Bow, New Hampshire
 REPORT SENT TO Phil Wagner PROJ. NO.
 SAMPLE SENT TO OUR JOB NO. 1370-81

SHEET 3 OF 3
 DATE 9-18-81
 HOLE NO. S B-4
 LINE & STA.
 OFFSET

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR	SURFACE ELEV.
At	at	Type H.S.A.	2"		DATE STARTED 9-18-81
	Hours	Size I. D. 2 3/4"	1 1/2"		DATE COMPL 9-21-81
At	at	Hammer Wt.	140#	BIT	BORING FOREMAN Myron Domingue
	Hours	Hammer Fall	30"		INSPECTOR
					SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depth From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil, etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				0-6	6-12	12-18				No.	Pen	Rec.
								84.0'				
85'		85' 86.5'	ss	12	14	15	Wet		M/den.br.fine to med.sand w/occasional small layer fine gravel	17	18"	18"
90'		90' 91.5'	ss	8	10	12				18	18"	18"
95'		95' 96.5'	ss	10	18	17				19'	18"	last
								97' 5"				
								99' 2"	Den. broken ledge & coarse gravel			
									Refusal - ledge or Boulder			
									Set 99.0' of 1 1/2" PVC in hole w/40.0' slotted & covered w/filter cloth. 3' riser above ground & capped			

GROUND SURFACE TO 99.2'	USED 99.2'	"CASING: THEN	140 lb. Wt. x 30 1/4 fall an 2" O. D. Sampler	SUMMARY
Sample Type	Proportions Used	Cohesionless Density	Cohesive Consistency	Earth Boring 99.2'
D-Dry C-Cored W-Washed	trace 0 to 10%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
UP-Undisturbed Piston	little 10 to 20%	10-30 Med. Dense	4-8 M/Stiff	Samples 17
TP-Test Pit A-Auger V-Vane Test	some 20 to 35%	30-50 Dense	8-15 Stiff	

Main St. Charlestown, N. H. 03603

TO Dubois & King, Inc
 PROJECT NAME PSNH - Merrimack Sta
 REPORT SENT TO Phil Wagner
 SAMPLE SENT TO

ADDRESS Concord, New Hampshire
 LOCATION Bow, New Hampshire
 PROJ. NO.
 OUR JOB NO. 1370-81

SHEET 1 of 2
 DATE 10/8/81
 HOLE NO. SB-6
 LINE & STA
 OFFSET

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR	SURFACE ELEV.
A1 61'10"	at 10/13/81 Hours	Type H.S.A.	2"		DATE STARTED 10/8/81
		Size I. D. 2 3/4"	1 1/2"		DATE COMPL 10/8/81
A1	at Hours	Hammer Wt.	140#	BIT	BORING FOREMAN Myron Domingue
		Hammer Fall	30"		INSPECTOR
					SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From	To					No.	Pen	Rec.
				0-6	6-12	12-18						
								No topsoil (removed)				
5'		5' 6.5'	SS	15	11	11			1	18"	18"	
10'		10' 11/5'	SS	10	12	11			2	18"	18"	
15'		15' 16.5'	SS	9	14	15		M/den.lt.br.fine to medium sand w/layers of fine gravel	3	18"	18"	
20'		20' 21.5'	SS	7	11	13			4	18"	18"	
25'		25' 26.5'	SS	10	11	11			5	18"	18"	
30'		30' 31.5'	SS	14	19	12			6	18"	18"	
35'		35' 36.5'	SS	10	10	16			7	18"	18"	
40'		40' 41.5'	SS	14	21	19			8	18"	18"	

28.0'

GROUND SURFACE TO 40:0' USED 40' CASING THEN DROVE SS 18'

Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston
 TP—Test Pit A—Auger V—Vane Test

Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%

Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense

Cohesive Consistency
 0-4 Soft 30 + Hard
 4-8 M/SHff
 8-15 Stiff

SUMMARY	
Earth Boring	41.5'
Rock Coring	8'
Samples	

TO Dubois & King, Inc. ADDRESS Concord, New Hampshire
 PROJECT NAME PSNH - Merrimack Sta LOCATION Bow, New Hampshire
 REPORT SENT TO Phil Wagner PROJ. NO. _____
 SAMPLE SENT TO _____ OUR JOB NO. 1370-81

DATE 10/8/81
 HOLE NO. SB-6
 LINE & STA. _____
 OFFSET _____

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR	SURFACE ELEV.
At _____ of _____ Hours	Type _____	H.S.A.	2"	_____	DATE STARTED <u>10-8-81</u>
	Size I. D. _____	2 3/4"	1 1/2"	_____	DATE COMPL. <u>10-8-81</u>
At _____ of _____ Hours	Hammer Wt. _____	_____	140#	BIT	BORING FOREMAN <u>M. Domingue</u>
	Hammer fall _____	_____	30"	_____	INSPECTOR _____
					SOILS ENGR. _____

LOCATION OF BORING: _____

DEPTH	Casing Blows per foot	Sample Depth From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				0-6	6-12	12-18				No.	Pen	Rec.
45'		45' 46.5'	ss	14	15	18			M/den: to den. lt. br. layers of fine & medium sand, Tr. of fine gravel	9	18"	18"
50'		50' 51.5'	ss	16	18	24				10	18"	18"
55'		55' 56.5'	ss	18	21	32				11	18"	18"
60'		60' 61.5'	ss	19	28	29		58'	water	12	18"	18"
65'		65' 66.5'	ss	14	16	17			m/den: to den. lt. br. layers of fine & medium sand, Tr. of fine gravel	13	18"	18"
70'		70' 71.5'	ss	13	20	19				14	18"	18"
75'		75' 76.5'	ss	14	17	22		74'8"				
80'		80' 80'7"	ss	62	150/1"	No penetration			Den. wet layers of silt, clay & coarse gravel	16	7"	7"

GROUND SURFACE TO 80'7"

USED 80' "CASING" THEN drave ss 7"

140 lb. Wt. x 30" fall on 2" O. D. Sampler

- Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston
 TP—Test Pit A—Auger V—Vane Test
 UT—Undisturbed Thinwall

- Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%
 and 35 to 50%

- Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense
 50+ Very Dense

- Cohesive Consistency
 0-4 Soft 30+ Hard
 4-8 M/Sluff
 8-15 Sluff
 15-30 V-Sluff

SUMMARY

Earth Boring 80'7"
 Rock Coring _____
 Samples 16

HOLE NO. SB-6

STRIP STOPPED, COVERED W/ FILTER CLOTH

Soils Engineering Inc.

Main St. Charlestown, N. H. 03603

TO Dubois & King, Inc. ADDRESS Concord, New Hampshire
 PROJECT NAME PSNH - Merrimack Sta LOCATION Bow, N.W. Hampshire
 REPORT SENT TO Phil Wagner PROJ. NO. _____
 SAMPLE SENT TO _____ OUR JOB NO. 1370-81

SHEET 1 OF 1
 DATE 10-9-81
 HOLE NO. SB-#13
 LINE & STA. _____
 OFFSET _____

GROUND WATER OBSERVATIONS	CASING	SAMPLER	CORE BAR.	SURFACE ELEV. _____
At <u>8:30</u> Immediately Hours	H.S.A.	2"		DATE STARTED <u>10/9/81</u>
Type _____	Size I. D. <u>2 3/4"</u>	1 1/2"		DATE COMPL. <u>10/12/81</u>
At _____ at _____ Hours	Hammer Wt. _____	140#	BIT	BORING FOREMAN <u>Myron Domingue</u>
Hammer Fall _____		30"		INSPECTOR _____
				SOILS ENGR. _____

