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CONTENTS

1.0 INTRODUCTION	1
1.1 BACKGROUND INFORMATION	1
1.2 QUALITY ASSURANCE	4
2.0 WELL 199-K-106A	5
2.1 DRILLING	5
2.2 WELL COMPLETION	5
2.3 WELL DEVELOPMENT AND PUMP INSTALLATION	6
2.4 AQUIFER TESTING	6
3.0 WELL 199-K-107A	6
3.1 DRILLING	6
3.2 WELL COMPLETION	8
3.3 WELL DEVELOPMENT AND PUMP INSTALLATION	9
3.4 AQUIFER TESTING	9
4.0 WELL 199-K-108A	9
4.1 DRILLING	9
4.2 WELL COMPLETION	10
4.3 WELL DEVELOPMENT AND PUMP INSTALLATION	10
4.4 AQUIFER TESTING	10
5.0 WELL 199-K-109A	10
5.1 DRILLING	10
5.2 WELL COMPLETION	11
5.3 WELL DEVELOPMENT AND PUMP INSTALLATION	12
5.4 AQUIFER TESTING	12
6.0 WELL 199-K-110A	12
6.1 DRILLING	12
6.2 WELL COMPLETION	13
6.3 WELL DEVELOPMENT AND PUMP INSTALLATION	14
6.4 AQUIFER TESTING	14
7.0 WELL 199-K-111A	14
7.1 DRILLING	14
7.2 WELL COMPLETION	15
7.3 WELL DEVELOPMENT AND PUMP INSTALLATION	15
7.4 AQUIFER TESTING	16
8.0 REFERENCES	16
APPENDIXES	
A. Drilling and Construction Data	A-1
B. Borehole Sample Data	B-1
C. Well Development and Pump Installation	C-1
D. Aquifer Tests	D-1

CONTENTS (cont.)

LIST OF FIGURES

1-1. Location of Wells 199-K-106A, 199-K-107A, 199-K-108A, 199-K-109A, 199-K-110A, and 199-K-111A	2
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LIST OF TABLES

1-1. Survey Data for RCRA Groundwater Monitoring Wells Installed in the 100-K Area in 1994	3
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BOREHOLE DATA PACKAGE FOR THE 100-K AREA
GROUNDWATER WELLS FOR CY 1994

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

Six new groundwater monitoring wells were installed in 1994 at the 100-K Area Fuel Storage Basins at the Hanford Site, located in southeast Washington State. These wells were constructed in support of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) milestone M-34-00, T-03 (Ecology et al. 1994). The wells will enhance the existing groundwater monitoring network that is used to detect impacts on groundwater resulting from K basin operations.

The hydrogeology of the 100-K Area is described in Lindberg (1993). The groundwater monitoring well installation plan (Williams 1994) provides the data quality objectives and justification for the new wells. All wells were constructed to the specifications described in WHC (1990).

All six wells are shallow (water table) groundwater monitoring wells. Wells 199-K-106A, 199-K-109A, and 199-K-111A were drilled deep through the upper unconfined aquifer into the first confining unit to collect hydrogeologic characterization data and confirm aquifer boundaries. Wells 199-K-106A, 199-K-107A, and 199-K-108A were installed around the K-West basin/reactor building (Building 105-KW) and Wells 199-K-109A, 199-K-110A, and 199-K-111A were installed around the K-East basin/reactor building (Building 105-KE). Wells 199-K-108A and 199-K-110A are upgradient monitoring wells for the facilities; the other wells are in downgradient locations. Figure 1-1 illustrates the six well locations. Coordinates and elevations are listed in Table 1-1. For convenience, well numbers are often shortened by dropping the "199-" prefix.

This data package is a compilation of data and information on well drilling, construction, development, and borehole hydrogeologic characterization. Copies of forms, notes, and diagrams completed in the field comprise the bulk of this document. Few interpretations are included. Major stratigraphic units were differentiated by the authors based on the geologic and geophysical logs, X-ray diffraction analysis, and lithologic samples. Aquifer test data were interpreted to estimate aquifer properties. Testing was accomplished by monitoring the aquifer development pumping for withdrawal and recovery data and conducting slug injection and withdrawal tests. A 2-m long, 0.06-m-diameter (6-ft long, 0.20-ft-diameter) rod was used for the slug testing. The test data were analyzed using the Bouwer-Rice (1976) method. The aquifer development testing was generally not interpretable because of the short test durations, variable flow rates, lack of a check valve, and partial well penetration. A summary of the hydrologic testing results is presented in Appendix D. An insitu groundwater flow meter test was conducted in one of the new wells (199-K-106A). Results are also included in Appendix D.

Figure 1-1. Location of Wells 199-K-106A, 199-K-107A, 199-K-108A, 199-K-109A, 199-K-110A, and 199-K-111A.

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Table 1-1. Survey Data for RCRA Groundwater Monitoring Wells Installed in the 100-K Area in 1994.

Well	Datum or coordinate system	Coordinate (center of casing)	Vertical datum (m)	Elevation (top of brass marker)	Elevation (top of Hydrostar® plate)
K-106A	100-K	N:4,625.7 W:6,397.7	NGVD29(93)	464.30	467.30
	Lambert	N:146,502.39 E:568,697.40	NAVD88	142.549	143.465
K-107A	100-K	N:4,704.6 E:6,790.7	NGVD29(93)	464.56	467.65
	Lambert	N:146,468.81 E:568,579.94	NAVD88	142.630	143.570
K-108A	100-K	N:4,331.3 W:6,587.4	NGVD29(93)	465.04	468.25
	Lambert	N:146,396.14 E:568,687.20	NAVD88	142.774	143.753
K-109A	100-K	N:4,703.69 W:4,788.80	NGVD29(93)	465.18	468.21
	Lambert	N:146,748.499 E:569,122.180	NAVD88	142.807	143.743
K-110A	100-K	N:4,335.56 W:4,580.71	NGVD29(93)	465.66	467.99
	Lambert	N:146,677.910 E:569,230.007	NAVD88	142.965	143.674
K-111A	100-K	N:5,066.17 W:3914.79	NGVD29(93)	459.12	462.04
	Lambert	N:146,968.875 E:569,308.169	NAVD88	140.972	141.862

NOTE: Lambert WCS83S coordinates are in meters. The 100-K coordinates are in feet (they are equivalent to "Hanford Coordinates"). NGVD29(93) elevations are based on a re-survey conducted by the U.S. Army Corp of Engineers in 1993. The 100-K elevations and coordinates are most comparable to survey data for other wells currently in the groundwater database.

NAVD = North American Vertical Datum.

NGVD = National Geodetic Vertical Datum.

The appendixes include the following documents for each well:

- Appendix A
 - Well summary sheet
 - Well construction report
 - Borehole log
 - Geophysical log(s)
 - Well Construction Verification Report
- Appendix B
 - Data summary tables
 - Soil physical data
 - Groundwater rad/chemistry data
- Appendix C
 - Well development record
 - Pump installation record
- Appendix D
 - Drawdown and recovery data
 - Slug test data
 - Flow meter test data
 - Aquifer test analysis.

The groundwater radioisotope results and the hydrologic sample results are presented in Appendix B.

The boreholes and soils were routinely monitored for organic vapors and radioactive contaminants. There was no detectable chemical contamination at any of the locations; however, above background radiation activity levels were discovered at all four downgradient wells and at K-108A. Monitoring results are presented in Appendix B.

A seismic engineering study, supported by seismic wave velocity testing during the construction of Well 199-K-109A, will be released in a separate report.

1.2 QUALITY ASSURANCE

First-line verification of well construction aspects that support groundwater monitoring wells "fitness for use" determination is performed by the well site geologist and is documented on the Well Construction Verification Report (Appendix A). Westinghouse Hanford Company (WHC) Engineering and Environmental Quality Assurance performed Quality Assurance surveillance on each of the six wells. The surveillance activity consisted of spot checks of various attributes such as equipment decontamination, personnel qualification, drilling process, construction materials, material storage, safety requirement compliance, waste handling, documentation, and drilling logs. All of the surveillance results were satisfactory. No nonconformances were noted or reported during this drilling campaign.

The surveillance reports issued for this campaign are E94-020, E94-045, E94-072, E94-091, E94-105, and E94-121. These reports and other records (e.g., chain of custody forms, decontamination records, daily field records, and training records) are on file with WHC.

2.0 WELL 199-K-106A

2.1 DRILLING

Well 199-K-106A was drilled with a cable tool rig. This borehole was drilled to characterize the vadose zone and the entire upper unconfined aquifer below the 105-KW facility and complete a shallow groundwater monitoring well. Drilling began on 19 January 1994 and was completed 16 February 1994. The total depth of the borehole was 58 m (190 ft) below land surface (bls). Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 3 m (9.5 ft) bls; 25.4-cm (10-in.) diameter casing from surface to 29 m (95 ft) bls; 20-cm (8-in.) diameter casing from surface to 50 m (164.2 ft) bls. Approximately 234 L (618 gal) of water were added during drilling. Drilling information is included in Appendix A.

Sediments were primarily gravelly sand to sandy gravel with the sandy silt of the Ringold Mud unit encountered at 50 m (162.5 ft) (see borehole log in Appendix A). The contact between the Hanford and Ringold formations was encountered at approximately 6.4 m (21 ft). The water table was encountered at 22.8 m (73.8 ft). Samples were collected approximately every 1.5 m (5 ft) of depth for calcium carbonate analysis, soil moisture, radiological screening, and lithologic archiving. A sample for grain size analysis was collected from the interval at the water table to be screened (27 m [88.5 ft] bls). Three split spoon samples were collected, two in the Ringold gravel and one in the lower mud, and submitted for saturated hydraulic conductivity and bulk density/porosity analysis. Four groundwater samples were collected during drilling through the aquifer and submitted for radiological analysis (the last groundwater sample, taken from the base of the aquifer, was submitted for chemical analysis also). All sediment and groundwater data results are contained in Appendix B.

Borehole geophysics, consisting of the radiologic logging system (RLS) spectral gamma tool, were run on 1 February 1994 from 0 to 27.9 m (0 to 91.5 ft) bls through the 25.4-cm (10-in.) temporary casing and on 16 February 1994 from 27.6 to 52 m (90.5 to 170 ft) bls through the 20-cm (8-in.) temporary casings. A copy of the geophysical log is included in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. These results and the groundwater sampling results indicate no detectable chemical contamination; however, groundwater sample analysis did reveal above background levels of Carbon-14, tritium, alpha, and beta radiation. These data and a summary of results are contained in Appendix B.

2.2 WELL COMPLETION

A permanent casing and screen were installed in Well K-106A between 17 and 24 February 1994. Static water level at that time was 22 m (72.36 ft) bls. The borehole was plugged back with bentonite (hole plug) from total depth (54.3 m [178.2 ft]) to 28.9 m (94.7 ft) bls. A 20-slot, 10-cm (4-in.) diameter stainless steel screen was set from 27.8 to 21.4 m (91.1 to 70.1 ft) bls. Permanent casing is 10-cm (4-in.) diameter stainless steel with centralizers from 21.4 m (70.1 ft) bls to above land surface. The sand pack is 10-20 mesh silica sand (28.9 to 19.8 m [94.7 to 65.1 ft] bls). The annular seal comprises bentonite pellets (19.8 to 18.9 m [65.1 to 62.0 ft] bls), bentonite crumbles (18.9 to 2.4 m [62.0 to 8.0 ft] bls), and cement grout (2.4 to 0.6 m [8.0 to 2.0 ft] bls). The remaining annulus was filled with

concrete and a 1.2 m by 1.2 m by 15 cm (4 ft by 4 ft by 6 in.) concrete pad, with a 15-cm (6-in.) protective stainless steel surface casing, locking cap, and four protective posts installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Appendix A contains documentation of well completion.

The only additives during well drilling and completion were water and "well guard,"¹ a non-petroleum-based lubricant used on drilling tools and casing threads.

2.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-106A was developed 1 March 1994. A temporary submersible pump removed 11,841 L (3,128 gal) of water with a final turbidity of 4.2 nephelometric turbidity units (NTUs). Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-106A on 3 March 1994. The pump intake is at 26.98 m (88.54 ft) below top of casing. A pump installation form is included in Appendix C.

2.4 AQUIFER TESTING

Water level data were collected during development (see Section 2.3). Slug injection and withdrawal test was also conducted in Well K-106A on 2 March 1994 after well development. Hydraulic conductivity was estimated as $3.0\text{E-}03$ cm/s (8.58ft/d), based on slug withdrawal, and $3.1\text{E-}03$ cm/s (8.80 ft/d) based on slug injection. Aquifer test data and their interpretation are included in Appendix D.

An in situ groundwater flow meter test was conducted in the screened interval in Well K-106A on 29 March 1994. The calculated average groundwater velocity is $7.29\text{E-}4$ cm/s (2.07 ft/day) assuming an average porosity of 20 percent. The groundwater flow direction measured during this test was 342.48 degrees azimuth (approximately NNW). Test results are included in Appendix D.

¹Well-guard is a trademark of Jet-Lube Incorporated of Houston, Texas.

3.0 WELL 199-K-107A

3.1 DRILLING

Well 199-K-107A was drilled with a cable tool rig. This borehole was drilled to characterize the vadose zone hydrogeology near the 105-KW facility sump (D-sump) and complete a shallow groundwater monitoring well. Drilling began on 2 March 1994 and was completed in 11 March 1994. The total depth of the borehole was 29 m (95.2 ft) bls. Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 3.0 m (9.6 ft) bls; 20.3-cm (8-in.) diameter casing from surface to 28.8 m (94.6 ft). Approximately 94.6 L (25 gal) of water were added during drilling. Drilling information is compiled in Appendix A.

Sediments were primarily gravelly sand to sandy gravel (see borehole log in Appendix A). The contact between the Hanford fill and Ringold E formation was encountered at approximately 5.8 m (19 ft). The water table was encountered at 22.8 m (74.7 ft) bls. Samples were collected approximately every 1.5 m (5 ft) of depth for calcium carbonate analysis, soil moisture, radiological screening, and lithologic archiving. Split spoon and water samples were collected from the Ringold at the water table (26.2 to 26.4 m [85.96 to 86.46 ft] bls). The split spoon sample was submitted for saturated hydraulic conductivity and grain size analysis. The water samples were submitted for radiological analysis. All data results are contained in Appendix B.

Borehole geophysics, consisting of the RLS spectral gamma tool, were run on 11 March 1994 from 0 to 28.0 m (0 to 92.0 ft) bls through the 20.3-cm (8-in.) temporary casing and on 14 February 1994 from 3.8 to 15.8 m (12.5 to 52 ft) bls through the 20.3-cm (8-in.) temporary casings. Copies of the geophysical logs are in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. There was no detectable chemical contamination; however, geophysical logging did detect several vadose anomalies that were identified to be manmade radionuclides (see Appendix A).

3.2 WELL COMPLETION

A permanent casing and screen were installed in Well K-107A between 11 and 16 March 1994. Static water level at that time was 22.5 m (73.98 ft) bls. A 10-slot, 10-cm (4-in.) diameter stainless steel screen was set from 28.2 to 21.8 m (92.64 to 71.65 ft) bls. Permanent casing is 10-cm (4-in.) diameter stainless steel with centralizers from 21.8 m (71.65 ft) bls to above land surface. The sand pack is 20-40 mesh silica sand (28.6 to 20.6 m [93.7 to 67.6 ft] bls). The annular seal comprises bentonite pellets (20.6 to 19.4 m [67.6 to 63.8 ft] bls), bentonite crumbles (19.4 to 2.6 m [63.8 to 8.5 ft] bls), and cement grout (2.6 to 0.6 m [8.5 to 2.0 ft] bls). The remaining annulus was filled with concrete and a 1.2 m by 1.2 m by 15.2 cm (4 ft by 4 ft by 6-in.) concrete pad, 15.2-cm (6-in.) protective stainless steel surface casing, locking cap, and four protective posts were installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Well completion documentation is compiled in Appendix A.

The only additives during well drilling and completion were water and "well guard," a non-petroleum-based lubricant used on drilling tools and casing threads.

3.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-107A was developed 13 April 1994. A temporary submersible pump removed 5,451 L (1,440 gal) of water with a final turbidity of 4.2 nephelometric turbidity units. Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-107A on 15 April 1994. The pump intake is at 28.1 m (92.14 ft) below top of casing. A pump installation form is included in Appendix C.

3.4 AQUIFER TESTING

Water level data were collected during development (see Section 2.3). Slug injection and withdrawal tests were conducted in Well K-107A on 15 April 1994 after well development. Hydraulic conductivity was estimated as $3.7\text{E-}03$ cm/s (10.50 ft/d), based on slug withdrawal, and $1.8\text{E-}03$ cm/s (5.13 ft/d) based on slug injection. Aquifer test data and their interpretation are included in Appendix D.

4.0 WELL 199-K-108A

4.1 DRILLING

Well 199-K-108A was drilled with a cable tool rig. This borehole was drilled to construct a shallow groundwater monitoring well. Drilling began on 18 March 1994 and was completed 29 March 1994. The total depth of the borehole was 28.5 m (93.5 ft) bls. Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 2.9 m (9.6 ft) bls; 20.3 (8-in.) diameter casing from surface to 28.4 m (93.3 ft). Approximately 56.8 L (15 gal) of water were added during drilling. Drilling information is compiled in Appendix A.

Sediments were primarily sandy gravel to silty sandy gravel (see borehole log in Appendix A). The contact between the Hanford fill and Ringold E formation was encountered at approximately 9.1 m (30 ft). The water table was encountered at 22.2 m (72.8 ft) bls. Samples were collected approximately every 1.5 m (5 ft) of depth for calcium carbonate analysis, soil moisture, radiological screening, and lithologic archiving. One split spoon and water samples were collected from the Ringold at the water table (23 to 24.4 m [75.5 to 80.0 ft] bls). The split spoon was submitted for grain size analysis and the the water samples were submitted for radiological analysis. These results are contained in Appendix B.

Borehole geophysics, consisting of the RLS spectral gamma tool, were run on 29 March 1994 from 0 to 28.3 m (0 to 93 ft) bls through the 20.3-cm (8-in.) temporary casing. A copy of the geophysical log is in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. There was no detectable chemical contamination. Above background radiation activity levels were detected in groundwater samples. These results are summarized in Appendix B.

4.2 WELL COMPLETION

A permanent casing and screen were installed in Well K-108A between 30 March and 6 April 1994. Static water level at that time was 22.7 m (74.4 ft) bls. A 10-slot, 10-cm (4-in.) diameter stainless steel screen was set from 27.4 to 21.1 m (90.0 to 69.35 ft) bls. Permanent casing is 10-cm (4-in.) diameter stainless steel with centralizers from 21.1 m (69.35 ft) bls to above land surface. The sand pack is 20-40 mesh silica sand (28.4 to 19.8 m [93.2 to 65.1 ft] bls). The annular seal comprises bentonite pellets (19.8 to 18.7 m [65.1 to 61.5 ft] bls), bentonite crumbles (18.7 to 2.6 m [61.5 to 8.5 ft] bls), and cement grout (2.6 to 0.6 m [8.5 to 2.0 ft] bls). The remaining annulus was filled with concrete and a 1.2 m by 1.2 m by 15.2 cm (4 ft by 4 ft by 6-in.) concrete pad, a 15.2-cm (6-in.) protective stainless steel surface casing, locking cap, and four protective posts were installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Documentation of well completion is compiled in Appendix A.

The only additives during well drilling and completion were water and "well guard," a non-petroleum-based lubricant used on drilling tools and casing threads.

4.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-108A was developed 12 April 1994. A temporary submersible pump removed 5,451 L (1,440 gal) of water with a final turbidity of 4.2 nephelometric turbidity units. Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-108A on 14 August 1994. The pump intake is at 26.6 m (87.25 ft) below top of casing. A pump installation form is included in Appendix C.

4.4 AQUIFER TESTING

Water level data were collected during development (see Section 2.3). Slug injection and withdrawal tests were conducted in Well K-108A on 14 April 1994 after well development. Hydraulic conductivity was estimated as $2.8\text{E-}03$ cm/s (8.01 ft/d), based on slug withdrawal, and $1.1\text{E-}03$ cm/s (3.19 ft/d) based on slug injection. Aquifer test data and their interpretation are included in Appendix D.

5.0 WELL 199-K-109A

5.1 DRILLING

Well 199-K-109A was drilled with a cable tool rig. This borehole was drilled to characterize the vadose zone and the entire upper unconfined aquifer near the 105-KE Facility drainage collection sump and complete a shallow groundwater monitoring well. This borehole was also used to obtain site specific seismic wave velocity data in support of basin structural engineering studies. For this purpose a hybrid well design (casing and screen) has been employed.

Drilling began on 13 July 1994 and was completed 31 August 1994. The total depth of the borehole was 50.5 m (165.7 ft) bls. Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 4.6 m (15 ft) bls; 25.4-cm (10-in.) diameter casing from surface to 28.2 m (92.5 ft) bls; 20.3-cm (8-in.) diameter casing from surface to 50.3 m (164.9 ft). Approximately 5,659 L (1,495 gal) of water were added during drilling. Drilling information is compiled in Appendix A.

Sediments were primarily silty sandy gravel to sandy gravel with the silty clay of the Ringold mud unit encountered at 45.7 m (150 ft) forming the first aquitard (see borehole log in Appendix A). The water table was encountered at 21.8 m (71.6 ft) bls. The contact between the Hanford and Ringold E formation was encountered at approximately 11.7 m (38.5 ft). Grab samples were collected approximately every 1.5 m (5 ft) of depth for radiological screening and lithologic archiving. Eight split spoon samples were attempted during drilling: one in the Hanford vadose (probably excavation backfill material), five in the Ringold gravel (two vadose and three saturated), and two in the lower mud. The three split samples collected in the vadose zone were analyzed for moisture retention, sieve, saturated hydraulic conductivity, specific gravity, moisture content, calcium carbonate content, bulk density, and porosity. Four split samples collected in the saturated zone were submitted for saturated hydraulic conductivity, bulk density/porosity, and sieve analysis. Split spoon sample #4 (26.6 to 27.1 m [86.8 to 88.8 ft]) was submitted for sieve and moisture content. Six groundwater samples were collected during drilling through the aquifer and submitted for radiological and chemical analysis (23 m [75.9 ft], 28.2 m [92.5 ft], 31.1 m [102 ft], 36 m [118 ft], 40.5 m [133 ft], and 46 m [151 ft] bls.). All sediment and groundwater data results are contained in Appendix B.

Borehole geophysics, consisting of the RLS spectral gamma tool, were run on 2 August 1994 from 0 to 27.1 m (0 to 89 ft) bls, on 11 August 1994 from 0 to 31.4 m (0 to 103 ft) bls, and on 12 August 1994 from 24.4 to 31.4 m (80 to 103 ft) bls through the 25.4-cm (10-in.) temporary casing. On 31 August 1994 the well was logged from 0 to 48.8 m (0 to 160 ft) bls through the 20.3-cm (8-in.) temporary casing. A seismic velocity survey was also completed on 31 August 1994. Copies of the geophysical logs are in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. There was no detectable chemical contamination; however, geophysical logging did detect an anomaly at 8.5 m (28 ft) bls that was identified as Cesium-137 by spectral analysis (see Appendix A). Groundwater sample analysis did reveal above background levels of Carbon-14, tritium, alpha, and beta in the first three water samples taken from 23 m (75.5 ft)

to 31 m [102 ft]). The radiation release survey also detected radiation in the 22.9 m (75 ft) soil sample (first sample taken in the aquifer), which is consistent with the groundwater results. The groundwater analytical results are contained in Appendix B.

5.2 WELL COMPLETION

Well K-109A was completed as a hybrid stainless steel and PVC shallow groundwater monitoring well. This is the first hybrid (PVC-stainless) well constructed under the WHC Project W-152 RCRA drilling program. Permanent PVC casing and a stainless steel screen were installed between 1 and 13 September 1994. Static water level at that time was 22.2 m (72.9 ft) bls. The borehole was plugged back with bentonite chunks from bottom hole (48.7 m [159.9 ft]) to 28.2 m (92.5 ft) bls. A 20-slot, 10-cm (4-in.) diameter stainless steel screen was set from 27.4 to 21.2 m (89.8 to 69.6 ft) bls. Permanent casing is 10-cm (4-in.) diameter Schedule 80 PVC with centralizers, from 21.2 m (69.6 ft) bls to above land surface. The sand pack consists of 8-20 mesh silica sand (28.2 to 27.3 m [92.5 to 89.5 ft] bls) and 10-20 mesh silica sand (27.3 to 19.7 m [89.5 to 64.5 ft] bls). The annular seal comprises bentonite pellets (19.7 to 18.7 m [64.5 to 61.4 ft] bls) and Type I and II cement from 18.7 to 0.6 m (61.4 to 2.0 ft) bls. The remaining annulus was filled with concrete and a 1.2 m by 1.2 m by 15.2 cm (4 ft by 4 ft by 6-in.) concrete pad with a 15.2-cm (6-in.) protective stainless steel surface casing, locking cap, and four protective posts installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Documentation of well completion is compiled in Appendix A.

The only additives during well drilling and completion were water and "well guard," a non-petroleum-based lubricant used on drilling tools and casing threads.

5.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-109A was developed 19-20 September 1994. A temporary submersible pump removed 4,921 L (1,300 gal) of water with a final turbidity of 5.0 nephelometric turbidity units. Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-109A on 3 October 1994. The pump intake is at 27.56 m (90.41 ft) below top of casing. A pump installation form is included in Appendix C.

5.4 AQUIFER TESTING

An aquifer slug test was not conducted in Well K-109A due to the restrictive diameter of the PVC casing. Water level data were collected during development (see Section 2.3).

6.0 WELL 199-K-110A

6.1 DRILLING

Well 199-K-110A was drilled with a cable tool rig for the purpose of installing a shallow groundwater monitoring well. Drilling began on 5 May 1994 and was completed 17 May 1994. The total depth of the borehole was 28.4 m (93.1 ft) bls. Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 3.1 m (10.1 ft) bls; 25.4-cm (10-in.) diameter casing from surface to 28.4 m (93.1 ft). Approximately 83.3 L (22 gal) of water were added during drilling. Drilling information is compiled in Appendix A.

Sediments were primarily sandy gravel (see borehole log in Appendix A). Samples were collected approximately every 1.5 m (5 ft) of depth for radiological screening and lithologic archiving. The contact between the Hanford and Ringold E formation was encountered at approximately 12.2 m (40 ft). The water table was encountered at 22 m (71.9 ft). One water sample was collected at the water table and submitted for radiological analysis. The results are reported in Appendix B. Four split spoon samples were attempted; one was successful in the Hanford (vadose) at 4.9 m (16 ft) bls, and two were successful in the Ringold at 12.2 m (40 ft) (Ringold contact) and 23.5 m (77 ft) bls in the aquifer. The vadose split spoon samples were submitted for saturated and unsaturated hydraulic conductivity, bulk density/porosity, specific gravity, moisture content, moisture retention, calcium carbonate, and grain size analysis. The saturated split sample was submitted for the above listed analytes with the exception of unsaturated hydraulic conductivity and moisture retention. All sediment data results are contained in Appendix B.

Borehole geophysics, consisting of the RLS spectral gamma tool, were run on 17 May 1994 from 0 to 27.7 m (0 to 91 ft) bls through the 25.4-cm (10-in.) temporary casing. A copy of the geophysical log is in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. There was no detectable contamination.

6.2 WELL COMPLETION

A permanent casing and screen were installed in Well K-110A between 18-20 May 1994. Static water level at that time was 21.7 m (71.3 ft) bls. A 10-slot, 10-cm (4-in.) diameter stainless steel screen was set from 27.3 to 20.9 m (89.7 to 68.7 ft) bls. Permanent casing is 10-cm (4-in.) diameter stainless steel with centralizers from 20.9 m (68.7 ft) bls to above land surface. The sand pack is 20-40 mesh silica sand (28.3 to 19.8 m [92.9 to 64.8 ft] bls). The annular seal comprises bentonite pellets (19.8 to 18.7 m [64.8 to 61.2 ft] bls), bentonite crumbles (18.7 to 2.8 m [61.2 to 9.1 ft] bls), and cement grout (2.8 to 0.6 m [9.1 to 2.0 ft] bls). The remaining annulus was filled with concrete and a 1.2-m by 1.2-m by 15.2-cm (4-ft by 4-ft by 6-in.) concrete pad, 15.2-cm (6-in.) protective stainless steel surface casing, locking cap, and four protective posts were installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Well completion documentation is compiled in Appendix A.

The only additives during well drilling and completion were water and "well guard," a non-petroleum-based lubricant used on drilling tools and casing threads.

6.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-110A was developed 16 June 1994. A temporary submersible pump removed 10,096 L (2,667 gal) of water with a final turbidity of 3.96 nephelometric turbidity units. Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-110A on 17 June 1994. The pump intake is at 26.5 m (87.1 ft) below top of casing. A pump installation form is included in Appendix C.

6.4 AQUIFER TESTING

Water level data were collected during development (see Section 2.3). Slug injection and withdrawal tests were conducted in Well K-110A on 17 June 1994 after well development. Hydraulic conductivity was estimated as $1.1\text{E-}02$ cm/s (32.08 ft/d), based on slug withdrawal, and $1.3\text{E-}03$ cm/s (3.62 ft/d) based on slug injection. Aquifer test data and their interpretation are included in Appendix D.

7.0 WELL 199-K-111A

7.1 DRILLING

Well 199-K-111A was drilled to characterize the vadose zone and the entire upper unconfined aquifer and complete a shallow groundwater monitoring well. Well K-111A was drilled with a cable tool rig. Drilling began on 25 May 1994 and was completed 29 June 1994. The total depth of the borehole was 56.4 m (185.0 ft) bls. Temporary carbon steel casing was used during drilling: 30.5-cm (12-in.) diameter casing from surface to 2.9 m (9.5 ft) bls; 25.4-cm (10-in.) diameter casing from surface to 26.5 m (87.1 ft) bls; 20.3-cm (8-in.) diameter casing from surface to 52 m (171 ft). Approximately 3,577 L (945 gal) of water were added during drilling. Drilling information is compiled in Appendix A.

Sediments were primarily silty sandy gravel to sandy gravel with the silty clay of the Ringold mud unit, encountered at 47.3 m (155.3 ft), forming the first aquitard (see borehole log in Appendix A). The water table was encountered at 20.4 m (66.8 ft) bls. The contact between the Hanford and Ringold E formation was encountered at approximately 8.1 m (26.5 ft). Grab samples were collected approximately every 1.5 m (5 ft) of depth for radiological screening and lithologic archiving. Eight split spoon samples were attempted during drilling: one in the Hanford vadose, six in the Ringold gravel (one vadose and five saturated), and one in the lower mud. The two split samples collected in the vadose zone were analyzed for moisture retention, unsaturated hydraulic conductivity, water retention, grain size sieve, saturated hydraulic conductivity, specific gravity, bulk density, and porosity. Five split samples collected in the saturated zone were submitted for saturated hydraulic conductivity, bulk density/porosity, and sieve analysis. Split spoon sample #4 (27.2 m [89.3 ft]) was not successful. Six groundwater samples were collected during drilling through the aquifer (21.5 m [70.5 ft], 26.5 m [86.8 ft], 30.96 m [101.58 ft], 36.67 m [120.32 ft], 43.3 m [142.0 ft], and 47.23 m [154.96 ft] bls). The first five samples were submitted for radiological analysis and the last sample was submitted for chemical analysis. All sediment and groundwater data results are contained in Appendix B.

Borehole geophysics, consisting of the RLS spectral gamma tool, were run on 8 June 1994 from 0 to 25.3 m (0 to 83 ft) bls through the 25.4-cm (10-in.) temporary casing, and on 30 June 1994 from 15.2 to 49.7 m (50 to 163 ft) bls through the 20.3-cm (8-in.) temporary casing. Copies of the geophysical logs are in Appendix A.

The borehole and soils were monitored regularly for organic vapors and radioactive contaminants. There was no detectable chemical contamination. Groundwater sample analysis did reveal above background levels of Carbon-14, alpha, and beta radiation. The radiation release survey did not detect radiation in the soil samples. These results are contained in Appendix B.

7.2 WELL COMPLETION

Well K-111A was completed as a shallow groundwater monitoring well. A permanent stainless steel casing and screen were installed between 30 June 1994 and 8 July 1994. Static water level at that time was 20.4 m (66.8 ft) bls. The borehole was plugged back with bentonite chunks from bottom hole (50.3 m [165.0 ft]) to 26.9 m (88.4 ft) bls. A 10-slot, 10-cm (4-in.) diameter stainless steel screen was set from 25.9 to 19.7 m (85.0 to 64.6 ft) bls. Permanent casing is 10-cm (4-in.) diameter stainless steel with centralizers from 20 m

(65.7 ft) bls to above land surface. The sand pack consists of 20-40 mesh silica sand (26.9 to 18.7 m [88.4 to 61.5 ft] bls). The annular seal comprises bentonite pellets (18.7 to 17.5 m [61.5 to 57.5 ft] bls), bentonite crumbles (17.4 to 2.9 m [57.3 to 9.5 ft] bls), and Type I and II cement from 2.9 to 0.6 m (9.5 to 2.0 ft) bls. The remaining annulus was filled with concrete and a 1.2 m by 1.2 m by 15.2 cm (4 ft by 4 ft by 6-in.) concrete pad with a 15.2-cm (6-in.) protective stainless steel surface casing with a locking cap and four protective posts were installed at the well head. A brass marker stamped with the well number was set into the concrete pad. The center line of the well was surveyed to Lambert and 100-K coordinates. Elevation was surveyed to NGVD29(93) and NAVD88 datums. Elevations were established for the top of the Hydrostar pump plate, the top of the protective casing (north side), and the brass marker (ground surface). Well completion documentation is compiled in Appendix A.

The only additives during well drilling and completion were water and "well guard," a non-petroleum-based lubricant used on drilling tools and casing threads.

7.3 WELL DEVELOPMENT AND PUMP INSTALLATION

Well K-111A was developed 26 July 1994. A temporary submersible pump removed 7,559 L (1,997 gal) of water with a final turbidity of 2.24 nephelometric turbidity units. Drawdown and recovery data were measured with a transducer in the pumping well during development. A well development log is included in Appendix C. Water level data from development and recovery are included in Appendix D.

A dedicated Hydrostar sampling pump was installed in Well K-111A on 27 July 1994. The pump intake is at 25.9 m (84.91 ft) below top of casing. A pump installation form is included in Appendix C.

7.4 AQUIFER TESTING

Water level data were collected during development (see Section 2.3). Slug injection and withdrawal tests were conducted in Well K-111A on 27 July 1994 after well development. Hydraulic conductivity was estimated as $9.7\text{E-}03$ cm/s (27.38 ft/d), based on slug withdrawal, and $9.0\text{E-}03$ cm/s (25.53 ft/d) based on slug injection. Aquifer test data and their interpretation are included in Appendix D.

8.0 REFERENCES

- Bouwer, H. and R. C. Rice, 1976, *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*, Water Resources Research, V.12, No. 3, P. 423-428.
- Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- Lindberg, J. W., 1993, *Geology of the 100-K Area, Hanford Site, South-Central Washington*, WHC-SD-EN-TI-155, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Williams, B. A., 1994, *Installation of Groundwater Monitoring Wells in Support of the 100-K Area Fuel Storage Basins*, WHC-SD-EN-AP-153, Rev. 1, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1990, *Generic Specifications-Groundwater Monitoring Wells*, WHC-S-014, Rev. 7, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

DRILLING AND CONSTRUCTION DATA

Appendix A includes the following records for each well:

- Well summary sheet
- Well construction report
- Borehole log
- Well construction verification report.

Geophysical logs are provided at the end of the report.

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WELL 199-K-106A

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WELL SUMMARY SHEET

Boring or Well No. 199-K-106A A9842

Sheet 1 of 2

Location 100K - NORTHEAST OF KW BUILDING

Project 100K WEST BRID/WO-152

Prepared By Edward C. Loh / C. Refusa Date 1/19/94
(Sign/Print Name)Reviewed By Donna J. Anderson Date 3/14/94
(Sign/Print Name)

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
12" C.S. temporary casing set at 9.50'		5		0-5': Sandy Gravel sG
10" C.S. temporary casing set at 95.09'		10		5'-20': Sandy Gravel sG
8" C.S. temporary casing set at 164.16'		15		Sandy Gravel sG
PORTLAND CEMENT - 8.0'-2.0'		20		Sandy Gravel sG
BENTONITE CRUMBLES 62.0'-8.0'		25		20'-21': Sandy Gravel
		30		21'-33': slightly silty sandy gravel
		35		(m) sG
		40		33'-38' 38': Gravelly Sand gS
		45		38'-42': Sandy Gravel sG
		50		42'-50': Silty Sandy Gravel msc
1/4" BENTONITE PELLETS 65.1'-62.0'		55		50'-57.64': Sandy Gravel sG
		60		Sandy Gravel sG
		65		Sandy Gravel sG
STATIC GROUNDWATER = 72.4' 2/24/94		70		Sandy Gravel sG
T304 STAINLESS STEEL SCREEN		75		Sandy Gravel sG
INTERVAL 91.1'-70.06' (.20 SWI)		80		Sandy Gravel sG
10-20 SAND PACK INTERVAL 94.7'-65.1'		85		Sandy Gravel sG
BOTTOM OF 10-20 SAND - 94.7'		90		Sandy Gravel sG
		95		90'-94': Sandy Gravel sG
		100		94'-95': Silty sandy Gravel msc
		105		95'-98': Sandy Gravel sG
		110		98'-125': Sandy Gravel sG or Silty
		115		Sandy Gravel msc
		120		Sandy Gravel sG
		125		Sandy Gravel sG
		130		Sandy Gravel sG
		135		Sandy Gravel sG
		140		Sandy Gravel sG
		145		Sandy Gravel sG
		150		Sandy Gravel sG
		155		Sandy Gravel sG
BENTONITE HOLE PLUG 94.7'-178.2'				Sandy Gravel sG

Boring or Well No. 199-K-106A A9842

Sheet 2 of 2

Project 100k-"k" West Basin/WO-152

Reviewed By Dennis Anderson Date 3/14/94
(Sign/Print Name)

A-6

WELL CONSTRUCTION SUMMARY REPORT

SIGNATURE/DATE

Page 1 of 1

Specification No. WHC-5-014 Rev. No. 7Well No. 199-K-106A A9842 Temp. Well No. N/AECNs 15045 172214

Approximate Location _____

Project 100 K BASIN - WEST WELL INSTALLATION/WO-152

Drill Method _____

Drilling Company KIESER ENGINEERINGType CORE TOOL DRILLINGDriller Kelly OlsonDrilling Fluid Columbia River Water

Other (Companies) _____

Total Amount of Water Added During Drilling 738 gallons DA 10/21/94Geologist(s) EDWARD C. RAFFERTY (WHC)Comments Corrected water added is 618 gallonsMonty Mehlhorn (WHC)L.D. Lockard (WHC) ReviewBret F. Stuede [Hydro/MCE]Date Drilling Started KEH - 1/19/94 TD: 2/16/94

Geophysical Logging

Sondes (type)	Interval	Date
<u>Spectral Gamma (RLS)</u>	<u>0' - 91'</u>	<u>2-1-94</u>
<u>Spectral Gamma (RLS)</u>	<u>90.5' - 170'</u>	<u>2-16-94</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

Temporary Casings and Drilled Depth

Casing Type and Size	Interval	Shoe OD
<u>12" Temporary casing</u>	<u>0 - 9.5</u>	<u>0.95'</u>
<u>10" Temporary casing</u>	<u>9.5 - 95.09'</u>	<u>0.84' 5" 3/18/94</u>
<u>8" Temporary casing</u>	<u>95.09' - 116.16'</u>	<u>0.76'</u>
_____	_____	_____
_____	_____	_____

Drilled Depth 190' Hole Diameter at TD 4.0.76'Static Water Level/Date 1/22/94 - 73.4' 74.6' - 2/18/94Comments 72.6' - 2/23/94 72.4' - 2/24/94
72.14' (TDC) 3/1/94 (Initiated Pump)

Completion Activity

Date Started 2/17/94

Type	Depths	Length	Slot Size
<u>T-304</u>	<u>91.1 - 70.06</u>	<u>21.04 w/cap</u>	<u>.20</u>
<u>T-304</u>	<u>70.06 - 2.90 AGS</u>	<u>72.96</u>	<u>BLANK (Riser)</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Annular Seal/Filter Pack

Type	Interval	Volume	Mesh Size
<u>ENVIA Plus</u>	<u>178.2 - 94.7</u>	<u>32 sks - 22.4 Ft³</u>	<u>COARSE</u>
<u>BENTONITE (CONCRETE)</u>	<u>94.7 - 65.1</u>	<u>16 sks - 17. Ft³</u>	<u>10-20</u>
<u>SILICA SAND</u>	<u>65.1 - 62.0</u>	<u>3 buckets - 1.86 Ft³</u>	<u>1/4"</u>
<u>BENTONITE</u>	<u>62.0 - 8.0</u>	<u>48 sks - 34.1 Ft³</u>	<u>8-20</u>
<u>PERMEABLE</u>	<u>8.0 - 2.0</u>	<u>8 sks - 10.3 Ft³</u>	_____
<u>IL & II type</u>	_____	_____	_____

Other Activity

Aquifer Test Performed? Installation Since 1/94Type 5.00 Date 2/18/94Well Abandoned? N/ADate N/A

Well Survey Data

Date 5/16/94Washington State Prime Coordinates N: 146,502.39 E 568,697.40Protective Casing Elevation 467.29'Brass Cap Elevation 464.30'

Comments/Remarks _____

~~VALIDATED~~

SIGNATURE/DATE

Boring or Well No.

20 6 101 A9842

A9842

Sheet *j* of 10

Location 100K - NE K-West Building

Project 100K K-WEST Basin W 15.2

Prepared By Edward C. LaFare / Edward C. LaFare Date 1/20/94
(Sign/Print Name)

Reviewed By *[Signature]* ²⁰¹¹
(Sign/Print Name) Date 2/5/07

Depth (20)	Sample		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
	Type and No.	Blows or Recovery			
5	1 R00 2 LITH 1 CALG MOIST	DB		0-5 SANDY GRAVEL sG 70% GRAVEL 30% SAND PL 10% SMALL COBBLES, 20% CP, 40% MP 30% FP, 20% CL, 40% MS, 40% FS SUBROUND - SUBANGULAR, POORLY SORTED NO XTN HCL 80% MAFIC 20% SAND 10% 4/3 dark brown - slightly moist 10% 2/3 VERY dark brown - WET	DISTURBED FILL 5' sample slightly moist -
10	1 R00 2 LITH 1 CALG MOIST	DB		5-20 SANDY GRAVEL sG 20% SAND, 80% GRAVEL 30% VFP, 20% FP, 30% MP, 20% CP 20% FPA, 70% MP, 40% CL 10% 4/3 dark brown - dry 5% 4/3 olive - WET SUBROUND - SUBANGULAR, SAME ANGULAR. NO XTN HCL 70% GRAVEL, 20% QUARTZ, 10% FELIC MAFIC	10' - sample at 10'
15	1 R00 2 LITH 1 CALG MOIST	DB		18-20 - slight decrease in pebbles size - 40-50% FINE PEBBLES 30-40% MEDIUM PEBBLES	END OF SHIFT 1/19/94 BASE OF DISTURBED SANDY GRAVELS @ ± 20.0'
20	1 R00 2 LITH 1 CALG MOIST	DB		20-22 SANDY GRAVELS sG 30% SAND 70% GRAVEL 10% 10% SMALL COBBLES, 10% CL 20% MP 60% FP, SUBROUND - SUBANGULAR, 10% 4/3 light brownish gray - dry 10% 3/1 dk gray 60% MAFIC, 20% QUARTZ, 20% FELIC NO XTN HCL	HANFORD CONTACT - 20.0'

BOREHOLE LOG

Boring or Well No. 199-K-106ASheet 2 of 10Location 100K BASIN - NE OF K-WEST BUILDINGProject 100K ^{EC} ~~Basin~~ K-WEST BASIN W 152Prepared By Edward C. Loh / C. Loh ^{EDWARD}
(Sign/Print Name) Date 1/20/94Reviewed By D. J. Anderson ^{DERMUS}
(Sign/Print Name) Date 2/5/94

Depth (<u>10</u>)	Sample		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
	Type and No.	Blows or Recovery			
					XLO sample 20.0
22	1 RAD 2 LITH 1 CALG / 100%	DB		22-33' slightly silty, sandy Gravel MSL 10% silt, 30% SAND, 60% Gravel 100% silt, SAND - 20% F ₃ , 20% ms 50% CAS, Gravel - 20% F ₃ , 60% ms 20% CLP, OCCASIONALLY SMALL COBBLES SUBANGULAR - SUBANGULAR, POORLY SORTED, 10% 4/3 dk brown - dry WET 10% 4/3 light yellow brown - dry 40% MAFIC, 30% QUARTZ, 30% FELSIC NO XTN HCL	RINGOLD CONTACT @ APPROXIMATELY 21.0 FEET XLO sample 22.0
25	1 RAD 2 LITH 1 CALG MOIST	DB			
30	1 RAD 2 LITH 1 CALG MOIST	AB		21-33' - impression of slightly silty, sand by itself 10% silt, 90% SAND, 100% silt SAND - 10% VFg, WELL SORTED, 2.54 - 4/3 light yellow brown - dry 2.57 - 4/3 olive yellow - WET VERY THIN BEDS (PLATES) < 1mm, 60% QUARTZ, 40% FELSIC, NO XTN HCL	XLO sample 28'
33	1 RAD 2 LITH 1 CALG MOIST	AB			
35	1 RAD 2 LITH 1 CALG MOIST	AB		33-38' GRAVELLY SAND GS 10% GRAVELS, 90% SAND GRAVELS - 50% F ₃ , 50% ms, SAND 20% F ₃ 10% ms, 20% CAS, 2.54 5/3 light OLIVE BROWN - dry 2.54 4/3 OLIVE BROWN - WET WELL SORTED, SUBANGULAR - ANGULAR TL MUCONITE, 10% MAFIC, 50% QUARTZ 40% FELSIC, NO XTN HCL	XLO sample 33'
40	1 RAD 2 LITH 1 CALG MOIST	AB		40-42 SANDY GRAVEL SG 30% SAND, 70% GRAVEL, SAND - 20% F ₃ 20% ms, 60% CAS, GRAVEL 20% F ₃ , 40% ms 40% CAS, 2.54 5/3 dk brown - dry 2.54 5/3 dk brown - WET, POORLY SORTED 20% MAFIC, 50% QUARTZ, 30% FELSIC, NO XTN HCL	END OF SHIF 01/20/94

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 3 of 10

Location 100K Basin - NE of K-West Building
Marty Melhorn / Marty Melhorn
 Prepared By Edward C. Loran / Edward Date 1/21/94
 (Sign/Print Name)

Project 100K K' WEST Basin W152
Reviewed By BENJAMIN Anderson Date 2/5/94
(Sign/Print Name)

Depth	Sample		Graphic Log	Sample Description	Comments
	Type and No.	Blows or Recovery			
(40)					
45	1 L20 2 L11A 1 CaCO ₃ Moist	DB		42-50 Silt, sandy Gravel m.s.G. 20% silt, 30% sand 60% Gravel Gravel - 50% Fp 50% mp, Muscovite 40% ms, 20% cs, 2.5% 5/8 light Olive brown - dry 10% 5/4 dark yellow brown - wet, poorly sorted, no visible bedding layers, semi-consolidated (moist), melange, 20% mafic, 40% quartz, 40% felsic, no xtn HCL, low plasticity	2nd sample 242' From 42-50 soil samples well moist, some thin staining noted around clasts End of shift 1/21/94
50	1 L20 2 L11A 1 CaCO ₃ /moist DB	DB		50-55 Sandy Gravel s.G 40% sand, 60% gravel Gravel - 10% small cobbles, 30% Fp 40% mp, 20% cs, sand 30% F, 40% ms, 30% cs, subangular - subangular, fine rounded, poorly sorted, 10% 5/4 yellowish brown - dry 2.5% 5/8 light olive brown - wet Ta muscovite, no xtn HCL 20% basalt, 50% quartz 30% felsic	2nd sample 242' 2nd sample 242'
55	1 L20 2 L11A 1 CaCO ₃ /moist DB	DB		57.64' - 70.0' Sandy Gravel s.G (~50% sand, 50% gravel); sand/ gravel sorting, particle size distribution, and exact percentage of sand indeterminate due to hard tool:	*Driller notes water loss at ~58'; cementation may be decreased.
60		HT 57.64' - 61'			

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 4 of 10

Location 100K Basin - N.E. of K-West Building

Project 100K "K" West Basin W152

Prepared By Monty Muhlhorn Date 1-28-94
(Sign/Print Name)Reviewed By Edward P. Rhee / EDWARD
(Sign/Print Name) C. R. Rhee Date 1/28/94

Depth (60')	Sample		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
	Type and No.	Blows or Recovery			
60'	X	HT 57.64'-61'		Gravel consists of 40% basalt, 20% greenstone/andesite, 20% quartzite, 10% granite, 10% gneiss; all clasts are sub-round to subangular; sand has 15% basalt (subangular, subround), 30% felsics (sub round), 55% quartz, 2.5% muscovite; no reaction to 10% HCl; cementation appears to be variable, minor Fe-oxide staining is present; trace metal fragments (from hard tool bit) are present. Gradational contact with:	* 2 archive, 1-moisture tin (CaCO ₃), 1-HPT sample
65'	2 archive samples 1 HPT sample, 1 XRD 1 moisture tin (CaCO ₃)	HT 61'-65'			
70'	2 archive samples 1 HPT sample 1 moisture tin (CaCO ₃)	HT 65'-70'			
75'	2 archive samples 1 HPT sample 1 moisture tin (CaCO ₃)	HT 70'-78'		70'-75': Sandy gravel sG (~60% sand, 40% gravel); Sorting, particle size distribution, and exact percentages of sand and gravel are indeterminate; 2.5% wet; Gravel consists of 20% basalt, 20% greenstone/andesite, 30% quartzite (round, spheroidal to discoidal), 15% gneiss, 10% granite, 5% felsic volcanics; Sand has ~10% basalt (angular, spheroidal), ~30% felsics (angular to subround), ~60% quartz (round, spheroidal); trace metal fragments (from hard tool), trace muscovite, no reaction to 10% HCl, minor Fe-oxide staining; cementation is slightly less than from 57.64'-70'; abrupt contact with:	* Driller notes changes in drilling at ~72'
80'	*	HT 78'-80'		75'-90': Sandy Gravel sG (~30% gravel, 70% sand, trace silt); Sorting, particle size distribution, and exact percentages of silt, sand, and gravel are indeterminate because of hard	* Driller notes less cemented sediments at ~75'.

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 5 of 10

Location 100k Basin, NE of K-West Building

Project 100k "K" West Basin W 152

Prepared By Monty Melhorn / Monty Melhorn Date 2-3-94
(Sign/Print Name)Reviewed By Edward C. Lipp / Edward C. Lipp Date 2/27/94
(Sign/Print Name)

Depth (80')	Sample		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
	Type and No.	Blows or Recovery			
80'		DB 80'-85'		tool; 2.5Y 7/2, wet; Gravel has 10% basalt (subround), 30% greenstone/andesite (?), 30% granite, 20% quartzite, ~10% gneiss; Sand consists of 10% basalt (angular-subround), 40% felsic (same composition as gravels, subround to subangular), 50% quartz (round) trace muscovite, trace metal fragments; no reaction to 10% HCl, minor Fe oxide staining; unit is much softer than overlying sediment.	
85'	2-archive 1-moisture tin (CaCO ₃) 1-HPT sample	B DB 85'-87'		82': Sandy Gravel s/c (30% gravel, 20% sand), 5% cobbles, 5% ucp, 10% cp, 20% mp, 30% fp, 30% wfp, 5% vcs, 5% cs, 50% ms, 20% fs, 10% lfs, 2.5Y 7/2, wet; Gravel is poorly sorted, with ~10% basalt (discoidal, round), 30% granite (round, spheroidal), 20% greenstone (round, spheroidal), 15% andesite (round, spheroidal), 20% quartzite (round, spheroidal), 5% sediments (round, spheroidal); Sand is moderately sorted, consists of 5% basalt (subround, spheroidal), 25% felsic (sub round-round, spheroidal), 70% quartz (round, spheroidal), traces of muscovite, phlogopite, garnet (?), and metal fragments (from HT) are present; no reaction to 10% HCl, minor Fe-oxide staining. Gradational contact with 90'-94': Sandy Gravel s/c (~2% silt, 45% sand, 50% gravel), 10% cobbles, 10% ucp, 10% cp, 30% mp, 20% fp, 20% wfp, 10% vcs, 10% cs, 50% ms, 20% fs, 10% lfs, 100% silt. 2.5Y 7/2, wet; Gravel is poorly sorted, with 20% basalt (spheroidal, sub round), 30% quartzite (spheroidal, round), 20% granite (spheroidal, round), 10% andesite (spheroidal-discoidal, round), 10% diorite (round, spheroidal),	87'-89.3': Split tube sample, blows per 6": 12, 18, 36, 36, 90% Recovery. Sampling: 87.5'-88': Physical sample, 88'-88.5': Physical sample, 88.5'-89': Archive sample, 1 HPT sample. * 90': 2-archive samples, 1-moisture tin, and 1-HPT sample
90'	* 2-archive samples 1-XRD sample 1-moisture tin (CaCO ₃) 1-HPT sample	ST 87'-89.3' Blows per 6": 12, 18, 36, 36 90% Recov. DB 89.3'-90' DB 90'-95'			
95'		DB 95'-96'			* Drilling becomes very difficult at 96'
100'	2-archive samples 1-moisture tin (CaCO ₃) 1-HPT sample	HT 96'-100'			

Sheet 6 of 10

Reviewed By Dennis Anderson Date 3/14/94
(Sign/Print Name)

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 7 of 10

Location 100K Basin, N.E. of 100K-West Building Project 100K "K" West Building W152

Prepared By Monty McElhannon / Monty McElhannon Date 2-10-94
(Sign/Print Name)Reviewed By Edward C. Lofgren / Edward C. Lofgren Date 02/11/94
(Sign/Print Name)

Depth (120')	Sample		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
	Type and No.	Blows or Recovery			
120'	*	HT 115'-121'		(round, spheroidal); Sand is moderately sorted, with ~10% basalt/mafic (sub rounded, spheroidal), 30% felsics (round, spheroidal), 60% quartz (round, spheroidal), trace muscovite, trace phlogopite, trace sphene (?). Sediments are moderately consolidated, weak reaction to 10% HCl, sequence becomes very well cemented at 96' contact	* 2-archive samples, 1-moisture tin (CaCO ₃), 1-HPT sample.
125'	*	ST 124.3'-126.3' Blows per 6": 9, 14, 19, 17; 95% Recovery		124.3'-126.3': Slightly silty gravelly sand (~15% silt, 65% sand, 20% gravel). Particle size distribution, bedding characteristics, sorting, and exact percentages of silt, sand and gravel are indeterminate; 2.5Y 7/4 wet.	* Drilling becomes easier at 123'.
130'	2-archive samples 1-moisture tin (CaCO ₃) 1-HPT sample	HT 126.3'-130'		126.3'-130': Silty sandy gravel (25% basalt (round), 20% greenstone/andesite, 25% granite/monzonite, 15% gneiss, 15% quartzite). Sand has 10% basalt, ~30% felsics (particles of similar gravel lithologies), 60% quartz, trace muscovite, trace metal fragments, no reaction to 10% HCl, minor Fe-oxide staining; the presence of heaving sand and sorting in the bailer may have resulted in elevated fine content, and the actual sediment type is Silty Sandy Gravel - SC ₁ at 105'.	124.3'-125.8' consisted of sluff, and 125.8'-126.3' (1-metal liner) was submitted as a physical sample. Archive samples: 125.3'-125.8', 126.3', 1-moisture tin: 125.3'-125.8' (CaCO ₃).
135'	2-archive samples 1-moisture tin (CaCO ₃) 1-HPT sample	HT 130'-135'		130'-135': Silty sandy gravel (50% sand, 20% silt); 10YR 7/3 wet; Gravel consists of ~35% basalt (sub round), 25% greenstone/andesite (round), 20% granite (round), 20% gneiss (round), 10% quartzite; Sand has 15% basalt, 30% felsics (angular), 55% quartz, trace mica (muscovite/phlogopite), trace metal frag-	125.8'-126.3' (1-metal liner) was submitted as a physical sample. Archive samples: 125.3'-125.8', 126.3', 1-moisture tin: 125.3'-125.8' (CaCO ₃).
140'	2-archive samples 1-moisture tin (CaCO ₃) 1-HPT sample	HT 135'-140'		135'-140': Same lithology as outlined above (Sandy Gravel/Silty sandy gravel) (~40% gravel, ~50% sand, ~10% silt); 10YR 7/3 wet; Gravel consists of ~35% basalt (sub round), 25% greenstone/andesite (round), 20% granite (round), 20% gneiss (round), 10% quartzite; Sand has 15% basalt, 30% felsics (angular), 55% quartz, trace mica (muscovite/phlogopite), trace metal frag-	125.8'-126.3' (1-metal liner) was submitted as a physical sample. Archive samples: 125.3'-125.8', 126.3', 1-moisture tin: 125.3'-125.8' (CaCO ₃).

BOREHOLE LOG

Boring or Well No. 199-K-106ASheet 8 of 10Location 100k Basin, N.E. of K-West BuildingProject 100k - "K" West Basin W 152Prepared By Marty Muhlher Date 2-14-94
(Sign/Print Name)Reviewed By Edward C. Rame Date 02/15/94
(Sign/Print Name)

Depth (<u>140</u>)	Sample		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
	Type and No.	Blows or Recovery			
145	2-archive samples 1-Moisture tin (CaCO ₃) 1-HPT sample	HT 140'-145.5'		ments; weak reaction to 10% HCl; Gravel clasts may be decreased in size; by cementation is slightly lower; drilling becomes easier.	
	2-archive samples 1-Moisture tin (CaCO ₃) 1-HPT sample	HT 145.5'-150'		126.3': Sandy Gravel s/c (~10% silt, 30% sand), ~20% mp, 40% fp, 40% wfp, 10% ucs, 10% cs, 50% ms, 20% fs, 10% outs, 100% silt; 10YR 7/6, wet; Gravel is moderately sorted, with ~5% basalt (subround, spheroidal), 25% gneiss (round, spheroidal-discoidal), 20% talite (round, discoidal-spheroidal), 10% greenstone (round, spheroidal), 40% quartzite (round, spheroidal-discoidal); Sand is poorly sorted, consists of ~10% basalt (subround, spheroidal), ~30% felsics (subround, spheroidal), 60% quartz (round, spheroidal), trace muscovite, trace phlogopite; sediment is moderately consolidated, minor Fe-oxides are present, no reaction to 10% HCl, at ~133', gravel content diminishes to 40%; cementation becomes strong at ~144', weak to moderate reaction to 10% HCl past 145', abrupt contact at 162.5' with:	Drilling becomes easier at 148'.
150	2-archive samples 1-Moisture tin (CaCO ₃) 1-HPT sample	HT 150'-155'			
155	2-archive samples 1-Moisture tin (CaCO ₃) 1-HPT sample	HT 155'-160'			
160	2-archive samples 1-Moisture tin (CaCO ₃) 1-HPT sample				

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 9 of 10

Location Look Basin, N.E. of West Building

Prepared By *Mark J. Blum / Mark J. Blum* Date 2-15-94

Project Look-K "West Basins" (1) 15A

Reviewed By *Edward C. Brown / Edward C. Brown* Date 02/15/94

(Sign/Print Name)

(Sign/Print Name)

Depth	Type and No.	Blows or Recovery	Graphic Log	Sample Description		Comments
				Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Sample Description	
160'	HT			Same sandy gravel as previously mentioned.		
160'-162.1'				obscure contact at 162.5' with:		
162.5' - 170'	SF	Blows per 6" 6, 6, 16		Sand, 55% silt, 5% fs, 95% wts, 100% sample, Blows per 6" 6, silt, 7.5 YR 7/4, wet, sand is very well sorted, with ~5% basalt/matrix		
164.1' - 165'	HT			(round, spheroidal), 20% felsics (sub round, physical sample, 163.1' - 163.6' sampling: 163.6' - 164.1' -		
165' - 170'	HT			spheroidal), 75% quartz (round, spheroidal), trace muscovite, trace biotite, 100% silt/clay, non-reactive to 10% HCl, moderate plasticity, weakly laminated, has 165' - 2-archival samples, consistent concentrically banded limonite / 1-moisture fin (CaCO ₃) banding, stained 7.5 YR 7/8, well consolidated, 1-HPT sample.		
165' - 170'	HT			170' - 175': Sandy silt s M (~40% sand, 60% silt), 5% fs, 95% wts, 100% silt, 7.5 YR 7/4, wet, sand is very well sorted, with ~20% felsics (sub round, spheroidal), 80% quartz (round, spheroidal), trace basalt/matrix, trace muscovite, non-reactive to 10% HCl, moderate plasticity, moderate to strong limonite staining at 175', there is a dense (thickness unknown) of: silt - M (~15% silt, sand, 80% silt, 5% clay (2)), 5% fs, 95% wts, 100% silt, 2.5 YR 7/4, wet, sand is very well sorted, consists of ~5% basalt/matrix, ~25% felsics, 70% quartz, all particles are round, spheroidal, moderate plasticity, no reaction to 10% HCl, thinly laminated, gradational contact with:		
170' - 175'	HT			175' - 190': silt M (15-20% sand, 80% - 85% silt), 100% wts, 100% silt, 2.5 YR 7/4, wet, sand is very well		
175' - 180'	HT					
175'						
180'						

BOREHOLE LOG

Boring or Well No. 199-K-106A

Sheet 10 of 10

Location 100k Basin, N.E. of West Building

Project 100k-"k" West Basin W 152

Prepared By Monty Hall / Monty Hall Date 2-15-94
(Sign/Print Name)

Reviewed By Edward C. Lopez / Edward C. Lopez Date 02/16/91
(Sign/print Name)

[illegible]

A7 S f 3

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Page 1 of 1

Well No.		Well Specification/Revision		
<u>199 - K - 106 A</u>		<u>A9842</u>		
Subject		Verification Method		Criteria
				Initials/Date
				Spec Chg. Doc.
Cleaning				
Drilling Rig/Tools		Visual		7.6.7.7 ECL 1/19/94
Temporary Mater.		Visual		7.7 ECL 1/19/94
Drill Method		Visual		5.2 ECL 1/19/94
Lubricants/Additives				
Lubricants		Visual		7.2 ECL 1/19/94
Additives		Visual		7.2 mm 1/24/94
Straightness Test		Visual		8.2 mm 2/15/94
Material Storage/Packing of Completion Material				
Mtl. Hand./Stor.		Visual		7.3 ECL 2/17/94
Material Packing		Visual		7.3 ECL 2/17/94
Casing and Screen (Permanent)		Visual		4.2 - 4.2.5, 12.2.1 ECL 2/18/94
Annular/Seal/Filter Pack		Visual		4.2.6 - 4.2.9, 5.3.1 ECL 2/23/94
Well Development		Visual		5.3.1.K BJS 3/1/94
Well Protection				
Surface Pad		Visual		4.2.9, 4.2.10 BJS 2/1/94
Prot. Casing		Visual		4.2.10 BJS 3/1/94
Prot. Posts		Visual		4.2.10 BJS 3/1/94
Cap, Hasp, Lock		Visual		4.2.10 ECL 3/2/94
Site Restored		Visual		11.0 DJA 10/10/94
Pump Installation				
Pump Decon/Prep.		Visual		4.2.10, 12.2.1 DJA 10/13/94
Installed		Visual		5.3.1.L DJA 10/13/94
Pump Tested		Visual		5.3.1.L DJA 10/13/94
Well Surveying/Labeling				
Ms. Pt. Surveyed		Visual		3.4 BJS 5/20/94
P. Casing/BC Surv.		Visual		3.4 BJS 5/20/94
Well No. Stamped		Visual		4.2.9 DJA 10/13/94
BC Labeled		Visual		4.2.9 DJA 10/13/94

Comments

WELL 199-K-107A

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WELL SUMMARY SHEET

VALIDATED
0066 11/4/94
SIGNATURE/DATE

Boring or Well No.

199-K-107A A9843

Sheet

1

of

1

Location 100 K - N.W. of Kth West BuildingProject W-152

Prepared By

Edward C. Ruffe
(Sign/Print Name)

Date

03/02/94

Reviewed By

Denise J. Anderson
(Sign/Print Name)

Date

3/29/94

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
4" STAINLESS STEEL CASING 1.3' ABOVE GROUND		0		
12" TEMPORARY C.S. CASING SET @ 9.6'		5		0-5': sandy GRAVEL SG
I&II TYPE PORTLAND CEMENT 8.5'-2.0'		10		5-19: sandy GRAVEL SG
		15		sandy GRAVEL
		20		19-25: silty sandy GRAVEL msG
		25		25-27: sandy GRAVEL SG
		30		27-30: SAND S
8" TEMPORARY C.S. CASING SET @ 94.6'		35		30-45: sandy GRAVEL SG
8-20 BENTONITE CRUMBLES 63.8'-8.5'		40		sandy GRAVEL
		45		sandy GRAVEL
		50		45-50: silty sandy GRAVEL msG
		55		50-55: slightly silty sandy GRAVEL msG
		60		55-60: sandy GRAVEL SG
3" BENTONITE PELLETS 63.8'-67.6'		65		60-65: slightly silty sandy GRAVEL msG
Top of 20-40 SAND 67.6'		70		65-75: sandy GRAVEL SG
STATIC GROUNDWATER 73.98' - 03/10/94		75		sandy GRAVEL
.10 SLOT SCREEN INTERVAL 92.64'-71.63'		80		75-85: sandy GRAVEL SG - INCREASE IN % GRAVEL CONTENT
BOTTOM OF SCREEN 92.64' (.10 SLOT)		85		
20-40 SAND INTERVAL 93.7'-67.6'		90		85-95.2: sandy GRAVEL SG - INCREASE % GRAVEL CONTENT
SLONGH 93.7'-95.2'		95		MEASURED TOTAL DEPTH = 95.2 m 3/10/94

WELL CONSTRUCTION SUMMARY REPORT

SIGNATURE/DATE

Page 1 of 1

Specification No. WHC-5014 Rev. No. 7Well No. 199-K-107A ^{A 9843} Temp. Well No. _____ECNs 150145, 172214Approximate Location ≈ 100' N.W. of X West BuildingProject 100 K BASIN / WO-152

Drill Method

Drilling Company KRIESEL ENGINEERINGType CABLE TOOL DRILLINGDriller Kelly OlsonDrilling Fluid COLUMBIA RIVER WATER

Other (Companies) _____

Total Amount of Water Added During Drilling 25 gallonsGeologist(s) EDWARD G. ROFESS (WHC)

Comments _____

Date Drilling Started 03/02/94

Geophysical Logging

Sondes (type) Interval Date

Spectral Gamma (KUT) 0 - 92.17 03/11/94

Spectral Gamma (RLS) 40 - 52.5 03/14/94

Temporary Casings and Drilled Depth

Casing Type and Size Interval Shoe OD

12" TEMPORARY C.S. CASING 0 - 9.6 0.95

8" TEMPORARY C.S. CASING 9.6 - 91.63 0.76

E.L. 03/07/94

Drilled Depth 95.2' Hole Diameter at TD 8"Static Water Level/Date 74.76' - 03/09/94, 74.18' - 03/10/94Comments 74.42' 3/11/94, 73.98' 3/16/94

Completion Activity

Date Started 03/11/94

Casing and Screen (Permanent)

Type Depths Length Slot Size

T-304 92.17 - 71.63 21.01' w/welded cap .10

T-304 71.63 - 1.3' 72.93' BLANK

Annular Seal/Filter Pack

Type Interval Volume Mesh Size

Colorado Silica Sand 93.7 - 67.6 8 1/2 sacks 9.52 ft³ 20/403/4" BENTONITE PERLETS 67.6 - 63.8 2 buckets 1.24 ft³BENTONITE CHUCKLES 63.8 - 85 27 sacks 19.17 ft³ 8/20I & B type PORTLAND CEMENT 8.5 - 2.0 8 sacks 6.72 ft³

Other Activity

Aquifer Test Performed? N/AType N/A Date N/AWell Abandoned? N/ADate N/A

Well Survey Data

Date 5/16/94Washington State Prime Coordinates N 146,468.81 E 568,579Protective Casing Elevation 467.63'Brass Cap Elevation 464.56'Comments/Remarks ① RLS - LONG COUNT WAS INITIATED @ 12.5' and 25.0' only.

