START

9513333.2327

0040293

41

BHI-00135
Rev. 00

N-Springs Barrier Wall Drilling Program Data Package

Author

V. M. Johnson
K. A. Lindsey
K. R. Simpson

Date Published
November 1994

Environmental Excellence
HANFORD

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Bechtel Hanford, Inc.
Richland, Washington

FEB 1995
RECEIVED
EDMC

Approved for Public Release

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

1.0 INTRODUCTION 1

2.0 DRILLING 1
2.1 COMPLETION AND ABANDONMENT 1

3.0 SAMPLING 4

4.0 GEOLOGY 4

5.0 AQUIFER TESTING 10

6.0 GEOTECHNICAL RESULTS 10

7.0 RADIOLOGICAL CONDITIONS 10

8.0 REFERENCES 12

APPENDICES:

A BOREHOLE LOGS A-1
B GRAIN SIZE DATA B-1

FIGURES:

1. Well and Borehole Location Map 3
2. Generalized Geology of the N-Springs 5
3. Geologic Cross-Section of the N-Springs 7

TABLES:

1. Well Construction Summary 2
2. Summary of the Drilling Depths to Geologic Units and the Lithologies of the Geologic Units in the Eight Boreholes Drilled 9
3. Summary of Blow Count Data from Boreholes at N-Springs 11

THIS PAGE INTENTIONALLY
LEFT BLANK

1.0 INTRODUCTION

Four groundwater wells and four geotechnical borings were installed in accordance with the *N Springs Expedited Response Action Proposal* (DOE-RL 1993) to provide geologic and geotechnical information to support the design and construction of a barrier wall adjacent to 100-N Springs. This report contains the geologic and geotechnical data gathered from field efforts in support of milestone M-16-01N of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the N-Springs expedited response action (ERA). Data on drilling and abandonment of the geotechnical borings and the drilling of the four groundwater monitoring wells are provided. This report will be revised at a later date and will include information on completion, development, aquifer testing, and the total strontium analyses. For each geotechnical boring and monitoring well, borehole logs and grain size data are included in Appendices A and B, respectively.

2.0 DRILLING

Eight borings were drilled (using a cable tool drill rig) from September 15 to October 11, 1994 by ICF Kaiser Hanford Company. Table 1 gives the details of the wells installed according to the N-Springs Barrier Wall Drilling Program (Simpson and Johnson 1994). Location of the borings were chosen based on the length of the proposed barrier wall. The proposed barrier alignment is located along the south bank of the Columbia River, following a bench approximately 10 to 15 ft above river level. Eight boring locations were picked based on a 3,800-ft-long wall; two borings at each end, five borings equally spaced or at convenient location on the riverside of the wall, and a middle boring on the inside of the wall. Figure 1 shows the approximate locations. Monitoring wells 199-N-94A and 199-N-99A were installed in a "matched pair" configuration on both sides of the proposed barrier and near the center of the alignment (see Figure 1).

Carbon steel 10-in. and 8-in. temporary welded casing was used on all borings, except 199-N-96A, where threaded casing was used. For starter casing, 10-in.-diameter was used and later telescoped to 8-in. diameter where it was seated within the upper mud unit of the Ringold Formation.

2.1 COMPLETION AND ABANDONMENT

Wells 199-N-91A, 199-N-93A, 199-N-95A, and 199-N-97A are geotechnical characterization borings that were abandoned with bentonite upon backpulling the temporary casing. Geotechnical borings were abandoned according to the Washington Administrative Code (WAC) Chapter 173-160. A 1-ft by 1-ft cement surface marker denotes the location for each abandoned boring.
Wells 199-N-92A, 199-N-94A, 199-N-96A, and 199-N-99A were drilled to be completed as groundwater monitoring wells. Wells 199-N-92A, 199-N-94A, and 199-N-96A had sieve analysis samples taken for screen selection; the analyses are included in Appendix B. Sieve analysis data for 199-N-94A and 199-N-96A appear skewed by the lack of coarser gravel; therefore, they may not be a true representative sample because gravels larger than 2 in. are characteristic of Ringold gravel.

Table 1. Well Construction Summary.

Well	Boring Type	Ground Surface Elevation (ft amsl)	Depth to Ground-water (ft bgs)	Start	Complete	Casing Size		Depth to Silt (ft bgs)	TD (ft bgs)	Drill Stem Weight (lbs)
						10 in. (ft bgs)	8 in. (ft bgs)			
199-N-91A	Geotechnical	398.6	20.0	24-Sep	30-Sep	20.0	57.0	44.0	59.0	1120
199-N-92A	Well	396.7	16.0	3-Oct	7-Oct	32.5	48.0	40.5	51.5	1120
199-N-93A	Geotechnical	392.9	20.0	11-Oct	14-Oct	30.8	43.0	N/A	43.0	1120
199-N-94A	Well	392.0	12.5	12-Sep	20-Sep	28.1	60.0	36.5	62.0	1120
199-N-95A	Geotechnical	395.6	15.5	15-Sep	22-Sep	26.4	48.5	38.5	49.0	1170
199-N-96A	Well	409.0	30.0	28-Sep	4-Oct	31.5	71.0	60.0	71.0	1170
199-N-97A	Geotechnical	392.8	13.0	22-Sep	27-Sep	20.2	45.0	35.0	46.0	1170
199-N-99A	Well	392.0	12.5	21-Sep	23-Sep	35.0	N/A	Shallow Well	35.0	1120

N/A = not available
bgs = below ground surface
msl = mean sea level

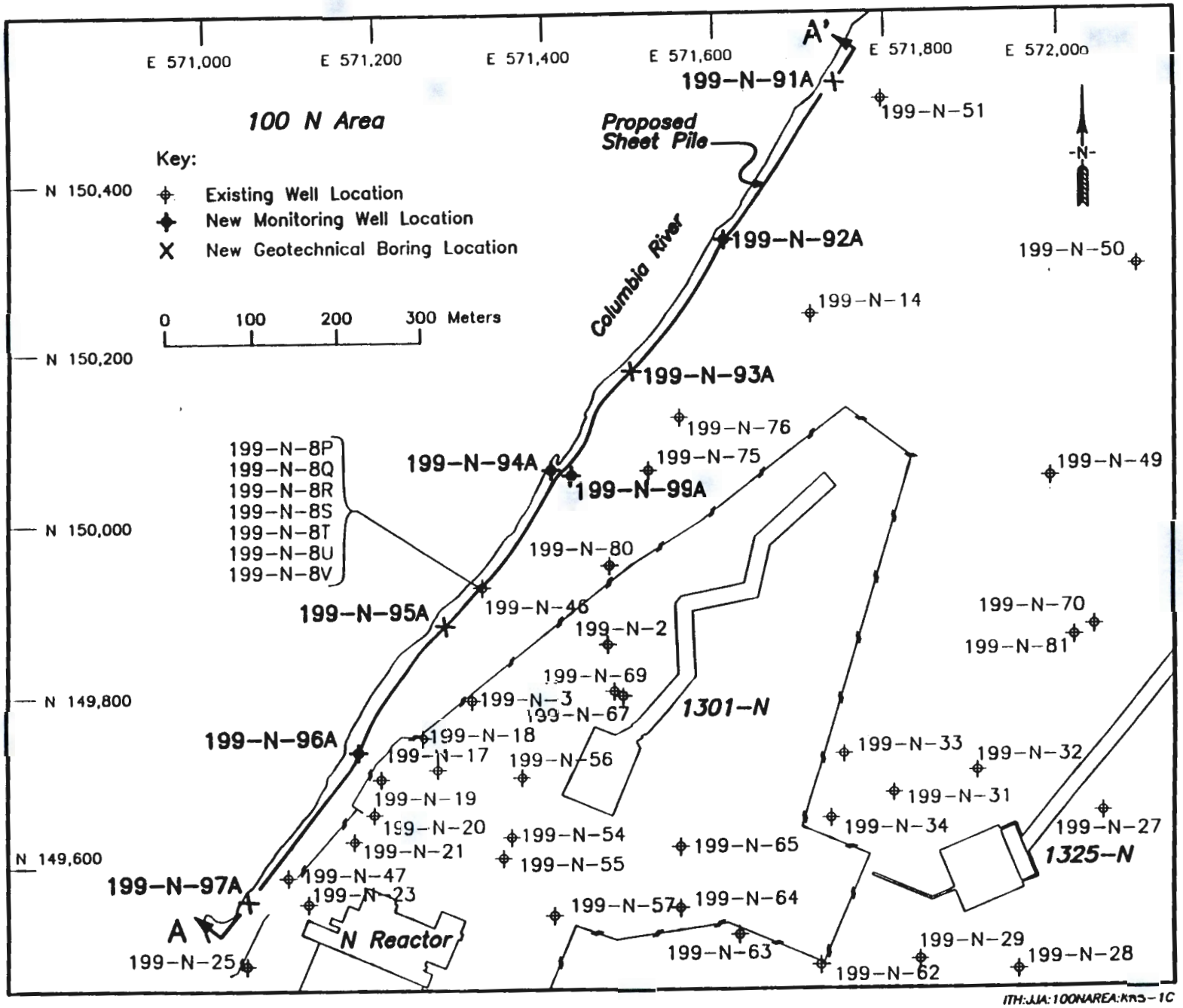


Figure 1. Well and Borehole Location Map.

9513333.2350

BHI-00135
Rev. 00

3.0 SAMPLING

Strontium-90 and retardation coefficient samples were taken from all seven boring at 5.0-ft intervals, except well 199-N-99A. Samples will be analyzed by Pacific Northwest Laboratory (PNL) to confirm the distribution of contamination within the subsurface. This is important for design of extraction and injection wells to calibrate the groundwater model and understand the results of the retardation coefficient analysis. Retardation coefficients are used to refine the conceptual model and provide inputs to the groundwater model (Simpson and Johnson 1994). Bechtel Hanford, Inc. is currently prioritizing samples to be analyzed based on field screening results.

4.0 GEOLOGY

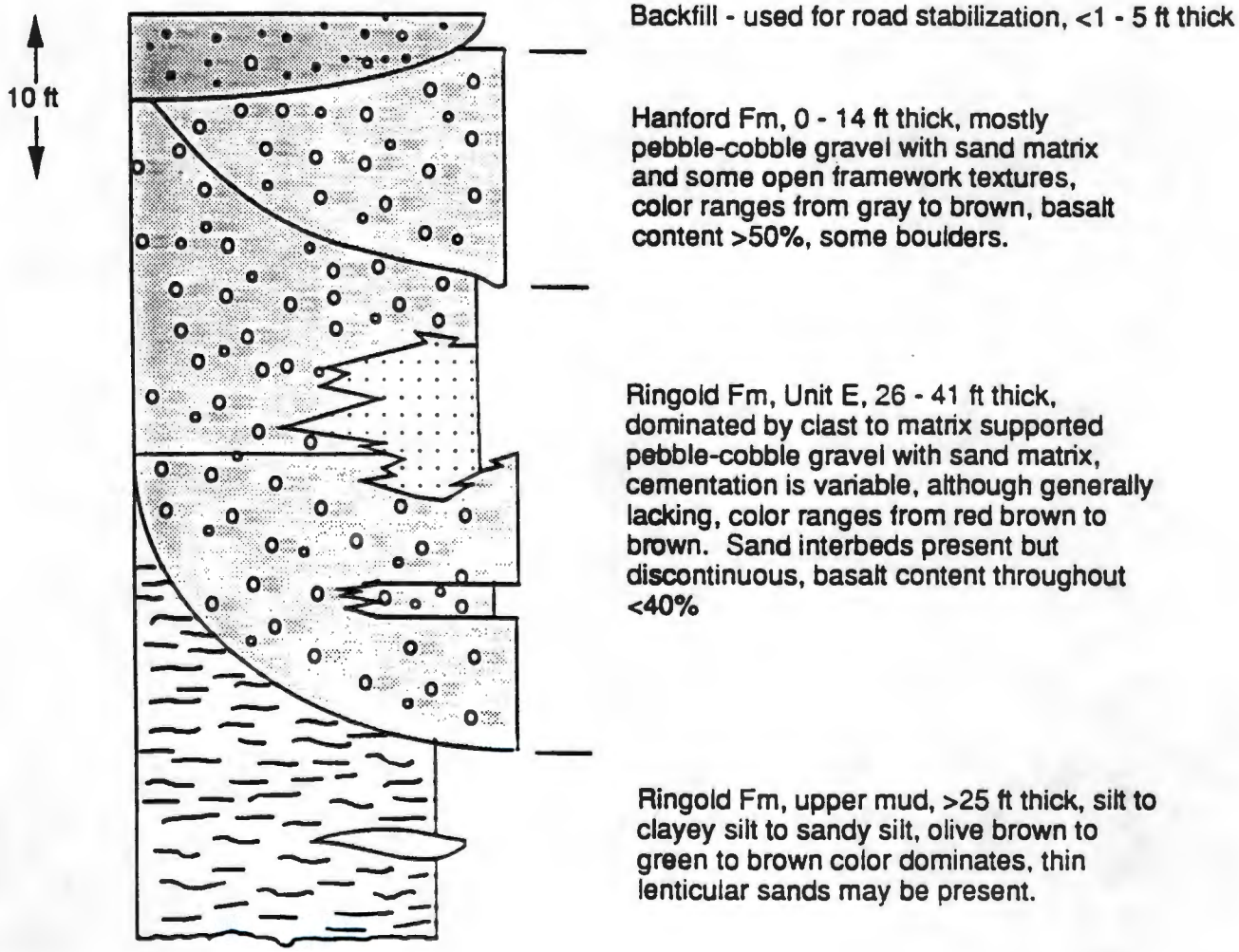
Three geologic units plus backfill were encountered during drilling (see Figure 2). The uppermost material encountered consisted of backfill used to stabilize the access roads to the drill sites. The backfill ranged from a thin veneer less than 1 ft thick up to 5 ft thick (see Figures 2 and 3 and Table 2). It is present at all the drill sites. Borehole 199-N-96A sits on 19.0 ft of sand and gravel backfill used in the construction of the berm located adjacent to the diesel burn pit.