LOCATION OF BORING: _____

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From 0-6	To 6-12	To 12-18				No.	Pen	Rec.
								No topsoil (removed)				
5'		5' - 6.5'	SS	4	3	3		Loose med. to coarse sand	1	18"	18"	
								8'2" water				
10'		10' - 11.5'	SS	18	24	29			2	18"	18"	
15'		15' - 16.5'	SS	12	6"		Wet	Den. lt. br. sandy coarse gravel w/cobbles & boulders	3	6"	6"	
20'		20' - 21.5'	SS	30	17	13			4	18"	12"	
25'		25' - 26.5'	SS	17	24	31			5	18"	15"	
30'		30' - 31.5'	SS	57	31	16			6	18"	18"	
35'		35' - 36.5'	SS	24	32	28	Wet	Den. lt. br. fine to med. sand w/little fine gravel, cobbles & sm. boulders	7	18"	18"	
								Refusal Ledge or boulder				
								Set 35' PVC last 25' slotted wrapped w/filter cloth. 24" Riser capped above grnd.				

GROUND SURFACE TO 36.5'

USED 35' "CASING: THEN drove ss 12"

Sample Type
 D—Dry C—Cored W—Washed
 UP—Undisturbed Piston
 TP—Test Pit A—Auger V—Vane Test
 UT—Undisturbed Thinwall

Proportions Used
 trace 0 to 10%
 little 10 to 20%
 some 20 to 35%
 and 35 to 50%

Cohesionless Density
 0-10 Loose
 10-30 Med. Dense
 30-50 Dense
 50+ Very Dense

Cohesive Consistency
 0-4 Soft 30 + Hard
 4-8 M/Stiff
 8-15 Stiff
 15-30 V. Stiff

SUMMARY

Earth Boring 37'
 Rock Coring _____
 Samples 7

HOLE NO. SB-12

CAPITAL ENVIRONMENTAL
 DRILLING SERVICES, INC.
 150 Concord Stage Road
 Dunbarton, NH 03045

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DEC 08 1993

PRODUCTION DIV.

Page: 1 of 2
 Hole No.: MW-14

Project: 931284 PUBLIC SERVICE OF N. H.
 Location: Bow , NH 03304-

Date Started: 10/04/1993 Completed: 10/04/1993

Consultant:

Project Manager:

Field Representative: Al Palmer

Driller: S. Voisine

Drilling Method: 4.25 HSA

Sampling Method: 2" Split Spoon

Drilled To: 45.000

Well Depth: 45.000

Drill Make and Model: B-53 Truck-Mounted Mobile Drill

Screen: 15.000

Weight: SCH. 40

Slot Size: 0.010

Material: PVC

Riser: 32.500

Diameter: 2.000

Filter Pack To: 28.000

Gravel Size: 2

Bentonite To: 26.000

Material: Chips

Backfill To: 24.000

Material: Native Backfill

Concrete To: 0.000

Closure: 4" X 5' Standpipe

Groundwater At: .000

Notes: Filter Pack to 28'; Bentonite to 26'; Native Backfill to 24';

Bentonite to 20'; Native Backfill to 2'; Concrete to 0'.

C - Number of Blows to Drive Casing 12" with 300 Lb. Weight Falling 24".

Depth	Sample Number	C	Recovery/ Penetration	Blows/Density	Description
5.000 - 7.000	1		0009/24	3 2 4 2	Coarse-medium gravel, some sand, brown, wet.
10.000 - 12.000	2		0013/24	1 1 1 3	3" gravel, fine-coarse, brown, wet. 10" of dark brown very fine sand, silt, wet.
15.000 - 17.000	3		0017/24	WOR	Weight of Rod: Some medium-fine sand, wet, silty sand.
20.000 - 22.000	4		0000/00		Skip sample because 3" blow in. Advance to next sampling int. came into gravel approx. 24'
25.000 - 27.000	5		0014/24	20 23 18 16	Wet rusty medium-coarse gravel, some small rocks. 5" dry coarse gravel, tan-brown.

CAPITAL ENVIRONMENTAL
DRILLING SERVICES INC.
150 Concord Stage Road
Dunbarton, NH 03045

Project: 931284 PUBLIC SERVICE OF N. H.
Consultant:

Page: 2 of 2
Hole No.: MW-14

C - Number of Blows to Drive Casing 12" with 300 Lb. Weight Falling 24".