BOREHOLE LOG

VALIDATED

D. J. Anderson 11/4/94

SIGNATURE DATE

Boring or Well No. 199-K-107A A9843

Sheet 1 of 5

Location 100K BASIN N.W. OF K-WEST BUILDING Project W 152

Prepared By Edward C. Ruffe / C. Ruffe Date 03/03/94

Reviewed By D. J. Anderson Date 3/15/94

Depth (0)	Sample		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
	Type and No.	Blows or Recovery			
5	1 RAD 2 LITH 1 CaCO ₃ MOIST	DB		0-5 SANDY GRAVEL SG 30% SAND, 70% GRAVEL SAND - 20%-40% GSS, 40%-50% MS 40%-50% F ₂ GRAVEL 10% SMALL COBBLES 20%-30% CP, 20-40% MP 40-50% F ₂ SUBROUND - SUBANGULAR SPHEROIDAL PROBABLY SORTED 70% MAFIC, 20% QUARTZ, 10% FELIC NO XRD HCL, 2.5Y 4/3 LT. YELLOWISH BROWN - DRY 2.5Y 4/3 VERY DARK GRAY - WET END OF SHEET 03/02/94	DISTURBED MATERIAL - FILL 25.0 SAMPLE - MOIST FILL MATERIAL
10	1 RAD 2 LITH 1 CaCO ₃ MOIST	DB		5-10 SANDY GRAVEL SG 20% SAND, 80% GRAVEL SAND - 50%-70% GSS, 20-40% MS GRAVEL 10% SMALL COBBLES, 20%-40% CP, 20-40% MP 20%-40% F ₂ 2.5Y 4/3 LIGHT YELLOWISH BROWN - DRY 2.5Y 4/3 VERY DARK GRAY - WET PROBABLY SORTED, SUBANGULAR SPHEROIDAL 80% MAFIC, 20% QUARTZ, NO XRD HCL 10-15 SILTY SANDY GRAVEL MS G 10% SILT, 40% SAND 50% GRAVEL SILT 100% SAND 30%-50% GSS, 20-30% MS, 20-40% F ₂ GRAVEL - 10% SMALL COBBLES, GSS 10-20% MP 20%-40% F ₂ 40%-60% 2.5Y 4/3 GRAYISH BROWN DRY 2.5Y 4/3 VERY DARK GRAY - WET, POORLY SORTED SUBANGULAR - ANGULAR, 60% MAFIC 20% QUARTZ, 20% FELIC, NO XRD HCL	END OF SHEET 03/02/94 10.0 SAMPLE - MOIST FILL MATERIAL
15	1 RAD 2 LITH 1 CaCO ₃ MOIST	DB		15-20 SANDY GRAVEL SG 40% SAND, 60% GRAVEL SAND - GSS 10%-30% MS 20%-40% F ₂ 20%-50% GRAVEL GSS 10%-30% MP 20%-40% F ₂ 20%-40% SAND - SUBANGULAR SOME SPHEROIDAL, PROBABLY SORTED, 10% 4/3 LIGHT BROWNISH GRAY - DRY 2.5Y 4/3 N/3 VERY DARK GRAY - WET 40% MAFIC	19.0 SAMPLE FILL MATERIAL 15.0 FILL MATERIAL
19	1 RAD 2 LITH 1 CaCO ₃ MOIST	DB		19-20 SANDY GRAVEL SG 40% SAND, 60% GRAVEL SAND - GSS 10%-30% MS 20%-40% F ₂ 20%-50% GRAVEL GSS 10%-30% MP 20%-40% F ₂ 20%-40% SAND - SUBANGULAR SOME SPHEROIDAL, PROBABLY SORTED, 10% 4/3 LIGHT BROWNISH GRAY - DRY 2.5Y 4/3 N/3 VERY DARK GRAY - WET 40% MAFIC	19.0 - UNDISTURBED MATERIAL RINGED CONTACT

BOREHOLE LOG

Boring or Well No. 199-K-107ASheet 2 of 5Location 100 K Basin N.W. 1/4 West BuildingProject WO-152Prepared By Edward C. Rame / C. Rame Date 03/04/94
(Sign/Print Name)Reviewed By D.J. Anderson Date 3/15/94
(Sign/Print Name)

Depth (<u>20</u>)	Sample		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
	Type and No.	Blows or Recovery			
			0.0	19-25 silty sandy gravel mlg	
			0.0	20% silt, 40% sand, 40% gravel	
			0.0	sand - 10% - 30% cas. ms - 20-40% F ₂ 20% F ₃	
			0.0	gravel - 10% - 30% casp 20-40% mp 20% 40% fp	
			0.0	10% 4% light brownish gray - dry 25% 4% 10% 4%	
			0.0	dark gray 1/3 dark brown - wet 03/04/94	END OF SHIFT 03/03/94
			0.0	SUBANGULAR - ROUNDED, SPHERICAL, 30%	
			0.0	MAFIC, 40% QUARTZ, 30% FELSIC	
25	1 RAD 2 LITH 1 CALS/moist	DB	0.0	24-25 silty sand layers - (m) 5 20% silt	
			0.0	80% sand with very thin beam (planes)	
			0.0	41 mm, weak reaction to HCL	
			0.0	25-27 sandy gravel SG	
			0.0	40% sand, 60% gravel 20-40% cas	
27	1 RAD 2 LITH 1 CALS/moist	DB	0.0	40-60% ms, 20-30% ms gravel -	
			0.0	10% - 20% casp, 40% - 50% mp 20-40% fp	
			0.0	10% 4% light brownish gray - dry	
			0.0	2.5% 5% 1/2 light brown gray - wet SUBANGULAR	
			0.0	SUBANGULAR, NO XTN HCL, 20% MAFIC, 40% QUARTZ	
			0.0	40% FELSIC	
30	1 RAD 2 LITH 1 CALS/moist	DB	0.0	27-30 SAND S	
			0.0	10% - 30% cas, 40% - 60% ms 20-40% F ₂	
			0.0	2.5% 4% light yellow brown, 2.5% 4%	
			0.0	OLIVE YELLOW - WET, WELL SORTED, SUBANGULAR	
			0.0	SUBANGULAR, NO XTN HCL 10% MAFIC	
			0.0	60% QUARTZ 30% FELSIC	
			0.0	30-35 sandy gravel SG	
			0.0	70% sand, 30% gravel sand 20-40% cas	
			0.0	20-40% ms, 20-50% F ₂ gravel 10-20% casp	
			0.0	20-30% mp, 40-60% fp, 2.5% 4% light	
35	1 RAD 2 LITH 1 CALS/moist	DB	0.0	brownish gray - dry 2.5% 5% light olive	
			0.0	medium - wet SUBANGULAR - SUBANGULAR	
			0.0	NO XTN HCL, 10% MAFIC, 60% QUARTZ	END OF SHIFT 03/03/94
			0.0	30% FELSIC	
			0.0	35-45 sandy gravel SG	
			0.0	50% sand 50% gravel	
			0.0	gravel 10-20% casp, 40% - 50% mp 40-60%	
			0.0	fp, sand 20-40% cas 30% - 50% ms 40-60% F ₂	
			0.0	SUBANGULAR - SUBANGULAR, SPHERICAL,	
			0.0	2.5% 1/2 pale yellow - dry 2.5% 1/2 olive brown - wet	
40	1 RAD 2 LITH 1 CALS/moist	DB	0.0	30% MAFIC 40% QUARTZ 30% FELSIC	

BOREHOLE LOG

Boring or Well No. 149-K-107ASheet 3 of 5Location 100 K Basin, N.W. 1/4 West BuildingProject W0-152Prepared By Edward C. Roper / E. Roper Date 03/07/94
(Sign/Print Name)Reviewed By D.J. Anderson Date 3/15/94
(Sign/Print Name)

Depth (<u>40</u>)	Sample		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
	Type and No.	Blows or Recovery			
				poorly sorted - gravel consist of greenstone andesite with 10-20% quartzite, 10-20% granite and 5%-10% gneiss, trace muscovite w/ minor Fe-oxide staining	@ 43.0 BOLLARD - CABLE TAPPING VERY SLOWLY THROUGH THIS AREA
45	1 RAD 2 LITH 1 CALCS MOIST	DB		50-50 silty sandy GRAVEL ms G 20% silt 40% sand, 40% GRAVEL sand 20%-40% cas, 20%-40% ms, 40%-50% Fp gravel 10%-20% cap, 20%-40% mp, 20%-40% Fp 2.5% 3/4 light olive brown - 2.5% 1/2 OLIVE BROWN - WET. POORLY SORTED, SUGARSUGAR - SUBANGULAR, NO RTD HCL, TA muscovite, some Fe-oxide staining, semi-consolidated silt (clayey) layer - low plasticity	45' sample pulverized FROM CORE BARREL ACTION 50' sample @ 1245
50	1 RAD 2 LITH 1 CALCS MOIST	DB		50-55 slightly silty, sandy GRAVEL ms G silt 10% sand 40%-40% cas, 20%-40% ms, 10-20% Fp gravel 10-20% small COBBLES 20%-40% cap, 20%-40% mp, 10-20% Fp 2.5% 3/4 pale yellow - dry 2.5% 1/2 dark yellow brown - WET, poorly sorted SUGARSUGAR - SUBANGULAR, 30% mafic, 40% quartz, 30% felsic, NO RTD HCL gravel consist of greenstone w/ 20% quartzite 10-20% granite, trace muscovite	55' sample @ 1345
55	1 RAD 2 LITH 1 CALCS MOIST	DB		55-60 sandy GRAVEL sg sand - 20-40% cas, 20%-40% ms, 20%-40% Fp, gravel - 10-20% small COBBLES cap 20%-40% mp - 20%-20%, 20%-40% Fp 2.5% 3/4 pale yellow - dry 2.5% 1/2 light OLIVE BROWN - WET. POORLY SORTED, SUGARSUGAR - SUBANGULAR, SOME ROUNDED 20% mafic, 30% quartz, 30% felsic TA muscovite, with greenstone 20% quartzite, 10%-20% granite, 5%-10% gneiss - TA iron oxide staining	END OF SHIFT 03/07/94 60' sample pulverized FROM CORE BARREL ACTION
60	1 RAD 2 LITH 1 CALCS MOIST	DB			

BOREHOLE LOG

Boring or Well No. 199-K-107ASheet 4 of 5Location 100 K BASIN, N.W. 1/4 WEST BOUNDARYProject W0-152Prepared By Edward C. Lane / Edward C. Lane Date 03/08/94
(Sign/Print Name)Reviewed By D.J. Anderson Date 3/15/94
(Sign/Print Name)

Depth (<u>60</u>)	Sample		Graphic Log	Sample Description	Comments
	Type and No.	Blows or Recovery		Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
65	1 RAD 2 LITH 1 CALCS/ MOIST	DB		65-65.5 slightly silty sand, gravel msG silt 20% 20% sand 60% gravel sand 40-40% CLS, 40-50% ms 40-50% F, gravel 10-20% small cobbles 20-40% CLP, 20-40% mp 10-20% Fp 2.5 y 7/8 pale yellow dry, 2.5 4/3 olive brown-wet, poorly sorted, subrounded - subangular, no xtn HCL, 20% mafic 40% quartz, 40% felsic	
70	1 RAD 2 LITH 1 CALCS MOIST	DB		65-75 sandy gravel sg 60% sand 40% gravel, sand 30-50% CLS, 20-40% ms, 20%-40% F, gravel - F 10% small cobbles, 10-20% CLP, # 03/07/94 20-40% mp, 30-50% Fp, subrounded - subangular, spheroidal, 2.5 y 4/3 light yellow brown-dry, 10% 4/3 light brown gray-wet, 10% 4/3 HCL, 20% mafic, 50% quartz 30% felsic gravel consist of 20-30% greenstone, 20-30% granite, 10-20% gneiss, 10-20% quartzite (round, spheroidal to discoidal), 10-20% basalt, poorly sorted	END OF SHIFT - 03/08/94
75	1 RAD 2 LITH 1 CALCS MOIST	DB		75-80 sandy gravel sg 40% sand, 60% gravel sand 40-60% CLS, 20-30% ms, 20-30% F, gravel - 10-20% small cobbles, 20-40% CLP, 20-50% mp, 20-30% Fp, 10 y 1/2 light brown gray-wet, no XTN, HCL, poorly sorted, subrounded - subangular, 1% muscovite, 20% MAFIC, 10% quartz, 20% felsic	static groundwater at 74.76" on 03/09/94
80	1 RAD 2 LITH 1 CALCS/ MOIST	DB		80-80.5 sandy gravel sg 40% sand, 60% gravel sand 40-60% CLS, 20-30% ms, 20-30% F, gravel - 10-20% small cobbles, 20-40% CLP, 20-50% mp, 20-30% Fp, 10 y 1/2 light brown gray-wet, no XTN, HCL, poorly sorted, subrounded - subangular, 1% muscovite, 20% MAFIC, 10% quartz, 20% felsic	

Sheet 5 of 5

Project WO-152

Reviewed By D.J. Anderson Date 3/15/94
(Sign/Print Name)

A-6000-382 (01/93)

VALIDATED

D. Anderson 11/4/94

SIGNATURE/DATE

1 of 1

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Well No.		Well Specification/Revision		
199-K-107A A9843		WHC-S-014 Rev. 7		
Subject	Verification Method	Criteria		Initials/Date
		Spec	Chg. Doc.	
Cleaning				
Drilling Rig/Tools	Visual	7.6.7.7		ECL 03/02/94
Temporary Mater.	Visual	7.7		ECL 03/02/94
Drill Method	Visual	5.2		ECL 03/02/94
Lubricants/Additives				
Lubricants	Visual	7.2		ECL 03/02/94
Additives	Visual	7.2		ECL 03/02/94
Straightness Test	Visual	8.2		ECL 03/10/94
Material Storage/Packing of Completion Material				
Mtl. Hand./Stor.	Visual	7.3		ECL 03/11/94
Material Packing	Visual	7.3		ECL 03/11/94
Casing and Screen (Permanent)	Visual	4.2 - 4.2.5, 12.2.1		ECL 03/11/94
Annular/Seal/Filter Pack	Visual	4.2.6 - 4.2.9, 5.3.1		ECL 03/11/94
Well Development	Visual	5.3.1.K		QK 11/04/94
Well Protection				
Surface Pad	Visual	4.2.9, 4.2.10		QGA 11/4/94
Prot. Casing	Visual	4.2.10		QGA 11/4/94
Prot. Posts	Visual	4.2.10		QGA 11/4/94
Cap, Hasp, Lock	Visual	4.2.10		QGA 11/4/94
Site Restored	Visual	11.0		QGA 11/4/94
Pump Installation				
Pump Decon/Prep.	Visual	4.2.10, 12.2.1		QK 11/04/94
Installed	Visual	5.3.1.L		QK 11/04/94
Pump Tested	Visual	5.3.1.L		QK 11/4/94
Well Surveying/Labeling				
Ms. Pt. Surveyed	Visual	3.4		QK 5/20/94
P. Casing/BC Surv.	Visual	3.4		QK 5/20/94
Well No. Stamped	Visual	4.2.9		QGA 11/4/94
BC Labeled	Visual	4.2.9		QGA 11/4/94

Comments

WELL 199-K-108A

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WELL SUMMARY SHEET

Boring or Well No. 199-K-108A A9844Sheet 1 of Location S.E. of 100 k - 'k' West BuildingProject W-0152Prepared By Edmund C. Rolin / E. Rolin ^{EDMUND}
(Sign/Print Name) Date 03/22/94Reviewed By D.J. Anderson ^{D.J. Anderson} Date 5/19/94
(Sign/Print Name)

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
STAINLESS STEEL SICKUP 0.9 A93		0		
12" TEMPORARY CASING SET 2		5		0-5 sandy GRAVEL SG
2 9.6'		10		5-15 sandy GRAVEL SG
CEMENT GROUT 8.5'-26'		15		sandy GRAVEL SG
		20		15-20 sandy GRAVEL SG
BENTONITE CRUMBS 61.5'-85'		25		20-30 sandy GRAVEL SG
		30		sandy GRAVEL SG
		35		30-32 GRAVELLY silty Sand gms
		40		32-35 GRAVELLY Sand gS
		45		35-48 sandy GRAVEL SG
		50		sandy GRAVEL SG
BENTONITE PELLETS 65.1'-615'		55		48-54 silty sandy GRAVEL mgG
TOP OF 20/40 SAND 65.1'		60		
SAND INTERVAL 93.2'-65.1'		65		60-74' sandy GRAVEL SG
STATIC GROUNDWATER 72.0' on 04/94		70		(LARGE BOULDER 65-67')
SCREEN INTERVAL 90.0'-69.35'		75		74-78 silty sandy GRAVEL
		80		78-81 silty sandy GRAVEL
8" CASING SET @ 93.28'		85		81-89 silty sandy GRAVEL
BOTTOM OF STAINLESS STEEL @ 90.0		90		89-93.5 silty sandy GRAVEL
		95'		
				Td-93.5' 3/29/94 10:30

VALIDATED

C. J. Riddle 1/25/94

1 of 2

WELL CONSTRUCTION SUMMARY REPORT

SIGNATURE/DATE

Page 1 of 1

Specification No. WHC-3014 Rev. No. 7ECNs: 150145, 172214Project 100 K Basin W-152Drilling Company KAISEN ENGINEERING COMPANYDriller KELLY OLSON

Other (Companies) _____

Geologist(s) EDWARD C. RAFFERTY (WHC)E.A. JOHNSON (SEG/WHC)Date Drilling Started 3/18/94

Geophysical Logging

Sondes (type)	Interval	Date
<u>Gamma (RLS)</u>	<u>0 - 93.0'</u>	<u>3/29/94</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Well No. 199-K-108A A9844 Temp. Well No. _____Approximate Location ≈ 100' S.E. OF K" West Building

Drill Method

Type CABLE TOOL DRILLINGDrilling Fluid COLUMBIA RIVER WATERTotal Amount of Water Added During Drilling 15 GAL

Comments _____

Temporary Casings and Drilled Depth

Casing Type and Size	Interval	Shoe OD
<u>12" TEMPORARY CASING</u>	<u>0 - 9.63</u>	<u>0.95</u>
<u>8" TEMPORARY CASING</u>	<u>0 - 93.38'</u>	<u>0.67</u>
<u>ELL 28/31/94</u>	_____	_____
_____	_____	_____
Drilled Depth <u>93.5'</u>	Hole Diameter at TD <u>0.67'</u>	

Static Water Level/Date 72.8', 3/28/94, 07:50Comments H₂O, 75.0', 3/29/94, 07:1574.4', 3/30/94, 07:15

Completion Activity

Date Started 3/30/94

Casing and Screen (Permanent)				Annular Seal/Filter Pack			
Type	Depths	Length	Slot Size	Type	Interval	Volume	Mesh Size
<u>TYPE 304</u>	<u>90.0 - 69.95'</u>	<u>20.65</u>	<u>.10</u>	<u>LIQUID SAND</u>	<u>95.2 - 65.1</u>	<u>7 bks 10.28 Ft³</u>	<u>20-40</u>
<u>BLANK</u>	<u>19.35 - 0.94'</u>	<u>18.41</u>	<u>ELL 28/31/94</u>	<u>3/8" PELLETS</u>	<u>65.1 - 61.5</u>	<u>2 buckets 1.24 Ft³</u>	
_____	_____	_____	_____	<u>BENTONITE</u>	<u>61.5 - 8.5</u>	<u>24 bks 15.62 Ft³</u>	<u>8/20</u>
_____	_____	_____	_____	<u>CRUMPLES</u>	<u>8.5 - 2.0</u>	<u>22 bks 28.27 Ft³</u>	
_____	_____	_____	_____	<u>PORTLAND CEMENT</u>	_____	_____	_____

Other Activity

Aquifer Test Performed? _____

Type _____ Date _____

Well Abandoned? _____

Date _____

Well Survey Data

Date 5/16/94Washington State Prime Coordinates N 146,396.14 E 568,687.20Protective Casing Elevation 468.23'Brass Cap Elevation 465.04'

Comments/Remarks _____

BOREHOLE LOG

VALIDATED
[Signature]
 SIGNATURE/DATE

Boring or Well No. 199-K-108A A9844

Sheet 1 of 5

Location 100 K - S.E. OF K-WEST BUILDING

Project 67-152

Prepared By *Edward C. Rame* / *E. Rame* Date 03/18/94
 (Sign/Print Name)Reviewed By *Sumner J. Anderson* Date 4/12/94
 (Sign/Print Name)

Depth (0)	Sample		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
	Type and No.	Blows or Recovery			
0				0-5 sandy GRAVEL SG 30% sand, 70% GRAVEL, 10% - 20% small COBBLES, 20% - 40% C&P, 40% - 50% MP, 20% - 30% - FP, sand - 40% - 6% G 20% - 40% M, 10% - 30% F 2.5 1/2 dk gray brown - dry 2.5 N3 / very dark gray - wet, p&e. subrounded - subangular, some EDWARDS NO XTN HCL, 80% BASALT, 10% QUARTZ, 10% FELSIC, poorly sorted	Commenced drilling at 9:00 AM 03/18/94 Fill material
5	1 RAD 2 Lith 1 Calc Moist	DB		5-10 sandy Gravel SG 20% sand, 80% Gravel, 20% - 30% small COBBLES, 20% - 40% C&P, 20% - 40% MP, 10% - 20% FP, 10% VFP, sand - 40% - 50% G, 20% - 40% M, 20% - 40% F, poorly sorted, 2.5 1/2 dk gray brown - dry 2.5 N3 very dark gray - wet, subrounded rounded, NO XTN HCL, 80% basalt, 10% quartz, 10% felsic	becoming slightly moist at approximately 7.0' Fill material
10	1 RAD 2 Lith 1 Calc Moist	DB		10-15 sandy Gravel SG - A/A	Fill material visible - moist END OF shift 03/18/94
15	1 RAD 2 Lith 1 Calc Moist	DB		15-20 sandy Gravel SG 30% sand 70% Gravel, 10% - 20% C&P, 30% - 50% MP, 30% - 50% FP, sand 40% - 60% C&P 20% - 30% M, 20% - 30% F, 2.5 1/2 very dark grayish brown - dry, 2.5 1/2 dk - wet poorly sorted, subangular - angular, some spherical, NO REACTION HCL 80% BASALT, 10% QUARTZ, 10% FELSIC	Fill material visible - moist
20	1 RAD 2 Lith 1 Calc Moist	DB			

BOREHOLE LOG

Boring or Well No. 199-K-108ASheet 2 of 5Location 100 K - S.E. OF K-WEST BUILDINGSProject W-152Prepared By Edward C. Rana / C. Rana Date 03/22/94
(Sign/Print Name)Reviewed By Ann J. Rana Date 4/10/94
(Sign/Print Name)

Depth (<u>20</u>)	Sample		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
	Type and No.	Blows or Recovery			
20	1 RAD 2 LITH 1 CALCS MOIST	DB		20-30 SANDY GRAVEL SG 40% SAND 60% GRAVEL, SAND- 20-40% CRS, 20-40% MS, 30%-50% FS, GRAVEL 10%-20% SMALL CORNERS, 10-20% CRP 40-60% MP, 20%-30% EP, SHAKE, COARSE ROUND, SOME SPHERICAL, POORLY SORTED, 2.54 1/2 OLIVE BROWN - DRY 2.54 3/4 VERY DARK GRAYISH BROWN - WET 70% BASALT, 20% QUARTZ, 10% FELTIL NO XTN HCL	20 sample - Fill materials
25	1 RAD 2 LITH 1 CALCS MOIST	DB		30-32 GRAVELLY Silt, SAND gms 30% gravel, 20% silt, 50% SAND 10% silt, GRAVEL 10-20% SMALL CORNERS 10-20% CRP, 20-40% MP, 20-40% EP, SAND 20-40% CRS, 20-40% MS, 20-40% FS, POORLY SORTED, SUBANGULAR - SUBROUND, 2.54 1/2 LIGHT YELLOW BROWN - DRY 2.54 3/4 OLIVE BROWN WET, Silt-INTERMEDIATE WITH GRAVEL - CONGLOMERATE 30% BASALT, 50% QUARTZ, 20% FELTIL 32-35 - GRAVELLY SAND g.s 5% silt 10% GRAVEL, 85% SAND, GRAVEL - 60-2-10% CRP 10-20% MP, SAND - 40-2-10% CRS, 20-30% MS 20-30% FS, MODERATELY SORTED, SUBANGULAR SUBROUND, 2.54 3/4 PALE YELLOW - DRY 2.54 5/4 LIGHT OLIVE BROWN - WET, NO XTN HCL, 10% BASALT, 40% QUARTZ, 50% FELTIL	25 sample - Fill materials
30	1 RAD 2 LITH 1 CALCS MOIST	DB		35-48 SANDY GRAVEL SG 30% SAND 70% GRAVEL, GRAVEL 10-30% SMALL CORNERS, 10-30% CRP, 20-40% MP 20-40% EP, SAND 20-40% CRS, 20-30% MP, 40-60% FS, 2.54 7/2 LIGHT GRAY - DRY, 54 1/2 OLIVE - WET	END OF SHIFT 03/21/94 30 sample - Biogold contact
35	1 RAD 2 LITH 1 CALCS MOIST	DB
40	1 RAD 2 LITH 1 CALCS MOIST	DB

BOREHOLE LOG

Boring or Well No. 199-K-108ASheet 3 of 5Location 100 K - S.E. OF 100 K - WEST BUILDINGProject W-152Prepared By Edward C. Refine / EDWARD C. REFIN Date 03/22/94
(Sign/Print Name)Reviewed By Shirley Anderson Date 4/10/94
(Sign/Print Name)

Depth (<u>40</u>)	Sample		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
	Type and No.	Blows or Recovery			
45	1 RAD 2 LITH 1 CALCS/ Moist	DB		SUBROUND - SUBANGULAR, POORLY SORTED, NO XTN HCL, TR MUSCOVITE, 20% BASALT, 50% QUARTZ, 20% FELIC GRAVEL CONSIST OF 10-20% GREENSTONE, 20-30% QUARTZITE, 10-20% GRANITE; SOME IRON ^{oxide} STAINING CLAY 45-48-54 silty sandy GRAVEL MSCL 20% SILT, 30% SAND, 50% GRAVEL 100% SILT TO CLAY, SAND 10-20% CLAY 30% - 50% MS, 30% - 50% F, GRAVEL - 20% - 30% SMALL COBBLES, 20% - 40% CLAY, 20-40% MP, 10-20% FP, SUBROUND TO SUBANGULAR - GRAVELS SPHERICAL, POORLY SORTED, NO XTN HCL, TR MUSCOVITE, 2.5% 1/2 light yellowish BROWN - dry, 10% 1/2 grayish BROWN - wet, some IRON OXIDE STAINING SILT - 14 brown to tan, 100% VF, 35% CONSOLIDATED, (CLAYEY IN PART), LOW PLASTICITY GRAVEL - CONSIST OF GNEISS 10-20% 10-20% QUARTZITE, 10-20% GRANITE, 20% BASALT, 40% QUARTZ, 40% FELIC	END OF SHIFT 03/22/94
48	1 RAD 2 LITH 1 CALCS Moist	DB		48-50 sample - slightly moist HPT CHECKED SAMPLE 100 GPM gamma, 1 DATA NO DETECT ALPHA	
54	1 RAD 2 LITH 1 CALCS Moist	DB		54-60 slightly silty sandy GRAVEL 5% SILT, 30% SAND, 65% GRAVEL 100% SILT, SAND LLS 20-30%, 30% - 50% MS, 30% - 50% F, GRAVEL - small COBBLES 20-30% MP, 20-40% MP 20-40% FP, 10-30% 2.5% 1/2 PARS YELLOW - dry 2.5 1/2 light olive brown - WET, TR MUSCOVITE, POORLY SORTED PREP SUBROUND - ROUNDED, SPHERICAL 20% BASALT, 50% QUARTZ, 40% 30% FELIC GRAVEL CONSIST OF 10-30% GRANITE, 10-20% GNEISS, 10-20% GREENSTONE, SOME IRON-OXIDE STAINING, NO XTN HCL	54 sample PULVERIZED DUE TO ACTION OF CORE BORREL.
60	1 RAD 2 LITH 1 CALCS/ Moist	DB		END OF SHIFT - 03/23/94	

BOREHOLE LOG

Boring or Well No. 199-K-108ASheet 4 of 5Location 100-K, S.E. of "K" West Bldg.Project WO-152Prepared By E.A. Johnson / E.A. Johnson Date 3/28/94
(Sign/Print Name)Reviewed By Samuel R. Wilson Date 4/6/94
(Sign/Print Name)

Depth (Feet)	Sample		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
	Type and No.	Blows or Recovery			
40		DRIVE BARREL	0:00	40-74.0' SANDY GRAVEL (3% SILT), DRY, 2.54 5/3, LT. OLIVE BROWN 40% GRAVEL, 40% SAND, SAND IS 30% TO COARSE GR., 40% MEDIUM GR., 30% TO FINE GR., GRAVELS ARE 30% TO SMALL CBBLES, 30% MEDIUM PEBBLES, 40% FINE PEBBLES AND GRAVELS. POORLY SORTED, SUB ANGULAR TO SUB ROUNDED.	ADD 9.93'-8" CASING
45	1 Rad 2 Lith 1 Moist CAND		0:00	(LARGE BOULDER 45-70')	END SHIFT 3/24/94 15:30 HOLE 47.0 CASING 44.3' START SHIFT 3/25/94
			0:00	(HARD TUBED PAST BOULDER, USED CORE BARREL TO RECOVER LITHOLOGY, NO IDENTIFIABLE FRAGS OF BOULDER RECOVERED.	
70	1 Rad 2 Lith 1 Moist CAND		0:00		HPT - Lithology to 49' - L.D.
			0:00	Slightly Moist AT 70'	
			0:00		ADD 9.76'-8" CASING
75	1 Rad 2 Lith 1 Moist CAND		0:00	74.0-78.0' Silty Sandy GRAVEL, 10/50/40%, POORLY SORTED, TR CLAY MOIST 2.54 5/3, LT OLIVE BROWN CBBLES TO 5" DIA, PEBBLES TO 2" DIA, ROUNDED, SANDS ARE 30% FINE + V. FINE GR., 40% MEDIUM GR., 30% COARSE GR., ROUNDED, GRAVELS ARE 20% BASALT, 50% WAFLE FLOW, 30% METASEDIMENTS,	550-75' LEL 15.0%, PID-0.0 ppm, 02-30% END SHIFT 3/25/94 13:00 HOLE 75.5' CASING 74.5' START SHIFT 3/28/94 * HAD SAMPLED, 74'-78'
			0:00		HPT - Lithology to 76' - L.D.
80	SPLIT 5 PPM 78.2'- 80.2' 100% RSC	13/100% 34/100% 50/100% 45/100%	0:00	78.0-81.0' Silty Sandy GRAVEL, 15/60/25% POORLY SORTED	

BOREHOLE LOG

Boring or Well No. 199-K-108A

Sheet 5 of 5

Location 100-N, SE of "K" West Bldg.

Project 440-152

Prepared By E.A. Johnson / E.A. Johnson Date 3/29/94
(Sign/Print Name)

Reviewed By Normie J. Anderson
(Sign/Print Name)

Date 4/10/94

[illegible]

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Page 1 of 1

Well No. <u>199-K-108A A9844</u>		Well Specification/Revision <u>WHC-5014 / REV. 7</u>	
Subject	Verification Method	Criteria	Initials/Date
		Spec	Chg. Doc.
Cleaning			
Drilling Rig/Tools	Visual	7.6.7.7	ECL / 03/18/94
Temporary Mater.	Visual	7.7	ECL / 03/18/94
Drill Method	Visual	5.2	ECL / 02/18/94
Lubricants/Additives			
Lubricants	Visual	7.2	ECL / 03/18/94
Additives	Visual	7.2	EAL / 3/24/94
Straightness Test	Visual	8.2	EAL / 3/29/94
Material Storage/Packing of Completion Material			
Mtl. Hand./Stor.	Visual	7.3	EAL 3/30/94
Material Packing	Visual	7.3	EAL 3/30/94
Casing and Screen (Permanent)	Visual	4.2 - 4.2.5, 12.2.1	ECL 3/30/94
Annular/Seal/Filter Pack	Visual	4.2.6 - 4.2.9, 5.3.1	RL 4/4/94
Well Development	Visual	5.3.1.K	R/E 10/10/94
Well Protection			
Surface Pad	Visual	4.2.9, 4.2.10	R/E 10/10/94
Prot. Casing	Visual	4.2.10	R/E 10/10/94
Prot. Posts	Visual	4.2.10	R/E 10/10/94
Cap, Hasp, Lock	Visual	4.2.10	R/E 10/10/94
Site Restored	Visual	11.0	R/E 10/10/94
Pump Installation			
Pump Decon/Prep.	Visual	4.2.10, 12.2.1	R/E 10/10/94
Installed	Visual	5.3.1.L	R/E 10/10/94
Pump Tested	Visual	5.3.1.L	R/E 10/10/94
Well Surveying/Labeling			
Ms. Pt. Surveyed	Visual	3.4	DL 5/19/94
P. Casing/BC Surv.	Visual	3.4	DL 5/19/94
Well No. Stamped	Visual	4.2.9	DJA 11/12/94
BC Labeled	Visual	4.2.9	DJA 11/12/94

Comments _____

WELL 199-K-109A

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Pg 2 of 4
A 98283

WELL SUMMARY SHEET

Boring or Well No.

199-K-101A

Sheet

of

2

Location Approx. 30' N.W. of 105 K East Building

Project

K02 9123/94

#1 IS 100K

Prepared By

Edward C. Lohr / EDWARD C. LOHR
(Sign/Print Name)Date 07/21/94

Reviewed By

Dennis Andrie

(Sign/Print Name)

Date

9/23/94Kent D. Ralston / Kent D. Ralston
(Sign/Print Name)

9/23/94

CONSTRUCTION DATA

GEOLOGIC/HYDROLOGIC DATA

Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description
12" temporary casing set @ 15.02'		0		
		5		0-20 sandy gravel SG
		10		" "
		15		" "
Type I & II cement Surface to 61.4' BLS		20		" "
		25		20-32 slightly silty sandy gravel (m) SG
		30		" "
4" Sch 80 PUC +1.4 to 69.6' BLS		35		32-38.5 sandy gravel SG
Stainless steel wirewrap screen (20 slot) 69.6 to 89.8' BLS		40		38.5-90 sandy gravel SG
		45		" "
Bentonite Pellets 61.4'-64.5' BLS		50		" "
Static water 72.9' on 9/7/94		55		" "
		60		" "
10" temporary casing set @ 92.51		65		" "
Sand filter pack (10-20 mesh) 64.5'-89.5' BLS		70		" "
Sand pack (8-12 mesh) 89.5'-92.5' BLS		75		" "
		80		" "
		85		" "
		90		90-145 slightly silty sandy gravel
		95		
		100		
		105		
		110		
		115		
		120		
		125		
		130		
Bentonite chunks 92.5' to 159.9' BLS		135		
		140		
		145		145-155 silty sandy gravel msk
		150		
		155		155-167.7 clay Ringold lower mud

A-6000-384 (01/93)

19344

WELL SUMMARY SHEET

Boring or Well No. 199K-109A A9928

Sheet 2 of 2

Location ~50' NW of 105-K East Building

Project W-152

Prepared By Chris Anderson / D. Anderson Date _____
(Sign/Print Name)Reviewed By Dennis Anderson Date 7/26/94
(Sign/Print Name)

CONSTRUCTION DATA

Description

Diagram

Depth
in
Feet

GEOLOGIC/HYDROLOGIC DATA

Graphic Log

Lithologic Description

8" temporary casing set

at 164.9'

Slough 159.9' to 165.7' BS

153.5

160

165

153.5 clay Ringold Lower Mud

w/ minor sand & gravel

Total depth 165.7 on

8/30/94

VALIDATED

WELL CONSTRUCTION SUMMARY REPORT

SIGNATURE/DATE

Page 1 of 1

Specification No. WHC-S-014 Rev. No. 7Well No. 199-K-109A Temp. Well No. 19828Approximate Location 350' N.W. of 105' K⁺ East BuildingECNs 172214, 166764, 150145Project 100K - STORAGE FACILITY BASINDrilling Company KAISER ENGINEERDriller GARY HOWELL

Other (Companies)

Geologist(s) EDWARD C. RAFFERTY (ITH)CLINTON E. DEGENHART (SGG)DENNIS J. ANDERSON WHCKENT D. REYNOLDS WHCDate Drilling Started 07/13/94

Geophysical Logging

Sondes (type)

Interval

Date

Gamma Logging (KUT) 0 - 89.0 08/02/94NAI Log - Gamma 0 - 103 8-11-94Gamma Logging VAI 0 - 160 8-31-94SEISMIC DOWN HOLE 0 - 153 8-31-94

Drill Method

Type COCKLE TOOL DRILLINGDrilling Fluid RAW COLUMBIA WATERTotal Amount of Water Added During Drilling 1495 gallonsComments Note that the make-up water added during drilling was added to the hole after drilling the screen interval.

Temporary Casings and Drilled Depth

Casing Type and Size

Interval

Shoe OD

12" TEMPORARY CASING 0 - 10.0 1.010" TEMPORARY CASING 0 - 92.5 0.838" TEMPORARY CASING 0 - 164.9 0.66Drilled Depth 165.7' Hole Diameter at TD 8" NOMINALStatic Water Level/Date 71.88 - 07/23/94 ; 71.60 07/29/94Comments 89.5' 3/31/94 , 72.9' BLS
9/17/94 , 72.7' BLS 9/31/94

Completion Activity

Date Started 9/6/94

Casing and Screen (Permanent)

Type

Depths

Length

Slot Size

S.E. well 89.8' - 69.6' 20.19' 20 slotSch 80 PVC 69.6' - 1.4' 71.03' NA

Annular Seal/Filter Pack

Type

Interval

Volume

Mesh Size

Bent. chunks 159.9' - 92.5' 38 sks/26.2 ft³ 1/2" NomSand 92.5' - 89.5' 3 sks/3.0 ft³ 8-12Sand 89.5' - 64.5' 16 1/2 sks/17.7 ft³ 10-20Bent. Pellets 64.5' - 61.4' 36 kts/1.86 ft³ 3/8"Cement 61.4' - 15' 64 sks/82.2 ft³ NAType III

Other Activity

Aquifer Test Performed? N/A

Type _____ Date _____

Well Abandoned? _____

Date _____

Well Survey Data

Date 10/20/94Washington State Prime Coordinates N: 146.748, 499 E: 569, 122.180Protective Casing Elevation 468.20Brass Cap Elevation 465.18'Comments/Remarks ID of PVC pipe too small to allow slug testing and a 1.5 hp R10 flow pump was used for development. Approximately 2000 gallons of water were pumped from the screen interval during development. Eight liters of sample water were collected at the end of development for testing/analysis purposes.

BOREHOLE LOG

VALIDATED
Dennis Anderson
 SIGNATURE/DATE

Boring or Well No. 199-K-109A19323

Sheet 1 of 9

Location ≈ 50' N.W. of 105' K' East BuildingProject W-152Prepared By Edward C. Palmer / E. Palmer Date 07/15/94
 (Sign/Print Name)Reviewed By Dennis Anderson Date 8/31/94
 (Sign/Print Name)

Depth ()	Sample		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
	Type and No.	Blows or Recovery			
0					
5	1 RD 2 Lith	DB		0-10' SANDY GRAVEL SG 30% sand, 70% GRAVEL GRAVEL - 10% small COBBLES 20%-40% CLAY, 20%-40% MP, 20%- 40% FP, SAND - 40%-60% CLAY, 20%-40% MP, poorly SORTED GRAVEL - SPHERICAL to ROUNDED, SAND - SUBANGULAR to SUBROUND, 2.5gr 4/2 dk grayish brown dry, 2.5gr N2/bk - WET NO REACTION HCL, EXCEPT SOME WHITE COATINGS AROUND BASALT - STRONG KNOCK-OUT, 70% BASALT, 20% QUARTZ, 10% FELSIC.	COMMENT: Drilling 07/14/94 @ 8:00 am LOT - BACKGROUND w/ GIEGLER-MILLER @ 150 rpm on BACKGROUND. ECW 7/15/94 50-0% CLAY 210% 21% Q, 6 DET w/ DET
10	1 RD 2 Lith	DB		10-20 SANDY GRAVEL SG 20% sand, 80% GRAVEL 10%-20% small COBBLES; between depths of 12.5 to 14.5 a large BOULDER WAS IMBEDDED IN SOILS. 20%-40% CLAY, 10%-20% MP, 40%- 50% FP, SAND - 20%-50% CLAY, 40%-60% MP, poorly SORTED 5y 4/3 olive - dry, 2.5 yf N2/bk - WET, NO REA to HCL GRAVEL - SPHERICAL; SAND - SUBANGULAR - SUBANGULAR, 80% BASALT, 10% QUARTZ, 10% FELSIC.	10' Fill MATERIAL SAMPLE PULVERIZED END OF SHIFT 07/14/94 PROBLEMS w/ RUNNING 10" Casing - 07/15-19/94 REQUIRED WELL BORE FROM 0-16.0'
15	1 RD 2 Lith	DB			15' sample Fill MATERIAL NOT SURVEY SAMPLES - NO DETECTABLE J, B, D.
20	1 RD 2 Lith	DB			

BOREHOLE LOG

Boring or Well No. 199-K-109ASheet 2 of 9Location 50' N.W. OF 105' K" EAST BUILDINGProject W-152Prepared By Edward C. Ruff / C. Ruff Date 07/20/94
(Sign/Print Name)Reviewed By Dennis Anderson Date 8/31/94
(Sign/Print Name)

Depth (<u>20</u>)	Sample		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
	Type and No.	Blows or Recovery			
25	1 RND 2 Lith	DB		20-22' slightly silty, sandy Gravel	SSO - 0% LEL, 21% O ₂
				(m) < G 10% silt, 20% sand	< DET W/ DET
				70% Gravel, 10-20% small	HPT - NO DETECTABLE
				COBBLES, 40-60% C.P., 20-40% MP,	
				20-40% SP, sand, 40-70% C.P.	
				40-50% MS, poorly sorted,	sample 25' Fill material
				2.5 y 4/3 olive brown - dry	due to action of drill
				2.5 y N=10 - black - wet, gravel -	bit - sample pulverized.
				spherical - some rounded and	
				prismatic, sand - subangular -	
30	1 RND 2 Lith	DB		subangular, weak rxn to HCL	
				20% gravel, 10% felsic, 10% quartz	END OF SHIFT 7/20/94
				some iron staining around gravel	
35	1 RND 2 Lith	DB		32-38.5' sandy Gravel < G	sample 30' - FILL MATERIAL
				30% sand 70% Gravel	METAL
				40-60% C.P., 20-40% MP, 20-40% FP	" = DENOTES MATERIAL(S)
				sand - 20-40% C.P., 40-70% MS,	FOUND IN FILL MATERIAL
				20-40% FS, poorly sorted, gravel -	
				rounded, pea shape gravel,	
				30% - subangular - subangular	HPT SURVEYS split 3000 #1
				5 y 4/3 olive - dry, 2.5 N=10	6" #2, NO DETECTABLE & P.C.
				black - wet, weak rxn to	
				HCL, 70% coarse, 20% quartz,	
38.5	1 RND 2 Lith	DB		10% felsic	sample 35' Fill material
					slightly moist, due to drill
					bit - sample pulverized.
39	1 RND 2 Lith	DB		38.5-45.0 sandy Gravel < G	sample 38.5' CONTACT
				40% sand, 60% Gravel	
				10-20% small COBBLES, 30-50%	Fill material / Ringold E"
				C.P., 20-40% MP, 10-20% FP,	
				sand - 40-60% C.P., 40-50%	
				MS, 10-20% FS, poorly sorted	
				2.5 y 7/8 pale yellow - dry	

BOREHOLE LOG

Boring or Well No. 199-K-109ASheet 3 of 9Location 50' NW. of 105 K" EAST BUILDINGProject W-152

Monty Mehner 19 Monty Mehner

Prepared By Edward L. Rahn / C. Rahn Date 07/22/94Reviewed By Dennis Anderson

(Sign/Print Name)

Date 5/31/94

Depth (<u>40</u>)	Sample		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
	Type and No.	Blows or Recovery			
	41.0	ST		2.54 1/2 OLIVE BROWN - WET GRAVEL - PRISMATICAL, SPHERICAL SAND - SUBANGULAR TO SUBANGULAR NO RTN TO HCL 20% BASALT, 40% QUARTZ, 40% FELSIC; FELSIC - 10% - 20% GRANITE 10-20% GNEISS, 10% QUARTZITE TO MUSCOVITE	END OF SHIFT 07/22/94 7-25-94: Drilling begins at 1418, and ceases at 1444 Cuttings were not removed from the well (on 7-25-94)
45	1 RAD 2 LITH	HT		45-68' : Sandy gravel SG (40% sand, 60% gravel); 20% cobbles, 10% UCP, 20% CP, 20% CMP, 20% AFP, 10% AUF, 15% UCS, 10% CCS, 5% CMS, 15% OFS, 10% LFS; 10YR 7/4, slightly moist; Gravel is very poorly sorted, with ~40% basalt (round, spheroidal-prismatoid), 30% granite (round, spheroidal-discoidal), ~15% gneiss (round, spheroidal- discoidal), 15% quartzite (round, spheroidal); Sand is poorly sorted, with ~5% basalt (sub round), 25% felsics (sub round), 70% quartz (round), trace muscovite, phlogo- pite, sphene(?); Very strong reaction to 10% HCl, cobbles content decreases downward.	
50	1 RAD 2 LITH	DB			
55	1 RAD 2 LITH	DB			
	1 RAD 2 LITH	DB 55'-60'			END OF SHIFT 7/26/94 7-27-94: Drilling begins at 0615

Sheet 4 of 9

Project W-152

Reviewed By Donna Anderson Date 2/21/94
(Sign/Print Name)

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. 199-K-109ASheet 5 of 9Location 50' NW of 105" K East BuildingProject W-152Prepared By Edward C. Rabe / Edward C. Rabe Date 8/1/94
(Sign/Print Name)Reviewed By Dennis Andersen Date 8/31/94
(Sign/Print Name)

Depth (<u>80</u>)	Sample		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
	Type and No.	Blows or Recovery			
85	1 KAD 2 LTH	DB 80-85		80-90 Sandy Gravel < 6 40% Sand, 60% Gravel, Gravel - 10"-20" COTTAGE, 10"-20" rcp, 40"-60" crp, 20"-40" mp, sand, 40"-60" crp, 20"-40" mp, 10"-20" fr. 2.5% 1/2 light olive brown - wet, very poorly sorted: gravel - subangular - rounded; 10% quartz, 10% 20% granite, 10"-20" gneiss, Trace greenstone, 10% muscovite Slight extn to HCL, 30% basalt 30% quartz, 40% felsic.	SSD - 20% LEL 15% O ₂ L DET W/PED
	1 KAD 2 LTH	DB			
	split spad #4	BLAND 26/27/20/25 75% RECOVER 35% REP. SAMPLE			
	1 KAD 2 LTH	DB 88.8			
90	1 KAD 2 LTH	DB		90- slightly silty, sandy gravel (m) < 10% silt, 40% sand 50% Gravel; Gravel - 10"-20" small cobbles, 20"-40" crp, 20"-40" mp, 20"-30" fr. sand, 40"-60" crp, 20"-40" mp, 10"-20" fr, poorly sorted, 2.5% 1/2 light olive brown, wet, Gravel - subangular, rounded. Sand - subangular - subangular, slight extn to HCL; Trace muscovite, and phlogopite, coarse content increased downward, past 98" gravel consist of 20% granite, 10"-20" quartzite, 10% gneiss, 10% andesite, 20% basalt, 45% felsic, 35% quartz.	END OF SHIFT 08/01/94 END OF SHIFT 08/02/94 Drill stem sampling device Test #2, @ 98.5' Downsize to 8" temporary casing @ 98.5' SSD - 2% LEL 5% O ₂ L DET W/PED END OF SHIFT 08/03/94
	1 KAD 2 LTH	DB			
	1 KAD 2 LTH	DB			
	1 KAD 2 LTH	DB			
100	1 KAD 2 LTH	DB

BOREHOLE LOG

Boring or Well No. 199K-109A

Sheet 6 of 9

Location 50' NW of "K" East 105-Building

Project W-15-2

Prepared By CLINT DEGENHART Date 6/15/94
(Sign/Print Name)

Reviewed By Dennis Anderson Date 5/31/98
(Sign/Print Name)

Chas. DeGroot

Depth (100)	Sample		Graphic Log	Sample Description	Comments
	Type and No.	Blows or Recovery		Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
105	1 Rad 2 bits	HT		105' as above	Rock at ~ 101' start HT at 102' End of shift 103'
				NOTE because of a hard tooling is running sand the gravel portion is not for examined -	107.3 water sample 8/15/44 107' Heaving sands
110	1 Rad 2 bits	HT		110 as above	
				Sand is 30% coarse 5% v.c 30% m, 30% R to v.c 50% quartz, 25% basalt 15% b. to v.c hor. & l. 10% feldspar color wet is salt/pepper no R to RM HCl	
115	1 Rad 2 bits	HT		115 as above	115 End of shift 8/16/44
		HT			
	SPHT SP00M #5	40/103/31 45 40-50% Rec.		116-118 slightly silty sandy gravel in 1.5 ft 5-10% silt 40% sand 50% gravel Poorly sorted Gravel 15% sm cobbles 30% RP 30% CP 30% RP sand 50% v.c 30% m, 20% R to v.c 2.5% 1/3 light olive brown, wet Gravel rounded to subrounded sand subrounded to subang. no R to HCl Gravel	
130	1 Rad 2 bits	HT			

BOREHOLE LOG

Boring or Well No. 199K-109A

Sheet 7 of 9

Location 50' NW "F" K East 105 Building

Project W-152

Prepared By Clint Degenhart
(Sign/Print Name)

Date 8-24-94

Reviewed By Dennis Anderson
(Sign/Print Name)

Date 6/31/94

Client Signature

(Sign/Print Name)

[illegible]

Sheet 8 of 9

Project W-152

Date 8-25-94

Date 7/8/24

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. 199K-109ASheet 9 of 9Location 50' NW OF KF 105 BuildingProject W152Prepared By Cliff Deanehart Date 5-31-94
(Sign/Print Name)Reviewed By Dennis Anderson Date 9/8/94
(Sign/Print Name)

Depth (160)	Sample		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
	Type and No.	Blows or Recovery			
165	1 Rod 247X	HT	0-2	clay - mudstone as above -	
			2-4	massive clay w/ ~5% quartz,	
			4-6	10% sand; sand is ~60% basalt	
			6-8	30% quartz, 10% epidote	
			8-10	no rxn to HCl.	
			10-12		
			12-14		
			14-16		
			16-18		
			18-20		
					165' 1140 8/30/94
				bottom of hole 165.7' split	
				spoon taken 165.7'-167.7'	SP 1400 5/30/94
	split SP # 8	blows 20-22 - 40-35 5-0% Rec.			TD = 165.7 w/ 2' split
170					

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Page 1 of 1

Well No.

199-K-109A A9828

Well Specification/Revision

WHC-S-014 REV. 7

Subject	Verification Method	Criteria		Initials/Date
		Spec	Chg. Doc.	
Cleaning				
Drilling Rig/Tools	Visual	7.6.7.7		ECL 07/13/94
Temporary Mater.	Visual	7.7		ECL 07/13/94
Drill Method	Visual	5.2		ECL 07/13/94
Lubricants/Additives				
Lubricants	Visual	7.2		ECL 07/14/94
Additives	Visual	7.2		ECL 07/14/94
Straightness Test	Visual	8.2		ECL 7/17/94
Material Storage/Packing of Completion Material				
Mtl. Hand./Stor.	Visual	7.3		KDR 9/19/94
Material Packing	Visual	7.3		KDR 9/19/94
Casing and Screen (Permanent)	Visual	4.2 - 4.2.5, 12.2.1		KDR 9/19/94
Annular/Seal/Filter Pack	Visual	4.2.6 - 4.2.9, 5.3.1		KDR 9/19/94
Well Development	Visual	5.3.1.K		KDR 9/20/94
Well Protection				
Surface Pad	Visual	4.2.9, 4.2.10		KDR 9/20/94
Prot. Casing	Visual	4.2.10		KDR 9/20/94
Prot. Posts	Visual	4.2.10		KDR 9/20/94
Cap, Hasp, Lock	Visual	4.2.10		KDR 9/20/94
Site Restored	Visual	11.0		DJA 10/13/94
Pump Installation				
Pump Decon/Prep.	Visual	4.2.10, 12.2.1		DJA 10/13/94
Installed	Visual	5.3.1.L		DJA 10/13/94
Pump Tested	Visual	5.3.1.L		DJA 10/13/94
Well Surveying/Labeling				
Ms. Pt. Surveyed	Visual	3.4		DJA 10/13/94
P. Casing/BC Surv.	Visual	3.4		DJA 10/13/94
Well No. Stamped	Visual	4.2.9		DJA 10/13/94
BC Labeled	Visual	4.2.9		DJA 10/13/94

Comments

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WELL 199-K-110A

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WELL SUMMARY SHEET

Boring or Well No. 199-K-110A 9329

Sheet 1 of 1

Location SOUTHEAST CORNER K-EAST REACTOR

Project W-152

Prepared By EDWARD C. RYAN / EDWARD C. RYAN
(Sign/Print Name) Date 05/05/94Reviewed By D.J. Anderson D.J. Anderson
(Sign/Print Name) Date 5/22/94

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
4" STAINLESS STEEL STICKUP 1.3'		0		
12" TEMPORARY C.I. CASING SET @ 10.05'		5		0-39.9 sandy Gravel sG
I & II Type PORTLAND CEMENT INTERVAL 9.1'-2.0'		10		" "
		15		" "
		20		" "
		25		" "
		30		" "
		35		" "
10" TEMPORARY C.I. CASING SET @ 93.10'		40		39.9-43.5 ^{43.5} silty ^{slightly} sandy Gravel MSG
8-20 MESH BENTONITE GRANULES 61.2'-9.1'		45		43.5-65.0 sandy Gravel sG
		50		" "
		55		" "
1/4" BENTONITE PELLETS - 64.8'-61.2'		60		" "
TOP OF 20-40 SAND @ 64.8'		65		65.0-70.0 slightly silty sandy Gravel (M).
STATIC GROUNDWATER 71.3' - 05/20/94		70		70.0-77.35 sandy Gravel sG
4" STAINLESS STEEL SCREEN INTERVAL 89.7'-64.8'		75		77.35-79.35 SAND S
20-40 SAND INTERVAL 92.9'-64.8'		80		79.35-84.5 sandy Gravel sG
BOTTOM 4" STAINLESS STEEL @ 89.7'		85		84.5-88.0 ^{88.0} sandy Gravel sG
		90		88.0-91.0 SAND S
SLUFF 93.1'-92.9'				91.0-93.1 sandy Gravel sG

VALIDATED
 1998/12/2/94
 SIGNATURE/DATE

B. 1.83

WELL CONSTRUCTION SUMMARY REPORT

Page 1 of 1

Specification No. WHC-S-014 Rev. No. 7ECNs 172214, 166764Project 100' K" STORAGE FACILITY BasinDrilling Company Kaiser ENGINEERDriller M.E. WILASPIR, GARY HOWELL

Other (Companies) _____

Geologist(s) EDWARD P. RAFFERTY (WHC)J.M. FOURDTE (WHC)Date Drilling Started 05/05/94

Geophysical Logging

Sondes (type) Interval Date

GEOPHYSICAL LOGGING (KUT) 0 - 91.0 05/17/94

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Other Activity

Aquifer Test Performed? N/A

Type _____ Date _____

Well Abandoned? _____

Date _____

Comments/Remarks _____

Well No. 199-K-110A Temp. Well No. _____Approximate Location SOUTHEAST CORNER K-EAST REACTION

Drill Method

Type CABLE TOOL DRILLINGDrilling Fluid LOW COLUMBIA WATERTotal Amount of Water Added During Drilling 22 gallons LOW COLUMBIA WATER

Comments _____

Temporary Casings and Drilled Depth

Casing Type and Size Interval Shoe OD

12" TEMPORARY CASING 0 - 10.55 0.9910" TEMPORARY CASING 10.55 - 93.2 0.85

Drilled Depth 93.10 Hole Diameter at TD 0.83Static Water Level/Date 71.4 - 05/12/94 71.5 - 05/16/94Comments 71.3 - 05/20/94

Completion Activity Date Started 05/18/94

Annular Seal/Filter Pack

Type Interval Volume Mesh Size

COARSE SILICA SAND 91.9 - 64.8 17 1/2 sacks 19.6 ft³ 20-40BENTONITE PELLETS 64.8 - 61.2 3 buckets 1.86 ft³ 1/4"BENTONITE CUMULUS 61.2 - 9.1 44 sacks 31.24 ft³ 8-20PORTLAND CEMENT 9.1 - 2 11 sacks 14.14 ft³ I+II type

Well Survey Data

Date 10/20Washington State Prime Coordinates N: 146,677.910 E: 569,230.007Protective Casing Elevation 467.97Brass Cap Elevation 465.66

BOREHOLE LOG

VALIDATED

D. J. Anderson 12/3/97
SIGNATURE/DATE

Boring or Well No. 199-K-110A

A9829

Sheet 1 of 5

Location 100K' S.E. of 105 K East Building

Project W-152

Prepared By Edward C. Rofner / EDWARD C. ROFNER Date 05/06/94
(Sign/Print Name)Reviewed By D. J. Anderson D.J. Anderson Date 5/19/94
(Sign/Print Name)

Depth (<u>20</u>) Feet 05/12/94	Sample		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
	Type and No.	Blows or Recovery			
5	1 ROD 2 Lith	DB		0-5 sandy Gravel SG (30% sand, 70% Gravel)	commence drilling 05/05/94 2:10:30 AM
				220d 40-60% cas, 30-50% ms, 20-40% Fe, Gravel - 10-20"	
				small COBBLES 20-40% cas p	
				20-40% mp, 40-60% Fe, poorly sorted	
				2.5y 1/2 dark grayish brown - clay	
10	1 ROD 2 Lith	DB		2.5y 2/3 black - WET, subangular	
				- rounded, Gravel - spherical	
				NO REACTION 10" HCL, 90% basalt, 10% quartz	Fill material; sample pulverized by action of core barrel
				5-15.9 sandy Gravel SG (30% sand, 80% Gravel)	
				sand - 40-50% cas, 20-40% ms, 20-40% Fe, Gravel - 10-30"	
15	1 ROD 2 Lith	DB		small COBBLES, 30-40% cas p	
				30-40% mp, 20-40% Fe, poorly sorted	
				40-60% subangular - subangular	END OF SHIFT - 05/05/94
				2.5y 3/4 gray - clay	Fill material; sample
				2.5y 1/2 black - WET	pulverized by action of core barrel
20	1 ROD 2 Lith	DB		WET REACTION HCL TO CARBON ON basalt gravel. obs. scattered granites & gneiss.	
				85% basalt, 10% quartz, 5% Fe sil	
				15.9-17.9 sandy Gravel SG (30% sand, 70% Gravel)	Fill material
				sand - 50-70% cas, 20-40% ms, 20-40% Fe, Gravel - 10-30"	split spoon #1 - 15.9-17.9"
				40-60% mp, 20-40% Fe, poorly sorted, 2.5 1/2 dark grayish brown - clay (same as 15.9-17.9)	Package B" 1" in - CaCO3 moist
20	1 ROD 2 Lith	DB		2.5 3/4 black - WET 90% basalt	- slightly moist @ 17.5"
				5% quartz, 5% Fe sil	

BOREHOLE LOG

Boring or Well No. 89-K-110ASheet 2 of 5Location 100K, SE of DS & EAST BUILDINGProject 47-152Prepared By Edward C. Rouse / E. Rouse Date 05/09/94
(Sign/Print Name)Reviewed By D. Anderson D. Anderson Date 5/19/94
(Sign/Print Name)

Depth (<u>20</u>)	Sample		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
	Type and No.	Blows or Recovery			
25	1 LAD 2 LITH	DB		17.9 - 20.0' sandy GRAVEL	SAMPLE MOIST 2
				SAME AS 15.9-17.9 split 3pm	20.0
				*1 SAMPLE; slight increase	Fill MATERIAL
				IN FELSIC 10-20% & QUARTZ 10-20%	
				20-25.0 slightly silty sandy	
				GRAVEL (M) 5 (10% silt, 20%	
				CLAY, 70% GRAVEL, 10% silt - 20%	
				EL. 10-20' 40-50' ME, 10-20%	
				20-25.0 F, 10-20% COBBLES, 10-20%	
				CLAY, 30-40% MP, 30-50% SP, 2.5	
30	1 LAD 2 LITH	DB		4 N/2 VERY dark gray, 2.5% N/2 - black WET	
				SILT - brown, poor Vfs located	END OF SHIT 05/09/94
				ROUND GRAVEL, 50% - SUBANGULAR -	
				SUBANGULAR; GRAVEL - SPHERICAL	SPLIT - 3pm #2 - Fill MATERIAL
				POORLY SORTED, NO REACTION HCL, 40%	26.0 - 26.5 - 10 blows
				BRICK 20% QUARTZ, 20% FELSIC	26.5 - 27.0 - 10 blows
				25.0 - 35.0 Sandy GRAVEL SG	27.0 - 27.5 - 24 blows
				20% silt, 80% GRAVEL, SAND -	27.5 - 28.0 - 22 blows
				40-40% CL, 20-40% ME, GRAVEL	NO SAMPLE, Fill Package B
				20-40% CL, 40-50% MP, 40-50%	30' sample moist
35	1 LAD 2 LITH	DB		EL. 2.5% N/2 VERY dark gray - dry	Fill MATERIAL
				2.5% N/2 black - WET, poorly	
				SORTED, SUBANGULAR - ANGULAR,	
				GRAVEL - SPHERICAL, NO REACTION	
				HCL, 90% BRICK, 5% QUARTZ,	
				5% FELSIC	
40	1 LAD 2 LITH	DB		39.9'	
				35.0 - 40.0 2.5/10/94 - Sandy GRAVEL SG	35' - sample moist
				10% sand, 90% GRAVEL, sand - 40%	Fill MATERIAL
				80% CL, 20-40% ME, 10-20% F, GRAVEL -	
				10-20% CL, 20-40% MP, 40-40% Fp,	
				POORLY SORTED, 2.5 N/2 gray - dry	
				2.5 N/2 VERY dark gray - WET	
				SUBANGULAR - ANGULAR, 90% BRICK	35.5 Ringold CONTACT
				0% QUARTZ	

BOREHOLE LOG

Boring or Well No. 199-K-110ASheet 3 of 5Location 100K - SE OF 105K EAST BUILDINGProject 42-152Prepared By Edward C. Remy / E. Remy Date 05/10/94
(Sign/Print Name)Reviewed By D. J. Anderson / D. J. Anderson Date 5/17/94
(Sign/Print Name)

Depth (<u>40</u>)	Sample		Graphic Log	Sample Description	Comments
	Type and No.	Blows or Recovery		Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCL	Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
		ST 39.7		39.9-43.5 - silty, sandy GRAVEL m.g.	CHOUX PERM. 5 - 15/32/74/85
		split sp		10% silt, 30% sand, 60% gravel,	41.4 - 40.4 - Packoff 1/8"
		#3, 75% Recovery		silt 100% sand - 40% - 10% cgs, 20% - 40% ms, 20% - 40% Fz, GRAVEL - 20% - 40% cgs	NOTED RETENTION/MOISTURE
		41.9		20-50% mp, 20-50% Fz, sand - subangular	RETENTION: sat. 1/4 grain cap.
43.5	1 RND 2 LITH	DB		2 subrounded, 2.5% 1/4 light yellowish brown - dry 2.5% 1/4 light olive brown - wet	
				NO REACTION TO HCL, poorly sorted,	
				silt - 100% VFz; low plasticity,	END OF SHIFT 05/09/94
				NO VISIBLE BEDDING PLANES in split	
				30% sample #3, NON-CALCAREOUS	
				30% basalt, 40% quartz, 30% felsic	
				10% - 20% granite, 10% - 20% greenstone,	
				10% - 20% gneiss	
				43.5 - 55.0 sandy GRAVEL sg	
				40% sand, 60% GRAVEL, sand	
				20-40% cgs, 20% - 40% ms, 30-50% Fz	
				GRAVEL - 10-20% small COBBLES, 20-40% cgs, 20-40% mp, 30-50% Fz, poorly	
50.0	1 RND 2 LITH	DB		sorted, sand - subangular - 5/16 - rounded, gravel - spherical,	
				2.5% 1/4 pale yellow - dry, 10% - 5/16 yellow brown - wet, 1/4	
				micaceous, 10% basalt, 40% quartz	
				30% felsic, 10-20% granite,	
				10-20% quartzite, 1/4 greenstone	
				NO REACTION HCL	
				55.0 - sandy GRAVEL sg	
				(30% sand, 70% GRAVEL), sand	
				30% - 50% cgs, 30% - 40% ms, 20-40% Fz	
				GRAVEL - 20-30% small COBBLES,	
				30-50% cgs, 30-40% mp, 20-40% - Fz, poorly sorted, sand - subangular	
				subrounded, gravel - spherical - rounded, 2.5% 1/4 pale yellow - dry	
				2.5% 1/4 olive brown - wet.	
				10% basalt, 40% quartz, 50% felsic	END OF SHIFT 05/10/94
60	1 RND 2 LITH	DB		IRON STRINGS NOTED AROUND COBBLES	

BOREHOLE LOG

Boring or Well No. 199-K-110A

Sheet 4 of 5

Location SE. OF 105 K" EAST BUILDINGProject W-152Prepared By Edward C. Rader / EDWARD C. RUFUS Date 05/11/94
(Sign/Print Name)Reviewed By DJ Anderson Date 5/15/94
(Sign/Print Name)

Depth (60)	Sample		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
	Type and No.	Blows or Recovery			
65	1 RAD 2 Lith	DB		65.0'-70.0' slightly silty sandy gravel (m) LG - 10% silt, 20% sand, 70% gravel, 100% silt, sand, 20-40" C/S, 40-50" MS, 20-40" F, gravel 10-20" small cobbles, 40-50" C/S, 40-50" MP, 20-40" F, sand - subangular - some angular, gravel some rounded - spherical, poorly sorted, 2.5 1/3 light yellow-brown 2.5 1/3 olive brown - wet, silty - light green; some light brown tan, non- plastic, very fine sand, to muscovite No reaction HCl, basalt 30%, quartz 50%, 20% feldspar, 70.0'-77.35' sandy gravel LG 40% sand 60% gravel, sand - 30-50" C/S, 30-50" MS, 20-40" F, gravel - 10-20" small cobbles, 20-40" C/S, 20-40" MP 20-50" F, sand, subangular - angular gravel - spherical - rounded, poorly sorted, no reaction HCl, 2.5 1/3 olive brown - wet, 10% basalt, 40% quartz 50% feldspar	DUE TO CORE BARREL ACTION - SAMPLES PULVERIZED.
70	1 RAD 2 Lith	DB		70.0'-77.35' sandy gravel LG 40% sand 60% gravel, sand - 30-50" C/S, 30-50" MS, 20-40" F, gravel - 10-20" small cobbles, 20-40" C/S, 20-40" MP 20-50" F, sand, subangular - angular gravel - spherical - rounded, poorly sorted, no reaction HCl, 2.5 1/3 olive brown - wet, 10% basalt, 40% quartz 50% feldspar	STATIC GROUNDWATER @ 71.4' 05/12/94 END OF SHIFT 05/11/94
75	1 RAD 2 Lith	DB		77.35-79.35: Sand (90% S, 10% F) may contain >5% ST. The poorly sorted (10% vcs, 20% ms, 40% ms, 15% fs and 15% vcs) sand (sub round to round grains that are spherical) is brown, 7.5 YR 5/3, and contains 25% basalt, 40% silica, and 15% feldspar, muscovite, phlogopite and accessories. The unit is below WL, and is nonreactive to HCl.	PREP TO USE DRILL STEM SAMPLING DEVICE Driller reports sand at ~76.5'
	rad lith D	SPICE Spoon #4			
	C	90% recov.			
	B	77.35- 79.35			
	lith A	79.35			

BOREHOLE LOG

Boring or Well No. 199-K-110ASheet 6 of 5Location SE of 105 KE buildingProject W-152Prepared By J. M. Faurde
(Sign/Print Name)Date 5/13/94Reviewed By D. J. Anderson
(Sign/Print Name)Date 5/17/94

Depth (<u>80</u>)	Sample		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
	Type and No.	Blows or Recovery			
				71.35 to 79.25 (cont'd) The Gravel (75% G, 20% S, ~5% M) is Sandy Gravel, very poorly sorted, sub-round, spheroidal and prismatic. The unit consists of 50% basalt, 30% meta-morphic and 20% silica plus felsic intrusive rocks. The grains (30% vcp, 10% cp, 35% mp, 15% Ep and 10% vfp) range to 3" plus, and matrix contains small cobbles. The matrix sand (10% cs, 65% ms, 15% fs, 10% vfs) has ~20% basalt.	The gravel is variegated in color, but the overall appearance is the brown of the matrix sand. @ 81' - very high granite percentage.
	1 HPT Dugger 2 AR	20		84.5' Sand (95% S, 5% G) The unit is below WL, med. gy-bn, composed of 75% silica, 15% feldspar plus accessories and 10% or < basalt plus mafic minerals. The sand is moderately sorted (<10% cs, 70% ms, 10% fs and 10% vfs), with grains from sub-angular to sub-round and typically spheroidal. Some basalt fragments are discoidal.	gradational contact gravel-sand-gravel Some <1" gravel between 82' and 83'
85				84.5-88.0 - sandy Gravel s.g. - same as 70.0' sample	Approx 85' begins large Cobble gravel, sandy gravel unit.
90	1 RAD 2 AR	20		88.0-91.0 Sand - same as 77.25-79.25 sample	88.5 and shift 1458, 5/13/94
				91.0-93.1 - sandy Gravel s.g. (30% S, 60% G, 10% M), sand, 30-50' LGS, 30-50' MS, 20-30' F, Gravel - some 10-20' sand cobbles, 20-30' cp, 20-30' mp, 30-50' Ep, poorly sorted, sand - sub-round - sub-angular gravel - spheroidal and prismatic 30% basalt, 30% Ffsil, 20% quartz	
93	1 RAD 2 AR				
					END OF SHIFT - 05/16/94 Drillerc Depth - 93.10 10' CS casing depth - 93.17

Pg 3 of 3

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Page 1 of 1

Well No. <u>199-K-110A A9829</u>		Well Specification/Revision <u>WHC-S-014 REV. 7</u>		
Subject	Verification Method	Criteria		Initials/Date
		Spec	Chg. Doc.	
Cleaning				
Drilling Rig/Tools	Visual	7.6.7.7		ECL 05/05/94
Temporary Mater.	Visual	7.7		ECL 05/05/94
Drill Method	Visual	5.2		ECL 05/05/94
Lubricants/Additives				
Lubricants	Visual	7.2		ECL 05/05/94
Additives	Visual	7.2		
Straightness Test	Visual	8.2		ECL 05/11/94
Material Storage/Packing of Completion Material				
Mtl. Hand./Stor.	Visual	7.3		ECL 05/17/94
Material Packing	Visual	7.3		ECL 05/17/94
Casing and Screen (Permanent)	Visual	4.2 - 4.2.5, 12.2.1		ECL 05/17/94
Annular/Seal/Filter Pack	Visual	4.2.6 - 4.2.9, 5.3.1		ECL 05/17/94
Well Development	Visual	5.3.1.K		DJA 6/16/94
Well Protection				
Surface Pad	Visual	4.2.9, 4.2.10		DJA 12/2/94
Prot. Casing	Visual	4.2.10		DJA 12/2/94
Prot. Posts	Visual	4.2.10		DJA 12/2/94
Cap, Hasp, Lock	Visual	4.2.10		DJA 12/2/94
Site Restored	Visual	11.0		DJA 12/2/94
Pump Installation				
Pump Decon/Prep.	Visual	4.2.10, 12.2.1		DJA 12/2/94
Installed	Visual	5.3.1.L		DJA 12/2/94
Pump Tested	Visual	5.3.1.L		DJA 12/2/94
Well Surveying/Labeling				
Ms. Pt. Surveyed	Visual	3.4		DJA 12/2/94
P. Casing/BC Surv.	Visual	3.4		DJA 12/2/94
Well No. Stamped	Visual	4.2.9		DJA 12/2/94
BC Labeled	Visual	4.2.9		DJA 12/2/94

Comments _____

WELL 199-K-111A

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WELL SUMMARY SHEET

Boring or Well No. 199-K-111A A9830Sheet 1 of 2Location NORTHEAST OF "K" EAST REACTORProject W-152Prepared By Edward R. L. / EDWARDS L. LAFLE Date 00/05/94
(Sign/Print Name)Reviewed By Annex Anderson D. Anderson Date 7-11-94
(Sign/Print Name)

CONSTRUCTION DATA		Depth in Feet	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram		Graphic Log	Lithologic Description
12" CS TEMPORARY CASING SET @ 9.55'		5		0-5 Sandy Gravel SG
I & II Type PORTLAND CEMENT 2.0'-9.5'		10		5-20 sandy Gravel SG
		15		20-29.5 Sandy Gravel SG
		20		29.5-35.0 silty sandy Gravel msG
BENTONITE CUMULETS 57.3'-9.5'		25		35.0-55.0 sandy Gravel SG
		30		55-60 Sandy Gravel SG
		35		60-80 Sandy Gravel SG
		40		80-85 sandy Gravel SG
		45		85-99 sandy Gravel SG
3/8" BENTONITE PELLETS 61.5'-57.5'		50		99-102 Sand
		55		102-120.9 silty sandy Gravel msG
STATIC GRANULAR MATERIAL 66.8'-07/07/94		60		120.9-135.0 silty gravelly sand (m)gs
4" STAINLESS STEEL (T304) 20-40 SAND INTERVAL 88.4'-61.5'		65		135-140 slightly silty sandy Gravel (m)SG
10" SCREEN INTERVAL - 85.0'-64.66'		70		140-150 sandy Gravel SG
10" TEMPORARY CS CASING SET @ 87.05'		75		150-155.3 - gravelly Sand gs
BOTTOM OF 20-40 SAND @ 88.4'		80		155.3-185.0 Sandy Silt SM
BENTONITE HOLE PLUG 165.0'-88.4'		85		

Boring or Well No. 199-K-111A A983.

Sheet 2 of 2

Project W-152

Reviewed By Sammi Anderson D. Anderson Date 7-11-94
(Sign/Print Name)

A-6000-384 (01/93)

VALIDATED

1 OF 3

WELL CONSTRUCTION SUMMARY REPORT

SIGNATURE/DATE

Page 1 of 1

Verification No. WHC-5-014 Rev. No. 7Well No. 199-K-111A ^{A983} Temp. Well No. _____cCNs 172214 166764Approximate Location NORTHWEST OF K" EAST REACTORProject 100 K" STORAGE FACILITY BRIN

Drill Method _____

Drilling Company KRIESEL ENGINEERType CABLE TOOL DRILLINGDriller BARRY HOWELLDrilling Fluid COLUMBIA RAW WATER

Other (Companies) _____

Total Amount of Water 945 1000 DSA 12/12/94Added During Drilling 895 GALLONS OF RAW COLUMBIA WATERGeologist(s) EDWARD C. RAFFLE (WHC)

Comments _____

CLINT DEGENHART (SEG)Date Drilling Started 05/25/94

Temporary Casings and Drilled Depth

Casing Type and Size Interval Shoe OD

12" CS TEMPORARY CASING 0 - 9.55 0.9910" CS TEMPORARY CASING 9.55 - 87.05 0.838" CS TEMPORARY CASING 87.05 - 170.98 0.67Drilled Depth 185.0 Hole Diameter at TD 8"

Geophysical Logging

Sondes (type) Interval Date

GLASS GAMMA (KUT) 0 - 83.77 06/08/94GLASS GAMMA (KUT) 50 - 163.0 06/30/94Static Water Level/Date 06/03/94 - 67.5' 06/27/94 - 67.7'Comments 06/29/94 - 67.0' 07/07/94 - 66.8'

Completion Activity

Date Started 06/30/94

Casing and Screen (Permanent)

Annular Seal/Filter Pack

Type Depths Length Slot Size

Type Interval Volume Mesh Size

T304 S.S. 85.0 - 64.66 20.34 w/cap .10BENTONITE 165.0 - 88.4 37.6 25.53 FT³ COARSET304 S.S. 64.66 - 3.31 AGS 67.97 BLANK (KRIESEL)20-40 SILICA SAND 88.4 - 61.5 16.6 17.92 FT³ 20-40BENTONITE PELLETS 61.5 - 57.3 4 bbls 2.48 FT³ 3/8"BENTONITE GRUMMOLS 57.3 - 9.5 41.6 29.11 FT³ 8-20I & II TYPE PORTLAND CEMENT 9.5 - 2.0 14.6 17.99 FT³

Other Activity

Well Survey Data

Aquifer Test Performed? _____

Date 10/30/94

Type _____ Date _____

Washington State Prime Coordinates N: 146,968.875 E: 569,308.169

Well Abandoned? _____

Protective Casing Elevation 462.03'

Date _____

Brass Cap Elevation 459.12'

Comments/Remarks _____

BOREHOLE LOG

VALIDATED

SIGNATURE/DATE

Boring or Well No. 199-K-111A

Sheet 1 of 10

Location NE of "K" 105 Eads Building

Project W-152

Prepared By Edwin C. Rine / C. Rine Date 05/28/94Reviewed By DJ Anderson Date 7-11-94

Depth ()	Sample		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
	Type and No.	Blows or Recovery			
0					COMMENCE DRILLING 9:00AM 05/25/94
5	1 RAO 2 Lith	DB		0-5 Sandy Gravel, SG 30% Sand, 70% Gravel Gravel - 10% small cobbles 20% - 40% cap, 20% - 40% mp. 20% - 40% Fp, sand - 40% - 60% cls 20% - 40% ms, 2.5 3 1/2 dark grayish brown - dry, 2.5 N/3 very dark gray - wet. poorly sorted, strong rxn HCL, gravel - spherical, discoidal, some 0.5/10/100 subangular - subrounded, 80% basalt, 20% quartz, trace felds.	Fill material CONTINUOUS HPT coverage to 50.0'; 20m sample L DET. & F.D. SSO - 0.5 L ₅₀ 20.8% O ₂ L DET. PLO
10	1 RAO 2 Lith	DB		5-20 sandy Gravel, SG 40% Sand, 20% Gravel 10-20% small cobbles, 30% 50% cap, 20-40% mp, 20-40% Fp sand - 20-50% cls, 10-20% ms, 20-40% Fp, 10% 3/4 VEG dark grayish brown - dry, 10% 3/4 black - wet. sand - subrounded - subangular, gravel - spherical, some prismatic, strong HCL RXN: increase iron staining coating basalt, poorly sorted, 80% basalt 10% quartz, 10% felds same 15' sample as above - 10 FAK HCL RXN.	END OF SHIFT 05/25/94 10' Sample - Fill material HPT - soil sample - L DET & F.D. SSO - 0.5 L ₅₀ 20.8% O ₂ L DET PLO
15	1 RAO 2 Lith	DB		20' sample same as above - ALSO weak HCL RXN.	15' sample - Fill material
20	1 RAO 2 Lith	DB			20' - Fill material END OF SHIFT 05/26/94

Sheet 2 of 10

Project 40-152

Reviewed By DJ Anderson DJ Anderson Date 7-11-94
(Sign/Print Name)

A-6000-382 (01/93)

BOREHOLE LOG

Boring or Well No. 199-K-111ASheet 3 of 10Location NE of K" 105 East BuildingProject W-152Prepared By Edward C. Rouse / E. Rouse Date 6/1/94
(Sign/Print Name)Reviewed By DJ Gordon / DJ Anderson Date 7-11-94
(Sign/Print Name)

Depth (<u>40</u>)	Sample		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
	Type and No.	Blows or Recovery			
45	1 Rnd 2 Lith	DB		20% basalt, 40% quartz, 40% felsic 5% quartzite, 5% muscovite, NO LXA HCL 10-20% granite, 10-20% greenstones 10% gneiss (olivine)	HPT CONTINUOUS COVERAGE DOWNGRADED TO AM/PM COVERAGE @ 41.0' penetration rate approx 1-2" per hour. From 41-57.0 feet.
50	1 Rnd 2 Lith	DB			END OF SHIFT 06/01/94
55	1 Rnd 2 Lith	DB		55'-60' sandy gravel & G 5% sil, 20% sand, 65% gravel 10% large cobbles, 10-20% small cobbles, 10-20% clay, 10-20% silt 20-30% MP, 20-30% FP, sand - 10-20% LFS, 10-20% MS, 30-40% F & VF GRAVEL - SPHERICAL - SOME PRISMOIDAL, SAND - SUBANGULAR, POORLY SORTED 54 1/3 OLIVE, NO LXA HCL 20% basalt, 40% quartz, 40% felsic FELSIC 10-20% granites w/ hornblende AND biotite, 5% muscovite, 10-20% quartzite, 10-20% greenstones, 10% andesite with amygdale phenocrysts	550 CHECKS WELLBORE 42% LEH, 20.8% CO ₂ , 2 DET PID END 06/02/94
60	1 Rnd 2 Lith	DB			END OF SHIFT 06/02/94

BOREHOLE LOG

Boring or Well No. 199-K-111ASheet 4 of 10Location NE OF "K" 105 EAST BUILDINGProject W-152Prepared By Edward C. Rosen / E. C. Rosen Date 6/03/94
(Sign/Print/Name)Reviewed By D. J. Anderson / D. J. Anderson Date 7-11-94
(Sign/Print Name)

Depth (60)	Sample		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
	Type and No.	Blows or Recovery			
60.9'	ST			60-80 sandy gravel s.g.	ELC 06/03/94
	split	29/38/15/12		8% silt, 30% sand, 62% gravel	END OF SHIFT 06/03/94
	spoon #2	1135		Gravel 10-20" large COBBLES, 10"-20" small COBBLES, 80%-30% V. CESP, 10"-20" CESP, 10"-20" mp, 10"-20" f.p. & vfp, sand -	split spoon #2, 100% recovery, 100% representative sample; 60.9-
62.9'	DB			20"-30" CESP, 10"-20" m, 20"-40" Fe, poorly sorted s.g. 1/3 olive -	blow pen. 5/10 = 29/38/75/135
65	1RAD 2 Lith	DB		WET, sand - SUBMERGED to SUBANGULAR, gravel - SPHERICAL & ROUNDED, some iron staining around felsic, 20% basalt, 40% quartz, 40% felsic.	SEE CHECK WELL LOG - 4% LEL, 19% O ₂ , 6 DET PIP
				Gravels = 30%-40% granite w/ hornblende & biotite, 10"-20" quartzite, 10"-20" gneiss, 5% muscovite	STATIC WATER @ 67.5' 06/03/94
70	1RAD 2 Lith	DB			SEE CHECK WELL LOG 2% LEL, 20.80% DET PIP
					END OF SHIFT 06/03/94
75	1RAD 2 Lith	DB		80- sandy gravel s.g. 60% gravel 35% sand, 5% silt, gravel - 10% large COBBLES, 10% small COBBLES, 10"-20" CESP, 20%-40" mp, 20%-40" f.p., sand 20-40" vfp, 20"-30" CESP, 10"-20" m, 10"-20" Fe	DRILL STEM SAMPLING DEVICE - TEST #1 SET @ 70.5 FEET - on 06/06/94
				54 1/3 OLIVE - WET, gravel - SPHERICAL, sand - ROUNDED - SUBANGULAR, poorly sorted, NO LEXN HCL, 20% basalt 50% quartz, 30% felsic - 10"-20" granite w/ hornblende, 10"-20" gneiss 10-20" quartzite, 5% mica	
80	1RAD 2 Lith	DB			

BOREHOLE LOG

Boring or Well No. 199-K-1110

Sheet 5 of 10

Location NE of "K" 105 East Building

Project W-152

Prepared By Edward C. Ruffin / C. Ruffin Date 05/02/94
(Sign/print Name)

Reviewed By D. J. Anderson D.J. Anderson Date 7-11-84
(Sign/Print Name)

Depth	Sample		Graphic Log	Sample Description	Comments	
	Type and No.	Blows or Recovery				
(80)						
82	80.0' split sand #3	Blows 45/36/38/100% RSC 60% Ref. 200		10-20% CONGLOMERATE with siltite, brown/gray and reddish pieces of magnetite, quartz and interchloritic alteration	split sand taken from 3AT K" and sieve analysis	
	82.0'					
						HPT CHECK WELLBORE NO DETECTABLE G.A.D.
85	1KAO 2Lith	DB			99 R+ 06/14/94	
					85-100 sandy Gravel SG	END OF SHIFT 06/07/94
					20% sand, 80% gravel, gravel - 10-20% small, 20-40% large, 40-60% very large, 60-80% very large, 80-100% very large	END OF SHIFT 06/08/94 - 06/09/94
					occ. large pebbles 20-40% - cap, 20-40% - mp, 10-20% - fp, sand 10-20% cl, 20-50% ms, 20-40% fs, poorly sorted, 2.54 1/2 light yellowish brown - wet sand. sub-angular to angular, gravel - spherical	@ 86.8' RUN DRILL TEST
					20% basalt, 40% quartz, 40% felsic, iron staining and some alteration	PACKED TEST #2.
					brown K-feldspar, 10-20% granite - w/ brown blebs, 10-20% gneiss, 5% mica, 10% quartzite, no rxn HCL	SSD - 99% LEL, 18% O ₂ < DET FID
90	SEE COMMENTS * split sand #4 1KAP 2Lith	DB				ADVANCE TO 8' TEMPORARY Casing @ 87.05'
				298.5'	RATE OF PENETRATION FROM	
				DUE TO HARD TOOLING, PARTICLE SIZE DISTRIBUTION, BEDDING CHARACTERISTICS, SORTING AND EXACT OF PERCENTAGE OF SAND AND GRAVELS UNDETERMINED	87-99.0 @ 1.0' PER HOUR	
95	1KAO 2Lith	HT			END OF Shift 06/10/94	
					</	

BOREHOLE LOG

Boring or Well No. 199-K-111ASheet 6 of 10Location NE OF K# 105 EAST BUILDINGProject W-152Prepared By Edward C. Runk / EDWARD C. RUNK Date 06/14/94
(Sign/Print Name)Reviewed By McGordon D.J. Anderson Date 7-11-94
(Sign/Print Name)