The uppermost geologic unit encountered is the Hanford formation (see Figure 2). It ranges from 0 to 14 ft thick, being found at six of the boreholes (199-N-91A, 199-N-93A, 199-N-94A, 199-N-95A, 199-N-97A, and 199-N-99A) and absent at the rest (199-N-96A and 199-N-92A) (see Figure 3 and Table 2). Generally, Hanford deposits here consist of sandy, pebble-cobble gravel with minor silt content. Small outcrops present along the river near the drill sites indicate that this gravel has some open framework textures. Colors range from gray to brown, and basalt content is estimated at 50% to 80%.

Ringold Formation unit E and the muds underlying unit E (referred to as the upper muds) are present at all of the drill sites (see Figures 2 and 3). The top of unit E is found approximately 2 ft below the ground surface (just below backfill) to as deep as 19 ft below surface (borehole 199-N-96A) (see Figure 3 and Table 2). Generally, unit E consists of brown, red brown, and gray, sandy, pebble-cobble gravel. Cementation was identified on borehole logs in unit E only at the north end of the line in boreholes 199-N-91A, 199-N-92A, and 199-N-93A. The presence of cementation was accompanied by increasingly red coloration. However, blow count data (see Chapter 6) indicated harder drilling conditions at the south end of the line (199-N-96A and 199-N-97A). Sandy interbeds are present in the middle to lower part of unit E in boreholes 199-N-92A, 199-N-93A, 199-N-95A, and 199-N-97A; and silt interbeds are present in borehole 199-N-94A.

The top of the Ringold upper muds is situated between 33 and 66 ft below the surface at elevations ranging from 347 to 357 ft above sea level (see Figure 3 and Table 2). The thickest interval of upper muds drilled was 26 ft in borehole 199-N-94A. The upper muds consist of a mix of clayey silt, silt, and sandy silt. Sandy interbeds are found in boreholes 199-N-91A and 199-N-94A.

Figure 2. Generalized Geology of the N-Springs.



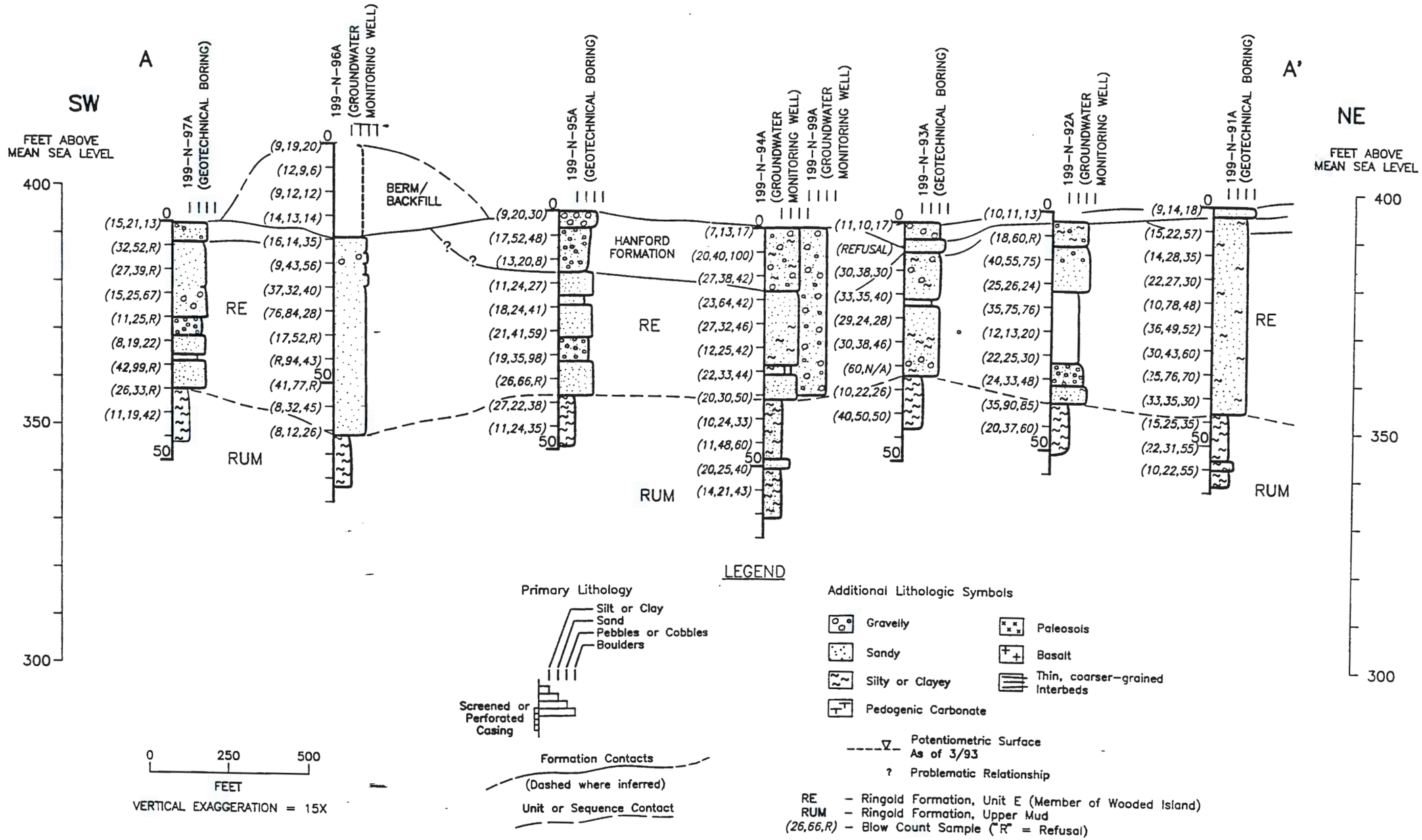


Figure 3. Geologic Cross Section of the N-Springs

THIS PAGE INTENTIONALLY
LEFT BLANK

Table 2. Summary of the Drilling Depths to Geologic Units and the Lithologies of the Geologic Units in the Eight Boreholes Drilled.

Borehole	Backfill	Hanford Formation	Ringold Unit E	Ringold Upper Mud
199-N-91A	0 to 2 ft: Gravel laid down to stabilize road surface.	2 to 4 ft: Basaltic pebble-cobble gravel.	4 to 44 ft: Pale brown, red-brown, and green sandy pebble-cobble gravel. Mafic content ranges from 25% to 35%. Slight cementation noted near bottom of unit. Silt content variable.	44 to 59 ft: Silt-rich fines. Silty sand bed at approximately 54 to 56 ft.
199-N-92A	0 to 2 ft: Gravel laid down to stabilize road surface.	Not present.	2 to 41 ft: Red-brown to brown, partially consolidated, sandy pebble-cobble gravel. Brown medium-grained sand interval from 19 to 33 ft. Overlies gravelly sand from 33 to 38 ft. Silt content variable throughout gravel.	40.5 to 51.5 ft: Pink to brown silt with minor clay and sand.
199-N-93A	0 to 5 ft: Red-brown gravel laid down to stabilize road surface.	5 to 7 ft: Gray to brown-gray pebble-cobble gravel with a sand matrix. Boulders may be present. Borehole logs (see Appendix A) note hard drilling.	7 to 33 ft: Gray, green-gray, brown, and red-brown sandy pebble-cobble gravel. Silt content variable and some cementation may be present in lower half. Sandy interbed from 15 to 17 ft.	33 to 43 ft: Green, gray, and brown silt with minor clay and sand.
199-N-94A 199-N-99A	None recorded on borehole log, <1 ft.	0 to 13.5 ft: Silty, sandy pebble-cobble gravel. Basalt content up to 80%.	13.5 to 36 ft: Brown sandy pebble-cobble gravel, silt content increases downwards. Basalt <35%. Silty interbed at 30 to 32 ft.	36 to 62 ft: Light olive brown to green sandy silt and silt. Fine-grained sand interbed at 50 to 51 ft.
199-N-95A	None recorded on borehole log, <1 ft.	0 to 14 ft: Gray to brown, sandy pebble-cobble gravel containing up to 70% basalt. Upper 4 ft may be boulder-rich.	14 to 38.5 ft: Sandy pebble-cobble gravel containing <40% basalt. Sandy interbeds at 18 to 20 ft and 27 to 32 ft. Iron oxides stains present in lower 8 ft.	38.5 to 49 ft: Clayey to sandy silt.
199-N-96A	0 to 19 ft: Sandy gravel used to construct berm the drill site is on.	Not present.	19 to 60 ft: Sandy pebble-cobble gravel containing <40% basalt. Large cobbles to small boulders may be present in upper 10 ft.	60 to 71 ft: Clayey to sandy silt.
199-N-97A	None recorded on borehole log, <1 ft.	0 to 4.5 ft: Light gray, sandy pebble-cobble gravel.	4.5 to 35 ft: Pale brown, sandy pebble-cobble gravel containing <30% basalt. Large cobbles may be present at 20 to 24 ft and 28 to 30 ft.	35 to 46 ft: Clayey to sandy silt.

5.0 AQUIFER TESTING

All borings except 199-N-99A were drilled a minimum of 10 ft into the confining upper mud unit. The temporary casing was then seated into the upper mud to allow for constant head aquifer testing of the Ringold upper mud. Aquifer testing will be performed in order to determine the hydrologic properties of both the Ringold upper mud unit and the unconfined aquifer in the upper Ringold unit E gravel. For each boring, water levels of the unconfined aquifer were measured by an electronic tape (see Table 2). Near the river, the unconfined water table has fluctuated up to 11 ft/year and as much as 6 ft/per day, as recorded by a nearby pressure transducer. The borings were drilled during a time of low river stage, and water levels within the wells are expected to fluctuate similarly. A more complete description of subsurface hydrogeologic conditions can be found in Hartman and Lindsey (1993).

6.0 GEOTECHNICAL RESULTS

The cable tool method was used for drilling the groundwater wells and geotechnical borings. Both drill stem weight and blow count data are documented for all characterization borings and groundwater wells, expect 199-N-99A. Because boreholes were drilled using the cable tool method and much of the material to be encountered was anticipated to be gravel, the standard penetration test as described in American Society for Testing and Material Standard D-1586 was considered inappropriate (Simpson and Johnson 1994). Therefore, a modified blow count procedure was used. Blow count samples were taken at 5-ft intervals using a carbon steel drive barrel. As the drive barrel advanced every 6-in. increment, the blow counts were recorded on the borehole log (Table 3 and Appendix A). The total advance for each sampling interval was 1.5 ft, but for several samples on well 199-N-94A, 2-ft advances were required to pack the sample within the drive barrel. Refusal was defined as less than 6 in. of penetration after 100 blows and noted on the borehole log.

Refusals were encountered on boreholes 199-N-92A, 199-N-93A, 199-N-95A, 199-N-96A, and 199-N-97A (Table 3). Borehole 199-N-93A had the only refusal noted for the entire sample interval. Borehole 199-N-96A had the only refusal that occurred within the upper 6 in. of the sample interval. The remaining refusals occurred within the bottom 6 in. of the sampling interval. Of those, the majority of the refusals were on boreholes 199-N-96A and 199-N-97A, which are located at the southern end of the alignment. This skew in information could be interpreted as a result of drilling technique, overpacking, or possibly natural occurrence.

7.0 RADIOLOGICAL CONDITIONS

Protective clothing was worn by employees while working in areas of contamination. In areas designated as a radiological buffer area, Radiological Worker I training was required. In areas that were designated radiological contamination areas, or surface contamination areas, Radiological Worker II training was required.

Table 3. Summary of Blow Count Data from Boreholes at N-Springs.