Depth	Sample Number	C	Recovery/ Penetration	Blows/Density	Description
30.000 -	32.000	6	0013/24	24 28 28 35	Dry, brown rusty coarse-medium gravel, some sand, small rocks.
35.000 -	37.000	7	0012/24	1 7 9 13	Water at 33', wet, medium-coarse gravel, tan, rusty, small rocks.
40.000 -	42.000	8	0000/00		Blow in, no sample. Drill to 45', set well.



CAPITAL ENVIRONMENTAL

DRILLING SERVICES INC.

150 Concord Stage Road

Dunbarton, NH 03045

invoice

IN ACCOUNT WITH:

Public Service of N.H.
P. O. Box 5017
Hartford, CT 06102-5017

DATE: 10/06/93

INVOICE NO: 93108

TERMS: NET 30

CUSTOMER NO. 0075

QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT
	Job Location: Ash Dump, River Rd., Bow, New Hampshire Req# N44582; P.O. No: 891747		
1	Mobilization/Demobilization @ N/C		
1	Mobile B-53 truck-mtd. Drill Rig	900.00	900.00
15	2" PVC Sch. 40 Well Screen	5.50	82.50
35	2" PVC Sch. 40 Riser Pipe	3.75	131.25
1	2" PVC Sch. 40 Bottom Plug	6.20	6.20
1	2" Non-Locking J-Plug	11.00	11.00
1	4" x 5' Protective Standpipe	65.00	65.00
1	Brass Padlock	10.50	10.50
9	Filter Pack Material	12.50	112.50
2	Wyoming Bentonite Chips	34.50	69.00
4	Pre-mix Concrete	15.00	60.00
TERMS: Net 30 Days: Interest 2% per Month/24% Annual			

** THANK YOU **

SUB-TOTAL:

1,447.95

SALES TAX:

0.00

TOTAL:

1,447.95



**CAPITAL ENVIRONMENTAL
DRILLING SERVICES INC.**
150 Concord Stage Road
Dunbarton, NH 03045

(603) 774-4920
Fax (603) 774-6165

DAILY WORKSHEET

Project Name	Public Service	Date	10-4-93
Location	River Rd. Bow NH	Job #	931284
		P.O. #	

QUANTITY	DESCRIPTION	UNIT COST	EXTENSION
X	Mobilization/Demobilization		
X	Mobile B-53 truck-mounted Drill Rig		
	Mobile B-47 track-mounted Drill Rig		
	DK 25 Driltech Air Rotary		
	Footage, Coring (if applicable)		
	Overtime		
	Stand-by Time		
X	Steam Cleaner Rental		
	Perdiem		
15'	PVC Well Screen (1 1/2" / 2" / 4")		
35'	PVC Solid Riser Pipe (1 1/2" / 2" / 4")		
1	PVC Bottom Plug (1 1/2" / 2" / 4")		
1	Locking / Non-Locking Well Cap (1 1/2" / 2" / 4")		
1	Brass Padlocks		
	Manhole		
1	Protective Standpipe 4" (w) Royer		
9	Filter Pack Material		
2	Bentonite		
4	Pre-Mix Concrete		
	Grout		

Stephen Votaw
Driller's Signature

Cell - P. [Signature]
Field Representative Signature

Total Mileage VT, ME, MA: _____

**CAPITAL ENVIRONMENTAL
DRILLING SERVICES INC.**
150 Concord Stage Road
Dunbarton, NH 03045

(603) 774-4920
Fax (603) 774-6165
NH (800) 924-1192

September 8, 1993

Public Service Company Of New Hampshire
Box 330
Manchester, NH 03105

Attention: Al Palmer

RF: Cost Estimate Installation of one 2" monitoring well, Bow, NH
Location

Dear Al

Confirming our telephone conversation of earlier this morning, we are pleased to offer our costing for drilling at the above-referenced location for your review and consideration as follows:

QUAN.	DESCRIPTION	UNIT	EXTENSION
1	Mobilization/Demobilization	\$ N/C LS	\$ N/C.00
1	Mobile B-53 truck-mtd. Drill Rig	900.00 PD	900.00
15'	2" PVC Sch. 40 .010-slot Well Screen	5.50 LF	82.50
25'	2" PVC Sch. 40 Riser Pipe	3.75 LF	93.75
1	2" PVC Bottom Plug	6.20 EA	6.20
1	2" Non-Locking J-Plug	11.00 EA	11.00
1	4" x 5' Protective Standpipe	65.00 EA	65.00
1	Brass Padlock	10.50 EA	10.50
5	Filter Pack Material	12.50 EA	62.50
1	Wyoming Bentonite Chips	34.50 EA	34.50
1	Pre-mix Concrete	15.00 EA	15.00
TOTAL ESTIMATE:			\$ 1280.95

Layout and utility clearance by others.

If you should have need of any additional information, please feel free to contact our office.

Thank you for the opportunity to quote; we hope to be of service.

CAPITAL ENVIRONMENTAL DRILLING
SERVICES, INC.

By: Terry Swain
Terry Swain, Vice President

Monitoring Wells • Soil Sampling • Rock Coring • Recovery Wells

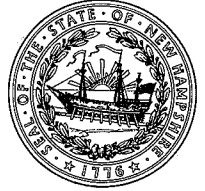


State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095

603-271-3503 FAX 603-271-2867

TDD Access: Relay NH 1-800-735-2964



October 30, 1992

RECEIVED AGP

NOV 04 1992

PRODUCTION DIV.

Mr. Alan Palmer
Public Service of New Hampshire
1000 Elm Street
PO Box 330
Manchester, NH 03105

Subject: Bow- Merrimack Station Ash Landfill Upgradient Monitoring Well
Proposal GWP-840065-B-001 (DES#840065)

Dear Mr. Palmer:

The Department of Environmental Services (DES) has completed the review of the monitoring well proposal as submitted for the PSNH site on August 1, 1991. Based on the information provided, location #2 as proposed, appears adequate for siting an upgradient monitoring well for the ash landfill. DES requests that you now move forward with the well installation. Please be advised that if this new well should prove to be hydraulically downgradient of the landfill (which does not appear to be the case, see groundwater contours Plate I plan R9703.1), DES will require the installation of a new upgradient well.

The monitoring well is to be screened in the upper most aquifer (drill 10-12 feet into the water table and set 10 to 15 foot screen to bridge the water table). The well should be installed in accordance with the current New Hampshire Groundwater Protection Bureau Typical Monitoring Well Details (see copy of details attached). The boring log and well construction details should be submitted as soon as they are available.

The revised groundwater permit will be issued once the installation of the monitoring well is complete and the boring log, well construction details, and revised site plan (showing as built monitoring locations) are submitted. We also ask that a reduced copy (8 1/2 x 11 or 11 x 17) of the revised site plan be submitted (for attachment to the permit).

AIR RESOURCES DIV.
64 No. Main Street
Caller Box 2033
Concord, N.H. 03302-2033
Tel. 603-271-1370
Fax 603-271-1381

WASTE MANAGEMENT DIV.
6 Hazen Drive
Concord, N.H. 03301
Tel. 603-271-2900
Fax 603-271-2456

WATER RESOURCES DIV.
64 No. Main Street
P.O. Box 2008
Concord, N.H. 03302-2008
Tel. 603-271-3406
Fax 603-271-1381

WATER SUPPLY & POLLUTION CONTROL DIV.
P.O. Box 95
Concord, N.H. 03302-0095
Tel. 603-271-3503
Fax 603-271-2181

Mr. Alan Palmer
Merrimack Station Ash Landfill
October 30, 1992
page 2

Please contact me at the Water Supply & Pollution Control address or call me at 271-3644 if you have any questions.