Depth (<u>100</u>)	Sample		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
	Type and No.	Blows or Recovery			
101				40% FELSIC, 20-30% - QUARTZITE w/ some iron staining, 10-20% gneiss 10-20% granite, thin muscovite	END OF SHIFT 06/13/94 Drill stem sampling device #3 was performed between 101.3 to 97.5 feet.
102					END OF SHIFT 06/14/94
105	1 LAP 2 Lith	HT		102-120.9 silty sandy gravel m&g silt 10%, sand 30%, Gravel - 60% sand 10-20% VLP, 20-30% C&P, 20-30% ms, 30%-5% VF&F, Gravel - 20-30% VLP, 20%-30% C&P, 10%-20% MP, 10%-20% FP 10%-20% VFP, silt 100% poorly sorted, 5% 5/8 olive gravel - spherical, some rounded, sand, subangular - subrounded, 20% basalt, 35% quartz, 45% FELSIC, NO RXN to HCL FELSIC CONSIST OF 10%-20% quartzite, 10-20% granite 10-20% gneiss, 10% GREENSTONE 10% EPIDOTE AND 5-10% mica. OCCASIONAL IRON STAINING AROUND FELSIC. 06/17/94	DUE TO HT - SAMPLES QUARTERIZED. END OF SHIFT 110.0" ON 06/15/94 SSD - 4% REL, 20% O ₂ L DET w/ PED
110	1 LAP 2 Lith	HT			
115	1 LAP 2 Lith	HT		120.9-122.9 silty sandy gravel m&g, 10% silt, 70% gravel, 20% sand, gravel - 10%-20% small cobbles, 10%-20% VLP, 20%-30% C&P, 20%-30% MP, 10%-20% FP, sand 10%-20% C&P, 20%-30% ms, 10-60% F ₂ , poorly sorted, subangular gravel - spherical - some octahedral, 06/17/94 sand - subangular & subrounded w/ reaction to HCL, 5% 1/2 olive gray	
120	1 LAP 2 Lith	HT			

BOREHOLE LOG

Boring or Well No. 199-K-111ASheet 7 of 10Location NE OF K-105 EAST BUILDINGProject W-152Prepared By Edward R. Ruff / EDWARD
(Sign/Print Name) Date 06/17/94Reviewed By R. J. Anderson / OT Anderson
(Sign/Print Name) Date 7-11-94

Depth (<u>120</u>)	Sample		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
	Type and No.	Blows or Recovery			
120	120.9	ST		GRAVELS CONSIST OF 10-20% ANDESITE, 20% QUARTZITE, 10% BASALT, & FELDSPAR	END OF SHIFT 06/16/94 Split spoon #5, 120.9-122.9
	split spoon #5 100% REC 75% REP			GLAUCITE w/ DIORITE - 10-20%, AND GREENS - 10%-20% GREENSTONE - 10%-20% 20% BASALT, 40% QUARTZ, 40% FELDSPAR	100% RECOVERY, 75% REPRESENTATIVE TIE SAMPLE
125	122.9			122.9-135.0 silty gravelly sand (m) 95 10% silt, 30% gravel, 40% sand, 100% silt, gravel - 40-60% Fp, 20-40% ms, 20-40% Fp sand - 10-20% c/s, 20-40% ms, 40%-60% Fp, 100% silt, poorly sorted, 5% 1/2 gray - wet, sand SUBANGULAR to SUBROUNDED, GRAVEL - SPHERICAL to ROUNDED 20% BASALT, 40% QUARTZ, 40% FELDSPAR - GRAVELS CONSIST OF 10%-20% GLAUCITE, 10%-20% GREENS 10%-20% QUARTZITE, SOME SAND STAINING SURROUNDING QUARTZ AND FELDSPAR GRAINS. NO REACTION TO HCL END OF SHIFT 06/20/94	END OF SHIFT 06/17/94 Prep to take DRILL STEM TEST #4 BOTTOM OF SCREEN INTERVAL IS 119.8' END OF SHIFT 06/20/94
	1 LAD 2 LITH	HT			122.9-135 - DUE TO HALL TAKING - SAMPLES PRELIMINARY
130	130.0			130.0-138.5 silty sandy gravel (m) 99 5% silt, 35% sand 60% gravel gravel 10-20% VCLSP, 10%-20% CLSP, 10%-20% ms, 30%-50% Fp, sand - 20%-40% c/s, 30%-50% ms 30%-50% Fp, poorly sorted, 5% 1/2 gray - wet, sand - ROUNDED - SUBANGULAR GRAVELS - SPHERICAL, PRISMATICAL 20% BASALT, 25% QUARTZ, 45% FELDSPAR NO REACTION TO HCL END OF SHIFT 06/21/94	END OF SHIFT 06/21/94
	1 LAD 2 LITH	HT			
135	138.5	ST		138.5-140.5 silty sandy gravel (m) 99 5% silt, 50% gravel, 45% sand gravel - 10%-20% VCLSP, 20%-40% CLSP	Split spoon sample #8 RECOVERED 100%, REPRESENTATIVE
	split spoon #5 100% Recovery 75% REP	42/57/52/86			SAMPLE 25% - Blows per 5 Feet = 42/57/52/86; 10' 25% REP
140				140.5-142.0 silty sandy gravel (m) 99 5% silt, 50% gravel, 45% sand gravel - 10%-20% VCLSP, 20%-40% CLSP	INTERVAL 138.5-140.5

BOREHOLE LOG

Boring or Well No. 199-K-111A

Sheet 8 of 10

Location NE of # 105 East Building

Project W-152

Prepared By Edward Rafe / EDWARD C. RAFF Date 06/23/94
(Sign/Print Name)

Reviewed By DJ Anderson DJ Anderson Date 7-11-94
(Sign/Print Name)

Depth	Sample		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
	Type and No.	Blows or Recovery			
140					
145	Split spoon #6	ST		30 ² -50 ² mp, 10 ² -20 ² Fp, sand	
		HT		10 ² -20 ² cs, 20 ² -40 ² ms, 20 ² -40 ²	
				F ₂ poorly sorted, 5y 5/2 gray-wet	
				Gravel - spherical - rounded, sand	
				Subangular - subrounded, no rxn to HCl, 20% basalt, 40% quartz	
				40% felsic, gravel - 10-20 ² quartzite	END OF SHIFT 06/23/94
	1 RAD 2 LITH			10 ² -20 ² quartz w/ biotite and	Split spoon #7 - split
	144.3	ST		hornblende, 10 ² -20 ² granite,	spoon interval 144.3 - 146.3
	8' 6"			5% muscovite, 5% epidote, split	END 06/23/94
	100% recovery			spoon sample between 144.3 to 146.3	BLW REC. 22/20/30/40
	75% R40			INDICATES SAND INTERBEDS ^{REALLY} APPROX	DRILL STEM SAMPLING DEVICES
	2-20/30			2 1/2" thick - AN ALTERNATING	TEST #5 WAS TAKEN @ 142.0"
	sample			SEQUENCE OF SAND, SANDY	
	split 1/40			GRAVEL AND SAND.	
	spoon #7				
146	146.3	HT			
	1 RAD 2 LITH				END OF SHIFT 06/23/94
150	1 RAD 2 LITH	HT		150-155.3 GRAVELLY SAND G.S.	
				20% gravel, 80% sand, sand-	
				5% 10% cs, 50% 70% ms, 20%	150-155.3 SAMPLE
				30% F ₂ , gravel - 40% 60 ² mp,	PULVERIZED DUE TO
				40% 60 ² Fp, moderately sorted,	MOORE TOOL W/ BIT. NOT
				5y 1/2 olive gray wet, sand-	A REPRESENTATIVE SAMPLE.
				rounded - subrounded, gravel -	
				subangular - angular, no rxn to HCl, 75% basalt 40% quartz	
				35% felsic.	
155	1 RAD 2 LITH	HT			END OF SHIFT 6/24/94
	155.1	ST		155.3 - 165.0 SANDY SILT SP	155.3" RINGWALL CONTACT
	split spoon #8			5% gravel, 40% sand, 55% silt	split spoon #8 155.1 - 156.8
	no rec.			Gravel - 10% mp, sand 40% 60 ² F ₂	@ 156.6 to 156.8 split
	53% R40 sample			40% 60 ² VF ₂ , silt 100%, sand -	spoon 3/10 = 100 blows; stop
	156.8	HT		subrounded - rounded, 5y 5/3	spanning @ this point.
	1 RAD 1 LITH			olive - wet, slight iron staining	END OF SHIFT 6/27/94
				ON SOME CLAYS. sands - moderately	DRILL STEM SAMPLING DEVICE
				well sorted, medium plasticity	TEST #6 FOR CHEMICAL PARAMETERS
				30% basalt, 40% quartz, 30% felsic.	@ 152.3" END OF SHIFT 6/28/94
	1 RAD 2 LITH	HT		felsic equalized, no rxn to HCl	

Boring or Well No. 199-K-1110		BOREHOLE LOG
Sheet 9 of 10		

Location NE of K" 105 East Building	Prepared By <u>Edward C. Rouse</u> Date <u>02/20/94</u>
Project W-152	Reviewed By <u>William A.J. Anderson</u> Date <u>7-11-94</u>

Depth	(160)	Sample		Graphic Log	Sample Description	Comments
		Blows or Recovery	Type and No.			
165	1.40	2.17H	HT		165-185 Sandy, 5.1H 3M 5% gravel, 25% sand, 70% silt, gravel - 20-40" mp, 80-40" vp, 80-40" vp, sand - 4.5 5A-10" mp, 30-50" ms, 40-60" fs, 5.1H-10" gravel - subrounded, sand - subrounded - subangular mod. sorted, break exp to HCL 5.9 5/8 olive - wet. sand - 6.5% quartz, 5-10" mica 5-10" granite, 10-20" quartzite 80% basalt, 40% quartz, 40% felsic	SSD checks w/1110
170	1.40	2.17H	HT		175 sample - some as above except strong exp to HCL	
175	1.40	2.17H	HT		180 sample - some as above except weak exp to HCL and increase in silt from 70% to 80%	SSD checks w/1110 49 let, 20% 0, 10% w/1110
180	1.40	2.17H	HT			

Sheet 10 of 10

Project W-152

Reviewed By D. J. Anderson D. J. Anderson Date 7-11-94
(Sign/Print Name)

A-6000-382 (01/93)

WELL CONSTRUCTION VERIFICATION REPORT

Criteria from WHC-S-014, and other change documents

Page 1 of 1

Well No.		Well Specification/Revision		
<u>199-K-111A</u>		<u>A 9830</u>		
		<u>WHC-S-014</u>		
		<u>REV. 7</u>		
Subject	Verification Method	Criteria		Initials/Date
		Spec	Chg. Doc.	
Cleaning				
Drilling Rig/Tools	<u>Visual</u>	<u>7.6.7.7</u>		<u>EC / 05/25/94</u>
Temporary Mater.	<u>Visual</u>	<u>7.7</u>		<u>EC / 05/25/94</u>
Drill Method	<u>Visual</u>	<u>5.2</u>		<u>EC / 05/25/94</u>
Lubricants/Additives				
Lubricants	<u>Visual</u>	<u>7.2</u>		<u>EC / 05/25/94</u>
Additives	<u>Visual</u>	<u>7.2</u>		<u>EC / 05/25/94</u>
Straightness Test	<u>Visual</u>	<u>8.2</u>		<u>EC 06/28/94</u>
Material Storage/Packing of Completion Material				
Mtl. Hand./Stor.	<u>Visual</u>	<u>7.3</u>		<u>EC 06/28/94</u>
Material Packing	<u>Visual</u>	<u>7.3</u>		<u>EC 06/28/94</u>
Casing and Screen (Permanent)	<u>Visual</u>	<u>4.2 - 4.2.5, 12.2.1</u>		<u>EC 06/28/94</u>
Annular/Seal/Filter Pack	<u>Visual</u>	<u>4.2.6 - 4.2.9, 5.3.1</u>		<u>EC 07/06/94</u>
Well Development	<u>Visual</u>	<u>5.3.1.K</u>		<u>DA 12/12/94</u>
Well Protection				
Surface Pad	<u>Visual</u>	<u>4.2.9, 4.2.10</u>		<u>DA 12/12/94</u>
Prot. Casing	<u>Visual</u>	<u>4.2.10</u>		<u>DA 12/12/94</u>
Prot. Posts	<u>Visual</u>	<u>4.2.10</u>		<u>DA 12/12/94</u>
Cap, Hasp, Lock	<u>Visual</u>	<u>4.2.10</u>		<u>DA 12/12/94</u>
Site Restored	<u>Visual</u>	<u>11.0</u>		<u>DA 12/12/94</u>
Pump Installation				
Pump Decon/Prep.	<u>Visual</u>	<u>4.2.10, 12.2.1</u>		<u>DA 12/12/94</u>
Installed	<u>Visual</u>	<u>5.3.1.L</u>		<u>DA 12/12/94</u>
Pump Tested	<u>Visual</u>	<u>5.3.1.L</u>		<u>DA 12/12/94</u>
Well Surveying/Labeling				
Ms. Pt. Surveyed	<u>Visual</u>	<u>3.4</u>		<u>12/12/94 DA</u>
P. Casing/BC Surv.	<u>Visual</u>	<u>3.4</u>		<u>DA 12/12/94</u>
Well No. Stamped	<u>Visual</u>	<u>4.2.9</u>		<u>DA 12/12/94</u>
BC Labeled	<u>Visual</u>	<u>4.2.9</u>		<u>DA 12/12/94</u>

Comments

GEOPHYSICAL LOGS 199-K-106A

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Westinghouse Hanford Company
RLS Spectral Gamma-Ray Borehole Survey Log Header

Project: RCRA 100-K Area

Borehole	<u>199-K-106A</u> <u>A9842</u>		
Coordinates	<u>NA</u>	<u>N</u>	<u>NA</u> W
Elevation	<u>NA</u>	ft	Top of casing

Feet (Hanford System)

Borehole Environment Information

Borehole liquid depth <u>74.4</u> (ft) from zero (0.0) depth reference of log			
Casing size (in.)	Casing thickness (in.)	Top depth (ft)	Base depth (ft)
12	0.375	0	9.5
10	0.375	0	96.4
8	0.322	0	166.3

RLS Passive Spectral Gamma Survey Information

Logging Engineers <u>R. V. Cram</u> <u>J. P. Kiesler</u>			
Log depth reference at zero (0.0) depth is <u>ground level</u>			
Log Date	Archive file names	Log mode speed	Depth interval (ft) Top Base Incr
Feb 01, 1994	H1K106A\A512	MSA 80sec RT	0 60.51 0.5
Feb 01, 1994	H1K106A\A513	MSA 80sec RT	59.0 91.5 0.5
Feb 16, 1994	H1K106A\A522	MSA 80sec RT	90.5 170.0 0.5

MSA: Move-Stop-Acquire
RT: Real time

Calibration and Analysis Information

RLS Calibration Date: <u>Nov. 21, 1991</u>
Calibration Report: <u>WHC-SD-EN-TRP-001</u>
Analyst Names: <u>S. E. Kos R. K. Price</u>
Analysis Date: <u>Feb 21, 1994</u>
Analysis Notes: <u>Exceeded maximum casing correction factor</u>
Radionuclides Identified: <u>No man-made radionuclides were identified</u>

RLS Borehole Survey Report

Borehole: 199-K-106A

Casing	Depth:	0.0' - 9.5'	Size:	12"	Thickness:	0.375"
		0.0' - 96.4'		10"		0.375"
		0.0' - 166.3'		8"		0.322"
Water		74.375'				
Survey	Interval:	0.0' - 60.51'	Date:	Feb 03, 1994		
		59.0' - 91.5'		Feb 10, 1994		
		90.5' - 170.0'		Feb 16, 1994		

General Notes:

The survey was conducted in 12, 10, and 8 inch diameter carbon steel casings. Overlaps between the 12 and 10 inch casings from 0' to 9.5', and between the 10 and 8 inch casings from 90.5' - 96.4' resulted in decreases in the observed gamma ray activity in these intervals. The survey was interrupted at 60.51' because of a failure of the power generator. The survey was restarted at 59.0' and continued to TD. A return error of minus 12" (detector zero at ground surface) was observed at the conclusion of logging. Repeat sections were conducted for the intervals 89.5 - 91.5', and 167.5' - 170.0', and are included on the plots.

No man-made radionuclides were detected in the survey. The naturally occurring radionuclides of potassium, uranium and thorium observed are typical for Hanford sediments.

RLS Spectral Gamma-Ray Borehole Survey

Project: RCRA 100-K
Borehole: 199-K-106A

Log Date : Feb 16, 1994
Anal Date: Feb 21, 1994

RLS Spectral Gamma-Ray Borehole Survey

Project: RCRA 100-K

Log Date : Feb 16, 1994

Borehole: 199-K-106A

Anal Date: Feb 21, 1994

GEOPHYSICAL LOGS 199-K-107A

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Westinghouse Hanford Company
RLS Spectral Gamma-Ray Borehole Survey Log Header

Project: RCRA 100-K Area

Borehole	<u>199-K-107A</u>	<u>A9843</u>
Coordinates	<u>NA</u> N <u>NA</u> W	Feet (Hanford System)
Elevation	<u>NA</u> ft	Top of casing

Borehole Environment Information

Borehole liquid depth <u>74.42</u> (ft) from zero (0.0) depth reference of log			
Casing size (in.)	Casing thickness (in.)	Top depth (ft)	Base depth (ft)
12	0.375	0	9.6
8	0.313	0	82.8
4	0.200	0	92.42

RLS Passive Spectral Gamma Survey Information

Logging Engineers <u>R. V. Cram</u> <u>J. P. Kiesler</u>			
Log depth reference at zero (0.0) depth is <u>ground level</u>			
Log Date	Archive file names	Log mode speed	Depth interval (ft) Top Base Incr
Mar 14, 1994	H1K107A\A541	MSA 80sec RT Stat. 300sec RT	40.0 52.0 0.5 12.5', 25.0', and 46.5'

MSA: Move-Stop-Acquire
RT: Real time

Calibration and Analysis Information

RLS Calibration Date: <u>Nov. 21, 1991</u>
Calibration Report: <u>WHC-SD-EN-TRP-001</u>
Analyst Names: <u>S. E. Kos</u>
Analysis Date: <u>May 19, 1994</u>
Analysis Notes: <u>Logged during well completion activities</u>
Radionuclides Identified: <u>Cs-137, Co-60, Eu-152, and Eu-154</u>

RLS Spectral Gamma-Ray Borehole Survey

Project: K BASIN

Log Date : Mar 13, 1994

Borehole: 199-K-107A

Anal Date: May 19, 1994

RLS Spectral Gamma-Ray Borehole Survey

Project: K BASIN

Log Date: Mar 13, 1994

Borehole: 199-K-107A

Anal. Date: May 19, 1994

14 ^{5/10/21/94}

RLS Borehole Survey Report

Borehole: 199-K-107A

Casing	Depth: 0.0' - 9.6'	Size: 12"	Thickness: 0.375"
	0.0' - 82.8'	8"	0.313"
	0.0' - 92.42'	4"	0.200"
Water	74.42'		
Survey	Interval: 40.0' - 52.0'	Date: Mar 14, 1994	

General Notes:

The survey was conducted in 12 and 8 inch carbon steel casings, and 4 inch stainless steel casing. The interval 40.0 to 52.0 feet was surveyed in the MSA mode at an acquisition time of 80 seconds RT. Stationary measurements were acquired at 12.5, 25.0, and 46.5 feet for 300 seconds RT at each location. A repeat section was conducted for the interval 49.5 to 52.0 feet, and the data are included on the plots.

The observed activities of the naturally occurring radionuclides potassium, uranium and thorium are typical for Hanford sediments.

Man-made Radionuclides

Cesium (Cs-137) was identified at the 12.5 foot stationary measurement at an activity of less than 2 pCi/g.

Cobalt (Co-60) was identified at 46.5 feet in both the stationary and MSA measurements at an activity of less than 1 pCi/g.

Europium (Eu-152) was identified from 46.0 to 47.5 feet at an activity of less than 2 pCi/g. It was identified at the 46.5 stationary measurement.

Europium (Eu-154) was identified at the 46.5 foot stationary measurement at an activity of less than 1 pCi/g.

Westinghouse Hanford Company

NaI Spectral Gamma-Ray Borehole Survey Log Header

Project Information

Borehole	<u>199-K-107A</u>
Project	<u>100-K-West Basin</u>

Borehole Environment Information

Borehole liquid depth <u>74.2</u> (ft) from zero (0.0) depth reference of log			
Casing size (inch)	Casing thickness (inch)	Top depth (feet)	Base depth (feet)
12	0.44	0	9.6
8	0.25	0	94.6

NaI Passive Spectral Gamma Survey Information

Logging Engineer(s) <u>A. W. Pearson</u> <i>Alan Pearson</i> Log depth reference at zero (0.0) depth is <u>ground level</u> Depth return error recorded at zero depth reference. ☒ Pre log energy calibration spectra recorded with field verifier. ☒ Logging Equipment was cleaned as described in WHC-CM-7-7 EII 11.1 Section 5.4 Signed <u>Alan Pearson</u> Date <u>5/3/94</u> Detector Type: <u>NaI Spectra</u> Detector ID: <u>RLSN3</u> Calibration Date: <u>Jul 26. 93</u> Notes: <u>Total Gamma-ray activity is computed from each recorded spectra.</u> <u>Casing thickness and borehole fluid corrections are not applied.</u>							
Log Date	Archive File Names	Log Mode	Speed ft/m	Depth interval (ft) Top Base Incr			Return Error (inch)
Mar 11, 94	N097	Fixed Fixed	2.5 2.5	0 0	92 92	0.5 0.5	zero

Fixed: Constant Winch Speed

Nal Gamma-Ray Borehole Survey

Project: 100K WEST BASIN

Log Date Depth Range

Borehole: 199-K-107A

Mar 11, 1994 0 - 92'

No Corrections Applied

GEOPHYSICAL LOGS 199-K-108A

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1 of 3
 VALIDATED
 [Signature] 11/2/94
 SIGNATURE/DATE

Westinghouse Hanford Company
 RLS Spectral Gamma-Ray Borehole Survey Log Header

Project: RCRA 100-K Area

Borehole	<u>199-K-108A</u>			<u>A9844</u>	
Coordinates	<u>NA</u>	<u>N</u>	<u>NA</u>	<u>W</u>	Feet (Hanford System)
Elevation	<u>NA</u>	ft			Top of casing

Borehole Environment Information

Borehole liquid depth <u>73.4</u> (ft) from zero (0.0) depth reference of log			
Casing size (in.)	Casing thickness (in.)	Top depth (ft)	Base depth (ft)
12	0.375	0	9.8
8	0.313	0	93.0

RLS Passive Spectral Gamma Survey Information

Logging Engineers <u>R. V. Cram</u> <u>S. E. Kos</u> <u>J. P. Kiesler</u>			
Log depth reference at zero (0.0) depth is <u>ground level</u>			
Log Date	Archive file names	Log mode speed	Depth interval (ft) Top Base Incr
Mar. 29, 1994	H1K108A\A549	MSA 80sec RT	0 93.0 0.5

MSA: Move-Stop-Acquire
 RT: Real time

Calibration and Analysis Information

RLS Calibration Date: Nov, 21, 1991	
Calibration Report: WHC-SD-EN-TRP-001	
Analyst Names:	<u>S. E. Kos</u>
Analysis Date:	<u>May 18, 1994</u>
Analysis Notes: <u>Double casing- exceeds max. correction factor 0-9.8'</u>	
Radionuclides Identified: <u>No man-made radionuclides were identified</u>	

RLS Spectral Gamma-Ray Borehole Survey

Project: K BASIN

Log Date : Mar 28, 1994

Borehole: 199-K-108A

Anal Date: May 18, 1994

3 of 3

RLS Borehole Survey Report

Borehole: 199-K-108A

Casing	Depth:	0.0' - 9.8'	Size:	12"	Thickness:	0.375"
		0.0' - 93.0'		8"		0.313"

Water 73.4'

Survey Interval: 0.0' - 93.0' Date: Mar 29, 1994

General Notes:

The survey was conducted in 12 and 8-inch-diameter carbon steel casings. Overlap between the 12 and 8-inch casings from 0 to 9.8 feet resulted in decreased observed gamma ray activity in this interval. A repeat section was conducted for the intervals 90.0 to 93.5 feet and is included on the plots.

No man-made radionuclides were identified in the survey. The observed activities of the natural radionuclides potassium, uranium and thorium are typical for Hanford sediments.

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GEOPHYSICAL LOGS 199-K-109A

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Westinghouse Hanford Company
NaI Spectral Gamma-Ray Borehole Survey Log Header

Project Information

Borehole	<u>199-K-109A</u>
Project	<u>K BASIN</u>

Borehole Environment Information

Borehole liquid depth <u>72</u> (ft) from zero (0.0) depth reference of log			
Casing size (inch)	Casing thickness (inch)	Top depth (feet)	Base depth (feet)
12	.375	0	15
10	.375	0	92.5
8	.375	0	164.9

NaI Passive Spectral Gamma Survey Information

Logging Engineer(s) <u>R. V. Cram</u> <u>J. R. Kunk</u>	
Log depth reference at zero (0.0) depth is <u>ground level</u>	
Depth return error recorded at zero depth reference.	
☒ Pre log energy calibration spectra recorded with field verifier.	
☒ Logging Equipment was cleaned as described in WHC-CM-7-7 EII 11.1	
Section 5.4	Signed <u>Steven E. Kunk</u> Date <u>10/24/94</u>
Detector Type: <u>NaI Spectra</u> Detector ID: <u>RLSN3</u>	
Calibration Date: _____	
Notes: <u>Total Gamma-ray activity is computed from each recorded spectra.</u>	
<u>Casing thickness and borehole fluid corrections are not applied.</u>	

Log Date	Archive File Names	Log Mode	Speed ft/m	Depth interval (ft)			Return Error (inch)
				Top	Base	Incr	
8/31/94	N154	Fixed	2.5	0 130	160 160	0.5 0.5	-2.0

Fixed: Constant Winch Speed

Westinghouse Hanford Company
RLS Spectral Gamma-Ray Borehole Survey Log Header

Project: 100 K Basin

Borehole	<u>199-K-109A</u>		
Coordinates	<u>NA</u> N	<u>NA</u> W	Feet (100 K Area)
Elevation	<u>NA</u> ft	Top of casing	

Borehole Environment Information

Borehole liquid depth <u>71.88</u> (ft) from zero (0.0) depth reference of log			
Casing size (in.)	Casing thickness (in.)	Top depth (ft)	Base depth (ft)
12	0.375	0.6	15
8	0.375	4.3	92.5

RLS Passive Spectral Gamma Survey Information

Logging Engineers <u>A W Pearson</u>					
Log depth reference at zero (0.0) depth is <u>ground level</u>					
Log Date	Archive file names	Log mode	speed	Depth interval (ft)	
				Top	Base Incr
Aug. 2, 1994	N145	Fix spd	2.5fpm	0	90 0.5

MSA: Move-Stop-Acquire

RT: Real time

Calibration and Analysis Information

RLS Calibration Date: Mar. 15, 1994	
Calibration Report: In Process	
Analyst Names: <u>R. R. Randall</u>	_____
Analysis Date: <u>Aug. 9, 1994</u>	_____
Analysis Notes: _____	
Radionuclides Identified: <u>Cs-137</u>	

Nal Gamma-Ray Borehole Survey

Project: K BASIN

Borehole: 199-K-109A

No Corrections Applied

Log Date Depth Range

Aug 2, 1994 0'–89'

Aug 11, 1994 0'–103'

Aug 12, 1994 80'–103'

NaI Gamma-Ray Borehole Survey

Project: 100 K

Log Date Depth Range

Borehole: 199-K-109A

Aug 31, 1994 0 - 160'

No Corrections Applied

RLS Borehole Survey Report

Borehole: 199-K-109A

Casing	Depth: 0-91.9'	Size: 10"	Thickness: 0.375"
	0-15'	12"	0.375"
Water	Depth: 71.88		
Survey	Depth: 0 - 90'	Date: 8/2/94	
	Stations: None		

General Notes:

The well was monitored at fixed logging speed at 0.5 foot intervals from ground level (0 ft) to 90 feet. The logging speed was 2.5 feet per minute. Naturally occurring thorium, uranium, and potassium are present. The total gross gamma ray count rate is normal for Hanford area.

The first plot shows the total gamma count rate. By comparing these results with the well construction, it may be seen that increased readings occur at a depth of 15 feet, where the well is cased with only one string from this point and down.

Man-made Radionuclides:

Cesium (Cs-137) decay activity was observed from approximately 25 to 31 feet. The maximum activity which occurred at 28 feet is estimated to be less than 20 pCi/g. The NaI instrumentation used for this well log is not calibrated for man made concentrations. However, a normalization using well log data from both the RLS HPGe and NaI gave an efficiency estimate for the NaI for the Cs-137 gamma ray. Therefore, spectra were analyzed by hand for this special case to arrive at the estimated concentration of Cs-137.

No other man made nuclides were observed in this view of the spectra.

100 K-Basin

100 K-Basin NaI KUT Analysis

149-K-109A

Not corrected for casing

199-K109A RLS NaI Log

Gross Pass2 Pe Pass2 Pe Pass1

100 K-Basin Nal Gross Gamma Ray Log

1992 K-109A

Count Rate (cts/sec)

Not corrected for casing

GEOPHYSICAL LOGS 199-K-110A

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Westinghouse Hanford Company
NaI Spectral Gamma-Ray Borehole Survey Log Header

Project Information

Borehole	199-K-110A	<u>A9829</u>
Project	<u>K BASIN</u>	

Borehole Environment Information

Borehole liquid depth <u>71.4</u> (ft) from zero (0.0) depth reference of log			
Casing size (inch)	Casing thickness (inch)	Top depth (feet)	Base depth (feet)
12	.438	0	10
10	.375	0	93

NaI Passive Spectral Gamma Survey Information

Logging Engineer(s) <u>A. W. Pearson</u> Log depth reference at zero (0.0) depth is <u>ground level</u> Depth return error recorded at zero depth reference. ☒ Pre log energy calibration spectra recorded with field verifier. ☒ Logging Equipment was cleaned as described in WHC-CM-7-7 EII 11.1 Section 5.4 Signed <u>Steven E. Kue</u> Date <u>10/6/94</u> Detector Type: <u>NaI Spectra</u> Detector ID: <u>RLSN3</u> Calibration Date: _____ Notes: <u>Total Gamma-ray activity is computed from each recorded spectra.</u> <u>Casing thickness and borehole fluid corrections are not applied.</u>							
Log Date	Archive File Names	Log Mode	Speed ft/m	Depth interval (ft) Top Base Incr			Return Error (inch)
5/17/94	N128	Fixed "	2.5 "	0 0	91 91	0.5 "	-2.0

Fixed: Constant Winch Speed

Nal Gamma-Ray Borehole Survey

Project: 100 K BASIN

Log Date Depth Range

Borehole: 199-K-110A

MAY 17, 1994 0 - 91'

No Corrections Applied

GEOPHYSICAL LOGS 199-K-111A

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Westinghouse Hanford Company
NaI Spectral Gamma-Ray Borehole Survey Log Header 1 OF CONT'D

Project Information

Borehole	199-K-111A	<i>A9830</i>
Project	100 K BASIN	

Borehole Environment Information

Borehole liquid depth <u>67.2</u> (ft) from zero (0.0) depth reference of log			
Casing size (inch)	Casing thickness (inch)	Top depth (feet)	Base depth (feet)
12	.375	0	9.6
10	.375	0	87

NaI Passive Spectral Gamma Survey Information

Logging Engineer(s) <u>A. W. Pearson</u> Log depth reference at zero (0.0) depth is <u>ground level</u> Depth return error recorded at zero depth reference. ☒ Pre log energy calibration spectra recorded with field verifier. ☒ Logging Equipment was cleaned as described in WHC-CM-7-7 EII 11.1 Section 5.4 Signed <u><i>Steven E. Kue</i></u> Date <u>10/28/94</u> Detector Type: <u>NaI Spectra</u> Detector ID: <u>RLSN3</u> Calibration Date: _____ Notes: <u>Total Gamma-ray activity is computed from each recorded spectra.</u> <u>Casing thickness and borehole fluid corrections are not applied.</u>							
Log Date	Archive File Names	Log Mode	Speed ft/m	Depth interval (ft) Top Base Incr			Return Error (inch)
6/8/94	N131	Fixed "	2.5 "	0 30	83 83	0.5 "	0.0

Fixed: Constant Winch Speed

Nal Gamma-Ray Borehole Survey

2 of CONT'D

Project: 100 K BASIN

Log Date Depth Range

Borehole: 199-K-111A

Jun 08, 1994 0 - 85

No Corrections Applied

Gross Gamma

1 * 100 cps

Gross Gamma

1 * 100 cps

Project Information

Borehole Environment Information

NaI Passive Spectral Gamma Survey Information

Fixed: Constant Winch Speed

NaI Gamma-Ray Borehole Survey

4 of 4

Project: 100 K BASIN

Log Date Depth Range

Borehole: 199-K-111A

Jun 30, 1994 50 - 165'

No Corrections Applied

Gross Gamma

1 * 100 cps

Gross Gamma

1 * 100 cps

APPENDIX B

BOREHOLE SAMPLE DATA

Appendix B includes the following summary data for each well:

- Radioisotope (water) analytical results
- Water chemistry results
- Hydraulic properties of sediment samples.

Appendix B also includes grain size data, CaCO_3 data, and moisture data.

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Table B-1. K-West Basin: Radioisotope Analysis Results for Water Samples Taken During Drilling at 199-K-106A.

Well/ HEIS No.	Collection date	Sample depth (ft)	Tritium	Carbon-14	Alpha	Beta	Co-60	Ru-106	Sb-125	CS-137
K-106A B09FF3	01/28/94	74.4 (water table)	40,700 42,900	3,020	3.8	10.6	U	U	U	U
K-106A B09FH0	02/02/94	94.1	10,400	1,470	33.2	27.5	U	U	U	U
K-106A B09FH1	02/04/94	78-80 (composite)	21,800	NA	NA	NA	NA	NA	NA	NA
K-106A B09FH2	02/09/94	124.9	1,710	115	7.3	12.1	U	U	U	U
K-106A B09F56	02/15/94	164.1	2,320	31	3.8	12.9	U	U	U	U
K-106A B0BKK3	03/11/94	(water table)	2,160	414	8.7	96.6	U	U	U	U
K-106A B0BKK4	03/28/94	(water table)	U	497	96.6	73.6	U	U	U	U

WARNING: Water samples were collected during the drilling operations. They may not accurately represent the discrete depths listed, because of mixing in the borehole. Units are pCi/L. "U" indicates undetected within counting error limits. "NA" means not analyzed.

HEIS = Hanford Environmental Information System.

Table B-2. K-East Basin: Radioisotope Analysis Results for Water Samples Taken During Drilling at 199-K-109A.

Well/ HEIS No.	Collection date	Sample depth (ft)	Tritium	Carbon-14	Alpha	Beta	Co-60	Ru-106	Sb-125	CS-137
K-109A B09H58	07/29/94	75.9 (water table)	172,000.	72.70	3.42	9,200.00	U	U	39.80	U
K-109A B09H60	08/02/94	92.5	137,000.	150.00	23.80	851.00	U	U	U	U
K-109A B09H57	08/15/94	102	6,310.00	16.60	12.10	57.70	U	U	U	U
K-109A B09H61	08/18/94	118	763.00	20.10	13.70	33.20	7.44	U	U	U
K-109A B09H59	08/24/94	133	604.00	2.25	21.60	19.40	U	U	U	U
K-109A B0BWD9	08/29/94	151	561.00	13.1	1.92	17.40	8.05	U	U	U

WARNING: Water samples were collected during the drilling operations. They may not accurately represent the discrete depths listed, because of mixing in the borehole. Units are pCi/L. "U" indicates undetected within counting error limits. "NA" means not analyzed.

HEIS = Hanford Environmental Information System.

Table B-3. K-East Basin: Radioisotope Analysis Results for Water Samples Taken at 199-K-111A.

Well/ HEIS No.	Collect date	Sample depth (ft)	Tritium	Carbon-14	Alpha	Beta	Co-60	Ru-106	Sb-125	CS-137
K-111A B0BWF4	06/06/94	70.5 (water table)	155.00 U	64.10	4.45	15.70	U	U	U	U
K-111A B09H62	06/08/94	86.85	49.50 U	NA	29.90	33.20	U	U	U	U
K-111A B09H63	06/14/94	101.58	258.00 U	NA	24.80	20.90	U	U	U	U
K-111A B09H65	06/20/94	119.8	2480.00	4.77	1.77 U	24.50	U	U	U	U
K-111A B09H64	06/23/94	142.0	-202.00 U	2.77 U	46.40	32.70	U	U	U	U

WARNING: Water samples were collected during the drilling operations. They may not accurately represent the discreet depths listed, because of mixing in the borehole. Units are pCi/L. "U" indicates undetected within counting error limits. "NA" means not analyzed.

HEIS = Hanford Environmental Information System.

Table B-4. K-Basins: Sediment Split Spoon Sampling Results - Hydrologic Parameters. (2 sheets)

Well	Formation	Sample depth (ft)	Geologic description	UnSaturated K	Saturated K (ave.) (cm/s)	Bulk density (g/cm ³)	Porosity (%)	Specific gravity	Moisture retention	Designation
K-106A	Ringold E	88.5-89 *	Sandy gravel	NA	2.55E-05	2.2	18.4	2.7	NA	aquifer
K-106A	Ringold E	125.8-126.3 *	Slightly silty gravelly sand	NA	1.45E-06	2.2	17.6	2.7	NA	aquifer
K-106A	Ringold mud	163.6-164.1	Sandy silt	NA	2.17E-08	1.8	31.4	2.7	NA	aquitard
K-107A	Ringold E	84.5-86 *	Sandy gravel	NA	1.18E-03	NA	NA	NA	NA	aquifer
K-108A	Ringold E	78.2-80.2	Silty sandy gravel	NA	NA	NA	NA	NA	NA	aquifer
K-109A	Hanford fill	32.8-34.8	Sandy gravel	See Appendix B	8.6E-04	2.1	24.0	2.80	See Appendix B	vadose
K-109A	Ringold E	39.0-41.0 *	Sandy gravel	See Appendix B	NA	NA	NA	2.68	See Appendix B	vadose
K-109A	Ringold E	61.5-63.0	Sandy gravel	See Appendix B	3.27E-04	2.0	24.6	2.68	See Appendix B	vadose
K-109A	Ringold E	87.8-88.3 *	Sandy gravel	NA	NA	NA	NA	NA	NA	aquifer
K-109A	Ringold E	117.4-118.4	Slightly silty sandy gravel	NA	3.71E-04	2.0	30.7	2.8	NA	aquifer
K-109A	Ringold E	145-147	Silty sandy gravel	NA	4.27E-04	2.0	29.8	2.8 (est)	NA	aquifer
K-109A	Ringold mud	154.8-156.8	Clay	NA	1.21E-04	1.9	32.7	2.8	NA	aquitard

Table B-4. K-Basins: Sediment Split Spoon Sampling Results - Hydrologic Parameters. (2 sheets)

Well	Formation	Sample depth (ft)	Geologic description	UnSaturated K	Saturated K (ave.) (cm/s)	Bulk density (g/cm ³)	Porosity (%)	Specific gravity	Moisture retention	Designation
K-109A	Ringold mud	165.7-167.7	Clay	NA	3.40E-08	1.9	26.1	2.6	NA	aquitard
K-110A	Hanford fill	16.4-17.4	Sandy gravel	See Appendix B	1.08E-02	2.2	1.5	2.76	See Appendix B	vadose
K-110A	Ringold E	39.9-41.9	Silty sandy gravel	See Appendix B	3.22E-03	2.1	20.8	2.69	See Appendix B	vadose
K-110A	Ringold E	77.35-79.35	Sand	NA	1.17E-03	2.0	24.3	2.67	NA	aquifer
K-111A	Hanford fill	25.9-26.9	Sandy gravel	See Appendix B	2.08E-04	2.1	20.9	2.65	See Appendix B	vadose
K-111A	Ringold E	60.9-62.9	Sandy gravel	See Appendix B	1.45E-04	1.8	32.7	2.67	See Appendix B	vadose
K-111A	Ringold E	81.5-82.0	Sandy gravel	NA	8.84E-06	2.4	10.3	2.7	NA	aquifer
K-111A	Ringold E	122.4-112.9	Silty sandy gravel	NA	3.45E-04	2.1	19	2.65	NA	aquifer
K-111A	Ringold E	140.-140.5	Sandy gravel	NA	9.69E-04	1.6	41.7	2.7	NA	aquifer
K-111A	Ringold E	145.8-146.3	Sandy gravel	NA	2.37E-05	2.0	23.6	2.67	NA	aquifer
K-111A	Ringold mud	155.1-156.1 *	Sandy silt	NA	2.15E-04	1.7	37.6	2.68	NA	aquitard

*Astrisk indicates sample was repacked prior to analysis or consisted of poor sample material which possibly affected the analytical results. For more information see notes on analysis work sheets on file with WHC.

Note: Moisture content, calcium carbonate content, and sieve data are not reported in this table.

Table B-5. K Basin: Radioisotope Analysis Results for Water Samples Taken During Drilling at 199-K-107A, 108-A, and 110-A.

Well/ HEIS No.	Collection date	Sample depth (ft)	Tritium	Carbon-14	Alpha	Beta	Co-60	Ru-106	Sb-125	CS-137
K-107A BOBKK3	03/11/94	water table	2,160.00	414.00	8.72	96.60	U	U	U	U
K-108A BOBKK4	03/28/94	water table	108.00	497.00	96.60	73.60	U	U	U	U
K-110A BOBWF3	05/13/94	water table	256.00	126.00	3.27	24.70	9.23	U	U	U

WARNING: Water samples were collected during the drilling operations. They may not accurately represent the discreet depths listed, because of mixing in the borehole. Units are pCi/L. "U" indicates undetected within counting error limits. "NA" means not analyzed.

HEIS = Hanford Environmental Information System.

199-K-106A

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WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-106A	1/28/94	B09FF3	Antimony-125	-13.10	U	15.23	pCi/L
			Cesium-137	2.08	U	6.42	pCi/L
			Cobalt-60	3.49	U	3.51	pCi/L
			Gross alpha	3.82		2.30	pCi/L
			Gross beta	10.60		3.14	pCi/L
			Ruthenium-106	-41.90	U	51.92	pCi/L
			Tritium	42900.00		3265.00	pCi/L
	2/02/94	B09FH0	Antimony-125	1.80	U		pCi/L
			Carbon-14	1470.00		72.50	
			Cesium-137	3.30	U		pCi/L
			Cobalt-60	.81	U		pCi/L
			Gross alpha	33.20			pCi/L
			Gross beta	27.50			pCi/L
			Ruthenium-106	-34.00	U		pCi/L
			Tritium	10400.00			pCi/L
	2/04/94	B09FH1	Tritium	21800.00			pCi/L
	2/09/94	B09FF4	Y Aluminum, filtered	4300.00		3480.00	ppb
			Y Antimony, filtered	69.40	U		ppb
			Y Barium, filtered	72.00	B	2.16	ppb
			Y Beryllium, filtered	.81	U		ppb
			Y Cadmium, filtered	4.70	U		ppb
			Y Calcium, filtered	19000.00	BQ	3420.00	ppb
			Y Chromium, filtered	9.40	L	1.97	ppb
			Y Cobalt, filtered	4.05	U		ppb
			Y Copper, filtered	17.00	L	10.20	ppb
			Y Iron, filtered	6000.00	B	1080.00	ppb
			Y Magnesium, filtered	6300.00	Q	945.00	ppb
			Y Manganese, filtered	200.00		60.00	ppb
			Y Nickel, filtered	17.90	U		ppb
			Y Potassium, filtered	7700.00		1160.00	ppb
			Y Silver, filtered	2.87	U		ppb
			Y Sodium, filtered	16000.00	BQ	4800.00	ppb
			Y Tin, filtered	51.10	U		ppb
			Y Vanadium, filtered	10.00	L	2.40	ppb
			Y Zinc, filtered	39.00	Q	1.17	ppb
		B09FH2	Antimony-125	-2.57	U		pCi/L
			Carbon-14	115.00		11.30	
			Cesium-137	.46	U		pCi/L
			Cobalt-60	-1.39	U		pCi/L
			Gross alpha	7.30			pCi/L
			Gross beta	12.10			pCi/L
			Ruthenium-106	-5.28	U		pCi/L
			Tritium	1710.00			pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-106A	2/09/94	B09GZ4	Alkalinity	80.00	BQ		ppm
			Aluminum	1200000.00		972000.00	ppb
			Antimony	130.00	L	62.40	ppb
			Barium	14000.00	B	420.00	ppb
			Beryllium	35.00		15.80	ppb
			Bromide	100.00	L	6.00	ppb
			Cadmium	33.00		18.80	ppb
			Calcium	1100000.00	BQ	198000.00	ppb
			Chloride	5300.00		954.00	ppb
			Chromium	2500.00		525.00	ppb
			Cobalt	890.00		427.00	ppb
			Copper	2900.00		1740.00	ppb
			Fluoride	800.00		48.00	ppb
			Iron	1700000.00	B	306000.00	ppb
			Magnesium	610000.00	Q	91500.00	ppb
			Manganese	52000.00		15600.00	ppb
			Nickel	3300.00		1290.00	ppb
			Nitrate	80.00	L	7.20	ppb
			Nitrite	38.30	U		ppb
			Phosphate	147.00	U		ppb
			Potassium	160000.00		24000.00	ppb
			Silver	2.87	U		ppb
			Sodium	110000.00	BQ	33000.00	ppb
			Specific conductance	210.00			umhos
			Sulfate	23000.00	D	1380.00	ppb
			Tin	110.00		224.00	ppb
			Total Dissolved Solids	140.00			ppm
			Total Organic Carbon	34000.00			ppb
			Turbidity	3.60			NTU
			Vanadium	3400.00		816.00	ppb
			Zinc	5500.00	Q	165.00	ppb
			pH	8.10	H		
	2/15/94	B09FS6	Antimony-125	-10.80	U	16.07	pCi/L
			Carbon-14	31.10		7.23	
			Cesium-137	-2.40	U	5.81	pCi/L
			Cobalt-60	.39	U	7.79	pCi/L
			Gross alpha	3.83		2.35	pCi/L
			Gross beta	12.90		3.33	pCi/L
			Ruthenium-106	-14.70	U	62.28	pCi/L
			Tritium	2320.00		363.70	pCi/L
	5/03/94	B0BRN7	Antimony-125	-5.54	U	19.03	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	20600.00		945.00	
			Cesium-137	.47	U	7.53	pCi/L
			Chloride	22000.00	D	7260.00	ppb
			Cobalt-60	9.27		5.93	pCi/L

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-106A	5/03/94	BOBRN7	Fluoride	700.00		399.00	ppb
			Gross alpha	7.22		2.86	pCi/L
			Gross beta	9.66		3.06	pCi/L
			Nitrate	11000.00	DH		ppb
			Nitrite	110.00	UH		ppb
			Phosphate	470.00	UH		ppb
			Ruthenium-106	7.95	U	47.08	pCi/L
			Specific conductance	650.00			umhos
			Sulfate	67000.00	D	14100.00	ppb
			Tritium	249000.00		18360.00	pCi/L
			Turbidity	6.60	H		NTU
		BOBRN8	Y Aluminum, filtered	30.00	L	6.30	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	55.00		13.20	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	75000.00	B	15800.00	ppb
			Y Chromium, filtered	14.00	L	6.72	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	3.20	L	.38	ppb
			Y Iron, filtered	41.00		13.50	ppb
			Y Magnesium, filtered	18000.00		4320.00	ppb
			Y Manganese, filtered	3.70	L	.67	ppb
			Y Nickel, filtered	19.00	L	5.13	ppb
			Y Potassium, filtered	8700.00		1040.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	29000.00		15700.00	ppb
			Y Tin, filtered	140.00	BQ	33.60	ppb
			Y Vanadium, filtered	8.30	L	2.74	ppb
			Y Zinc, filtered	4.40	U		ppb
	7/13/94	BOC7K5	Antimony-125	-7.22	U	15.49	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	14400.00		660.00	
			Cesium-137	-1.37	U	6.63	pCi/L
			Chloride	19000.00	D	6270.00	ppb
			Cobalt-60	3.72	U	9.11	pCi/L
			Fluoride	800.00		456.00	ppb
			Gross alpha	5.57		2.60	pCi/L
			Gross beta	8.79		3.01	pCi/L
			Nitrate	100000.00	D		ppb
			Nitrite	110.00	U		ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	14.70	U	50.00	pCi/L
			Specific conductance	660.00			umhos
			Sulfate	69000.00	D	14500.00	ppb
			Tritium	43000.00		3333.00	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-106A	7/13/94	B0C7K5	Turbidity	4.30	Q		NTU
		B0C7K6	Y Aluminum, filtered	19.00	U		ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	53.00		12.70	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	72000.00	Q	15100.00	ppb
			Y Chromium, filtered	23.00	B	11.00	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	18000.00		4320.00	ppb
			Y Manganese, filtered	1.00	U		ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	7700.00		924.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	27000.00	Q	14600.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	36.00		11.90	ppb
	10/24/94	B0D5K3	Antimony-125	6.47	U	11.19	pCi/L
			Carbon-14	19800.00		912.00	
			Cesium-137	- .17	U	4.86	pCi/L
			Cobalt-60	4.68	U	6.03	pCi/L
			Ruthenium-106	16.00	U	44.92	pCi/L
			Specific conductance	650.00			umhos
				641.00			umhos
			Temperature, field	16.50			
			pH	7.75			
199-K-107A	3/11/94	B0BKK3	Antimony-125	8.37	U		pCi/L
			Carbon-14	414.00		24.10	
				414.00		24.10	
			Cesium-137	3.03	U		pCi/L
			Cobalt-60	.29	U		pCi/L
			Gross alpha	8.72			pCi/L
			Gross beta	96.60			pCi/L
			Ruthenium-106	-63.40	U		pCi/L
			Tritium	2160.00			pCi/L
	5/03/94	B0BRN9	Antimony-125	7.22	U	17.44	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	559.00		27.50	
			Cesium-137	-1.01	U	7.43	pCi/L
			Chloride	8500.00		2810.00	ppb
			Cobalt-60	.93	U	6.16	pCi/L

E 4782

BATTELLE Pacific Northwest Laboratories		GROUND-WATER SAMPLE FIELD RECORD	
Well Name 199-K-106A	Zone 1	Project OPER/RCRA	Date 1-28-74
Recommended Purge Volume (gal) NA		Calculations NA	
Purge Flow Rate (gal/min) NA			
Pump type B-12			
SAMPLES COLLECTED			
SAMPLE NUMBER(S) 809FF3 809FF4 12L 1-25-94	BOTTLE ID (1) 250ml (1) 1000ml GAS (6) 125ml (3) 1000ml (1) 500ml (1) 500ml (F) (1) 250ml GAS (1) 50ml 12L 1-25-94	PUMP NA	COLLECTOR NA
	BOTTLE ID (1) 125ML (P) (3) 1000ML (P)	↓ Baiker Baiker	↓ B.T. Whitten B.T. Whitten
TOTAL NUMBER OF BOTTLES 1574 4 1-25-94		Containment Code #: _____	
FIELD MEASUREMENTS			
Previous PH	Prev. Depth	WATER LEVELS (ft)	Time 1205
Steel Tape # NA	Held	NA	PH 8.23
pH/Cond Meter# NA	Cut		Temp (DEG.C) 16.9
Thermometer # NA	Depth below TC		Cond (µm/cm) 592
FIELD OBSERVATIONS Turbidity 100 NTU			
Weather 40°F Cloudy			
General Problems/Unusual Events Bailed sample from well being drilled at 73.40 BLS at 1200			
Equipment Irregularities NA			
Container Irregularities NA			
Comments Sampled at 73.40' BLS			
Well capped and locked? Yes ☒ No ☐			
Data Recorded by K.F. Donnelson		Data Checked by _____	
Chain of Custody form # 26363 26364 26365 - H&G SURFACE		FRF LOGBOOK and Pageno: 10/712	

E 48-4

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

NO DUMP

Well Name 199-K-106A - DEPTH 9.5' Zone 1
Recommended Purge Volume (gal) N/A
Purge Flow Rate (gal/min) 1/1
Pump type (RUN) FJSProject OPER/RCRA Date 02/02/94

Calculations

N/A

SAMPLES COLLECTED

SAMPLE NUMBER(S)

BOTTLE ID

PUMP

COLLECTOR

B05FHO

(3) 1000mLP

GRUNNINGS

K.D. LEE

(1) 125mLP

"

"

G05FHO

TOTAL NUMBER OF BOTTLES

4

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)	Time						
Steel Tape # <u>N/A</u>	Held		pH						
pH/Cond Meter # <u>N/A</u>	Cut		Temp (DEG. C)						
Thermometer # <u>N/A</u>	Depth below TC	74.47'	Cond (µm/cm)						

FIELD OBSERVATIONS

Weather: OVERCAST CLOUDY WIND: calmGeneral Problems/Unusual Events N/A

Equipment Irregularities _____

Container Irregularities _____

Comments WATER IN TUBESWell capped and locked? Yes ☒ No ☐Data Recorded by K.D. LEE

Data Checked by _____

Chain of Custody form # 26366

SURFACE

FRF LOGBOOK and Page no: 10/713

E 4795

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

NO DUMP

Well Name 199-K-106A Zone 1
Recommended Purge Volume (gal) 351
Purge Flow Rate (gal/min) 3.8
Pump type Grundfos

Project OPER/RCRA

Date 2-9-94Calculations 351 = 92
3.8 purge over 1132

SAMPLES COLLECTED

SAMPLE NUMBER(S)

B09FF3 → B09GZ4
B09FF4

BOTTLE ID

(1)250mlP -
(1)1000mlGAS -
5 (1)125mlP
(3)1000mlP KA 2-9-94
(1)500mlP
(1)500mlP(F)
(1)250mlGAS -
(1)30mlP 1-25-94

PUMP

Grundfos
"
"
"
"
"
"
"
NA
NA
NA

COLLECTOR

K.D. Lee
"
"
"
"
"
"
"
NA
NA
NA

TOTAL NUMBER OF BOTTLES

1514

Containment Code #: _____

1-25-94

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)	Time
Steel Tape # <u>NA</u>	Held		pH <u>NA</u>
pH/Cond Meter# <u>NA</u>	Cut	<u>NA</u>	Temp (DEG.c)
Thermometer # <u>NA</u>	Depth below TC	<u>80.36</u>	Cond (µm/cm)

FIELD OBSERVATIONS

Weather 28°F Sunny

General Problems/Unusual Events Water dropped below pump at 1025 lowered pump to 118 and slowed purge down to .75 g/min. 1050 Grundfos stopped/awaiting for recharge

Equipment Irregularities _____

Container Irregularities Filtered the samples except the non-filtered ICP, etc

Comments 1150 Start Sampling / recharge was slow 0.5' hr, sampled and recharged to 1024'

Well capped and locked? Yes ☒ NoData Recorded by V. J. ... / K. E. ...

Data Checked by _____

Chain of Custody form # 26363 26364 26365 - WWS SURFACE

FRF LOGBOOK and Pageno: 10/712

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

*** NO DUMP ***

Well Name 199-K-106A Zone 1 Project OPER/RCRA Date 02/15/94
Recommended Purge Volume (gal) 1.1/1
Purge Flow Rate (gal/min) 1
Pump type R.A.L.P. Calculations 1/1

SAMPLES COLLECTED

SAMPLE NUMBER(S)	BOTTLE ID	PUMP	COLLECTOR
B09FS6	(3)1000mLP	BAILER	K. N. Lee
	(1)125mLP	1/1	1/1
09FS6			

TOTAL NUMBER OF BOTTLES

4

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)	Time						
Steel Tape # 1/1	Held		pH						
pH/Cond Meter#	Cut		Temp (DEG.c)						
Thermometer # 1	Depth below TC	75.21	Cond (µm/cm)						

FIELD OBSERVATIONS

Weather overcast cool 38°F wind calm
General Problems/Unusual Events 1/1
Equipment Irregularities
Container Irregularities
Comments GRAB SAMPLE WITH DISPOSABLE BAILER

Well capped and locked? Yes No
Data Recorded by K. N. Lee
Chain of Custody form # 49399 SURFACE

Data Checked by _____
FRF LOGBOOK and Pageno: 29/427

*** NO DUMP ***

Calculations 11/11

COLLECTOR

(1) 1000 mL P

✓

Containment Code #:

		WATER LEVELS			
Previous PH	Prev. Depth	(ft)	Time		
Steel Tape #	Heid		pH		
pH/Cond. Meter #	Cut		Temp (DEG.c)		
Thermometer #	Depth below TC		Cond ($\mu\text{m/cm}$)		

Weather	2001-01-01
General Problems/Unusual Events	100
Equipment Irregularities	1
Container Irregularities	1
Comments	100 - 100, 100, 100, 100

FRF LOGBOOK and Pageno: 10/647

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

*** NO DUMP ***

Well Name 199-K-106A 7-13-94 Zone 1
Recommended Purge Volume (gal) 31
Purge Flow Rate (gal/min) 2
Pump type 7-13-94 14

Project OPER/RCRADate 7-13-94Calculations $3\frac{1}{2} = 16$

PURGE VOLUME 1056

SAMPLES COLLECTED

SAMPLE NUMBER(S)	BOTTLE ID	PUMP	COLLECTOR
BOC7K5	(3)125mLP	H	L. Thompson
BOC7K6	(2)1000mLP	H	"
	(1)500mLP(F)	H	"
	(1)125mLP	H	"
	(1)250mLP	H	"

1056 7-13-94

TOTAL NUMBER OF BOTTLES

15 7/13/94

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH	8.10	Prev. Depth	NA	WATER LEVELS (ft)	Time	1045	1050	1055	1100	7-13-94
Steel Tape #	NA	Held	NA	NA	pH	7.43	7.42	7.42	7.41	NA
pH/Cond Meter#	NA	Cut	NA	NA	Temp (DEG.c)	17.2	17.0	17.0	17.1	NA
Thermometer #	NA	Depth below TC	74.76	NA	Cond (µm/cm)	652	656	656	653	NA

74.76 64.46 7-13-94

FIELD OBSERVATIONS

Turbidity 4.88 NTU

Weather 80° SUNNYGeneral Problems/Unusual Events NAEquipment Irregularities NAContainer Irregularities NAComments NARebook EPL-1111Well capped and locked? X Yes NoData Recorded by Paul E. Thompson

Data Checked by _____

FRF LOGBOOK and Pageno: 10EPL-1111

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-0968-2 Well no./depth 199-K-106A 163.6-164.1' VISCOSITY 1

Tested By: R. T. McIntosh, L.D. Bruggeman, H. Hampt Date 4/11/94

Specimen Diameter (D, cm) 9.55 Specimen Length (L, cm) 15.12

Start Date	05-Apr-94	06-Apr-94	07-Apr-94	08-Apr-94		
Start Time	07:36:00	07:30:00	07:24:00	07:30:00		
End Date	06-Apr-94	07-Apr-94	08-Apr-94	11-Apr-94		
End Time	07:30:00	07:24:00	07:30:00	07:37:00		
Time Sec.	86040	86040	86760	259620		
Volume, cm ³	14.07	12.27	14.11	43.63		
Head, cm	1548	1548	1548	1548		
"Q"	1.64E-04	1.43E-04	1.63E-04	1.68E-04		
L/(A*H)	1.36E-04	1.36E-04	1.36E-04	1.36E-04		
K, cm/sec	2.23E-08	1.94E-08	2.22E-08	2.29E-08		
Kc, (K*Visc)	2.23E-08	1.94E-08	2.22E-08	2.29E-08		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc = HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 2.17E-08

STANDARD DEVIATION 1.34E-09

Remarks: Run as constant head under 22 psi head (1548 cm)

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

Checked By: *R.T. McIntosh*

Date: 4/18/94

WHC-SD-EN-DP-090, Rev. 0

19 14 94

B-21

Pg 15 of 18

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-106A
Depth	163.6-164.1
Lab #	4-0968-2
Heis #	NA
Tested by	HH/RTM
Contact	Rafuse
Phone #	2-1051
Date	4/11/94
length (cm)	15.12
diameter (cm)	9.55
volume (cm ³)	1083.02
wt of sample + mold (g)	2663.7
wt of mold (g)	330.2
wet wt of sample (g)	2333.5
dry wt of sample (g)	1999.9
wet density of sample (g/cm ³)	2.2
water content % dry wt	16.68%
dry density (g/cm ³)	1.8
specific gravity	2.7
void ratio	0.46
porosity	31.4%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>R. T. H. H. H.</i> Date: <i>4/19/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-0967 Well no./depth 199-K-106A 125.8-126.3' VISCOSITY 1

Tested By: R. T. McIntosh, L.D. Bruggeman, H. Hampt Date 4/13/94

Specimen Diameter (D, cm) 9.8 Specimen Length (L, cm) 13.96

Start Date	13-Apr-94	14-Apr-94	14-Apr-94	15-Apr-94		
Start Time	15:15:00	08:37:00	15:25:00	08:33:00		
End Date	14-Apr-94	14-Apr-94	15-Apr-94	15-Apr-94		
End Time	08:36:00	15:25:00	08:33:00	13:20:00		
Time Sec.	62460	24480	61680	17220		
Volume, cm ³	39.5	16	39.5	10.8		
Head, cm	81.28	81.92	82.55	81.28		
"Q"	6.32E-04	6.54E-04	6.40E-04	6.27E-04		
L/(A*H)	2.28E-03	2.26E-03	2.24E-03	2.28E-03		
K, cm/sec	1.44E-06	1.48E-06	1.44E-06	1.43E-06		
Kc,(K*Visc)	1.44E-06	1.48E-06	1.44E-06	1.43E-06		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 1.45E-06

STANDARD DEVIATION 1.87E-08

Remarks: Sample too disturbed to run as is. Sample recompacted to a dry Db of 2.22g/cc by RTM prior to running test.
 Sleeve not full. Sand added to top to fill.

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

Checked By:

R. T. McIntosh

Date:

4/18/94

B-23

WHC-SD-EN-DP-090, Rev. 0

Pg 10 of 18

Pg 11 of 18

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-106A
Depth	125.8-126.3
Lab #	4-0967
Heis #	NA
Tested by	HH/RTM
Contact	Rafuse
Phone #	2-1051
Date	4/13/94
length (cm)	13.96
diameter (cm)	9.80
volume (cm ³)	1052.97
wt of sample + mold (g)	NA
wt of mold (g)	NA
wet wt of sample (g)	NA
dry wt of sample (g)	2333.9
wet density of sample (g/cm ³)	NA
water content % dry wt	NA
dry density (g/cm ³)	2.2
specific gravity	2.7
void ratio	0.21
porosity	17.6%
COMMENTS:	
This is the bulk density of the sample after recompaction.	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>R. L. McIntosh</i> Date: <i>4/19/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-0966-1,2 Well no./depth 199-K-106A 88.5-89' VISCOSITY 1

Tested By: R. T. McIntosh, L.D. Bruggeman, H. Hamp Date 4/11/94

Specimen Diameter (D, cm) 9.56 Specimen Length (L, cm) 15.27

Start Date	12-Apr-94	12-Apr-94	13-Apr-94	13-Apr-94		
Start Time	00:00:00	15:43:00	10:52:00	11:15:00		
End Date	12-Apr-94	12-Apr-94	13-Apr-94	13-Apr-94		
End Time	00:15:00	15:54:00	11:14:00	11:44:00		
Time Sec.	900	660	1320	1740		
Volume, cm ³	8.8	6.6	10.5	14.5		
Head, cm	74.93	74.93	75.57	75.57		
"Q"	9.78E-03	1.00E-02	7.95E-03	8.33E-03		
L/(A*H)	2.84E-03	2.84E-03	2.82E-03	2.82E-03		
K, cm/sec	2.78E-05	2.84E-05	2.24E-05	2.35E-05		
Kc, (K*Visc)	2.78E-05	2.84E-05	2.24E-05	2.35E-05		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 2.55E-05

STANDARD DEVIATION 2.61E-06

Remarks: Both samples too disturbed to use. Samples combined and recompactd by RTM prior to running.

Dry density after recompactd was 2.19g/cc.

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

Checked By:

R. T. McIntosh

Date:

4/18/94

WHC-SD-EN-DP-090, Rev. 0

19 5 9 18

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GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-106A
Depth	88.5-89
Lab #	4-0966
Heis #	NA
Tested by	HH/RTM
Contact	Rafuse
Phone #	2-1051
Date	4-0966
length (cm)	15.27
diameter (cm)	9.56
volume (cm ³)	1096.05
wt of sample + mold (g)	NA
wt of mold (g)	NA
wet wt of sample (g)	NA
dry wt of sample (g)	2405.3
wet density of sample (g/cm ³)	NA
water content % dry wt	NA
dry density (g/cm ³)	2.2
specific gravity	2.7
void ratio	0.23
porosity	18.4%
COMMENTS:	
This is the bulk density of the sample after recompaction.	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>K. T. M. P. [Signature]</i> Date: <i>4/19/94</i>

4-0860

19 09 18

SIEVE ANALYSIS REPORT SHEET

WELL #	199-L-16A	CONTACT	RAFUSE	ORIG COD	81235	PHONE	544-8137
LAB #	4-0860	DEPTH	3' 5 3/4'	TESTED BY	HH	DATE	2/7/94

SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	GRAIN SIZ	COMMENTS	
WT (g)	SIZE IN.	WEIGHT	RETAINED	PASSING	MM		
2251.3	4.000	0.0	0.0	100.0	101.600		
	2.500	0.0	0.0	100.0	63.500		
	2.000	220.1	9.8	90.2	50.800		
	1.500	220.1	9.8	90.2	38.100		
	0.750	915.8	40.7	59.3	19.050		
	0.375	1259.1	55.9	44.1	9.525		
WT. #10	SIEVE# 4	1473.7	65.5	34.5	4.750		
SAMP.(g)	S# 10	1666.6	74.0	26.0	2.000		
127.8	S# 40	40.2	31.5	17.8	0.425	SAMPLE SPLIT	
	S# 60	68.1	53.3	12.1	0.250	WASH SIEVE	
	S# 100	92.1	72.1	7.3	0.150		
	S# 200	108.8	85.1	3.9	0.075

TEST CHECKED BY:

J.R. Lyen

DATE: 2-8-94

GEL 07 ☒ GEL 09 ☐ GEL 10 ☐ GEL 14 ☐	GEL 16 ☐ GEL 17 ☐ GEL 19 ☐ GEL ☐	GEOTECHNICAL ENGINEERING LABORATORY GEL-07 SIEVE AND HYDROMETER ANALYSIS	Sample No. <u>4-0860</u> Page <u>4</u> of <u>18</u>
GEL-07 SIEVE ANALYSIS			
Date <u>2-7-94</u> Calibration Due Date <u>2-7-94</u> Balance: <u>331</u>			
Sample Description <u>wet sand & Gravel</u> Sieve Time <u>10</u> (min)			
Reduced By: ☐ Splitting ☐ Quartering ☐ Stockpile			
Sieve Size	Sample Weight	Cumulative Wt. Retained	Cumulative % Retained
<u>2 1/2</u>	<u>2251.3</u>	<u>0</u>	<u>0</u>
<u>1 1/2</u>		<u>220.1</u>	<u>100</u>
<u>3/4</u>		<u>915.8</u>	
<u>3/8</u>		<u>1259.1</u>	
<u>100 to 4</u>	↓	<u>1473.7</u>	
<u>10</u>	<u>127.8</u>	<u>1666.6</u>	
<u>40</u>		<u>40.2</u>	
<u>60</u>		<u>68.1</u>	
<u>100</u>		<u>92.1</u>	
<u>200</u>	↓	<u>108.8</u>	↓
Tested By <u>LD Bruggen</u>			
Remarks: <u>pc 301 T=251.8</u> <u>As Rec'd 2650.1 -251.8=</u> <u>oven dried 2503.1 -251.8</u>			
GEL-07 HYDROMETER ANALYSIS			
Date _____ Balance: _____ Calibration Due Date _____ Thermometer: _____ Calibration Due Date _____ Hydrometer: _____ Calibration Due Date _____			
<u>WEIGHT OF SAMPLE</u>		<u>COMPOSITE CORRECTION</u>	
Wt. Container + Soil _____ (g)	Specific Gravity of Sample _____	1st Reading _____ at _____ °C	
Wt. Container _____ (g)	% Passing No. 10 Sieve _____ %	2nd Reading _____ at _____ °C	
Wt. Soil _____ (g)	A = _____ W = _____ K = _____		
Date	Clock Time	Elapsed Time (min)	Hydrometer Reading
		2.0	
		5.0	
		15.0	
		30.0	
		60.0	
		250.0	
		1440.0	
Hydrometer with Composite Correction _____ Temperature (°C) _____ Soil in Suspension (%) _____ Particle Diameter (mm) _____ Tested By _____			
Remarks: _____			
Tests Checked By <u>1/4 Relyea</u> Date <u>2-8-94</u>			

<p>GEL-07 GRAIN SIZE ANALYSIS PLOT</p>	
<p>Well # <u>199-K-106A</u></p>	<p>Sample No. <u>4-2860</u></p>
<p>Remarks <u>205'bt 10.20 sand</u></p>	<p>Page <u>1</u> of <u>1</u></p>
<p>Hydrometer Analysis</p>

<p>Plotted By <u>Daniel J. Anderson</u></p>	<p>Date <u>2/17/94</u></p>
<p>Plot Checked By <u>D. Anderson</u></p>	
<p>Date <u>2/17/94</u></p>	

VALIDATED

SIGNATURE/DATE

NA
B.S. 10/21/94 P. 192

GEOTECHNICAL ENGINEERING LABORATORY

GEL-14, GEL-19

DATE 3/4/94 GEL-14 SOIL MOISTURE

GEL-19 CALCIUM CARBONATE

Tested by LDB Balance 3304 Calibration due date 5/7/94

Vessel no. 5697 Sample wt. 8.0(g)

WELLNO 199-K-106A

OP. UNIT K BASIN CONTAC Refuse

PHONE 372-1051

Sample no.	Wet wt. & tare	Dry wt. & tare	Tare wt.	Moisture wt. soil	Dry wt. soil	Wet wt. soil	% Moisture	Pressure SOIL	% CaCO3 per gram	Calculate by	COMMENTS
4-0926	612.47	586.48	60.13	25.99	526.35	552.3	4.94	0.5	< 1%	HH	
927	585.87	567.92	62.96	17.95	504.96	522.9	3.55	0.4	< 1%	HH	
928	510.16	494.6	63.72	15.56	430.88	446.4	3.61	0.3	< 1%	HH	
929	563.62	545.88	62.34	17.74	483.54	501.3	3.67	0.3	< 1%	HH	
930	551.71	533.61	62.21	18.1	471.4	489.5	3.84	0.3	< 1%	HH	
931	542.14	524.79	61.94	17.35	462.85	480.2	3.75	0.3	< 1%	HH	
932	436.14	419.41	62.99	16.73	356.42	373.2	4.69	0.4	< 1%	HH	
933	554.95	538.24	62.752	16.71	475.49	492.2	3.51	0.3	< 1%	HH	
934	461.69	425.16	63.37	36.53	361.79	398.3	10.10	0.4	< 1%	HH	
935	562.08	544.36	63.18	17.72	481.18	498.9	3.68	0.4	< 1%	HH	
936	595.69	567.65	62.47	28.04	505.18	533.2	5.55	0.5	< 1%	HH	
937	598.54	582.78	62.38	15.76	520.4	536.2	3.03	0.3	< 1%	HH	
938	561.24	549.25	62.83	11.99	486.42	498.4	2.46	0.6	< 1%	HH	
*939	436.49	382.08	62.82	54.41	319.26	373.7	17.04	0.2	< 1%	HH	
940	687.53	627.77	61.56	59.76	566.21	626.0	10.55	0.3	< 1%	HH	
941	674.7	614.24	62.54	60.46	551.7	612.2	10.96	0.2	< 1%	HH	
942	627.64	565.43	63.75	62.21	501.68	563.9	12.40	0.3	< 1%	HH	
*943	506.12	451.19	63.41	54.93	387.78	442.7	14.17	0.3	< 1%	HH	
*944	510.09	444.66	62.58	65.43	382.08	447.5	17.12	0.5	< 1%	HH	
*945	503.97	476.09	62.21	27.88	413.88	441.8	6.74	0.5	< 1%	HH	
946	545.98	516.45	60.95	29.53	455.5	485.0	6.48	0.5	< 1%	HH	
*947	546.28	457.11	63.43	89.17	393.68	482.9	22.65	0.3	< 1%	HH	
*948	561.81	461.9	62.56	99.91	399.34	499.3	25.02	0.5	< 1%	HH	
*949	375.09	307.25	62.46	67.84	244.79	312.6	27.71	0.7	1.0	HH	
*950	542.84	469.34	64.34	73.5	405	478.5	18.15	0.7	1.0	HH	
*951	483.85	405.43	61.47	78.42	343.96	422.4	22.80	0.5	< 1%	HH	
952	546.61	514.25	62.93	32.36	451.32	483.7	7.17	0.3	< 1%	HH	
*953	600.45	519.74	62.31	80.71	457.43	538.1	17.64	0.2	< 1%	HH	
*954	487.56	402.15	64.09	85.41	338.06	423.5	25.26	0.2	< 1%	HH	

COMMENTS: *STANDING WATER

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

Checked by:

R. J. McDaniel

Date:

3/16/94

GEL-14, GEL-19

GEL-19 CALCIUM CARBONATE

Vessel no. 5697 Sample wt.8.0(g)

OP.UNIT K BASIN CONTAC Rafuse

PHONE 372-1051

10

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

Checked by:

Date:

199-K-107A

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GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
109-K-106A	7/13/94	B0C7K5	Turbidity	4.30	Q		NTU
		B0C7K6	Y Aluminum, filtered	19.00	U		ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	53.00		12.70	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	72000.00	Q	15100.00	ppb
			Y Chromium, filtered	23.00	B	11.00	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	18000.00		4320.00	ppb
			Y Manganese, filtered	1.00	U		ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	7700.00		924.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	27000.00	Q	14600.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	36.00		11.90	ppb
	10/24/94	B0D5K3	Antimony-125	6.47	U	11.19	pCi/L
			Carbon-14	19800.00		912.00	
			Cesium-137	- .17	U	4.86	pCi/L
			Cobalt-60	4.68	U	6.03	pCi/L
			Ruthenium-106	16.00	U	44.92	pCi/L
			Specific conductance	650.00			umhos
				641.00			umhos
			Temperature, field	16.50			
			pH	7.75			
<u>199-K-107A</u>	3/11/94	B0BKK3	Antimony-125	8.37	U		pCi/L
			Carbon-14	414.00		24.10	
				414.00		24.10	
			Cesium-137	3.03	U		pCi/L
			Cobalt-60	.29	U		pCi/L
			Gross alpha	8.72			pCi/L
			Gross beta	96.60			pCi/L
			Ruthenium-106	-63.40	U		pCi/L
			Tritium	2160.00			pCi/L
	5/03/94	B0BRN9	Antimony-125	7.22	U	17.44	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	559.00		27.50	
			Cesium-137	-1.01	U	7.43	pCi/L
			Chloride	8500.00		2810.00	ppb
			Cobalt-60	.93	U	6.16	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-107A	5/03/94	BOBRN9	Fluoride	700.00		399.00	ppb
			Gross alpha	3.80		1.94	pCi/L
			Gross beta	88.50		9.40	pCi/L
			Nitrate	16000.00	D		ppb
			Nitrite	110.00	U		ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	-15.50	U	53.74	pCi/L
			Specific conductance	340.00			umhos
			Sulfate	33000.00	D	6930.00	ppb
			Tritium	1870.00		387.90	pCi/L
			Turbidity	32.00			NTU
		BOBRP0	Y Aluminum, filtered	19.00	U		ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	40.00		9.60	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	40000.00	B	8400.00	ppb
			Y Chromium, filtered	150.00		72.00	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	5.10	L	.61	ppb
			Y Iron, filtered	21.00		6.93	ppb
			Y Magnesium, filtered	8100.00		1940.00	ppb
			Y Manganese, filtered	91.00		16.40	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	4500.00		540.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	17000.00		9180.00	ppb
			Y Tin, filtered	95.00	BLQ	22.80	ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	4.40	U		ppb
	7/13/94	BOC7K7	Antimony-125	-9.62	U	13.70	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	511.00		25.30	
			Cesium-137	1.32	U	6.38	pCi/L
			Chloride	7200.00		2380.00	ppb
			Cobalt-60	-2.58	U	5.67	pCi/L
			Fluoride	400.00		228.00	ppb
			Gross alpha	3.07		1.73	pCi/L
			Gross beta	98.00		9.91	pCi/L
			Nitrate	16000.00	D		ppb
			Nitrite	110.00	U		ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	32.20	U	49.84	pCi/L
			Specific conductance	340.00			umhos
			Sulfate	30000.00	D	6300.00	ppb
			Tritium	1760.00		386.30	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-107A	7/13/94	B0C7K7	Turbidity	15.00	Q		NTU
		B0C7K8	Y Aluminum, filtered	35.00	L	7.35	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	35.00		8.40	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	40000.00	Q	8400.00	ppb
			Y Chromium, filtered	160.00	B	76.80	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	8200.00		1970.00	ppb
			Y Manganese, filtered	11.00		1.98	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	3900.00		468.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	16000.00	Q	8640.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	37.00		12.20	ppb
	10/22/94	B0D5K5	Antimony-125	-1.49	U	15.88	pCi/L
			Carbon-14	841.00		40.80	
			Cesium-137	-5.49	U	6.08	pCi/L
			Cobalt-60	-1.70	U	5.90	pCi/L
			Ruthenium-106	93.70		51.06	pCi/L
			Specific conductance	350.00			umhos
				353.00			umhos
			Temperature, field	15.10			
			pH	7.76			
199-K-108A	3/28/94	B0BKK4	Antimony-125	-5.62	U	15.11	pCi/L
			Carbon-14	497.00		28.10	
			Cesium-137	-0.96	U	5.70	pCi/L
			Cobalt-60	-9.83	U	9.23	pCi/L
			Gross alpha	96.60		27.29	pCi/L
			Gross Beta	73.60		18.28	pCi/L
			Ruthenium-106	-18.70	U	37.08	pCi/L
			Tritium	108.00	U	229.40	pCi/L
	5/03/94	B0BRP1	Antimony-125	5.74	U	16.16	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	2790.00		130.00	
			Cesium-137	5.12	U	5.69	pCi/L
			Chloride	4900.00		1620.00	ppb
			Cobalt-60	.47	U	9.38	pCi/L
			Fluoride	700.00		399.00	ppb

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1006 Well no./depth 199-K-107A 85.46-85.96' VISCOSITY 1

Tested By: R. T. McIntosh, L.D. Bruggeman, H. Hampt Date 4/11/94

Specimen Diameter (D, cm) 9.27 Specimen Length (L, cm) 15.19

Start Date	12-Apr-94	12-Apr-94	12-Apr-94	13-Apr-94	13-Apr-94	
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	
End Date	12-Apr-94	12-Apr-94	12-Apr-94	13-Apr-94	13-Apr-94	
End Time	00:03:00	00:03:00	00:03:00	00:03:00	00:03:00	
Time Sec.	180	180	180	180	180	
Volume, cm ³	79	75.6	73.6	81.7	82.1	
Head, cm	81.28	81.28	81.28	85.09	85.09	
"Q"	4.39E-01	4.20E-01	4.09E-01	4.54E-01	4.56E-01	
L/(A*H)	2.77E-03	2.77E-03	2.77E-03	2.65E-03	2.65E-03	
K, cm/sec	1.22E-03	1.16E-03	1.13E-03	1.20E-03	1.21E-03	
Kc, (K*Visc)	1.22E-03	1.16E-03	1.13E-03	1.20E-03	1.21E-03	

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc = HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 1.18E-03

STANDARD DEVIATION 3.12E-05

Remarks: Sample too disturbed to run as is. Sample recompacted by RTM prior to running test.