Depth (ft)	Geotech-nical Boring 199-N-91A Blow Counts	Depth (ft)	Well 199-N-92A Blow Counts	Depth (ft)	Geotech-nical Boring 199-N-93A Blow Counts	Depth (ft)	Well 199-N-94A Blow Counts	Depth (ft)	Geotech-nical Boring 199-N-95A Blow Counts	Depth (ft)	Well 199-N-96A Blow Counts	Depth (ft)	Geotech-nical Boring 199-N-97A Blow Counts
0.0-1.5	9,14,18	0.0-1.5	10,11,13	0.0-1.5	11,10,17	0.0-1.5	7,13,17	0.0-1.5	9,20,30	0.0-1.5	9,19,20	0.0-1.5	15,21,13
4.5-6.0	15,22,57	5.0-6.5	18,60, refusal	5.0-6.5	refusal	5.0-6.5	20,40,100	5.0-6.5	17,52,48	5.0-6.5	12,9,6	5.0-6.5	32,52, refusal
10.0-11.5	14,28,35	10.0-11.5	40,55,75	10.0-11.5	30,38,30	10.0-12.0	27,38,42	10.0-11.5	13,20,8	10.0-11.5	9,12,12	9.5-11.0	27,39, refusal
15.0-16.5	22,27,30	15.0-16.5	25,26,24	15.0-16.5	33,35,40	15.0-17.0	23,64,42	15.0-16.5	11,24,27	15.5-17.0	14,13,14	16.0-17.5	15,25,67
20.0-21.5	10,78,48	20.0-21.5	35,75,76	20.0-21.5	29,24,28	20.0-22.0	27,32,46	20.0-21.5	18,24,41	20.5-22.0	16,14,35	20.0-21.5	11,25, refusal
25.0-26.5	36,49,52	25.0-26.5	12,13,20	25.0-26.5	30,38,46	25.0-27.0	12,25,42	25.0-26.5	21,41,59	25.0-26.5	9,43,56	24.5-26.0	8,19,22
30.0-31.5	30,43,60	30.0-31.5	22,25,30	30.0-31.5	60,N/A	30.0-32.0	22,33,44	30.0-31.5	19,35,98	30.0-31.5	37,32,40	29.5-31.0	42,99, refusal
35.0-36.5	25,76,70	35.0-36.5	24,33,48	35.0-36.5	10,22,26	35.0-37.0	20,30,50	34.0-35.5	26,66, refusal	35.0-36.5	76,84,28	35.0-36.5	26,33, refusal
40.0-41.5	33,35,30	40.0-41.5	35,90,85	40.0-41.5	40,50,50	40.0-41.5	10,24,33	39.0-40.5	27,22,38	39.5-41.0	17,52, refusal	40.0-41.5	11,19,42
45.0-46.5	15,25,35	45.0-46.5	20,37,60			45.0-46.5	11,48,60	43.0-44.5	11,24,35	45.0-46.5	refusal, 94,43		
50.0-51.5	22,31,55					51.0-52.5	20,25,40			49.5-51.0	41,77, refusal		
54.5-56.0	10,22,55					55.0-56.5	14,21,43			55.5-57.0	8,32,45		
										60.0-61.5	8,12,26		

N/A = not available
refusal = >100 blows

9513333.2334

For well 199-N-94A, radiological contamination was detected by Health Physics with a pancake Geiger-Mueller (GM) field instrument directly below the subsurface to approximately 17 ft below ground surface. The highest radiological contamination detected was 400 cpm beta/gamma from 0.0 to 1.5 ft below ground surface. No alpha contamination was detected with the portable alpha monitor. No chemical contamination was detected with the organic vapor monitor (OVM). See comment section on borehole log in Appendix A.

For well 199-N-99A, radiological contamination was detected by Health Physics with a pancake GM from just below ground surface to approximately 18.0 ft below ground surface. The highest contamination value recorded was 1,100 cpm beta/gamma on the GM at approximately 5 ft below surface. After 18 ft, contamination was less than detectable. No alpha contamination was detected with the portable alpha monitor. No chemical contamination was detected with the OVM.

The remainder of the boreholes had less than detectable radiological and chemical contamination reported. See comment section of borehole logs in Appendix A. Radiological contamination levels detected by the GM are for screening purposes only, and detection limits may vary according to field conditions.

8.0 REFERENCES

DOE-RL, 1993, *N Springs Expedited Response Action Proposal*, DOE/RL-92-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1989, et seq., *Hanford Federal Facility Agreement and Consent Order*, 2 vol., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Hartman, M. J. and K. A. Lindsey, 1993, *Hydrogeology of the 100-N Area*, WHC-SD-EN-EV-027, Westinghouse Hanford Company, Richland, Washington.

Simpson, K. R. and V. M. Johnson, 1994, *100 N Barrier Wall Design Drilling Program*, BHI-00045, Rev. 01, Bechtel Hanford Inc., Richland, Washington.

APPENDIX A

BOREHOLE LOGS

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 1 of 7

Location N-Springs

Project N Springs ERA

Prepared By D Walker / L.D. Walker (Sign/Print Name) Date 9-24-94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/94

Depth (Ft)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
0	.5 Ft	9		1 Foot · Sandy Gravel (road fill) Poorly sorted, 50% cobbles and pebbles, 40% sand, 10% silt. 10YR 7/2 light grey (dry) angular to rounded	Hammer weight 1120 l Stroke approx. 24 inche Blow count sample and ~~Sr~~ sample for 0'-1. No detectable β, γ wit Field instruments
	.5 Ft	14			
1	.5 Ft	18			
	DB			Approx 2 Feet - contact between new road fill and old ground surface.	6" Drive barrel 10" carbon steel casin 10.85' in length, no drive shoe.
2					
3				Silty Sandy Gravel Small cobbles 5%, coarse to fine pebbles 40%, Sand (very coarse to very fine) 40%, Silt 15%, pale brown (dry) poorly sorted, sub-angular to rounded pebbles, sub-angular to angular sand. Sand 70% qtzite 30% mafics, gravels 60% qtzite 40% mafics	Some large rocks ma driving casing very difficult
4					
	.5 Ft	15			At 4.5 feet, blow cou sample and Sr sample and total activity sample
5	.5 Ft	22			
	.5 Ft	57			No detectable β, γ wit Field instruments
6	DB				
7					At 7 Feet, First trac of moisture
8				Silty Sandy Gravel similar to above, but trace of moisture	
9					
10					

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 2 of 7

Location N Springs

Project N Springs ERA

Prepared By L.D. Walker / L.D. Walker (Sign/Print Name) Date 9-24-94

Reviewed By K.R. Simpson / K.R. Simpson (Sign/Print Name) Date 11/7/94

Linda R. Glaman / Glaman 9/26/94

Depth (Ft.)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
10	.5 Ft	14		Silty Sandy Gravel 45% LW 4-24	At 10 feet blow coun
	.5 Ft	28		Gravel 40%, Sand 45%, silt 15%. Gravel 5% small cobbles,	and Sr sample and total activity sampl
11	.5 Ft.	35		25% vc to coarse pebbles, 70% medium to very fine pebbles. Sand	No detectable β, γ with field instruments
	DB			30% very coarse to coarse, 30% medium, 40% fine to very fine.	
12				pale brown (moist) Poorly sorted gravel sub angular to rounded, sand angular to sub angular.	Drilling and driving 10' casing becoming easier
13				Gravel 70% qtzite, granitics, 30% mafic; Sand 80% qtz, 20% mafics. No cementation noted, trace of clay at 10 feet	
14					9-24-94 End of shift at 15 Fe
15	.5	22		Silty Sandy Gravel; 10% silt; 20% sand - ~~fine~~ to medium grained to coarse grained, sub-angular; 70% gravel - pea to 3+ inches, larger cobbles broken, rounded to subrounded;	Start Shift 9/26/94 no detectable β γ
16	1.0	27		red brown changing to light greenish grey; damp; poorly sorted; loose	
	1.5	30			
17					
18				Same as above, cuttings very moist	
19				Silty Sandy Gravel; 10% silt, 20% Sand - coarse, subangular; 70% gravel pea to 3+"; reddish brown to greenish brown; wet; poorly sorted; subrounded silt sticks gravel + sand together	Water table ~~[illegible]~~ 20ft no detectable β γ
20					

9513333.2337

BHI-00
Rev. 00

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 3 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] (Sign/Print Name) Date 9/26/94

Reviewed By [signature] (Sign/Print Name) Date 11/7/94

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
20	.5	10		Silty Sandy Gravel; 5% silt; 5% sand - coarse, angular to subangular; 90% gravel - pea to 4+ inches, rounded, oblong - largest cobbles broken; brown; wet; somewhat sorted; clast supported; silt ~~and~~ sticks sand to cobbles	no detectable β γ sample N-91A-20
	1	28			
21	1.5	48			
22				large cobble - 6+ inches (broken on all sides)	
23					
24					
25	.5	36			sample N-91A-25
	1	49			
26	1.5	52			
27				Silty Sandy Gravel; 5% silt, 10% sand - medium to mostly coarse grained, subangular; 85% gravel - pea to 4+ inches, rounded, oblong; brown; wet; somewhat sorted;	no detectable β γ
28					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 4 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By Linda [illegible]/Glaman (Sign/Print Name) Date 9/26/94

Reviewed By KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
28					
29					
30	.5	30		Silty Sandy Gravel; 5% silt; 20% sand - medium grained, subangular; 75% gravel - pea to 4+", subrounded to rounded; brown; wet; somewhat sorted; loose	May have some flow sand coming in casing (medium grained, subangular, loose, wet - consistency of soft serve ice cream)
	1	43			
31	1.5	60			sample N-91A-30 No detectable β, γ
32					
33				Silty Sandy Gravel; 10% silt, 20% sand - fine to coarse grained; 70% gravel - pea to 4+", subrounded to rounded; brown to greenish grey (in silt balls); wet; unsorted; loose; silt in balls sticking fine sand to cobbles.	
34					
35	.5	25			Sample N-91A-35 No detectable β, γ
	1	76			
36					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 5 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] / Glaman (Sign/Print Name) Date 9/27/94 9/29/94

Reviewed By KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
36	1.5	70		Silty Sandy Gravel; 10% silt; 20% sand - fine to coarse grained; 70% gravel - pea to 4+", subrounded to rounded; brown to greenish-grey (in silt clumps); wet; unsorted; loose; silt in clumps sticking fine sand to cobbles	
37					
					End shift 7/27/94
38					Start shift 7/29/94
39					
40	.5	33		Silty Sandy Gravel; 10% silt; 25% sand - medium to coarse grain; 65% gravel - pea (subangular) to 3+" (rounded); wet; somewhat bimodal sorted; brown to greenish-grey (silt); well consolidated - maybe cemented.	Sample N-91A-40 No detectable β, γ
	1	35			
41	1.5	30			
				Sand - fine to medium grained (mostly medium grained) few gravels (1") subangular; wet (consistency of soft serve)	flowing sand
42				Silty Sandy Gravel; 20% silt 20% sand - fine to medium, subangular; 60% gravel - pea to 3", subrounded (pea) to rounded; greenish brown; wet; unsorted; well consolidated to cemented	No detectable β, γ
43					
44					Silt/gravel interface

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 6 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] Glaman/Glaman (Sign/Print Name) Date 9/29/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
44	N-91A-45			Silt to Muddy Silt thin layer of silt then 40% Clay, 60% Silt; tan brown; moist; well sorted; very well ~~cemented to~~ consolidated to cemented, somewhat plastic	no detectable β, γ
45	.5	15			no detectable β, γ
	1	25			
46	.5	35		Clay; plagioclase pink; moist; plastic, consolated	
				Muddy Silt; 50% clay 50% silt; greenish brown; moist; well sorted; consolidated plastic	
47					
48					
49					
50	.5	22			
	1	31			
51	1.5	55			
				Muddy Silt - Same as above	No β or γ detected.
52					

A-6000-382 (01/S

BOREHOLE LOG

Boring or Well No. N-91A

Sheet 7 of 7

Location 100 N Springs

Project 100 N Springs Barrier Wall

Prepared By R.R. Simpson (Sign/Print Name) Date 9/30/94

Reviewed By VM Johnson VM Johnson (Sign/Print Name) Date 11/7/94

Depth (____)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
53				Same as above	no detectable β+γ
				Ringold lower mud.	
54					Corebarrel coming up empty twice
		10		54.5' Silty fine well sorted well rounded Sand w/ silt to clay. Not cemented balls in hand.	Blows 10, 22, 55
55		22		muddy brown color	Sample N-91A- Total activity Same
		55			Weld on 10.26' 8" Casing
56				Back to Ringold lower mud same as above	
57					
58					
59				59'	59' TD Took another sample, but no blow count N91A-59

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-92-A

Sheet 1 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By Linda RB Glomani (Sign/Print Name) Date 10/3/94 10/4/94

Reviewed By KRSimpson (Sign/Print Name) Date 11/7/9

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
		10		Clean Fill: Silty Sandy Gravel 20% silt; 30% sand - fine to medium grained, subangular; 50% gravel - pea to 6+", subrounded to rounded, oblong; red brown; dry; poorly sorted; loose	no detected b.x
1		11			
		13			
2				Silty Sandy Gravel: 20% silt; 20% sand - fine to medium grained; 60% gravel - 1 to 6+" (mostly 2-3"), subrounded to rounded, broken by drilling; red-brown; dry; poorly sorted; loose	No detected b.x
3					End Shift 10/3/94 Start Shift 10/4/94
4				Silty Sandy Gravel; 20% silt; 20% fine to medium sand; 60% gravel - 1 to 7", subrounded to rounded (large cobbles well broken; red brown; dry; poorly sorted; loose	hard drilling No detected b.x
5	.5	14			
	1	60			
6	1.5	refused			some dense silty sand
7					hard drilling
8					

BOREHOLE LOG

Boring or Well No. N-92A

Sheet 2 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] Glaman (Sign/Print Name) Date 10/4/94

Reviewed By [signature] KRSimpson (Sign/Print Name) Date 11/7/9

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
8				Sandy Gravel; <5% silt; 25% Sand - fine to medium (some coarse probably rock fragments from drilling); sub angular (angular fragments); 75+% gravel - pea to 7+", sub rounded to rounded, oblong, many broken during drilling; red brown; slightly damp; poorly sorted; loose	hard drilling
9					
					rock kicking casing & plumb.
10	.5	40		Sandy Gravel; 25% sand - fine to coarse subangular to angular (coarse) coarse is actually rock fragments from drilling; 75% gravel - angular rock fragments from drilling; rounded pebbles & cobbles, pea (fragments) to 6+" (probably 8+"); red brown (whitish grey rock powder); bimodely sorted; loose; slightly damp (majority of cobbles came up broken)	very hard drilling
	1	55			
11	1.5	75			
12					
13					
14				Cuttings are moist	
15	.5	25			?
	1	26			
16					

BOREHOLE LOG

Boring or Well No. N-92A

Sheet 3 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] Glaman/Glaman (Sign/Print Name) Date 10/4/94 10/5/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/9