Sincerely,



Karlee Kenison
Groundwater Protection Bureau

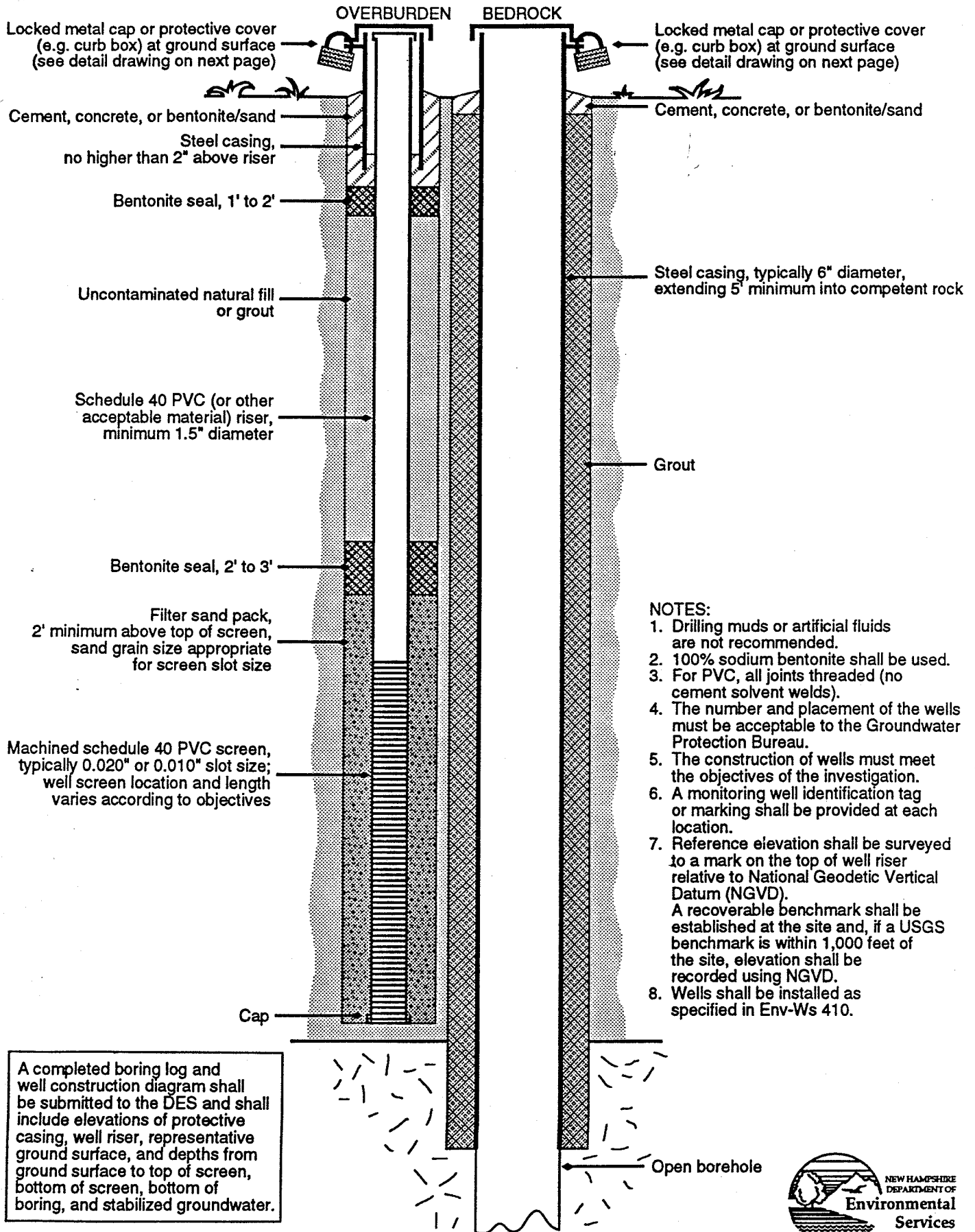
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Enclosure

cc: File

George Lombardo, GPB
Richard Reed, SWCS/WMD
Pamela Sprague, PA&DRS/WMD
Dennis Brown, PSNH