Sample recompacted to a dry density of 1.77g/cc.

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

Checked By:

R. T. McIntosh

Date:

4/18/94

B-38

WHC-SD-EN-DP-090, Rev. 0

10/21/94 14:07

376-1081

GEO-TECH

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10/21/94 Time 1505

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Please call to let me know when you receive this fax.

Sample Depths

Well no. 199-K-106A		Well no. 199-K-107A		Well no. 199-K-108A	
lab sample #	sample depth (ft)	lab sample #	sample depth (ft)	lab sample #	sample depth (ft)
4-0926	5	4-0986	5	4-1016	5
927	10	987	10	1017	10
928	15	988	15	1018	15
929	20	989	19	1019	20
930	22	990	25	1020	25
931	25	991	27	1021	30
932	30	992	30	1022	32
933	33	993	35	1023	35
934	35	994	40	1024	40
935	40	995	45	1025	45
936	45	996	50	1026	48
937	50	997	55	1027	54
938	55	998	60	1028	60
939	61	999	65	1029	65
940	65	1000	70	1030	70
941	70	1001	75	1031	75
942	78	1002	80	1032	80
943	80	1003	85	1033	85
944	85	1004	90	1034	90
945	90	1005	95	1088	77.35-79.35
946	95				
947	100				
948	105				
949	112				
950	115				
951	121				
952	125.3-125.8				
953	130				
954	135				
955	140				
956	145.5				
957	150				
958	155				
959	160				
960	165				
961	170				

GEL-14, GEL-19

GEL-19 CALCIUM CARBONATE

Vessel no. 5697 Sample wt.8.0(g)

OP.UNIT K BASIN

CONTAC Rafuse

PHONE 372-1051

COMMENTS:

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

Checked by:

Date:

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-107A	CONTACT	Rafuse	ORIG COD	81550	PHONE	539-2125
LAB #	4-0984	DEPTH	85.96-86.46	TESTED BY	LDB/HH	DATE	2/18/94

SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	GRAIN SIZ	COMMENTS	
WT (g)	SIZE IN.	WEIGHT	RETAINED	PASSING	MM		
2083.9	4.000	0.0	0.0	100.0	101.600		
	2.500	0.0	0.0	100.0	63.500		
	2.000	0.0	0.0	100.0	50.800		
	1.500	150.9	7.2	92.8	38.100		
	0.750	300.7	14.4	85.6	19.050		
	0.375	437.2	21.0	79.0	9.525		
WT. #10	SIEVE# 4	631.0	30.3	69.7	4.750		
SAMP.(g)	S# 10	804.9	38.6	61.4	2.000		
138.6	S# 40	32.9	23.7	46.8	0.425	SAMPLE SPLIT	
	S# 60	84.6	61.0	23.9	0.250	WASH SIEVE	
	S# 100	116.3	83.9	9.9	0.150		
	S# 200	127.6	92.1	4.9	0.075

TEST CHECKED BY:

R. A. McIntosh

DATE:

3/11/94

4-0984

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199-K-108A

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GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-107A	7/13/94	B0C7K7	Turbidity	15.00	Q		NTU
		B0C7K8	Y Aluminum, filtered	35.00	L	7.35	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	35.00		8.40	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	40000.00	Q	8400.00	ppb
			Y Chromium, filtered	160.00	B	76.80	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	8200.00		1970.00	ppb
			Y Manganese, filtered	11.00		1.98	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	3900.00		468.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	16000.00	Q	8640.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	37.00		12.20	ppb
	10/22/94	B0D5K5	Antimony-125	-1.49	U	15.88	pCi/L
			Carbon-14	841.00		40.80	
			Cesium-137	-5.49	U	6.08	pCi/L
			Cobalt-60	-1.70	U	5.90	pCi/L
			Ruthenium-106	93.70		51.06	pCi/L
			Specific conductance	350.00			umhos
				353.00			umhos
			Temperature, field	15.10			
			pH	7.76			
199-K-108A	3/28/94	B0BKK4	Antimony-125	-5.62	U	15.11	pCi/L
			Carbon-14	497.00		28.10	
			Cesium-137	-.96	U	5.70	pCi/L
			Cobalt-60	-9.83	U	9.23	pCi/L
			Gross alpha	96.60		27.29	pCi/L
			Gross beta	73.60		18.28	pCi/L
			Ruthenium-106	-18.70	U	37.08	pCi/L
			Tritium	108.00	U	229.40	pCi/L
	5/03/94	B0BRP1	Antimony-125	5.74	U	16.16	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	2790.00		130.00	
			Cesium-137	5.12	U	5.69	pCi/L
			Chloride	4900.00		1620.00	ppb
			Cobalt-60	.47	U	9.38	pCi/L
			Fluoride	700.00		399.00	ppb

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-108A	5/03/94	80BRP1	Gross alpha	5.29		2.36	pCi/L
			Gross beta	9.73		2.99	pCi/L
			Nitrate	14000.00	D		ppb
			Nitrite	200.00	L		ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	25.60	U	57.80	pCi/L
			Specific conductance	380.00			umhos
			Sulfate	32000.00	D	6720.00	ppb
			Tritium	425.00		304.90	pCi/L
			Turbidity	11.00			NTU
		80BRP2	Y Aluminum, filtered	19.00	U		ppb
			Y Antimony, filtered	45.00	L	8.10	ppb
			Y Barium, filtered	45.00		10.80	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	49000.00	B	10300.00	ppb
			Y Chromium, filtered	41.00		19.70	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	4.40	L	.53	ppb
			Y Iron, filtered	22.00		7.26	ppb
			Y Magnesium, filtered	9800.00		2350.00	ppb
			Y Manganese, filtered	86.00		15.50	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	7200.00		864.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	17000.00		9180.00	ppb
			Y Tin, filtered	110.00	BQ	26.40	ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	4.40	U		ppb
	7/13/94	80C7L1	Antimony-125	5.27	U	10.56	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	3720.00		172.00	
			Cesium-137	-3.90	U	6.88	pCi/L
			Chloride	5700.00		1880.00	ppb
			Cobalt-60	1.02	U	5.21	pCi/L
			Fluoride	800.00		456.00	ppb
			Gross alpha	6.82		2.81	pCi/L
			Gross beta	8.05		2.92	pCi/L
			Nitrate	23000.00	D		ppb
			Nitrite	110.00	U		ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	44.20	U	58.80	pCi/L
			Specific conductance	440.00			umhos
			Sulfate	38000.00	D	7980.00	ppb
			Tritium	632.00		321.50	pCi/L
			Turbidity	4.00	Q		NTU

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-108A	7/13/94	B0C7L2	Y Aluminum, filtered	39.00	L	8.19	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	44.00		10.60	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	55000.00	Q	11600.00	ppb
			Y Chromium, filtered	160.00	B	76.80	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	12000.00		2880.00	ppb
			Y Manganese, filtered	6.30	L	1.13	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	6800.00		816.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	17000.00	Q	9180.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	81.00		26.70	ppb
	10/24/94	B0D5K7	Antimony-125	-2.12	U	14.68	pCi/L
			Carbon-14	4690.00		217.00	
			Cesium-137	-1.39	U	6.80	pCi/L
			Cobalt-60	-.88	U	6.34	pCi/L
			Ruthenium-106	4.47	U	52.88	pCi/L
			Specific conductance	450.00			umhos
				416.00			umhos
			Temperature, field	15.60			
			pH	7.85			
199-K-109A	7/29/94	B09H58	Antimony-125	39.80		18.23	pCi/L
			Carbon-14	72.70		5.72	
			Cesium-137	1.89	U	5.28	pCi/L
			Cobalt-60	3.82	U	5.78	pCi/L
			Gross alpha	3.42	Y	3.19	pCi/L
			Gross beta	9200.00		697.20	pCi/L
			Ruthenium-106	-26.20	U	46.26	pCi/L
			Specific conductance	462.00			umhos
			Temperature, field	30.30			
			Tritium	172000.00		12620.00	pCi/L
			pH	7.94			
	8/02/94	B09H60	Antimony-125	-3.69	U	11.83	pCi/L
			Carbon-14	150.00		9.03	
			Cesium-137	1.39	U	5.24	pCi/L
			Cobalt-60	2.63	U	7.23	pCi/L
			Gross alpha	23.80		10.41	pCi/L

P 144

GEOTECHNICAL ENGINEERING LABORATORY							
SIEVE ANALYSIS							
GEL-07							
WELL #	199-K-108A	DEPTH	79.5-80	CONTACT	WILLIAMS	PHONE	NA
LAB #	4-1015	HEIS NO.	NA	TESTED BY	LDB	DATE	3/30/94
SAMPLE WT (g)	SIEVE SIZE INCHES	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	GRAIN SIZE MM	COMMENTS	
2146.7	4.000	0.0	0.0	100.0	101.600		
	2.500	0.0	0.0	100.0	63.500		
	2.000	0.0	0.0	100.0	50.800		
	1.500	178.9	8.3	91.7	38.100		
	0.750	621.2	28.9	71.1	19.050		
	0.375	1109.3	51.7	48.3	9.525		
SAMPLE WT (g) - #10	SIEVE# 4	1353.2	63.0	37.0	4.750		
	S# 10	1487.8	69.3	30.7	2.000	SAMPLE SPLIT	
129.7	S# 40	26.7	20.6	24.4	0.425	WASH SIEVE	
	S# 60	70.5	54.4	14.0	0.250		
	S# 100	103.3	79.6	6.2	0.150		
	S# 200	115.0	88.7	3.5	0.075		

% PASSING

GRAIN SIZE (MM)

Comments:

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

Checked by: H. Gump Date: 3/30/94

4-1015

B-51

12 2 of 4

10/21/94 14:07 3764081

GEO-TECH

001

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Sample Depths

Well no. 199-K-106A		Well no. 199-K-107A		Well no. 199-K-108A	
lab sample #	sample depth (ft)	lab sample #	sample depth (ft)	lab sample #	sample depth (ft)
4-0926	5	4-0986	5	4-1016	5
927	10	987	10	1017	10
928	15	988	15	1018	15
929	20	989	19	1019	20
930	22	990	25	1020	25
931	25	991	27	1021	30
932	30	992	30	1022	32
933	33	993	35	1023	35
934	35	994	40	1024	40
935	40	995	45	1025	45
936	45	996	50	1026	48
937	50	997	55	1027	54
938	55	998	60	1028	60
939	61	999	65	1029	65
940	65	1000	70	1030	70
941	70	1001	75	1031	75
942	78	1002	80	1032	80
943	80	1003	85	1033	85
944	85	1004	90	1034	90
945	90	1005	95	1088	77.35-79.35
946	95			sample is for well 110	
947	100				
948	105				
949	112				
950	115				
951	121				
952	125.3-125.8				
953	130				
954	135				
955	140				
956	145.5				
957	150				
958	155				
959	160				
960	165				
961	170				

GEL-14, GEL-19

GEL-19 CALCIUM CARBONATE

Vessel no. 5697 Sample wt.8.0(g)

OP.UNIT K BASIN

CONTAC Rafuse

PHONE 372-1051

COMMENTS:

Checked by: A. Hargrett

Date: 4/11/94

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199-K-109A

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GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-108A	7/13/94	B0C7L2	Y Aluminum, filtered	39.00	L	8.19	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	44.00		10.60	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	55000.00	Q	11600.00	ppb
			Y Chromium, filtered	160.00	B	76.80	ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	18.00	U		ppb
			Y Magnesium, filtered	12000.00		2880.00	ppb
			Y Manganese, filtered	6.30	L	1.13	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	6800.00		816.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	17000.00	Q	9180.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	81.00		26.70	ppb
	10/24/94	B0D5K7	Antimony-125	-2.12	U	14.68	pCi/L
			Carbon-14	4690.00		217.00	
			Cesium-137	-1.39	U	6.80	pCi/L
			Cobalt-60	-0.88	U	6.34	pCi/L
			Ruthenium-106	4.47	U	52.88	pCi/L
			Specific conductance	450.00			umhos
				416.00			umhos
			Temperature, field	15.60			
			pH	7.85			
199-K-109A	7/29/94	B09H58	Antimony-125	39.80		18.23	pCi/L
			Carbon-14	72.70		5.72	
			Cesium-137	1.89	U	5.28	pCi/L
			Cobalt-60	3.82	U	5.78	pCi/L
			Gross alpha	3.42	Y	3.19	pCi/L
			Gross beta	9200.00		697.20	pCi/L
			Ruthenium-106	-26.20	U	46.26	pCi/L
			Specific conductance	462.00			umhos
			Temperature, field	30.30			
			Tritium	172000.00		12620.00	pCi/L
			pH	7.94			
	8/02/94	B09H60	Antimony-125	-3.69	U	11.83	pCi/L
			Carbon-14	150.00		9.03	
			Cesium-137	1.39	U	5.24	pCi/L
			Cobalt-60	2.63	U	7.23	pCi/L
			Gross alpha	23.80		10.41	pCi/L

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-109A	8/02/94	B09H60	Gross beta	851.00		72.81	pCi/L
			Ruthenium-106	8.08	U	48.42	pCi/L
			Specific conductance	344.00			umhos
			Temperature, field	22.00			
			Tritium	137000.00		10160.00	pCi/L
			pH	8.14			
	8/15/94	B09H57	Antimony-125	5.24	U	14.33	pCi/L
			Carbon-14	16.60		3.61	
			Cesium-137	-.54	U	6.11	pCi/L
			Cobalt-60	-10.10	U	9.52	pCi/L
			Gross alpha	12.10		5.89	pCi/L
			Gross beta	57.70		9.96	pCi/L
			Ruthenium-106	-26.10	U	57.08	pCi/L
			Specific conductance	148.00			umhos
			Temperature, field	26.00			
			Tritium	6310.00		689.00	pCi/L
			pH	9.05			
	8/18/94	B09H61	Antimony-125	1.73	U	16.72	pCi/L
			Carbon-14	20.10		3.72	
			Cesium-137	-.28	U	4.82	pCi/L
			Cobalt-60	7.44		5.31	pCi/L
			Gross alpha	13.70		8.34	pCi/L
			Gross beta	33.20		5.24	pCi/L
			Ruthenium-106	27.50	U	41.70	pCi/L
			Specific conductance	199.00			umhos
			Temperature, field	27.50			
			Tritium	763.00		246.50	pCi/L
			pH	9.01			
	8/24/94	B09H59	Antimony-125	2.49	U	14.87	pCi/L
			Carbon-14	2.25	U	3.19	
			Cesium-137	-3.36	U	6.35	pCi/L
			Cobalt-60	-6.96	U	7.34	pCi/L
			Gross alpha	21.60		6.54	pCi/L
			Gross beta	19.40		4.16	pCi/L
			Ruthenium-106	-32.10	U	59.90	pCi/L
			Specific conductance	140.00			umhos
			Temperature, field	20.80			
			Tritium	604.00		408.30	pCi/L
			pH	9.10			
	8/29/94	B08WD9	Alkalinity	50.00			ppm
			Aluminum	1000000.00		210000.00	ppb
			Antimony	140.00	LB	25.20	ppb
			Antimony-125	.50	U	13.34	pCi/L
			Barium	10000.00		2400.00	ppb

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-109A	8/29/94	808WD9	Beryllium	35.00		11.60	ppb
			Bromide	110.00	U		ppb
			Cadmium	54.00		17.80	ppb
			Calcium	540000.00		113000.00	ppb
			Carbon-14	13.10		3.50	
			Cesium-137	-3.54	U	5.24	pCi/L
			Chloride	1400.00		462.00	ppb
			Chromium	1900.00	Q	912.00	ppb
			Cobalt	730.00		219.00	ppb
			Cobalt-60	8.05		6.21	pCi/L
			Copper	1800.00	Q	216.00	ppb
			Fluoride	500.00		285.00	ppb
			Gross alpha	1.92	U	2.80	pCi/L
			Gross beta	17.40		5.22	pCi/L
			Iron	1600000.00	Q	528000.00	ppb
			Magnesium	500000.00		120000.00	ppb
			Manganese	31000.00	Q	5580.00	ppb
			Nickel	2100.00	Q	567.00	ppb
			Nitrate	96.00	UH		ppb
			Nitrite	110.00	UH		ppb
			Phosphate	470.00	UH		ppb
			Potassium	98000.00		11800.00	ppb
			Ruthenium-106	-55.30	U	53.12	pCi/L
			Silver	3.40	U		ppb
			Sodium	81000.00	Q	43700.00	ppb
			Specific conductance	150.00			umhos
			Sulfate	13000.00	D	2730.00	ppb
			Tin	340.00	B	81.60	ppb
			Total Dissolved Solids	80.00			ppm
			Total Organic Carbon	2000.00			ppb
			Total Organic Halogen	6.70			ppb
			Tritium	561.00		354.00	pCi/L
			Turbidity	66000.00	QH		NTU
			Vanadium	3100.00		1020.00	ppb
			Zinc	4100.00		1350.00	ppb
			pH	8.80	H		
		808WFO	Y Aluminum, filtered	200.00		42.00	ppb
			Y Antimony, filtered	34.00	LB	6.12	ppb
			Y Barium, filtered	44.00		10.60	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	13000.00		2730.00	ppb
			Y Chromium, filtered	11.00	UQ		ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	4.40	LQ	.53	ppb
			Y Iron, filtered	250.00	Q	82.50	ppb
			Y Magnesium, filtered	4000.00		960.00	ppb

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-109A	8/29/94	B0BWF0	Y Manganese, filtered	45.00	Q	8.10	ppb
			Y Nickel, filtered	16.00	UQ		ppb
			Y Potassium, filtered	4800.00		576.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	7900.00	Q	4270.00	ppb
			Y Tin, filtered	56.00	LB	13.40	ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	8.70	L	2.87	ppb
	9/20/94	B0D0H9	Antimony-125	39.60		19.26	pCi/L
			Cesium-137	-4.80	U	5.92	pCi/L
			Cobalt-60	.39	U	7.84	pCi/L
			Ruthenium-106	34.50	U	36.96	pCi/L
			Strontium-90	803.00		140.70	pCi/L
			Tritium	158000.00		11710.00	pCi/L
		B0D0J5	Gross alpha	8.24	Q	3.00	pCi/L
			Gross beta	1140.00		80.60	pCi/L
			Strontium-90	614.00		114.00	pCi/L
			Tritium	181000.00		13450.00	pCi/L
	9/28/94	B0C8P8	Tritium	61100.00		4673.00	pCi/L
			Turbidity	48.00			NTU
	11/03/94	B0D5K9	Carbon-14	161.00		9.61	
			Specific conductance	394.00			umhos
			Temperature, field	14.50			
			pH	7.72			
	11/21/94	B0D8W2	Specific conductance	383.00			umhos
			Temperature, field	14.50			
			pH	7.92			
	5/13/94	B0BWF3	Antimony-125	10.20	U	14.96	pCi/L
			Carbon-14	126.00		8.05	
			Cesium-137	-2.52	U	8.12	pCi/L
			Cobalt-60	9.23		5.91	pCi/L
			Gross alpha	3.27		2.32	pCi/L
			Gross beta	24.70		4.54	pCi/L
			Ruthenium-106	-4.68	U	53.76	pCi/L
			Tritium	256.00	U	287.20	pCi/L
	7/07/94	B0C0Q2	Tritium	205.00	U	231.10	pCi/L
	7/15/94	B0C7L7	Antimony-125	-3.34	U	17.67	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	87.80		6.34	
			Cesium-137	-.18	U	8.53	pCi/L

N 6625

No Damp

FATTELL
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

Well Name 199-K-189A Zone 1
Recommended Purge Volume (gal) NA
Purge Flow Rate (gal/min) NA
Pump type Bladder

Project OPER/RCRA

Date 7-29-94

Calculations

NA

SAMPLES COLLECTED

SAMPLE NUMBER(S)

BOTTLE ID

PUMP

COLLECTOR

989H58

(2) 188mlP

(1) 125mlP

(1) 250mlP

Bladder

K. Donnellson (WIK)

TOTAL NUMBER OF BOTTLES

4

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)	Time										
<u>NA</u>				1142	1146	1155	1159	1257	1225	1225	1230		
Steel Tape # <u>NA</u>	Held		pH	7.94	7.93	7.94	7.97	7.95	7.70	7.89	7.94		
pH/Cond Meter # <u>NA</u>	Cut	<u>NA</u>	Temp (DEG.c)	30.2	31.4	31.4	30.8	31.0	28.1	28.2	30.3		
Thermometer # <u>NA</u>	Depth below TC	70.6'	Cond (µm/ca)	474	461	458	462	461	41.5	467	462		

FIELD OBSERVATIONS

Weather 70°F / Clear

General Problems/Unusual Events Sent on bladder were not working, P. 1142, pump 1146

Equipment Irregularities Water in tubing → making high Temp readings

Container Irregularities NA

Comments Turbidity Time: 1120 1125 1133 1145 1147 1157 1225 1220 1225 1230
NTU: 171 94 95.6 47.6 42.2 29.3 70.1 39.4 29.3 34.4
Pumped ≈ 12 gallons Pump at 75.5', Depth to bottom 76.88'

Well capped and locked? Yes ☒ No ☐

Data Recorded by R. F. Donnellson (WIK) Data Checked by _____

Chain of Custody form # 28373 SURFACE FRF LOGBOOK NO. 10

N 1686

-No Dump

BATTELLE Pacific Northwest Laboratories		GROUND-WATER SAMPLE FIELD RECORD										
Well Name 199-K-189A Zone 1				Project OPER/RCRA			Date 8-2-94					
Recommended Purge Volume (gal) <u>NA</u>				Calculations <u>NA</u>								
Purge Flow Rate (gal/min) <u>350 ml/min</u>												
Pump type <u>Bladder</u>												
SAMPLES COLLECTED												
SAMPLE NUMBER(S)		BOTTLE ID		PUMP			COLLECTOR					
B09H60		(2) 1800mlP (1) 125mlP (1) 250mlP		Bladder			K. Danielson (WHC)					
				↓			↓					
				↓			↓					
				↓			↓					
				↓			↓					
				↓			↓					
TOTAL NUMBER OF BOTTLES 4												
Containment Code #: _____												
FIELD MEASUREMENTS												
Previous PH	Prev. Depth	WATER LEVELS (ft)		Time	12:30	12:35	12:45	12:48	13:00			
Steel Tape # <u>114</u>	Held	/		pH	8.11	8.11	8.13	8.14	8.14	2/7		
ori/Cond Meter # <u>114</u>	Cut			Temp (DEG.c)	24.0	21.7	21.5	20.9	22.0			
Thermometer # <u>114</u>	Depth below TC	71.88		Cond (µm/cm)	354	345	342	343	344			
FIELD OBSERVATIONS												
Weather <u>80°F / Clear</u>												
General Problems/Unusual Events <u>NA</u>												
Equipment Irregularities <u>NA</u>												
Container Irregularities <u>NA</u>												
Comments <u>Started readings at 12:30 - Muddy water. - logbook FFL-1111</u> <u>2mp. valves) water traveling through 100' tubing.</u> <u>Depth to bottom = 92.5' tagged at 92.17' Pump at 91.6' J</u>												
Well capped and locked? <u>X</u> Yes <u>No</u> <u>NO 8-2-94</u>												
Data Recorded by <u>K. Danielson (WHC)</u>												
Chain of Custody form # 26375 SURFACE												
Data Checked by _____ FRF LOGBOOK NO. _____ 10												

111806

No Dump

BATTELLE Pacific Northwest Laboratories		GROUND-WATER SAMPLE FIELD RECORD	
Well Name 199-K-189A Zone 1 Recommended Purge Volume (gal) <u>Unfil clear</u> Purge Flow Rate (gal/min) <u>1500 ml/min</u> Pump type <u>Bladder</u>		Project OPER/RCRA Date <u>8-15-97</u> Calculations <u>Sample at 1245</u>	
SAMPLES COLLECTED			
SAMPLE NUMBER(S)	BOTTLE ID	PUMP	COLLECTOR
B09H57	(2) 1000mlP (1) 125mlP (1) 250mlP	<u>Bladder</u>	<u>K. Donnellson (WHC)</u>
		↓	↓
TOTAL NUMBER OF BOTTLES		Containment Code #:	
4			
FIELD MEASUREMENTS			
Previous PH	Prev. Depth	WATER LEVELS (ft)	Time
<u>NA</u>	Held	1230	1232
Steel Tape # <u>NA</u>	Cut	1235	1236
pH/Cond Meter # <u>NA</u>	Depth below TC	1255	1255
Thermometer # <u>NA</u>	71.7'	pH	8.99
		Temp (DEG.c)	9.06
		Cond (µm/cm)	26.3
		150	153
		150	149
		148	
FIELD OBSERVATIONS			
Weather <u>80°F / Sunny</u>			
General Problems/Unusual Events <u>Water is muddy</u>			
Equipment Irregularities <u>NA</u>			
Container Irregularities <u>NA</u>			
Comments <u>Water moving through 250' to 6m tubing (150' in the sun)</u>			
Well capped and locked? <u>Yes</u> ☒ No ☐			
Data Recorded by <u>K. Donnellson (WHC)</u>		Data Checked by	
Chain of Custody form # 28372 SURFACE		FRF LOGBOOK NO. <u>18</u>	

300 Dump

N 1911

BATTLE		GROUND-WATER SAMPLE FIELD RECORD																															
Pacific Northwest Laboratories		Zone 1																															
Well Name 199-K-189A		Project OPER/RCRA																															
Recommended Purge Volume (gal) 31g		Date 8-18-94																															
Purge Flow Rate (gal/min) 3.0		Calculations NA																															
Pump type Bladder		SAMPLES COLLECTED																															
SAMPLE NUMBER(S) BOTTLE ID (2) 1800AIP (1) 125AIP (1) 250AIP		PUMP Bladder																															
		COLLECTOR K.F. Davis (WAC)																															
TOTAL NUMBER OF BOTTLES 4																																	
Containment Code #:																																	
FIELD MEASUREMENTS																																	
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Previous PH</th> <th>Prev. Depth (ft)</th> <th>Time</th> <th>PH</th> <th>Temp (DEG.C)</th> <th>Cond (um/cm)</th> </tr> <tr> <td>NA</td> <td></td> <td>11:30</td> <td>8.96</td> <td>26.0</td> <td>197</td> </tr> <tr> <td></td> <td></td> <td>11:45</td> <td>8.79</td> <td>25.9</td> <td>192</td> </tr> <tr> <td></td> <td></td> <td>11:50</td> <td>8.47</td> <td>27.8</td> <td>192</td> </tr> <tr> <td></td> <td></td> <td>12:00</td> <td>9.01</td> <td>27.5</td> <td>199</td> </tr> </table>				Previous PH	Prev. Depth (ft)	Time	PH	Temp (DEG.C)	Cond (um/cm)	NA		11:30	8.96	26.0	197			11:45	8.79	25.9	192			11:50	8.47	27.8	192			12:00	9.01	27.5	199
Previous PH	Prev. Depth (ft)	Time	PH	Temp (DEG.C)	Cond (um/cm)																												
NA		11:30	8.96	26.0	197																												
		11:45	8.79	25.9	192																												
		11:50	8.47	27.8	192																												
		12:00	9.01	27.5	199																												
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Steel Tape #</th> <th>Hold</th> <th>Cut</th> <th>Thermometer #</th> </tr> <tr> <td>NA</td> <td></td> <td></td> <td>NA</td> </tr> </table>				Steel Tape #	Hold	Cut	Thermometer #	NA			NA																						
Steel Tape #	Hold	Cut	Thermometer #																														
NA			NA																														
Comments: Sampling in off due to water sitting in the sun.																																	
General Problems/Unusual Events NA																																	
Equipment Irregularities NA																																	
Container Irregularities NA																																	
Well capped and locked? Yes																																	
Data Recorded by J. Davis (WAC)																																	
Chain of Custody Form # 2837B SURFACE																																	
RRF LOGBOOK NO. 18																																	

B-65

GROUND-WATER SAMPLE FIELD RECORD

Project OPER/RCRA Date 8/29/94

Calculations

N/A

SAMPLES COLLECTED

COLLECTOR

D. M. Murillo (WNC)

4

1

i

1

1

(1) $X \sim 1^{\circ}$

~~(1) [unclear]~~ GB 7/5/94

(1) 250ml P

Containment Code #:

~~13-14-15~~

96 7/25/94

FIELD MEASUREMENTS

		WATER LEVELS				
Previous PH _____	Prev. Depth _____ (ft)	Time	1445	1456	1458	1530
Steel Tape # _____	Reid _____	pH	8.83	8.82	8.84	8.73
pH/Cond Meter# _____	Cut <i>N/A</i>	Temp (DEG.C)	21.7	21.6	21.4	22.7
Thermometer # _____	Depth below TC <i>44C</i>	Cond (µm/cm)	151	153	153	157

FIELD OBSERVATIONS

Weather 25°C Sunny

General Problems/Unusual Events Hydraulic jacks leaked hydraulic fluid on the ground.

Equipment Irregularities N/A

Container Irregularities N/A

Comments Sampled water is slightly turbid, in bottle, some air in bottles
 DTB = 156 Intake = 155
 47mg bottom = 150.5

Well capped and locked? Yes ☒ No

Data Recorded by Am. Mus. 110 1947

Data Checked by

FRF LOGBOOK and Pageno: 10/771

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1118 Well no./dept 199-K-109A/32.8-34.8' VISCOSITY 1

Tested By: F.M. Williams Date 08/12/94

Specimen Diameter (D, cm) 9.56 Specimen Length (L, cm) 12.82

Start Date	15-Aug-94	15-Aug-94	15-Aug-94	17-Aug-94	17-Aug-94	17-Aug-94	17-Aug-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
End Date	15-Aug-94	15-Aug-94	15-Aug-94	17-Aug-94	17-Aug-94	17-Aug-94	17-Aug-94
End Time	00:04:00	00:03:00	00:06:00	00:03:00	00:03:00	00:03:00	00:03:00
Time Sec.	240	180	360	180	180	180	180
Volume, cm ³	80	49.5	100.9	72.8	68	68.1	67
Head, cm	67	73	71.8	73.2	73	72.5	72.5
"Q"	3.33E-01	2.75E-01	2.80E-01	4.04E-01	3.78E-01	3.78E-01	3.72E-01
L/(A*H)	2.67E-03	2.45E-03	2.49E-03	2.44E-03	2.45E-03	2.46E-03	2.46E-03
K, cm/sec	8.89E-04	6.73E-04	6.97E-04	9.87E-04	9.24E-04	9.32E-04	9.17E-04
Kc,(K*Visc)	8.89E-04	6.73E-04	6.97E-04	9.87E-04	9.24E-04	9.32E-04	9.17E-04

Darcy's Law $K = (Q*L)/(A*H)$

Kc AVERAGE 8.60E-04
 STANDARD DEV. 1.14E-04
 % STAND. DEV. 13.3%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks:

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

Checked By: H. Haupt Date: 9/2/94

B-67

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	32.8-34.8'
Lab #	4-1118
Heis #	NA
Tested by	FMW
Contact	B. Williams
Phone #	6-3416
Date	8/12/94
length (cm)	12.82
diameter (cm)	9.56
volume (cm ³)	920.20
wt of sample + mold (g)	2341.2
wt of mold (g)	311.7
wet wt of sample (g)	2029.5
water content % dry wt	3.7%
wet density of sample (g/cm ³)	2.2
dry wt. of sample (g)	1957.8
dry density (g/cm ³)	2.1
specific gravity	2.8
void ratio	0.32
porosity	24.0%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>P. Haupt</i> Date: <i>9/2/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-109A	DEPTH	32.8-34.8'	LAB #	4-1118	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/19/94
	1	2	3				
Wt. oven dry soil, g	30.00	30.00	30.00				
Wt. pycnometer + wetting agent, g	168.27	167.66	168.23				
Wt. pycnometer+wetting agent+ soil,	187.88	187.29	187.88				
Temperature (Tx), degrees C	24.1	23.9	24				
Specific gravity of wetting agent	1.00	1.00	1.00				
Specific gravity of soil at Tx	2.89	2.89	2.90				
Specific gravity of soil at 20 C	2.88	2.89	2.90				
AVG. Specific gravity of -10 material	2.89						
Wt. sample (SSD), g (B)	1370.4	NA	NA				
Wt. sample in water, g (C)	880.4	NA	NA				
Wt. oven dry sample, g (A)	1356.3	NA	NA				
Bulk specific gravity, 23/23 C	2.77	NA	NA				
Bulk specific gravity SSD, 23/23 C	2.80	NA	NA				
Apparent specific gravity, 23/23 C	2.85	NA	NA				
Size fraction, coarse	69	NA	NA				
Size fraction, fine	31	NA	NA				
Avg. specific gravity, 23/23 C	2.80	NA	NA				
Avg. specific gravity based on:	Bulk	NA	NA				
COMMENTS:							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: J. Hampton				Date: 8/23/94			

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	32.8-34.8'	LAB #	4-1118	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/12/94
GEL-14 SOIL MOISTURE							
BALANCE	3304/3311	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
8/12/94	565.20	547.44	62.33	17.76	485.11	3.66%	FMW
8/12/94	2270.4	2210.3	240.9	60.1	1969.4	3.1%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	8/15/94	Sample pressure (psi)	0.3	% Calcium carbonate	<1%		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: H. Haupt				Date: 9/2/94			

GEOTECHNICAL ENGINEERING LABORATORY

GEL-07

SIEVE ANALYSIS

WELL #	199-K-109A	DEPTH	32.8-34.8'	LAB#	4-1118	HEIS #	NA
TESTED B	FMW	CONTACT	B. Williams	PHONE	376-3416	DATE	08/18/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1969.4	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	394.0	20.0	80.0	50.800	
	1.5"	394.0	20.0	80.0	38.100	
	3/4"	879.3	44.6	55.4	19.050	
	3/8"	1161.4	59.0	41.0	9.525	
WT.-#10	# 4	1358.1	69.0	31.0	4.750	
SAMP.(g)	#10	1563.1	79.4	20.6	2.360	
202.4	#40	121.9	60.2	8.2	0.500	
	#60	145.4	71.8	5.8	0.250	
	#100	153.5	75.8	5.0	0.150	
	#200	161.2	79.6	4.2	0.075	

Sieve Analysis Data for Sample 4-1118

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

Checked By: *H. Hought*Date: *8/23/94*

SAMPLE NO.	4-1118
Contact	BRUCE WILLIAMS
Well No.	199-K-109A
Operable Unit	W-152
HEIS No.	NA
Depth	33.3-33.8'

FIELD CAPACITY	
Weight of column at -100 cm =	4749.46
Weight of water in filler =	32.9
Weight of water in column =	139.34
Field Capacity, Vol.% =	13.5%

Mean Tension	0	-49	-83	-131	-240	-327
Std. Dev. (Tension)		1	1	2	4	3
Mean K value	8.6E-04	2.2E-06	6.6E-07	1.8E-07	8.3E-08	6.7E-08
Std. Dev./Mean	13%	7%	26%	13%	10%	24%
Water Content, Vol%	17.6%	14.2%	13.9%	13.3%	12.7%	11.7%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1118

The data package consists of three graphs, seven pages of computer printout (the preparation, data and analysis of the test) four pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data for the original sample used for obtaining the minus ten mesh sample for moisture retention. New grain size distribution data sheets are attached for the sample that was actually tested for unsaturated hydraulic conductivity.

The Grain Size distribution graph shows both the cumulative and fraction retained on each sieve for both the original liner used to obtain moisture retention data and for the sleeve used for unsat. K testing. The two grain size distributions have similar shapes, but the unsat. K sample had more fines (particles less than 2 mm). The bulk densities of the two sleeves; were almost identical (2.12 g/cm³ for the unsat. K column and 2.14 g/cm³ for the liner used for moisture retention).

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 2.12 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.34 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are slightly above the corrected curve. This is not too surprising, since the moisture retention sleeve had only 21% fines compared to 34% in the liner tested for unsat. K.

J.F. RELYEA
376-4676
11/15/94

COPY

WHC-SD-EN-DP-090, Rev. 0

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1118

Grain Size Distribution for Test Sample 4-1118

Moisture Retention Curve From Unsaturated Hydraulic Conductivity Test Sample 4-1118

B-75

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1118 1 of 7

Tested By: J.F. Relyea Date 8/23/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	11/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.58 cm
 Column Length 15.06 cm
 Saturated Sample + Column Weight 4806.56 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.80 g/cm³
 Filler Final Moisture Content Data
 Container ID No 7-2
 Container + Filler Wet wt. 287.35 g
 Container+ Filler Dry wt. 272.23 g
 Container Tare wt. 146.05 g
 Dry Filler Wt. 126.18 g
 Weight of Water 15.12 g
 Filler Moisture Content 12.0% by weight

Filler Soil ID/Sample No. 1-1417
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 69.2 g
 Specific Gravity g/cm³
 Column Volume Filled 27.6 cm³
 Soil Added To Fill Bottom Void - Yes (X) No ()
 Dry Weight of Soil Added 64.7 g
 Specific Gravity g/cm³
 Column Volume Filled 24.8 cm³

Type of Water tap water

REMARKS
 SAMPLE NO. 4-1118 Weight for Water Retention (field capacity) = 4749.46 g.
 Field Capacity (-100 cm) = 13.5%, Vol. %
 Contact BRUCE WILLIAMS
 Well No. 199-K-109A
 Operable Unit W-152
 HEIS No. NA
 Depth 33.3-33.8'

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

Checked By: PR Hellos Date: 11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1118

Page 2 of 7

Tested By: J.F. Relyea Date: 8/25/94
 Procedure No: GEL-32 Rev. 1 Date Issue: 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue: N/A

Container No. USK-1
 Container + wet soil wt. 3015.07 g
 Container + dry soil wt. 2890.33 g
 Container Tare Wt. 693.25 g
 Dry soil wt. 2197.08 g
 Moisture Content 5.7% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	11/7/94
Gauge	5667	10/25/94

Empty Column Wt. 2253.94 g (before cleanup)
 Empty Column Wt. — g (after cleanup)

Start Date	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/30/94	8/31/94	8/31/94	9/1/94	9/1/94	9/1/94
Start Time	11:25	12:26	7:31	11:04	12:45	13:42	12:36	13:58	6:12	9:07	11:09
End Date	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/31/94	8/31/94	9/1/94	9/1/94	9/1/94	9/1/94
End Time	12:26	13:58	11:04	12:45	13:42	7:05	13:58	6:12	9:07	11:09	12:50
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters	38.1	37.5	49.6	48.6	48.1	47.8	48.7	48.3	45.7	45.3	45.0
Outlet Burette Reading End, milliliters	37.5	36.7	48.6	48.1	47.8	42.1	48.3	45.7	45.3	45.0	44.7
Inlet Tensiometer reading, cm	start	-50	-50	-52	-52	-53	-50	-80	-81	-85	-84
	end	-50	-50	-52	-53	-50	-50	-81	-85	-84	-83
Outlet Tensiometer reading, cm	start	-51	-51	-47	-47	-49	-45	-79	-81	-87	-80
	end	-51	-45	-47	-49	-45	-46	-81	-87	-80	-83
Weight of Column and Wet Sample, g						4759.53					

REMARKS

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

Checked By: *P. Keller*

Date: 11-16-94

B-77

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1118

Page 3 of 7

Tested By: J.F. Relyea

Date 9/1/94

Start Date		9/1/94	9/5/94	9/6/94	9/7/94	9/8/94	9/10/94	9/11/94	9/12/94	9/14/94	9/15/94	9/16/94
Start Time		12:50	12:46	7:47	6:06	6:00	8:37	8:23	6:19	6:55	6:06	6:04
End Date		9/2/94	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/15/94	9/16/94	9/17/94
End Time		6:07	7:47	6:06	6:00	6:10	8:23	6:19	7:29	6:06	6:04	7:22
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		44.7	46.7	45.3	43.6	41.8	19.2	18.1	17.3	50.0	49.1	48.3
Outlet Burette Reading End, milliliters		42.7	45.3	43.6	41.8	40.2	18.1	17.3	16.3	49.1	48.3	46.7
Inlet Tensiometer reading, cm	start	-83	-129	-128	-126	-130	-226	-236	-238	-315	-322	-325
	end	-86	-128	-126	-130	-132	-236	-238	-239	-322	-325	-322
Outlet Tensiometer reading, cm	start	-83	-132	-131	-136	-135	-236	-246	-246	-319	-332	-333
	end	-85	-131	-136	-135	-136	-246	-246	-247	-332	-333	-330
Weight of Column and Wet Sample, g		4753.27				4744.96			4733.09			

REMARKS

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

Checked By: *R. Keller*

Date: 11-16-94

B-78

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1118
 Tested By: J.F. Relyea

Page 4 of 7
 Date 9/16/94

Start Date	9/17/94	9/18/94										
Start Time	7:22	8:07										
End Date	9/18/94	9/19/94										
End Time	8:07	6:04										
Inlet Burette Reading Start, milliliters	N/A	N/A										
Inlet Burette Reading End, milliliters	N/A	N/A										
Outlet Burette Reading Start, milliliters	46.7	46.1										
Outlet Burette Reading End, milliliters	46.1	45.4										
Inlet Tensiometer reading, cm	start	-322	-325									
	end	-325	-325									
Outlet Tensiometer reading, cm	start	-330	-335									
	end	-335	-334									
Weight of Column and Wet Sample, g		4720.37										

REMARKS

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

Checked By: PRHOLLS Date: 11-16-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO. 4-1118

Tested By: J.F. Relyea

Date

Page 5

of

7

11/15/94

Tensiometer Separation	10.0 cm	Column Volume	1084.7 cm ³	Test Sample Bulk Density	2.12 g/cm ³
Column Length	15.1 cm	Filler Volume	52.4 cm ³	Test Sample Porosity	0.24 cm ³ /cm ³
Column Diameter	9.6 cm	Filler Dry Wt.	133.8 g	Empty Column Wt.	2253.9 g, Average
Column Area	72.0 cm ²	Sample Volume	1032.4 cm ³	Field Sample Bulk Density	2.14 g/cm ³
Final Moisture Content	5.7% by wt.	Sample Dry Wt.	2189.4 g	Type of water used	Tap Water

Start Date		8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/30/94	8/31/94	9/1/94
Start Time		11:25	12:26	7:31	11:04	12:45	13:42	13:58	6:12
End Date		8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/31/94	9/1/94	9/1/94
End Time		12:26	13:58	11:04	12:45	13:42	7:05	6:12	9:07
Total Elapsed, sec		3660	5520	12780	6060	3420	62580	58440	10500
Volume, cm ³		0.60	0.80	1.00	0.50	0.30	5.70	2.60	0.40
Tension - inlet, cm		-50	-50	-52	-53	-52	-50	-83	-85
Tension - outlet, cm		-51	-48	-47	-48	-47	-46	-84	-84
Average Tension, cm	0	-51	-49	-50	-50	-49	-48	-84	-84
K, cm/sec	8.60E-04	2.07E-06	2.52E-06	2.17E-06	2.08E-06	2.21E-06	2.30E-06	5.62E-07	5.88E-07
Weight of Column + Wet Sample, g	4806.56						4759.53		
Weight of Water in Filler, g (from MRC)	47.6						35.7		
Weight of Water in Sample, g	181.77						146.62		
Moisture Content (volumetric %)	17.6%						14.2%		

REMARKS

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

Checked By:

Prithvi

Date:

11-16-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.
Tested By:

4-1118
J.F. Relyea

Date

Page 6
11/15/94

of

7

Start Date	9/1/94	9/1/94	9/1/94	9/5/94	9/6/94	9/7/94	9/8/94	9/10/94	9/11/94
Start Time	9:07	11:09	12:50	12:46	7:47	6:06	6:00	8:37	8:23
End Date	9/1/94	9/1/94	9/2/94	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94
End Time	11:09	12:50	6:07	7:47	6:06	6:00	6:10	8:23	6:19
Total Elapsed, sec	7320	6060	62220	68460	80340	86040	87000	85560	78960
Volume, cm ³	0.30	0.30	2.00	1.40	1.70	1.80	1.60	1.10	0.80
Tension - Inlet, cm	-84	-84	-85	-129	-127	-128	-131	-231	-237
Tension - outlet, cm	-81	-82	-84	-132	-134	-136	-136	-241	-246
Average Tension, cm	-82	-83	-84	-130	-130	-132	-133	-236	-242
K, cm/sec	8.76E-07	8.09E-07	4.70E-07	2.18E-07	1.78E-07	1.66E-07	1.76E-07	8.93E-08	7.40E-08
Weight of Column + Wet Sample, g			4753.27				4744.96		
Weight of Water in Filler, g (from MRC)			33.0				30.4		
Weight of Water in Sample, g			143.04				137.37		
Moisture Content (volumetric %)			13.9%				13.3%		

REMARKS

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

Checked By:

Pat Keller

Date: 11-16-94

SAMPLE NO. 4-1118
Tested By: J.F. Relyea

Date 11/15/94 Page 7 of 7

Start Date	9/12/94	9/14/94	9/15/94	9/17/94	9/18/94				
Start Time	6:19	6:55	6:06	7:22	8:07				
End Date	9/13/94	9/15/94	9/16/94	9/18/94	9/19/94				
End Time	7:29	6:06	6:04	8:07	6:04				
Total Elapsed, sec	90600	83460	86280	89100	79020				
Volume, cm ³	1.00	0.90	0.80	0.60	0.70				
Tension - inlet, cm	-239	-319	-324	-324	-325				
Tension - outlet, cm	-247	-326	-333	-333	-335				
Average Tension, cm	-243	-322	-328	-328	-330				
K, cm/sec	8.51E-08	8.81E-08	6.78E-08	4.92E-08	6.31E-08			FIELD CAPACITY	
Weight of Column + Wet Sample, g	4733.09				4720.37			4749.46	
Weight of Water in Filler, g (from MRC)	24.5				22.5			32.9	
Weight of Water in Sample, g	131.37				120.67			139.34	
Moisture Content (volumetric %)	12.7%				11.7%			13.5%	

REMARKS

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

Checked By:

P.R. Heller

Date: 11-17-94

B-82

WHC-SD-EN-DP-090, Rev. 0

Moisture Retention Sample Number 4-1118

COPY

SAMPLE NO.	4-1118	Operable Unit	W-152
Contact	BRUCE WILLIAMS	HEIS No.	NA
Well No.	199-K-109A	Depth	33.8-34.3'

TEMPE CELLS	Sample #	4-1118 1 Bar Main Drying Curve (natural saturation from the bottom)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
container number	MC-1	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
weight of container/ring,+wet sample	165.31	554.44	576.63	577.23	577.41	577.55	577.64	577.38	577.58
weight of container/ring,+ dry sample	165.09	554.17	553.70	553.70	553.70	553.70	553.70	553.70	553.70
weight of moisture	0.22	0.27	22.93	23.53	23.71	23.85	23.94	23.68	23.88
weight of container and ring	62.70	426.88	426.50	426.50	426.50	426.50	426.50	426.50	426.50
weight of dry sample	102.61	127.29	127.20	127.20	127.20	127.20	127.20	127.20	127.20
moisture content, wt. %	0.21%		18.03%	18.50%	18.64%	18.75%	18.82%	18.62%	18.77%
date measured			10/6/94	10/7/94	10/10/94	10/11/94	10/13/94	10/14/94	10/17/94
temperature deg. C			26	25	26	25	23	24	20

TEMPE CELLS	Sample #	4-1118 1 Bar Main Drying Curve							
tension in cm	5.0	8.0	11.5	27	49	70.5	104	202	300
container number	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
weight of container/ring,+wet sample	576.47	576.52	576.15	573.89	572.76	571.65	568.81	568.17	567.16
weight of container/ring,+ dry sample	553.70	553.70	553.70	553.70	553.70	553.70	553.70	553.70	553.70
weight of moisture	22.77	22.82	22.45	20.19	19.06	17.95	15.11	14.47	13.46
weight of container and ring	426.50	426.50	426.50	426.50	426.50	426.50	426.50	426.50	426.50
weight of dry sample	127.20	127.20	127.20	127.20	127.20	127.20	127.20	127.20	127.20
moisture content, wt. %	17.90%	17.94%	17.65%	15.87%	14.98%	14.11%	11.88%	11.38%	10.58%
date measured	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/26/94	10/27/94	10/28/94	10/31/94
temperature deg. C	24	21	26	23	23	24	23	24	22

TEMPE CELLS	Sample #	4-1118 1 Bar Main Drying Curve			
tension in cm	500.0	700.0	1000	N/A	N/A
container number	TC-21	TC-21	TC-21	TC-21	MC-6
weight of container/ring,+wet sample	566.11	565.40	564.75	564.75	199.17
weight of container/ring,+ dry sample	553.70	553.70	553.70	553.70	188.12
weight of moisture	12.41	11.70	11.05	11.05	11.05
weight of container and ring	426.50	426.50	426.50	426.50	61.06
weight of dry sample	127.20	127.20	127.20	127.20	127.06
moisture content, wt. %	9.76%	9.20%	8.69%	8.69%	8.70%
date measured	11/1/94	11/2/94	11/3/94		11/7/94
temperature deg. C	23	21	26		22

Sample Bulk Density = 1.86 g/cm³
 Field Bulk Density = 2.14 g/cm³
 Fraction < 2 mm = 0.21

Cell wt. before cleanup = 426.50 grams
 Cell wt. after cleanup = 427.25 grams
 Average of all 3 = 426.88

volume of brass ring 68.26 cm³

KETTLES	Sample #	4-1118 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA11	BA12	BA11	BA12	BA11	BA12	BB11	BB12
weight of container/ring,+wet sample	50.24	50.51	50.45	50.63	50.10	50.33	49.41	50.53
weight of container/ring,+ dry sample	48.44	48.74	48.35	48.65	48.26	48.58	48.09	49.07
weight of moisture	1.80	1.77	2.10	1.98	1.84	1.75	1.32	1.46
Container Tare Wt.,g	27.47	28.18	27.47	28.18	27.47	28.18	27.76	27.85
weight of dry sample	20.97	20.56	20.88	20.47	20.79	20.40	20.33	21.22
moisture content %	8.58%	8.61%	10.06%	9.67%	8.85%	8.58%	6.49%	6.88%
date measured	10/17/94	10/17/94	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94
temperature deg. C	20	20	24	24	22	22	20	20

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	9.8	9.8
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB11	BB12	BB11	BB12	BC11	BC12	BC11	BC12
weight of container/ring,+wet sample	49.34	50.46	49.25	50.32	51.73	52.72	51.71	52.66
weight of container/ring,+ dry sample	48.01	49.00	47.97	48.92	50.78	51.62	50.69	51.53
weight of moisture	1.33	1.46	1.28	1.40	0.95	1.10	1.02	1.13
Container Tare Wt.,g	27.76	27.85	27.76	27.85	30.33	29.18	30.33	29.18
weight of dry sample	20.25	21.15	20.21	21.07	20.45	22.44	20.36	22.35
moisture content %	6.57%	6.90%	6.33%	6.64%	4.65%	4.90%	5.01%	5.06%
date measured	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94	10/28/94	10/28/94
temperature deg. C	24	24	22	22	20	20	24	24

WHC-SD-EN-DP-090, Rev. 0

Water Potential Data for CX-2 Samples

Sample No.	4-1118	4-1118
Container Number	BC11	BC12
Aw Reading	0.961	0.988
Temperature °C	26.3	25.8
Water Potential, Bars	54.9	16.6
Can ID No	BC11	BC12
Can + Soil Wet wt., g	51.26	52.47
Can + Soil Dry wt., g	50.66	51.52
Can Tare wt., g	30.33	29.18
Weight of Water, g	0.60	0.95
Dry Weight of Sample, g	20.33	22.34
Moisture Content, wt. %	2.95%	4.25%
date measured	10/8/94	10/8/94

POINTS SELECTED FOR PLOTTING

Sample # 4-1118

	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
container number	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
tension in cm	1	5	8	11.5	27	49	70.5	104	202	300	500
Tempe Main Drying Curve	18.8%	17.9%	17.9%	17.6%	15.9%	15.0%	14.1%	11.9%	11.4%	10.6%	9.8%
date measured	10/17/94	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/26/94	10/27/94	10/28/94	10/31/94	11/1/94

	TC-21	TC-21	BA11	BA11	BA11	BB11	BB11	BB11	BC11	BC11	BC11
container number	TC-21	TC-21	BA11	BA11	BA11	BB11	BB11	BB11	BC11	BC11	BC11
tension in cm	700	1000	510	714	1020	2040	3060	5100	7140	9996	56014
Tempe Main Drying Curve	9.2%	8.7%	8.6%	9.9%	8.7%	6.7%	6.7%	6.5%	4.8%	5.0%	3.0%
Kettle/CX-2 Main Drying Curve											
date measured	11/2/94	11/3/94	10/17/94	10/28/94	11/7/94	10/17/94	10/28/94	11/7/94	10/17/94	10/28/94	10/8/94

container number	BC12
tension in cm	16971
Tempe Main Wetting Curve	
Kettle/CX-2 Main Drying Curve	4.3%
date measured	10/8/94

B-86

WHC-SD-EN-DP-090, Rev. 0

Points from kettle are enclosed by the double outline ☐Points from CX-2 are enclosed by the single outline ☐

GEOTECHNICAL ENGINEERING LABORATORY
SPECIFIC GRAVITY
GEL 10

WELL #	199-K-109A	DEPTH	39.0-41.0'	LAB #	4-1119-1	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/19/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	161.92	168.56	167.86
Wt. pycnometer+wetting agent+ soil,	180.89	187.54	186.82
Temperature (Tx), degrees C	24.1	24.2	24.2
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.72	2.72	2.72
Specific gravity of soil at 20 C	2.72	2.72	2.71
AVG. Specific gravity of -10 material	2.72		
Wt. sample (SSD), g (B)	893.7	NA	NA
Wt. sample in water, g (C)	560	NA	NA
Wt. oven dry sample, g (A)	885	NA	NA
Bulk specific gravity, 23/23 C	2.65	NA	NA
Bulk specific gravity SSD, 23/23 C	2.68	NA	NA
Apparent specific gravity, 23/23 C	2.72	NA	NA
Size fraction, coarse	59.8	NA	NA
Size fraction, fine	40.2	NA	NA
Avg. specific gravity, 23/23 C	2.68	NA	NA
Avg. specific gravity based on:	Bulk	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: H. Haupt

Date: 8/23/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	39.0-41.0	LAB #	4-1119	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/12/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
8/12/94	535.60	525.85	63.54	9.75	462.31	2.11%	FMW
8/17/94	1773.1	1736.1	253.9	37	1482.2	2.5%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	8/15/94	Sample pressure (psi)	0.4	% Calcium carbonate	<1%		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: H. Camp				Date: 8/23/94			

GEOTECHNICAL ENGINEERING LABORATORY

GEL-07

SIEVE ANALYSIS

WELL #	199-K-109A	DEPTH	39.0-41.0'	LAB#	4-1119	HEIS #	NA
TESTED B FMW		CONTACT	B. Williams	PHONE	376-3416	DATE	08/18/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1482.2	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	360.2	24.3	75.7	50.800	
	1.5"	360.2	24.3	75.7	38.100	
	3/4"	551.6	37.2	62.8	19.050	
	3/8"	760.7	51.3	48.7	9.525	
WT.-#10	#4	885.8	59.8	40.2	4.750	
SAMP.(g)	#10	978.6	66.0	34.0	2.360	
127.8	#40	27.1	21.2	26.8	0.500	
	#60	54.7	42.8	19.4	0.250	
	#100	69.7	54.5	15.4	0.150	
	#200	80.6	63.1	12.5	0.075	

Sieve Analysis Data for Sample 4-1119

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

Checked By: 11/1/aupt

Date: 8/23/94

SAMPLE NO.	4-1119
Contact	BRUCE WILLIAMS
Well No.	199-K-109A
Operable Unit	W-152
HEIS No.	NA
Depth	39.5-40.0'

Field Capacity	
Weight of column at -100 cm =	4665.91
Weight of water in column =	161.25
Field Capacity, Vol.% =	14.8%

Mean Tension	0	-43	-79	-124	-216	-280
Std. Dev. (Tension)	0	3	2	2	1	6
Mean K value	2.1E-04	1.2E-05	5.9E-06	2.9E-06	7.8E-07	4.3E-07
SDev/Mean	10%	25%	21%	13%	23%	13%
Water Content, Vol.%	21.1%	19.8%	16.8%	15.0%	12.6%	11.8%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1119

The data package consists of three graphs, nine pages of computer printout (the preparation, data and analysis of the test) five pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data for the sample that was tested for unsaturated hydraulic conductivity. The second liner did not have enough material for measuring saturated conductivity and bulk density so it was sieved and used for moisture retention.

The Grain Size distribution graph shows both the cumulative and fraction retained on each sieve for both the original liner used to obtain moisture retention data and for the sleeve used for unsat. K testing. The sample used for unsat. K had significantly more fine material (50%) than the moisture retention sample (34%). The bulk density of the unsat. K column was 1.97 g/cm³ and had a porosity of 26%.

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 1.97 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.50 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are slightly above the corrected curve. This is not too surprising, since the moisture retention sleeve had only 34% fines compared to 50% in the liner tested for unsat. K.

J.F. RELYEA
376-4676
11/16/94

COPY

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1119

Grain Size Distribution for Test Sample 4-1119

Moisture Retention Curve From Unsaturated
Hydraulic Conductivity Test Sample 4-1119

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1119 1 of 9

Tested By: J.F. Relyea Date 8/22/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	11/7/94

Water Volume - Inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.5 cm
 Column Diameter 9.58 cm
 Column Length 15.11 cm
 Saturated Sample + Column Weight 4734.4 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.68 g/cm³
 Filler Final Moisture Content Data
 Container ID No
 Container + Filler Wet wt. g
 Container+ Filler Dry wt. g
 Container Tare wt. g
 Dry Filler Wt. g
 Weight of Water g
 Filler Moisture Content by weight

Filler Soil ID/Sample No. 4-1119
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 163.3 g
 Specific Gravity g/cm³
 Column Volume Filled 38.41 cm³
 Soil Added To Fill Bottom Void - Yes (X) No ()
 Dry Weight of Soil Added 29.5 g
 Specific Gravity g/cm³
 Column Volume Filled cm³

Type of Water tap water

REMARKS
 SAMPLE NO. 4-1119 During Sat-K sample settled, added more to top.
 Weight for Water Retention (field capacity) = 4665.91 g.
 Contact BRUCE WILLIAMS
 Well No. 199-K-109A
 Operable Unit W-152
 HEIS No. NA
 Depth 39.5-40.0'

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

Checked By: PRHoller Date: 11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1119

Page 2 of 9

Tested By: J.F. Relyea Date 8/23/94
 Procedure No: GEL-32 Rev. 1 Date Issue 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue N/A

Container No. USK-1
 Container + wet soil wt. 3084.82 g
 Container + dry soil wt. 2958.7 g
 Container Tare Wt. 693.3 g
 Dry soil wt. 2265.4 g
 Moisture Content 5.6% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	8/7/94
Gauge	5667	10/25/94

Empty Column Wt. 2239.26 g (before cleanup)
 Empty Column Wt. — g (after cleanup)

Start Date	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/25/94	8/25/94	8/26/94	8/26/94
Start Time	9:30	9:37	9:49	9:57	10:03	10:05	10:08	11:32	12:22	7:32	8:45
End Date	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/25/94	8/25/94	8/26/94	8/26/94
End Time	9:37	9:49	9:57	10:03	10:05	10:08	10:11	12:22	13:47	8:45	9:38
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters	50.0	42.0	27.1	17.1	11.1	8.5	4.8	25.7	21.4	43.0	39.1
Outlet Burette Reading End, milliliters	42.0	27.1	17.1	11.1	8.5	4.8	2.1	21.4	15.2	39.1	36.9
Inlet Tensiometer reading, cm	start	33.9	33.9	33.9	33.6	33.6	33.6	33.6	-39	-39	-41
	end	33.9	33.9	33.6	33.6	33.6	33.6	33.6	-39	-38	-40
Outlet Tensiometer reading, cm	start	9.7	9.7	9.7	9.7	9.7	9.7	9.7	-40	-41	-41
	end	9.7	9.7	9.7	9.7	9.7	9.7	9.7	-41	-39	-41
Weight of Column and Wet Sample, g							4734.40				

REMARKS

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

Checked By: PLH Date: 11-17-94

B-95

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1119

Page 3 of 9

Tested By: J.F. Relyea

Date 8/29/94

Start Date		8/29/94	8/29/94	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/31/94	8/31/94	8/31/94	9/1/94
Start Time		8:33	9:20	10:14	11:24	7:35	11:04	12:45	8:26	9:08	13:55	6:11
End Date		8/29/94	8/29/94	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94	8/31/94	8/31/94	9/1/94	9/1/94
End Time		9:20	10:14	11:24	12:26	11:04	12:45	13:41	9:08	9:46	6:11	6:48
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		39.2	37.1	34.7	31.6	43.6	35.1	32.0	47.1	46.0	42.9	29.3
Outlet Burette Reading End, milliliters		37.1	34.7	31.6	29.1	35.1	32.0	30.2	46.0	45.1	29.3	29.0
Inlet Tensiometer reading, cm	start	-41	-44	-47	-46	-75	-77	-77	-79	-80	-116	-128
	end	-44	-47	-46	-46	-77	-77	-79	-80	-79	-128	-129
Outlet Tensiometer reading, cm	start	-43	-44	-45	-45	-79	-79	-79	-81	-82	-114	-125
	end	-44	-45	-45	-46	-79	-79	-79	-82	-83	-125	-125
Weight of Column and Wet Sample, g					4712.34					4687.92		

REMARKS

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

Checked By: P. Heller Date: 11-17-94

WHC-SD-EN-DP-090, Rev. 0

B-96

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1119

Tested By: J.F. Relyea

Date 9/1/94 Page 4 of 9

Start Date		9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/7/94	9/8/94	9/9/94	9/10/94	9/11/94
Start Time		6:48	9:06	9:39	11:08	11:56	12:53	6:04	5:59	6:08	8:36	8:22
End Date		9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/2/94	9/8/94	9/9/94	9/10/94	9/11/94	9/12/94
End Time		9:06	9:39	11:08	11:56	12:53	6:05	5:59	6:08	8:36	8:22	6:18
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		29.0	27.8	27.4	26.5	26.0	25.4	44.7	42.1	39.8	37.7	35.5
Outlet Burette Reading End, milliliters		27.8	27.4	26.5	26.0	25.4	16.6	42.1	39.8	37.7	35.5	33.8
Inlet Tensiometer reading, cm	start	-129	-121	-124	-125	-123	-124	-216	-220	-219	-217	-221
	end	-121	-124	-125	-123	-124	-127	-220	-219	-217	-221	-218
Outlet Tensiometer reading, cm	start	-125	-119	-122	-125	-121	-120	-210	-214	-212	-212	-216
	end	-119	-122	-125	-121	-120	-126	-214	-212	-212	-216	-213
Weight of Column and Wet Sample, g							4667.82					4642.08

WHC-SD-EN-DP-090, Rev. 0

REMARKS

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

Checked By:

Date: 11-7-94

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1119
 Tested By: J.F. Relyea

Page 5 of 9
 Date 9/14/94

Start Date		9/14/94	9/15/94	9/16/94	9/17/94	9/18/94	9/19/94	9/21/94				
Start Time		6:47	6:05	10:36	7:22	8:07	6:03	6:47				
End Date		9/15/94	9/16/94	9/17/94	9/18/94	9/19/94	9/20/94	9/22/94				
End Time		6:05	6:03	7:22	8:07	6:03	6:41	6:11				
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A				
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A				
Outlet Burette Reading Start, milliliters		45.7	43.0	50.0	47.2	44.7	42.8	47.6				
Outlet Burette Reading End, milliliters		43.0	41.0	47.2	44.7	42.8	41.2	45.7				
Inlet Tensiometer reading, cm	start	-269	-278	-274	-279	-284	-279	-288				
	end	-278	-274	-279	-284	-279	-268	-289				
Outlet Tensiometer reading, cm	start	-265	-271	-266	-278	-281	-276	-285				
	end	-271	-266	-278	-281	-276	-264	-288				
Weight of Column and Wet Sample, g								4633.02				

REMARKS

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

Checked By: Pat Hollar

Date: 11-17-94

WHC-SD-EN-DP-090, Rev. 0

B-98

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO. 4-1119 Page 6 of 9
 Tested By: J.F. Relyea Date 11/16/94

Tensiometer Separation	<u>10.5 cm</u>	Column Volume	<u>1088.2 cm³</u>	Test Sample Bulk Density	<u>1.97 g/cm³</u>
Column Length	<u>15.1 cm</u>	Filler Volume	<u>38.4 cm³</u>	Test Sample Porosity	<u>0.26 cm³/cm³</u>
Column Diameter	<u>9.6 cm</u>	Filler Dry Wt.	<u>192.8 g</u>	Empty Column Wt.	<u>2239.3 g, Average</u>
Column Area	<u>72.0 cm²</u>	Sample Volume	<u>1049.8 cm³</u>	Field Sample Bulk Density	<u>N.A. g/cm³</u>
Final Moisture Content	<u>5.6% by wt.</u>	Sample Dry Wt.	<u>2072.6 g</u>	Type of water used	<u>Tap Water</u>

Start Date	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/25/94	8/25/94
Start Time	9:30	9:37	9:49	9:57	10:03	10:05	10:08	11:32	12:22
End Date	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/23/94	8/25/94	8/25/94
End Time	9:37	9:49	9:57	10:03	10:05	10:08	10:11	12:22	13:47
Total Elapsed, sec	420	720	480	360	120	180	180	3000	5100
Volume, cm ³	8.00	14.90	10.00	6.00	2.60	3.70	2.70	4.30	6.20
Tension - inlet, cm	34	34	34	34	34	34	34	-39	-39
Tension - outlet, cm	10	10	10	10	10	10	10	-41	-40
Average Tension, cm	0	0	0	0	0	0	0	-40	-39
K, cm/sec	2.03E-04	2.20E-04	2.24E-04	1.81E-04	2.36E-04	2.24E-04	1.63E-04	1.74E-05	1.48E-05
Weight of Column + Wet Sample, g							4734.4		
Weight of Water in Filler, g (from MRC)							0		
Weight of Water in Sample, g							229.74		
Moisture Content (volumetric %)							21.1%		

REMARKS

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

Checked By:

Pr. Heller

Date:

11-17-94

WHC-SD-EN-DP-090, Rev. 0

B-99

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1119
 Tested By: J.F. Relyea

Date _____ Page 7 of 9
11/16/94

Start Date	8/26/94	8/26/94	8/29/94	8/29/94	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94
Start Time	7:32	8:45	8:33	9:20	10:14	11:24	7:35	11:04	12:45
End Date	8/26/94	8/26/94	8/29/94	8/29/94	8/29/94	8/29/94	8/30/94	8/30/94	8/30/94
End Time	8:45	9:38	9:20	10:14	11:24	12:26	11:04	12:45	13:41
Total Elapsed, sec	4380	3180	2820	3240	4200	3720	12540	6060	3360
Volume, cm ³	3.90	2.20	2.10	2.40	3.10	2.50	8.50	3.10	1.80
Tension - Inlet, cm	-41	-41	-43	-46	-47	-46	-76	-77	-78
Tension - outlet, cm	-42	-42	-44	-45	-45	-46	-79	-79	-79
Average Tension, cm	-41	-41	-43	-45	-46	-46	-78	-78	-79
K, cm/sec	1.08E-05	8.77E-06	9.44E-06	1.14E-05	1.20E-05	9.80E-06	7.32E-06	5.97E-06	6.79E-06
Weight of Column + Wet Sample, g						4712.34			
Weight of Water in Filler, g (from MRC)						1			
Weight of Water in Sample, g						207.68			
Moisture Content (volumetric %)						19.8%			

REMARKS

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

Checked By: 1

Pe Heller

Date: 11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1119 Page 8 of 9
 Tested By: J.F. Relyea Date 11/16/94

Start Date	8/31/94	8/31/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94
Start Time	8:26	9:08	6:11	6:48	9:06	9:39	11:08	11:56	12:53
End Date	8/31/94	8/31/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/1/94	9/2/94
End Time	9:08	9:46	6:48	9:06	9:39	11:08	11:56	12:53	6:05
Total Elapsed, sec	2520	2280	2220	8280	1980	5340	2880	3420	61920
Volume, cm ³	1.10	0.90	0.30	1.20	0.40	0.90	0.50	0.60	8.80
Tension - inlet, cm	-80	-80	-129	-125	-123	-125	-124	-124	-126
Tension - outlet, cm	-82	-83	-125	-122	-121	-124	-123	-121	-123
Average Tension, cm	-81	-81	-127	-124	-122	-124	-124	-122	-124
K, cm/sec	5.09E-06	4.26E-06	2.81E-06	2.82E-06	3.47E-06	2.59E-06	2.66E-06	3.41E-06	2.59E-06
Weight of Column + Wet Sample, g		4687.92							4667.82
Weight of Water in Filler, g (from MRC)		0							0
Weight of Water in Sample, g		183.26							163.16
Moisture Content (volumetric %)		16.8%							15.0%

REMARKS

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

Checked By:

PR Keller

Date:

11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1119
 Tested By: J.F. Relyea

Page 9 of 9
 Date 11/16/94

Start Date	9/7/94	9/8/94	9/9/94	9/10/94	9/11/94	9/17/94	9/18/94	9/19/94	9/21/94
Start Time	6:04	5:59	6:08	8:36	8:22	7:22	8:07	6:03	6:47
End Date	9/8/94	9/9/94	9/10/94	9/11/94	9/12/94	9/18/94	9/19/94	9/20/94	9/22/94
End Time	5:59	6:08	8:36	8:22	6:18	8:07	6:03	6:41	6:11
Total Elapsed, sec	86100	86940	95280	85560	78960	89100	78960	88680	84240
Volume, cm ³	2.60	2.30	2.10	2.20	1.70	2.50	1.90	1.60	1.90
Tension - inlet, cm	-218	-220	-218	-219	-220	-282	-282	-274	-289
Tension - outlet, cm	-212	-213	-212	-214	-215	-280	-279	-270	-287
Average Tension, cm	-215	-216	-215	-217	-217	-281	-280	-272	-288
K, cm/sec	9.78E-07	9.64E-07	7.14E-07	6.82E-07	5.71E-07	4.81E-07	4.68E-07	3.76E-07	3.87E-07
Weight of Column + Wet Sample, g					4642.08				4633.02
Weight of Water in Filler, g (from MRC)					0				0
Weight of Water in Sample, g					137.42				128.36
Moisture Content (volumetric %)					12.6%				11.8%

REMARKS

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

Checked By:

P.R. Heller

Date:

11-17-94

B-102

WHC-SD-EN-DP-090, Rev. 0

COPY

Moisture Retention Sample Number 4-1119

TEMPE CELLS	Sample #	4-1119 1 Bar Main Drying Curve (natural saturation from the bottom)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
error in tension value +/-									
container number	MC-2	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
weight of container/ring,+wet sample	171.78	561.60	580.78	581.22	581.69	581.79	581.68	581.76	581.88
weight of container/ring,+ dry sample	171.59	561.38	561.40	561.40	561.40	561.40	561.40	561.40	561.40
weight of moisture	0.19	0.22	19.38	19.82	20.29	20.39	20.28	20.36	20.48
weight of container and ring	60.80	431.98	431.90	431.90	431.90	431.90	431.90	431.90	431.90
weight of dry sample	110.98	129.40	129.50	129.50	129.50	129.50	129.50	129.50	129.50
moisture content, wt. %	0.17%		14.97%	15.31%	15.67%	15.75%	15.66%	15.72%	15.81%
date measured			10/6/94	10/7/94	10/10/94	10/11/94	10/13/94	10/14/94	10/17/94
temperature deg. C			26	25	26	25	23	24	20

TEMPE CELLS	Sample #	4-1119 1 Bar Main Drying Curve							
tension in cm	5.0	8.0	11.5	27	49	70.5	104	202	300
error in tension value +/-									
container number	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
weight of container/ring,+wet sample	582.05	581.86	581.85	581.12	580.26	580.35	576.38	575.64	574.07
weight of container/ring,+ dry sample	561.40	561.40	561.40	561.40	561.40	561.40	561.40	561.40	561.40
weight of moisture	20.65	20.46	20.45	19.72	18.86	18.95	14.98	14.24	12.67
weight of container and ring	431.90	431.90	431.90	431.90	431.90	431.90	431.90	431.90	431.90
weight of dry sample	129.50	129.50	129.50	129.50	129.50	129.50	129.50	129.50	129.50
moisture content, wt. %	15.95%	15.80%	15.79%	15.23%	14.56%	14.63%	11.57%	11.00%	9.78%
date measured	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/26/94	10/27/94	10/28/94	10/31/94
temperature deg. C	24	21	26	23	23	24	23	24	22

TEMPE CELLS	Sample #	4-1119 1 Bar Main Drying Curve					
tension in cm	500.0	700.0	1000	N/A	N/A	of brass ring	68.26 cm ³
error in tension value +/-							
container number	TC-22	TC-22	TC-22	TC-22	MC-7		
weight of container/ring,+wet sample	572.17	570.99	569.43	569.43	198.34		
weight of container/ring,+ dry sample	561.40	561.40	561.40	561.40	190.25		
weight of moisture	10.77	9.59	8.03	8.03	8.09		
weight of container and ring	431.90	431.90	431.90	431.90	60.75		
weight of dry sample	129.50	129.50	129.50	129.50	129.50		
moisture content, wt. %	8.32%	7.41%	6.20%	6.20%	6.25%		
date measured	11/1/94	11/2/94	11/3/94		11/7/94		
temperature deg. C	23	21	26		22		

Sample Bulk Density = 1.90 g/cm³
 Field Bulk Density = 1.97 g/cm³
 Fraction < 2 mm = 0.34

Cell wt. before cleanup = 431.64 grams
 Cell wt. after cleanup = 432.19 grams
 Average of all 3 = 431.94

KETTLES	Sample # 4-1119 15 Bar Drying Curve							
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA13	BA14	BA13	BA14	BA13	BA14	BB13	BB14
weight of container/ring,+wet sample	51.63	47.46	51.96	47.71	51.44	47.24	50.13	47.33
weight of container/ring,+ dry sample	50.10	46.07	50.04	46.00	49.98	45.93	49.14	46.44
weight of moisture	1.53	1.39	1.92	1.71	1.46	1.31	0.99	0.89
Container Tare Wt.,g	30.43	28.06	30.43	28.06	30.43	28.06	28.34	28.42
weight of dry sample	19.67	18.01	19.61	17.94	19.55	17.87	20.80	18.02
moisture content %	7.78%	7.72%	9.79%	9.53%	7.47%	7.33%	4.76%	4.94%
date measured	10/17/94	10/17/94	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94
temperature deg. C	20	20	24	24	22	22	20	20

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	9.8	9.8
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB13	BB14	BB13	BB14	BC13	BC14	BC13	BC14
weight of container/ring,+wet sample	50.07	47.27	49.90	47.12	51.68	46.87	51.66	46.89
weight of container/ring,+ dry sample	49.08	46.41	49.02	46.36	51.17	46.46	51.11	46.41
weight of moisture	0.99	0.86	0.88	0.76	0.51	0.41	0.55	0.48
Container Tare Wt.,g	28.34	28.42	28.34	28.42	30.59	29.07	30.59	29.07
weight of dry sample	20.74	17.99	20.68	17.94	20.58	17.39	20.52	17.34
moisture content %	4.77%	4.78%	4.26%	4.24%	2.48%	2.36%	2.68%	2.77%
date measured	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94	10/28/94	10/28/94
temperature deg. C	24	24	22	22	20	20	24	24

Water Potential Data for CX-2 Samples

Sample No.	4-1119	4-1119
Container Number	BC13	BC14
Aw Reading	0.930	0.984
Temperature °C	26.4	26.1
Water Potential, Bars	100.2	22.3
Can ID No	BC13	BC14
Can + Soil Wet wt., g	51.27	46.72
Can + Soil Dry wt., g	51.09	46.39
Can Tare wt., g	30.59	29.07
Weight of Water, g	0.18	0.33
Dry Weight of Sample, g	20.50	17.32
Moisture Content, wt. %	0.88%	1.91%
date measured	10/8/94	10/8/94

POINTS SELECTED FOR PLOTTING

Sample # 4-1119

container number	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
tension in cm	1	5	8	11.5	27	49	104	202	300	500
Tempe Main Drying Curve	15.8%	15.9%	15.8%	15.8%	15.2%	14.56%	11.6%	11.0%	9.8%	8.3%
date measured	10/17/94	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/27/94	10/28/94	10/31/94	11/1/94

container number	TC-22	TC-22	BA13	BB13	BB13	BB13	BC13	BC13	BC14	BC13
tension in cm	700	1000	1020	2040	3060	5100	7140	9996	22696	102219
Tempe Main Drying Curve	7.4%	6.2%								
Kettle/CX-2 Main Drying Curve			7.4%	4.8%	4.8%	4.2%	2.4%	2.7%	1.9%	0.9%
date measured	11/2/94	11/3/94	11/7/94	10/17/94	10/28/94	11/7/94	10/17/94	10/28/94	10/8/94	10/8/94

Points from kettle are enclosed by the double outline ☐Points from CX-2 are enclosed by the single outline ☐

**GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09**

SAMPLE NO. 4-1120 Well no./depth 199-K-109A/61.5-63.0" VISCOSITY 1

Tested By: F.M. Williams Date 08/12/94

Specimen Diameter (D, cm) 9.56 Specimen Length (L, cm) 15.08

Start Date	15-Aug-94	15-Aug-94	15-Aug-94	16-Aug-94	17-Aug-94	17-Aug-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
End Date	15-Aug-94	15-Aug-94	15-Aug-94	16-Aug-94	17-Aug-94	17-Aug-94
End Time	00:06:00	00:16:00	00:08:00	00:04:00	00:06:00	00:12:00
Time Sec.	360	960	480	240	360	720
Volume, cm ³	56.9	103.5	46.2	31.3	53.4	85.3
Head, cm	75	78.5	78	77.5	76.5	76.8
"Q"	1.58E-01	1.08E-01	9.62E-02	1.30E-01	1.48E-01	1.18E-01
L/(A*H)	2.80E-03	2.68E-03	2.69E-03	2.71E-03	2.75E-03	2.74E-03
K, cm/sec	4.43E-04	2.89E-04	2.59E-04	3.54E-04	4.07E-04	3.24E-04
Kc, (K*Visc)	4.43E-04	2.89E-04	2.59E-04	3.54E-04	4.07E-04	3.24E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 3.27E-04
STANDARD DEV. 5.15E-05
% STAND. DEV. 15.8%

K = Hydraulic Conductivity (cm/sec)
Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
A = Area (cm²)
H = Hydraulic Head (cm - water)
L = Length of soil in column (cm)
Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks:

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

Checked By:

H. Hampton

Date: 8/23/94

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	61.5-63.0'
Lab #	4-1120
Heis #	NA
Tested by	FMW
Contact	B. Williams
Phone #	6-3416
Date	8/12/94
length (cm)	15.08
diameter (cm)	9.56
volume (cm ³)	1082.42
wt of sample + mold (g)	2564.7
wt of mold (g)	329.1
wet wt of sample (g)	2235.6
water content % dry wt	2.2%
wet density of sample (g/cm ³)	2.1
dry wt. of sample (g)	2188.3
dry density (g/cm ³)	2.0
specific gravity	2.7
void ratio	0.33
porosity	24.6%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>H. Hume</i> Date: <i>8/23/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-109A	DEPTH	61.5-63.0'	LAB #	4-1120	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/19/94
	1	2	3				
Wt. oven dry soil, g	30.00	30.00	30.00				
Wt. pycnometer + wetting agent, g	167.19	163.41	162.96				
Wt. pycnometer+wetting agent+ soil,	186.47	182.65	182.18				
Temperature (Tx), degrees C	24	24	23.6				
Specific gravity of wetting agent	1.00	1.00	1.00				
Specific gravity of soil at Tx	2.80	2.79	2.78				
Specific gravity of soil at 20 C	2.80	2.79	2.78				
AVG. Specific gravity of -10 material	2.79						
Wt. sample (SSD), g (B)	1370.9	NA	NA				
Wt. sample in water, g (C)	856.2	NA	NA				
Wt. oven dry sample, g (A)	1355.7	NA	NA				
Bulk specific gravity, 23/23 C	2.63	NA	NA				
Bulk specific gravity SSD, 23/23 C	2.66	NA	NA				
Apparent specific gravity, 23/23 C	2.71	NA	NA				
Size fraction, coarse	67.7	NA	NA				
Size fraction, fine	32.3	NA	NA				
Avg. specific gravity, 23/23 C	2.68	NA	NA				
Avg. specific gravity based on:	Bulk	NA	NA				
COMMENTS:							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <u>H. Haupt</u>				Date: <u>8/23/94</u>			

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	61.5-63.0'	LAB #	4-1120	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	6-3416	DATE	8/12/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
8/12/94	448.52	437.63	62.31	10.89	375.32	2.90%	FMW
8/17/94	2487.5	2440.2	251.9	47.3	2188.3	2.2%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	8/15/94	Sample pressure (psi)	0.9	% Calcium carbonate	1.50%		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <u>H. Haupt</u>				Date: <u>8/23/94</u>			

GEOTECHNICAL ENGINEERING LABORATORY

GEL-07
SIEVE ANALYSIS

WELL #	199-K-109A	DEPTH	61.5-63.0'	LAB#	4-1120	HEIS #	NA
TESTED B	FMW	CONTACT	B. Williams	PHONE	376-3416	DATE	08/18/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2188.3	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	50.800	
	1.5"	255.5	11.7	88.3	38.100	
	3/4"	770.6	35.2	64.8	19.050	
	3/8"	1144.5	52.3	47.7	9.525	
WT. #10	# 4	1355.9	62.0	38.0	4.750	
SAMP.(g)	#10	1482.1	67.7	32.3	2.360	
185.9	#40	35.5	19.1	26.1	0.500	
	#60	72.6	39.1	19.7	0.250	
	#100	107.6	57.9	13.6	0.150	
	#200	132.0	71.0	9.4	0.075	

Sieve Analysis Data for Sample 4-1120

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

Checked By: H. HauptDate: 8/23/94

COPY

SAMPLE NO.	4-1120
Contact	BRUCE WILLIAMS
Well No.	199-K-109A
Operable Unit	W-152
HEIS No.	NA
Depth	61.5-62.0'

FIELD CAPACITY	
Weight of column at -100 cm =	4561.75
Weight of water in filler =	19.8
Weight of water in column =	106.32
Field Capacity, Vol.% =	10.3%

Mean Tension	0	-27	-61	-88	-118	-265	-448
Std. Dev. (Tension)	0	2	2	2	1		
Mean K value	3.3E-04	4.1E-05	1.1E-05	7.4E-06	4.8E-06		
SDev/Mean	16%	12%	9%	7%	19%		
Water Content, Vol.%	13.4%	12.6%	10.5%	10.4%	10.0%	8.2%	8.1%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1120

The data package consists of three graphs, seven pages of computer printout (the preparation, data and analysis of the test) four pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data for the original sample used for obtaining the minus ten mesh sample for moisture retention. New grain size distribution data sheets are attached for the sample that was actually tested for unsaturated hydraulic conductivity.