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
16	1.5	24		Clayey sandy gravel; 30% Clay - moist plastic, green brown to red brown; sticking together ~~15~~ 20% sand - medium grained subangular; 50% gravel - 2ea to 6+", subrounded to rounded, oblong; beige brown; wet; poorly sorted; somewhat consolidated 17ft. Sandy Gravel; 40% Sand - mostly medium grained some coarse subangular; 60% gravel - 1" to 6", rounded oblong; brown; wet; poorly bimodally sorted; loose.	- Water -
17					
18				flowing Sand →	End Shift 10/4/94 Start shift 10/5/94 No recovery in DB - coated w/ silty sand 20% silt, 50% sand - med grained, brown, soupy w
19					
20	.5	35		Sand; Brown; wet; Medium grained well sorted; subangular; well consolidated to cemented, clast supported	Still flowing sand
	1	75			
21	1.5	76			
22					
23					
24					

A-6000-382 (01/9

9513333.2341

BHI-00
Rev. 00

BOREHOLE LOG

Boring or Well No. N-92A-

Sheet 4 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] (Sign/Print Name) Date 10/5/94

Reviewed By KRSimpson (Sign/Print Name) Date 11/7/94

Depth (24)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
					still flowing sand
25		.2		Sand; brown; wet; well sorted; sub angular; consolidated, soupy	
		.3			
26		20			
27					
28					
29					
					≈5 ft of sand in casing over much 10/5/94
30	.5	22			Casing (3") driving w/ drilling
	1	25			
31	1.5	30			
32					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. 100-N-92A

Sheet 5 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [illegible] (Sign/Print Name) Date 10/5/94 10/6/94

Reviewed By [illegible] K.R. Simpson (Sign/Print Name) Date 11/7/9

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
32					
33				Gravelly Sand; 10% Gravel - 1-4", subrounded; 90% Sand - medium grained subangular; brown; wet; bimodally sorted; sloppy	End Shift 10/5/94 Start Shift 10/6/94 ≈ 3 ft of sand up in casing over night
34					
35	.5	24			8" casing sand weighed down 10" casing - fill end of hole.
	1	33			
36	1.5	48			
37					
38				Silty Sandy Gravel; 10% silt; 20% medium - coarse grained Sand, subangular 70% Gravel; 1" to 6+" (quite large) subrounded to rounded; moist; wet; poorly sorted; consolidated (silt sticking together	
39					
40					

9513333.2342

BHI-001
Rev. 00

BOREHOLE LOG

Boring or Well No. 11-SZA

Sheet 6 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By Linda RBA Lamar/Gbman (Sign/Print Name) Date 10/6/94 10/7/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
40					
	.5	35		Silty Clay; 30% silt; 70% clay	
				reddish brown; moist to damp (interior);	
	1	90		well sorted; well consolidated; crumbly	
41				when damp, plastic when wet	
	1.5	85			
42					End Shift 10/6/94 Start Shift 10/7/94
43					
44					
45				Clay; Pink; damp to moist; well	
	.5	20		sorted; well consolidated; plastic	
	1	37			
46					
	1.5	60			
47					
				Muddy Silt to Silty Mud; 50% clay	
				50% silt, brown; damp to moist;	
				well consolidated; plastic	
48					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-92A

Sheet 7 of 7

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By Linda R. Glaman/Glaman (Sign/Print Name) Date 10/7/94

Reviewed By KRSimpson KR Simpson (Sign/Print Name) Date 11/7/

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Ca Size & Type, Bit Size, Water Lev
48				Muddy Silt to Silty Mud; 50% Clay 50% Silt; brown; damp to moist; well consolidated; plastic	
49					
50		19			
		25			
51		35			
					TD 51.5 ft. 10/7/9
52					

A-6000-382 (01

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 1 of 6

Location 100-N Springs

Project 100-N Springs

Prepared By [signature] / Gloman (Sign/Print Name) Date 10/1/94

Reviewed By [signature] KR Simpson (Sign/Print Name) Date 11/7/94

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
0	.5	11		Clean fill: Silty Sandy Gravel; 20% Silt; 20% Sand - fine to medium grained; 60% Gravel - 1" to 4", rounded; dry; red brown; poorly sorted; loose	less than detectable β, γ; 460 ppb OVM
	1	10			
1	1.5	17			
2				Sandy Gravel; 50% medium grained sand, subangular; 50% Gravel - 1" to 5+", rounded, oblong; reddish brown; dry to slightly moist; bimodally sorted; loose	less than detectable β, γ
3					
4					
5	.5	refusal		large cobble/boulder - no advancement	Hard drilling
6	1			Sandy Gravel: 40% Sand - medium grained, subangular; 60% Gravel - 1" to large broken piece (½-7+"), rounded when unbroken, oblong; grey to brownish grey, slightly moist; poorly sorted; loose	
	1.5				
7					less than background β, γ
8				Sandy Gravel; 40% Sand - medium grained, subangular; 60% Gravel - 1" to 6+", rounded, oblong; red brown	0 ppb OVM Hard drilling

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 2 of 6

Location 100-N Springs

Project 100-N-Springs Characterization

Prepared By [signature] (Sign/Print Name) Date 10/11/94 10/12/94

Reviewed By [signature] KR Simpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casin Size & Type, Bit Size, Water Level
8				moist; poorly sorted; loose	hard drilling
9					
10	.5	30		Slightly ~~#~~ 0% Silty Sandy Gravel; 5% silt 30% Sand - medium grained subangular; 65% Gravel - 1" to 8" ", rounded where not broken, oblong; reddish brown greenish grey in [illegible] portions); very moist to ~~damp~~ wet; poorly sorted; loose	water
	1	38			
11	1.5	30			
12					
13					End Shift 10/11/94 Begin Shift 10/12/9 Open cum below background B.S
14					
15	.5	33			below background B.S
	1	35			
16					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 3 of 6

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By Linda [illegible]/Glamen (Sign/Print Name) Date 10/12/94

Reviewed By KR Simpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
	1.5	40		Silty Sandy Gravel] 5% silt; 30% Sand - medium grained, subangular; 65% Gravel - 1" to 8+", rounded when not broken, oblong; reddish brown to brown; wet; poorly sorted; loose - some cobbles ~~stuck~~ 10% covered with sand stuck by silt.	below Background β & γ
17					
				Sand] medium grained; brown; wet; well sorted; subangular; slurry when water saturated, packs when not saturated	below Background β & γ
18					
				[Gravelly Sand] 45% gravel - 1-2" rounded; 55% Sand - medium grained subangular; brown; wet; bimodally sorted; slurry when saturated, packed when not saturated.	below Background β & γ
19					
				Sandy Gravel] 35% sand - medium grained, subangular; 65% Gravel - 1-3", rounded; brown; wet; bimodally sorted; somewhat consolidated.	Below Background β & γ
20					
	.5	29		Slightly Silty Sandy Gravel] 5% silt; 20% Sand - medium to Coarse grained subangular; 75% Gravel; pea to 5+", rounded; brown; wet; poorly sorted; somewhat consolidated.	Below Background β & γ
	1	24			
21					
	1.5	28			Open DUM
22					
23				[Sandy Silty Gravel] 10% sand - fine; 20% silt; 70% Gravel - pea to 3", rounded; tan; wet; poorly sorted; silt and fine sand cements gravel together	
24				[Sandy Gravel] 30% Sand - medium grained, subangular; 70% Gravel -	

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 4 of 6

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [illegible] / [illegible] (Sign/Print Name) Date 10/12/94 10/13/94

Reviewed By [illegible] KR Simpson (Sign/Print Name) Date 11/7/9

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
24				pea to 6", rounded; brown; wet; poorly sorted; loose to somewhat packed.	
25					
	.5	30		Sand and Silt sticking ~~[illegible]~~ gravel together	
	1	38			
26					
	1.5	46			End Shift 10/12/94
					Start Shift 10/13/94
					Open KVM
27					
28					Heaving Sand - Medium grained subangular w. brown, sandy silt not consolidated when wet!
29					
30				Silty Sandy Gravel: 10% silt, 10% sand - mostly coarse, angular, some medium, subangular; 80% gravel - pea to 6", rounded when not broken; green brown to brown with black stripes; wet; poorly sorted; silt "cements" sand and gravel together, consolidated	Heaving sand filled up DB before completing blow count drive - Zattle Failed
	.5	6			
	1	refused (DB full of heaving sand)			
31					
	1.5				
32					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 5 of 6

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] Gleman (Sign/Print Name) Date 10/13/94

Reviewed By [signature] Kr Gumpson (Sign/Print Name) Date 11/7/94

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
32					0ppm OVM
33				Slightly Sandy Silt: 10% Fine sand; 90% silt; greenish grey; wet-outside damp-inside; well sorted; well consolodated.	Below Background β, γ
34					
35	.5	10		Silt; red brown with greenish grey and greyish white layers; damp to almost dry; well sorted; very well consolodated to cemented (especially in the greyish white layers.	
	1	22			
36	1.5	26			
37					End Shift 10/13/94 Start Shift 10/14/94 Below Background β, γ 0ppm on OVM
38					
39					
40					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-93A

Sheet 6 of 6

Location 100-N Springs

Project 100-N Springs ~~Church~~ 10/14 Characterization

Prepared By Linda B. Glaman / Glaman (Sign/Print Name) Date 10/14/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
40	.5	40		Muddy Silt; 30% Clay; 70% Silt; ≈6" pink then greenish grey-brown; damp to moist; well consolidated	Below Background β, X
	1	50			
41	1.5	50			
42					
43					TD @ 43 ft 10/14/94
44					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-94A

Sheet 1 of 8

Location Shoreline adjacent to 100 N Springs

Project 100 N Springs Barrier Well

Prepared By _____ (Sign/Print Name) Date _____

Reviewed By KRSimpson (Sign/Print Name) Date 11/7/94

Depth (FEET)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
	Surface	Blow Counts		Ground surface has been stabilized	50 cpm β, γ background
	.5ft	- 7		Unable to determine depth of	0-18ft 400 cpm β, γ from
1	1.0ft	- 13		stabilization or possible fill material	HPT instrument
	1.5ft	-17/37		due to bagged cuttings.	Well started 9/12/94
				Surface composed of Sandy GRAVEL	
				(SG) 70% gravel, 30% sand	
2				gravel composed of 30% cobble size	
				material and 60% medium pebble.	
				Approximately 10% coarse-very	
				coarse pebble. Some broken up	
				fine pebbles. Trace of silt; dry;	3.0ft 250 counts/minute
3	Drive Barrel			Very poorly sorted; loosely	β, γ
				consolidated. Open framework;	3.0ft hard drilling. No
				cobbles and gravels are mostly	VOA's or Semi-VOA detected
				subrounded to rounded; 70% basalts	with PID
4				30% gneiss, granodiorites, meta quartz	
				ites.	
				3.0ft Silty Sandy GRAVEL (MSG)	
				60% cobble/gravels, 30% sand, 10%	5.0ft 250 cpm β, γ
5				Silt. Silt coatings present on cobble/	5.5'-7.0ft Sr sample
	5.0ft	Blow counts		gravels. Cobbles are 4 in diameter	taken in 1 liter jug and
				average. Washed river cobbles and	Total Activity
	5.5ft	-20		gravels; subrounded to rounded;	250 cpm at 5.0'-7.0' inter
6	6.0ft	-40		slightly damp. Difficult to describe	9/14/95 9.99ft casing
	6.5ft	-100/160		looking through and into bagged	with shoe
				cuttings. Very poorly sorted; loosely	
				consolidated. No contacts noticed.	
7				3.5ft. Grading to gravelly SAND	
				80% sand, 10% fine gravel, 10% silt	
				sand; very coarse to fine; dry;	
				moderately sorted.	
8				5.0' Grading to Sandy GRAVEL hard	
				drilling. Cobbles present. 60% sand	
				40% cobble/gravels, loosely consolidated	
				matrix supported; washed river	
9				cobble/gravels; subrounded; hard to	
				determine mineralogy through bag.	
				8.5ft Sandy GRAVEL same as	
				previous material	
10					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-94A

Sheet 2 of 8

Location 100 N Springs

Project 100 N Springs

Prepared By [signature] K.M. Singleton (Sign/Print Name) Date 9-16-94

Reviewed By [signature] K.R. Spruce (Sign/Print Name) Date 11/7/94

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
10	Soil 10'-12'	27		10'-12.5' Silty Sandy Gravel	10'-12 B 300 cmp
				dark brown to black, moist, poorly sorted	First Blow counts for last
		38		70% Gravel, very fine pebbles to sm cobbles	1.5' of sample. Core
11	0825			round to subrnd	barrel packed last 0.5'
				23% Sand - mostly med	keep material in sampler.
				7% Silt 70-80% Basalt, 20% other	
				(saturated at ~12.5)	
		42'			
12		See not under comments			
					▽ Water table ~12.5
13					
				13.5'-20' Sandy Gravel	~Ringold 13.5' bgs
14				brown, wet, poorly sorted, well graded	
				70% Gravel, very fine to very coarse pebble	
				~~some~~ Few sm cobbles, rnd to subrnd.	[illegible] 9-16-94
				27% Sand - mostly med to vc	
				≤3% Silt ; 70% Feld+Qtz	
15				30% Basalt + others	
	Soil 15'-17'	23			15-17 B 150 cpm
16	0925	64			
		42			
17					
18					