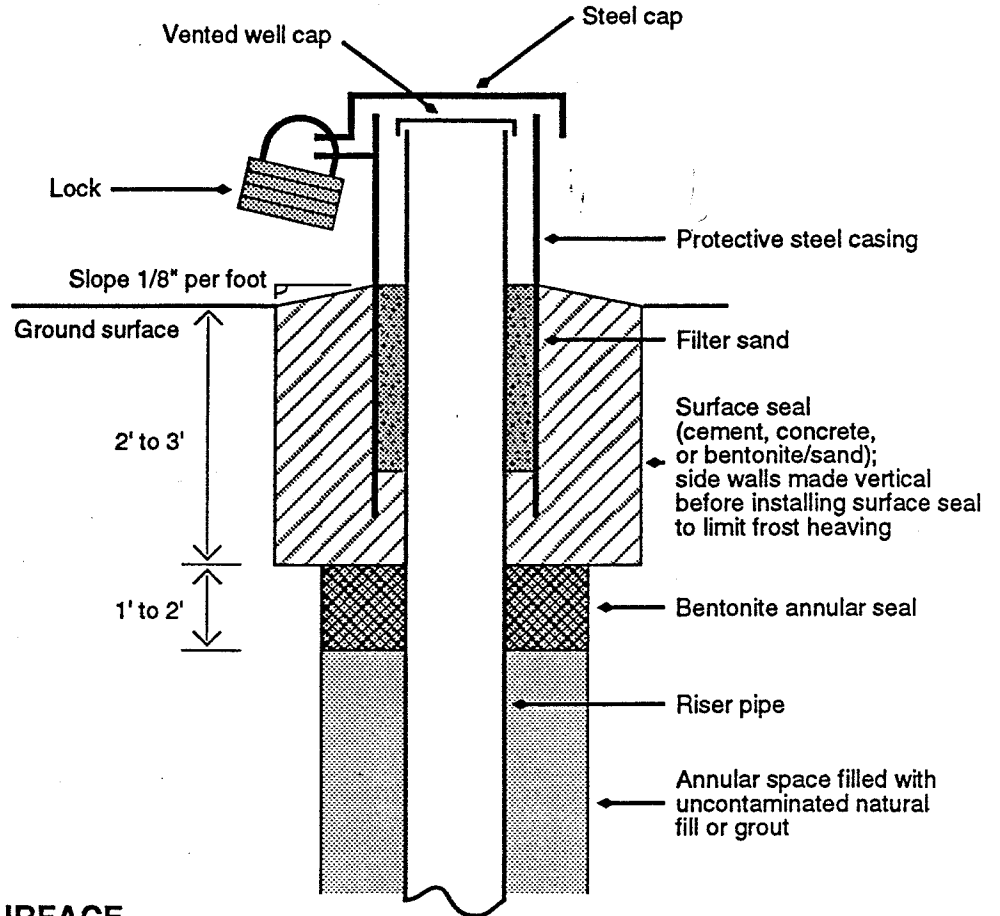
NEW HAMPSHIRE GROUNDWATER PROTECTION BUREAU TYPICAL MONITORING WELL DETAIL (not to scale)



NOTES:

1. Drilling muds or artificial fluids are not recommended.
2. 100% sodium bentonite shall be used.
3. For PVC, all joints threaded (no cement solvent welds).
4. The number and placement of the wells must be acceptable to the Groundwater Protection Bureau.
5. The construction of wells must meet the objectives of the investigation.
6. A monitoring well identification tag or marking shall be provided at each location.
7. Reference elevation shall be surveyed to a mark on the top of well riser relative to National Geodetic Vertical Datum (NGVD).
A recoverable benchmark shall be established at the site and, if a USGS benchmark is within 1,000 feet of the site, elevation shall be recorded using NGVD.
8. Wells shall be installed as specified in Env-Ws 410.

TYPICAL ABOVE-GROUND MONITORING WELL COMPLETION



TYPICAL FLUSH-TO-GROUND-SURFACE MONITORING WELL COMPLETION