The Grain Size distribution graph shows both the cumulative and fraction retained on each sieve for both the original liner used to obtain moisture retention data and for the sleeve used for unsat. K testing. The two grain size distributions are similar. The bulk densities of the two sleeves; were almost identical (2.06 g/cm³ for the unsat. K column and 2.02 g/cm³ for the liner used for moisture retention).

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 2.06 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.37 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test essentially fall on top of the corrected data from the moisture retention test.

We did have a problem getting data after about -120 cm of tension. Water still flowed through the sample, but the measured gradient reversed. We changed tensiometers four times and reversed the direction of flow by turning the column upside down twice. We tried increasing the tension in an effort to slow down the flow and reverse the gradient, but all efforts failed. We did manage to measure the water content for comparison to the moisture retention curve. The data appear to be very good for moisture content and the unsaturated conductivity values we were able to measure should be more than adequate to predict unsat. K in the drier range of tensions > -500 cm.

J.F. RELYEA
376-4676
11/16/94

B-112

WHC-SD-EN-DP-090, Rev. 0

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1120

Grain Size Distribution for Test Sample 4-1120

Moisture Retention Curve From Unsaturated
Hydraulic Conductivity Test Sample 4-1120

B-115

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1120 1 of 7

Tested By: J.F. Relyea Date 8/23/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	11/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.57 cm
 Column Length 15.10 cm
 Saturated Sample + Column Weight 4610.98 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.68 g/cm³
 Filler Final Moisture Content Data
 Container ID No 3081
 Container + Filler Wet wt. 262.63 g
 Container + Filler Dry wt. 254.67 g
 Container Tare wt. 146.04 g
 Dry Filler Wt. 108.63 g
 Weight of Water 7.96
 Filler Moisture Content 7.3% by weight

Filler Soil ID/Sample No. 4-1120
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 109.3 g
 Specific Gravity g/cm³
 Column Volume Filled 56.6 cm³
 Soil Added To Fill Bottom Void - Yes (X) No ()
 Dry Weight of Soil Added 73.6 g
 Specific Gravity g/cm³
 Column Volume Filled cm³

Type of Water tap water

REMARKS 0.31" average depth void on top.
 SAMPLE NO. 4-1120 Weight for Field Capacity = 4561.75 g.
 Contact BRUCE WILLIAMS
 Well No. 199-K-109A
 Operable Unit W-152
 HEIS No. NA
 Depth 61.5-62.0'

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

Checked By: PR Heller Date: 11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1120

Page 2 of 7

Tested By: J.F. Relyea Date: 8/28/94
 Procedure No: GEL-32 Rev. 1 Date Issue: 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue: N/A

Container No. USK-1
 Container + wet soil wt. 2974.73 g
 Container + dry soil wt. 2888.04 g
 Container Tare Wt. 693.35 g
 Dry soil wt. 2194.69 g
 Moisture Content 3.9% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	11/7/94
Gauge	5667	10/25/94

Empty Column Wt. 2132.36 g (before cleanup)
 Empty Column Wt. — g (after cleanup)

Start Date	9/7/94	9/8/94	9/8/94	9/8/94	9/8/94	9/9/94	9/9/94	9/9/94	9/9/94	9/9/94	9/12/94
Start Time		9:32	10:34	12:19	12:50	6:08	7:01	11:55	12:46	13:20	6:53
End Date		9/8/94	9/8/94	9/8/94	9/8/94	9/9/94	9/9/94	9/9/94	9/9/94	9/9/94	9/12/94
End Time		10:34	12:19	12:50	13:22	7:01	8:10	12:46	13:20	13:52	7:20
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		26.8	20.5	9.3	6.0	50.0	44.4	50.0	46.4	44.2	47.4
Outlet Burette Reading End, milliliters		20.5	9.3	6.0	2.3	44.4	37.1	46.4	44.2	42.3	45.9
Inlet Tensiometer reading, cm	start	-32	-29	-29	-29	-30	-28	-57	-57	-60	-60
	end	-29	-29	-29	-28	-28	-28	-57	-60	-60	-63
Outlet Tensiometer reading, cm	start	-28	-25	-25	-24	-27	-25	-61	-61	-62	-60
	end	-25	-25	-24	-24	-25	-24	-61	-62	-63	-64
Weight of Column and Wet Sample, g	4596.63 4605.88						4606.82				

REMARKS 9/7 bottom tensiometer broken, changed for new one.

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

Checked By: *P. Heller* Date: 11-17-94

B-117

WMC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1120

Page 3 of 7

Tested By: J.F. Relyea

Date 9/12/94

Start Date		9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/13/94	9/13/94	9/13/94	9/13/94
Start Time		7:20	9:18	10:01	10:35	11:01	11:36	12:06	7:27	8:26	8:48	9:15
End Date		9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/13/94	9/13/94	9/13/94	9/13/94
End Time		7:55	10:01	10:35	11:01	11:36	12:06	12:28	8:26	8:48	9:15	9:44
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		45.9	50.0	47.9	46.4	45.2	43.9	42.7	50.0	48.8	48.3	47.8
Outlet Burette Reading End, milliliters		44.3	47.9	46.4	45.2	43.9	42.7	41.9	48.8	48.3	47.8	47.2
Inlet Tensiometer reading, cm	start	-63	-80	-84	-85	-88	-88	-88	-117	-119	-117	-117
	end	-62	-84	-85	-88	-88	-88	-88	-119	-117	-117	-118
Outlet Tensiometer reading, cm	start	-64	-85	-89	-90	-90	-89	-90	-121	-120	-118	-115
	end	-63	-89	-90	-90	-89	-90	-91	-120	-118	-115	-116
Weight of Column and Wet Sample, g		4584.72						4578.42				4570.33

REMARKS

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

Checked By: PR Heller

Date: 11-17-94

B-118

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1120
 Tested By: J.F. Relyea

Page 4 of 7
 Date 9/13/94

Start Date		9/28/94	10/5/94	10/19/94	10/21/94							
Start Time												
End Date												
End Time												
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A							
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A							
Outlet Burette Reading Start, milliliters												
Outlet Burette Reading End, milliliters												
Inlet Tensiometer reading, cm	start											
	end	-278	-278	-455	-453							
Outlet Tensiometer reading, cm	start											
	end	-253	-251	-440	-384							
Weight of Column and Wet Sample, g		4540.08 4545.54	4540.88 4540.59	4522.79 4529.4	4532.37							

REMARKS

For some reason we never obtained another data point. We still had flow, but the measured gradient was reversed. We changed tensiometers and reversed direction of flow through the column several times. We did however manage to measure the tension and obtain moisture retention data on the intact column to almost - 500 cm.

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

Checked By: PC Helton Date: 11-17-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO. 4-1120
 Tested By: J.F. Relyea

Date 11/16/94 Page 5 of 7

Tensiometer Separation <u>10.0</u> cm	Column Volume <u>1086.2</u> cm ³	Test Sample Bulk Density <u>2.06</u> g/cm ³
Column Length <u>15.1</u> cm	Filler Volume <u>56.6</u> cm ³	Test Sample Porosity <u>0.23</u> cm ³ /cm ³
Column Diameter <u>9.6</u> cm	Filler Dry Wt. <u>182.9</u> g	Empty Column Wt. <u>2132.4</u> g, Average
Column Area <u>71.9</u> cm ²	Sample Volume <u>1029.5</u> cm ³	Field Sample Bulk Density <u>2.02</u> g/cm ³
Final Moisture Content <u>3.9%</u> by wt.	Sample Dry Wt. <u>2120.4</u> g	Type of water used <u>Tap Water</u>

Start Date		9/8/94	9/8/94	9/8/94	9/8/94	9/9/94	9/9/94	9/9/94	9/9/94
Start Time		9:32	10:34	12:19	12:50	6:08	7:01	11:55	12:46
End Date		9/8/94	9/8/94	9/8/94	9/8/94	9/9/94	9/9/94	9/9/94	9/9/94
End Time		10:34	12:19	12:50	13:22	7:01	8:10	12:46	13:20
Total Elapsed, sec		3720	6300	1860	1920	3180	4140	3060	2040
Volume, cm ³		6.30	11.20	3.30	3.70	5.60	7.30	3.60	2.20
Tension - Inlet, cm		-31	-29	-29	-29	-29	-28	-57	-59
Tension - outlet, cm		-27	-25	-25	-24	-26	-25	-61	-62
Average Tension, cm	0	-29	-27	-27	-26	-28	-26	-59	-60
K, cm/sec	3.27E-04	3.92E-05	4.12E-05	4.48E-05	4.87E-05	3.50E-05	3.77E-05	1.17E-05	1.15E-05
Weight of Column + Wet Sample, g	4610.98						4606.82		
Weight of Water in Filler, g (from MRC)	30.6						29.7		
Weight of Water in Sample, g	137.99						129.66		
Moisture Content (volumetric %)	13.4%						12.6%		

REMARKS

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

Checked By:

P. Heller

Date: 11-17-94

B-120

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1120 Page 6 of 7
 Tested By: J.F. Relyea Date 11/16/94

Start Date	9/9/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94
Start Time	13:20	6:53	7:20	9:18	10:01	10:35	11:01	11:36	12:06
End Date	9/9/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94	9/12/94
End Time	13:52	7:20	7:55	10:01	10:35	11:01	11:36	12:06	12:28
Total Elapsed, sec	1920	1620	2100	2580	2040	1560	2100	1800	1320
Volume, cm ³	1.90	1.50	1.60	2.10	1.50	1.20	1.30	1.20	0.80
Tension - Inlet, cm	-60	-62	-63	-82	-85	-87	-88	-88	-88
Tension - outlet, cm	-63	-62	-64	-87	-90	-90	-90	-90	-91
Average Tension, cm	-61	-62	-63	-85	-87	-88	-89	-89	-89
K, cm/sec	1.10E-05	1.23E-05	9.63E-06	7.54E-06	6.81E-06	7.92E-06	7.48E-06	8.06E-06	6.74E-06
Weight of Column + Wet Sample, g			4584.72						4578.42
Weight of Water in Filler, g (from MRC)			28.8						23.9
Weight of Water in Sample, g			108.50						107.07
Moisture Content (volumetric %)			10.5%						10.4%

REMARKS

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

Checked By:

PR. Heller

Date: 11-17-94

B-121

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1120
 Tested By: J.F. Relyea

Date _____ Page 7 of 7
11/16/94

Start Date	9/13/94	9/13/94	9/13/94	9/13/94	9/28/94	10/5/94	10/19/94	10/21/94	
Start Time	7:27	8:26	8:48	9:15					
End Date	9/13/94	9/13/94	9/13/94	9/13/94					
End Time	8:26	8:48	9:15	9:44					
Total Elapsed, sec	3540	1320	1620	1740					
Volume, cm ³	1.20	0.50	0.50	0.60					
Tension - inlet, cm	-118	-118	-117	-118	-278	-278	-455	-453	
Tension - outlet, cm	-121	-119	-117	-116	-253	-251	-440	-384	
Average Tension, cm	-119	-119	-117	-117	-266	-265	-448	-419	
K, cm/sec	3.77E-06	4.79E-06	4.52E-06	5.99E-06					
Weight of Column + Wet Sample, g				4570.33	4545.54	4540.59	4529.4	4532.37	
Weight of Water in Filler, g (from MRC)				19.5	16.5	16.4	13.3	13.7	
Weight of Water in Sample, g				103.35	81.62	76.70	68.68	71.20	
Moisture Content (volumetric %)				10.0%	7.9%	7.4%	6.7%	6.9%	

REMARKS

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

Checked By: _____

PRH

Date: 11-17-94

B-122

WHC-SD-EN-DP-090, Rev. 0

COPY

Moisture Retention Sample Number 4-1120

SAMPLE NO.	4-1120	Operable Unit	W-152
Contact	BRUCE WILLIAMS	HEIS No.	NA
VWell No.	199-K-109A	Depth	62.0-62.5'

TEMPE CELLS	Sample #	4-1120 1 Bar Main Drying Curve (natural saturation from the bottom)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
container number	MC-6	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
weight of container/ring,+wet sample	98.50	555.44	574.56	575.81	576.22	576.26	576.58	576.26	576.36
weight of container/ring,+ dry sample	98.35	554.93	554.80	554.80	554.80	554.80	554.80	554.80	554.80
weight of moisture	0.15	0.51	19.76	21.01	21.42	21.46	21.78	21.46	21.56
weight of container and ring	61.05	426.43	426.10	426.10	426.10	426.10	426.10	426.10	426.10
weight of dry sample	37.45	128.50	128.70	128.70	128.70	128.70	128.70	128.70	128.70
moisture content, wt. %	0.40%		15.35%	16.32%	16.64%	16.67%	16.92%	16.67%	16.75%
date measured			10/6/94	10/7/94	10/10/94	10/11/94	10/13/94	10/14/94	10/17/94
temperature deg. C			26	25	26	25	23	24	20

TEMPE CELLS	Sample #	4-1120 1 Bar Main Drying Curve							
tension in cm	5.0	8.0	11.5	27	49	70.5	104	202	300
container number	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
weight of container/ring,+wet sample	576.10	576.42	576.26	575.70	575.34	574.80	568.70	567.54	565.74
weight of container/ring,+ dry sample	554.80	554.80	554.80	554.80	554.80	554.80	554.80	554.80	554.80
weight of moisture	21.30	21.62	21.46	20.90	20.54	20.00	13.90	12.74	10.94
weight of container and ring	426.10	426.10	426.10	426.10	426.10	426.10	426.10	426.10	426.10
weight of dry sample	128.70	128.70	128.70	128.70	128.70	128.70	128.70	128.70	128.70
moisture content, wt. %	16.55%	16.80%	16.67%	16.24%	15.96%	15.54%	10.80%	9.90%	8.50%
date measured	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/26/94	10/27/94	10/28/94	10/31/94
temperature deg. C	24	21	26	23	23	24	23	24	22

volume of brass ring 68.26 cm³

TEMPE CELLS	Sample #	4-1120 1 Bar Main Drying Curve			
tension in cm	500.0	700.0	1000	N/A	N/A
container number	TC-23	TC-23	TC-23	TC-23	MC-8
weight of container/ring,+wet sample	563.57	562.56	561.28	561.28	195.95
weight of container/ring,+ dry sample	554.80	554.80	554.80	554.80	189.46
weight of moisture	8.77	7.76	6.48	6.48	6.49
weight of container and ring	426.10	426.10	426.10	426.10	60.76
weight of dry sample	128.70	128.70	128.70	128.70	128.70
moisture content, wt. %	6.81%	6.03%	5.03%	5.03%	5.04%
date measured	11/1/94	11/2/94	11/3/94		11/7/94
temperature deg. C	23	21	26		22

Sample Bulk Density = 1.89 g/cm³
Field Bulk Density = 2.02 g/cm³
Fraction < 2 mm = 0.32

Cell wt. before cleanup = 425.90 grams
Cell wt. after cleanup = 426.05 grams
Average of all 3 = 426.13

TEMPE CELLS	Sample #	4-1120 1 Bar Main Wetling Curve							
tension in cm	N/A	N/A	1000	1000	1000	1000	1000	1000	1000
error in tension value +/-									
container number	MC-6	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
weight of container/ring,+wet sample	98.50	559.52	563.67	563.66	563.68	563.67	563.79	563.87	563.80
weight of container/ring,+ dry sample	98.35	558.99	560.60	560.60	560.60	560.60	560.60	560.60	560.60
weight of moisture	0.15	0.53	3.07	3.06	3.08	3.07	3.19	3.27	3.20
weight of container and ring	61.05	426.67	428.30	428.30	428.30	428.30	428.30	428.30	428.30
weight of dry sample	37.45	132.32	132.30	132.30	132.30	132.30	132.30	132.30	132.30
moisture content, wt. %	0.40%		2.32%	2.31%	2.33%	2.32%	2.41%	2.47%	2.42%
date measured	8/25/94	8/25/94	8/30/94	8/31/94	9/1/94	9/2/94	9/6/94	9/7/94	9/8/94
temperature deg. C		27	27	26	27	26	27	27	27

TEMPE CELLS	Sample #	4-1120 1 Bar Main Wetling Curve							
tension in cm	700	500	300	202	103	82.5	54.3	31.8	20
error in tension value +/-									
container number	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
weight of container/ring,+wet sample	564.41	565.40	567.08	569.66	573.09	574.12	575.97	577.44	577.93
weight of container/ring,+ dry sample	560.60	560.60	560.60	560.60	560.60	560.60	560.60	560.60	560.60
weight of moisture	3.81	4.80	6.48	9.06	12.49	13.52	15.37	16.84	17.33
weight of container and ring	428.30	428.30	428.30	428.30	428.30	428.30	428.30	428.30	428.30
weight of dry sample	132.30	132.30	132.30	132.30	132.30	132.30	132.30	132.30	132.30
moisture content, wt. %	2.88%	3.63%	4.90%	6.85%	9.44%	10.22%	11.62%	12.73%	13.10%
date measured	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94	9/16/94	9/18/94	9/19/94
temperature deg. C	26	25	26	27	26	26	25	26	27

TEMPE CELLS	Sample #	4-1120 1 Bar Main Wetling Curve						
tension in cm	11.0	9.0	4.5	1.5	0.0	0.0	N/A	N/A
error in tension value +/-								
container number	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	MC-6
weight of container/ring,+wet sample	578.24	578.84	579.06	579.51	580.48	580.59	580.59	212.85
weight of container/ring,+ dry sample	560.60	560.60	560.60	560.60	560.60	560.60	560.60	193.00
weight of moisture	17.64	18.24	18.46	18.91	19.88	19.99	19.99	19.85
weight of container and ring	428.30	428.30	428.30	428.30	428.30	428.30	428.30	61.07
weight of dry sample	132.30	132.30	132.30	132.30	132.30	132.30	132.30	131.93
moisture content, wt. %	13.33%	13.79%	13.95%	14.29%	15.03%	15.11%	15.11%	15.05%
date measured	9/20/94	9/21/94	9/22/94	9/23/94	9/26/94	9/27/94		9/28/94
temperature deg. C	27	26	26	26	26	26		26

volume of brass ring 68.26 cm³
 Sample Bulk Density = 1.94 g/cm³

Cell wt. before cleanup = 428.34 grams
 Cell wt. after cleanup = 426.81 grams
 Average of all 3 = 427.27

KETTLES	Sample #	4-1120 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA15	BA16	BA15	BA16	BA15	BA16	BB15	BB16
weight of container/ring,+wet sample	47.49	42.96	47.78	43.14	47.29	42.65	45.15	47.63
weight of container/ring,+ dry sample	46.30	42.07	46.22	42.02	46.14	41.93	44.52	46.92
weight of moisture	1.19	0.89	1.56	1.12	1.15	0.72	0.63	0.71
Container Tare Wt.,g	27.72	27.63	27.72	27.63	27.72	27.63	28.05	28.53
weight of dry sample	18.58	14.44	18.50	14.39	18.42	14.30	16.47	18.39
moisture content %	6.40%	6.16%	8.43%	7.78%	6.24%	5.03%	3.83%	3.86%
date measured	10/17/94	10/17/94	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94
temperature deg. C	20	20	24	24	22	22	20	20

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	9.8	9.8
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB15	BB16	BB15	BB16	BC15	BC16	BC15	BC16
weight of container/ring,+wet sample	45.09	47.57	45.00	47.48	47.06	48.29	47.07	48.32
weight of container/ring,+ dry sample	44.47	46.87	44.42	46.81	46.71	47.94	46.65	47.87
weight of moisture	0.62	0.70	0.58	0.67	0.35	0.35	0.42	0.45
Container Tare Wt.,g	28.05	28.53	28.05	28.53	29.04	29.26	29.04	29.26
weight of dry sample	16.42	18.34	16.37	18.28	17.67	18.68	17.61	18.61
moisture content %	3.78%	3.82%	3.54%	3.67%	1.98%	1.87%	2.39%	2.42%
date measured	10/28/94	10/28/94	11/7/94	11/7/94	10/17/94	10/17/94	10/28/94	10/28/94
temperature deg. C	24	24	22	22	20	20	24	24

Water Potential Data for CX-2 Samples

Sample No.	4-1120	4-1120
Container Number	BC15	BC16
Aw Reading	0.853	0.980
Temperature °C	26.3	26.3
Water Potential, Bars	219.5	27.9
Can ID No	BC15	BC16
Can + Soil Wet wt., g	46.79	48.17
Can + Soil Dry wt., g	46.63	47.85
Can Tare wt., g	29.04	29.26
Weight of Water, g	0.16	0.32
Dry Weight of Sample, g	17.59	18.59
Moisture Content, wt. %	0.91%	1.72%
date measured	10/8/94	10/8/94

POINTS SELECTED FOR PLOTTING

Sample # 4-1120

container number	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
tension in cm	1	5	8	11.5	27	49	70.5	104	202	300	500
Tempe Main Drying Curve	16.8%	16.6%	16.8%	16.7%	16.2%	16.0%	15.5%	10.8%	9.9%	8.5%	6.8%
date measured	10/17/94	10/18/94	10/19/94	10/21/94	10/24/94	10/25/94	10/26/94	10/27/94	10/28/94	10/31/94	11/1/94

container number	TC-23	TC-23	BA15	BA15	BB15	BB15	BB15	BC15	BC16	BC15
tension in cm	700	1000	510	1020	2040	3060	5100	9996	28447	223878
Tempe Main Drying Curve	6.0%	5.0%								
Kettle/CX-2 Main Drying Curve			6.3%	5.6%	3.8%	3.8%	3.6%	2.4%	1.7%	0.9%
date measured	11/2/94	11/3/94	10/17/94	11/7/94	10/17/94	10/28/94	11/7/94	10/28/94	10/8/94	10/8/94

container number	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21	TC-21
tension in cm	1000	700	500.0	300.0	103.0	54.3	20.0	11.0	9.0	4.5
Tempe Main Wetling Curve	2.4%	2.9%	3.6%	4.9%	9.4%	11.6%	13.1%	13.3%	13.8%	14.0%
date measured	9/8/94	9/9/94	9/11/94	9/12/94	9/14/94	9/16/94	9/19/94	9/20/94	9/21/94	9/22/94

container number	TC-21	TC-21
tension in cm	1.5	1.0
Tempe Main Wetling Curve	14.3%	15.0%
date measured	9/23/94	9/26/94

Points from kettle are enclosed by the double outline Points from CX-2 are enclosed by the single outline

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GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	87.8-88.3'	LAB #	4-1121	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	376-3416	DATE	8/3/94
GEL-14 SOIL MOISTURE							
BALANCE	3311	CALIBRATION DUE	2/7/95	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
8/3/94	2505.8	2320.9	254.1	184.9	2066.8	8.9%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	NA	TESTED BY	NA		
VESSEL	5697	CALIBRATION DUE	NA	SAMPLE WT. (g)	8.00		
Date	NA	Sample pressure (psi)	NA	% Calcium carbonate	NA		
Comments Calcium carbonate testing was not requested.							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Haupt</i>				Date: 10/28/94			

FOR INFORMATION ONLY

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-109A	CONTACT	Williams	ORIG CODE	86950	PHONE	376-3416
LAB #	4-1121	DEPTH	87.8-88.3'	TESTED BY	FMW	DATE	08/03/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2066.8	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	852.3	41.2	58.8	50.800	
	1.5"	852.3	41.2	58.8	38.100	0 retained om 1.5" scree
	3/4"	1008.0	48.8	51.2	19.050	
	3/8"	1158.8	56.1	43.9	9.525	
WT. #10 SAMP. (g) 145.5	# 4	1365.8	66.1	33.9	4.750	
	#10	1545.4	74.8	25.2	2.360	
	#40	46.9	32.2	17.1	0.500	
	#60	100.6	69.1	7.8	0.250	
	#100	126.2	86.7	3.3	0.150	
	#200	134.7	92.6	1.9	0.075	

Sieve Analysis Data for Sample 4-1121

CHECKED BY: *F.M. Williams* 10/28/94

FOR INFORMATION ONLY

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-109A	CONTACT	Williams	ORIG CODE	86950	PHONE	376-3416
LAB #	4-1121	DEPTH	87.8-88.3'	TESTED BY	FMW	DATE	08/08/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1214.5	4"	0.0	0.0	100.0	101.600	This sieve report was calculated with the 2" material removed.
	2.5"	0.0	0.0	100.0	63.500	
	2"	0.0	0.0	100.0	50.800	
	1.5"	0.0	0.0	100.0	38.100	
	3/4"	155.7	12.8	87.2	19.050	
	3/8"	306.5	25.2	74.8	9.525	
WT. #10 SAMP. (g) 145.5	#4	513.5	42.3	57.7	4.750	
	#10	693.1	57.1	42.9	2.360	
	#40	46.9	32.2	29.1	0.500	
	#60	100.6	69.1	13.2	0.250	
	#100	126.2	86.7	5.7	0.150	
	#200	134.7	92.6	3.2	0.075	

Sieve Analysis Data for Sample 4-1121

CHECKED BY:

H.M. Williams 10/28/94

FOR INFORMATION ONLY

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**GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09**

SAMPLE NO. 4-1159 Well no./depth 199-K-109A/117.4-118.4' VISCOSITY 1

Tested By: H. Hampt/F. M. Williams Date 10/07/94

Specimen Diameter (D, cm) 9.54 Specimen Length (L, cm) 15.06

Start Date	10-Oct-94	10-Oct-94	10-Oct-94	10-Oct-94	11-Oct-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
End Date	10-Oct-94	10-Oct-94	10-Oct-94	10-Oct-94	11-Oct-94
End Time	00:12:00	00:05:00	00:09:11	00:15:30	00:09:00
Time Sec.	720	300	551	930	540
Volume, cm ³	103.4	43	88.5	124	61.8
Head, cm	80	80	78.1	78.7	77.5
"Q"	1.44E-01	1.43E-01	1.61E-01	1.33E-01	1.14E-01
L/(A*H)	2.63E-03	2.63E-03	2.70E-03	2.68E-03	2.72E-03
K, cm/sec	3.78E-04	3.77E-04	4.33E-04	3.57E-04	3.11E-04
Kc, (K*Visc)	3.78E-04	3.77E-04	4.33E-04	3.57E-04	3.11E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 3.71E-04
STANDARD DEV. 3.94E-05
% STAND. DEV. 10.6%

Remarks:

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

Checked By: *F. M. Williams*

Date: *10/24/94*

B-133

WHC-SD-EN-DP-090, Rev. 0

GEL 07 ☐ GEL 16 ☒
 GEL 09 ☒ GEL 17 ☐
 GEL 10 ☒ GEL 19 ☐
 GEL 14 ☐ GEL ☐

GEOTECHNICAL ENGINEERING LABORATORY GEL-09 HYDRAULIC CONDUCTIVITY DATA SHEET

Sample No.
 4-1159

Page _____ of _____

Balance No. 3311

Permeameter No. _____

Test Initiated By H4

Date 10/7/94

Procedure _____

Sleeve Type: ☐ Metal ☒ Plastic

Specimen Diameter (D) 9.54 cm

Specimen Length (L) 15.06 cm

$$A = \left(\frac{D}{2} \right)^2 \times 3.1415$$

Specimen Area (A) 71.48 cm²

Darcy's Law

K = Hydraulic Conductivity (cm/sec)

Q = Flow (cm³/sec) = Vol. g/Time (sec)

A = Area (cm²)

H = Hydraulic Head

$$K = \frac{QL}{AH}$$

L = Length (cm)

Date Year <u>94</u> (Mo/Day)	Run Time			Container			Room	Pressure	Effluent Description	Operator Initials	Hydraulic Conductivity (cm/sec)	Calculated By
	System (Hr:Min)	System (Hr:Min)	Time Change	Weight (± 0.1 g)	Tare (± 0.1 g)	Tare & Effluent (± 0.1 g)	Temp (°C)	Pore H ₂ O (cm)				
10/10/94	0:0:0	0:12:0	720s	103.4	154.5	257.9	21°C	80.0	clear	H4	3.8x10 ⁻⁴	H4
10/10/94	0:0:0	0:5:0	300s	43.0	257.9	300.9	21°C	80.0	clear	H4	3.8x10 ⁻⁴	H4
10/10/94	0:0:0	0:9:11	551s	88.5	155.3	243.8	22.3°C	78.1	clear	FMW	3.7x10 ⁻⁴	FMW
10/10/94	0:0:0	0:15:30	930s	124.0	155.1	279.1	22.0	78.7	clear	FMW	3.4x10 ⁻⁴	FMW
10/11/94	0:0:0	0:9:00	540s	61.8	154.9	216.7	17.8	77.5	clear	FMW	3.0x10 ⁻⁴	FMW

Remarks _____

Test Checked By J. M. Williams

Date 11/25/94

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	117.4-118.4'
Lab #	4-1159
Heis #	NA
Tested by	HH
Contact	Williams
Phone #	376-3416
Date	10/14/94
length (cm)	15.06
diameter (cm)	9.54
volume (cm ³)	1076.46
wt of sample + mold (g)	2629.9
wt of mold (g)	317.0
wet wt of sample (g)	2312.9
dry wt of sample (g)	2103.4
wet density of sample (g/cm ³)	2.1
water content % dry wt	9.96%
dry density (g/cm ³)	2.0
specific gravity	2.8
void ratio	0.44
porosity	30.7%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by:	Date:

GEOTECHNICAL ENGINEERING LABORATORY
SPECIFIC GRAVITY
GEL 10

WELL #	199-K-109A	DEPTH	117.4-118.4	LAB #	4-1159	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	11/7/94

	1	2	3	temp	K
Wt. oven dry soil, g	30.00	30.00	30.00	16	1.0001
Wt. pycnometer + wetting agent, g	162.06	168.68	168.01	18	1.0004
Wt. pycnometer+wetting agent+ soil,	181.45	188.13	187.53	19	1.0002
Temperature (Tx), degrees C	16.5	16.3	16.4	20	1.0000
Specific gravity of wetting agent	1.00	1.00	1.00	21	0.9998
Specific gravity of soil at Tx	2.83	2.84	2.86	22	0.9996
Specific gravity of soil at 20 C	2.83	2.84	2.86	23	0.9993
AVG. Specific gravity of -10 material	2.84			24	0.9991
Wt. sample (SSD), g (B)	473.1	NA	NA	25	0.9989
Wt. sample in water, g (C)	303	NA	NA	26	0.9986
Wt. oven dry sample, g (A)	472.5	NA	NA	27	0.9983
Bulk specific gravity, 23/23 C	2.78	NA	NA	28	0.998
Bulk specific gravity SSD, 23/23 C	2.78	NA	NA	29	0.9977
Apparent specific gravity, 23/23 C	2.79	NA	NA	30	0.9974
Size fraction, coarse	34.5	NA	NA		
Size fraction, fine	65.5	NA	NA		
Avg. specific gravity, 23/23 C	2.8	NA	NA		
Avg. specific gravity based on:	Bulk	NA	NA		

COMMENTS:

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

Checked By:

Date:

GEL 07 ☐ GEL 16 ☒
 GEL 09 ☒ GEL 17 ☐
 GEL 10 ☒ GEL 19 ☐
 GEL 14 ☐ GEL ☐

GEOTECHNICAL ENGINEERING LABORATORY
GEL-10 SPECIFIC GRAVITY SOILS FINE/COARSE

Sample No. 4-1159
 Page ____ of ____

GEL-10 SPECIFIC GRAVITY OF SOILS

Date 10/14/94 Tested By F.M. Williams
 Balance: 3304 Calibration Due Date 11/7/94

DETERMINATION NO.		1	2	3
W _o	Wt. Oven Dry, Soil, g	30.00	30.00	30.00
	Pycnometer No.	4	5	6
	Wt. Pycnometer, g	162.33	169.01	168.27
W _a	Wt. Pycnometer + Wetting Agent, g	162.08	168.68	168.01
W _b	Wt. Pycnometer + Wetting Agent + Soil, g	181.45	188.13	187.53
	Temperature, T _x at W _b , °C	16.5	16.3	16.4
G _w	Specific Gravity of Wetting Agent at T _x	1.00	1.00	1.00
G _t	Specific Gravity of Soil at T _x	2.82	2.84	2.86
G _s	Specific Gravity of Soil at 20 °C	—	—	—

Wetting Agent D.I. H₂O

$$C_t = \frac{W_o}{W_o + W_a - W_b}$$

Remarks: avg - 16, 17, 18

2.84

GEL-10 SPECIFIC GRAVITY COARSE AGGREGATES

Date 10/17/94 Tested By: F.M. Williams
 Balance: 3312 Calibration Due Date 5/5/95

DETERMINATION NO.		1	
	Size fraction	1 1/2 → 4	10-40
P ₁	Size fraction, wt. % total, g	34.5	65.5
	Tare weight		254.0
B	Weight sample (SSD), g	727.1	473.1
C	Weight sample in H ₂ O, g	303.0	—
A	Weight of oven dry sample, g	726.5	472.5

Bulk Specific Gravity, 23/23 °C = A/(B-C) = 2.78

A = wt. oven dry sample in air, g
 B = wt. SSD sample in air, g
 C = wt. saturated sample in H₂O, g

Bulk Specific Gravity SSD, 23/23 °C = B/(B-C) = 2.78

Apparent Specific Gravity, 23/23 °C = A/(A-C) = 2.79

*Average Specific Gravity Values, 23/23 °C $\bar{G}$ = 2.82

Remarks: _____

$$\bar{G} = \frac{1}{\frac{P_1 = \% \text{ coarse}}{G_1 = \text{coarse sp. gr.} \times 100} + \frac{P_2 = \% \text{ fines}}{G_2 = \text{fines sp. gr.} \times 100}}$$

$\bar{G}$ = Ave. Specific Gravity for all forms of Specific Gravity i.e., formula applicable to Bulk, Bulk SSD and Apparent Specific Gravity.

G₁, G₂ = appropriate Specific Gravity values for each size fraction depending on the type of Specific Gravity being averaged.

P₁, P₂ = wt. percentages of each size fraction present in the original sample.

*State type of Specific Gravity Reported i.e., either Bulk, Bulk SSD or Apparent.

Tests Checked By F.M. Williams

Date 10/26/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	117.4-118.4'	LAB #	4-1159	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	376-3416	DATE	10/14/94
GEL-14 SOIL MOISTURE							
BALANCE	3311	CALIBRATION DUE	2/7/95	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
10/114/94	2567.1	2357.7	254.2	209.4	2103.5	10.0%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	NA	TESTED BY	NA		
VESSEL	5697	CALIBRATION DUE	NA	SAMPLE WT. (g)	8.00		
Date	NA	Sample pressure (psi)	NA	% Calcium carbonate	NA		
Comments Calcium carbonate testing was not requested.							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By:				Date:			

GEL 07 ☐ GEL 16 ☒
 GEL 09 ☒ GEL 17 ☐
 GEL 10 ☒ GEL 19 ☐
 GEL 14 ☐ GEL ☐

GEOTECHNICAL ENGINEERING LABORATORY
 GEL-14, GEL-16, GEL-19

Sample No.
 4-1159

Page _____ of _____

GEL-14 SOIL MOISTURE

Balance: 3311

Calibration Due Date 2/7/95

Tested By FMW

Thermometer: oven

Calibration Due Date Variable

Date	Wet Wt. + Can	Dry Wt. + Can	Tare Wt.	Moisture	Dry Wt. Soil	% Moisture	Calculated By
10/14/94	2567.1	2351.7	254.2	209.4	2103.5	9.96 ^{HM} 10.0%	FMW

Remarks: _____

GEL-16 BULK DENSITY-POROSITY

DETERMINATION NO.			1	9.54
Pan No.:	Mold: ☐ Plastic ☒ Metal	Length:	15.06	
Sample Volume, V, cc			1076.5	
Wt. of Sample & Mold, g			2629.9	
Wt. of Mold, g			317.0	
Wet Wt. of Sample, g			2312.9	
Wet Density of Sample, γ_m , g/cc			2.14	2.15
Water Content % Dry Weight			9.96	
Dry Density, g/cc γ_d			1.95	
Dry weight of Sample, g, Ws			2103.4	
*Void Ratio, e				
**Porosity, n, %				

Tested By HCH

$$W_s = \frac{\text{Wet Wt.}}{1 + \% \text{ Dry Wt.}}$$

$$\text{*Void Ratio, } e = \frac{\text{Avg. Sp. Gr.} \times \text{Vol.} - 1}{W_s}$$

$$\text{**Porosity, } n, \% = \left(\frac{e}{1+e} \right) 100$$

Remarks: 199-K-109A, 117-4-118.4, 100K D=9.57, 9.56, 9.54, 9.53, 9.54, 9.51
L= 15.06, 15.07, 15.06

GEL-19 CALCIUM CARBONATE

Vessel No. _____

Tested By _____

Balance No. 3304

Date Due _____

Sample Weight 8.0 (g)

Sample Pressure _____ (psi) %CaCO₃ _____ Per Gram

NA

Remarks: _____

Tests Checked By: J. M. Williams

Date 10/25/94

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1160 Well no./depth 199-K-109A/146.5-147' VISCOSITY 1

Tested By: H. Hampt Date 09/26/94

Specimen Diameter (D, cm) 9.54 Specimen Length (L, cm) 13.31

Start Date	04-Oct-94	04-Oct-94	04-Oct-94	05-Oct-94		
Start Time	00:00:00	00:00:00	00:00:00	00:00:00		
End Date	04-Oct-94	04-Oct-94	04-Oct-94	05-Oct-94		
End Time	00:07:30	00:04:00	00:03:00	00:04:00		
Time Sec.	450	240	180	240		
Volume, cm ³	89.1	46.7	35	40.9		
Head, cm	83.2	83.2	83.2	80.6		
"Q"	1.98E-01	1.95E-01	1.94E-01	1.70E-01		
L/(A*H)	2.24E-03	2.24E-03	2.24E-03	2.31E-03		
K, cm/sec	4.43E-04	4.35E-04	4.35E-04	3.94E-04		
Kc, (K*Visc)	4.43E-04	4.35E-04	4.35E-04	3.94E-04		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 4.27E-04
 STANDARD DEV. 1.94E-05
 % STAND. DEV. 4.5%

Remarks: Readings were not consistent the first day of testing. Those readings are not included in the final calculations.

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

Checked By: H. Hampt

Date: 10/18/94

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	146-147'
Lab #	4-1160
Heis #	NA
Tested by	HH
Contact	B. Williams
Phone #	6-3416
Date	9/26/94
length (cm)	13.31
diameter (cm)	9.54
volume (cm ³)	951.38
wt of sample + mold (g)	2340.4
wt of mold (g)	328.4
wet wt of sample (g)	2012.0
water content % dry wt	7.6%
wet density of sample (g/cm ³)	2.1
dry wt. of sample (g)	1869.9
dry density (g/cm ³)	2.0
specific gravity	2.8 *
void ratio	0.42
porosity	29.8%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt Date: 11/7/94	

* Specific gravity is estimated -

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	146.5-147'	LAB #	4-1160	HEIS #	NA
TESTED BY	HH/FMW	CONTACT	Williams	PHONE	376-3416	DATE	9/21/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	HH		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
9/21/94	475.82	446.14	63.16	29.68	382.98	7.75%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	1/4/95	SAMPLE WT. (g)	8.00		
Date	10/5/94	Sample pressure (psi)	0.2	% Calcium carbonate	< 1		0.2
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>R. T. M. Gubish</i>				Date: <i>10/12/94</i>			

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1161 Well no./depth 199-K-109A/156.2-156.7' VISCOSITY 1

Tested By: H. Hampt Date 09/26/94

Specimen Diameter (D, cm) 9.54 Specimen Length (L, cm) 15.06

Start Date	04-Oct-94	04-Oct-94	04-Oct-94	05-Oct-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	04-Oct-94	04-Oct-94	04-Oct-94	05-Oct-94
End Time	00:12:00	00:14:00	00:10:00	00:10:00
Time Sec.	720	840	600	600
Volume, cm ³	34.4	39.4	28	26.2
Head, cm	80.6	80.6	80.6	80
"Q"	4.78E-02	4.69E-02	4.67E-02	4.37E-02
L/(A*H)	2.61E-03	2.61E-03	2.61E-03	2.63E-03
K, cm/sec	1.25E-04	1.23E-04	1.22E-04	1.15E-04
Kc, (K*Visc)	1.25E-04	1.23E-04	1.22E-04	1.15E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 1.21E-04
 STANDARD DEV. 3.70E-06
 % STAND. DEV. 3.1%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks:

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

Checked By: *R.T. G. J. T. J. T. J. T.* Date: 10/12/94

B-145

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	156.2-156.7'
Lab #	4-1161
Heis #	NA
Tested by	HH
Contact	Williams
Phone #	376-3416
Date	9/21/94
length (cm)	15.06
diameter (cm)	9.54
volume (cm ³)	1076.46
wt of sample + mold (g)	2706.2
wt of mold (g)	317.8
wet wt of sample (g)	2388.4
dry wt of sample (g)	2034.4
wet density of sample (g/cm ³)	2.2
water content % dry wt	17.40%
dry density (g/cm ³)	1.9
specific gravity	2.8
void ratio	0.49
porosity	32.7%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>R.T. M. [Signature]</i> Date: 10/12/94	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-109A	DEPTH	156.2-156.	LAB #	4-1161	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	10/7/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	168.36	167.75	168.3
Wt. pycnometer+wetting agent+ soil,	187.67	187.08	187.63
Temperature (Tx), degrees C	20.2	20	20.5
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.81	2.81	2.81
Specific gravity of soil at 20 C	2.81	2.81	2.81
AVG. Specific gravity of -10 material	2.81		
Wt. sample (SSD), g (B)	NA	NA	NA
Wt. sample in water, g (C)	NA	NA	NA
Wt. oven dry sample, g (A)	NA	NA	NA
Bulk specific gravity, 23/23 C	NA	NA	NA
Bulk specific gravity SSD, 23/23 C	NA	NA	NA
Apparent specific gravity, 23/23 C	NA	NA	NA
Size fraction, coarse	NA	NA	NA
Size fraction, fine	NA	NA	NA
Avg. specific gravity, 23/23 C	NA	NA	NA
Avg. specific gravity based on:	NA	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: R. T. McArthur Date: 10/12/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	156.2-156.7'	LAB #	4-1161	HEIS #	NA
TESTED BY	HH/FMW	CONTACT	Williams	PHONE	376-3416	DATE	9/21/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	HH		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
9/21/94	389.63	341.37	63.89	48.26	277.48	17.39%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	1/4/95	SAMPLE WT. (g)	8.00		
Date	10/5/94	Sample pressure (psi)	0.2	% Calcium carbonate	< 1	0.2	
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>R. T. McIntosh</i>				Date: 10/12/94			

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1162 Well no./depth 199-K-109A/165.7-167.7' VISCOSITY 1

Tested By: RTM/HH Date 09/26/94

Specimen Diameter (D, cm) 9.54 Specimen Length (L, cm) 15.06

Start Date	13-Oct-94	17-Oct-94	20-Oct-94		
Start Time	12:55:00	07:45:00	08:15:00		
End Date	17-Oct-94	20-Oct-94	21-Oct-94		
End Time	07:45:00	08:15:00	13:56:00		
Time Sec.	327000	261000	106860		
Volume, cm ³	79.9	58.6	23.7		
Head, cm	1426.46	1426.46	1426.46		
"Q"	2.44E-04	2.25E-04	2.22E-04		
L/(A*H)	1.48E-04	1.48E-04	1.48E-04		
K, cm/sec	3.61E-08	3.32E-08	3.28E-08		
Kc, (K*Visc)	3.61E-08	3.32E-08	3.28E-08		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 3.40E-08
 STANDARD DEV. 1.48E-09
 % STAND. DEV. 4.4%

Remarks:

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

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

Checked By: H. Hampt

Date: 11/2/94

B-149

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-109A
Depth	165.7-167.7'
Lab #	4-1162
Heis #	NA
Tested by	HH
Contact	B. Williams
Phone #	6-3416
Date	9/26/94
length (cm)	15.06
diameter (cm)	9.54
volume (cm ³)	1076.46
wt of sample + mold (g)	2815.5
wt of mold (g)	324.3
wet wt of sample (g)	2491.2
water content % dry wt	19.0%
wet density of sample (g/cm ³)	2.3
dry wt. of sample (g)	2093.4
dry density (g/cm ³)	1.9
specific gravity	2.6
void ratio	0.35
porosity	26.1%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>H. Haupt</i> Date: <i>11-7-94</i>	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-109A	DEPTH	165.7-167.	LAB #	4-1162	HEIS #	NA
TESTED BY	FMW/HH	CONTACT	B. Williams	PHONE	376-3416	DATE	11/1/94
	1	2	3				
Wt. oven dry soil, g	30.00	30.00	30.00				
Wt. pycnometer + wetting agent, g	162.05	168.67	167.99				
Wt. pycnometer+wetting agent+ soil,	180.5	187.32	186.61				
Temperature (Tx), degrees C	18.4	18.5	18.4				
Specific gravity of wetting agent	1.00	1.00	1.00				
Specific gravity of soil at Tx	2.60	2.64	2.64				
Specific gravity of soil at 20 C	2.60	2.64	2.64				
AVG. Specific gravity of -10 material	2.63						
Wt. sample (SSD), g (B)	NA	NA	NA				
Wt. sample in water, g (C)	NA	NA	NA				
Wt. oven dry sample, g (A)	NA	NA	NA				
Bulk specific gravity, 23/23 C	NA	NA	NA				
Bulk specific gravity SSD, 23/23 C	NA	NA	NA				
Apparent specific gravity, 23/23 C	NA	NA	NA				
Size fraction, coarse	NA	NA	NA				
Size fraction, fine	NA	NA	NA				
Avg. specific gravity, 23/23 C	NA	NA	NA				
Avg. specific gravity based on:	NA	NA	NA				
COMMENTS:							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>B. Williams</i>				Date: 11/3/94			

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-109A	DEPTH	165.7-167.7'	LAB #	4-1162	HEIS #	NA
TESTED BY	HH/FMW	CONTACT	Williams	PHONE	376-3416	DATE	9/21/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	HH		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
9/21/94	501.22	436.09	62.50	65.13	373.59	17.43%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	11/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	1/4/95	SAMPLE WT. (g)	8.00		
Date	10/5/94	Sample pressure (psi)	0.8	% Calcium carbonate	1.6		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>R. T. M. [Signature]</i>				Date: <i>10/12/94</i>			

GEOTECHNICAL ENGINEERING LABORATORY
SIEVE/HYDROMETER ANALYSIS
GEL-07

WELL #	199-K-109A	DEPTH	165.7-167.7	LAB#	4-1162	HEIS #	NA
TESTED BY	FMW/HH	CONTACT	Williams	PHONE	6-3416	DATE	10/25/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	COMMENTS	GRAIN SIZE MM
2093.5	4"	0.0	0.0	100%		101.600
	2.5"	0.0	0.0	100%		63.500
	2"	0.0	0.0	100%		50.800
	1.5"	0.0	0.0	100%		38.100
	3/4"	0.0	0.0	100%		19.050
	3/8"	41.9	2.0	98%		9.525
WT. #10	#4	121.2	5.8	94%		4.750
SAMP. (g)	#10	440.8	21.1	79%		2.000
61.7	#40	7.4	12.0	69%	SAMPLE SPLIT	0.425
	#60	11.2	18.1	65%		0.250
	#100	18.9	30.6	55%		0.150
	#200	26.9	43.6	45%		0.075

HYDROMETER ANALYSIS

BALANCE NUMBER	3304	CALIBRATION DUE DATE	11/07/94
THERMOMETER NUMBER.	18	CALIBRATION DUE DATE	NA
HYDROMETER	1007	CALIBRATION DUE DATE	NA

WEIGHT OF SAMPLE	61.71	SPECIFIC GRAVITY of SAMPLE	2.6
COMP. CORRECTION	7	% TOTAL SAMPLE PASSING #10 SIEVE	100.0%

DATE / TIME	ELAPSED TIME	HYDRO. READING	HYDRO. CORRECTED	TEMP. CENT.	%SOIL in SUSPENSION	"K"	"L"	PARTICLE SIZE (mm)
11/1/94	0	0						
07:55	2	28.5	21.5	20	34.8%	0.01386	11.6	0.0334
	5	24	17	20	27.5%	0.01386	12.4	0.0218
	15	22	15	20	24.3%	0.01386	12.7	0.0127
	30	20	13	20	21.1%	0.01386	13.0	0.0091
	60	18	11	20	17.8%	0.01386	13.3	0.0065
	250	15	8	20	13.0%	0.01386	13.8	0.0033
11/2/94	1440	12	5	19	8.1%	0.01386	14.3	0.0014

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

Checked By: E. Haupt

Date: 11/3/94

199-K-110A

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WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-109A	8/29/94	B0BWF0	Y Manganese, filtered	45.00	Q	8.10	ppb
			Y Nickel, filtered	16.00	UQ		ppb
			Y Potassium, filtered	4800.00		576.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	7900.00	Q	4270.00	ppb
			Y Tin, filtered	56.00	LB	13.40	ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	8.70	L	2.87	ppb
	9/20/94	B0D0H9	Antimony-125	39.60		19.26	pCi/L
			Cesium-137	-4.80	U	5.92	pCi/L
			Cobalt-60	.39	U	7.84	pCi/L
			Ruthenium-106	34.50	U	36.96	pCi/L
			Strontium-90	803.00		140.70	pCi/L
			Tritium	158000.00		11710.00	pCi/L
		B0D0J5	Gross alpha	8.24	Q	3.00	pCi/L
			Gross beta	1140.00		80.60	pCi/L
			Strontium-90	614.00		114.00	pCi/L
			Tritium	181000.00		13450.00	pCi/L
	9/28/94	B0CBP8	Tritium	61100.00		4673.00	pCi/L
			Turbidity	48.00			NTU
	11/03/94	B0D5K9	Carbon-14	161.00		9.61	
			Specific conductance	394.00			umhos
			Temperature, field	14.50			
			pH	7.72			
	11/21/94	B0D8W2	Specific conductance	383.00			umhos
			Temperature, field	14.50			
			pH	7.92			
199-K-110A	5/13/94	B0BWF3	Antimony-125	10.20	U	14.96	pCi/L
			Carbon-14	126.00		8.05	
			Cesium-137	-2.52	U	8.12	pCi/L
			Cobalt-60	9.23		5.91	pCi/L
			Gross alpha	3.27		2.32	pCi/L
			Gross beta	24.70		4.54	pCi/L
			Ruthenium-106	-4.68	U	53.76	pCi/L
			Tritium	256.00	U	287.20	pCi/L
	7/07/94	B0C0Q2	Tritium	205.00	U	231.10	pCi/L
	7/15/94	B0C7L7	Antimony-125	-3.34	U	17.67	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	87.80		6.34	
			Cesium-137	-.18	U	8.53	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-110A	7/15/94	B0C7L7	Chloride	40000.00	D	13200.00	ppb
			Cobalt-60	0.00	U	8.32	pCi/L
			Fluoride	600.00		342.00	ppb
			Gross alpha	.72	U	1.01	pCi/L
			Gross beta	6.47		2.94	pCi/L
			Nitrate	18000.00	DH		ppb
			Nitrite	110.00	UH		ppb
			Phosphate	470.00	UH		ppb
			Ruthenium-106	60.00		52.54	pCi/L
			Specific conductance	570.00			umhos
			Sulfate	24000.00	D	5040.00	ppb
			Tritium	273.00	U	302.60	pCi/L
			Turbidity	3.10	H		NTU
		B0C7L8	Y Aluminum, filtered	42.00	BLQ	8.82	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	55.00		13.20	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	79000.00		16600.00	ppb
			Y Chromium, filtered	11.00	U		ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	U		ppb
			Y Iron, filtered	42.00		13.90	ppb
			Y Magnesium, filtered	13000.00		3120.00	ppb
			Y Manganese, filtered	150.00		27.00	ppb
			Y Nickel, filtered	30.00	L	8.10	ppb
			Y Potassium, filtered	5600.00		672.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	10000.00		5400.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	52.00	B	17.20	ppb
	8/31/94	B0CBP9	Tritium	514.00		349.00	pCi/L
			Turbidity	60.00	Q		NTU
	9/28/94	B0CYD6	Tritium	67.10	U	327.80	pCi/L
	10/24/94	B0D5L1	Antimony-125	1.00	U	11.08	pCi/L
			Carbon-14	108.00		7.81	
			Cesium-137	-.17	U	4.86	pCi/L
			Cobalt-60	1.27	U	4.96	pCi/L
			Ruthenium-106	-45.90	U	55.88	pCi/L
			Specific conductance	370.00			umhos
				359.00			umhos
			Temperature, field	14.20			
			pH	7.52			

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1086 Well no./depth 199-K-110A 16.4-17.4' VISCOSITY 1

Tested By: F.M. Williams/H.L. Benny/H. Hampt Date 05/24/94

Specimen Diameter (D, cm) 9.53 Specimen Length (L, cm) 13.87

Start Date	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
End Date	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94
End Time	00:00:30	00:00:30	00:00:30	00:00:30	00:00:30	00:00:30
Time Sec.	30	30	30	30	30	30
Volume, cm ³	166.9	162	152.9	120.1	112.2	103.6
Head, cm	80	80	80	83.9	83.9	83.9
"Q"	5.56E+00	5.40E+00	5.10E+00	4.00E+00	3.74E+00	3.45E+00
L/(A*H)	2.43E-03	2.43E-03	2.43E-03	2.32E-03	2.32E-03	2.32E-03
K, cm/sec	1.35E-02	1.31E-02	1.24E-02	9.28E-03	8.67E-03	8.00E-03
Kc, (K*Visc)	1.35E-02	1.31E-02	1.24E-02	9.28E-03	8.67E-03	8.00E-03

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 1.08E-02
 STANDARD DEVIATI 2.24E-03
 % STAND. DEV. 20.7%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks:

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

Checked By: H. Hampt

Date: 7/11/94

B-159

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-110A
Depth	16.4-17.4
Lab #	4-1086
Heis #	NA
Tested by	HLB/FMW/HH
Contact	Williams
Phone #	376-3416
Date	5/24/94
length (cm)	13.87
diameter (cm)	9.53
volume (cm ³)	989.33
wt of sample + mold (g)	2519.6
wt of mold (g)	303.1
wet wt of sample (g)	2216.5
dry wt of sample (g)	2143.7
wet density of sample (g/cm ³)	2.2
water content % dry wt	3.40%
dry density (g/cm ³)	2.2
specific gravity	2.8
void ratio	0.27
porosity	21.5%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt	Date: 7/11/94

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-110A	DEPTH	16.4-17.4	LAB #	4-1086	HEIS #	NA
TESTED BY	FMW/HH	CONTACT	Williams	PHONE	6-3416	DATE	6/8/94

	1	2	3	4
Wt. oven dry soil, g	30.00	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	167.61	168.18	167.61	168.51
Wt. pycnometer+wetting agent+ soil,	187.16	187.74	187.01	187.89
Temperature (Tx), degrees C	26.2	25.5	25.6	25.6
Specific gravity of wetting agent	1.00	1.00	1.00	1.00
Specific gravity of soil at Tx	2.87	2.87	2.83	2.82
Specific gravity of soil at 20 C	2.87	2.87	2.83	2.82
AVG. Specific gravity of -10 material	2.85			
Wt. sample (SSD), g (B)	1172.1	NA	NA	NA
Wt. sample in water, g (C)	739	NA	NA	NA
Wt. oven dry sample, g (A)	1159	NA	NA	NA
Bulk specific gravity, 23/23 C	2.68	NA	NA	NA
Bulk specific gravity SSD, 23/23 C	2.71	NA	NA	NA
Apparent specific gravity, 23/23 C	2.76	NA	NA	NA
Size fraction, coarse	53.8	NA	NA	NA
Size fraction, fine	46.2	NA	NA	NA
Avg. specific gravity, 23/23 C	2.76	NA	NA	NA
Avg. specific gravity based on:	BULK	NA	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: H. Haupt Date: 7/11/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-110A	DEPTH	16.4-17.4	LAB #	4-1086	HEIS #	NA
TESTED BY	LDB	CONTACT	Williams	PHONE	376-3416	DATE	5/24/94
GEL-14 SOIL MOISTURE							
BALANCE	3304/3311	CALIBRATION DUE	8/7/94	TESTED BY	HLB/FMW/HH		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
5/24/94	598.00	577.59	62.02	20.41	515.57	3.96%	FMW
5/24/94	2519.6	2445.75	303.06	73.8	2142.7	3.4%	HH
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	6/3/94	Sample pressure (psi)	0.3	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>W. Lang</i>				Date: <i>7/11/94</i>			

ESTIMATION OF THE WATER HOLDING CAPACITY OF SOIL ON AN INTACT SAMPLE

Estimate of the Field Capacity

	SAMPLE 4-1086	SAMPLE 4-1087
A. Length of Sample (cm)	13.87	11.10
B. Diameter of Sample (cm)	9.53	9.57
C. Volume of Sample (g/cm**3)	988.85	798.03
D. Wet (after 48 hr drain) Sample Wt. +Tare Wt. (g)	2915.42	2568.79
E. Dry Sample Wt. + Tare Wt. (g)	2742.14	2381.59
F. Tare Wt. (g)	599.45	693.32
G. Water Content (estimated Field Capacity) (%)	8.09	11.09

Tested By: P. R. Heller Date: 6/8/94

Reference: Cassel, D. K. and D. R. Nielsen. 1986. "Field Capacity and Available Water." In Methods Soil Analysis, Part 1, ed. A. Klute, pp. 901-924. American Society of Agronomy, Madison Wisconsin.

Balance: ETAL 3315 Expires: 8/7/94

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

Checked By: R. T. M. [Signature] Date: 7/1/94

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-111A	CONTACT	WILLIAMS	ORIG COD	86950	PHONE	6-3416
LAB #	4-1086	DEPTH	16.4-17.4	TESTED BY	HH	DATE	07/07/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2428.8	4"	0.0	0.0	100.0	101.600	
	2.5"	0.0	0.0	100.0	63.500	
	2"	331.4	13.6	86.4	50.800	
	1.5"	516.2	21.3	78.7	38.100	
	3/4"	707.2	29.1	70.9	19.050	
	3/8"	887.5	36.5	63.5	9.525	
WT.-#10	# 4	1042.8	42.9	57.1	4.750	
SAMP.(g)	#10	1396.0	57.5	42.5	2.360	
245.9	#40	155.7	63.3	15.6	0.500	
	#60	175.6	71.4	12.2	0.250	
	#100	189.4	77.0	9.8	0.150	
	#200	203.1	82.6	7.4	0.075	

Sieve Analysis Data for Sample 4-1086

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

Checked By: *J. F. Reyea*

Date: *7-8-94*

Moisture Retention Sample Number 4-1086

SAMPLE NO. 4-1086 Contact B WILLIAMS Well No. 199-K-110A Operable Unit 100 K HEIS No. N/A Depth 16.4'-17.4'

SAMPLE NO.	4-1086	Operable Unit	100 K
Contact	B WILLIAMS	HEIS No.	N/A
Well No.	199-K-110A	Depth	16.4'-17.4'

TEMPE CELLS	Sample #	4-1086	1 Bar Primary	Drying Curve (vacuum saturated)					
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	2.0	4.0
error in tension value +/-			0.1	0.1	0.1	0.1	0.1	0.1	0.1
container number	MC-7	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
weight of container/ring,+wet sample	176.94	568.84	590.98	592.20	592.33	592.45	592.34	591.37	590.03
weight of container/ring,+ dry sample	176.58	568.42	568.20	568.20	568.20	568.20	568.20	568.20	568.20
weight of moisture	0.36	0.42	22.78	24.00	24.13	24.25	24.14	23.17	21.83
weight of container and ring	60.74	431.66	431.80	431.80	431.80	431.80	431.80	431.80	431.80
weight of dry sample	116.20	136.76	136.40	136.40	136.40	136.40	136.40	136.40	136.40
moisture content, wt. %	0.3%		16.7%	17.6%	17.7%	17.8%	17.7%	17.0%	16.0%
date measured			7/26/94	7/27/94	7/28/94	7/29/94	8/1/94	8/2/94	8/3/94
temperature deg. C			28	28	27	28	27	27	28

TEMPE CELLS	Sample #	4-1086	1 Bar Primary	Drying Curve					
tension in cm	6.0	8.0	12.5	25.5	32	51	70	103	200
error in tension value +/-	0.1	0.1	0.1	1	1	1	1	2	2
container number	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
weight of container/ring,+wet sample	589.75	589.44	588.16	587.14	586.38	585.31	584.26	583.10	580.46
weight of container/ring,+ dry sample	568.20	568.20	568.20	568.20	568.20	568.20	568.20	568.20	568.20
weight of moisture	21.55	21.24	19.96	18.94	18.18	17.11	16.06	14.90	12.26
weight of container and ring	431.80	431.80	431.80	431.80	431.80	431.80	431.80	431.80	431.80
weight of dry sample	136.40	136.40	136.40	136.40	136.40	136.40	136.40	136.40	136.40
moisture content, wt. %	15.8%	15.6%	14.6%	13.9%	13.3%	12.5%	11.8%	10.9%	9.0%
date measured	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94
temperature deg. C	27	26	26	26	27	27	27	26	26

TEMPE CELLS	Sample #	4-1086	1 Bar Primary	Drying Curve		
tension in cm	300	500	700	850	1000	1000
error in tension value +/-	20	20	20	20	20	N/A
container number	TC-22	TC-22	TC-22	TC-22	TC-22	MC-22
weight of container/ring,+wet sample	579.31	578.52	577.95	577.80	577.27	577.31
weight of container/ring,+ dry sample	568.20	568.20	568.20	568.20	568.20	568.20
weight of moisture	11.11	10.32	9.75	9.60	9.07	9.11
weight of container and ring	431.80	431.80	431.80	431.80	431.80	431.80
weight of dry sample	136.40	136.40	136.40	136.40	136.40	136.40
moisture content, wt. %	8.1%	7.6%	7.1%	7.0%	6.6%	6.7%
date measured	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94
temperature deg. C	26	26	26	26	27	26
volume of brass ring	68.26					

Sample Bulk Density =	2.00	g/cm³	Cell wt. before cleanup =	432.32
Field Bulk Density =	2.2	g/cm³	Cell wt. after cleanup =	431.95
Fraction < 2 mm =	0.43		Average of all 3	431.98

TEMPE CELLS	Sample #	4-1086 1 Bar Main Wetting Curve							
tension in cm	N/A	N/A	1000	1000	1000	700	500	300	203
error in tension value +/-									
container number	MC-7	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
weight of container/ring,+wet sample	176.94	560.09	566.97	567.38	567.45	568.09	568.33	569.80	571.17
weight of container/ring,+ dry sample	176.58	559.66	559.10	559.10	559.10	559.10	559.10	559.10	559.10
weight of moisture	0.36	0.43	7.87	8.28	8.35	8.99	9.23	10.70	12.07
weight of container and ring	60.74	419.63	419.60	419.60	419.60	419.60	419.60	419.60	419.60
weight of dry sample	116.20	140.03	139.50	139.50	139.50	139.50	139.50	139.50	139.50
moisture content, wt. %	0.31%		5.64%	5.94%	5.99%	6.44%	6.62%	7.67%	8.65%
date measured			8/9/94	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94	8/17/94
temperature deg. C			27	27	27	28	26	27	26

TEMPE CELLS	Sample #	4-1086 1 Bar Main Wetting Curve							
tension in cm	104	71.5	53	32.5	23.5	11.0	7.5	6	4
error in tension value +/-									
container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
weight of container/ring,+wet sample	573.34	574.07	574.97	575.59	576.02	576.69	577.08	577.38	577.77
weight of container/ring,+ dry sample	559.10	559.10	559.10	559.10	559.10	559.10	559.10	559.10	559.10
weight of moisture	14.24	14.97	15.87	16.49	16.92	17.59	17.98	18.28	18.67
weight of container and ring	419.60	419.60	419.60	419.60	419.60	419.60	419.60	419.60	419.60
weight of dry sample	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.50
moisture content, wt. %	10.21%	10.73%	11.38%	11.82%	12.13%	12.61%	12.89%	13.10%	13.38%
date measured	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	8/25/94	8/26/94	8/27/94	8/29/94
temperature deg. C	27	26	27	27	27	25	26	26	26

TEMPE CELLS	Sample #	4-1086 1 Bar Main Wetting Curve						
tension in cm	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
error in tension value +/-								
container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
weight of container/ring,+wet sample	578.12	578.53	578.78	578.93	579.01	579.33	579.74	579.74
weight of container/ring,+ dry sample	559.10	559.10	559.10	559.10	559.10	559.10	559.10	559.10
weight of moisture	19.02	19.43	19.68	19.83	19.91	20.23	20.64	20.64
weight of container and ring	419.60	419.60	419.60	419.60	419.60	419.60	419.60	419.60
weight of dry sample	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.50
moisture content, wt. %	13.63%	13.93%	14.11%	14.22%	14.27%	14.50%	14.80%	14.80%
date measured	8/30/94	8/31/94	9/1/94	9/2/94	9/6/94	9/7/94	9/8/94	9/8/94
temperature deg. C	26	26	27	28	26	26	26	26

Cell wt. before cleanup = _____ grams
 Cell wt. after cleanup = _____ grams
 Average of all 3 139.88 grams

volume of brass ring 68.26 cm³
 Sample Bulk Density = 2.04 g/cm³

KETTLES		Sample # 4-1086 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA13	BA14	BA13	BA14	BA13	BA14	BB13	BB14
weight of container/ring,+wet sample	53.82	51.53	53.66	51.36	53.53	51.27	51.02	52.23
weight of container/ring,+ dry sample	52.23	49.95	52.19	49.88	52.10	49.84	49.81	50.96
weight of moisture	1.59	1.58	1.47	1.48	1.43	1.43	1.21	1.27
Container Tare Wt.,g	30.43	28.06	30.43	28.06	30.43	28.06	28.34	28.42
weight of dry sample	21.80	21.89	21.76	21.82	21.67	21.78	21.47	22.54
moisture content %	7.29%	7.22%	6.76%	6.78%	6.60%	6.57%	5.64%	5.63%
date measured	8/10/94	8/10/94	8/16/94	8/16/94	8/22/94	8/22/94	8/10/94	8/10/94
temperature deg. C	27	27	27	27	27	27	27	27

KETTLES		Sample # 4-1086 15 Bar Drying Curve						
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	10.0	10.0
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB13	BB14	BB13	BB14	BC13	BC14	BC13	BC14
weight of container/ring,+wet sample	50.68	51.08	50.55	50.97	51.66	51.02	51.97	51.05
weight of container/ring,+ dry sample	49.54	49.91	49.51	49.89	50.86	50.20	50.84	50.16
weight of moisture	1.14	1.17	1.04	1.08	0.80	0.82	1.13	0.89
Container Tare Wt.,g	28.34	28.42	28.34	28.42	30.59	29.07	30.59	29.07
weight of dry sample	21.20	21.49	21.17	21.47	20.27	21.13	20.25	21.09
moisture content %	5.38%	5.44%	4.91%	5.03%	3.95%	3.88%	5.58%	4.22%
date measured	8/20/94	8/20/94	8/27/94	8/27/94	8/10/94	8/10/94	8/16/94	8/16/94
temperature deg. C	27	27	26	26	27	27	27	27

Water Potential Data for CX-2 Samples

Sample No.	4-1086
Container Number	BC13 BC14
Aw Reading	0.993 0.908
Temperature °C	28.3 27.7
Water Potential, Bars	9.8 133.9

Can ID No	BC13 BC14
Can + Soil Wet wt., g	51.73 50.57
Can + Soil Dry wt., g	50.81 50.11
Can Tare wt., g	30.59 29.07
Weight of Water, g	0.92 0.46
Dry Weight of Sample, g	20.22 21.04
Moisture Content, wt. %	4.55% 2.19%
date measured	8/29/94 8/29/94

POINTS SELECTED FOR PLOTTING

Sample # 4-1086

container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
Tension in cm	1.0	4.0	12.0	20.0	31.0	52.0	70.1	100.9	213.0	300.0	500.0
Primary Drying Curve											
Tempe Main Drying Curve	14.8%	13.9%	13.6%	13.2%	12.7%	12.2%	12.0%	11.5%	9.6%	8.6%	7.6%
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94	9/16/94	9/18/94	9/19/94	9/21/94
container number	TC-6	TC-6	BA13	BA13	BA13	BB13	BB13	BB13	BC14	TC-6	TC-6
tension in cm	690	1000	510	714	1020	2040	3060	5100	136530	1000	700
Tempe Primary Drying Curve											
Tempe Main Drying Curve	7.1%	6.6%									
Kettle/CX-2 Main Drying Curve			7.3%	6.8%	6.6%	5.6%	5.4%	5.0%	2.2%		
Tempe Main Wetling Curve										6.0%	6.4%
date measured	9/22/94	9/23/94	8/10/94	8/16/94	8/22/94	8/10/94	8/20/94	8/27/94	8/29/94	8/11/94	8/12/94
container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
tension in cm	500	300	203	104	72	53	32.5	23.5	11.0	7.5	6.0
Tempe Primary Drying Curve											
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	6.6%	7.7%	8.7%	10.2%	10.7%	11.4%	11.8%	12.1%	12.6%	12.9%	13.1%
date measured	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	8/25/94	8/26/94	8/27/94
container number	TC-6	TC-6	TC-6	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22
tension in cm	4.0	2.0	1.0	1.0	2.0	4.0	6.0	8.0	12.5	25.5	32.0
Tempe Primary Drying Curve				17.7%	17.0%	16.0%	15.8%	15.6%	14.6%	13.9%	13.3%
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	13.4%	13.6%	14.8%								
date measured	8/29/94	8/30/94	1/0/00	8/1/94	8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94
container number	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22	TC-22		
tension in cm	51.0	70.0	103.0	200.0	300.0	500.0	700.0	850.0	1000.0		
Tempe Primary Drying Curve	12.5%	11.8%	10.9%	9.0%	8.1%	7.6%	7.1%	7.0%	6.7%		
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	8/11/94	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/24/94		

B-169

WHC-SD-EN-DP-090, Rev. 0

Points from kettle are enclosed by the double outline

Points from CX-2 are enclosed by the single outline

TEMPE CELLS	Sample #	4-1086 1 Bar Main Drying Curve (natural saturation from the bottom)							
tension in cm	0.0	0.0	0.0	4.0	12.0	20.0	31.0	52.0	70.1
error in tension value +/-									
container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6
weight of container/ring,+wet sample	579.01	579.33	579.74	578.56	578.11	577.46	576.81	576.15	575.82
weight of container/ring,+ dry sample	559.10	559.10	559.10	559.10	559.10	559.10	559.10	559.10	559.10
weight of moisture	19.91	20.23	20.64	19.46	19.01	18.36	17.71	17.05	16.72
weight of container and ring	419.60	419.60	419.60	419.60	419.60	419.60	419.60	419.60	419.60
weight of dry sample	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.50
moisture content, wt.%	14.27%	14.50%	14.80%	13.95%	13.63%	13.16%	12.70%	12.22%	11.99%
date measured	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94
temperature deg. C	26	26	26	26	25	26	27	26	26

TEMPE CELLS	Sample #	4-1086 1 Bar Main Drying Curve						
tension in cm	100.9	213.0	300	500	690	1000	N/A	N/A
error in tension value +/-								
container number	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	TC-6	MC-7
weight of container/ring,+wet sample	575.18	572.49	571.10	569.71	569.03	568.28	568.29	209.23
weight of container/ring,+ dry sample	559.10	559.10	559.10	559.10	559.10	559.10	559.10	200.03
weight of moisture	16.08	13.39	12.00	10.61	9.93	9.18	9.19	9.20
weight of container and ring	419.60	419.60	419.60	419.60	419.60	419.60	419.60	60.75
weight of dry sample	139.50	139.50	139.50	139.50	139.50	139.50	139.50	139.28
moisture content, wt.%	11.53%	9.60%	8.60%	7.61%	7.12%	6.58%	6.59%	6.61%
date measured	9/16/94	9/18/94	9/19/94	9/21/94	9/22/94	9/23/94		9/26/94
temperature deg. C	25	26	26	26	26	26		26

volume of brass ring 68.26 cm³
 Sample Bulk Density = 2.04 g/cm³
 Cell wt. before filling = 419.63 grams
 Cell wt. before cleanup = 419.55 grams
 Cell wt. after cleanup = 419.94 grams
419.71 Average of all 3

B-170

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1086 1 of 6

Tested By: J.F. Relyea Date 6/8/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	8/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.60 cm
 Column Length 15.06 cm
 Saturated Sample + Column Weight 5081.92 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.75 g/cm³
 Filler Final Moisture Content Data
 Container ID No
 Container + Filler Wet wt. g
 Container+ Filler Dry wt. g
 Container Tare wt. g
 Dry Filler Wt. g
 Weight of Water g
 Filler Moisture Content by weight

Filler Soil ID/Sample No. 4-1086
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 181.7 g
 Specific Gravity g/cm³
 Column Volume Filled 94.1 cm³
 Soil Added To Fill Bottom Void - Yes (X) No ()
 Dry Weight of Soil Added 112.0 g
 Specific Gravity g/cm³
 Column Volume Filled 50.8 cm³

Type of Water tap water

REMARKS The bulk density of material used to fill the top was 1.69. This value was used to estimate the volume filled on the bottom.
 SAMPLE NO. 4-1086
 Contact B WILLIAMS
 Well No. 199-K-110A
 Operable Unit 100 K
 HEIS No. N/A
 Depth 16.4'-17.4'

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

Checked By: PC Helbert Date: 10-4-94

B-171

WHC-SD-EN-DP-090, Rev. 0

SAMPLE NO.	4-1086
Contact	B WILLIAMS
Well No.	199-K-110A
Operable Unit	100 K
HEIS No.	N/A
Depth	16.4'-17.4'

Mean Tension	0	-19	-36	-88	-247	-296
Std. Dev. (Tension)	0	1	5	4	3	9
Mean K value	1.1E-02	1.4E-04	1.0E-05	1.4E-06	4.6E-07	1.4E-07
Std.Dev./Mean	21%	46%	62%	24%	21%	55%
Water Content, Vol. %	13.1%	11.4%		9.7%	8.5%	8.1%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1086

The data package consists of three graphs, six pages of computer printout (the preparation, data and analysis of the test) three pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data for the original sample used for obtaining the minus ten mesh sample for moisture retention. A grain size distribution data sheet is attached for the sample that was actually tested for unsaturated hydraulic conductivity.