A-6000-382 (01/9

9513333.2347

BHI-0013
Rev. 00

BOREHOLE LOG

Boring or Well No. N 94A

Sheet 3 of 8

Location 100 N Springs

Project 100 N Springs

Prepared By [signature], K.M. Singleton (Sign/Print Name) Date 9-16-94

Reviewed By [signature] K.R. Simpson (Sign/Print Name) Date 11/7/9

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
18				13.5'-20' SANDY GRAVEL	
				brown, wet, poorly sorted, well graded	
				70% Gravel - very fine to vcp -	
19				Few small cobbles ~~[illegible]~~ to subrnd	[initials] 9-16-94 END
				27% SAND - med to vcs	
				≤3% Silt: 70% Feld + Qtz	
				30% Basalt	
				+ other	
20				Trace Mica	
	Soil 20'-22'	27		20'-30' Silty SANDY GRAVEL	20-22' B < detect cpm
		32		brown, wet poorly sorted, well graded	
21	1345hrs			65-75% GRAVEL - vfp to large cobbles	
				~~25-35%~~ well to subround	[initials] 9-16-94
		46		25-35% SAND - vc-ms	
				5-10% Silt 80% Feld + Qtz	
				20% Basalt +	
22				others	
				Trace Mica	
23					
24					
25				Silt increase to 13% at 25'	25'-27 B < detec
	Soil 25-27	12		Matrix Brown to tan	
				Slightly compact	
26	1445hrs	25			

A-6000-382 (01/93

BOREHOLE LOG

Boring or Well No. N 94A

Sheet 6 of 8

Location 100-N Springs

Project 100-N Springs

Prepared By K.M. Singleton (Sign/Print Name) Date 9/19/94

Reviewed By K.R. Gunn (Sign/Print Name) Date 11/7/94

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
26	Soil 2527 1445hrs	42		20'-30' Silty Sandy Gravel - silt to 13%	
27					
28					
29					
30	Soil	22-.5 33-1.5 44-2		30 ft Silty Sand 10% silt 5% coarse sand/fine gravel, 85% sand, wet	END 9-16-94 at 30' 10" casing at 28.0 Start 9-19-94 at 22' 8" casing
31					
32				32.5 to 33 ft Sandy Gravel; 30% fine to medium sand, 70% Gravel, 1/4" to 4", well rounded cobbles, wet	
33					
34					

A-6000-382 (01/9:

BOREHOLE LOG

Boring or Well No. N-94A

Sheet 5 of 8

Location 100-N-Springs

Project 100-N-Springs

Prepared By [illegible] (Sign/Print Name) Date 9/19/94 9/20/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
34				Sandy Gravel: 30% fine to med. sand; 70% Gravel, 1/4" to 4", well rounded; wet.	
35				34.5ft Sand to Silty Sand; up to 10% silt; 5% gravel, 1/4 to 2" well rounded; 85% fine to medium sand; wet	
		.5ft-20			
36	soil	1.5ft 30		36.5ft Sandy Silt: 30% very fine to fine sand; 70% Silt; damp; red brown; well sorted; cemented	cuttings stuck in Driveb have to dig out w/crow bar will not knock o
		1.5ft 50			
37					
38					
39					
40				40ft. Sandy Silt; 25% very fine sand; 5% clay; 70% silt; slightly damp; red-brown; well sorted; cemented	cuttings stick in DB, have to dig out w/crow bar, will not knock ou
	soil	.5ft 10			
41		1ft 24			
		1.5ft 33			
42					

BOREHOLE LOG

Boring or Well No. W-94-A

Sheet ~~67~~ 6 of 8

Location 100-N springs

Project 100-N Springs

Prepared By Linda [illegible] (Sign/Print Name) Date

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample: Type and No.	Sample: Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
42					
43					
44					
45		.5ft/11		45ft: ~~Silt~~ Sandy mudy Silt; 25% very fine sand, 25% clay; 70% silt; greenish beige; damp; well sorted; cemented.	End 9/19/94 casing o 38 ft.
					Start 9/20/94
46		1ft/48 1.5ft/60		46ft. Sandy muddy Silt; 5% fine sand ~~[illegible]~~ 45% ~~[illegible]~~ clay 50% silt; 2.5Y 5/3, light olive brown, moist to wet; well sorted.	cuttings no longer stick in DB to the point o digging out - will pou out w/work.
47					
48					
49					
50					

A-6000-382 (01/

BOREHOLE LOG

Boring or Well No. N-94-A

Sheet 67 of 8

Location 100-N-Springs

Project 100-N-Springs

Prepared By [illegible] Glaman (Sign/Print Name) Date 9/20/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 11/7/9

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
50				Fine Sand; red brown, wet, well sorted, rounded, well consolidated	
51		.5/20		Silty Clay / Clayey silt; 2.5y 5/3, light olive brown; well sorted - 50% silt 50% clay, cemented, damp	Cuttings difficult to get out of DB.
52	soil	1/25			
		1.5/40			
53					
54				54 ft sandy silty Clay; 10% fine sand, 30% silt, 60% clay 2.5y 5/3, light olive brown, well sorted, damp to wet, cemented	
55		.5/14		55 ft Silty Sand; 20% silt; 80% fine to very fine sand; 2.5y 5/3, light olive brown, well sorted, wet, well consolidated	
56	soil	1/21			
		1.5/43			
57				57 ft. Sandy Silty Clay, 15% very fine sand, 25% silt, 70% clay; 2.5y 5/3, light olive brown, well sorted, wet, well consolidated.	
58					

BOREHOLE LOG

Boring or Well No. N-94-A

Sheet 8 of 8

Location 100-N-Springs

Project 100-N-Springs

Prepared By Linda L. Glaman/Glaman (Sign/Print Name) Date 9/20/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 11/7/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
58					
59					
60				60 ft. Sandy silty Clay: 5% very fine sand; 30% silt; 65% clay; 2.5y 5/3, light olive brown; well sorted; wet; well consolodated.	
		.5/16			
	soil				
61		1/25			
		15/28			
62					TD - 62 ft. 9/20/94

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-95A

Sheet 1 of 5

Location N-Springs

Project 100 N Springs

Prepared By [signature] Date 9/19/94 (Sign/Print Name)

Reviewed By [signature] KRSimpson Date 9/27/9 (Sign/Print Name)

Depth (FEET)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
				Surface has been stabilized.	9/15/94 start drilling
	.5ft	9		Sandy GRAVEL (SG) 68% gravel	HPT checked from 0-1.5
				40% sand; GRAVEL: 80% very	clean. No β, γ detected.
1	1.0ft	20		coarse gravel, 20% coarse gravel;	No VOA's or semi-VOA's
				dry; loosely consolidated; matrix	detected with PID
	1.5ft	30		supported, very poorly sorted.	Blow counts every 5ft at .5ft
				subrounded to rounded gravels	increments
2				80% basalts, 20% gneisses, meta-	1.5 ft No β, γ detected
				quartzites	with HPT instruments
				1.5 ft encounter large cobbles approxim-	
				ately 8 in in diameter. Digging out	Casing - 1st pipe 10.83'
3	Drive Barrel			with shovel. Mostly 4 in diameter	with shoe. Shoe has od
				cobbles that are subrounded to	11.38 in so of 10 in.
				rounded. Predominantly basalt. Trace	
				of μ-oxide staining on gravel/cobbles	0'-1.5' Blow count sample
4				Sand is slightly damp and fairly	and Sr sample
				well sorted. Mostly medium to coarse	
				sand.	
				3.0' Sandy GRAVEL (SG) sand 50%	
5	Blow Counts 5.0'			gravel 50%. Loosely consolidated; matrix	5.0'-6.5' Blow count
				supported; gravel: 70% coarse to very coarse	sample and Sr sample
	.5ft	17		gravel, 30% medium gravel; sand: medium	
				- coarse grain; dry; very poorly sorted	
	.5ft	52		gravels mostly subrounded, some rounded	
6				75% basalts, 25% metaquartzites, gneiss,	
	.5ft	48		plutonic origin. No apparent bedding or	START 16 SEPT 94
				contact observed.	
7				3.5' Grading to gravelly SAND. Sand 70%	Hammer Weight 1170 lbs
				gravel 30% trace of silt. sand 50% medium	Drive Barrel size 7 in.
				grain 25% coarse to very coarse 25% fines.	
				gravel 50% coarse gravel 50% medium gravel.	
8	Drive Barrel			poorly sorted; loosely consolidated; dry;	
				gravel is subrounded to subangular; gravel	
				mostly basalt 70%, 30% quartzites, plutonics	
				7.0' Same as above.	
9					
10				10.0 ft. Gravelly SAND	

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. 199-N-95A

Sheet 2 of 5

Location N Springs, Berm Along Col. R. Project 100 N Springs Barrier Wall

Prepared By RFRaidl/RFRaidl (Sign/Print Name) Date 16Sept94 Reviewed By KRSimpson (Sign/Print Name) Date 9/27/9

Depth (ft)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
10	.SPT	13		10.0 - GRAVELLY SAND 80% med-crse qtz rich sand (brn) and 20% gravel to 6" max. Gravelly portion largely basaltic - subrded. sl. moist; sand brn	Added 8.61 ft 10 in CS casing. 300 cts.
	.SPT	20			
11	.SPT	8			
12	Drive Barrel			Increasing sand to 90%	
13					9/19/94 Commence drilling at 14.0' hole depth.
14					Hit water at 15.5 ft
15	Blow Counts/Sr			15.0' Sandy GRAVEL (SG) 60% sand 40% gravel; gravel: 30% very coarse gravel, 50% coarse gravel, 20% medium-fine gravel; sand: 80% medium-coarse grain, 20% very coarse grain; trace of fines, damp, appear to be within capillary fringe; very poorly sorted; gravels range from subangular-subrounded 65% quartz, meta-quartz, 35% basalts. Gravels - 70% quartzites, gneisses, granitics; 30% basalts, mafics; loosely consolidated, matrix supported, Ringold 15.5 ft hit groundwater. At 16.0' medium-coarse gravel concentration increases. 16.5% trace of silt present in cuttings. May be silt bed, but hard to determine through bagged cuttings.	Blow counts 11, 24, 27 at 15.5 ft Sr sample taken as well as total activity at 15. No β γ detected off of sample or drum cuttings No volatiles or semi-vol. detected with PID instrum 0838 hr Tag water at 14.
16	.5 ft	11			
	.5 ft	24			
	.5 ft	27			
17	Drive Barrel				0918 hr Add 9.43 ft section of casing
18					
19				Approximately 18.0' Sandy GRAVEL grades to uniform sand. Sand 70% med-coarse grain, 20% fines, 10% v. coarse sand. Quartz-rich, trace mica. Wet sand	
20					

A-6000-382 (01/9

BOREHOLE LOG

Boring or Well No. N-95A

Sheet 3 of 5

Location N Springs

Project 100 N-Springs Barrier Wall

Prepared By VM Johnson VM Johnson (Sign/Print Name) Date 9/21/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
20	.5ft	18		20.5ft Sandy GRAVEL (sG) Sand: 75% coarse-very coarse grain 25% medium grain; GRAVEL: 65%	No β, γ detected with HPT instruments
	.5ft	24		coarse gravel, 25% fine-medium	No hazards detected w
21	.5ft	41		gravel, 10% very coarse gravel; very poorly sorted; wet; subangular -	PID 20.0' Blow count and S
22	Air Barrel			subrounded. 75% metaquartzite, gneisses, plutonic; 25% basalt, mafics loosely consolidated, matrix supported. Sample has some silt approx. 5% 23.0' Increasing gravel/size to small cobble	Sample
23					
24				25.0'-26.0' Sandy GRAVEL (sG) 75% coarse-very coarse grain, 20% medium grain, 5% fines. GRAVEL 30% very coarse gravel, 30% coarse gravel, 30% medium-fine gravel. silt minds	25-26.5' Blow count
25	.5ft	21		present in some larger gravels, weather-ing present of smaller gravels: very poorly sorted; wet; subrounded-subangular. Sand: 60% quartzites, 40% mafics,	Sample and Sr Sample No β, γ detected.
26	.5ft	41		trace amounts; loosely consolidated matrix supported. Little Fe-oxide staining	End shift hole 26.5' Start shift 9/21/94
	.5ft	59		Sand is very angular to large particles	27.0' No β, γ detected.
27	Air Barrel			27.0' Gravelly SAND Sand 70% gravel 30% (gS) 0% silt. Gravel 80% fine-medium gravel, 20% coarse gravel. Sand 60% coarse to very coarse 20% medium, 20% fines -	
28				silt, wet, moderately-poorly sorted, sub-rounded, rounded to subangular. 65% quartzite metamorphics, plutonics, 35% mafics, trace of mica, increasing % of silt 29.0' Same material as above. Hole	
29				slowly advancing.	30' Sr and Total Activ Sample. No β, γ detec with field instrument
30					

BOREHOLE LOG

Boring or Well No. N-95A

Sheet 4 of 5

Location 100 N Springs

Project N-Springs Barrier Well

Prepared By VM Johnson VM Johnson (Sign/Print Name) Date 9/21/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 9/27/94

Depth (FEET)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
30	.5ft	19			Blow count sample 30'-31.5' No β, γ detected with field instruments
	.5ft	35			
31	.5ft	98			
32	Air Barrel			32.5' Silty Sandy GRAVEL (GmSG) Silt ~20%, Sand: 20%, Gravel 60%. Silt and sand make up matrix w/in gravel/cobble material; slight cementation. Weathered appearance of gravel material. Some gravels are easily crumbled. Fe-oxide present on gravel cobbles and in spots w/in matrix; wet; very poorly sorted; cobble/gravels mostly subrounded. Some weathered gravels in matrix. Subangular – subrounded. Quartzite, metamorphics, mafic quartzite, feldspathic, igneous, plutonic.	
33					
34					34-35.5' Blow count sample 26, 66, 103
	.5ft	26			
	.5ft	66			
35	.5ft	103			
36					
37					
38				38.5' SILT (ML) 100% silt. Sharp contact. Color 2.5Y 7/3 pale yellow (dry), very well sorted; compact; small traces of medium quartzite/mafic sand.	Rinsed silt contact at 38.5' 5" Sample taken at 39.0' Total activity at 39.0' Blow counts at 39.0' 27, 22, 38
39	.5ft	27			
40	.5ft	22			

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-95A

Sheet 5 of 5

Location 100 N Springs

Project N Springs Barrier Wall

Prepared By VMJohnson VMJohnson (Sign/Print Name) Date 9/22/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
40	Drive Barrel			40.0' SILT/CLAY 70% silt, 30% clay. Clay has high plasticity. easily rolled. Trace of quartzite mafic. medium-fine size. sand grains. 2.5Y 7/3 pale yellow	
41				41.0' Increasing percentage of clay 50% clay, 50% silt	
42					
					End Shift 9/21/94 43.0'
43				43.0' SILT 100% SILT trace of Clay. Consolidated; dry sample low plasticity	Start Shift 9/22/94
	.5 ft	11			43'-44.5' Sr and Blow count sample
	.5 ft	24			No β, γ detected on
44	.5 ft	35			Chemical constituents with field instrument
45	Drive Barrel			45.0' CLAY/SILT 60% CLAY 40% SILT. High plasticity; wet; very well sorted. 10YR 6/4 light yellowish brown	
46					
47					
48					
				49.0' CLAY/SILT same material	
49					49.0' Total Depth
50					

A-6000-382 (01/5

BOREHOLE LOG

Boring or Well No. N-96A

Sheet 1 of

Location N Springs

Project N Springs Barrier Wall

Prepared By VAJohns VAJohns (Sign/Print Name) Date 9/28/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 9/28/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
0	.5ft	9		Sandy GRAVEL (SG) 50% sand, 50% gravel Gravel small cobble, coarse-very coarse gravel, dry. Non-cemented loosely consolidated. Very poorly sorted. Drilling through man-made berm (edge of diesel pit) 10YR 5/3 Brown Dry, dead, surface vegetation Comp - 75% quartzites, plutonics, feldspathics, 25% mafic, igneous	1170 lbs. hammer Drilling within berm No β, γ detected
	.5ft	19			
-1	.5ft	20			Hole sloughing in
2	Drive Barrel				No chemical constituents detected with OVM
3					Blow counts 0-1.5'
4					
5	.5ft	12		5.0' Sandy GRAVEL (SG) 10YR 5/3 brown 55% sand, 40% gravel, 5% silt. Silt present in sand clumps adhering to gravels. Sand 60% med-coarse grain, 40% fines Gravel 70% med-fine gravel, 30% coarse gravel. 55% quartzite, plutonic gravels, 45% igneous, mafic sand 60% quartzite 40% mafic, igneous loosely consolidated. Non-cemented easy drilling	No β, γ detected or chemical constituents
	.5ft	9			Blow counts and Sr Sample 5'-6.5'
6	.5ft	6			
7	Drive Barrel				Easily drilling. Non-cemented. Loose sandy gravels make up berm
8				8.0' Sandy GRAVEL (SG) 10YR 5/3 brown. Still same fill material for berm loosely consolidated. Non-cemented. dry.	
9					
10					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-96A

Sheet 2 of

Location N-Springs

Project N Springs Barrier Wall

Prepared By VM Johnson VMJohnson (Sign/Print Name) Date 9/28/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 9/28/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
10	.5ft	9		Sandy GRAVEL (SG) Sand 60% Gravel 40% sand 50% medium-coarse sand, 50% fines GRAVEL 40% fine-med gravel 40% coarse gravel, 20% very coarse gravel. 10yr 5/3 brown; dry; loosely consolidated, non-cemented; very poorly sorted; gravels rounded to subangular sand; 60% quartzite 40% igneous, mafic (Larger sand)	Blow count Sample 10-11.5 9,12,12 Sr Sam
	.5ft	12			
11	.5ft	12			
12	Drive Barrel				
13					
14				14.0' Sandy GRAVEL (SG) accassional cobbles. Non-cemented; loosely consolidated	
15					
	.5ft	14		Sandy GRAVEL (SG) 10yr 6/2 light brownish gray, sand 50% gravel 50% some silt. Sand: 50% medium-coarse grain, 30% very coarse grain 20% fines. Gravel, 50% fine-medium angular-subangular gravel, 30% very coarse gravel, 20% coarse gravel. loosely consolidated; dry; non-cemented Gravel - 50% igneous, mafic, 50% quartzite, feldspathoes, plutonics Sand - 75% quartzite 25% igneous mafic. Still berm material	Blow count and Sr Sample 15.5' No B, X or chemical constituents detected. Easy drilling
16	.5ft	13			
	.5ft	14			
17	Drive Barrel				
18					
19					
20					

BOREHOLE LOG

Boring or Well No. N-96A

Sheet 3 of

Location N Springs

Project N Springs Burner Well

Prepared By [signature] / L.D. Walker (Sign/Print Name) Date 9-29-94

Reviewed By [signature] (Sign/Print Name) Date 11/7/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
20				Sandy GRAVEL (SG) 10YR5/2 grayish brown. Sand: 50% Gravel: 50% trace or silt. Sand, 20% very coarse grain 40% medium-coarse grain, 40% fines. Gravel 40% fine-medium gravel, 20% coarse gravel 40% very coarse gravel. Very poorly sorted, loosely consolidated: non-cemented. Some cobbles. Gravels 50% quartzite, feldspathic, plutonic 50% igneous, mafic. Sand 75% quartzite, 25% igneous, mafic	
	.5 ft	16			20.5'-22.0' Blow count and Sr sample. No β, γ detected.
21	.5 ft	A			
	.5 ft	35			Easy drilling
22	Drive Barrel				Occassional cobble or two tearing up edge of drive barrel
23					
					End shift 9/28/94 24.5'
24					9/29/94 Begin Shift
25					
	.5 ft	9			25'-26.5' Blow count and Sr and total activity samples. No β, γ detected in Field.
	.5 ft	43		Sandy Gravel (SG) 10YR4/2 dark grayish brown. Sand: 40% Gravel: 60%, tr: silt. Sand 20% v fine to Fine, 50% medium to coarse, 30% very coarse grain. Gravel 30% fine, 30% medium, 20% coarse, 20% very coarse, poorly sorted. Sand angular, Gravel sub-rounded to rounded. No cementation; Some cobble fragments broken by drilling. Gravels 60% basaltic, 40% qtzite, granitics, Sand 50% qtzite, 50% mafics.	
26	.5 ft	56			
27	Drive barrel				Larger rocks - large cobble to boulder size being broken by drilling. Difficult drilling.
28					29' sediment very moist
29					
30					30' water level

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N96A

Sheet 4 of

Location 100-N Springs

Project N Springs ERA

Prepared By L.D. Walker (Sign/Print Name) Date 9-29-94

Reviewed By K.R. Simpson (Sign/Print Name) Date 11/7/9

Depth (Ft.)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
30	.5 ft	37			Water level at 3
				Sandy Gravel (SG)	
	.5 ft	32		Sand 50%, Gravel 50%, silt trace. Sand 20% Fine, 30% med	10" casing set at 31.
31				to crs, 50% very coarse; Gravel	run in with 8" three
	.5 ft	40		40% Fine to med., 30% coarse,	casing; 6" DB
				30% v coarse. Dark grayish	At 30' Blow counts, S
32				brown, (10YR 4/2) Poorly sorted,	and total activity
				Sand angular, Gravel rounded to	samples. No β, γ conta
				sub rounded. Some cobble frags	8" Drive shoe .73' O
				broken from drilling, moisture:	.63' ID.
33	Drive barrel			saturated; Sand 60% qtzite,	At 33', water sampl
				40% mafics, Gravels 50%	collected - total activi
				qtzite, granitics, etc., 50% basalt.	
34					40.80' of 8" casing w/
					shoe.
35					At 35-36.5'; Blow count
	.5 ft	76		Sandy Gravel (SG)	Sr + total activity
	.5 ft	84		As above, slight increase	samples collected.
36				in Sand (60%) to Gravel (40%)	No β, γ detected wit
	.5 ft	28		trace clay bands.	field instruments.
37					
38	Drive barrel				
39					39' - End shift 9/29
					Begin shift 9/30
40	.5 ft	17			

BOREHOLE LOG

Boring or Well No. N96A

Sheet 5 of

Location 100 N Springs

Project N Springs ERA

Prepared By LD Walker / L.D. Walker (Sign/Print Name) Date 9-30-94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 11/7/94

Depth (Ft.)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
40	.5 ft	52			Blow counts, Sr and total activity samples at 39.5' to 41.0'
	.5 ft	refusal		Sandy Gravel (sG) Gravel 60%, Sand 40%, tr silt and clay. Sand 20% fine, 30% medium, 50% coarse. Gravel 40% fine, 30% med., 30% coarse, tr very coarse. Grayish brown (10YR 5/2) moisture: saturated. Sand sub angular to angular, Gravel sub-rounded to angular. Sand 75% qtz, 25% mafics, tr mica. Gravel 60% qtzite, gneiss 40% mafic	No detectable β, γ contamination with Field instruments 6" DB
41	Drive Barrel				
42					Add 10.0' of 8" cs casing. Total 50.80' with shoe.
43					
44					Heaving sand, sometimes about 1 ft into casing.
45	.5 ft	refusal		Sandy Gravel (sG) Similar to above. Sand 50%, Gravel 50%	At 45.0' to 46.5' Blow Counts, Sr and total activity samples No detectable β, γ
	.5 ft	94			
46	.5 ft	43			
47					
48					48 Feet - End shift 9-30-94
49				49.0' Sandy GRAVEL (sG). No change.	49.0' Heaving sands. Blow count sample 49.5'-51' Sr. Sample. No β, γ detected
50	.5ft	41			

A-6000-382 (01/93)

9513333.2355

BHI-001
Rev. 00

BOREHOLE LOG

Boring or Well No. N 96A

Sheet 6 of 8

Location N Springs

Project N Springs ERA

Prepared By [signature] V M Johnson (Sign/Print Name) Date 10/4/94

Reviewed By [signature] KR Simpson (Sign/Print Name) Date 10/4/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
60	.5ft	8		60.0' Silt contact. Clay; very compact 10YR, 5/3 brown. Contact up sharp with sandy GRAVELS. Silt falls out of prior barrel in chunks. Low plasticity	Blow count and Sr sump from 60'-61.5'
61	.5ft	12			No β, γ detected.
	.5ft	26			
62	Drive Barrel			Approximately 62.0' increasing clay content. Moderate to high plasticity. Same color	
63					
64					
65					
66					
67				67.0' Same material No significant change Silt/clay	No β, γ detected at 67.0'
68					Drilling easy through material
69					
70					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N36A

Sheet 7 of 8

Location N Springs

Project N-Springs ERA

Prepared By [signature] (Sign/Print Name) Date 10/4/94

Reviewed By KR Simpson KR Simpson (Sign/Print Name) Date 10/4/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
50	.5ft	77			Blow counts and Sr sam 49.5-51.0'
	.5ft	102		Sandy GRAVEL (SG) 60% sand 40% gravels. Some silt. Sand 60% medium-coarse grain 30% very coarse grain 10% fine. GRAVELS: 70% fine-medium gravels, 20% coarse gravel 10% very coarse very poorly sorted, loosely consolidated Non-cemented. 10YR 5/2 grayish brown (wet), rounded-angular Sands - 80% quartzite, 20% igneous, mafic. GRAVELS 70% quartzites, gneiss, feldspathic 30% igneous, mafics.	Difficulty obtaining recovery! Drive barrel appears likely getting wedged into casing. No B, Y detected. Driller says that the formation is heaving into casing. Drilling plug.
51					
52					
53					
54				At 51.0' layer of small cobbles amongst sandy GRAVELS	
55				55.5' Same Sandy GRAVELS. No significant change. No large cobbles to be seen just small to medium gravels with few coarse gravels. Sands are controlling drilling at this point. We are advancing hole, but sands and small gravels are heaving into casing. Drilling plug. (Sample for Sr prelim) ground up from recovery attempts	Blow counts 55.5'-57.0' (8, 32, 45) Sr Sample
56	.5ft	8			
	.5ft	32			End shift 10/3/94 hole 57.0'. Let sit overnight
57	.5ft	45			Start shift 10/4/94 first drive barrel w/ other recovery
58				58.0' Silt (SG) Non-cemented loosely consolidated. Obtaining recovery. Cleanout plug	No B, Y detected. Obtaining recovery advanced hole. Left silt/clay at 60.0'
59					
60					

Drive Barrel

Drive Barrel

A-6000-382 (01/

9513333.2356

BHI-00
Rev. 0(

BOREHOLE LOG

Boring or Well No. N96A

Sheet 8 of 8

Location N Springs

Project N Springs ERA

Prepared By VM Johnson — VM Johnson (Sign/Print Name) Date 10/4/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 10/4/

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Cas Size & Type, Bit Size, Water Lev
70					
				Total Depth 71.0'	End Shift 10/4/94, hole and casing at 71
71					

A-6000-382 (01

BOREHOLE LOG

Boring or Well No. N-97A

Sheet 1 of 5

Location N Springs

Project N-Springs Barrier Well

Prepared By [illegible] (Sign/Print Name) Date 9/27/94

Reviewed By KR Simpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
0	.5ft	15		1.5' Sandy GRAVEL (sG) Sand 40%	Hammer Weight 1170 lbs
	.5ft	21		gravel 60%; Color 10YR 7/2 light	7" drive barrel 1.8ft length
1	.5ft	13		gray (dry); angular, large basalt	Blow count sample and
				cobbles, medium-coarse gravels	Jr sample for 0-1.5'
				70% small gravels ~ 30%; 60%	No β γ detected with
				quartzite, feldspathic, 40% basalt	field instruments
2				mafic; very poorly sorted; loosely	
				consolidated; Non-cemented; max	
				particle size, cobble.	Casing joint (1) 9.44'
3	Drive Barrel				
				4.0' Same material, but slightly damp	
4				Approximately 4.5'-5.0' Contact between	
				Stabilized or Hanford material and Ringold	
				Sandy GRAVEL (sG) 5.0' Sand	5.0ft blow counts 32, 52,
5				60% med. grain 40% coarse grain	114 Jr sample
	.5ft	32		Gravel; 50% fine gravel, 40% medium	
	.5ft	52		gravel, 10% coarse; 10YR 6/3 pale	No β γ detected with
6				brown (slightly damp); poorly	HPT instruments
	.5ft	114		sorted; angular to subangular;	No chemical constituents
				Sand grains adhering to gravels	detected with OVM
				along with mica (muscovite) flakes	
7				Sand 80% quartzite, 20% mafics; gravels	
				80% quartzite, feldspathics, metamorphs	
				phyllitics, 20% mafics, basalts	
8	Drive Barrel			8.0' Gravelly SAND (GS) Sand 70%	
				gravel 30% Sand: quartzite 70%	
				30% mafics; poorly sorted;	
				Slightly damp.	
9					Blow counts 9.5ft
					27, 39, 107
10	.5ft	27			Jr Sample

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-47A

Sheet 2 of 5

Location N-Springs.