The Grain Size distribution graph shows both the cumulative and fraction retained on the sieve used for unsat. K testing. Only one sieve was suitable for testing, so only one grain size distribution was determined. However, quite a bit of filler material was required from the other sieve. We had to assume that the material in the two sieves was the same to correct for the water content of the filler. The corrected curve on the grain size distribution graph was obtained by subtracting the amount of filler expected in that size fraction (based on sieve data from the whole sample).

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sieve). It is raw in the respect that the water content values obtained were multiplied by 2.26 g/cm³; the bulk density of the sieve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.35 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are just barely above the corrected curve, which is quite good considering the number of corrections that had to be made.

J.F. RELYEA
376-4676
10/4/94

B-172

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1086

Grain Size Distribution for Test Sample 4-1086

B-174

Moisture Retention Curve From Unsaturated
Hydraulic Conductivity Test Sample 4-1086

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1086

Page 2 of 6

Tested By: J.F. Relyea Date: 6/8/94
 Procedure No: GEL-32 Rev. 1 Date Issue: 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue: N/A

Container No. USK-6
 Container + wet soil wt. 3139.45 g
 Container + dry soil wt. 3012.96 g
 Container Tare Wt. 583.51 g
 Dry soil wt. 2429.45 g
 Moisture Content 5.2% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	8/7/94
Gauge	5667	10/25/94

Empty Column Wt. 2452.80 g (before cleanup)
 Empty Column Wt. — g (after cleanup)

Start Date	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/11/94	6/12/94	6/18/94	6/19/94
Start Time	10:40	11:00	11:21	11:47	12:07	9:29	10:42	7:09	8:26	7:29	12:40
End Date	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/12/94	6/13/94	6/19/94	6/20/94
End Time	11:00	11:21	11:47	12:07	12:23	10:42	11:40	8:26	5:52	12:40	7:10
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters	42.1	40.9	39.8	38.7	37.7	50.0	45.4	50.0	45.5	38.9	30.5
Outlet Burette Reading End, milliliters	40.9	39.8	38.7	37.7	37.1	45.4	43.2	45.5	43.2	30.5	24.1
Inlet Tensiometer reading, cm	start	-15	-19	-18	-18	-19	-28	-35	-83	-89	-92
	end	-19	-18	-18	-19	-21	-35	-39	-89	-90	-92
Outlet Tensiometer reading, cm	start	-17	-19	-19	-19	-20	-23	-40	-81	-82	-95
	end	-19	-19	-19	-20	-22	-40	-45	-82	-82	-88
Weight of Column and Wet Sample, g					5056.28			* Before -> 5035.11 After -> 5033.33			5030.15

REMARKS * 6-17-94 Changed bottom tensiometer.

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

Checked By: *[Signature]*

Date: 10-4-94

B-176

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1086

Page 3 of 6

Tested By: J.F. Relyea

Date 6/20/94

Start Date		6/21/94	6/22/94	6/23/94	6/26/94	6/28/94	6/30/94	7/1/94	7/2/94	7/3/94	7/4/94	7/5/94
Start Time		6:12	6:14	6:17	8:56	5:57	6:09	6:03	8:13	9:28	7:38	9:29
End Date		6/22/94	6/23/94	6/24/94	6/27/94	6/29/94	7/1/94	7/2/94	7/3/94	7/4/94	7/5/94	7/6/94
End Time		6:14	6:17	6:15	5:56	5:32	6:03	8:13	9:28	7:38	9:21	6:03
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		42.8	39.8	37.3	47.6	47.6	48.0	46.1	44.6	44.0	43.6	50.0
Outlet Burette Reading End, milliliters		39.8	37.3	35.2	45.6	47.4	46.1	44.6	44.0	43.6	43.5	47.9
Inlet Tensiometer reading, cm	start	-243	-245	-257	-249	-285	-302	-300	-301	-291	-281	-279
	end	-245	-257	-240	-246	-290	-300	-301	-291	-281	-279	-290
Outlet Tensiometer reading, cm	start	-239	-245	-255	-248	-279	-304	-309	-308	-293	-279	-280
	end	-245	-255	-237	-247	-265	-309	-308	-293	-279	-280	-303
Weight of Column and Wet Sample, g					5011.71							5006.35

REMARKS

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

Checked By: PAHLLER Date: 10-4-94

B-177

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO. 4-1086 Page 4 of 6
 Tested By: J.F. Relyea Date 10/4/94

Tensiometer Separation	<u>10.0 cm</u>	Column Volume	<u>1090.5 cm³</u>	Test Sample Bulk Density	<u>2.26 g/cm³</u>
Column Length	<u>15.1 cm</u>	Filler Volume	<u>144.9 cm³</u>	Test Sample Porosity	<u>0.18 cm³/cm³</u>
Column Diameter	<u>9.6 cm</u>	Filler Dry Wt.	<u>293.7 g</u>	Empty Column Wt.	<u>2452.8 g, Average</u>
Column Area	<u>72.4 cm²</u>	Sample Volume	<u>945.6 cm³</u>	Field Sample Bulk Density	<u>N/A g/cm³</u>
Final Moisture Content	<u>5.2% by wt.</u>	Sample Dry Wt.	<u>2135.7 g</u>	Type of water used	<u>Tap Water</u>

Start Date		6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/11/94
Start Time		10:40	11:00	11:21	11:47	12:07	9:29	10:42	7:09
End Date		6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/12/94
End Time		11:00	11:21	11:47	12:07	12:23	10:42	11:40	8:26
Total Elapsed, sec		1200	1260	1560	1200	960	4380	3480	91020
Volume, cm³		1.20	1.10	1.10	1.00	0.60	4.60	2.20	4.50
Tension - inlet, cm		-17	-19	-18	-19	-20	-32	-37	-86
Tension - outlet, cm		-18	-19	-19	-20	-21	-32	-43	-82
Average Tension, cm		-18	-19	-19	-19	-21	-32	-40	-84
K, cm/sec	1.08E-02	1.38E-04	2.41E-04	9.74E-05	1.15E-04	8.63E-05	1.45E-05	5.63E-06	1.24E-06
Weight of Column + Wet Sample, g	5081.92					5056.28			
Weight of Water in Filler, g (from MRC)	56.80					49.50			
Weight of Water in Sample, g	142.87					124.53			
Moisture Content (volumetric %)	15.1%					13.2%			

REMARKS

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

Checked By: _____

Date: _____

B-178

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1086 Page 5 of 6
 Tested By: J.F. Relyea Date 10/4/94

Start Date	6/12/94	6/18/94	6/19/94	6/21/94	6/22/94	6/23/94	6/26/94	6/30/94	7/1/94
Start Time	8:26	7:29	12:40	6:12	6:14	6:17	8:56	6:09	6:03
End Date	6/13/94	6/19/94	6/20/94	6/22/94	6/23/94	6/24/94	6/27/94	7/1/94	7/2/94
End Time	5:52	12:40	7:10	6:14	6:17	6:15	5:56	6:03	8:13
Total Elapsed, sec	77160	105060	66600	86520	86580	86280	75600	86040	94200
Volume, cm ³	2.30	8.40	6.40	3.00	2.50	2.10	2.00	1.90	1.50
Tension - inlet, cm	-90	-91	-91	-244	-251	-249	-248	-301	-301
Tension - outlet, cm	-82	-92	-89	-242	-250	-246	-248	-307	-309
Average Tension, cm	-86	-91	-90	-243	-251	-247	-248	-304	-305
K, cm/sec	1.65E-06	1.05E-06	1.77E-06	5.99E-07	4.43E-07	4.48E-07	3.65E-07	1.97E-07	1.22E-07
Weight of Column + Wet Sample, g			5030.15				5011.71		
Weight of Water in Filler, g (from MRC)			42.07				36.83		
Weight of Water in Sample, g			105.83				92.63		
Moisture Content (volumetric %)			11.2%				9.8%		

REMARKS

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

Checked By:

PC-Her

Date: 10-4-94

B-179

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1086
 Tested By: J F. Relyea

Date Page 6 of 6
 10/4/94

Start Date	7/2/94	7/3/94	7/5/94						
Start Time	8:13	9:28	9:29						
End Date	7/3/94	7/4/94	7/6/94						
End Time	9:28	7:38	6:03						
Total Elapsed, sec	90900	79800	74040						
Volume, cm ³	0.60	0.40	2.10						
Tension - inlet, cm	-296	-286	-285						
Tension - outlet, cm	-301	-286	-292						
Average Tension, cm	-298	-286	-288						
K, cm/sec	6.29E-08	6.92E-08	2.30E-07						
Weight of Column + Wet Sample, g			5006.35						
Weight of Water in Filler, g (from MRC)			35.30						
Weight of Water in Sample, g			88.80						
Moisture Content (volumetric %)			9.4%						

REMARKS

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

Checked By:

P. R. Heller

Date: 10-4-94

B-180

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1087 Well no./depth 199-K-110A 39.9-41.9 VISCOSITY 1

Tested By: F.M. Williams/H.L. Benny/H. Hampt Date 05/24/94

Specimen Diameter (D, cm) 9.57 Specimen Length (L, cm) 11.1

Start Date	24-May-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00
End Date	24-May-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94	02-Jun-94
End Time	00:01:30	00:01:00	00:01:00	00:01:00	00:01:00	00:01:00
Time Sec.	90	60	60	60	60	60
Volume, cm ³	41.5	98.2	96.2	89.9	88	78.9
Head, cm	95.3	72.4	72.4	72.4	72.4	71.1
"Q"	4.61E-01	1.64E+00	1.60E+00	1.50E+00	1.47E+00	1.31E+00
L/(A*H)	1.62E-03	2.13E-03	2.13E-03	2.13E-03	2.13E-03	2.17E-03
K, cm/sec	7.47E-04	3.49E-03	3.42E-03	3.19E-03	3.13E-03	2.85E-03
Kc, (K*Visc)	7.47E-04	3.49E-03	3.42E-03	3.19E-03	3.13E-03	2.85E-03

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 3.22E-03

STANDARD DEVIATI 2.26E-04

% STAND. DEV. 7.0%

Remarks: Sample void in top filled with coarse gravel.

First reading not included in average.

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

Checked By: H.L. Hampt

Date: 7/11/94

WHC-SD-EN-DP-090, Rev. 0

B-181

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-110A
Depth	39.9-41.9
Lab #	4-1087
Heis #	NA
Tested by	HLB/FMW/HH
Contact	Williams
Phone #	376-3416
Date	5/24/94
length (cm)	11.10
diameter (cm)	9.57
volume (cm ³)	798.41
wt of sample + mold (g)	2097.9
wt of mold (g)	307.5
wet wt of sample (g)	1790.4
dry wt of sample (g)	1687.4
wet density of sample (g/cm ³)	2.2
water content % dry wt	6.10%
dry density (g/cm ³)	2.1
specific gravity	2.7
void ratio	0.26
porosity	20.8%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt Date: 7/11/94	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-110A	DEPTH	39.9-41.9'	LAB #	4-1087	HEIS #	NA
TESTED BY	FMW/HH	CONTACT	Williams	PHONE	6-3416	DATE	6/8/94
	1	2	3				
Wt. oven dry soil, g	30.00	30.00	30.00			temp	K
Wt. pycnometer + wetting agent, g	163.36	167.81	163.36			18	1.0004
Wt. pycnometer+wetting agent+ soil,	182.2	186.59	182.2			19	1.0002
Temperature (Tx), degrees C	25.9	25.5	25.6			20	1.0000
Specific gravity of wetting agent	1.00	1.00	1.00			21	0.9998
Specific gravity of soil at Tx	2.69	2.67	2.69			22	0.9996
Specific gravity of soil at 20 C	2.68	2.67	2.68			23	0.9993
AVG. Specific gravity of -10 material	2.68					24	0.9991
Wt. sample (SSD), g (B)	906.1	NA	NA			25	0.9989
Wt. sample in water, g (C)	571.6	NA	NA			26	0.9986
Wt. oven dry sample, g (A)	899	NA	NA			27	0.9983
Bulk specific gravity, 23/23 C	2.69	NA	NA			28	0.998
Bulk specific gravity SSD, 23/23 C	2.71	NA	NA			29	0.9977
Apparent specific gravity, 23/23 C	2.75	NA	NA			30	0.9974
Size fraction, coarse	55.5	NA	NA				
Size fraction, fine	44.5	NA	NA				
Avg. specific gravity, 23/23 C	2.69	NA	NA				
Avg. specific gravity based on:	BULK	NA	NA				
COMMENTS:							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Williams</i>				Date: <i>7/11/94</i>			

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-110A	DEPTH	39.9-41.9'	LAB #	4-1087	HEIS #	NA
TESTED BY	LDB	CONTACT	Williams	PHONE	376-3416	DATE	5/24/94
GEL-14 SOIL MOISTURE							
BALANCE	3304/3311	CALIBRATION DUE	8/7/94	TESTED BY	HLB/FMW/HH		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
5/24/94	495.20	451.91	61.71	43.29	390.20	11.09%	HH
5/24/94	2097.9	1995.8	307.52	102.1	1688.3	6.0%	HH
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	6/3/94	Sample pressure (psi)	0.5	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Haupt</i>				Date: <i>7/11/94</i>			

ESTIMATION OF THE WATER HOLDING CAPACITY OF SOIL ON AN INTACT SAMPLE

Estimate of the Field Capacity

	SAMPLE 4-1086	SAMPLE 4-1087
A. Length of Sample (cm)	13.87	11.10
B. Diameter of Sample (cm)	9.53	9.57
C. Volume of Sample (g/cm**3)	988.85	798.03
D. Wet (after 48 hr drain) Sample Wt. +Tare Wt. (g)	2915.42	2568.79
E. Dry Sample Wt. + Tare Wt. (g)	2742.14	2381.59
F. Tare Wt. (g)	599.45	693.32
G. Water Content (estimated Field Capacity) (%)	8.09	11.09

Tested By: P. R. Heller Date: 6/8/94

Reference: Cassel, D. K. and D. R. Nielsen. 1986. "Field Capacity and Available Water." In Methods Soil Analysis, Part 1, ed. A. Klute, pp. 901-924. American Society of Agronomy, Madison Wisconsin.

Balance: ETAL 3315 Expires: 8/7/94

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

Checked By: *P. R. Heller* Date: 7/1/94

110A SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-171A	CONTACT	WILLIAMS	ORIG COD	86950	PHONE	6-3416
LAB #	4-1087	DEPTH	39.9-41.9	TESTED BY	HH	DATE	06/29/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2245.4	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	50.800	
	1.5"	442.0	19.7	80.3	38.100	
	3/4"	891.1	39.7	60.3	19.050	
	3/8"	1072.7	47.8	52.2	9.525	
WT.-#10	# 4	1091.8	48.6	51.4	4.750	
SAMP.(g)	#10	1322.6	58.9	41.1	2.360	
144.1	#40	28.9	20.1	32.9	0.500	
	#60	38.9	27.0	30.0	0.250	
	#100	47.7	33.1	27.5	0.150	
	#200	62.3	43.2	23.3	0.075	

Sieve Analysis Data for Sample 4-1087

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

Checked By: *J. Relyea*

Date: *7-8-94*

B-186

SAMPLE NO.	4-1087
Contact	B WILLIAMS
Well No.	199-K-110A
Operable Unit	100 K
HEIS No.	N/A
Depth	39.9'-41.9'

Mean Tension	0	-25	-62	-79	-126	-230	-291
Std. Dev. (Tension)	0	3	9	4	3	8	
Mean K value	3.2E-03	5.1E-06	9.6E-07	4.8E-07	3.6E-07	1.3E-07	
Std.Dev./Mean	7%	10%	41%	22%	27%	29%	
Moisture Content, Vol.	23.7%	21.3%	N/A	19.7%	19.1%	18.8%	18.5%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1087

The data package consists of three graphs, seven pages of computer printout (the preparation, data and analysis of the test) four pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data for the original sample used for obtaining the minus ten mesh sample for moisture retention. A grain size distribution data sheet is attached for the sample that was actually tested for unsaturated hydraulic conductivity. Only one liner was suitable for testing, thus only one grain size distribution and bulk density value are available for this test.

A moisture retention curve was obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 2.05 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.41 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are essentially identical to those values predicted from the moisture retention test.

J.F. RELYEA
376-4676
10/4/94

B-187

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1087

Grain Size Distribution for Test Sample 4-1087

Moisture Retention Curve From Unsaturated
Hydraulic Conductivity Test Sample 4-1087

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1087 1 of 7

Tested By: J.F. Relyea Date 6/8/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	8/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.58 cm
 Column Length 15.09 cm
 Saturated Sample + Column Weight 4773.15 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.69 g/cm³
 Filler Final Moisture Content Data
 Container ID No
 Container + Filler Wet wt. g
 Container+ Filler Dry wt. g
 Container Tare wt. g
 Dry Filler Wt. g
 Weight of Water g
 Filler Moisture Content by weight

Filler Soil ID/Sample No. 4-1087
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 54.47 g
 Specific Gravity g/cm³
 Column Volume Filled 19.1 cm³
 Soil Added To Fill Bottom Void - Yes (X) No ()
 Dry Weight of Soil Added 4.79 g
 Specific Gravity g/cm³
 Column Volume Filled cm³

Type of Water tap water

REMARKS

SAMPLE NO. 4-1087
 Contact B WILLIAMS
 Well No. 199-K-110A
 Operable Unit 100 K
 HEIS No. N/A
 Depth 39.9'-41.9'

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

Checked By: PR. Helle

Date: 10-4-94

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1087

Page 2 of 7

Tested By: J.F. Relyea Date: 6/8/94
 Procedure No: GEL-32 Rev. 1 Date Issue: 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue: N/A

Container No. USK-2
 Container + wet soil wt. 3039.97 g
 Container + dry soil wt. 2845.27 g
 Container Tare Wt. 599.31 g
 Dry soil wt. 2245.96 g
 Moisture Content 8.7% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	8/7/94
Gauge	5667	10/25/94

Empty Column Wt. 2269.96 g

Start Date		6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/10/94	6/11/94
Start Time		11:47	12:07	12:23	12:46	13:06	13:32	13:58	9:29	10:42	11:40	7:08
End Date		6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/9/94	6/10/94	6/10/94	6/11/94	6/12/94
End Time		12:07	12:23	12:46	13:06	13:32	13:58	14:19	10:42	11:40	7:08	8:27
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		39.2	38.3	37.6	36.6	35.8	34.9	34.0	50.0	49.1	48.7	43.3
Outlet Burette Reading End, milliliters		38.3	37.6	36.6	35.8	34.9	34.0	33.4	49.1	48.7	43.3	38.3
Inlet Tensiometer reading, cm	start	-13	-17	-17	-19	-21	-22	-23	-47	-54	-65	-77
	end	-17	-17	-19	-21	-22	-23	-22	-54	-65	-77	-76
Outlet Tensiometer reading, cm	start	-18	-22	-22	-23	-25	-27	-28	-56	-71	-75	-81
	end	-22	-22	-23	-25	-27	-28	-26	-71	-75	-81	-83
Weight of Column and Wet Sample, g								4747.16				

REMARKS

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

Checked By: *[Signature]*

Date: 12-1-94

B-192

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1087

Page 3 of 7

Tested By: J.F. Relyea

Date 6/13/94

Start Date		6/12/94	6/13/94	6/15/94	6/15/94	6/16/94	6/17/94	6/18/94	6/19/94	6/21/94	6/22/94	6/23/94
Start Time		8:27	5:53	5:41	13:26	6:05	8:19	7:30	12:40	6:12	6:15	6:17
End Date		6/13/94	6/14/94	6/15/94	6/16/94	6/17/94	6/18/94	6/19/94	6/20/94	6/22/94	6/23/94	6/24/94
End Time		5:53	6:18	13:26	6:05	6:24	7:30	12:40	7:11	6:15	6:17	6:15
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters		38.3	34.6	50.0	49.7	47.1	50.0	46.7	44.4	47.1	46.3	45.3
Outlet Burette Reading End, milliliters		34.6	31.5	49.7	47.1	44.3	46.7	44.4	42.2	46.3	45.3	44.8
Inlet Tensiometer reading, cm	start	-76	-77	-132	-135	-127	-125	-124	-122	-231	-234	-230
	end	-77	-83	-135	-127	-125	-124	-122	-122	-234	-230	-223
Outlet Tensiometer reading, cm	start	-83	-82	-128	-129	-127	-125	-128	-125	-236	-240	-231
	end	-82	-83	-129	-127	-125	-128	-125	-123	-240	-231	-217
Weight of Column and Wet Sample, g			4730.49						4723.74			

REMARKS

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

Checked By: PL Keller

Date: 10-4-94

B-193

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1087
 Tested By: J.F. Relyea

Page 4 of 7
 Date 6/24/94

Start Date	6/24/94	6/26/94	6/27/94								
Start Time	6:15	8:56	13:33								
End Date	6/25/94	6/27/94	6/28/94								
End Time	8:16	5:56	5:57								
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A								
Inlet Burette Reading End, milliliters	N/A	N/A	N/A								
Outlet Burette Reading Start, milliliters	44.8	47.1	49.1								
Outlet Burette Reading End, milliliters	44.6	45.3	47.6								
Inlet Tensiometer reading, cm	start	-223	-231	-291							
	end	-223	-232	-295							
Outlet Tensiometer reading, cm	start	-217	-240	-303							
	end	-213	-240	-273							
Weight of Column and Wet Sample, g		4720.12	4716.50								

REMARKS

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

Checked By: PC-Heller

Date: 10-4-94

B-194

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO.

4-1087

Tested By:

J.F. Reilyea

Date

10/4/94

Page

5

of

7

Tensiometer Separation

10.0 cm

Column Length

15.1 cm

Column Diameter

9.6 cm

Column Area

72.0 cm²

Final Moisture Content

8.7% by wt.

Column Volume

1086.6 cm³

Filler Volume

19.1 cm³

Filler Dry Wt.

59.3 g

Sample Volume

1067.4 cm³

Sample Dry Wt.

2186.7 g

Test Sample Bulk Density

2.05 g/cm³

Test Sample Porosity

0.24 cm³/cm³

Empty Column Wt.

2270.0 g

Field Sample Bulk Density

N.A. g/cm³

Type of water used

Tap Water

Start Date

6/10/94

Start Time

10:42

End Date

6/10/94

End Time

11:40

Total Elapsed, sec

3480

Volume, cm³

0.40

Tension - inlet, cm

-60

Tension - outlet, cm

-73

Average Tension, cm

-66

K, cm/sec

6.79E-07

Weight of Column + Wet Sample, g

4773.15

Weight of Water in Filler, g (from MRC)

0

Weight of Water in Sample, g

257.23

Moisture Content (volumetric %)

23.7%

REMARKS

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

calibrated instruments

Checked By:

[Signature]

Date: 10-4-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO. 4-1087

Tested By: J.F. Relyea

Date

Page 6

10/4/94

of

7

Start Date	6/10/94	6/11/94	6/12/94	6/13/94	6/15/94	6/16/94	6/17/94	6/18/94	6/19/94
Start Time	11:40	7:08	8:27	5:53	5:41	6:05	8:19	7:30	12:40
End Date	6/11/94	6/12/94	6/13/94	6/14/94	6/15/94	6/17/94	6/18/94	6/19/94	6/20/94
End Time	7:08	8:27	5:53	6:18	13:26	6:24	7:30	12:40	7:11
Total Elapsed, sec	70080	91140	77160	87900	27900	87540	83460	105000	66660
Volume, cm ³	5.40	5.00	3.70	3.10	0.30	2.80	3.30	2.30	2.20
Tension - inlet, cm	-71	-77	-77	-80	-134	-126	-125	-123	-122
Tension - outlet, cm	-78	-82	-83	-83	-129	-126	-127	-127	-124
Average Tension, cm	-75	-79	-80	-81	-131	-126	-126	-125	-123
K, cm/sec	6.29E-07	4.91E-07	4.16E-07	3.92E-07	2.99E-07	4.44E-07	4.58E-07	2.25E-07	3.82E-07
Weight of Column + Wet Sample, g				4730.49					4723.74
Weight of Water in Filler, g (from MRC)				0					0
Weight of Water in Sample, g				214.57					207.82
Moisture Content (volumetric %)				19.7%					19.1%

REMARKS

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

Checked By:

PR HOLLER

Date: 10-4-94

B-196

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1087

Tested By:

J.F. Reilyea

Date

10/4/94

Page

7

of

7

REMARKS

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

Checked By:

Date:

10-4-94

Start Date	Start Time	End Date	End Time	Total Elapsed, sec	Volume, cm ³	Tension - Inlet, cm	Tension - outlet, cm	Average Tension, cm	K, cm/sec	Weight of Column + Wet Sample, g	Weight of Water in Filler, g (from MRC)	Weight of Water in Sample, g	Moisture Content (volumetric %)
6/21/94	6:12	6/22/94	6:15	86580	0.80	-233	-238	-235	1.19E-07	8.28E-08			
6/23/94	6:17	6/24/94	6:15	86280	0.50	-227	-224	-225	1.07E-07				
6/24/94	6:15	6/25/94	8:16	93660	0.20	-223	-215	-219	1.48E-07				
6/26/94	8:56	6/27/94	5:56	75600	1.80	-232	-240	-236	1.79E-07			204.20	18.8%
6/27/94	13:33	6/28/94	5:57	59040	1.50	-293	-288	-291	7.06E-07			200.58	18.5%

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Moisture Retention Sample Number 4-1087

SAMPLE NO.	4-1087	Operable Unit	100 K
Contact	B WILLIAMS	HEIS No.	N/A
Well No.	199-K-110A	Depth	39.9'-41.9'

TEMPE CELLS	Sample #	4-1087 1 Bar Primary Drying Curve (vacuum saturated)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	2.0	4.0
error in tension value +/-			0.1	0.1	0.1	0.1	0.1	0.1	0.1
container number	MC-8	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
weight of container/ring,+wet sample	166.88	539.81	568.55	568.59	568.53	568.53	568.64	568.19	567.56
weight of container/ring,+ dry sample	166.74	539.66	539.20	539.20	539.20	539.20	539.20	539.20	539.20
weight of moisture	0.14	0.15	29.35	29.39	29.33	29.33	29.44	28.99	28.36
weight of container and ring	60.75	425.92	425.90	425.90	425.90	425.90	425.90	425.90	425.90
weight of dry sample	106.13	113.74	113.30	113.30	113.30	113.30	113.30	113.30	113.30
moisture content, wt. %	0.1%		25.9%	25.9%	25.9%	25.9%	26.0%	25.6%	25.0%
date measured			7/26/94	7/27/94	7/28/94	7/29/94	8/1/94	8/2/94	8/3/94
temperature deg. C			28	28	27	28	27	27	28

TEMPE CELLS	Sample #	4-1087 1 Bar Primary Drying Curve							
tension in cm	6.0	8.0	12.5	25.5	32	51	70	103	200
error in tension value +/-	0.1	0.1	0.1	1	1	1	1	2	2
container number	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
weight of container/ring,+wet sample	567.43	567.33	567.16	566.97	566.91	566.58	566.18	565.68	563.70
weight of container/ring,+ dry sample	539.20	539.20	539.20	539.20	539.20	539.20	539.20	539.20	539.20
weight of moisture	28.23	28.13	27.96	27.77	27.71	27.38	26.98	26.48	24.50
weight of container and ring	425.90	425.90	425.90	425.90	425.90	425.90	425.90	425.90	425.90
weight of dry sample	113.30	113.30	113.30	113.30	113.30	113.30	113.30	113.30	113.30
moisture content, wt. %	24.9%	24.8%	24.7%	24.5%	24.5%	24.2%	23.8%	23.4%	21.6%
date measured	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94
temperature deg. C	27	26	26	26	27	27	27	26	26

TEMPE CELLS	Sample #	4-1087 1 Bar Primary Drying Curve					
tension in cm	300	500	700	850	1000	1000	N/A
error in tension value +/-	20	20	20	20	20	20	
container number	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	MC-23
weight of container/ring,+wet sample	562.72	561.32	559.39	558.10	557.35	557.40	191.95
weight of container/ring,+ dry sample	539.20	539.20	539.20	539.20	539.20	539.20	173.78
weight of moisture	23.52	22.12	20.19	18.90	18.15	18.20	18.17
weight of container and ring	425.90	425.90	425.90	425.90	425.90	425.90	60.64
weight of dry sample	113.30	113.30	113.30	113.30	113.30	113.30	113.14
moisture content, wt. %	20.8%	19.5%	17.8%	16.7%	16.0%	16.06%	16.06%
date measured	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	
temperature deg. C	26	26	26	26	27	26	

volume of brass ring 68.26

Sample Bulk Density = 1.66 g/cm ³	Cell wt. before cleanup = 425.86
Field Bulk Density = 2.1 g/cm ³	Cell wt. after cleanup = 425.85
Fraction < 2 mm = 0.41	Average of all 3 425.88

W/C-SD-EN-DP-090, Rev. 0

TEMPE CELLS

tension in cm	Sample #	4-1087 1 Bar Main Drying Curve (natural saturation from the bottom)							
error in tension value +/-	0.0	0.0	0.0	4.0	12.0	20.0	31.0	52.0	70.1
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33
weight of container/ring,+wet sample	554.00	554.02	553.99	553.34	553.14	553.10	552.97	552.85	552.77
weight of container/ring,+ dry sample	526.20	526.20	526.20	526.20	526.20	526.20	526.20	526.20	526.20
weight of moisture	27.80	27.82	27.79	27.14	26.94	26.90	26.77	26.65	26.57
weight of container and ring	412.50	412.50	412.50	412.50	412.50	412.50	412.50	412.50	412.50
weight of dry sample	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.70
moisture content, wt. %	24.45%	24.47%	24.44%	23.87%	23.69%	23.66%	23.54%	23.44%	23.37%
date measured	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94
temperature deg. C	26	26	26	26	25	26	27	26	26

TEMPE CELLS

tension in cm	Sample #	4-1087 1 Bar Main Drying Curve						
error in tension value +/-	100.9	213.0	300	500	690	1000	N/A	N/A
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	MC-8
weight of container/ring,+wet sample	552.39	551.25	550.40	548.27	546.99	544.02	544.02	192.18
weight of container/ring,+ dry sample	526.20	526.20	526.20	526.20	526.20	526.20	526.20	174.33
weight of moisture	26.19	25.05	24.20	22.07	20.79	17.82	17.82	17.85
weight of container and ring	412.50	412.50	412.50	412.50	412.50	412.50	412.50	60.74
weight of dry sample	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.59
moisture content, wt. %	23.03%	22.03%	21.28%	19.41%	18.28%	15.67%	15.67%	15.71%
date measured	9/16/94	9/18/94	9/19/94	9/21/94	9/22/94	9/23/94		9/26/94
temperature deg. C	25	26	26	26	26	26		26

volume of brass ring 68.26 cm³
 Sample Bulk Density = 1.67 g/cm³
 Cell wt. before filling = 412.51 grams
 Cell wt. before cleanup = 412.42 grams
 Cell wt. after cleanup = 412.77 grams
412.57 Average of all 3

TEMPE CELLS	Sample #	4-1087 1 Bar Main Wetting Curve							
tension in cm	N/A	N/A	1000	1000	1000	1000	1000	1000	1000
error in tension value +/-									
container number	MC-8	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33
weight of container/ring,+wet sample	166.88	527.11	538.93	539.06	539.03	539.11	539.21	539.26	539.22
weight of container/ring,+ dry sample	166.74	526.96	526.20	526.20	526.20	526.20	526.20	526.20	526.20
weight of moisture	0.14	0.15	12.73	12.86	12.83	12.91	13.01	13.06	13.02
weight of container and ring	60.75	412.51	412.50	412.50	412.50	412.50	412.50	412.50	412.50
weight of dry sample	106.13	114.45	113.70	113.70	113.70	113.70	113.70	113.70	113.70
moisture content, wt. %	0.13%		11.20%	11.31%	11.28%	11.35%	11.44%	11.49%	11.45%
date measured		8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94
temperature deg. C		26.9	28	28	27	26	27	27	27

TEMPE CELLS	Sample #	4-1087 1 Bar Main Wetting Curve							
tension in cm	700	500	300	203	104	71.5	53	32.5	23.5
error in tension value +/-									
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33
weight of container/ring,+wet sample	541.45	543.79	547.52	549.25	551.22	551.23	551.58	551.86	552.01
weight of container/ring,+ dry sample	526.20	526.20	526.20	526.20	526.20	526.20	526.20	526.20	526.20
weight of moisture	15.25	17.59	21.32	23.05	25.02	25.03	25.38	25.66	25.81
weight of container and ring	412.50	412.50	412.50	412.50	412.50	412.50	412.50	412.50	412.50
weight of dry sample	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.70
moisture content, wt. %	13.41%	15.47%	18.75%	20.27%	22.01%	22.01%	22.32%	22.57%	22.70%
date measured	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94
temperature deg. C	28	26	27	26	27	26	27	27	27

TEMPE CELLS	Sample #	4-1087 1 Bar Main Wetting Curve							
tension in cm	11.0	7.5	6	4	2.0	0.0	0.0	0.0	
error in tension value +/-									
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	
weight of container/ring,+wet sample	552.37	552.61	552.73	552.94	553.09	553.29	553.38	553.67	
weight of container/ring,+ dry sample	526.20	526.20	526.20	526.20	526.20	526.20	526.20	526.20	
weight of moisture	26.17	26.41	26.53	26.74	26.89	27.09	27.18	27.47	
weight of container and ring	412.50	412.50	412.50	412.50	412.50	412.50	412.50	412.50	
weight of dry sample	113.70	113.70	113.70	113.70	113.70	113.70	113.70	113.70	
moisture content, wt. %	23.02%	23.23%	23.33%	23.52%	23.65%	23.83%	23.91%	24.16%	
date measured	8/25/94	8/26/94	8/27/94	8/29/94	8/30/94	8/31/94	9/1/94	9/2/94	
temperature deg. C	25	26	26	26	26	26	27	26	

Cell wt. before cleanup = _____ grams

Cell wt. after cleanup = _____ grams

Average of all 3 = 137.50 grams

volume of brass ring = 68.26 cm³
 Sample Bulk Density = 1.67 g/cm³

KETTLES	Sample #	4-1087 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA15	BA16	BA15	BA16	BA15	BA16	BB15	BB16
weight of container/ring,+wet sample	46.36	49.16	46.12	48.89	45.90	48.64	44.54	44.97
weight of container/ring,+ dry sample	43.32	45.67	43.28	45.63	43.21	45.56	42.78	43.19
weight of moisture	3.04	3.49	2.84	3.26	2.69	3.08	1.76	1.78
Container Tare Wt.,g	27.72	27.63	27.72	27.63	27.72	27.63	28.05	28.53
weight of dry sample	15.60	18.04	15.56	18.00	15.49	17.93	14.73	14.66
moisture content %	19.49%	19.35%	18.25%	18.11%	17.37%	17.18%	11.95%	12.14%
date measured	8/10/94	8/10/94	8/16/94	8/16/94	8/22/94	8/22/94	8/10/94	8/10/94
temperature deg. C	27	27	27	27	27	27	27	27

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	10.0	10.0
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB15	BB16	BB15	BB16	BC15	BC16	BC15	BC16
weight of container/ring,+wet sample	44.26	44.69	43.90	44.33	43.15	42.80	43.55	43.72
weight of container/ring,+ dry sample	42.63	43.05	42.60	43.02	42.33	42.04	42.30	42.00
weight of moisture	1.63	1.64	1.30	1.31	0.82	0.76	1.25	1.72
Container Tare Wt.,g	28.05	28.53	28.05	28.53	29.04	29.26	29.04	29.26
weight of dry sample	14.58	14.52	14.55	14.49	13.29	12.78	13.26	12.74
moisture content %	11.18%	11.29%	8.93%	9.04%	6.17%	5.95%	9.43%	13.50%
date measured	8/20/94	8/20/94	8/27/94	8/27/94	8/10/94	8/10/94	8/16/94	8/16/94
temperature deg. C	27	27	26	26	27	27	27	27

Water Potential Data for CX-2 Samples

Sample No.	4-1087	
Container Number	BC15	BC16
Aw Reading	0.994	0.993
Temperature °C	28.2	27.2
Water Potential, Bars	8.4	9.7

Can ID No	BC11	BC12
Can + Soil Wet wt., g	43.32	42.73
Can + Soil Dry wt., g	42.25	41.71
Can Tare wt., g	29.04	29.26
Weight of Water, g	1.07	1.02
Dry Weight of Sample, g	13.21	12.45
Moisture Content, wt. %	8.10%	8.19%
date measured	8/29/94	8/29/94

POINTS SELECTED FOR PLOTTING		Sample #		4-1087							
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33
Tension in cm	1.0	4.0	12.0	20.0	31.0	52.0	70.1	100.9	213.0	300.0	500.0
Primary Drying Curve											
Tempe Main Drying Curve	24.4%	23.9%	23.7%	23.7%	23.5%	23.4%	23.4%	23.0%	22.0%	21.3%	19.4%
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94	9/16/94	9/18/94	9/19/94	9/21/94
container number	TC-33	TC-33	BA15	BA15	BB15	BB15	BB15	BC15	BC16	TC-33	TC-33
tension in cm	690	1000	510	714	2040	3060	5100	8528	9921	1000	700
Tempe Primary Drying Curve											
Tempe Main Drying Curve	18.3%	15.7%									
Kettle/CX-2 Main Drying Curve			19.4%	18.2%	12.0%	11.2%	9.0%	8.1%	8.2%		
Tempe Main Wetling Curve										11.5%	13.4%
date measured	9/22/94	9/23/94	8/10/94	8/16/94	8/10/94	8/20/94	8/27/94	8/29/94	8/29/94	8/11/94	8/12/94
container number	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33	TC-33
tension in cm	300	203.0	104.0	71.5	53.0	32.5	23.5	11.0	7.5	6.0	4.0
Tempe Primary Drying Curve											
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	18.8%	20.3%	22.0%	22.0%	22.3%	22.6%	22.7%	23.0%	23.2%	23.3%	23.5%
date measured	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	8/25/94	8/26/94	8/27/94	8/29/94
container number	TC-33	TC-33	TC-33	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23
tension in cm	2.0	500	1.0	1.0	2.0	4.0	6.0	8.0	12.5	25.5	32.0
Tempe Primary Drying Curve				26.0%	25.6%	25.0%	24.9%	24.8%	24.7%	24.5%	24.5%
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	23.6%	15.5%	24.2%								
date measured	8/30/94	8/15/94	9/2/94	8/1/94	8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94
container number	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23	TC-23		
tension in cm	51.0	70.0	103.0	200.0	300.0	500.0	700.0	850.0	1000.0		
Tempe Primary Drying Curve	24.2%	23.8%	23.4%	21.6%	20.8%	19.5%	17.8%	16.7%	16.1%		
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	8/11/94	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/24/94		

Points from kettle are enclosed by the double outline

Points from CX-2 are enclosed by the single outline

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1088 Well no./depth 199-K-110A / 77.35-79.35' VISCOSITY 1

Tested By: H. Hampt Date 06/02/94

Specimen Diameter (D, cm) 9.58 Specimen Length (L, cm) 15.08

Start Date	06-Jun-94	06-Jun-94	06-Jun-94	06-Jun-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	06-Jun-94	06-Jun-94	06-Jun-94	06-Jun-94
End Time	00:02:00	00:03:00	00:02:30	00:02:00
Time Sec.	120	180	150	120
Volume, cm ³	53.4	83.4	71	47.6
Head, cm	78.74	78.74	78.74	81.5
"Q"	4.45E-01	4.63E-01	4.73E-01	3.97E-01
L/(A*H)	2.66E-03	2.66E-03	2.66E-03	2.57E-03
K, cm/sec	1.18E-03	1.23E-03	1.26E-03	1.02E-03
Kc, (K*Visc)	1.18E-03	1.23E-03	1.26E-03	1.02E-03

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 1.17E-03

STANDARD DEV. 9.30E-05

% STAND. DEV. 7.9%

Remarks: Sample saturated on arrival.

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

Checked By:

H. Hampt

Date:

7/11/94

B-205

W/H-C-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-110A
Depth	77.35-79.35'
Lab #	4-1088
Heis #	NA
Tested by	HH
Contact	Williams
Phone #	376-3416
Date	6/2/94
length (cm)	15.08
diameter (cm)	9.58
volume (cm ³)	1086.95
wt of sample + mold (g)	2743.3
wt of mold (g)	321.7
wet wt of sample (g)	2421.6
dry wt of sample (g)	2197.5
wet density of sample (g/cm ³)	2.2
water content % dry wt	10.20%
dry density (g/cm ³)	2.0
specific gravity	2.7
void ratio	0.32
porosity	24.3%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>H. H. H. H.</i>	Date: <i>7/11/94</i>

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-110A	DEPTH	77.35-79.3	LAB #	4-1088	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	6/8/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	167.61	168.18	168.51
Wt. pycnometer+wetting agent+ soil,	186.53	187.16	187.47
Temperature (Tx), degrees C	25.6	25.6	25.5
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.71	2.72	2.72
Specific gravity of soil at 20 C	2.70	2.72	2.71
AVG. Specific gravity of -10 material	2.71		
Wt. sample (SSD), g (B)	1154.2	NA	NA
Wt. sample in water, g (C)	720.8	NA	NA
Wt. oven dry sample, g (A)	1145	NA	NA
Bulk specific gravity, 23/23 C	2.64	NA	NA
Bulk specific gravity SSD, 23/23 C	2.66	NA	NA
Apparent specific gravity, 23/23 C	2.70	NA	NA
Size fraction, coarse	47.9	NA	NA
Size fraction, fine	52.1	NA	NA
Avg. specific gravity, 23/23 C	2.67	NA	NA
Avg. specific gravity based on:	BULK	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: H. Hampton Date: 7/11/95

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-110A	DEPTH	77.35-79.35'	LAB #	4-1088	HEIS #	NA
TESTED BY	LDB	CONTACT	Williams	PHONE	376-3416	DATE	6/2/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/2/94	670.1	636.2	63.5	33.9	572.8	5.9%	FMW
6/2/94	2671.7	2446.9	250.1	224.8	2196.8	10.2%	HH
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB		
VESSEL	5697	CALIBRATION DUE	6/3/94	SAMPLE WT. (g)	8.00		
Date	6/3/94	Sample pressure (psi)	0.6	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Hammett</i>				Date: <i>7/11/94</i>			

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-110A	CONTACT	Williams	ORIG COD	86950	PHONE	376-3416
LAB #	4-1088	DEPTH	77.35-79.35	TESTED BY	FMW	DATE	06/09/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
2196.8	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	50.800	
	1.5"	513.4	23.4	76.6	38.100	
	3/4"	774.8	35.3	64.7	19.050	
	3/8"	974.8	44.4	55.6	9.525	
WT. #10 SAMP.(g) 208.1	#4	1052.7	47.9	52.1	4.750	
	#10	1144.1	52.1	47.9	2.360	
	#40	38.1	18.3	39.1	0.500	
	#60	152.5	73.3	12.8	0.250	
	#100	195.8	94.1	2.8	0.150	
	#200	206.5	99.2	0.4	0.075	

Sieve Analysis Data for Sample 4-1088

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

Checked by: U. Haupt

Date: 7/11/94

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SIEVE ANALYSIS REPORT SHEET

SAMPLE NO. 4-1085

Page 1 of 2

Tested By: L.D. Bruggeman

Date 5/17/94

Total Sample Weight (g)	Sieve Size (inches)	Cumulative Soi Weight (g)	Cumulative etained (% wt.	Fraction etained (% wt.	% Finer Weight (g)	Grain Size (mm)	
264.4	4.000	0.0	0.0%	0.0%	100.0%	101.600	
	2.500	0.0	0.0%	0.0%	100.0%	63.500	
	2.000	0.0	0.0%	0.0%	100.0%	50.800	
	1.500	0.0	0.0%	0.0%	100.0%	38.100	
	1.000	0.0	0.0%	0.0%	100.0%	25.400	
	0.750	0.0	0.0%	0.0%	100.0%	19.050	
	0.500	0.0	0.0%	0.0%	100.0%	12.700	
	0.375	0.0	0.0%	0.0%	100.0%	9.525	
	Sieve (Mesh Number)	Cumulative Soi Weight (g)	Cumulative etained (% wt.	Fraction etained (% wt.	% Finer Weight (g)	Grain Size (mm)	
Wt. of -#10 Sample Split	#4	0.0	0.0%	0.0%	100.0%	4.750	
	#10	0.0	0.0%	0.0%	100.0%	2.000	
	264.4	#40	17.00	6.4%	6.4%	93.6%	0.425
		#60	154.90	58.6%	52.2%	41.4%	0.250
		#100	226.60	85.7%	27.1%	14.3%	0.150
		#200	246.10	93.1%	7.4%	6.9%	0.075

REMARKS

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

Checked By:

J. F. Relyea Date: 5-17-94

GRAIN SIZE ANALYSIS PLOT

SAMPLE N 4-1085

Page 2 of 2

GRAIN SIZE ANALYSIS PLOT

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

Checked By: J. A. Relyea Date: 5-17-94

B-212

WHC-SD-EN-DP-090, Rev. 0

199-K-111A

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WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-111A	5/13/94	B08WF4	Antimony-125	-2.58	U	16.58	pCi/L
			Cesium-137	-.82	U	6.72	pCi/L
			Cobalt-60	-5.09	U	8.19	pCi/L
			Gross alpha	4.45		3.27	pCi/L
			Gross beta	15.70		3.63	pCi/L
			Ruthenium-106	-32.00	U	55.76	pCi/L
			Tritium	155.00	U	283.90	pCi/L
	6/06/94	B08WF4	Carbon-14	64.10		5.38	
			Specific conductance	3760.00			umhos
			Temperature, field	21.60			
			pH	8.21			
	6/08/94	B09H62	Antimony-125	10.10	U	14.04	pCi/L
			Carbon-14	18.70		3.81	
			Cesium-137	4.11	U	6.42	pCi/L
			Cobalt-60	-3.25	U	8.20	pCi/L
			Gross alpha	29.90		10.61	pCi/L
			Gross beta	33.20		7.45	pCi/L
			Ruthenium-106	-3.20	U	64.16	pCi/L
			Tritium	49.50	U	295.50	pCi/L
	6/14/94	B09H63	Antimony-125	10.40	U	15.92	pCi/L
			Carbon-14	62.80		5.33	
			Cesium-137	4.76	U	5.89	pCi/L
			Cobalt-60	.15	U	5.16	pCi/L
			Gross alpha	24.80		6.90	pCi/L
			Gross beta	20.90		6.29	pCi/L
			Ruthenium-106	39.70	U	47.28	pCi/L
			Tritium	258.00	U	305.30	pCi/L
	6/20/94	B09H65	Antimony-125	-1.29	U	17.28	pCi/L
			Carbon-14	4.77		3.31	
			Cesium-137	.27	U	6.89	pCi/L
			Cobalt-60	-1.85	U	7.86	pCi/L
			Gross alpha	1.77	U	3.51	pCi/L
			Gross beta	24.50		6.67	pCi/L
			Ruthenium-106	-13.80	U	58.70	pCi/L
			Tritium	2480.00		359.50	pCi/L
				-40.20	U	310.90	pCi/L
	6/23/94	B09H64	Antimony-125	-17.30	UG	19.77	pCi/L
			Carbon-14	2.77	U	3.25	
			Cesium-137	1.19	UG	7.74	pCi/L
			Cobalt-60	-8.33	UG	8.52	pCi/L
			Gross alpha	46.40	G	12.72	pCi/L
			Gross beta	32.70	G	5.23	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-111A	6/23/94	B09H64	Ruthenium-106	12.20	UG	57.28	pCi/L
			Tritium	-202.00	UG	303.40	pCi/L
	6/28/94	B0C233	Alkalinity	70.00	Q		ppm
			Aluminum	210000.00		44100.00	ppb
			Antimony	45.00	L	8.10	ppb
			Barium	4700.00		1130.00	ppb
			Beryllium	10.00		3.30	ppb
			Bromide	200.00	L	78.00	ppb
			Cadmium	36.00		11.90	ppb
			Calcium	320000.00		67200.00	ppb
			Chloride	3000.00		990.00	ppb
			Chromium	410.00		197.00	ppb
			Cobalt	350.00		105.00	ppb
			Copper	460.00		55.20	ppb
			Fluoride	700.00		399.00	ppb
			Iron	350000.00		116000.00	ppb
			Magnesium	120000.00		28800.00	ppb
			Manganese	20000.00	B	3600.00	ppb
			Nickel	700.00		189.00	ppb
			Nitrate	1700.00			ppb
			Nitrite	110.00	U		ppb
			Phosphate	470.00	U		ppb
			Potassium	36000.00		4320.00	ppb
			Silver	3.40	U		ppb
			Sodium	32000.00		17300.00	ppb
			Specific conductance	210.00			umhos
			Sulfate	20000.00	D	4200.00	ppb
			Tin	110.00		26.40	ppb
			Total Dissolved Solids	130.00			ppm
			Total Organic Carbon	7000.00			ppb
			Total Organic Halogen	7.70			ppb
			Turbidity	590.00			NTU
			Vanadium	690.00		228.00	ppb
			Zinc	1100.00		363.00	ppb
			pH	8.20	H		
		B0C234	Y Aluminum, filtered	78.00	L	16.40	ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	30.00		7.20	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	17000.00		3570.00	ppb
			Y Chromium, filtered	11.00	U		ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	5.10	L	.61	ppb
			Y Iron, filtered	150.00		49.50	ppb
			Y Magnesium, filtered	4700.00		1130.00	ppb

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Qualifiers	Error	Units
199-K-111A	6/28/94	B0C234	Y Manganese, filtered	51.00	B	9.18	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	5600.00		672.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	12000.00		6480.00	ppb
			Y Tin, filtered	39.00	L	9.36	ppb
			Y Vanadium, filtered	6.40	U		ppb
			Y Zinc, filtered	4.40	U		ppb
	7/28/94	B0C7M1	Antimony-125	9.00	UG	13.85	pCi/L
			Bromide	110.00	U		ppb
			Carbon-14	67.00		5.49	
			Cesium-137	.28	UG	4.69	pCi/L
			Chloride	5500.00		1820.00	ppb
			Cobalt-60	0.00	UG	6.94	pCi/L
			Fluoride	700.00		399.00	ppb
			Gross alpha	4.08		2.05	pCi/L
			Gross beta	8.47		2.85	pCi/L
			Nitrate	49000.00	D		ppb
			Nitrite	300.00			ppb
			Phosphate	470.00	U		ppb
			Ruthenium-106	-64.10	UG	63.58	pCi/L
			Specific conductance	380.00			umhos
			Sulfate	30000.00	D	6300.00	ppb
			Tritium	-119.00	U	330.20	pCi/L
			Turbidity	17.00	Q		NTU
		B0C7M2	Y Aluminum, filtered	19.00	U		ppb
			Y Antimony, filtered	26.00	U		ppb
			Y Barium, filtered	45.00		10.80	ppb
			Y Beryllium, filtered	1.50	U		ppb
			Y Cadmium, filtered	3.00	U		ppb
			Y Calcium, filtered	42000.00	Q	8820.00	ppb
			Y Chromium, filtered	11.00	U		ppb
			Y Cobalt, filtered	6.50	U		ppb
			Y Copper, filtered	2.60	UQ		ppb
			Y Iron, filtered	21.00		6.93	ppb
			Y Magnesium, filtered	9300.00		2230.00	ppb
			Y Manganese, filtered	41.00		7.38	ppb
			Y Nickel, filtered	16.00	U		ppb
			Y Potassium, filtered	6200.00		744.00	ppb
			Y Silver, filtered	3.40	U		ppb
			Y Sodium, filtered	15000.00	Q	8100.00	ppb
			Y Tin, filtered	24.00	U		ppb
			Y Vanadium, filtered	8.00	L	2.64	ppb
			Y Zinc, filtered	14.00	B	4.62	ppb
10/28/94		B0D5L3	Antimony-125	-6.15	U	16.53	pCi/L

WHC-SD-EN-DP-090, Rev. 0

GeoDAT Report - 12/19/94

Groundwater Data Report

Well	Sample Date	Sample Number	Constituent Name	Result	Quali- fiers	Error	Units
199-K-111A	10/28/94	B0D5L3	Carbon-14	75.60		5.83	
			Cesium-137	1.68	U	7.18	pCi/L
			Cobalt-60	-6.04	U	7.57	pCi/L
			Gross alpha	1.29		1.12	pCi/L
			Gross beta	6.83		2.75	pCi/L
			Ruthenium-106	4.84	U	57.32	pCi/L
			Specific conductance	392.00			umhos
			Temperature, field	18.60			
			Tritium	160.00	U	192.30	pCi/L
			pH	8.01			

No Dump

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

Name 199-K-111A

Zone 1

Project OPER/RCRA

Date 5/2/90

Recommended Purge Volume (gal) NA

Purge Flow Rate (gal/min)

Pump type Peristaltic

Calculations

Purge Vol 750 ml/min

SAMPLES COLLECTED

SAMPLE NUMBER(S)

BOBW4

BOBW5

BOTTLE ID

(1)250mLGA

(1)1000mLGA

(4)125mLP

(1)250mLP

(1)500mLP

(2)1000mLP

(1)500mLP(F)

(2)125mLP

PUMP

Peristaltic

COLLECTOR

G. Hamilton WHE

E7223

Sample 1250mLP (recovered 2225)
 (1) 250mLP

AL NUMBER OF BOTTLES

15 of 15 5-6-9499
 93 5/5/94

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH		WATER LEVELS		Time	
NA		Prev. Depth <u>67</u> (ft)		1530/1552/1555	
Steel Tape # <u>NA</u>		Held		pH 8.35 8.24 8.21	
pH/Cond Meter # <u>91054283</u> <u>AS 4149</u>		Cut		Temp (DEG.c) 21.6 21.6 21.6	
Cond Meter # <u>746200150</u>		Depth below <u>67.2</u> GROUND LEVEL		Cond (µm/cm) 3770 3750 3760	
Thermometer # _____					

FIELD OBSERVATIONS

Weather Mostly cloudy 50°FGeneral Problems/Unusual Events NA

Equipment Irregularities _____

Container Irregularities _____

Comments Sample taken during the drilling of 199-K-111A

SAMPLING THIS HOLE IN PROGRESS SAMPLING AT 69.7 ft. WATER SAMPLED FROM
ELIMINATE LINE APPROX. 50 ft FROM WELL WATER TEMP RECORDED BY SLOO, DURING TURN
ING LINE FROM SURFACE

Well capped and locked? ☒ Yes ☐ No G. Hamilton WHEData Recorded by G. Hamilton WHE

Data Checked by _____

Chain of Custody form # B013Y2 B013Y3 B013Y4 WHEFRF LOGBOOK and Pageno: 10/773Surface

No Dump

GROUND-WATER SAMPLE FIELD RECORD

Zone 1

Project OPER/RCRA

Date 6-5-64

vented Purge Volume (gal)

Large Flow Rate (gal/min) < 1000 gal/min

Pump type *Radial*

Calculations

$$N^A$$

SAMPLES COLLECTED

SAMPLE NUMBER(S)

BOTTLE ID

PUNE

COLLECTOR

235H62

(2) 1000=1P

(1) 125-1P

(1) 250.1P

PUMP
LA DIER

[illegible]

TOTAL NUMBER OF BOTTLES

1

Containment Code 4:

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)		Time	1055	1056	1057	AFTER SAMPLING		
Steel Tape #	Heid			pH	8.43	8.51	8.67	8.60		
pH/Cond Meter #	Cut			Temp (DEG.c)	22.4	22.4	22.8	22.9		
Thermometer #	Depth below FC Ground Surface	67.2		Cond (µm/cm)	2440	2470	2492	3000		

FIELD OBSERVATIONS

Weather Sunny

General Problems/Unusual Events N/A

Equipment Irregularities

Container Irregularities

Comments Sampled @ 86' Note in stream hose from well to sample collection s. to ~400'
Is on top of ground fern reading probably affected.
Turbidity, Excess - minor rain

capped and locked? ☒ Yes ☐ No

Data Recorded by L. D. Mason

Chain of Custody form # 28377' SURFACE

Data Checked by

FRF LOGBOOK NO. 10

X1823

No Dump

BATTELLE
Pacific Northwest Laboratories

GROUND-WATER SAMPLE FIELD RECORD

Name 199-K-111A

Zone 1

Project OPER/RCRA

Date 1-25-94

Amended Purge Volume (gal) 10.0

Purge Flow Rate (gal/min) 300 ml/min

Pump type 1/2" bore pump

Calculations

SAMPLES COLLECTED

SAMPLE NUMBER(S)

BOTTLE ID

PUMP

COLLECTOR

B09H64

(2) 1000mlP

(1) 125mlP

(1) 250mlP

TOTAL NUMBER OF BOTTLES

4

Containment Code #: _____

FIELD MEASUREMENTS

Previous PH	Prev. Depth	WATER LEVELS (ft)	Time						
				10:27	10:28	10:30			
Steel Tape # 100	Held	10.0	pH	6.95	6.97	7.00			
pH/Cond Meter # 100	Cut	N/A	Temp (DEG.c)	22.5	23.2	22.0			
Thermometer # 100	Depth below TC	10.0	Cond (µm/cm)	0.16	0.16	0.16			

FIELD OBSERVATIONS

Weather 6-2 F - 50 F

General Problems/Unusual Events N/A

Equipment Irregularities 1/2"

Container Irregularities 1/2"

Comments N/A

capped and locked? Yes ☒ No

Data Recorded by K. J. J.

Chain of Custody form # 28379 SURFACE.

Data Checked by

FRF LOGBOOK NO. 10

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1090 Well no./depth 199-K-111A 25.9-26.9' VISCOSITY 1

Tested By: F.M. Williams/H. Hampt Date 06/24/94

Specimen Diameter (D, cm) 9.55 Specimen Length (L, cm) 12.52

Start Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94		
Start Time	00:00:00	00:00:00	00:00:00	00:00:00		
End Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94		
End Time	00:03:00	00:03:00	00:03:00	00:03:00		
Time Sec.	180	180	180	180		
Volume, cm ³	17.1	17.2	16.9	17.2		
Head, cm	80	80	80	80		
"Q"	9.50E-02	9.56E-02	9.39E-02	9.56E-02		
L/(A*H)	2.18E-03	2.18E-03	2.18E-03	2.18E-03		
K, cm/sec	2.08E-04	2.09E-04	2.05E-04	2.09E-04		
Kc, (K*Visc)	2.08E-04	2.09E-04	2.05E-04	2.09E-04		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 2.08E-04
 STANDARD DEVIATI 1.49E-06
 % STAND. DEV. 0.7%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks: Sample vacuum saturated on 6/24/94.
 Void space filled with -3/4, +3/8 gravel.

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

Checked By: H. Hampt

Date: 7-11/94

B-223

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	25.9-26.9'
Lab #	4-1090
Heis #	NA
Tested by	PRH, HH, FMW
Contact	WILLIAMS
Phone #	6-3416
Date	6/8/94
length (cm)	12.52
diameter (cm)	9.55
volume (cm ³)	896.78
wt of sample + mold (g)	2174.4
wt of mold (g)	247.0
wet wt of sample (g)	1927.4
water content % dry wt	2.5%
wet density of sample (g/cm ³)	2.1
dry wt. of sample (g)	1880.4
dry density (g/cm ³)	2.1
specific gravity	2.7
void ratio	0.26
porosity	20.9%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt Date: 7/11/94	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	25.9-26.9'	LAB #	4-1090	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	7/7/94
	1	2	3				
Wt. oven dry soil, g	30.00	30.00	30.00			temp	K
Wt. pycnometer + wetting agent, g	161.94	168.58	167.86			18	1.0004
Wt. pycnometer+wetting agent+ soil,	181.03	187.72	186.95			19	1.0002
Temperature (Tx), degrees C	23.4	23.2	23.5			20	1.0000
Specific gravity of wetting agent	1.00	1.00	1.00			21	0.9998
Specific gravity of soil at Tx	2.75	2.76	2.75			22	0.9996
Specific gravity of soil at 20 C	2.75	2.76	2.75			23	0.9993
AVG. Specific gravity of -10 material	2.75					24	0.9991
Wt. sample (SSD), g (B)	899.9	NA	NA			25	0.9989
Wt. sample in water, g (C)	549	NA	NA			26	0.9986
Wt. oven dry sample, g (A)	894.8	NA	NA			27	0.9983
Bulk specific gravity, 23/23 C	2.55	NA	NA			28	0.998
Bulk specific gravity SSD, 23/23 C	2.56	NA	NA			29	0.9977
Apparent specific gravity, 23/23 C	2.59	NA	NA			30	0.9974
Size fraction, coarse	47.4	NA	NA				
Size fraction, fine	52.6	NA	NA				
Avg. specific gravity, 23/23 C	2.65	NA	NA				
Avg. specific gravity based on:	BULK	NA	NA				
COMMENTS:							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: H. Hewitt				Date: 7/11/94			

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1881.1	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	50.800	
	1.5"	0.0	0.0	100.0	38.100	
	3/4"	309.1	16.4	83.6	19.050	
	3/8"	664.6	35.3	64.7	9.525	
WT.-#10	# 4	890.9	47.4	52.6	4.750	
SAMP.(g)	#10	1047.2	55.7	44.3	2.360	
331.2	#40	148.3	44.8	24.5	0.500	
	#60	200.1	60.4	17.5	0.250	
	#100	230.0	69.4	13.5	0.150	
	#200	255.9	77.3	10.1	0.075

CHECKED BY: H. Hump 7/11/94

ESTIMATION OF THE WATER HOLDING CAPACITY OF SOIL ON AN INTACT SAMPLE

Estimate of the Field Capacity

	SAMPLE 4-1090	SAMPLE 4-1091
A. Length of Sample (cm)	<u>12.52</u>	<u>11.32</u>
B. Diameter of Sample (cm)	<u>9.55</u>	<u>9.55</u>
C. Volume of Sample (g/cm**3)	<u>896.36</u>	<u>810.44</u>
D. Wet (after 48 hr. drain) Sample Wt. +Tare Wt. (g)	<u>2309.11</u>	<u>1931.32</u>
E. Dry Sample Wt. + Tare Wt. (g)	<u>2128.10</u>	<u>1702.70</u>
F. Tare Wt. (g)	<u>247.00</u>	<u>246.70</u>
G. Water Content (estimated Field Capacity) (%)	<u>9.62</u>	<u>15.70</u>

Tested By: P. R. Heller Date: 7/14/94

Reference: Cassel, D. K. and D. R. Nielsen. 1986. "Field Capacity and Available Water." In Methods Soil Analysis, Part 1, ed. A. Klute, pp. 901-924. American Society of Agronomy, Madison Wisconsin.

Balance: ETAL 3315 Expires: 8/7/94

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

Checked By: J. J. Redger Date: 7-15-94

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SAMPLE NO.	4-1090
Contact	B WILLIAMS
Well No.	199-K-111A
Operable Unit	100 K
HEIS No.	N/A
Depth	26.4-26.9'

Mean Tension	0	-61	-120	-231	-320
Std. Dev. (Tension)		2	1	5	4
Mean K value	2.1E-04	1.4E-05	3.6E-06	7.6E-07	2.9E-07
Std.Dev./Mean		26%	30%	28%	22%
Water Content, Vol. %	17.4%	12.3%	11.1%	9.3%	9.7%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1090

The data package consists of three graphs, six pages of computer printout (the preparation, data and analysis of the test) three pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data.

The Grain Size distribution graph shows both the cumulative and fraction retained for both the original liner used to obtain moisture retention data and for the sleeve used for unsat. K testing. The two grain size distributions are not very different for the region below 1 mm. The bulk densities of the two sleeves were also similar (2.21 g/cm³ for the unsat. K column and 2.10 g/cm³ for the liner used for moisture retention).

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 2.21 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.50 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are slightly above the corrected curve.

The sample had a very large void to fill (2.4 cm deep) which made accurately determining the moisture content difficult. Notice that the last moisture content value at -320 cm is slightly higher than the value calculated at -230 cm. The value determined at -320 cm is based on oven dry water contents of both the sample and the filler and is very accurate (within 0.5%). All other values had to be determined by approximating how much water was contained in the filler using the moisture retention curve for the filler. These values are probably good to within 2% volumetric water content.

J.F. RELYEA
376-4676
10/6/94

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1090

Grain Size Distribution for Test Sample 4-1090

B-231

WHC-SD-EN-DP-090, Rev. 0

Moisture Retention Curve From Unsaturated
Hydraulic Conductivity Test Sample 4-1090

B-232

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1090 1 of 6

Tested By: J.F. Relyea Date 7/12/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	8/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.58 cm
 Column Length 15.09 cm
 Saturated Sample + Column Weight 5070.52 g
 Sample + Column Weight g
 Empty Column Weight g
 Specific Gravity 2.65 g/cm³
 Filler Final Moisture Content Data
 Container ID No 7-2
 Container + Filler Wet wt. 447.41 g
 Container+ Filler Dry wt. 413.64 g
 Container Tare wt. 146.03 g
 Dry Filler Wt. 267.61 g
 Weight of Water 33.77 g
 Filler Moisture Content 12.6% by weight

Filler Soil ID/Sample No. 1-1417
 Soil Added To Fill Top Void - Yes (X) No ()
 Dry Weight of Soil Added 277.4 g
 Specific Gravity g/cm³
 Column Volume Filled 172.9 cm³
 Soil Added To Fill Bottom Void - Yes (X) No () 4-1090
 Dry Weight of Soil Added 12.00 g
 Specific Gravity g/cm³
 Column Volume Filled cm³

Type of Water tap water

REMARKS

SAMPLE NO. 4-1090

Contact B WILLIAMS

Well No. 199-K-111A

Operable Unit 100 K

HEIS No. N/A

Depth 26.4-26.9'

Top void dimension = 3.76" diameter, 0.95" deep.

Note: sleeve # 2 that was used as fill in the bottom is of totally different texture and much lighter color.

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

Checked By: PR Heiler

Date: 10 6-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1090

Tested By:

J.F. Relyea

Date

Page

6

of

6

10/6/94

Start Date	8/11/94	8/11/94							
Start Time	10:27	13:57							
End Date	8/11/94	8/12/94							
End Time	13:57	6:03							
Total Elapsed, sec	12600	57960							
Volume, cm ³	0.40	1.30							
Tension - inlet, cm	-314	-317							
Tension - outlet, cm	-320	-320							
Average Tension, cm	-317	-318							
K, cm/sec	2.84E-07	2.31E-07							
Weight of Column + Wet Sample, g		4933.09							
Weight of Water in Filler, g (from MRC)		36.5							
Weight of Water in Sample, g		88.20							
Moisture Content (volumetric %)		9.7%							

REMARKS

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

Checked By:

PR. H. Llo

Date:

10-6-94

B-234

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO.

4-1090

Tested By:

J.F. Relyea

Date

10/6/94

Page

4

of

6

Tensiometer Separation

10.0 cm

Column Length

15.1 cm

Column Diameter

9.6 cm

Column Area

72.0 cm²

Final Moisture Content

4.3% by wt.

Sample Dry Wt.

2023.1 g

Sample Volume

913.7 cm³

Filler Dry Wt.

289.4 g

Filler Volume

172.9 cm³

Column Volume

1086.6 cm³

Test Sample Bulk Density

2.21 g/cm³

Test Sample Porosity

0.16 cm³/cm³

Empty Column Wt.