Project N Springs Barrier Wall

Prepared By VM Johnson VM Johnson (Sign/Print Name) Date 9/27/94

Reviewed By KRS KRSimpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
10	.5ft	39		9.5-11.0' Sandy GRAVEL (SG)	No B, T, or chemical
	.5ft	107		Sand: 40% gravel 60%. GRAVEL:	constituents detected
11				20% fine gravel, 60% medium-coarse	with field instruments
				gravel, 20% very coarse gravel. Sand:	
				60% medium grain, 20% coarse grain	11.33' Casing grout added
				20% fine grain (adhering to gravels.	(2)
12				10YR 7/3 very pale brown (slightly wet),	
				very poorly sorted; subangular - sub	
				rounded. Non-cemented. Loosely	Wet ground water at 13.0'
				consolidated. 70% meta quartzites	
13				30% other metamorphics, plutonics, mica	
				grains (flakes) on gravels, some oxidation	
				and rust (weathering) present on and off	
				gravels.	
14				14.0'-16.0' Sandy GRAVEL (SG)	
				Sand 40% GRAVEL 60% GRAVEL:	End Shift 16.0'
				50% coarse gravel, 30% fine-medium	Start Shift 9/24/94
				gravel, 20% very coarse gravel. SAND:	
15				70% medium-coarse, 20% coarse, 10%	
				fines: very poorly sorted: subrounded-	5r sample taken 9/23/94
				subangular. Some gravels rounded, wet	from 14.0'-16.0'
				70% meta quartzites, metamorphics, plutonics	
16				30% mafic igneous; some silt present,	16.0' Blow counts at 16.0'
	.5ft	15		in matrix; appears to be matrix supported.	15, 25, 67
				16.0'-18.0' Same material as above,	
	.5ft	25		but with an increasing percentage	Groundwater sample taken
17				of silt - 10%. Hole advancing at	9/24/94 from 12.25'
	.5ft	67		a somewhat slower rate than	static water level
				previous material. This is due to	
				larger gravel/cobbles.	No B, T, or chemical
18					constituents detected from
					14-17'
					18-19' Driller having
					hard time setting the casing.
19					Change drive barrels
20					

Drive Barrel

5r Sample 14'-16'

Drive Barrel

BOREHOLE LOG

Boring or Well No. N-97A

Sheet 3 of 5

Location N Springs

Project N Springs

Prepared By [illegible] (Sign/Print Name) Date 9/27/94

Reviewed By KRSimpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
20	.5ft	11		Gravelly SAND (GS) 80% sand: medium-coarse grain, some fines. Gravel 90% small cobble, 10% very coarse gravel; wet; moderately-poorly sorted; gravels are rounded; metaquartzite cobbles/gravels. Sand 80% quartzite, 20% igneous, mafic. Mostly present within sand and on gravels/cobbles	20-21.5 Blow counts and Sr sample taken
	.5ft	25			
21	.5ft	120			21'-22' Driller says he is experiencing heavin sands within the casing
22	Thin Bed			22.0' Gravelly SAND (GS) increasing amount of small gravels with decreasing amount of cobbles	
23					
24				24.5' Increasing to very coarse gravel	
	.5ft	8			24.5'-26.0' Blow count and Sr sample
25	.5ft	19		25.0'- 26.5' Sandy GRAVEL (SG) 50% sand 50% gravel sand: 70% med-coarse grain. Mostly quartzite Sand some mafic sand. 30% fines trace of silt. Gravel: 60% med-coarse gravel, 20% very coarse gravel, 20% fine gravel 70% quartzite, plutonic, 30% igneous, mafic; wet; very poorly sorted. Gravels subrounded-rounded	
	.5ft	22			
26					
27					
28	Thin Bed			28.0' Slightly Silty SAND 90% sand 15% silt. Sand: 70% med-coarse grain, 30% fines; wet; moderately sorted	28' difficulty retrieving drill stem from hole. Plug forming from sands
29				29.0' Slightly silty SAND 90% sand, 15% silt, same as above, well sorted. Slumping consistency. Sands are heaving up in casing	End Shift 9/24/94 29.0'
	.5ft	42			
30					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-97A

Sheet 4 of 5

Location N Springs

Project N Springs Barrier Well

Prepared By VM Johnson VM Johnson (Sign/Print Name) Date 9/27/94

Reviewed By KRSimpson KRSimpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
30	.5ft	99		Contact at 30.0' with Sandy GRAVEL (SG) Sand: 35%, gravel 55%, silt 10% Sand: well sorted 80% medium sand, 20% fines, 75% quartzite 25% mafic, igneous. Gravel 30% very coarse gravel, 30% coarse gravel, 40% medium-fine, very poorly sorted; wet: 80% quartzite, metamorphics, plutonics, 20% mafic, igneous clasts gravels rounded, smaller gravels are subangular-subrounded; loosely consolidated	9/26/94 Blow count and Sr Sample 29.5'-31.0' 42, 99, 102
	.5ft	102			
31	Drive Barrel				
32					
33				31.5' Grading to Gravelly SAND (GS) 80% sand, 20% fine to medium gravel 70% fine 30% medium; moderately sorted; wet; some silt	
34				33.5' Sandy GRAVEL (SG) sand 45% gravel 55% gravels: fine-medium	
35				35.0' Sharp contact with SILT (M) 80-90% silt, 10-20% clay, trace of fine quartzite/mafic sands mostly quartzites; medium-low plasticity 2.5y 6/2 light brownish gray; compact	35 Blow count and Sr Sample
	.5ft	26			
	.5ft	33			No β, γ, or chemical constituents detected with field instruments
36	.5ft	102			
37	Drive Barrel				
38					
39					
40					

BOREHOLE LOG

Boring or Well No. N-97A

Sheet 5 of 5

Location N Springs

Project N Springs Barrier Well

Prepared By [illegible] (Sign/Print Name) Date 9/27/94

Reviewed By [illegible] KRSimpson (Sign/Print Name) Date 9/27/94

Depth (FT)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
40	.5ft	11		SILT/CLAY high percentage of clay. High plasticity 2.5Y 6/2 light brownish gray.	Blow count sample from 40-41.5'
	.5ft	19			
41	.5ft	42			No β, γ or chemical constituents detected
42	Mini Barrel				
43					
44					
45				SILT/CLAY	
46					Total depth reached at 46.0' 9/27/94

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-99-A

Sheet 1 of 5

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [illegible] Date 8/21/94 (Sign/Print Name)

Reviewed By KRSimpson KRSimpson Date 9/24/94 (Sign/Print Name)

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
0				Sandy Gravel; 30% fine to med. sand, subangular; 70% gravel, pea gravel to 6+ inches, rounded, oblong; poorly sorted, dry, reddish brown w/ some whitish grey fines some caliche on larger cobbles	
1					
2	TA.				600 cpm out of bottom of DB, 400 cpm in drum, 200 cpm on fi for total activity
3					
4					
5				note: cobble 8+" x 4+"	500 cpm cobble w/caliche 400 cpm drum, 200 cp Total activity fines
6					difficult drilling due to rocks
					cobble w/caliche 1100 cpm
7				sandy gravel; 40% sand (fine grained) 60% gravel, 1/4" to 3" rounded, dark greenish grey, poorly sorted, dry	
8					

BOREHOLE LOG

Boring or Well No. N-99-A

Sheet 2 of 5

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [illegible] (Sign/Print Name) Date 9/21-9/22/94

Reviewed By KRSimpson (Sign/Print Name) Date 9/26/94

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
8				sandy gravel, 40% fine sand, 60% gravel 1/4" to 3", dark greenish gray (w/ lite whitish fines, dry, poorly sorted, loose	end 9/21/94 Start 9/22/94
9				sandy gravel, 50% medium to coarse sand, subangular, somewhat sorted, 50% gravel pea to 4", predominately 1-2", rounded to well rounded, oblong, poorly sorted, damp to moist, loose, reddish brown	
10		TA			
11				sandy gravel, 10% coarse sand, 90% gravel pea to 3" rounded, poorly sorted, wet	400 cpm
12					
13					Water 12.56ft 350 cpm
14					400 cpm
15					no recovery in OB
16					

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. N-99-A

Sheet 3 of 5

Location 100-N-Springs

Project 100-N Springs Characterization

Prepared By Linda R B Glaman Glaman (Sign/Print Name) Date 9/22/94 9/23/94

Reviewed By K R Simpson (Sign/Print Name) Date 9/26/

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
16				Sandy gravel; 20% medium to coarse sand, subangular; 80% gravel pea to 4+" (broken), rounded, oblong; wet, poorly sorted, loose	~~No R~~
17		TA N-99A-15 N-99A-15W			
18					200 cpm
					No recovery
19					
20				Sandy Gravel 40% sand - med to coarse grained, subangular; 60% gravel - pea to 3" rounded, mostly 1-2"; wet, bimodal sorting, loose	
21		TA N-99A-20 N-99A-20W		Sandy Gravel 20% sand - 5% fine, 90% coarse, subangular; 80% gravel 1/4" to 3", rounded; wet; poorly sorted; loose	
22					
					End Shift 9/22/94 - 23 ft
23					Start work 9/23/94
					0 cpm
24					

BOREHOLE LOG

Boring or Well No. N-99 A

Sheet 4 of

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] Date 9/23/94 (Sign/Print Name)

Reviewed By [signature] Date 9/26/9 (Sign/Print Name)

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
24					
					0 cpm
25	TA N-99A-25			Sand 5% gravel, 1-2", rounded; 95% medium sand; subrounded; wet; well sorted; loose	
26				Sandy Gravel <5% medium sand; 95% Gravel 1/2 to 3" mostly 1/2-1"; wet; moderately well sorted; rounded-oblong; loose	0 cpm
27					
28					
29					
30	TA N-99A-30 N-99A-30			Sandy Gravel; 10% medium sand, 90% gravel 1/2-2+", wet, sorted, rounded-oblong, loose	0 cpm
31					
32					

A-6000-382 (01/93)

BHI-00
Rev. 00

BOREHOLE LOG

Boring or Well No. 100-N-99-A

Sheet 5 of 5

Location 100-N Springs

Project 100-N Springs Characterization

Prepared By [signature] (Sign/Print Name) Date 9/23/94

Reviewed By KRSimpson (Sign/Print Name) Date 9/26/

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
32				Sandy Gravel: 10% medium sand, 90% gravel ½-2+", wet, sorted, rounded-oblong, loose	
33				(now in bottom of hole - Medium sand, sub angular to subrounded wet, well sorted, loose)	TD at 33ft (note 2f of sand washed back into casing.
34					
35				Drilled to 35ft.	Drilled to 35ft.

A-6000-382 (01/93)

APPENDIX B

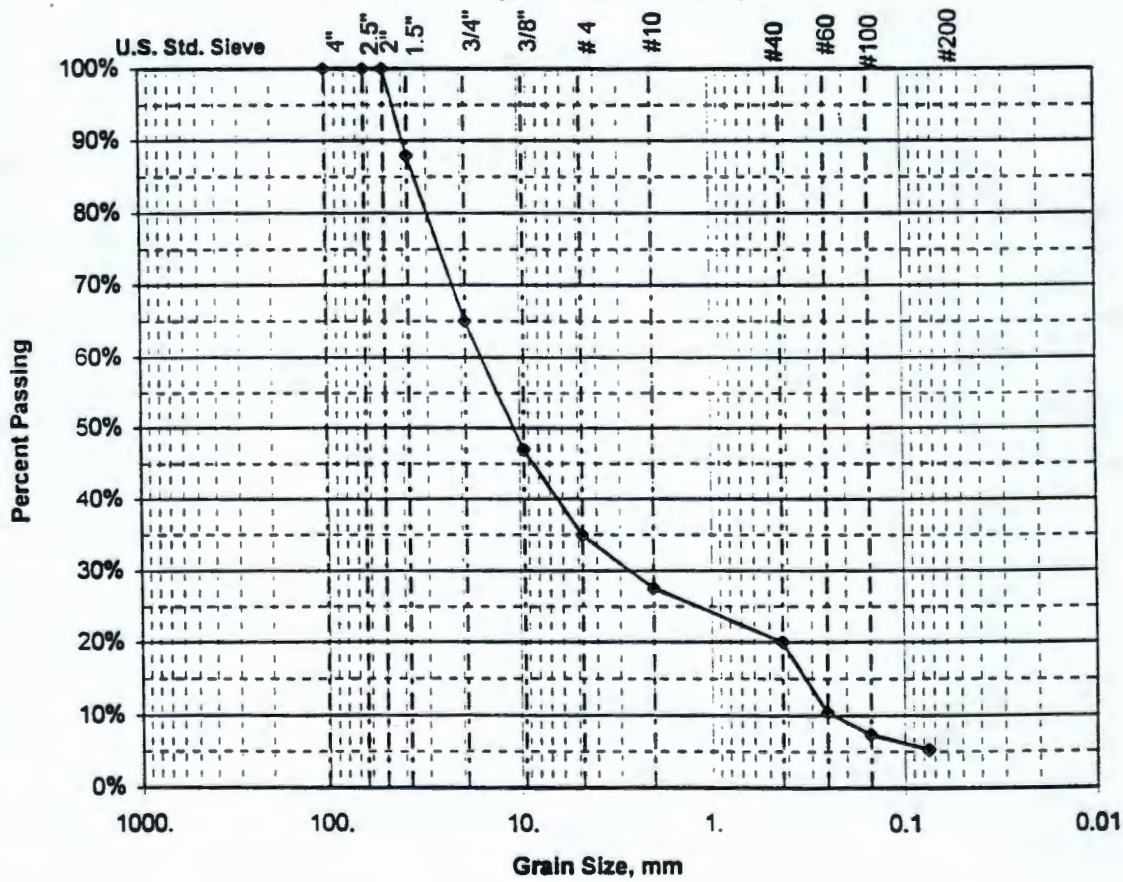
GRAIN SIZE DATA

GEOTECHNICAL ENGINEERING LABORATORY
GEL-07
SIEVE ANALYSIS

WELL #	N96A	DEPTH	49.5-51'	LAB#	5-0011	HEIS #	NA
TESTED BY	HLB/FMW	CONTACT	V. Johnson	PHONE	2-0557	DATE	10/19/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
3377.2	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	0.0	0.0	100.0	50.000	
	1.5"	409.1	12.1	87.9	37.500	
	3/4"	1182.4	35.0	65.0	19.000	
	3/8"	1791.4	53.0	47.0	9.500	
WT.-#10	# 4	2196.6	65.0	35.0	4.750	
SAMP.(g)	#10	2446.5	72.4	27.6	2.000	
223.3	#40	61.5	27.5	20.0	0.425	
	#60	139.1	62.3	10.4	0.250	
	#100	164.1	73.5	7.3	0.150	
	#200	181.0	81.1	5.2	0.075	

Sieve Analysis Data for Sample 5-0011



All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.

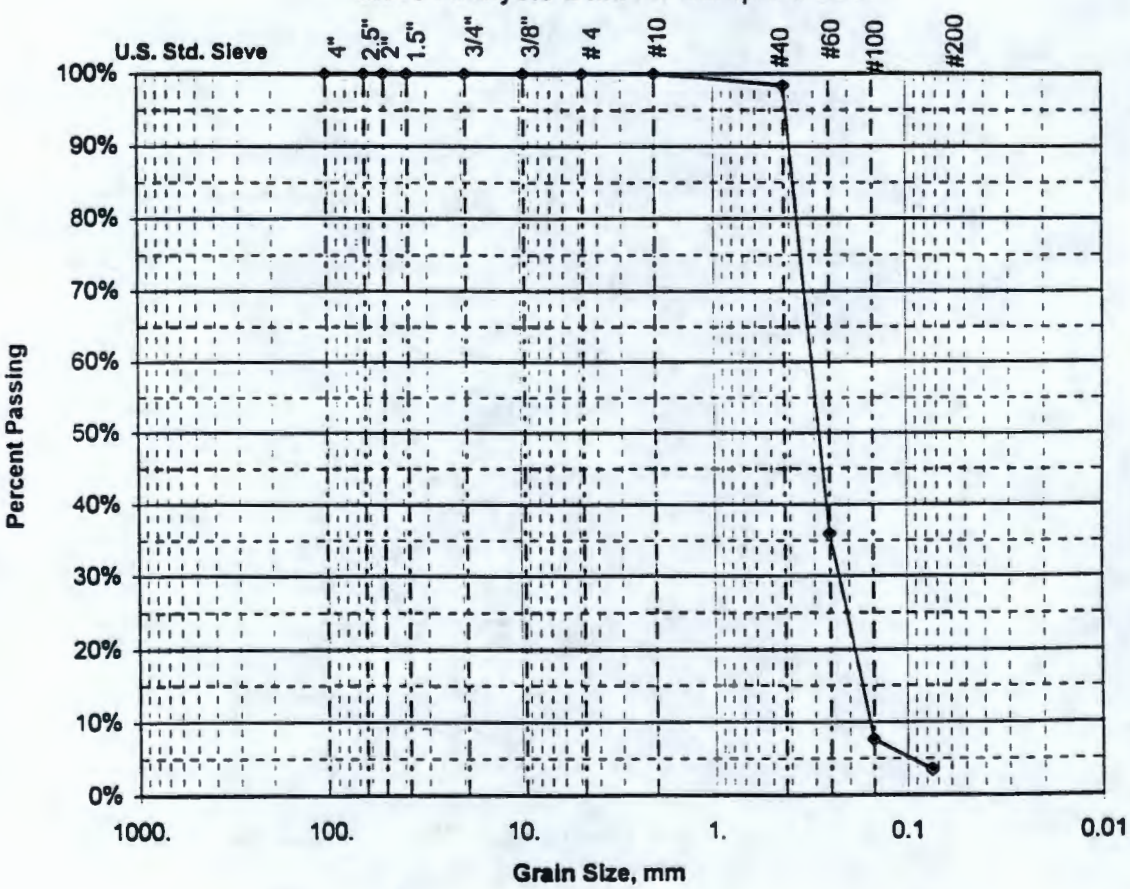
Checked By: H Hamget Date: 10/19/94

GEOTECHNICAL ENGINEERING LABORATORY
GEL-07
SIEVE ANALYSIS

WELL #	N92A	DEPTH	25'	LAB#	5-0010	HEIS #	NA
TESTED BY	HLB/FMW	CONTACT	V. Johnson	PHONE	2-0557	DATE	10/19/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1088.2	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	0.0	0.0	100.0	50.000	
	1.5"	0.0	0.0	100.0	37.500	
	3/4"	0.0	0.0	100.0	19.000	
	3/8"	0.0	0.0	100.0	9.500	
WT.-#10	# 4	0.0	0.0	100.0	4.750	
SAMP.(g)	#10	0.0	0.0	100.0	2.000	
204.2	#40	3.4	1.7	98.3	0.425	
	#60	130.8	64.1	35.9	0.250	
	#100	188.6	92.4	7.6	0.150	
	#200	197.1	96.5	3.5	0.075	

Sieve Analysis Data for Sample 5-0010



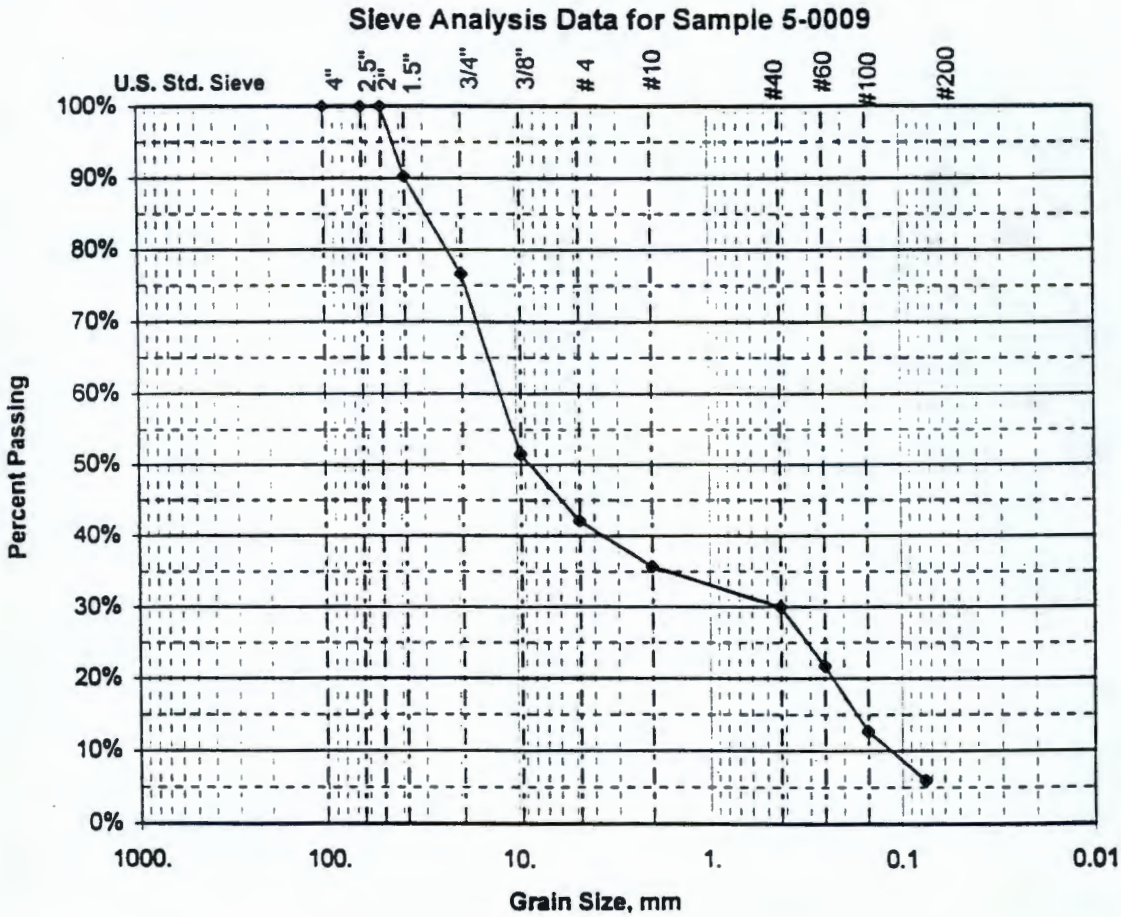
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.

Checked By: J Harrupt Date: 10/19/94

GEOTECHNICAL ENGINEERING LABORATORY
GEL-07
SIEVE ANALYSIS

WELL #	N94A	DEPTH	20-22'	LAB#	5-0009	HEIS #	NA
TESTED BY	HLB	CONTACT	V. Johnson	PHONE	2-0557	DATE	10/19/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2511.9	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	0.0	0.0	100.0	50.000	
	1.5"	244.3	9.7	90.3	37.500	
	3/4"	588.0	23.4	76.6	19.000	
	3/8"	1219.3	48.5	51.5	9.500	
WT.-#10	# 4	1455.6	57.9	42.1	4.750	
SAMP.(g)	#10	1615.7	64.3	35.7	2.000	
239.1	#40	38.4	16.1	29.9	0.425	
	#60	93.9	39.3	21.7	0.250	
	#100	154.1	64.5	12.7	0.150	
	#200	199.4	83.4	5.9	0.075	



All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.

Checked By: [illegible] Date: 10/19/94

DISTRIBUTION

Number of Copies

ONSITE

43

D. R. Baker (3)	X7-02
M. P. Connelly	H6-04
S. R. Durfee	X5-50
R. R. Gauthier	X0-37
R. C. Havenor (3)	N3-05
M. R. Hood	X0-17
G. L. Jacksha (3)	H4-79
R. L. Jackson	H6-04
V. M. Johnson (3)	H6-04
A. L. Langstaff (2)	H6-01
M. J. Lauterbach (3)	H6-01
K. A. Lindsey	H6-02
G. B. Mitchem	X4-80
A. L. Nellesen	X0-30
J. C. Plastino	X5-57
R. E. Peterson	H6-05
T. P. Rudolph	R3-54
K. R. Simpson	H6-07
E. F. Shorey	H4-79
P. J. Valcich	H6-04
L. D. Walker	H6-05
J. L. Walsh	X5-54
J. P. Zoric (2)	X0-21
BHI Document Control (3)	H4-79
BHI Project File	H6-08
N Springs Project File	N3-05
ERC	H6-07
EPIC (2)	H6-08

THIS PAGE INTENTIONALLY
LEFT BLANK

DISTRIBUTION

Number of Copies

ONSITE

43

D. R. Baker (3)	X7-02
M. P. Connelly	H6-04
S. R. Durfee	X5-50
R. R. Gauthier	X0-37
R. C. Havenor (3)	N3-05
M. R. Hood	X0-17
G. L. Jacksha (3)	H4-79
R. L. Jackson	H6-04
V. M. Johnson (3)	H6-04
A. L. Langstaff (2)	H6-01
M. J. Lauterbach (3)	H6-01
K. A. Lindsey	H6-02
G. B. Mitchem	X4-80
A. L. Nellesen	X0-30
J. C. Plastino	X5-57
R. E. Peterson	H6-05
T. P. Rudolph	R3-54
K. R. Simpson	H6-07
E. F. Shorey	H4-79
P. J. Valcich	H6-04
L. D. Walker	H6-05
J. L. Walsh	X5-54
J. P. Zoric (2)	X0-21
BHI Document Control (3)	H4-79
BHI Project File	H6-08
N Springs Project File	N3-05
ERC	H6-07
EPIC (2)	H6-08

THIS PAGE INTENTIONALLY
LEFT BLANK

9513333.2367

SECTION 3

SOIL GEOCHEMISTRY

THIS PAGE INTENTIONALLY
LEFT BLANK