2495.8 g, Average

Field Sample Bulk Density

2.10 g/cm³

Type of water used

Tap Water

Start Date

7/29/94

Start Time

6:53

End Date

7/29/94

End Time

8:19

Total Elapsed, sec

5160

Volume, cm³

3.60

Tension - Inlet, cm

-63

Tension - outlet, cm

-60

Average Tension, cm

0

K, cm/sec

2.08E-04

Weight of Column + Wet Sample, g

5070.52

Weight of Water in Filler, g (from MRC)

102.9

Weight of Water in Sample, g

159.23

Moisture Content (volumetric %)

17.4%

REMARKS

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

Checked By:

J.F. Relyea

Date:

10-6-94

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1090

Tested By:

J.F. Relyea

Date

Page

5

of

6

10/6/94

Start Date	8/1/94	8/2/94	8/2/94	8/2/94	8/3/94	8/3/94	8/3/94	8/11/94	8/11/94
Start Time	9:43	6:58	9:01	11:13	6:12	8:18	12:45	7:00	10:27
End Date	8/1/94	8/2/94	8/2/94	8/3/94	8/3/94	8/3/94	8/4/94	8/11/94	8/11/94
End Time	12:06	9:01	11:13	6:12	8:18	12:45	6:11	10:27	13:57
Total Elapsed, sec	8580	7380	7920	68340	7560	16020	62760	12420	12600
Volume, cm ³	2.40	0.90	0.40	9.30	0.80	1.90	7.30	0.40	0.40
Tension - inlet, cm	-121	-226	-225	-225	-227	-227	-228	-323	-314
Tension - outlet, cm	-120	-236	-236	-237	-237	-236	-237	-325	-320
Average Tension, cm	-121	-231	-230	-231	-232	-231	-232	-324	-317
K, cm/sec	4.32E-06	8.26E-07	3.42E-07	8.79E-07	7.35E-07	8.90E-07	8.73E-07	3.58E-07	2.84E-07
Weight of Column + Wet Sample, g	4977.74						4946.64		
Weight of Water in Filler, g (from MRC)	67.8						53.5		
Weight of Water in Sample, g	101.55						84.74		
Moisture Content (volumetric %)	11.1%						9.3%		

REMARKS

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

Checked By:

PR Heller

Date:

10-6-94

B-236

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1090

Page 2 of 6

Tested By: J.F. Relyea Date: 7/15/94
 Procedure No: GEL-32 Rev. 1 Date Issue: 6/30/93
 Test Plan No: N/A Rev. N/A Date Issue: N/A

Container No. USK-2
 Container + wet soil wt. 2732.81 g
 Container + dry soil wt. 2644.50 g
 Container Tare Wt. 599.36 g
 Dry soil wt. 2045.14 g
 Moisture Content 4.3% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	
Gauge	5667	10/25/94

Empty Column Wt. 2495.79 g (before cleanup)
 Empty Column Wt. — g (after cleanup)

Start Date	7/29/94	7/29/94	7/29/94	7/29/94	7/30/94	7/31/94	8/1/94	8/1/94	8/1/94	8/2/94	8/2/94
Start Time	6:53	8:19	9:44	10:42	8:08	8:00	6:16	8:03	9:43	6:58	9:01
End Date	7/29/94	7/29/94	7/29/94	7/29/94	7/31/94	8/1/94	8/1/94	8/1/94	8/1/94	8/2/94	8/2/94
End Time	8:19	9:44	10:42	11:31	7:59	6:16	8:03	9:43	12:06	9:01	11:13
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters	50.0	46.4	43.9	40.5	50.0	50.0	24.8	24.1	22.5	50.0	49.1
Outlet Burette Reading End, milliliters	46.4	43.9	40.5	38.5	22.6	24.8	24.1	22.5	20.1	49.1	48.7
Inlet Tensiometer reading, cm	start	-63	-63	-61	-62	-120	-120	-119	-122	-121	-225
	end	-63	-61	-62	-62	-120	-119	-122	-121	-121	-226
Outlet Tensiometer reading, cm	start	-59	-60	-59	-59	-120	-123	-118	-121	-120	-236
	end	-60	-59	-59	-58	-123	-118	-121	-120	-120	-235
Weight of Column and Wet Sample, g				4993.68					4977.74		

REMARKS

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

Checked By: PR Heiler Date: 10-6-94

WHC-SD-EN-DP-090, Rev. 0

B-237

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1090

Page 3 of 6

Tested By: J.F. Relyea

Date 8/2/94

Start Date	8/2/94	8/3/94	8/3/94	8/3/94	8/9/94	8/10/94	8/11/94	8/11/94	8/11/94		
Start Time	11:13	6:12	8:18	12:45	9:40	8:56	7:00	10:27	13:57		
End Date	8/3/94	8/3/94	8/3/94	8/4/94	8/10/94	8/11/94	8/11/94	8/11/94	8/12/94		
End Time	6:12	8:18	12:45	6:11	8:56	7:00	10:27	13:57	6:03		
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Outlet Burette Reading Start, milliliters	48.7	39.4	38.6	36.7	50.0	49.8	46.1	45.7	45.3		
Outlet Burette Reading End, milliliters	39.4	38.6	36.7	29.4	49.8	46.1	45.7	45.3	44.0		
Inlet Tensiometer reading, cm	start	-224	-226	-228	-226	-279	-301	-328	-317	-311	
	end	-226	-228	-226	-230	-301	-328	-317	-311	-322	
Outlet Tensiometer reading, cm	start	-235	-238	-236	-235	-271	-292	-330	-320	-319	
	end	-238	-236	-235	-238	-292	-330	-320	-319	-321	
Weight of Column and Wet Sample, g				4946.64					4933.09		

REMARKS

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

Checked By: P. R. Heller Date: 10-6-94

B-238

WHC-SD-EN-DP-090, Rev. 0

Moisture Retention Sample Number 4-1090

WHC-SD-EN-DP-090, Rev. 0

B-239

SAMPLE NO.	4-1090	Operable Unit	100 K
Contact	B WILLIAMS	HEIS No.	N/A
Well No.	199-K-111A	Depth	26.4-26.9'

TEMPE CELLS	Sample #	4-1090 1 Bar Primary Drying Curve (vacuum saturated)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	2.0	4.0
error in tension value +/-			0.1	0.1	0.1	0.1	0.1	0.1	0.1
container number	MC-9	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24
weight of container/ring,+wet sample	213.42	560.01	582.37	582.34	582.20	582.11	582.15	582.12	580.04
weight of container/ring,+ dry sample	213.23	559.84	559.50	559.50	559.50	559.50	559.50	559.50	559.50
weight of moisture	0.19	0.17	22.87	22.84	22.70	22.61	22.65	22.62	20.54
weight of container and ring	60.87	423.06	422.80	422.80	422.80	422.80	422.80	422.80	422.80
weight of dry sample	152.55	136.78	136.70	136.70	136.70	136.70	136.70	136.70	136.70
moisture content, wt. %	0.1%		16.7%	16.7%	16.6%	16.5%	16.6%	16.5%	15.0%
date measured			7/26/94	7/27/94	7/28/94	7/29/94	8/1/94	8/2/94	8/3/94
temperature deg. C			28	28	27	28	27	27	28

TEMPE CELLS	Sample #	4-1090 1 Bar Primary Drying Curve							
tension in cm	6.0	8.0	12.5	25.5	32	51	70	103	200
error in tension value +/-	0.1	0.1	0.1	1	1	1	1	2	2
container number	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24
weight of container/ring,+wet sample	579.80	579.73	579.47	579.08	578.09	577.06	576.08	573.04	569.51
weight of container/ring,+ dry sample	559.50	559.50	559.50	559.50	559.50	559.50	559.50	559.50	559.50
weight of moisture	20.30	20.23	19.97	19.58	18.59	17.56	16.58	13.54	10.01
weight of container and ring	422.80	422.80	422.80	422.80	422.80	422.80	422.80	422.80	422.80
weight of dry sample	136.70	136.70	136.70	136.70	136.70	136.70	136.70	136.70	136.70
moisture content, wt. %	14.9%	14.8%	14.6%	14.3%	13.6%	12.8%	12.1%	9.9%	7.3%
date measured	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94
temperature deg. C	27	26	26	26	27	27	27	26	26

TEMPE CELLS	Sample #	4-1090 1 Bar Primary Drying Curve					
tension in cm	300	500	700	850	1000	1000	N/A
error in tension value +/-	20	20	20	20	20	20	
container number	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	60.4
weight of container/ring,+wet sample	567.80	566.20	565.24	564.75	564.49	564.33	201.58
weight of container/ring,+ dry sample	559.50	559.50	559.50	559.50	559.50	559.50	196.73
weight of moisture	8.30	6.70	5.74	5.25	4.99	4.83	4.85
weight of container and ring	422.80	422.80	422.80	422.80	422.80	422.80	60.60
weight of dry sample	136.70	136.70	136.70	136.70	136.70	136.70	136.13
moisture content, wt. %	6.1%	4.9%	4.2%	3.8%	3.7%	3.53%	3.56%
date measured	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	
temperature deg. C	26	26	26	26	27	26	

volume of brass ring 68.26

Sample Bulk Density =	2.00 g/cm ³	Cell wt. before cleanup =	422.82
Field Bulk Density =	2.1 g/cm ³	Cell wt. after cleanup =	422.78
Fraction < 2 mm =	0.44	Average of all 3	422.89

WHC-SD-EN-DP-090, Rev. 0

TEMPE CELLS

tension in cm	Sample #	4-1090 1 Bar Main Drying Curve (natural saturation from the bottom)							
error in tension value +/-	0.0	0.0	0.0	4.0	12.0	20.0	31.0	52.0	70.1
container number	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34
weight of container/ring,+wet sample	564.27	565.19	565.14	563.77	563.36	563.22	562.98	562.57	560.59
weight of container/ring,+ dry sample	546.20	546.20	546.20	546.20	546.20	546.20	546.20	546.20	546.20
weight of moisture	18.07	18.99	18.94	17.57	17.16	17.02	16.78	16.37	14.39
weight of container and ring	409.80	409.80	409.80	409.80	409.80	409.80	409.80	409.80	409.80
weight of dry sample	136.40	136.40	136.40	136.40	136.40	136.40	136.40	136.40	136.40
moisture content, wt. %	13.25%	13.92%	13.89%	12.88%	12.58%	12.48%	12.30%	12.00%	10.55%
date measured	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94
temperature deg. C	26	26	26	26	25	26	27	26	26

TEMPE CELLS

tension in cm	Sample #	4-1090 1 Bar Main Drying Curve						
error in tension value +/-	100.9	213.0	300	500	690	1000	N/A	N/A
container number	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	MC-9
weight of container/ring,+wet sample	558.90	555.87	554.26	552.65	551.87	551.06	551.06	201.96
weight of container/ring,+ dry sample	546.20	546.20	546.20	546.20	546.20	546.20	546.20	197.11
weight of moisture	12.70	9.67	8.06	6.45	5.67	4.86	4.86	4.85
weight of container and ring	409.80	409.80	409.80	409.80	409.80	409.80	409.80	61.04
weight of dry sample	136.40	136.40	136.40	136.40	136.40	136.40	136.40	136.07
moisture content, wt. %	9.31%	7.09%	5.91%	4.73%	4.16%	3.56%	3.56%	3.56%
date measured	9/16/94	9/18/94	9/19/94	9/21/94	9/22/94	9/23/94		9/26/94
temperature deg. C	25	26	26	26	26	26		26

volume of brass ring 68.26 cm³
 Sample Bulk Density = 2.00 g/cm³
 Cell wt. before filling = 409.69 grams
 Cell wt. before cleanup = 409.77 grams
 Cell wt. after cleanup = 410.05 grams
409.84 Average of all 3

KETTLES	Sample #	4-1090 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA17	BA18	BA17	BA18	BA17	BA18	BB17	BB18
weight of container/ring,+wet sample	50.56	50.07	50.46	49.97	50.35	49.88	46.65	44.19
weight of container/ring,+ dry sample	49.56	49.28	49.52	49.21	49.45	49.16	46.15	43.77
weight of moisture	1.00	0.79	0.94	0.76	0.90	0.72	0.50	0.42
Container Tare Wt.,g	27.63	30.61	27.63	30.61	27.63	30.61	27.85	27.63
weight of dry sample	21.93	18.67	21.89	18.60	21.82	18.55	18.30	16.14
moisture content %	4.56%	4.23%	4.29%	4.09%	4.12%	3.88%	2.73%	2.60%
date measured	8/10/94	8/10/94	8/16/94	8/16/94	8/22/94	8/22/94	8/10/94	8/10/94
temperature deg. C	27	27	27	27	27	27	27	27

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	10.0	10.0
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB17	BB18	BB17	BB18	BC17	BC18	BC17	BC18
weight of container/ring,+wet sample	46.42	43.92	46.33	43.81	46.05	46.90	46.39	47.29
weight of container/ring,+ dry sample	45.98	43.52	45.94	43.48	45.84	46.67	45.79	46.63
weight of moisture	0.44	0.40	0.39	0.33	0.21	0.23	0.60	0.66
Container Tare Wt.,g	27.85	27.63	27.85	27.63	29.58	30.31	29.58	30.31
weight of dry sample	18.13	15.89	18.09	15.85	16.26	16.36	16.21	16.32
moisture content %	2.43%	2.52%	2.16%	2.08%	1.29%	1.41%	3.70%	4.04%
date measured	8/20/94	8/20/94	8/27/94	8/27/94	8/10/94	8/10/94	8/16/94	8/16/94
temperature deg. C	27	27	26	26	27	27	27	27

WHC-SD-EN-DP-090, Rev. 0

Water Potential Data for CX-2 Samples

Sample No.	4-1090	
Container Number	BC17	BC18
Aw Reading	0.994	0.851
Temperature °C	28.0	27.9
Water Potential, Bars	8.4	223.9

Can ID No	BC17	BC18
Can + Soil Wet wt., g	46.14	46.71
Can + Soil Dry wt., g	45.77	46.60
Can Tare wt., g	29.58	30.31
Weight of Water, g	0.37	0.11
Dry Weight of Sample, g	16.19	16.29
Moisture Content, wt. %	2.29%	0.68%
date measured	8/29/94	8/29/94

POINTS SELECTED FOR PLOTTING

			Sample #		4-1090						
container number	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34
Tension in cm	1.0	4.0	12.0	20.0	31.0	52.0	70.1	100.9	213.0	300.0	500.0
Primary Drying Curve											
Tempe Main Drying Curve	13.9%	12.9%	12.6%	12.5%	12.3%	12.0%	10.5%	9.3%	7.1%	5.9%	4.7%
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94	9/16/94	9/18/94	9/19/94	9/21/94
container number	TC-34	TC-34	BA17	BA17	BA17	BB17	BB17	BB17	BC17	BC18	TC-34
tension in cm	690	1000	510	714	1020	2040	3060	5100	8522	228397	1000
Tempe Primary Drying Curve											
Tempe Main Drying Curve	4.2%	3.6%									
Kettle/CX-2 Main Drying Curve			4.4%	4.2%	4.0%	2.7%	2.5%	2.1%	2.3%	0.7%	
Tempe Main Wetling Curve											2.4%
date measured	9/22/94	9/23/94	8/10/94	8/16/94	8/22/94	8/10/94	8/20/94	8/27/94	8/29/94	8/29/94	8/11/94
container number	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34	TC-34
tension in cm	700	300	203.0	104.0	71.5	53.0	32.5	23.5	11.0	7.5	6.0
Tempe Primary Drying Curve											
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	2.7%	4.5%	5.5%	7.3%	7.9%	9.0%	10.3%	10.9%	11.7%	12.0%	12.2%
date measured	8/12/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	8/25/94	8/26/94	8/27/94
container number	TC-34	TC-34	TC-34	TC-34	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24
tension in cm	4.0	2.0	500	1.0	1.0	2.0	4.0	6.0	8.0	12.5	25.5
Tempe Primary Drying Curve					16.6%	16.5%	15.0%	14.9%	14.8%	14.6%	14.3%
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve	12.4%	12.6%	3.3%	13.2%							
date measured	8/29/94	8/30/94	8/15/94	9/2/94	8/1/94	8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94
container number	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24	TC-24
tension in cm	32.0	51.0	70.0	103.0	200.0	300.0	500.0	700.0	850.0	1000.0	
Tempe Primary Drying Curve	13.6%	12.8%	12.1%	9.9%	7.3%	6.1%	4.9%	4.2%	3.8%	3.5%	
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetling Curve											
date measured	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/24/94	

Points from kettle are enclosed by the double outline
 Points from CX-2 are enclosed by the single outline

WHC-SD-EN-DP-090, Rev. 0

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1091 Well no./depth 199-K-111A 60.9-62.9' VISCOSITY 1

Tested By: F.M. Williams/H. Hampt Date 06/24/94

Specimen Diameter (D, cm) 9.55 Specimen Length (L, cm) 11.32

Start Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94		
Start Time	00:00:00	00:00:00	00:00:00	00:00:00		
End Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94		
End Time	00:03:00	00:04:00	00:03:00	00:03:00		
Time Sec.	180	240	180	180		
Volume, cm ³	13	18	13.8	12.7		
Head, cm	80.5	80.5	80.5	80.5		
"Q"	7.22E-02	7.50E-02	7.67E-02	7.06E-02		
L/(A*H)	1.96E-03	1.96E-03	1.96E-03	1.96E-03		
K, cm/sec	1.42E-04	1.47E-04	1.51E-04	1.39E-04		
Kc, (K*Visc)	1.42E-04	1.47E-04	1.51E-04	1.39E-04		

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 1.45E-04
 STANDARD DEV. 4.66E-06
 % STAND. DEV. 3.2%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc = HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks: Sample vacuum saturated on 6/24/94.
 Void space filled with -3/8, +4 gravel.

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

Checked By: H. Hampt

Date: 7/11/94

B-245

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	60.9-62.9'
Lab #	4-1091
Heis #	NA
Tested by	PRH, HH, FMW
Contact	WILLIAMS
Phone #	6-3416
Date	6/8/94
length (cm)	11.32
diameter (cm)	9.55
volume (cm ³)	810.83
wt of sample + mold (g)	1765.8
wt of mold (g)	246.7
wet wt of sample (g)	1519.1
water content % dry wt	4.3%
wet density of sample (g/cm ³)	1.9
dry wt. of sample (g)	1456.5
dry density (g/cm ³)	1.8
specific gravity	2.7
void ratio	0.49
porosity	32.7%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt Date: 7/12/94	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	60.9-62.9'	LAB #	4-1091	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	7/7/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	
Wt. pycnometer + wetting agent, g	168.3	167.69	
Wt. pycnometer+wetting agent+ soil,	187.23	186.59	
Temperature (Tx), degrees C	23.1	23.2	
Specific gravity of wetting agent	1.00	1.00	
Specific gravity of soil at Tx	2.71	2.70	
Specific gravity of soil at 20 C	2.71	2.70	
AVG. Specific gravity of -10 material	2.70		
Wt. sample (SSD), g (B)	506.4	NA	NA
Wt. sample in water, g (C)	311.8	NA	NA
Wt. oven dry sample, g (A)	505	NA	NA
Bulk specific gravity, 23/23 C	2.60	NA	NA
Bulk specific gravity SSD, 23/23 C	2.60	NA	NA
Apparent specific gravity, 23/23 C	2.61	NA	NA
Size fraction, coarse	34.5	NA	NA
Size fraction, fine	65.5	NA	NA
Avg. specific gravity, 23/23 C	2.67	NA	NA
Avg. specific gravity based on:	BULK	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: *H. Harnett*

Date: *7/12/94*

GEOTECHNICAL ENGINEERING LABORATORY SOIL MOISTURE/CALCIUM CARBONATE GEL-14, GEL-19							
WELL #	199K-111A	DEPTH	61.9'	LAB #	4-1091-3	HEIS #	NA
TESTED BY	LDB	CONTACT	Weekes	PHONE	376-9839	DATE	6/16/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	HH/LDB		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/14/94	366.4	349.0	63.0	17.4	286.0	6.1%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	6/16/94	Sample pressure (psi)	0.8	% Calcium carbonate	1.3		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Haupt</i>				Date: <i>6/28/94</i>			

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-111A	CONTACT	Williams	ORIG COD	86950	PHONE	376-3416
LAB #	4-1091	DEPTH	60.9-62.9'	TESTED BY	FMW	DATE	07/01/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1456.0	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	50.800	
	1.5"	0.0	0.0	100.0	38.100	
	3/4"	225.1	15.5	84.5	19.050	
	3/8"	393.1	27.0	73.0	9.525	
WT. #10 SAMP.(g)	#4	502.1	34.5	65.5	4.750	
	#10	631.6	43.4	56.6	2.360	
202.5	#40	40.0	19.8	45.4	0.500	
	#60	59.3	29.3	40.0	0.250	
	#100	89.3	44.1	31.7	0.150	
	#200	117.5	58.0	23.8	0.075	

Sieve Analysis Data for Sample 4-1091

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

Checked by: H. Hampton

Date: 7/12/94

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SAMPLE NO.	4-1091
Contact	B WILLIAMS
Well No.	199-K-111A
Operable Unit	100 K
HEIS No.	N/A
Depth	62.4-62.9'

Mean Tension	0	-30	-79	-126	-218	-314
Std. Dev. (Tension)	0	2	1	1	10	5
Mean K value	1.5E-04	5.5E-06	1.9E-06	6.1E-07	1.2E-07	1.1E-07
Std.Dev./Mean	3%	13%	9%	31%	77%	26%
Water Content, Vol%	21.2%	19.8%	17.5%	15.9%	12.7%	11.8%

UNSATURATED HYDRAULIC CONDUCTIVITY SAMPLE 4-1091

The data package consists of three graphs, nine pages of computer printout (the preparation, data and analysis of the test) five pages of original unsaturated hydraulic conductivity data (preparation and test data) and copies of the specific gravity, bulk density and grain size data.

The Grain Size distribution graph shows both the cumulative and fraction retained on each sieve for both sleeves. The two grain size distributions are very similar, with the moisture retention sample having a little more material passing the #200 sieve (24% for the moisture retention sample, vs 18% for the unsat. K sample). The bulk density of the unsat K sample was almost 0.3 g/cm³ higher than that of the moisture retention sample (2.08 g/cm³ for the unsat. K column and 1.80 g/cm³ for the liner used for moisture retention).

A moisture retention curve was also obtained during the unsat K test. The graph shows three curves. The first one is the moisture retention data obtained from the unsaturated hydraulic conductivity data. The second curve is raw moisture retention data (from the first sleeve). It is raw in the respect that the water content values obtained were multiplied by 2.08 g/cm³; the bulk density of the sleeve (not the bulk density of the Tempe cell sample). The third curve is the same as curve two except that it is corrected by multiplying by the fraction of fines (less than 2 mm or minus ten mesh); i.e., 0.49 times each moisture content value. The moisture content data from the unsaturated hydraulic conductivity test are much closer to the corrected curve than the uncorrected moisture retention data.

J.F. RELYEA
376-4676
10/06/94

Unsaturated Hydraulic Conductivity Values for Test Sample 4-1091

Grain Size Distribution for Test Sample 4-1091

Moisture Retention Curve From Unsaturated,
Hydraulic Conductivity Test Sample 4-1091

UNSATURATED HYDRAULIC CONDUCTIVITY - INTACT SAMPLE PREPARATION - DATA SHEET

SAMPLE NO. 4-1091 1 of 9

Tested By: J.F. Relyea Date 7/12/94
 Procedure No: GEL-32 Rev. 1 Date Issued 6/30/93
 Test Plan No: N/A Rev. N/A Date Issued N/A

Equipment	GEL No.	Calibration Due
Calipers	5645	2/1/95
Balance	3315	8/7/94
Balance	3315	11/7/94

Water Volume - inlet tensiometer N/A cm
 Water Volume - outlet tensiometer N/A cm
 Tensiometer Separation 10.0 cm
 Column Diameter 9.55 cm
 Column Length 15.10 cm

Saturated Sample + Column Weight 4854.53 g

Sample + Column Weight g

Empty Column Weight g

Specific Gravity 2.67 g/cm³

Filler Final Moisture Content Data

Container ID No

Container + Filler Wet wt. g

Container + Filler Dry wt. g

Container Tare wt. g

Dry Filler Wt. g

Weight of Water g

Filler Moisture Content by weight

Filler Soil ID/Sample No. 4-1091

Soil Added To Fill Top Void - Yes (X) No ()

Dry Weight of Soil Added 55.8 g

Specific Gravity g/cm³

Column Volume Filled 20.1 cm³

Soil Added To Fill Bottom Void - Yes (X) No ()

Dry Weight of Soil Added 34.73 g

Specific Gravity g/cm³

Column Volume Filled cm³

Type of Water tap water

REMARKS

SAMPLE NO. 4-1091

Contact B WILLIAMS

Well No. 199-K-111A

Operable Unit 100 K

HEIS No. N/A

Depth 62.4-62.9'

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

Checked By: PR Miller

Date: 10-6-94

B-255

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY DATA SHEET

SAMPLE NO. 4-1091

Page 2 of 9

Tested By: J.F. Relyea

Date 7/18/94

Procedure No: GEL-32

Rev. 1

Date Issue 6/30/93

Test Plan No: N/A

Rev. N/A

Date Issue N/A

Container No. USK-1

Container + wet soil wt. 3113.06 g

Container + dry soil wt. 2989.96 g

Container Tare Wt. 693.27 g

Dry soil wt. 2296.69 g

Moisture Content 5.4% by wt.

Equipment	GEL No.	Calibration Due
Balance	3315	8/7/94
Gauge	5667	10/25/94
Balance	3315	11/7/94

Empty Column Wt. 2341.32 g (before cleanup)

Empty Column Wt. — g (after cleanup)

Start Date	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/27/94	7/27/94	7/28/94	7/28/94
Start Time	9:12	9:59	10:40	11:18	11:54	12:49	13:41	6:03	7:12	6:06	8:49
End Date	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/27/94	7/27/94	7/27/94	7/28/94	7/29/94
End Time	9:59	10:40	11:18	11:54	12:49	13:41	6:02	7:12	8:42	8:49	6:51
Inlet Burette Reading Start, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outlet Burette Reading Start, milliliters	44.6	43.1	41.6	40.4	39.1	37.3	35.6	50.0	48.2	50.0	48.8
Outlet Burette Reading End, milliliters	43.1	41.6	40.4	39.1	37.3	35.6	6.6	48.2	46.0	48.8	38.0
Inlet Tensiometer reading, cm	start	-29	-29	-27	-27	-28	-27	-27	-27	-30	-78
	end	-29	-27	-27	-28	-27	-27	-27	-30	-34	-79
Outlet Tensiometer reading, cm	start	-32	-31	-32	-31	-30	-31	-32	-32	-32	-77
	end	-31	-32	-31	-30	-31	-32	-32	-32	-78	-78
Weight of Column and Wet Sample, g									4835.3		

REMARKS

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

Checked By: PR Heller

Date: 10-6-94

B-256

W/C-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1091

Page 3 of 9

Tested By: J.F. Relyea

Date 7/29/94

Start Date		7/29/94	7/29/94	7/29/94	7/30/94	7/31/94	8/1/94	8/1/94	8/3/94	8/4/94	8/9/94	8/11/94
Start Time		6:51	8:18	9:44	8:06	7:59	6:15	9:43	12:44	10:21	9:40	7:00
End Date		7/29/94	7/29/94	7/29/94	7/31/94	8/1/94	8/1/94	8/1/94	8/4/94	8/5/94	8/10/94	
End Time		8:18	9:44	10:42	7:59	6:15	9:43	12:06	6:11	9:02	8:55	
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Outlet Burette Reading Start, milliliters		38.0	37.4	36.9	50.0	45.4	41.3	41.0	46.2	50.0	50.0	
Outlet Burette Reading End, milliliters		37.4	36.9	36.5	45.4	41.3	41.0	40.6	43.6	46.7	47.1	
Inlet Tensiometer reading, cm	start	-79	-80	-80	-115	-132	-123	-127	-225	-233	-212	
	end	-80	-80	-77	-132	-123	-127	-126	-233	-231	-228	
Outlet Tensiometer reading, cm	start	-78	-78	-78	-122	-130	-123	-126	-215	-237	-215	
	end	-78	-78	-78	-130	-123	-126	-126	-213	-223	-213	
Weight of Column and Wet Sample, g				4810.44				4793.89				*

REMARKS

• 8/11/94 Bottom septum leaked. Changed out for newer one.

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

Checked By:

[Signature]

Date:

10-6-94

B-257

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1091

Tested By: J.F. Relyea

Page 4 of 9
Date 8/11/94

Start Date	8/11/94	8/11/94	8/15/94	8/16/94	8/21/94	8/24/94	8/25/94	8/31/94	9/7/94	9/8/94	9/9/94
Start Time	10:26	13:57	8:45	6:42			6:19	9:50		5:59	6:09
End Date	8/11/94	8/12/94		8/17/94			8/26/94	9/1/94		9/9/94	9/10/94
End Time	13:57	6:03		6:41			5:59	6:12		6:09	8:37
Inlet Burette Reading Start, milliliters	N/A	N/A		N/A			N/A	N/A		N/A	N/A
Inlet Burette Reading End, milliliters	N/A	N/A		N/A			N/A	N/A		N/A	N/A
Outlet Burette Reading Start, milliliters	45.2	44.9		39.5			39.7	44.6		50.0	48.4
Outlet Burette Reading End, milliliters	44.9	44.0		35.1			39.6	43.3		48.4	47.3
Inlet Tensiometer reading, cm	start	-220	-210	-218			-203	-202		-210	-212
	end	-210	-224	-214			-185	-189		-212	-215
Outlet Tensiometer reading, cm	start	-221	-211	-217			-214	-207		-229	-230
	end	-211	-215	-206			-198	-211		-230	
Weight of Column and Wet Sample, g			* Before -> After ->	4770.94 4848.82	4840.42 4851.02	4850.48 4842.87			4844.38 4776.84		

REMARKS

* 8/15/94 Bottom septum leaked again. Changed out for newer one.

8/18/94 changed bottom tensiometer, weight before = 4770.94; after = 4848.82
8/21 changed bottom tensiometer
8/24 changed top tensiometer
9/7 changed both tensiometers

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

Checked By:

J.F. Relyea

Date:

10-6-94

B-258

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY CONTINUATION SHEET

SAMPLE NO. 4-1091

Tested By: J.F. Relyea

Page 5 of 9
Date 9/11/94

Start Date		9/10/94	9/11/94	9/15/94	9/23/94	9/24/94	9/25/94					
Start Time		8:37	8:22	6:06	6:01	15:48	7:13					
End Date		9/11/94	9/12/94	9/16/94	9/24/94	-9/25/94	9/26/94					
End Time		8:22	6:18	6:04	15:48	7:13	6:09					
Inlet Burette Reading Start, milliliters		N/A	N/A	N/A	N/A	N/A	N/A					
Inlet Burette Reading End, milliliters		N/A	N/A	N/A	N/A	N/A	N/A					
Outlet Burette Reading Start, milliliters		47.3	46.3	46.7	47.6	45.8	45.1					
Outlet Burette Reading End, milliliters		46.3	45.5	45.8	45.8	45.1	44.4					
Inlet Tensiometer reading, cm	start	-215	-218	-318	-301	-308	-313					
	end	-218	-219	-315	-308	-313	-308					
Outlet Tensiometer reading, cm	start	-230	-229	-320	-314	-318	-323					
	end	-229	-224	-313	-318	-323	-304					
Weight of Column and Wet Sample, g			4772.97				4763.44					

REMARKS

9-19-94 The bottom tensiometer was acting up; reading lower each day. It was tested with a syringe and a large bubble of air was removed. It is apparently holding now and was set at -331 cm.

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

Checked By:

[Signature]

Date:

10-10-94

B-259

W/C-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET

SAMPLE NO. 4-1091 Page 6 of 9
 Tested By: J.F. Relyea Date 10/6/94

Tensiometer Separation <u>10.0 cm</u>	Column Volume <u>1081.7 cm³</u>	Test Sample Bulk Density <u>2.08 g/cm³</u>
Column Length <u>15.1 cm</u>	Filler Volume <u>20.1 cm³</u>	Test Sample Porosity <u>0.22 cm³/cm³</u>
Column Diameter <u>9.6 cm</u>	Filler Dry Wt. <u>90.5 g</u>	Empty Column Wt. <u>2341.3 g, Average</u>
Column Area <u>71.6 cm²</u>	Sample Volume <u>1061.6 cm³</u>	Field Sample Bulk Density <u>1.80 g/cm³</u>
Final Moisture Content <u>5.4% by wt.</u>	Sample Dry Wt. <u>2206.2 g</u>	Type of water used <u>Tap Water</u>

Start Date		7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/27/94
Start Time		9:12	9:59	10:40	11:18	11:54	12:49	13:41	6:03
End Date		7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/26/94	7/27/94	7/27/94
End Time		9:59	10:40	11:18	11:54	12:49	13:41	6:02	7:12
Total Elapsed, sec		2820	2460	2280	2160	3300	3120	58860	4140
Volume, cm ³		1.50	1.50	1.20	1.30	1.80	1.70	29.00	1.80
Tension - inlet, cm		-29	-28	-27	-28	-28	-27	-27	-29
Tension - outlet, cm		-32	-32	-32	-31	-31	-32	-32	-32
Average Tension, cm	0	-30	-30	-29	-29	-29	-29	-30	-30
K, cm/sec	1.45E-04	5.94E-06	6.31E-06	5.07E-06	6.46E-06	5.86E-06	5.25E-06	4.59E-06	4.50E-06
Weight of Column + Wet Sample, g	4854.53								
Weight of Water in Filler, g (from MRC)	0								
Weight of Water in Sample, g	229.85								
Moisture Content (volumetric %)	21.2%								

REMARKS

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

Checked By:

P.R. Heller

Date: 10-6-94

B-260

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1091

Tested By:

J.F. Relyea

Date

Page 7

of

9

10/6/94

Start Date	7/27/94	7/28/94	7/28/94	7/29/94	7/29/94	7/29/94	7/30/94	7/31/94	8/1/94
Start Time	7:12	6:06	8:49	6:51	8:18	9:44	8:06	7:59	6:15
End Date	7/27/94	7/28/94	7/29/94	7/29/94	7/29/94	7/29/94	7/31/94	8/1/94	8/1/94
End Time	8:42	8:49	6:51	8:18	9:44	10:42	7:59	6:15	9:43
Total Elapsed, sec	5400	9780	79320	5220	5160	3480	85980	80160	12480
Volume, cm ³	2.20	1.20	10.80	0.60	0.50	0.40	4.60	4.10	0.30
Tension - Inlet, cm	-32	-79	-79	-80	-80	-79	-124	-128	-125
Tension - outlet, cm	-32	-78	-78	-78	-78	-78	-126	-127	-125
Average Tension, cm	-32	-78	-79	-79	-79	-78	-125	-127	-125
K, cm/sec	5.69E-06	1.90E-06	2.11E-06	1.89E-06	1.69E-06	1.69E-06	5.97E-07	7.93E-07	3.53E-07
Weight of Column + Wet Sample, g	4835.3					4810.44			
Weight of Water in Filler, g (from MRC)	0					0			
Weight of Water in Sample, g	210.62					185.76			
Moisture Content (volumetric %)	19.8%					17.5%			

REMARKS

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

Checked By:

PR. H. O. O. C.

Date: 10-6-94

B-261

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1091

Tested By:

J.F. Relyea

Date

Page 8

of

9

10/6/94

Start Date	8/1/94	8/11/94	8/31/94	9/8/94	9/9/94	9/10/94	9/11/94	9/15/94	9/23/94
Start Time	9:43	10:26	9:50	5:59	6:09	8:37	8:22	6:06	6:01
End Date	8/1/94	8/11/94	9/1/94	9/9/94	9/10/94	9/11/94	9/12/94	9/16/94	9/24/94
End Time	12:06	13:57	6:12	6:09	8:37	8:22	6:18	6:04	15:48
Total Elapsed, sec	8580	12660	73320	87000	95280	85500	78960	86280	121620
Volume, cm ³	0.40	0.30	1.30	1.60	1.10	1.00	0.80	0.90	1.80
Tension - inlet, cm	-127	-215	-196	-211	-214	-217	-219	-317	-305
Tension - outlet, cm	-126	-216	-209	-230	-230	-230	-227	-317	-316
Average Tension, cm	-126	-216	-202	-220	-222	-223	-223	-317	-310
K, cm/sec	6.85E-07	3.01E-07	1.05E-07	9.01E-08	6.08E-08	7.10E-08	7.86E-08	1.46E-07	9.61E-08
Weight of Column + Wet Sample, g	4793.89						4772.97		
Weight of Water in Filler, g (from MRC)	0						0		
Weight of Water in Sample, g	169.21						134.96		
Moisture Content (volumetric %)	15.9%						12.7%		

REMARKS

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

Checked By:

J.F. Relyea

Date 10-6-94

B-262

WHC-SD-EN-DP-090, Rev. 0

UNSATURATED HYDRAULIC CONDUCTIVITY ANALYSIS SHEET (CONTINUED)

SAMPLE NO.

4-1091

Tested By:

J.F. Relyea

Date

Page

9

of

9

10/6/94

Start Date	9/24/94	9/25/94							
Start Time	15:48	7:13							
End Date	9/25/94	9/26/94							
End Time	7:13	6:09							
Total Elapsed, sec	55500	82560							
Volume, cm ³	0.70	0.70							
Tension - Inlet, cm	-311	-311							
Tension - outlet, cm	-321	-314							
Average Tension, cm	-316	-312							
K, cm/sec	8.80E-08	9.10E-08							
Weight of Column + Wet Sample, g		4763.44							
Weight of Water in Filler, g (from MRC)		0							
Weight of Water in Sample, g		125.43							
Moisture Content (volumetric %)		11.8%							

REMARKS

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

Checked By:

PR Heller

Date: 10-10-94

B-263

WHC-SD-EN-DP-090, Rev. 0

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Moisture Retention Sample Number 4-1091

SAMPLE NO.	4-1091	Operable Unit	100 K
Contact	B WILLIAMS	HEIS No.	N/A
Well No.	199-K-111A	Depth	61.9-62.4'

TEMPE CELLS	Sample #	4-1091 1 Bar Primary Drying Curve (vacuum saturated)							
tension in cm	N/A	N/A	0.0	0.0	0.0	0.0	0.0	2.0	4.0
error in tension value +/-			0.1	0.1	0.1	0.1	0.1	0.1	0.1
container number	MC-10	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25
weight of container/ring,+wet sample	161.07	552.26	577.62	577.77	577.66	577.60	577.24	577.41	577.05
weight of container/ring,+ dry sample	161.00	552.17	551.70	551.70	551.70	551.70	551.70	551.70	551.70
weight of moisture	0.07	0.09	25.92	26.07	25.96	25.90	25.54	25.71	25.35
weight of container and ring	60.50	425.93	425.50	425.50	425.50	425.50	425.50	425.50	425.50
weight of dry sample	100.57	126.24	126.20	126.20	126.20	126.20	126.20	126.20	126.20
moisture content, wt. %	0.1%		20.5%	20.7%	20.6%	20.5%	20.2%	20.4%	20.1%
date measured			7/26/94	7/27/94	7/28/94	7/29/94	8/1/94	8/2/94	8/3/94
temperature deg. C			28	28	27	28	27	27	28

TEMPE CELLS	Sample #	4-1091 1 Bar Primary Drying Curve							
tension in cm	6.0	8.0	12.5	25.5	32	51	70	103	200
error in tension value +/-	0.1	0.1	0.1	1	1	1	1	2	2
container number	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25
weight of container/ring,+wet sample	574.99	574.92	574.84	574.52	574.44	574.30	573.94	573.55	571.33
weight of container/ring,+ dry sample	551.70	551.70	551.70	551.70	551.70	551.70	551.70	551.70	551.70
weight of moisture	23.29	23.22	23.14	22.82	22.74	22.60	22.24	21.85	19.63
weight of container and ring	425.50	425.50	425.50	425.50	425.50	425.50	425.50	425.50	425.50
weight of dry sample	126.20	126.20	126.20	126.20	126.20	126.20	126.20	126.20	126.20
moisture content, wt. %	18.5%	18.4%	18.3%	18.1%	18.0%	17.9%	17.6%	17.3%	15.6%
date measured	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94	8/12/94	8/15/94	8/16/94
temperature deg. C	27	26	26	26	27	27	27	26	26

TEMPE CELLS	Sample #	4-1091 1 Bar Primary Drying Curve					
tension in cm	300	500	700	850	1000	1000	N/A
error in tension value +/-	20	20	20	20	20	20	
container number	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	MC-15
weight of container/ring,+wet sample	568.85	565.88	563.64	563.03	562.35	562.27	199.01
weight of container/ring,+ dry sample	551.70	551.70	551.70	551.70	551.70	551.70	188.44
weight of moisture	17.15	14.18	11.94	11.33	10.65	10.57	10.57
weight of container and ring	425.50	425.50	425.50	425.50	425.50	425.50	62.44
weight of dry sample	126.20	126.20	126.20	126.20	126.20	126.20	126.00
moisture content, wt. %	13.6%	11.2%	9.5%	9.0%	8.4%	8.38%	8.39%
date measured	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	
temperature deg. C	26	26	26	26	27	26	

volume of brass ring 68.26

Sample Bulk Density =	1.85 g/cm ³	Cell wt. before cleanup =	425.35
Field Bulk Density =	1.8 g/cm ³	Cell wt. after cleanup =	425.55
Fraction < 2 mm =	0.57	Average of all 3	425.61

TEMPE CELLS

	Sample #	4-1091 1 Bar Main Drying Curve (natural saturation from the bottom)							
tension in cm	0.0	0.0	0.0	4.0	12.0	20.0	31.0	52.0	70.1
error in tension value +/-									
container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35
weight of container/ring,+wet sample	565.36	566.18	567.09	564.70	564.64	564.56	564.31	564.26	564.29
weight of container/ring,+ dry sample	542.70	542.70	542.70	542.70	542.70	542.70	542.70	542.70	542.70
weight of moisture	22.66	23.48	24.39	22.00	21.94	21.86	21.61	21.56	21.59
weight of container and ring	418.50	418.50	418.50	418.50	418.50	418.50	418.50	418.50	418.50
weight of dry sample	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.20
moisture content, wt. %	18.24%	18.90%	19.64%	17.71%	17.67%	17.60%	17.40%	17.36%	17.38%
date measured	9/6/94	9/7/94	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94
temperature deg. C	26	26	26	26	25	26	27	26	26

TEMPE CELLS

	Sample #	4-1091 1 Bar Main Drying Curve						
tension in cm	100.9	213.0	300	500	690	1000	N/A	N/A
error in tension value +/-								
container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	MC-10
weight of container/ring,+wet sample	564.23	562.71	560.31	557.08	555.67	553.69	553.69	195.57
weight of container/ring,+ dry sample	542.70	542.70	542.70	542.70	542.70	542.70	542.70	184.61
weight of moisture	21.53	20.01	17.61	14.38	12.97	10.99	10.99	10.96
weight of container and ring	418.50	418.50	418.50	418.50	418.50	418.50	418.50	60.59
weight of dry sample	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.02
moisture content, wt. %	17.33%	16.11%	14.18%	11.58%	10.44%	8.85%	8.85%	8.84%
date measured	9/16/94	9/18/94	9/19/94	9/21/94	9/22/94	9/23/94		9/26/94
temperature deg. C	25	26	26	26	26	26		26

B-267

volume of brass ring	68.26	cm ³
Sample Bulk Density =	1.82	g/cm ³
Cell wt. before filling =	418.51	grams
Cell wt. before cleanup =	418.51	grams
Cell wt. after cleanup =	418.47	grams
	418.50	Average of all 3

TEMPE CELLS	Sample #	4-1091	1 Bar Main Wetling Curve						
tension in cm	N/A	N/A	1000	1000	1000	1000	1000	1000	1000
error in tension value +/-									
container number	MC-10	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35
weight of container/ring,+wet sample	161.07	543.24	550.13	550.40	550.41	550.12	550.46	550.42	550.42
weight of container/ring,+ dry sample	161.00	543.15	542.70	542.70	542.70	542.70	542.70	542.70	542.70
weight of moisture	0.07	0.09	7.43	7.70	7.71	7.42	7.76	7.72	7.72
weight of container and ring	60.50	418.51	418.50	418.50	418.50	418.50	418.50	418.50	418.50
weight of dry sample	100.57	124.64	124.20	124.20	124.20	124.20	124.20	124.20	124.20
moisture content, wt. %	0.07%		5.98%	6.20%	6.21%	5.97%	6.25%	6.22%	6.22%
date measured		8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94
temperature deg. C		26.9	28	28	27	26	27	27	27

TEMPE CELLS	Sample #	4-1091	1 Bar Main Wetling Curve						
tension in cm	700	500	300	203	104	71.5	53	32.5	23.5
error in tension value +/-									
container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35
weight of container/ring,+wet sample	551.69	553.53	556.13	558.12	561.55	562.39	563.26	563.82	564.14
weight of container/ring,+ dry sample	542.70	542.70	542.70	542.70	542.70	542.70	542.70	542.70	542.70
weight of moisture	8.99	10.83	13.43	15.42	18.85	19.69	20.56	21.12	21.44
weight of container and ring	418.50	418.50	418.50	418.50	418.50	418.50	418.50	418.50	418.50
weight of dry sample	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.20
moisture content, wt. %	7.24%	8.72%	10.81%	12.42%	15.18%	15.85%	16.55%	17.00%	17.26%
date measured	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94
temperature deg. C	28	26	27	26	27	26	27	27	27

TEMPE CELLS	Sample #	4-1091	1 Bar Main Wetling Curve						
tension in cm	11.0	7.5	6	4	2.0	0.0	0.0	0.0	
error in tension value +/-									
container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	
weight of container/ring,+wet sample	564.47	564.74	564.92	565.21	565.23	565.47	565.62	565.45	
weight of container/ring,+ dry sample	542.70	542.70	542.70	542.70	542.70	542.70	542.70	542.70	
weight of moisture	21.77	22.04	22.22	22.51	22.53	22.77	22.92	22.75	
weight of container and ring	418.50	418.50	418.50	418.50	418.50	418.50	418.50	418.50	
weight of dry sample	124.20	124.20	124.20	124.20	124.20	124.20	124.20	124.20	
moisture content, wt. %	17.53%	17.75%	17.89%	18.12%	18.14%	18.33%	18.45%	18.32%	
date measured	8/25/94	8/26/94	8/27/94	8/29/94	8/30/94	8/31/94	9/1/94	9/2/94	
temperature deg. C	25	26	26	26	26	26	27	26	

volume of brass ring 68.26 cm³
 Sample Bulk Density = 1.82 g/cm³

KETTLES	Sample #	4-1091 15 Bar Drying Curve						
tension in Bars	0.5	0.5	0.7	0.7	1.0	1.0	2.0	2.0
error in tension value +/-	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
container number	BA19	BA20	BA19	BA20	BA19	BA20	BB19	BB20
weight of container/ring,+wet sample	46.49	44.64	46.35	44.52	46.22	44.39	43.80	45.88
weight of container/ring,+ dry sample	44.81	43.12	44.75	43.05	44.70	42.99	42.88	44.90
weight of moisture	1.68	1.52	1.60	1.47	1.52	1.40	0.92	0.98
Container Tare Wt.,g	28.03	27.61	28.03	27.61	28.03	27.61	27.78	28.44
weight of dry sample	16.78	15.51	16.72	15.44	16.67	15.38	15.10	16.46
moisture content %	10.01%	9.80%	9.57%	9.52%	9.12%	9.10%	6.09%	5.95%
date measured	8/10/94	8/10/94	8/16/94	8/16/94	8/22/94	8/22/94	8/10/94	8/10/94
temperature deg. C	27	27	27	27	27	27	27	27

KETTLES								
tension in Bars	3.0	3.0	5.0	5.0	7.0	7.0	10.0	10.0
error in tension value +/-	0.02	0.02	0.1	0.1	0.1	0.1	0.1	0.1
container number	BB19	BB20	BB19	BB20	BC19	BC20	BC19	BC20
weight of container/ring,+wet sample	43.57	45.61	43.44	45.45	44.56	44.49	45.36	45.29
weight of container/ring,+ dry sample	42.76	44.73	42.74	44.70	44.14	44.10	44.11	44.07
weight of moisture	0.81	0.88	0.70	0.75	0.42	0.39	1.25	1.22
Container Tare Wt.,g	27.78	28.44	27.78	28.44	29.14	29.20	29.14	29.20
weight of dry sample	14.98	16.29	14.96	16.26	15.00	14.90	14.97	14.87
moisture content %	5.41%	5.40%	4.68%	4.61%	2.80%	2.62%	8.35%	8.20%
date measured	8/20/94	8/20/94	8/27/94	8/27/94	8/10/94	8/10/94	8/16/94	8/16/94
temperature deg. C	27	27	26	26	27	27	27	27

Water Potential Data for CX-2 Samples

Sample No.	4-1091	
Container Number	BC19	BC20
Aw Reading	0.997	0.989
Temperature °C	28.0	27.4
Water Potential, Bars	4.2	15.3

Can ID No	BC19	BC20
Can + Soil Wet wt., g	45.13	44.57
Can + Soil Dry wt., g	44.10	44.05
Can Tare wt., g	29.14	29.20
Weight of Water, g	1.03	0.52
Dry Weight of Sample, g	14.96	14.85
Moisture Content, wt. %	6.89%	3.50%
date measured	8/29/94	8/29/94

POINTS SELECTED FOR PLOTTING

	Sample # 4-1091										
container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35
Tension in cm	1.0	4.0	12.0	20.0	31.0	52.0	70.1	100.9	213.0	300.0	500.0
Primary Drying Curve											
Tempe Main Drying Curve	19.6%	17.7%	17.7%	17.6%	17.4%	17.4%	17.4%	17.3%	16.1%	14.2%	11.6%
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetting Curve											
date measured	9/8/94	9/9/94	9/11/94	9/12/94	9/13/94	9/14/94	9/15/94	9/16/94	9/18/94	9/19/94	9/21/94

container number	TC-35	TC-35	BA19	BA19	BB19	BB19	BB19	BC20	TC-35	TC-35	TC-35
tension in cm	690	1000	714	1020	2040	3060	5100	15632	1000	700	300
Tempe Primary Drying Curve											
Tempe Main Drying Curve	10.4%	8.8%									
Kettle/CX-2 Main Drying Curve			9.5%	9.1%	6.0%	5.4%	4.6%	3.5%			
Tempe Main Wetting Curve									6.2%	7.2%	10.8%
date measured	9/22/94	9/23/94	8/16/94	8/22/94	8/10/94	8/20/94	8/27/94	8/29/94	8/11/94	8/12/94	8/16/94

container number	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35	TC-35
tension in cm	203.0	104.0	71.5	53.0	32.5	23.5	11.0	7.5	6.0	4.0	2.0
Tempe Primary Drying Curve											
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetting Curve	12.4%	15.2%	15.9%	16.6%	17.0%	17.3%	17.5%	17.7%	17.9%	18.1%	18.1%
date measured	8/17/94	8/18/94	8/19/94	8/22/94	8/23/94	8/24/94	8/25/94	8/26/94	8/27/94	8/29/94	8/30/94

container number	TC-35	TC-35	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25
tension in cm	500	1.0	1.0	2.0	4.0	6.0	8.0	12.5	25.5	32.0	51.0
Tempe Primary Drying Curve			20.2%	20.4%	20.1%	18.5%	18.4%	18.3%	18.1%	18.0%	17.9%
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetting Curve	8.7%	18.3%									
date measured	8/15/94	9/2/94	8/1/94	8/2/94	8/3/94	8/4/94	8/5/94	8/8/94	8/9/94	8/10/94	8/11/94

container number	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25	TC-25			
tension in cm	70.0	103.0	200.0	300.0	500.0	700.0	850.0	1000.0			
Tempe Primary Drying Curve	17.6%	17.3%	15.6%	13.6%	11.2%	9.5%	9.0%	8.4%			
Tempe Main Drying Curve											
Kettle/CX-2 Main Drying Curve											
Tempe Main Wetting Curve											
date measured	8/12/94	8/15/94	8/16/94	8/17/94	8/18/94	8/19/94	8/22/94	8/24/94			

Points from kettle are enclosed by the double outline

Points from CX-2 are enclosed by the single outline

WHC-SD-EN-DP-090, Rev. 0

B270

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1098 Well no./depth 199-K-111A/81.5-82.0' VISCOSITY 1

Tested By: H. Hamp/F. M. Williams Date 06/30/94

Specimen Diameter (D, cm) 9.57 Specimen Length (L, cm) 12.75

Start Date	01-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94
Start Time	00:00:00	00:00:00	00:00:00	11:43:00	13:33:30
End Date	01-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94
End Time	00:04:00	00:12:00	00:17:00	13:33:00	15:23:00
Time Sec.	240	720	1020	6600	6570
Volume, cm ³	1	2.8	4	29	26
Head, cm	81.3	82.5	81.3	81.3	81.3
"Q"	4.17E-03	3.89E-03	3.92E-03	4.39E-03	3.96E-03
L/(A*H)	2.18E-03	2.15E-03	2.18E-03	2.18E-03	2.18E-03
K, cm/sec	9.08E-06	8.36E-06	8.55E-06	9.58E-06	8.63E-06
Kc, (K*Visc)	9.08E-06	8.36E-06	8.55E-06	9.58E-06	8.63E-06

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 8.84E-06

STANDARD DEV. 4.41E-07

% STAND. DEV. 5.0%

Remarks: Sample was recompacted to a dry bulk density of 2.4 g/cm³ prior to running test.

Void space at top of sample was filled with +4, -3/8 gravel.

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

Checked By: H. Hamp

Date: 7/11/94

B-271

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	81-81.5'
Lab #	4-1098
Heis #	NA
Tested by	FMW/HH
Contact	B. Williams
Phone #	376-3416
Date	11/16/94
length (cm)	12.70
diameter (cm)	9.57
volume (cm ³)	913.49
wt of sample + mold (g)	2672.2
wt of mold (g)	352.2
wet wt of sample (g)	2320.0
water content % dry wt	4.9%
wet density of sample (g/cm ³)	2.5
dry wt. of sample (g)	2211.6
dry density (g/cm ³)	2.4
specific gravity	2.7
void ratio	0.12
porosity	10.3%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>FM Williams</i> Date: <i>11/17/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	81-81.5'	LAB #	4-1098	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	376-3416	DATE	11/4/94

	1	2	3		temp	K
Wt. oven dry soil, g	30.00	30.00	30.00		15	0.99913
Wt. pycnometer + wetting agent, g	167.3	163.52	163.07		16	0.99901
Wt. pycnometer+wetting agent+ soil,	186.38	182.54	182.17		18	1.0004
Temperature (Tx), degrees C	19	19	19		19	1.0002
Specific gravity of wetting agent	1.00	1.00	1.00		20	1.0000
Specific gravity of soil at Tx	2.75	2.73	2.75		21	0.9998
Specific gravity of soil at 20 C	2.75	2.73	2.75		22	0.9996
AVG. Specific gravity of -10 material	2.74				23	0.9993
Wt. sample (SSD), g (B)	1465	NA	NA		24	0.9991
Wt. sample in water, g (C)	917.9	NA	NA		25	0.9989
Wt. oven dry sample, g (A)	1460.9	NA	NA		26	0.9986
Bulk specific gravity, 23/23 C	2.67	NA	NA		27	0.9983
Bulk specific gravity SSD, 23/23 C	2.68	NA	NA		28	0.998
Apparent specific gravity, 23/23 C	2.69	NA	NA		29	0.9977
					30	0.9974
Size fraction, coarse	66.3	NA	NA			
Size fraction, fine	33.7	NA	NA			
Avg. specific gravity, 23/23 C	2.70	NA	NA			
Avg. specific gravity based on:	Bulk	NA	NA			

COMMENTS:

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

Checked By: FMW Date: 11/15/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-111A	DEPTH	80.-82'	LAB #	4-1099	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	376-3416	DATE	6/21/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/21/94	679.63	623.45	62.86	56.18	560.59	10.0%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB/FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	7/1/94	Sample pressure (psi)	0.9	% Calcium carbonate	1.5		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Haupt</i>				Date: <i>7/7/94</i>			

SIEVE ANALYSIS REPORT SHEET

WELL #	199-K-111A	CONTACT	B. WILLIAM	ORIG COD	86950	PHONE	3-3416
LAB #	4-1097	DEPTH	81.5-82'	TESTED BY	LDB	DATE	06/23/94

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1525.2	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	50.800	
	1.5"	604.6	39.6	60.4	38.100	
	3/4"	823.6	54.0	46.0	19.050	
	3/8"	1101.6	72.2	27.8	9.525	
WT.-#10	# 4	1201.6	78.8	21.2	4.750	
SAMP.(g)	#10	1265.8	83.0	17.0	2.360	
258.6	#40	49.5	19.1	13.8	0.500	
	#60	133.0	51.4	8.3	0.250	
	#100	187.3	72.4	4.7	0.150	
	#200	212.6	82.2	3.0	0.075	

Sieve Analysis Data for Sample 4-1097

R. T. McIntosh
 CHECKED BY: R T MCINTOSH

06/23/94

Sieve Analysis Data for Sample 4-1097

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1100 Well no./depth 199-K-111A/122.4-122.9' VISCOSITY 1

Tested By: H. Hampt/F. M. Williams Date 06/24/94

Specimen Diameter (D, cm) 9.6 Specimen Length (L, cm) 15.13

Start Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	28-Jun-94	28-Jun-94	28-Jun-94	29-Jun-94
End Time	00:03:00	00:03:00	00:03:00	00:03:00
Time Sec.	180	180	180	180
Volume, cm ³	22.8	22.8	26.4	21.6
Head, cm	78.7	78.7	78.7	78.7
"Q"	1.27E-01	1.27E-01	1.47E-01	1.20E-01
L/(A*H)	2.66E-03	2.66E-03	2.66E-03	2.66E-03
K, cm/sec	3.36E-04	3.36E-04	3.90E-04	3.19E-04
Kc, (K*Visc)	3.36E-04	3.36E-04	3.90E-04	3.19E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 3.45E-04

STANDARD DEV. 2.66E-05

% STAND. DEV. 7.7%

Remarks: Void space filled with -3/8, +4 gravel. Sample vacuum satur Dry bulk density =1.7 g/cm³.

Moisture content on arrival = 6.6% of dry weight.

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

Checked By:

H. Hampt

Date:

7/11/94

B-277

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY	
BULK DENSITY/POROSITY	
GEL-16	
Well no.	199-K-111A
Depth	121.9-122.4'
Lab #	4-1101
Heis #	NA
Tested by	LDB/FMW
Contact	Williams
Phone #	376-3416
Date	6/28/94
length (cm)	14.92
diameter (cm)	9.57
volume (cm ³)	1073.17
wt of sample + mold (g)	2850.0
wt of mold (g)	322.8
wet wt of sample (g)	2527.2
dry wt of sample (g)	2384.2
wet density of sample (g/cm ³)	2.4
water content % dry wt	6.00%
dry density (g/cm ³)	2.2
specific gravity	2.7
void ratio	0.19
porosity	16.2%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: H. Haupt Date: 7/7/94	

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	122.4-122.9'
Lab #	4-1100
Heis #	NA
Tested by	FMW
Contact	B. Williams
Phone #	376-3416
Date	11/16/94
length (cm)	11.73
diameter (cm)	9.60
volume (cm ³)	849.02
wt of sample + mold (g)	2328.3
wt of mold (g)	386.7
wet wt of sample (g)	1941.6
water content % dry wt	6.6%
wet density of sample (g/cm ³)	2.3
dry wt. of sample (g)	1821.4
dry density (g/cm ³)	2.1
specific gravity	2.7
void ratio	0.24
porosity	19.0%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>B. Williams</i> Date: <i>11/17/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY
SPECIFIC GRAVITY
GEL 10

WELL #	199-K-111A	DEPTH	121.9-122.4	LAB #	4-1101	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	6-3416	DATE	6/23/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	167.56	168.13	167.21
Wt. pycnometer+wetting agent+ soil,	186.47	186.91	186.07
Temperature (Tx), degrees C	27.5	27.5	23.4
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.71	2.67	2.69
Specific gravity of soil at 20 C	2.70	2.67	2.69
AVG. Specific gravity of -10 material	2.69		
Wt. sample (SSD), g (B)	1411.6	NA	NA
Wt. sample in water, g (C)	879.9	NA	NA
Wt. oven dry sample, g (A)	1397.4	NA	NA
Bulk specific gravity, 23/23 C	2.63	NA	NA
Bulk specific gravity SSD, 23/23 C	2.65	NA	NA
Apparent specific gravity, 23/23 C	2.70	NA	NA
Size fraction, coarse	59.3	NA	NA
Size fraction, fine	40.7	NA	NA
Avg. specific gravity, 23/23 C	2.66	NA	NA
Avg. specific gravity based on:	BULK	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: *H. Haupt*

Date: *7/11/94*

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	122.4-122.9'	LAB #	4-1100	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	376-3415	DATE	11/9/94

	1	2	3		temp	K
Wt. oven dry soil, g	30.00	30.00	30.00		15	0.99913
Wt. pycnometer + wetting agent, g	168.38	167.77	168.34		16	0.99901
Wt. pycnometer+wetting agent+ soil,	187.13	186.6	187.19		18	1.0004
Temperature (Tx), degrees C	19	19	19		19	1.0002
Specific gravity of wetting agent	1.00	1.00	1.00		20	1.0000
Specific gravity of soil at Tx	2.67	2.69	2.69		21	0.9998
Specific gravity of soil at 20 C	2.67	2.69	2.69		22	0.9996
AVG. Specific gravity of -10 material	2.68				23	0.9993
Wt. sample (SSD), g (B)	1001.2	NA	NA		24	0.9991
Wt. sample in water, g (C)	625.9	NA	NA		25	0.9989
Wt. oven dry sample, g (A)	992.2	NA	NA		26	0.9986
Bulk specific gravity, 23/23 C	2.64	NA	NA		27	0.9983
Bulk specific gravity SSD, 23/23 C	2.67	NA	NA		28	0.998
Apparent specific gravity, 23/23 C	2.71	NA	NA		29	0.9977
					30	0.9974
Size fraction, coarse	54.7	NA	NA			
Size fraction, fine	45.3	NA	NA			
Avg. specific gravity, 23/23 C	2.65	NA	NA			
Avg. specific gravity based on:	Bulk	NA	NA			

COMMENTS:

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

Checked By: B. Williams Date: 11/15/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-111A	DEPTH	121.9-122.4'	LAB #	4-1101	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	376-3416	DATE	6/27/94
GEL-14 SOIL MOISTURE							
BALANCE	3311	CALIBRATION DUE	8/7/94	TESTED BY	LDB/FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/27/94	2831.6	2688.7	307.5	142.9	2381.2	6.0%	FMW
Comments No calcium carbonate was requested.							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	NA		
VESSEL	5697	CALIBRATION DUE	6/3/94	SAMPLE WT. (g)	8.00		
Date	NA	Sample pressure (psi)	NA	% Calcium carbonate	NA		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: H. Hainey				Date: 6/7/94			

GEOTECHNICAL ENGINEERING LABORATORY SOIL MOISTURE/CALCIUM CARBONATE GEL-14, GEL-19							
WELL #	199-K-111A	DEPTH	120.9-122.9'	LAB #	4-1102	HEIS #	NA
TESTED BY	FMW	CONTACT	Williams	PHONE	376-3416	DATE	6/21/94
GEL-14 SOIL MOISTURE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/21/94	569.0	530.4	60.5	38.6	469.9	8.2%	FMW
Comments No calcium carbonate was requested.							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	6/3/94	SAMPLE WT. (g)	8.00		
Date	6/21/94	Sample pressure (psi)	0.3	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>H. Haupt</i>				Date: <i>6/7/94</i>			

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1103 Well no./depth 199-K-111A/140.0-140.5' VISCOSITY 1

Tested By: H. Hamp/F. M. Williams Date 06/30/94

Specimen Diameter (D, cm) 9.58 Specimen Length (L, cm) 14.17

Start Date	06-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	06-Jul-94	06-Jul-94	06-Jul-94	06-Jul-94
End Time	00:03:00	00:03:00	00:03:00	00:03:00
Time Sec.	180	180	180	180
Volume, cm ³	68.1	77.6	69.7	69.7
Head, cm	81.3	80	80	80
"Q"	3.78E-01	4.31E-01	3.87E-01	3.87E-01
L/(A*H)	2.42E-03	2.46E-03	2.46E-03	2.46E-03
K, cm/sec	9.15E-04	1.06E-03	9.52E-04	9.52E-04
Kc, (K*Visc)	9.15E-04	1.06E-03	9.52E-04	9.52E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Kc AVERAGE 9.69E-04

STANDARD DEV. 5.41E-05

% STAND. DEV. 5.6%

Remarks: Sample was recompacted to a dry bulk density of 1.52 g/cm³ prior to running test.

Void space at top of sample was filled with +4, -3/8 gravel.

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

Checked By: H. Hamp

Date: 7/11/94

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	140-140.5'
Lab #	4-1103
Heis #	NA
Tested by	FMW/HH
Contact	B. Williams
Phone #	376-3416
Date	11/16/94
length (cm)	14.27
diameter (cm)	9.58
volume (cm ³)	1028.57
wt of sample + mold (g)	1973.6
wt of mold (g)	319.1
wet wt of sample (g)	1654.5
water content % dry wt	2.5%
wet density of sample (g/cm ³)	1.6
dry wt. of sample (g)	1614.1
dry density (g/cm ³)	1.6
specific gravity	2.7
void ratio	0.71
porosity	41.7%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>F.M. Williams</i> Date: <i>11/17/94</i>	

199-K-111A
Sample

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	140-140.5'	LAB #	4-1103	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	376-3416	DATE	11/14/94

	1	2	3		temp	K
Wt. oven dry soil, g	30.00	30.00	30.00		15	0.99913
Wt. pycnometer + wetting agent, g	168.67	168.67	167.97		16	0.99901
Wt. pycnometer+wetting agent+ soil,	187.69	187.74	187.04		18	1.0004
Temperature (Tx), degrees C	20	19	19		19	1.0002
Specific gravity of wetting agent	1.00	1.00	1.00		20	1.0000
Specific gravity of soil at Tx	2.73	2.74	2.74		21	0.9998
Specific gravity of soil at 20 C	2.73	2.75	2.75		22	0.9996
AVG. Specific gravity of -10 material	2.74				23	0.9993
Wt. sample (SSD), g (B)	955	NA	NA		24	0.9991
Wt. sample in water, g (C)	598.8	NA	NA		25	0.9989
Wt. oven dry sample, g (A)	946	NA	NA		26	0.9986
Bulk specific gravity, 23/23 C	2.66	NA	NA		27	0.9983
Bulk specific gravity SSD, 23/23 C	2.68	NA	NA		28	0.998
Apparent specific gravity, 23/23 C	2.72	NA	NA		29	0.9977
					30	0.9974
Size fraction, coarse	60.6	NA	NA			
Size fraction, fine	39.4	NA	NA			
Avg. specific gravity, 23/23 C	2.69	NA	NA			
Avg. specific gravity based on:	Bulk	NA	NA			

COMMENTS:

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

Checked By: B. Williams Date: 11/15/94

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GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1104-1 Well no./depth 199-K-111A/145.8-146.3' VISCOSITY 1

Tested By: F.M. WILLIAMS/H. HAMPT Date 06/20/94

Specimen Diameter (D, cm) 9.61 Specimen Length (L, cm) 13.95

Start Date	01-Jul-94	01-Jul-94	01-Jul-94	06-Jul-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	01-Jul-94	01-Jul-94	01-Jul-94	06-Jul-94
End Time	00:04:00	00:04:30	00:04:30	00:10:00
Time Sec.	240	270	270	600
Volume, cm ³	2.3	2.5	2.4	5.9
Head, cm	76	76	76	76.2
"Q"	9.58E-03	9.26E-03	8.89E-03	9.83E-03
L/(A*H)	2.53E-03	2.53E-03	2.53E-03	2.52E-03
K, cm/sec	2.43E-05	2.34E-05	2.25E-05	2.48E-05
Kc, (K*Visc)	2.43E-05	2.34E-05	2.25E-05	2.48E-05

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 2.37E-05
 STANDARD DEV. 8.76E-07
 % STAND. DEV. 3.7%

K = Hydraulic Conductivity (cm/sec)
 Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)
 A = Area (cm²)
 H = Hydraulic Head (cm - water)
 L = Length of soil in column (cm)
 Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks: Sample was recompacted to a dry bulk density of 2.1g/cm³ prior to running test.
 Void space at top of sample was filled with +4, -3/8 gravel.

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

Checked By: H. Hampton

Date: 7/11/94

B-289

WHC-SD-EN-DP-090, Rev. 0

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	145.3-145.8'
Lab #	4-1104-2
Heis #	NA
Tested by	LDB
Contact	Williams
Phone #	376-3416
Date	6/28/94
length (cm)	14.07
diameter (cm)	9.55
volume (cm ³)	1007.81
wt of sample + mold (g)	2567.8
wt of mold (g)	315.2
wet wt of sample (g)	2252.6
dry wt of sample (g)	2062.8
wet density of sample (g/cm ³)	2.2
water content % dry wt	9.20%
dry density (g/cm ³)	2.0
specific gravity	2.7
void ratio	0.31
porosity	23.6%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>J. Williams</i> Date: <i>6/28/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY							
SPECIFIC GRAVITY							
GEL 10							
WELL #	199-K-111A	DEPTH	145.3-145.	LAB #	4-1104-2	HEIS #	NA
TESTED BY	LDB/FMW	CONTACT	Williams	PHONE	6-3416	DATE	6/28/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	168.19	167.59	168.15
Wt. pycnometer+wetting agent+ soil,	187.21	186.6	187.26
Temperature (Tx), degrees C	26.8	26.7	27
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.73	2.73	2.75
Specific gravity of soil at 20 C	2.73	2.73	2.75
AVG. Specific gravity of -10 material	2.73		
Wt. sample (SSD), g (B)	959	NA	NA
Wt. sample in water, g (C)	594.2	NA	NA
Wt. oven dry sample, g (A)	952.1	NA	NA
Bulk specific gravity, 23/23 C	2.61	NA	NA
Bulk specific gravity SSD, 23/23 C	2.63	NA	NA
Apparent specific gravity, 23/23 C	2.66	NA	NA
Size fraction, coarse	46.3	NA	NA
Size fraction, fine	53.7	NA	NA
Avg. specific gravity, 23/23 C	2.67	NA	NA
Avg. specific gravity based on:	BULK	NA	NA

temp	K
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: 11 Haupt Date: 6/7/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-111A	DEPTH	144.3-146.3'	LAB #	4-1104-2,3	HEIS #	NA
TESTED BY	LDB/FMW	CONTACT	Williams	PHONE	376-3416	DATE	6/27/94
GEL-14 SOIL MOISTURE							
BALANCE	3304/3311	CALIBRATION DUE	8/7/94	TESTED BY	LDB/FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
6/28/94	2501.3	2312.1	251.9	189.2	2060.2	9.2%	LDB
6/27/94	626.88	577.23	62.9	49.65	514.33	9.7%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	LDB/FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	7/1/94	Sample pressure (psi)	0.4	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>Heidi Haupt</i>				Date: 6/7/94			

GEOTECHNICAL ENGINEERING LABORATORY
SATURATED HYDRAULIC CONDUCTIVITY
GEL-09

SAMPLE NO. 4-1105-1 Well no./depth 199-K-111A/155.1-156.1' VISCOSITY 1

Tested By: F.M. WILLIAMS/H. HAMPT Date 07/07/94

Specimen Diameter (D, cm) 9.6 Specimen Length (L, cm) 13.9

Start Date	11-Jul-94	11-Jul-94	11-Jul-94	12-Jul-94
Start Time	00:00:00	00:00:00	00:00:00	00:00:00
End Date	11-Jul-94	11-Jul-94	11-Jul-94	12-Jul-94
End Time	00:05:00	00:05:00	00:05:00	00:05:00
Time Sec.	300	300	300	300
Volume, cm ³	26.5	27.5	27.4	24
Head, cm	78.5	78.5	78.5	78.2
"Q"	8.83E-02	9.17E-02	9.13E-02	8.00E-02
L/(A*H)	2.45E-03	2.45E-03	2.45E-03	2.46E-03
K, cm/sec	2.16E-04	2.24E-04	2.23E-04	1.96E-04
Kc, (K*Visc)	2.16E-04	2.24E-04	2.23E-04	1.96E-04

Darcy's Law $K = (Q \cdot L) / (A \cdot H)$

Kc AVERAGE 2.15E-04
 STANDARD DEV. 1.12E-05
 % STAND. DEV. 5.2%

K = Hydraulic Conductivity (cm/sec)

Q = Flow Rate (cm³/sec) = Volume (cm³)/Time (sec)

A = Area (cm²)

H = Hydraulic Head (cm - water)

L = Length of soil in column (cm)

Kc= HYDRAULIC CONDUCTIVITY corrected to VISCOSITY

Remarks: The liner contained one end of disturbed clay which was removed. The sample had natural structure with evident channels, that were filled with sand and could be the cause of the high conductivity. The sample was a mixture of sand and clay.

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

Checked By:

H. Haupt

Date:

7/13/94

GEOTECHNICAL ENGINEERING LABORATORY BULK DENSITY/POROSITY GEL-16	
Well no.	199-K-111A
Depth	155.1-156.1'
Lab #	4-1105
Heis #	NA
Tested by	HH
Contact	B. Williams
Phone #	376-3416
Date	11/16/94
length (cm)	13.90
diameter (cm)	9.60
volume (cm ³)	1006.08
wt of sample + mold (g)	2345.2
wt of mold (g)	308.5
wet wt of sample (g)	2036.7
water content % dry wt	21.1%
wet density of sample (g/cm ³)	2.0
dry wt. of sample (g)	1681.8
dry density (g/cm ³)	1.7
specific gravity	2.7
void ratio	0.60
porosity	37.6%
COMMENTS:	
All data are accurately and completely recorded.	
The test operator was trained and used calibrated instruments.	
Checked by: <i>B. Williams</i> Date: <i>11/17/94</i>	

GEOTECHNICAL ENGINEERING LABORATORY
SPECIFIC GRAVITY
GEL 10

WELL #	199-K-111A	DEPTH	155.1-156.6'	LAB #	4-1105	HEIS #	NA
TESTED BY	FMW	CONTACT	B. Williams	PHONE	376-3416	DATE	11/14/94

	1	2	3
Wt. oven dry soil, g	30.00	30.00	30.00
Wt. pycnometer + wetting agent, g	168.38	167.77	168.34
Wt. pycnometer+wetting agent+ soil,	187.17	186.61	187.06
Temperature (Tx), degrees C	19	19	19
Specific gravity of wetting agent	1.00	1.00	1.00
Specific gravity of soil at Tx	2.68	2.69	2.66
Specific gravity of soil at 20 C	2.68	2.69	2.66
AVG. Specific gravity of -10 material	2.68		
Wt. sample (SSD), g (B)	245.7	NA	NA
Wt. sample in water, g (C)	155	NA	NA
Wt. oven dry sample, g (A)	242.7	NA	NA
Bulk specific gravity, 23/23 C	2.68	NA	NA
Bulk specific gravity SSD, 23/23 C	2.71	NA	NA
Apparent specific gravity, 23/23 C	2.77	NA	NA
Size fraction, coarse	14.8	NA	NA
Size fraction, fine	85.2	NA	NA
Avg. specific gravity, 23/23 C	2.68	NA	NA
Avg. specific gravity based on:	Bulk	NA	NA

temp	K
15	0.99913
16	0.99901
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983
28	0.998
29	0.9977
30	0.9974

COMMENTS:

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

Checked By: J. M. Williams

Date: 11/15/94

GEOTECHNICAL ENGINEERING LABORATORY							
SOIL MOISTURE/CALCIUM CARBONATE							
GEL-14, GEL-19							
WELL #	199-K-111A	DEPTH	155.1-156.1'	LAB #	4-1105-1,2	HEIS #	NA
TESTED BY	HH/FMW	CONTACT	Williams	PHONE	376-3416	DATE	7/7/94
GEL-14 SOIL MOISTURE							
BALANCE	3304/3311	CALIBRATION DUE	8/7/94	TESTED BY	HH/FMW		
Date	Wet wt. + can (g)	Dry wt. + can (g)	Tare wt. (g)	Wt. of moisture (g)	Dry wt. soil (g)	Moisture (%)	Calculated by
7/6/94	485.15	411.20	61.10	73.95	350.10	21.12%	FMW
7/6/94	2290.8	2004.7	254.1	286.1	1750.6	16.3%	FMW
Comments							
GEL-19 CALCIUM CARBONATE							
BALANCE	3304	CALIBRATION DUE	8/7/94	TESTED BY	FMW		
VESSEL	5697	CALIBRATION DUE	8/27/94	SAMPLE WT. (g)	8.00		
Date	7/7/94	Sample pressure (psi)	0.4	% Calcium carbonate	<1		
Comments							
All data are accurately and completely recorded. The test operator was trained and used calibrated instruments.							
Checked By: <i>A. Hampton</i>				Date: <i>7/13/94</i>			

APPENDIX C

WELL DEVELOPMENT AND PUMP INSTALLATION

Appendix C includes the following data for each well:

- Well development log
- Pump installation report.

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SAMPLE PUMP INSTALLATION FORM

Well no: 199-K106A

Project no: K-Basins

Installation date: 12-21-94

Installed by: B. Strode

Pump type: Positivedisplacement

Pump model: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 8@10' & 1@5' x 3/4" SS

Pump length: 2.41'

Material cleaning: Manufacture

Pump screen length: 1.91'

PUMP TESTING INFORMATION

Test date: N/A Strokes: N/A

Pump efficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. 10 strokes/1 gal. $\times 100 = \frac{N/A \text{ strokes/gal.}}{N/A \text{ strokes/gal.}}$

PUMP INSTALLATION DRAWING

Total material length: 90.45'

Comments:

This pump was re-installed at this time. No test of the pump was performed.

Report by: Robert S. Edrington
 Title: Advanced Scientist
 Signature: Robert S. Edrington

Reviewed by: Renae Anderson
 Title: Cy Eng
 Signature: Renae Anderson

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-106AWell Depth: 94.75' TOC 6"Screened Interval: 73.71-94.75' TOC 6"Date Well Devel. Performed: 03-01-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK:

N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:

N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 93.54' TOC Pump Start Time: 1022Flow Rate: 13.3 gpm Accumulated Flow: 3128 gallons Pump Stop Time: 1525Turbidity (NTU): >1000 590 41.5 53.8 58.6 91.6 25.6 16.3 9.1 6.3
5.7 4.3 4.2COMMENTS: Pump rate reduced at 1315 to 6.32 gpm.

Recorded by: _____

Sign and Print Name

R.S. Edrington

Date: 03-01-94

VALIDATED
Robert S. Edrington 11/1/94
 SIGNATURE/DATE

SAMPLE PUMP INSTALLATION FORM

Well no: 199-K107A A9843Project no: K-BasinsInstallation date: 04-15-94Installed by: G HowellPumptype: PositivedisplacementPumpmodel: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 9@10"x3/4" SSPumplength: 2.42'Material cleaning: ManufacturePump screen length: 1.99'

PUMP TESTING INFORMATION

Test date: 04-15-94 Strokes: 52

Pumpefficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. 10 strokes/1gal. x 100 = 84.75%
 11.8 strokes/gal.

PUMP INSTALLATION DRAWING

Total material length: 94.56'

Comments:

This well will produce
 water @ no more
 than 8 gallons per
 minute without
 excessive drawdown.

Report by: Robert S. EdringtonTitle Advanced ScientistSignature *Robert S. Edrington*Reviewed by: Bret F. StrickTitle: Cooperative AgentSignature: *Bret F. Strick*

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-107AWell Depth: 96.29' TOC 6"Screened Interval: 76.29-96.29' TOC 6"Date Well Devel. Performed: 04-13-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK: N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 95.08' TOC Pump Start Time: 1133Flow Rate: 7.87 gpm Accumulated Flow: 1,440 gallons Pump Stop Time: 1436Turbidity (NTU): 45.3 33.9 30.1 27.6 21.1 8.36 4.31 4.28 4.2COMMENTS:Recorded by: R.S. Edrington

R.S. Edrington

Date: 04-18-94

Sign and Print Name

SAMPLE PUMP INSTALLATION FORM

Well no: 199-K108AProject no: K-BasinsInstallation date: 08-14-94Installed by: G. HowellPump type: Positive displacementPump model: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 8@10', 1@5'x3/4"SSPump length: 2.41'Material cleaning: ManufacturePump screen length: 1.91'

PUMP TESTING INFORMATION

Test date: N/A Strokes: N/A

Pump efficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. 10 strokes/1 gal. $\times 100 = ?$
N/A strokes / gal.

PUMP INSTALLATION DRAWING

Total material length: 89.16'

Comments:

Pump test not recorded. Report by: RSEdringtonTitle: Advanced ScientistSignature: [Signature]Reviewed by: [Signature]Title: [Signature]Signature: [Signature]

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-108AWell Depth: 93.88' TOC 6"Screened Interval: 73.88-93.88' TOC 6"Date Well Devel. Performed: 04-12-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK: N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:

N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 92.78' TOC Pump Start Time: 0849Flow Rate: 5.5 gpm Accumulated Flow: 2,592 gallons Pump Stop Time: 1639
Turbidity (NTU): 81.6 43.9 66.3 58.3 47.1 37.2 30.3 25.1 15.1 11.9
11.7 9.9 6.3 4.2
COMMENTS:

Recorded by: _____

Signed and Printed Name

R.S. Edrington

Date: 04-21-94

SAMPLE PUMP INSTALLATION FORM

Well no: 199-K109A A9828Project no: K-BasinsInstallation date: 10-03-94Installed by: D. LudtkePumptype: Positive displacementPumpmodel: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 8@10', 1@5', 1@3'x3/4" SSPumplength: 2.41'Material cleaning: ManufacturePumpscreen length: 1.91'

PUMP TESTING INFORMATION

Test date: N/A Strokes: N/A

Pumpefficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. 10 strokes/1 gal. $\times 100 = ?$
N/A strokes / gal.

PUMP INSTALLATION DRAWING

Total material length: 92.32'

Comments:

~~Pump test not recorded.~~

Report by: EA JohnsonTitle: GeoSignature: [Signature]Reviewed by: D.J. AndersonTitle: Co. Engr.Signature: [Signature]

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-109AWell Depth: 93.17' TOC 6"Screened Interval: 72.90-93.17' TOC 6"Date Well Devel. Performed: 09-19&20-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK: N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 87.30' TOC Pump Start Time: 1102(10/19)Flow Rate: 3.89 to 2.68 Accumulated Flow: 1,300 gallons Pump Stop Time: 1459(10/20)Turbidity (NTU): 47.0 16 7.0 9.0 5.4 8.5 5.8 8.8 5.0

COMMENTS: Development occurred over a two day period and included three drawdowns and two recoveries. The pump intake for the last drawdown was moved to 76' bls. No Slug test was performed due to the smaller inner diameter of the PVC piping used in this well.

Recorded by: R.S. Edrington Date: 10-25-94

Sign and Print Name

A-6000-393 (03/90)

SAMPLE PUMP INSTALLATION FORM

Well no: 199-K110AProject no: K-BasinsInstallation date: 06-17-94Installed by: J. CarpenterPump type: PositivedisplacementPump model: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 8@10', 2@2'x3/4"SSPump length: 2.41'Material cleaning: ManufacturePump screen length: 1.91'

PUMP TESTING INFORMATION

Test date: 06-17-94 Strokes: 51

Pump efficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. $\frac{10 \text{ strokes/1 gal.}}{10.2 \text{ strokes/gal.}} \times 100 = 98.03\%$

PUMP INSTALLATION DRAWING

Total material length: 89.00'

Comments:

This well will produce
water at 10 gallons
per minute without
excessive drawdown.

Report by: RSEdringtonTitle: Advanced ScientistSignature: [Signature]Reviewed by: [Signature]Title: Cy EngSignature: [Signature]

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-110AWell Depth: 92.71' TOC 6"Screened Interval: 70.62-92.71' TOC 6"Date Well Devel. Performed: 06-16-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK: N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 91.43' TOC Pump Start Time: 1030Flow Rate: 10.1 gpm Accumulated Flow: 2,667 gallons Pump Stop Time: 1344Turbidity (NTU): 159 19.3 22.1 11.6 9.6 6.5 5.65 23.6 7.9 5.213.96COMMENTS:

Recorded by: _____

Sign and Print Name

R.S. Edrington

Date: 06-21-94

SAMPLE PUMP INSTALLATION FORM

Well no: 199-K111A

Project no: K-Basins

Installation date: 07-27-94

Installed by: D. Rossman

Pump type: Positive displacement

Pump model: Hydrostar HS-8001

PUMP AND RISER PIPE INFORMATION

Pipe: 8@10', 1@3'x3/4"SS

Pump length: 2.29'

Material cleaning: Manufacture

Pump screen length: 1.94'

PUMP TESTING INFORMATION

Test date: 07-27-94 Strokes: 56

Pump efficiency = $\frac{\text{calculated strokes/volume @ 100\%}}{\text{observed strokes/volume}} \times 100$

Pump eff. $\frac{10 \text{ strokes/1 gal.}}{11.2 \text{ strokes/gal.}} \times 100 = 89.28\%$

PUMP INSTALLATION DRAWING

Total material length: 87.20'

Comments:

This well will produce
water at 12 gallons
per minute without
excessive drawdown.

Report by: RSEdrington

Title: Advanced Scientist

Signature: [Signature]

Reviewed by: Dennis Anderson

Title: Log Eng

Signature: [Signature]

WELL DEVELOPMENT FORM

page 1 of 1

Well Designation: 199-K-111AWell Depth: 88.76' TOC 6"Screened Interval: 68.42-88.76' TOC 6"Date Well Devel. Performed: 07-26-94BAILING

Water Level Prior to Bailing: _____ Time of Measurement: _____

Volume of Bailer: _____ Number of Bails Removed: _____ Gallons: _____

Summary Description of Water Removed: _____

Water Level After Bailing: _____ Time of Measurement: _____

SURGE BLOCK:

N.A.

Type of Surge Block: _____ Dimensions of Surge Block: _____

TD Before	Stroke Length	Stroke Frequency	Surge Interval	Surge Time	TD After	TD Difference

AIRLIFT:

N.A.

Depth to Eductor Pipe: _____ Airlift Start Time: _____

Flow Rate: _____ Accumulated Flow: _____ Airlift Stop Time: _____

Turbidity (NTU): _____

MECHANICAL PUMPING:Pumping Technique: Constant Discharge Pump Depth: 87.48' TOC Pump Start Time: 0900Flow Rate: 13.7 gpm Accumulated Flow: 1,997 gallons Pump Stop Time: 1323Turbidity (NTU): > 1000 67.2 19.6 18.1 22.2 5.05 2.24

COMMENTS: Pump rate started at 13.7, dropped to 13.0 and came back up to 13.5 during the course of developing. The pump rate was adjusted to 12.0 at 1045 due to excessive drawdown.

Recorded by: _____

Signature and Print Name

R.S. Edrington

Date: 07-26-94

APPENDIX D

AQUIFER TESTS

Appendix D includes aquifer test data and interpretations for each well.

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1.0 INTRODUCTION

This appendix includes descriptions and analysis of slug tests conducted at wells 199-K-106A, 199-K-107A, 199-K-108A, 199-K-110A, and 199-K-111A and insitu flow meter testing in well 199-K-106A during the time period March to July, 1994.

These wells were drilled with a cable-tool drilling rig using nominal 20 cm (8 in) or 25 cm (10 in) diameter temporary, carbon steel casing sections that were removed as the permanent stainless steel casing and screen were backfilled. The wells were designed as resource protection wells and conform to the WHC generic well specification (WHC 1992, Rev. 6) and WAC 173-160-500 to -550 (Minimum Standards for Construction and Maintenance of Wells, Part Three - Resource Protection Wells). The completed wells consist of nominal 10 cm (4 in) diameter stainless steel casing and spiral wrap screen (either .10- or .20-slot), and the screened interval is backfilled with either a 10-20 or 20-40 sand pack. Well screens are 6.1 m (20 ft) in length and extend to a level approximately 5 1/2 m (18 ft) below the water table.

The five wells penetrate the Hanford formation consisting of gravel and sandy gravel and encounter unit E (Lindsey 1991) of the Ringold Formation at approximately 7.6 to 9.1 m (25-30 ft) of drill depth. Unit E of the Ringold Formation is composed of partially cemented, fluvial gravel and fluvial sand facies (Lindberg 1993). The water table is within unit E at approximately 21 m (70 ft) of depth. Total thickness of unit E is approximately 35 to 40 m (115 to 131 ft), but only 27 m (90 ft) are saturated and below the water table. The base of the unconfined aquifer locally is the fine-grained paleosols and overbank deposits of the Ringold Formation which are at a depth of approximately 58 m (190 ft).

2.0 DATA COLLECTION

2.1 Slug Tests

Both injection and withdrawal slug tests were conducted at each of the five 100-K wells (procedure EII 10.1 Aquifer Testing, WHC 1991). For both slug test types, a slugging rod (displacement rod) was used to quickly raise or lower the water level in the wells from equilibrium. The rod (no. BR-2) had a volume of $5.49\text{E-}3 \text{ m}^3$ or $5.49\text{E+}3 \text{ cm}^3$ (0.194 ft^3) and raised or lowered the water level in the 10 cm (4 in) diameter wells about 0.67 m or 67 cm (2.2 ft). Water level changes during injection or withdrawal of the slugging rod were measured with an *in situ* pressure transducer, and the data were collected using a data logger. The rate at which data were recorded changed from a very high frequency immediately after displacement to a lower frequency later, thereby concentrating the recordings when the level was changing the most. The data collected are on pages D-20 through D-33.

Prior to displacing water in either an injection or withdrawal slug test, the wells were allowed to come to equilibrium and a record of water level and barometric pressure were maintained to establish a baseline. In every case, the change in water level or barometric pressure during baseline measurement indicated that the change during slugging and recording would be insignificant because of the overall rapid recovery of the wells. Baseline measurements of water level and barometric pressure are listed with the data at the end of this appendix.

2.2 Insitu Flow Meter Testing

The K-V Associates groundwater flowmeter was used at one 100-K Area well (199-K-106A) to estimate groundwater flow direction and flow rate. This type of flowmeter uses an electric heat source and four thermistor pairs arranged in a circle around the heat source to measure changes in groundwater flow with time (Barnett et al. 1994). Groundwater flow was measured March 29, 1994, at four levels within the screened portion of the well. The levels were 23.5 m (77 ft), 25 m (82 ft), 26.5 m (87), and 28 m (92 ft) below ground surface. The water table was approximately 23.2 m (76 ft) below ground surface at the time of the flowmeter testing. During data collection at each of the four levels the heat source was turned on (for 30 seconds) to cause a heat pulse in the water while the thermistor pairs measured the resulting heat. Thermistor data were transmitted to the data recorder in millivolts. After 180 seconds the recording was stopped, the system allowed to come to equilibrium (cooled to ambient conditions), the flowmeter rotated 180 degrees, the heat pulse reinitiated, and recording repeated. The repeat of testing at 180 degrees is to eliminate inherent instrument bias. The data from each thermistor pair for each level tested are presented later in this appendix on pages D-35 through D-37, D-43 through D-45, D-51 through D-53, and D-59 through D-61 along with graphs of recorded heat (millivolts) for each thermistor pair versus time (pages D-38, D-46, D-54, and D-62).

3.0 ANALYSIS OF RESULTS

3.1 Slug Test Analysis

The analysis method used to analyze the slug test data was the method developed by Bouwer and Rice (1976) and later updated by Bouwer (1989). This method is appropriate to measure hydraulic conductivity (K) of the aquifer around the screen for fully or partially penetrating wells in unconfined aquifers. Figure D-1 shows the schematic well geometry and symbols used in the analysis.

The data were plotted as the natural logarithm of the change in water level due to slugging on the Y-axis versus time on the X-axis (Figures D-2 through D-11). In order to use the natural logarithm of the change in water level, the negative values recorded for the slug withdrawal tests had to be changed to positive numbers. The hydraulic conductivity (K) corresponding to each plot was then calculated as the following:

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \frac{1}{t} \ln(y_o/y_t) \quad (1)$$

where r_c = radius of the screen,
 R_e = effective radial distance over which y is dissipated,
 r_w = radial distance of undisturbed portion of aquifer from centerline of well,
 t = time since slug test started, corresponding to y_t ,
 L_e = saturated length of the screen,
 y_o = y at time zero (y intercept of straight line portion of curve),
 y_t = y at time t ,
 and $\ln(R_e/r_w)$ = dimensionless ratio to evaluate R_e for various system geometries (see discussion below).

Because y and t are the only variables in equation (1), a plot of y versus t should be a straight line. A number of y and t measurements were taken and $(\ln(y_o/y_t))/t$ determined as the slope of the best fitting line through the y versus t points on the semilogarithmic plot. The straight line through the data points was also used to select two values of y (i.e., y_o and y_t) along with the time interval t between them for substitution into equation (1).

Since the water level during the slug test was within the screen rather than above it, r_c was modified to r_e to take into account the thickness and porosity of the sand pack envelope. The modified radius was calculated as the following:

$$r_e = ((1-n)r_c^2 + nr_w^2)^{1/2} \quad (2)$$

where n = porosity (assumed to be approximately 0.25). The radius r_e was substituted for r_c in equation (1).

The dimensionless ratio $\ln(R_e/r_w)$ varies for different system geometries and was calculated as:

$$\ln(R_e/r_w) = \frac{1}{\frac{1.1}{\ln(L_w/r_w)} + \frac{A+B\ln((H-L_w)/r_w)}{L_e/r_w}} \quad (3)$$

for the system geometry associated with the 100-K Area wells where $L_w < H$, and L_w = distance from water table to bottom of screen, and H = the thickness of the aquifer. A and B are dimensionless numbers plotted in Figure D-12 as a function of L_e/r_w .

The results of the slug injection and withdrawal tests are shown in Table D-1. Because the data were collected and recorded in the field in the English system, the parameters and variables are expressed in feet (ft). However, hydraulic conductivity (K) (in the last four rows of the Table D-1) is expressed in both metric (cm/sec) and English (ft/day) units. Resulting hydraulic conductivities varied from $1.1\text{E-}03$ cm/sec (3.2 ft/day) in the slug injection test on well 199-K-108A to $1.1\text{E-}02$ cm/sec (32.1 ft/day) in the slug withdrawal test on well 199-K-110A.

Slug test at the Hanford Site have sometimes been perceived as not very reliable because of the very rapid recovery times. Some wells recover as fast as a few seconds. Near-hole effects and factors related to well structures become more significant when the recovery is rapid. However, the slug tests reported here did not have rapid recovery times. The 95% recovery time ranged from about 14 seconds to over 2 minutes. Therefore, the hydraulic conductivities reported here are interpreted to be relatively reliable and representative.

Comparison of these results with slug test results from other areas where the wells are screened in fluvial gravels and sands of the Ringold Formation shows that the calculated hydraulic conductivity values reported here are about the same or slightly lower. The slightly lower hydraulic conductivity results may be due to a greater amount of local cementation in the Ringold Formation unit E. Attesting to the greater cementation in unit E

Table D-1. Summary of Slug Test Analysis Results of 100-K Area Wells Using Bouwer and Rice (1976) and Bouwer (1989) Method.

Well	1-K-106A	1-K-107A	1-K-108A	1-K-110A	1-K-111A
L_w (ft)	18.7000	18.7000	17.0000	18.4000	18.2000
H (ft)	90.1000	90.0000	90.0000	90.0000	88.0000
L_e (ft)	18.7000	18.7000	17.0000	18.4000	18.2000
r_c (ft)	0.1670	0.1670	0.1670	0.1670	0.1670
r_w (ft)	0.4170	0.3330	0.3330	0.4170	0.4170
r_e (ft)	0.2537	0.2205	0.2205	0.2537	0.2537
L_e/r_w (ft)	44.8441	56.1562	51.0511	44.1247	43.6451
A	2.9000	3.2000	3.1000	2.8500	2.8000
B	0.8500	1.1000	1.0000	0.8300	0.8000
$\ln R_o/r_w$	2.2154	2.2979	2.2421	2.2131	2.2256
Y_o (inj)ft	0.2470	0.7410	0.6640	0.2470	0.3500
Y_r (inj)ft	0.0498	0.2250	0.3330	0.1290	0.1650
t(inj)min	1.0000	1.0000	1.0000	1.0000	0.1670
Y_o (wth)ft	0.2470	1.7680	2.0960	2.1170	1.4190
Y_r (wth)ft	0.0518	0.5220	1.2460	0.6700	1.0620
t(wth)min	1.0000	0.5000	0.3000	0.2000	0.0600
K (inj) cm/sec	3.1E-03	1.8E-03	1.1E-03	1.3E-03	9.0E-03
K (wth) cm/sec	3.0E-03	3.7E-03	2.8E-03	1.1E-02	9.7E-03
K (inj) ft/day	8.7953	5.1291	3.1876	3.6221	25.5280
K (wth) ft/day	8.5790	10.4995	8.0074	32.0761	27.3822

Note: Change ft to cm by multiplying ft by 30.48. Change ft to m by multiplying ft by 0.3048.

List of abbreviations:

ft = feet, min = minute, cm = centimeter, m = meter

L_w = Distance from water table to bottom of screen (ft)

H = Thickness of aquifer (ft)

L_e = Length of screen (saturated length same as L_w) (ft)

r_c = Radius of screen (inside diameter)(ft)

r_w = Radius of well (radius of disturbed zone)(ft)

r_e = Equivalent radius (ft) [r_c modified to r_e because water level within screened interval]

continued on next page

Table D-1 continued

L_e/r_w = Ratio of screen length to radius of well
 A = Dimensionless parameter to calculate $\ln R_e/r_w$ (see text)
 B = Dimensionless parameter to calculate $\ln R_e/r_w$ (see text)
 $\ln R_e/r_w$ = Dimensionless ratio to evaluate effective radius (R_e) for various system geometries (see text)
 Y = change in water level due to slugging (ft)
 Y_o = Y at time 0.0,
 Y_t = Y at time t (ft)
 t = time (in min) since slug test started (corresponding with Y_t)
 inj = slug injection test
 wth = slug withdrawal test
 K = hydraulic conductivity (cm/sec or ft/day)

locally is Coyote Rapids which is located in the Columbia River adjacent to the 100-K Area (Lindberg 1993). The development of rapids in the river there is a response to the greater resistance of unit E to the erosive power of the Columbia River, which in turn may be a indication that unit E has a greater amount of cementation than observed elsewhere at the Hanford Site.

3.2 Analysis of Insitu Flow Meter Testing

The following discussion of flowmeter data analysis is a very brief summary. A more detailed discussion of flowmeter data analysis can be found in Barnett et al. (1994). The analysis of flowmeter data is greatly enhanced by the use of a computer. In this case, Quattro^R Pro and Autocad^R were extensively used to analyze and plot data.

Resultant groundwater flow vectors were resolved from the magnitude of groundwater flow (flow rate in equivalent millivolts) and azimuthal direction of the thermistor pairs. The flow rate in millivolt equivalents was entered into the equation:

$$V = \frac{(\text{resultant(mV)} \times \text{slope.curve}) + \text{y.intercept.curve}}{n_e} \quad (4)$$

where n_e = effective porosity of the sediment, resultant (mV) = reading from flowmeter, slope.curve = slope of the calibration curve, and y.intercept.curve = y intercept of the calibration curve. The numerator of the right side of equation (4) is a direct measurement of Darcy velocity. Dividing by the effective porosity of the formation (assumed to be 0.2) yields the magnitude component of the average linear flow velocity. Calculations of this component were performed for both the point-140 and curve-summation methods (Barnett et al. 1994). The resultant azimuth and magnitude of the vectors for each method were calculated by averaging the results from the four levels. A summary sheet of resultant flow vector azimuth (theta) and magnitude (r) is on page D-34. Calculations are on pages D-39 through D-42, D-47 through D-50, D-55 through D-58, and D-53 through D-66. For the point method the resulting average azimuth was calculated as 342 degrees (N.18°W.) and average flow velocity as 0.63 m/d (2.06 ft/d). For the curve summation method the resulting average azimuth was calculated as 348 degrees (N.12°W.) and average flow velocity as 0.78 m/d (2.57 ft/d).

The calculated average flow velocities from the flowmeter can be compared to the hydraulic conductivities from the slug testing by the Darcy equation:

$$V = \frac{K (i)}{n_e} \quad (5)$$

where V = groundwater flow velocity, K = hydraulic conductivity, i = hydraulic gradient (slope of water table), and n_e = effective porosity of the aquifer. If the hydraulic gradient is assumed to be 0.006 and effective porosity 0.1 (Peterson 1994, p. 20), then hydraulic conductivity is either 10.5 m/d (34 ft/d) or 13 m/d (42.5 ft/d) depending on whether the flow velocity is calculated from the point method or summation method. (Note: 10.5 m/d = 1.22E-02 cm/s and 13 m/d = 1.50E-02 cm/s.)

Hydraulic conductivities estimated by the flowmeter testing (1.22E-02 to 1.5E-02 cm/s) are approximately four times higher than those from the slug testing (3.0E-03 to 3.1E-03 cm/s, Table D-1). However, there is a known magnification effect in the flowmeter when the hydraulic conductivity of the natural formation is lower than in the flowmeter/well annulus (Barnett et al. 1994). Because the hydraulic conductivity of the local natural formation (unit E of the Ringold Formation) is lower than the flowmeter/well annulus, V (and, in turn, K) derived from the flowmeter may be magnified by a factor of up to 2.0 (Barnett et al. 1994). If the estimated K s calculated from the flowmeter testing are lowered by a factor of 2.0 to account for this magnification effect, then instead of four times higher, the flowmeter-derived values are only two times higher than those calculated from the slug testing.

4.0 REFERENCES

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Figure D-1. Geometry and symbols for slug test on partially penetrating, partially screened well in unconfined aquifer with sand pack around screen. [Taken from Bouwer and Rice (1976).]

Figure D-2. Semilogarithmic plot of water level changes vs. time for the slug injection test on well 199-K-106A.

Figure D-3. Semilogarithmic plot of water level changes vs. time for the slug withdrawal test on well 199-K-106A.

Figure D-4. Semilogarithmic plot of water level changes vs. time for the slug injection test on well 199-K-107A.

Well 199-K-107A Slug Injection

Figure D-5. Semilogarithmic plot of water level changes vs. time for the slug withdrawal test on well 199-K-107A.

Figure D-6. Semilogarithmic plot of water level changes vs. time for the slug injection test on well 199-K-108A.

Figure D-7. Semilogarithmic plot of water level changes vs. time for the slug withdrawal test on well 199-K-108A.

Well 199-K-108A Slug Withdrawal

Figure D-8. Semilogarithmic plot of water level changes vs. time for the slug injection test on well 199-K-110A.

Figure D-9. Semilogarithmic plot of water level changes vs. time for the slug withdrawal test on well 199-K-110A.

Figure D-10. Semilogarithmic plot of water level changes vs. time for the slug injection test on well 199-K-111A.

Well 199-K-111A Slug Injection

Figure D-11. Semilogarithmic plot of water level changes vs. time for the slug withdrawal test on well 199-K-111A.

Figure D-12. Dimensionless parameters A, B, and C as a function of L_e/r_w for calculation of $\ln(R_e/r_w)$. Taken from Bouwer (1989).

Well 199-K-106A (K-38)

Hermit Unit# 2K-193

Test 4: Slug Injection

Start Time: 09:16 03/02/94

SWL: 76.072'

Test 6: Slug Withdrawal

Start Time: 09:38 03/02/94

SWL: 76.075'

Time (min)	dWL(ft)	In Hg
------------	---------	-------

0.0000	1.569	29.584
0.0083	4.898	29.582
0.0166	1.621	29.582
0.0250	1.023	29.584
0.0333	-0.006	29.582
0.0416	0.474	29.582
0.0500	0.291	29.582
0.0583	0.301	29.584
0.0666	0.273	29.584
0.0750	0.270	29.582
0.0833	0.214	29.582
0.0916	0.251	29.584
0.1000	0.214	29.582
0.1083	0.211	29.582
0.1166	0.205	29.582
0.1250	0.229	29.582
0.1333	0.202	29.582
0.1416	0.205	29.582
0.1500	0.198	29.584
0.1583	0.202	29.582
0.1666	0.192	29.582
0.1750	0.189	29.584
0.1833	0.177	29.582
0.1916	0.192	29.582
0.2000	0.183	29.584
0.2083	0.177	29.582
0.2166	0.177	29.584
0.2250	0.177	29.582
0.2333	0.171	29.582
0.2416	0.164	29.582
0.2500	0.164	29.582
0.2583	0.164	29.584
0.2666	0.161	29.582
0.2750	0.155	29.584
0.2833	0.155	29.584
0.2916	0.152	29.582
0.3000	0.152	29.584
0.3083	0.149	29.584
0.3166	0.146	29.584
0.3250	0.146	29.582
0.3333	0.143	29.584
0.3500	0.140	29.584
0.3666	0.133	29.584
0.3833	0.130	29.582
0.4000	0.127	29.582
0.4166	0.124	29.584
0.4333	0.121	29.582
0.4500	0.118	29.584
0.4666	0.115	29.582
0.4833	0.112	29.584
0.5000	0.109	29.582

Time (min)	dWL(ft)	In Hg
------------	---------	-------

0.0000	-0.027	29.582
0.0083	-1.152	29.584
0.0166	-0.802	29.584
0.0250	-0.607	29.584
0.0333	-0.473	29.582
0.0416	-0.405	29.582
0.0500	-0.365	29.582
0.0583	-0.343	29.582
0.0666	-0.328	29.582
0.0750	-0.315	29.582
0.0833	-0.312	29.582
0.0916	-0.303	29.584
0.1000	-0.293	29.582
0.1083	-0.290	29.584
0.1166	-0.281	29.582
0.1250	-0.275	29.582
0.1333	-0.269	29.582
0.1416	-0.259	29.582
0.1500	-0.253	29.582
0.1583	-0.247	29.582
0.1666	-0.241	29.582
0.1750	-0.235	29.580
0.1833	-0.228	29.582
0.1916	-0.222	29.582
0.2000	-0.219	29.582
0.2083	-0.216	29.582
0.2166	-0.210	29.582
0.2250	-0.207	29.584
0.2333	-0.200	29.582
0.2416	-0.197	29.582
0.2500	-0.194	29.582
0.2583	-0.188	29.582
0.2666	-0.185	29.582
0.2750	-0.182	29.582
0.2833	-0.179	29.582
0.2916	-0.176	29.582
0.3000	-0.173	29.580
0.3083	-0.169	29.582
0.3166	-0.166	29.582
0.3250	-0.163	29.582
0.3333	-0.160	29.582
0.3500	-0.154	29.582
0.3666	-0.151	29.580
0.3833	-0.145	29.582
0.4000	-0.138	29.582
0.4166	-0.135	29.582
0.4333	-0.129	29.584
0.4500	-0.126	29.582
0.4666	-0.123	29.582
0.4833	-0.120	29.580
0.5000	-0.117	29.582

WHC-SD-EN-DP-090, Rev. 0

0.5166	0.105	29.584	0.5166	-0.114	29.582
0.5333	0.102	29.582	0.5333	-0.107	29.582
0.5500	0.099	29.584	0.5500	-0.104	29.582
0.5666	0.096	29.584	0.5666	-0.101	29.582
0.5833	0.096	29.584	0.5833	-0.098	29.582
0.6000	0.093	29.584	0.6000	-0.095	29.580
0.6166	0.090	29.584	0.6166	-0.092	29.580
0.6333	0.087	29.582	0.6333	-0.089	29.580
0.6500	0.087	29.584	0.6500	-0.089	29.580
0.6666	0.084	29.582	0.6666	-0.086	29.580
0.6833	0.081	29.584	0.6833	-0.083	29.580
0.7000	0.081	29.584	0.7000	-0.080	29.582
0.7166	0.078	29.582	0.7166	-0.080	29.580
0.7333	0.074	29.582	0.7333	-0.076	29.580
0.7500	0.071	29.586	0.7500	-0.073	29.580
0.7666	0.071	29.584	0.7666	-0.073	29.580
0.7833	0.071	29.584	0.7833	-0.070	29.582
0.8000	0.068	29.584	0.8000	-0.070	29.580
0.8166	0.065	29.584	0.8166	-0.067	29.580
0.8333	0.065	29.584	0.8333	-0.067	29.580
0.8500	0.062	29.584	0.8500	-0.064	29.580
0.8666	0.062	29.584	0.8666	-0.061	29.580
0.8833	0.059	29.584	0.8833	-0.061	29.580
0.9000	0.056	29.584	0.9000	-0.061	29.580
0.9166	0.056	29.584	0.9166	-0.058	29.577
0.9333	0.056	29.584	0.9333	-0.058	29.582
0.9500	0.053	29.586	0.9500	-0.055	29.580
0.9666	0.053	29.586	0.9666	-0.055	29.580
0.9833	0.050	29.584	0.9833	-0.052	29.580
1.0	0.050	29.584	1.0	-0.052	29.580
1.2	0.034	29.584	1.2	-0.036	29.580
1.4	0.022	29.586	1.4	-0.027	29.580
1.6	0.016	29.586	1.6	-0.021	29.580
1.8	0.006	29.586	1.8	-0.015	29.582
2.0	0.003	29.589	2.0	-0.012	29.582
2.2	-0.003	29.586	2.2	-0.009	29.582
2.4	-0.006	29.586	2.4	-0.009	29.582
2.6	-0.006	29.589	2.6	-0.006	29.582
2.8	-0.009	29.586	2.8	-0.006	29.582
3.0	-0.012	29.589	3.0	-0.006	29.582
3.2	-0.012	29.589	3.2	-0.006	29.584
3.4	-0.012	29.586	3.4	-0.006	29.582
3.6	-0.012	29.584	3.6	-0.006	29.582
3.8	-0.012	29.584	3.8	-0.006	29.582
4.0	-0.015	29.582	4.0	-0.006	29.582
4.2	-0.012	29.584	4.2	-0.006	29.582
4.4	-0.012	29.582	4.4	-0.006	29.580
4.6	-0.012	29.580	4.6	-0.006	29.582
4.8	-0.009	29.580	4.8	-0.006	29.580
5.0	-0.009	29.580	5.0	-0.006	29.582
5.2	-0.009	29.582	5.2	-0.003	29.582
5.4	-0.009	29.582	5.4	-0.003	29.582
5.6	-0.009	29.582	5.6	-0.003	29.582
5.8	-0.009	29.582	5.8	-0.003	29.582
6.0	-0.009	29.582	6.0	-0.003	29.582
6.2	-0.009	29.584	6.2	-0.003	29.582
6.4	-0.006	29.584	6.4	-0.003	29.584
6.6	-0.009	29.586	6.6	-0.003	29.582
6.8	-0.009	29.584	6.8	-0.003	29.582
7.0	-0.009	29.584	7.0	-0.003	29.584

7.2	-0.009	29.584
7.4	-0.009	29.584
7.6	-0.009	29.584
7.8	-0.012	29.586
8.0	-0.012	29.584
8.2	-0.012	29.586
8.4	-0.012	29.586
8.6	-0.012	29.584
8.8	-0.012	29.584
9.0	-0.012	29.584
9.2	-0.012	29.584
9.4	-0.012	29.584
9.6	-0.012	29.584
9.8	-0.012	29.584
10	-0.009	29.584
11	-0.006	29.582
12	0.000	29.577

7.2	-0.003	29.584
7.4	-0.003	29.584
7.6	-0.003	29.584
7.8	-0.003	29.586
8.0	-0.003	29.586
8.2	-0.003	29.586
8.4	-0.003	29.584
8.6	-0.003	29.584
8.8	-0.003	29.584
9.0	-0.003	29.584
9.2	-0.003	29.584
9.4	-0.003	29.582
9.6	-0.003	29.584
9.8	-0.003	29.582
10	-0.003	29.584
11	0.006	29.582
12	0.009	29.582
13	0.012	29.582
14	0.012	29.584
15	0.012	29.584
16	0.012	29.589
17	0.003	29.586
18	0.000	29.586
19	0.003	29.586
20	0.006	29.586
21	0.009	29.586
22	0.009	29.586
23	0.003	29.586
24	0.000	29.584

Well 199-K-107A

Hermit Unit# 2K-262

SWL: 77.58' toc

Test# 1: Slug Injection
 Start Time: 08:58 04/15/94
 Stop Time: 09:28

Test# 2: Slug Withdr
 Start Time: 09:29 04/
 Stop Time: 09:59

Time(min)	dWL(ft)	Time(min)	dWL(ft)
0.0000	2.473	0.0000	-1.034
0.0083	4.655	0.0083	-2.150
0.0166	2.441	0.0166	-1.341
0.0250	0.501	0.0250	-2.214
0.0333	1.212	0.0333	-1.875
0.0416	1.050	0.0416	-2.020
0.0500	0.856	0.0500	-1.891
0.0583	1.002	0.0583	-1.875
0.0666	1.018	0.0666	-1.778
0.0750	0.937	0.0750	-1.762
0.0833	0.921	0.0833	-1.632
0.0916	0.905	0.0916	-1.584
0.1000	0.937	0.1000	-1.535
0.1083	0.872	0.1083	-1.503
0.1166	0.840	0.1166	-1.454
0.1250	0.840	0.1250	-1.406
0.1333	0.824	0.1333	-1.374
0.1416	0.775	0.1416	-1.341
0.1500	0.775	0.1500	-1.309
0.1583	0.759	0.1583	-1.260
0.1666	0.743	0.1666	-1.228
0.1750	0.727	0.1750	-1.212
0.1833	0.711	0.1833	-1.180
0.1916	0.711	0.1916	-1.147
0.2000	0.678	0.2000	-1.131
0.2083	0.678	0.2083	-1.099
0.2166	0.662	0.2166	-1.066
0.2250	0.646	0.2250	-1.050
0.2333	0.630	0.2333	-1.018
0.2416	0.630	0.2416	-1.002
0.2500	0.614	0.2500	-0.986
0.2583	0.614	0.2583	-0.953
0.2666	0.598	0.2666	-0.937
0.2750	0.598	0.2750	-0.921
0.2833	0.581	0.2833	-0.889
0.2916	0.565	0.2916	-0.872
0.3000	0.565	0.3000	-0.856
0.3083	0.549	0.3083	-0.840
0.3166	0.549	0.3166	-0.824
0.3250	0.533	0.3250	-0.808
0.3333	0.533	0.3333	-0.775
0.3500	0.517	0.3500	-0.743
0.3666	0.501	0.3666	-0.711
0.3833	0.484	0.3833	-0.678
0.4000	0.468	0.4000	-0.646
0.4166	0.468	0.4166	-0.630
0.4333	0.452	0.4333	-0.598
0.4500	0.436	0.4500	-0.581

0.4666	0.436	0.4666	-0.549
0.4833	0.420	0.4833	-0.533
0.5000	0.404	0.5000	-0.517
0.5166	0.404	0.5166	-0.484
0.5333	0.387	0.5333	-0.468
0.5500	0.387	0.5500	-0.452
0.5666	0.371	0.5666	-0.436
0.5833	0.371	0.5833	-0.420
0.6000	0.355	0.6000	-0.404
0.6166	0.355	0.6166	-0.387
0.6333	0.339	0.6333	-0.387
0.6500	0.339	0.6500	-0.371
0.6666	0.323	0.6666	-0.355
0.6833	0.323	0.6833	-0.339
0.7000	0.323	0.7000	-0.323
0.7166	0.307	0.7166	-0.323
0.7333	0.307	0.7333	-0.307
0.7500	0.307	0.7500	-0.290
0.7666	0.290	0.7666	-0.290
0.7833	0.290	0.7833	-0.274
0.8000	0.274	0.8000	-0.274
0.8166	0.274	0.8166	-0.258
0.8333	0.274	0.8333	-0.258
0.8500	0.274	0.8500	-0.242
0.8666	0.258	0.8666	-0.242
0.8833	0.258	0.8833	-0.226
0.9000	0.258	0.9000	-0.226
0.9166	0.242	0.9166	-0.226
0.9333	0.242	0.9333	-0.210
0.9500	0.242	0.9500	-0.210
0.9666	0.242	0.9666	-0.210
0.9833	0.226	0.9833	-0.193
1.0	0.226	1.0	-0.193
1.2	0.193	1.2	-0.145
1.4	0.161	1.4	-0.113
1.6	0.145	1.6	-0.096
1.8	0.129	1.8	-0.064
2.0	0.113	2.0	-0.064
2.2	0.096	2.2	-0.048
2.4	0.096	2.4	-0.032
2.6	0.080	2.6	-0.032
2.8	0.064	2.8	-0.032
3.0	0.064	3.0	-0.016
3.2	0.064	3.2	-0.016
3.4	0.048	3.4	-0.016
3.6	0.048	3.6	-0.016
3.8	0.048	3.8	-0.016
4.0	0.048	4.0	-0.016
4.2	0.048	4.2	-0.016
4.4	0.048	4.4	-0.016
4.6	0.032	4.6	0.000
4.8	0.048	4.8	0.000
5.0	0.048	5.0	0.000
5.2	0.048	5.2	0.000
5.4	0.048	5.4	0.000
5.6	0.048	5.6	0.000
5.8	0.048	5.8	0.000
6.0	0.048	6.0	0.000
6.2	0.048	6.2	0.000
6.4	0.048	6.4	0.000

6.6	0.032	6.6	0.000
6.8	0.032	6.8	0.000
7.0	0.048	7.0	0.000
7.2	0.048	7.2	0.000
7.4	0.048	7.4	0.000
7.6	0.048	7.6	0.000
7.8	0.048	7.8	0.000
8.0	0.032	8.0	0.000
8.2	0.032	8.2	0.000
8.4	0.032	8.4	0.000
8.6	0.032	8.6	0.000
8.8	0.032	8.8	0.000
9.0	0.032	9.0	0.000
9.2	0.032	9.2	0.000
9.4	0.032	9.4	0.000
9.6	0.032	9.6	0.000
9.8	0.032	9.8	0.000
10	0.048	10	0.000
12	0.016	12	-0.016
14	0.016	14	-0.016
16	0.016	16	-0.016
18	0.016	18	-0.016
20	0.016	20	-0.016
22	0.016	22	0.000
24	0.032	24	-0.016
26	0.016	26	-0.016
28	0.016	28	0.000
30	0.016	30	0.000

Well 199-K108A

Hermit 2K-192

Test# 6:

Slug Injection

Start Time: 09:21 04/14/94

Test# 8:

Slug Withdrawal

Start Time: 10:25 04/14/94

Time(min) dWL(ft)

0.0000	0.015
0.0083	2.482
0.0166	6.071
0.0250	4.341
0.0333	4.890
0.0416	-1.494
0.0500	1.428
0.0583	0.693
0.0666	0.737
0.0750	0.870
0.0833	0.788
0.0916	0.759
0.1000	0.753
0.1083	0.753
0.1166	0.715
0.1250	0.712
0.1333	0.699
0.1416	0.687
0.1500	0.674
0.1583	0.668
0.1666	0.659
0.1750	0.649
0.1833	0.640
0.1916	0.633
0.2000	0.624
0.2083	0.630
0.2166	0.621
0.2250	0.614
0.2333	0.611
0.2416	0.602
0.2500	0.595
0.2583	0.589
0.2666	0.583
0.2750	0.577
0.2833	0.567
0.2916	0.573
0.3000	0.561
0.3083	0.567
0.3166	0.554
0.3250	0.551
0.3333	0.548
0.3500	0.539
0.3666	0.532
0.3833	0.523
0.4000	0.513
0.4166	0.507
0.4333	0.501
0.4500	0.491
0.4666	0.485

Time(min) dWL(ft)

0.0000	-1.355
0.0083	-0.866
0.0166	-3.201
0.0250	-1.806
0.0333	-1.843
0.0416	-1.950
0.0500	-1.954
0.0583	-1.925
0.0666	-1.884
0.0750	-1.853
0.0833	-1.828
0.0916	-1.799
0.1000	-1.771
0.1083	-1.746
0.1166	-1.720
0.1250	-1.698
0.1333	-1.673
0.1416	-1.648
0.1500	-1.623
0.1583	-1.601
0.1666	-1.579
0.1750	-1.557
0.1833	-1.535
0.1916	-1.509
0.2000	-1.487
0.2083	-1.468
0.2166	-1.446
0.2250	-1.424
0.2333	-1.405
0.2416	-1.383
0.2500	-1.361
0.2583	-1.342
0.2666	-1.327
0.2750	-1.298
0.2833	-1.279
0.2916	-1.260
0.3000	-1.245
0.3083	-1.229
0.3166	-1.213
0.3250	-1.191
0.3333	-1.175
0.3500	-1.141
0.3666	-1.109
0.3833	-1.074
0.4000	-1.043
0.4166	-1.015
0.4333	-0.983
0.4500	-0.955
0.4666	-0.926

0.4833	0.485	0.4833	-0.901
0.5000	0.476	0.5000	-0.873
0.5166	0.469	0.5166	-0.847
0.5333	0.460	0.5333	-0.822
0.5500	0.457	0.5500	-0.800
0.5666	0.457	0.5666	-0.778
0.5833	0.444	0.5833	-0.753
0.6000	0.454	0.6000	-0.734
0.6166	0.435	0.6166	-0.712
0.6333	0.431	0.6333	-0.693
0.6500	0.425	0.6500	-0.674
0.6666	0.416	0.6666	-0.655
0.6833	0.413	0.6833	-0.639
0.7000	0.406	0.7000	-0.624
0.7166	0.403	0.7166	-0.605
0.7333	0.400	0.7333	-0.592
0.7500	0.397	0.7500	-0.576
0.7666	0.387	0.7666	-0.564
0.7833	0.387	0.7833	-0.548
0.8000	0.384	0.8000	-0.535
0.8166	0.378	0.8166	-0.523
0.8333	0.375	0.8333	-0.510
0.8500	0.375	0.8500	-0.498
0.8666	0.372	0.8666	-0.488
0.8833	0.365	0.8833	-0.476
0.9000	0.362	0.9000	-0.466
0.9166	0.359	0.9166	-0.453
0.9333	0.359	0.9333	-0.444
0.9500	0.324	0.9500	-0.435
0.9666	0.349	0.9666	-0.425
0.9833	0.343	0.9833	-0.416
1.0	0.334	1.0	-0.406
1.2	0.312	1.2	-0.312
1.4	0.274	1.4	-0.245
1.6	0.239	1.6	-0.198
1.8	0.217	1.8	-0.167
2.0	0.192	2.0	-0.138
2.2	0.173	2.2	-0.116
2.4	0.157	2.4	-0.097
2.6	0.145	2.6	-0.081
2.8	0.129	2.8	-0.072
3.0	0.116	3.0	-0.056
3.2	0.107	3.2	-0.050
3.4	0.104	3.4	-0.044
3.6	0.094	3.6	-0.037
3.8	0.088	3.8	-0.031
4.0	0.078	4.0	-0.031
4.2	0.072	4.2	-0.028
4.4	0.066	4.4	-0.022
4.6	0.063	4.6	-0.022
4.8	0.056	4.8	-0.018
5.0	0.053	5.0	-0.022
5.2	0.053	5.2	-0.018
5.4	0.047	5.4	-0.012
5.6	0.044	5.6	-0.015
5.8	0.037	5.8	-0.012
6.0	0.037	6.0	-0.009
6.2	0.028	6.2	-0.012
6.4	0.028	6.4	-0.009
6.6	0.025	6.6	-0.009

6.8	0.034	6.8	-0.009
7.0	0.028	7.0	-0.009
7.2	0.022	7.2	-0.009
7.4	0.028	7.4	-0.009
7.6	0.028	7.6	-0.006
7.8	0.028	7.8	-0.006
8.0	0.025	8.0	-0.006
8.2	0.018	8.2	-0.009
8.4	0.025	8.4	-0.006
8.6	0.022	8.6	-0.006
8.8	0.025	8.8	-0.009
9.0	0.022	9.0	-0.006
9.2	0.018	9.2	-0.006
9.4	0.018	9.4	-0.009
9.6	0.012	9.6	-0.006
9.8	0.025	9.8	-0.006
10	0.009	10	-0.006
11	0.015	11	-0.006
12	0.018	12	-0.006
13	0.025	13	-0.006
14	0.015	14	-0.006
15	0.015	15	-0.003
16	0.015	16	-0.009
17	0.015	17	-0.006
18	0.015	18	-0.009
19	0.009	19	-0.006
20	0.009	20	-0.009
21	0.012	21	-0.006
22	0.015	22	-0.006
23	0.015	23	-0.009
24	0.012	24	0.000
25	0.018	25	-0.006
26	0.015	26	-0.009
27	0.012	27	-0.006
28	0.015	28	0.000
29	0.015	29	-0.003
30	0.009	30	-0.009
		31	-0.003
		32	0.000

Well 199-K110A**Well Development: Slug Test**

Hermit Unit# 1KB-700
XD 2541DI (04/20/95)

Test# 0: Baseline
Start Time: 09:05 06/17/94

Test# 1: Injection
Start Time: 11:24 06/17/94

Test# 2: Withdrawal
Start Time: 11:38 06/17/94

Time(min)	dWL(ft)	Time(min)	dWL(ft)	Time(min)	dWL(ft)
0	-0.02	0.0000	1.51	0.0000	-3.65
1	-0.03	0.0033	3.40	0.0033	2.00
2	-0.01	0.0066	5.14	0.0066	-1.57
3	-0.01	0.0099	4.69	0.0099	-2.24
4	-0.02	0.0133	-3.68	0.0133	-1.59
5	-0.02	0.0166	5.46	0.0166	-1.80
6	-0.02	0.0200	1.42	0.0200	-1.68
7	-0.03	0.0233	-1.37	0.0233	-1.69
8	-0.02	0.0266	-1.00	0.0266	-1.67
9	-0.02	0.0300	2.69	0.0300	-1.62
10	-0.03	0.0333	2.67	0.0333	-1.61
11	-0.02	0.0500	0.47	0.0500	-1.48
12	-0.02	0.0666	0.52	0.0666	-1.36
13	-0.02	0.0833	0.40	0.0833	-1.25
14	-0.03	0.1000	0.39	0.1000	-1.15
15	-0.03	0.1166	0.37	0.1166	-1.05
16	-0.02	0.1333	0.39	0.1333	-0.97
17	-0.01	0.1500	0.25	0.1500	-0.88
18	-0.02	0.1666	0.27	0.1666	-0.81
19	-0.02	0.1833	0.23	0.1833	-0.74
20	-0.01	0.2000	0.24	0.2000	-0.67
21	-0.02	0.2166	0.23	0.2166	-0.61
22	-0.01	0.2333	0.23	0.2333	-0.55
23	-0.02	0.2500	0.23	0.2500	-0.50
24	-0.02	0.2666	0.22	0.2666	-0.45
25	-0.02	0.2833	0.21	0.2833	-0.41
26	-0.02	0.3000	0.20	0.3000	-0.37
27	-0.02	0.3166	0.22	0.3166	-0.34
28	-0.01	0.3333	0.15	0.3333	-0.30
29	-0.01	0.4167	0.19	0.4167	-0.20
30	-0.01	0.5000	0.17	0.5000	-0.15
31	-0.01	0.5833	0.17	0.5833	-0.12
32	-0.02	0.6667	0.15	0.6667	-0.10
33	0.00	0.7500	0.15	0.7500	-0.09
34	-0.01	0.8333	0.13	0.8333	-0.08
35	-0.01	0.9167	0.13	0.9167	-0.08
36	-0.01	1.0000	0.13	1.0000	-0.07
37	-0.01	1.0833	0.12	1.0833	-0.07
38	-0.02	1.1667	0.11	1.1667	-0.07
39	-0.01	1.2500	0.11	1.2500	-0.06
40	-0.01	1.3333	0.11	1.3333	-0.06
41	-0.01	1.4166	0.10	1.4166	-0.06
42	-0.01	1.5000	0.10	1.5000	-0.06
43	-0.01	1.5833	0.09	1.5833	-0.05
44	-0.01	1.6667	0.08	1.6667	-0.05
45	-0.01	1.7500	0.08	1.7500	-0.05
46	-0.01	1.8333	0.08	1.8333	-0.05
47	-0.01	1.9167	0.07	1.9167	-0.05

WHC-SD-EN-DP-090, Rev. 0

48	-0.01	2.0	0.06	2.0	-0.05
49	-0.01	2.5	0.05	2.5	-0.03
50	-0.01	3.0	0.04	3.0	-0.02
51	-0.01	3.5	0.03	3.5	-0.01
52	-0.01	4.0	0.03	4.0	-0.01
53	-0.01	4.5	0.02	4.5	0.00
54	-0.01	5.0	0.01	5.0	0.00
55	-0.01	5.5	0.00	5.5	0.00
56	-0.01	6.0	0.00	6.0	0.00
57	-0.01	6.5	0.00	6.5	0.00
58	-0.01	7.0	0.00	7.0	0.00
59	-0.01	7.5	0.00	7.5	0.00
60	-0.01	8.0	0.00	8.0	0.00
61	-0.01	8.5	0.00	8.5	0.00
62	-0.01	9.0	0.00	9.0	0.00
63	-0.01	9.5	0.00	9.5	0.00
64	-0.01	10	0.00	10	0.00
65	-0.01	12	0.00	12	0.00
66	-0.01				
67	-0.01				
68	0.00				
69	0.00				
70	0.00				
71	0.00				
72	-0.01				
73	-0.01				
74	0.00				
75	0.00				
76	0.00				
77	0.00				
78	-0.01				
79	-0.01				
80	-0.01				
81	-0.01				
82	0.00				
83	0.00				
84	0.00				
85	0.00				
86	0.00				
87	0.00				
88	-0.01				
89	0.00				
90	-0.01				
91	0.00				
92	-0.01				
93	-0.01				
94	-0.01				
95	0.00				
96	0.00				
97	-0.01				
98	0.00				
99	0.00				
100	-0.01				
101	0.00				
102	0.00				
103	-0.01				

Well 199-K-111A Well Development

Hermit Unit# 2K-459

Test# 3: Baseline

Setups: INPUT 1 INPUT 2
 Type: Level(ft) Function
 Mode: Surface Baro
 I.D. 4988GC 300053

Start Time: 12:37 07/26/94

Time(min) INPUT 1 INPUT 2

0	0.000	29.657
1	0.006	29.662
2	0.009	29.662
3	0.006	29.662
4	0.012	29.662
5	0.015	29.662
6	0.018	29.662
7	0.022	29.662
8	0.022	29.662
9	0.025	29.662
10	0.028	29.662
11	0.028	29.653
12	0.031	29.657
13	0.031	29.657
14	0.037	29.657
15	0.034	29.657
16	0.037	29.657
17	0.044	29.657
18	0.050	29.657
19	0.053	29.657

Test# 4/Step 1: Slug Injection

Setups: INPUT 1 INPUT 2
 Type: Level(ft) Function
 Mode: Surface Baro
 I.D. 4988GC 300053

Start Time: 12:58 07/26/94

Time(min) INPUT 1 INPUT 2

0.0000	5.740	29.653
0.0083	0.468	29.653
0.0166	-0.927	29.653
0.0250	1.626	29.653
0.0333	0.522	29.653
0.0416	0.395	29.653
0.0500	0.636	29.653
0.0583	0.455	29.653
0.0666	0.348	29.653
0.0750	-0.360	29.653
0.0833	0.170	29.653
0.0916	0.471	29.653
0.1000	0.458	29.653
0.1083	0.205	29.653
0.1166	0.183	29.653
0.1250	0.218	29.653
0.1333	0.148	29.653
0.1416	0.177	29.653
0.1500	0.174	29.653
0.1583	0.158	29.653
0.1666	0.158	29.653
0.1750	0.170	29.653
0.1833	0.148	29.653
0.1916	0.151	29.653
0.2000	0.145	29.653
0.2083	0.136	29.653
0.2166	0.123	29.653
0.2250	0.129	29.653
0.2333	0.120	29.653
0.2416	0.113	29.653
0.2500	0.107	29.653
0.2583	0.113	29.653
0.2666	0.110	29.653
0.2750	0.107	29.653
0.2833	0.107	29.653
0.2916	0.107	29.653
0.3000	0.104	29.653
0.3083	0.104	29.653
0.3166	0.104	29.653
0.3250	0.101	29.653
0.3333	0.101	29.653
0.3500	0.098	29.653
0.3666	0.094	29.653
0.3833	0.094	29.653
0.4000	0.094	29.653

Test# 4/Step 2: Slug Withdrawal

Setups: INPUT 1 INPUT 2
 Type: Level(ft) Function
 Mode: Surface Baro
 I.D. 4988GC 300053

Start Time: 13:22 07/26/94

Time(min) INPUT 1 INPUT 2

0.0000	0.094	29.639
0.0083	-0.009	29.639
0.0166	-2.386	29.639
0.0250	-1.557	29.639
0.0333	-1.408	29.639
0.0416	-1.326	29.639
0.0500	-1.221	29.639
0.0583	-1.126	29.639
0.0666	-1.038	29.639
0.0750	-0.952	29.639
0.0833	-0.876	29.639
0.0916	-0.803	29.639
0.1000	-0.731	29.639
0.1083	-0.664	29.639
0.1166	-0.601	29.639
0.1250	-0.541	29.639
0.1333	-0.484	29.639
0.1416	-0.433	29.639
0.1500	-0.382	29.639
0.1583	-0.338	29.639
0.1666	-0.294	29.639
0.1750	-0.259	29.639
0.1833	-0.221	29.639
0.1916	-0.189	29.639
0.2000	-0.158	29.639
0.2083	-0.132	29.639
0.2166	-0.107	29.639
0.2250	-0.088	29.639
0.2333	-0.066	29.639
0.2416	-0.050	29.639
0.2500	-0.034	29.639
0.2583	-0.022	29.639
0.2666	-0.009	29.639
0.2750	0.000	29.639
0.2833	0.009	29.639
0.2916	0.018	29.639
0.3000	0.025	29.639
0.3083	0.028	29.639
0.3166	0.037	29.639
0.3250	0.041	29.639
0.3333	0.044	29.639
0.3500	0.050	29.639
0.3666	0.056	29.639
0.3833	0.060	29.639
0.4000	0.066	29.639

0.4166	0.091	29.653	0.4166	0.063	29.639
0.4333	0.091	29.653	0.4333	0.066	29.639
0.4500	0.088	29.653	0.4500	0.069	29.639
0.4666	0.088	29.653	0.4666	0.069	29.639
0.4833	0.088	29.653	0.4833	0.072	29.639
0.5000	0.088	29.653	0.5000	0.072	29.639
0.5166	0.088	29.653	0.5166	0.072	29.639
0.5333	0.088	29.653	0.5333	0.072	29.639
0.5500	0.085	29.653	0.5500	0.075	29.639
0.5666	0.085	29.653	0.5666	0.075	29.639
0.5833	0.079	29.653	0.5833	0.075	29.639
0.6000	0.094	29.653	0.6000	0.075	29.639
0.6166	0.082	29.653	0.6166	0.075	29.639
0.6333	0.082	29.653	0.6333	0.075	29.639
0.6500	0.082	29.653	0.6500	0.075	29.639
0.6666	0.082	29.653	0.6666	0.075	29.639
0.6833	0.085	29.653	0.6833	0.075	29.639
0.7000	0.082	29.653	0.7000	0.075	29.639
0.7166	0.082	29.653	0.7166	0.075	29.639
0.7333	0.085	29.653	0.7333	0.075	29.639
0.7500	0.082	29.653	0.7500	0.075	29.639
0.7666	0.085	29.653	0.7666	0.075	29.639
0.7833	0.082	29.653	0.7833	0.075	29.639
0.8000	0.082	29.653	0.8000	0.075	29.639
0.8166	0.082	29.653	0.8166	0.075	29.639
0.8333	0.082	29.653	0.8333	0.075	29.639
0.8500	0.082	29.653	0.8500	0.075	29.639
0.8666	0.082	29.653	0.8666	0.075	29.639
0.8833	0.082	29.653	0.8833	0.075	29.639
0.9000	0.082	29.653	0.9000	0.075	29.639
0.9166	0.082	29.653	0.9166	0.075	29.639
0.9333	0.082	29.653	0.9333	0.075	29.639
0.9500	0.082	29.653	0.9500	0.075	29.639
0.9666	0.082	29.653	0.9666	0.075	29.639
0.9833	0.082	29.653	0.9833	0.075	29.639
1.0	0.082	29.653	1.0	0.075	29.639
1.2	0.082	29.653	1.2	0.079	29.639
1.4	0.082	29.653	1.4	0.079	29.639
1.6	0.079	29.648	1.6	0.082	29.639
1.8	0.079	29.653	1.8	0.085	29.639
2.0	0.079	29.648	2.0	0.085	29.639
2.2	0.075	29.653	2.2	0.085	29.639
2.4	0.072	29.648	2.4	0.085	29.639
2.6	0.072	29.653	2.6	0.085	29.639
2.8	0.069	29.653	2.8	0.085	29.639
3.0	0.069	29.648	3.0	0.085	29.639
3.2	0.069	29.653	3.2	0.085	29.635
3.4	0.072	29.653	3.4	0.085	29.639
3.6	0.069	29.648	3.6	0.088	29.639
3.8	0.069	29.648	3.8	0.091	29.639
4.0	0.072	29.648	4.0	0.091	29.639
4.2	0.072	29.648	4.2	0.091	29.639
4.4	0.072	29.648	4.4	0.091	29.635
4.6	0.072	29.648	4.6	0.091	29.639
4.8	0.072	29.648	4.8	0.091	29.635
5.0	0.072	29.648	5.0	0.094	29.635
5.2	0.072	29.648	5.2	0.098	29.635
5.4	0.069	29.653	5.4	0.098	29.635
5.6	0.069	29.648	5.6	0.098	29.635
5.8	0.069	29.648	5.8	0.098	29.635

WHC-SD-EN-DP-090, Rev. 0

6.0	0.072	29.648	6.0	0.098	29.635
6.2	0.069	29.648	6.2	0.101	29.635
6.4	0.069	29.648	6.4	0.101	29.635
6.6	0.069	29.648	6.6	0.101	29.635
6.8	0.069	29.648	6.8	0.101	29.639
7.0	0.069	29.648	7.0	0.101	29.635
7.2	0.072	29.648	7.2	0.101	29.635
7.4	0.072	29.648	7.4	0.101	29.635
7.6	0.072	29.648	7.6	0.101	29.635
7.8	0.075	29.648	7.8	0.101	29.635
8.0	0.072	29.648	8.0	0.101	29.635
8.2	0.072	29.648	8.2	0.104	29.635
8.4	0.072	29.648	8.4	0.104	29.635
8.6	0.072	29.648	8.6	0.104	29.639
8.8	0.072	29.648	8.8	0.104	29.635
9.0	0.072	29.648	9.0	0.104	29.635
9.2	0.072	29.648	9.2	0.104	29.639
9.4	0.072	29.648	9.4	0.104	29.639
9.6	0.072	29.648	9.6	0.104	29.635
9.8	0.072	29.648	9.8	0.104	29.639
10	0.075	29.648	10	0.107	29.639
12	0.079	29.653	12	0.107	29.644
14	0.079	29.648	14	0.113	29.639
16	0.082	29.648			
18	0.082	29.648			
20	0.091	29.648			
22	0.085	29.644			

Flow Meter Vector Analysis

POINT METHOD

Quadrant Factor:

360

Well : 199-K-106A

Test Date: 3/94

3/23/94

Theta Av. 342.48 degrees

r = 8.25

Avg r = 2.06 ft/day

Sdev = 0.87

VALIDATED

SIGNATURE/DATE

Theta	n	Sin Theta	Cos Theta	nSin Theta	nCos Theta	Sum nSin Theta	Sum nCos Theta
6	1.26	0.10	0.99	0.13	1.25	-2.48	7.87
329	2.76	-0.52	0.86	-1.42	2.37		
350	3.19	-0.17	0.98	-0.55	3.14		
330	1.28	-0.50	0.87	-0.64	1.11		

Flow Meter Vector Analysis

CURVE SUM METHOD

Quadrant Factor

360

Well : 199-K-106A

Test Date: 3/94

Theta Av. 347.61 degrees

r = 10.28

Avg r = 2.57 ft/day

Sdev = 1.00

Theta	n	Sin Theta	Cos Theta	nSin Theta	nCos Theta	Sum nSin Theta	Sum nCos Theta
352	1.67	-0.14	0.99	-0.23	1.65	-2.21	10.05
329	3.73	-0.52	0.86	-1.92	3.20		
13	3.74	0.22	0.97	0.84	3.64		
330	1.79	-0.50	0.87	-0.89	1.55		

Measurement Depth
Below Top of CasingPoint Method
Theta Ft. / DayCurve Method
Theta Ft. / Day

77 feet

6

1.26

352

1.67

82 feet

329

2.76

329

3.73

87 feet

350

3.19

13

3.74

92 feet

330

1.28

330

1.79

INSITU FLOW MEASUREMENTS

WELL N 199-F-106A 10677N2 - 10677S1
DATE: 3-29-94 2

5 SEC INTERVAL	mV PROBE 1 +N/-S	mV PROBE 2 +NE/-SW	mV PROBE 3 +E/-W	mV PROBE 4 +SE/-NW
0	0	0	0	0
5	0.00442	-0.001135	-0.002275	-0.002655
10	0.04484	-0.032075	-0.028545	-0.019455
15	0.136275	-0.11101	-0.084745	-0.073635
20	0.242315	-0.20634	-0.14118	-0.101665
25	0.342865	-0.28007	-0.178705	-0.135495
30	0.438165	-0.30002	-0.201655	-0.18733
35	0.506965	-0.27582	-0.209605	-0.17433
40	0.554815	-0.18777	-0.180755	-0.16073
45	0.567565	-0.03277	-0.132505	-0.13468
50	0.524815	0.11718	-0.080955	-0.10423
55	0.484115	0.25078	-0.032355	-0.07658
60	0.454415	0.35188	0.006545	-0.05878
65	0.432065	0.41313	0.038395	-0.04868
70	0.410115	0.45323	0.061095	-0.04638
75	0.397865	0.47403	0.081795	-0.07843
80	0.387015	0.47288	0.097595	-0.04503
85	0.367315	0.46948	0.110345	-0.04918
90	0.366315	0.45428	0.113795	-0.05388
95	0.362015	0.44188	0.121195	-0.05868
100	0.349285	0.43013	0.120095	-0.07063
105	0.340065	0.40548	0.121495	-0.06323
110	0.333415	0.38733	0.121095	-0.06828
115	0.323785	0.37888	0.119845	-0.09543
120	0.316065	0.35358	0.118145	-0.06878
125	0.308015	0.33968	0.116145	-0.08403
130	0.300565	0.31898	0.113145	-0.07588
135	0.291215	0.305455	0.109545	-0.06932
140	0.282865	0.29689	0.106695	-0.06475
145	0.275165	0.280555	0.104445	-0.07812
150	0.267115	0.27451	0.101895	-0.06627
155	0.250785	0.259605	0.100645	-0.06034
160	0.249265	0.252525	0.095445	-0.087245
165	0.256515	0.23928	0.091495	-0.062485
170	0.236315	0.233685	0.090545	-0.06552
175	0.223765	0.21991	0.089645	-0.058955
180	0.222015	0.21841	0.086445	-0.08148
PT SUM	11.84803	7.667625	1.163345	-2.78657

INSITU FLOW MEASUREMENTS

WELL NO. 199-F-106A 10677N2 - 10677S1
DATE: 3-29-94 2

5 SEC INTERVAL	mV PROBE 1 +N/-S	+NE/-SW	+E/-W	+SE/-NW
0	0	0	0	0
5	0.106963	-0.08764	-0.0641883	-0.0493525
10	0.181574	-0.15737	-0.1082938	-0.0825625
15	0.289405	-0.22436	-0.1515713	-0.1195313
20	0.382078	-0.28556	-0.1827883	-0.144705
25	0.460153	-0.28092	-0.19268	-0.1594713
30	0.518328	-0.1991	-0.18113	-0.1592875
35	0.53844	-0.0948	-0.150955	-0.1434925
40	0.532728	0.038855	-0.1068425	-0.119055
45	0.507678	0.171767	-0.0598175	-0.0935675
50	0.473803	0.283243	-0.0170925	-0.0720675
55	0.445178	0.387255	0.01842	-0.057605
60	0.423815	0.423068	0.0469575	-0.0575675
65	0.408765	0.453318	0.06972	-0.05413
70	0.390578	0.467405	0.0877075	-0.054255
75	0.379628	0.467668	0.1008825	-0.05613
80	0.370665	0.45983	0.1107325	-0.0516925
85	0.361228	0.448943	0.1163575	-0.0580925
90	0.354415	0.432943	0.119145	-0.061605
95	0.34619	0.416205	0.12097	-0.065205
100	0.336628	0.400455	0.1206325	-0.0743925
105	0.328328	0.381318	0.120145	-0.07393
110	0.320315	0.364868	0.1185575	-0.07913
115	0.312103	0.34803	0.11657	-0.08103
120	0.303965	0.329674	0.113995	-0.0745025
125	0.295665	0.315501	0.1111325	-0.073495
130	0.287453	0.30072	0.1084575	-0.0715175
135	0.27909	0.289353	0.10587	-0.069115
140	0.268978	0.27789	0.103445	-0.06687
145	0.260578	0.268799	0.1006325	-0.0724938
150	0.255915	0.25648	0.097395	-0.069085
155	0.248215	0.246274	0.0945325	-0.0688975
160	0.241465	0.23635	0.0917825	-0.0685513
165	0.234653	0.227821	0.0895325	-0.06211
170	0.227365	0.224002	0.08887833	-0.061985
175	0.22289	0.21916	0.088045	-0.0602175
180	0.222015	0.21841	0.086445	-0.08148
PT SUM	12.12302	8.041654	1.33158583	-2.8481575

VALIDATED
SIGNATURE/DATE

WHC-SD-EN-DP-090, Rev. 0

INSITU FLOW MEASUREMENTS

WELL NO. 199-F-106A

TEST NO. 10677N2

DATE: 3-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE +SE/-NW
88	1039	0.82551	-0.44433	-0.59842	0.01844
88	1040	0.8348	-0.44509	-0.60246	0.0101
88	1040	0.92529	-0.51253	-0.6598	-0.0288
88	1040	1.2077	-0.73684	-0.83384	-0.18011
88	1040	1.6929	-1.1584	-1.1185	-0.39962
88	1040	2.3293	-1.7358	-1.4674	-0.72724
88	1040	3.0489	-2.3629	-1.845	-1.0966
88	1040	3.7597	-2.9923	-2.2181	-1.4744
88	1040	4.4019	-3.5109	-2.5379	-1.8074
88	1040	4.9129	-3.7936	-2.7713	-2.0542
88	1040	5.1778	-3.888	-2.9236	-2.1987
88	1040	5.2662	-3.7947	-3.0083	-2.2515
88	1041	5.2358	-3.5871	-3.0472	-2.2417
88	1041	5.1295	-3.3345	-3.052	-2.1927
88	1041	4.9661	-3.049	-3.0311	-2.1181
88	1041	4.7887	-2.7691	-2.9952	-2.0418
88	1041	4.5879	-2.5039	-2.9432	-1.9229
88	1041	4.3654	-2.255	-2.8798	-1.8269
88	1041	4.1784	-2.0421	-2.8214	-1.7352
88	1041	3.9791	-1.8471	-2.7464	-1.6311
88	1041	3.7914	-1.6698	-2.6852	-1.5578
88	1041	3.6118	-1.5298	-2.614	-1.4568
88	1041	3.4469	-1.4012	-2.544	-1.3868
88	1041	3.2897	-1.2817	-2.4738	-1.3133
88	1042	3.144	-1.1938	-2.4054	-1.2408
88	1042	3.0091	-1.1059	-2.3399	-1.1852
88	1042	2.8861	-1.044	-2.2742	-1.1229
88	1042	2.7686	-0.98215	-2.2129	-1.0514
88	1042	2.661	-0.91798	-2.152	-0.9968
88	1042	2.5622	-0.88085	-2.0931	-0.97129
88	1042	2.4703	-0.83134	-2.0373	-0.91091
88	1042	2.3667	-0.80355	-1.9812	-0.85711
88	1042	2.3028	-0.77551	-1.9332	-0.82275
88	1042	2.2203	-0.75	-1.885	-0.78435
88	1042	2.1598	-0.71539	-1.8372	-0.75101
88	1042	2.0843	-0.70554	-1.7892	-0.71767
88	1043	2.035	-0.67624	-1.7486	-0.69316

INSITU FLOW MEASUREMENTS

WELL NO. 199-F-106A

TEST NO. 10677N2

DATE: 3-29-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE +SE/-NW
88	0	0	0	0	0
88	5	0.00909	-0.00078	-0.00404	-0.00834
88	10	0.09978	-0.0682	-0.08138	-0.04724
88	15	0.38219	-0.29251	-0.23542	-0.19855
88	20	0.86739	-0.71407	-0.52008	-0.41808
88	25	1.50379	-1.29127	-0.86898	-0.74568
88	30	2.22439	-1.91857	-1.24658	-1.11504
88	35	2.93419	-2.54797	-1.61968	-1.49284
88	40	3.57639	-3.06657	-1.93948	-1.82584
88	45	4.08739	-3.34927	-2.17288	-2.07264
88	50	4.35209	-3.44167	-2.32518	-2.21714
88	55	4.44069	-3.35037	-2.40988	-2.26894
88	60	4.41009	-3.14277	-2.44878	-2.26014
88	65	4.30399	-2.89017	-2.45358	-2.21114
88	70	4.14059	-2.60467	-2.43268	-2.13654
88	75	3.96319	-2.32477	-2.39678	-2.06024
88	80	3.76239	-2.05957	-2.34478	-1.94134
88	85	3.53989	-1.81067	-2.28138	-1.84534
88	90	3.35289	-1.59777	-2.22298	-1.75364
88	95	3.15359	-1.40277	-2.14798	-1.64954
88	100	2.96589	-1.22547	-2.08678	-1.57824
88	105	2.78829	-1.08527	-2.01558	-1.47524
88	110	2.62139	-0.95687	-1.94558	-1.40524
88	115	2.46419	-0.83737	-1.87538	-1.33174
88	120	2.31849	-0.74947	-1.80698	-1.25924
88	125	2.18359	-0.66157	-1.74148	-1.20364
88	130	2.06059	-0.59967	-1.67578	-1.14134
88	135	1.94309	-0.53782	-1.61448	-1.06984
88	140	1.83549	-0.47365	-1.55358	-1.01524
88	145	1.73669	-0.43652	-1.49468	-0.98973
88	150	1.64479	-0.38701	-1.43888	-0.92935
88	155	1.54119	-0.35922	-1.38278	-0.87555
88	160	1.47729	-0.33118	-1.33478	-0.84119
88	165	1.40379	-0.30587	-1.28658	-0.80279
88	170	1.33409	-0.27108	-1.23878	-0.76945
88	175	1.25879	-0.26121	-1.19078	-0.73611
88	180	1.20949	-0.23191	-1.15018	-0.7116

2 OF CONT'D

WHC-SD-EN-DP-090, Rev. 0

INSITU FLOW MEASUREMENTS

WELL NO. 199-F-106A

TEST NO. 10677S1

DATE: 3-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
88	1140	0.82914	-0.45347	-0.60253	-0.05432
88	1140	0.82939	-0.45196	-0.60202	-0.05735
88	1140	0.83924	-0.45752	-0.60682	-0.06265
88	1140	0.93878	-0.52398	-0.66846	-0.1056
88	1140	1.2119	-0.75488	-0.84025	-0.26905
88	1140	1.6472	-1.1848	-1.1141	-0.52901
88	1140	2.1812	-1.772	-1.4458	-0.8347
88	1140	2.7494	-2.4498	-1.803	-1.1985
88	1140	3.2963	-3.1445	-2.1805	-1.5587
88	1140	3.7814	-3.7372	-2.5104	-1.8576
88	1140	4.132	-4.1295	-2.7658	-2.063
88	1141	4.3018	-4.3054	-2.9477	-2.1711
88	1141	4.3304	-4.3	-3.0644	-2.1869
88	1141	4.269	-4.1699	-3.1329	-2.1681
88	1141	4.1495	-3.9648	-3.1574	-2.0981
88	1141	3.9968	-3.7263	-3.1629	-1.9617
88	1141	3.8175	-3.4588	-3.1425	-1.9058
88	1141	3.6344	-3.2031	-3.1046	-1.8013
88	1141	3.4494	-2.9598	-3.0531	-1.7002
88	1141	3.2587	-2.74	-2.9929	-1.5865
88	1141	3.0965	-2.5392	-2.9295	-1.4893
88	1141	2.9353	-2.3497	-2.8611	-1.4031
88	1141	2.7837	-2.185	-2.7903	-1.323
88	1142	2.6458	-2.0488	-2.7176	-1.1952
88	1142	2.5155	-1.9101	-2.6458	-1.178
88	1142	2.3967	-1.7944	-2.5743	-1.0899
88	1142	2.2888	-1.6931	-2.5048	-1.0439
88	1142	2.1898	-1.6022	-2.4361	-0.98552
88	1142	2.0989	-1.5209	-2.3695	-0.94006
88	1142	2.0155	-1.4511	-2.3081	-0.89181
88	1142	1.9397	-1.3895	-2.2454	-0.85113
88	1142	1.8688	-1.3319	-2.1868	-0.80919
88	1142	1.8079	-1.2897	-2.1282	-0.72102
88	1142	1.7199	-1.2377	-2.0721	-0.73214
88	1142	1.6908	-1.1919	-2.0224	-0.69273
88	1143	1.6404	-1.1545	-1.9726	-0.67252
88	1143	1.5948	-1.1222	-1.9256	-0.64296

INSITU FLOW MEASUREMENTS

WELL NO. 199-F-106A

TEST NO. 10677S1

DATE: 3-29-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
	0	0	0	0	0
	5	0.00025	0.00151	0.00051	-0.00303
	10	0.0101	-0.00405	-0.00429	-0.00833
	15	0.10964	-0.07049	-0.06593	-0.05128
	20	0.38278	-0.30139	-0.23772	-0.21473
	25	0.81808	-0.73113	-0.51157	-0.47469
	30	1.35208	-1.31853	-0.84327	-0.78038
	35	1.92028	-1.99633	-1.20047	-1.14418
	40	2.46718	-2.69103	-1.57797	-1.50438
	45	2.95228	-3.28373	-1.90787	-1.80328
	50	3.30288	-3.87603	-2.16327	-2.00888
	55	3.47248	-3.85193	-2.34517	-2.11678
	60	3.50128	-3.84653	-2.46187	-2.14258
	65	3.43988	-3.71643	-2.53037	-2.11378
	70	3.32038	-3.51113	-2.55487	-2.04378
	75	3.16748	-3.27283	-2.56037	-1.90738
	80	2.98838	-3.00533	-2.53997	-1.85128
	85	2.80528	-2.74963	-2.50207	-1.74698
	90	2.62028	-2.50633	-2.45057	-1.64588
	95	2.42958	-2.28653	-2.39037	-1.53218
	100	2.26738	-2.08573	-2.32697	-1.43498
	105	2.10618	-1.89623	-2.25857	-1.34878
	110	1.95458	-1.73153	-2.18777	-1.26868
	115	1.81668	-1.59513	-2.11507	-1.14088
	120	1.68638	-1.45663	-2.04327	-1.12168
	125	1.56758	-1.34093	-1.97177	-1.03558
	130	1.45948	-1.23963	-1.90207	-0.98958
	135	1.36068	-1.14873	-1.83357	-0.9312
	140	1.26978	-1.06743	-1.76697	-0.88574
	145	1.18638	-0.99763	-1.70357	-0.83749
	150	1.11058	-0.93603	-1.64287	-0.79681
	155	1.03968	-0.87843	-1.58407	-0.75487
	160	0.97878	-0.83623	-1.52587	-0.6667
	165	0.89078	-0.78423	-1.46957	-0.67782
	170	0.86148	-0.73843	-1.41987	-0.63841
	175	0.81128	-0.70103	-1.37007	-0.6182
	180	0.76548	-0.66873	-1.32307	-0.58884

D-38

WHC-SD-EN-DP-090, Rev. 0

4 OF CONT'D

WELL NO. 199-K-106A (106:77N2)-(106:77S)/2

PROBE 1 + N/-S
 PROBE 2 + NE/-S
 PROBE 3 + E/-W
 PROBE 4 + SE/-N

5 of CONT'D

WELL NO. 199-K-106A

Test 106A-77NS1

CURVE SUM

DECLINATION CORRECTION

13° EAST + 21° WEST = 8° WEST OF NORTH

FLOW CALCULATION

(mVOLTS * 0.031144) + 0.026505

POROSITY

1.67 ft/day @ 20% porosity

mVOLTS = 9.8930

VECTOR FIT RATIO

$$100 - (((0.6534 + 2.1665 + 1.2462 + 0.2668) / 9.8930) \times 100) = \boxed{56.2\%}$$

D-41

WELL NO. 199-K-106A

Test 106A-77NS1

CURVE SUMDECLINATION CORRECTION

13° EAST + 21° WEST = 8° WEST OF NORTH

FLOW CALCULATION $(\text{mVOLTS} \times 0.031144) + 0.026505$

POROSITY

 $\boxed{1.67 \text{ ft/day @ 20\% porosity}}$

mVOLTS = 9.8930

WELL NO. 199-K-106A

106A-77

Plot Point 140

D-42

ANGLE CORRECTION (DECLINATION)
 $27^{\circ} \text{ E} + 21^{\circ} \text{ W} = 6^{\circ} \text{ EAST OF NORTH}$

FLOW CALCULATION

$$\frac{(\text{mVOLTS} * 0.781113) + 0.01765}{\text{POROSITY}}$$

POROSITY

1.26 ft/day @ 20% porosity

$$\text{mV} = 0.3014$$

8 OF CONT'D

FIT RATIO :

$$100 - \langle \langle (0.0102 + 0.0129 + 0.0121 + 0.0094) / 0.3014 \rangle * 100 \rangle = \boxed{85.2\%}$$

WELL NO. 199-K-106A
106A-77

Plot Point 140

$$\frac{\text{ANGLE CORRECTION } \langle \text{DECLINATION} \rangle}{27^{\circ} \text{ E} + 21^{\circ} \text{ W}} = 6^{\circ} \text{ EAST OF NORTH}$$

D-43

FLOW CALCULATION

$$\frac{\langle \text{mVOLTS} * 0.781113 \rangle + 0.01765}{\text{POROSITY}}$$

1.26 ft/day @ 20% porosity

mV - 0.3014

INSITU FLOW MEASUREMENTS

WELL NO 199-K-106A

10682N1 - 10682S1

DATE: 03-29-94

2

5 SEC	mV PROBE 1	mV PROBE 2	mV PROBE 3	mV PROBE 4
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW

0	0	0	0	0
5	0.00644	0.00556	-0.003025	-0.007955
10	0.012745	0.007585	-0.003905	-0.00239
15	0.02859	0.01393	-0.00325	-0.006665
20	0.06964	0.028635	-0.00571	-0.01459
25	0.14089	0.057385	-0.01138	-0.006845
30	0.22229	0.097185	-0.02611	-0.04494
35	0.31139	0.138985	-0.04841	-0.102585
40	0.39304	0.193485	-0.07188	-0.172135
45	0.45854	0.238835	-0.09731	-0.273335
50	0.51319	0.277285	-0.11551	-0.346535
55	0.55524	0.317685	-0.12826	-0.411335
60	0.58769	0.346935	-0.13796	-0.469285
65	0.60724	0.378535	-0.14318	-0.516035
70	0.63084	0.398185	-0.14781	-0.555235
75	0.64459	0.410785	-0.14881	-0.589735
80	0.65494	0.427785	-0.15046	-0.590335
85	0.66079	0.444585	-0.15191	-0.60488
90	0.66474	0.449835	-0.14846	-0.61033
95	0.66884	0.450335	-0.14878	-0.615885
100	0.66554	0.452485	-0.14968	-0.615165
105	0.66454	0.453985	-0.14908	-0.617025
110	0.66699	0.452585	-0.14828	-0.613035
115	0.65824	0.449835	-0.14811	-0.60875
120	0.65374	0.442415	-0.14516	-0.601055
125	0.65334	0.44053	-0.14411	-0.599645
130	0.63774	0.43289	-0.14051	-0.585885
135	0.63118	0.424685	-0.13871	-0.57732
140	0.63419	0.43047	-0.13978	-0.575275
145	0.62779	0.41253	-0.13941	-0.564935
150	0.61464	0.40828	-0.13571	-0.554215
155	0.60724	0.408765	-0.13401	-0.545395
160	0.59954	0.3985	-0.13261	-0.540225
165	0.59069	0.393825	-0.13031	-0.528345
170	0.59344	0.384855	-0.13031	-0.526565
175	0.57854	0.382705	-0.12866	-0.51407
180	0.56634	0.37438	-0.12491	-0.501695
PT SUM	18.473995	11.827235	-4.04931	-15.58961

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

10682N1 - 10682S1

DATE: 03-29-94

2

(5 POINT RUNNING AVERAGE)

5 SEC	mV PROBE 1			
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW

0	0	0	0	0
5	0.029354	0.013928	-0.0039725	-0.0079
10	0.062968	0.028884	-0.00605825	-0.0076225
15	0.115353	0.049284	-0.0116075	-0.01828
20	0.186053	0.080548	-0.0228975	-0.04224
25	0.266903	0.12178	-0.039435	-0.08162625
30	0.346315	0.167123	-0.0609225	-0.14824875
35	0.41904	0.212147	-0.0832725	-0.2238475
40	0.480003	0.256823	-0.103235	-0.300835
45	0.528665	0.295185	-0.11976	-0.3751225
50	0.56584	0.33011	-0.1312225	-0.4357975
55	0.595203	0.360335	-0.1392975	-0.4879725
60	0.61754	0.38361	-0.144435	-0.5275725
65	0.634353	0.403823	-0.14758	-0.557835
70	0.64774	0.420335	-0.1497475	-0.58004125
75	0.656265	0.433247	-0.14991	-0.593815
80	0.661778	0.443135	-0.1498975	-0.6053525
85	0.664428	0.44931	-0.1498975	-0.61158
90	0.665365	0.45168	-0.148985	-0.61460125
95	0.665928	0.452348	-0.148935	-0.6152775
100	0.663828	0.452223	-0.1482725	-0.61349375
105	0.660878	0.449705	-0.1471475	-0.60996625
110	0.658077	0.446341	-0.14591	-0.60582125
115	0.650765	0.441418	-0.1439725	-0.59883375
120	0.644003	0.43513	-0.1421225	-0.59097825
125	0.639115	0.432144	-0.1407725	-0.58453125
130	0.632728	0.425144	-0.1395975	-0.57585375
135	0.626953	0.418986	-0.1383975	-0.56793625
140	0.620965	0.415006	-0.1372225	-0.559955
145	0.612303	0.407014	-0.135435	-0.5511925
150	0.603028	0.402338	-0.13316	-0.542045
155	0.597728	0.396486	-0.13181	-0.5351325
160	0.590803	0.389971	-0.1304725	-0.52730125
165	0.582503	0.383941	-0.1285475	-0.51766875
170	0.579773	0.380647	-0.12796	-0.51411
175	0.57294	0.378543	-0.126785	-0.5078825
180	0.56634	0.37438	-0.12491	-0.501695
PT SUM	19.31181	12.38101	-4.23334125	-16.3395225

D-44

WHC-SD-EN-DP-090, Rev. 0

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10682N1

DATE: 03-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
88	1339	0.87158	-0.45107	-0.59402	0.0591
88	1339	0.89001	-0.44804	-0.60361	0.05102
88	1339	0.98321	-0.49224	-0.65741	0.00455
88	1339	1.2534	-0.69125	-0.81803	-0.14573
88	1339	1.7207	-1.04	-1.0928	-0.39652
88	1339	2.3281	-1.5065	-1.4413	-0.66498
88	1339	2.965	-2.0099	-1.8328	-1.037
88	1339	3.6025	-2.5185	-2.2382	-1.4378
88	1339	4.1897	-2.9458	-2.5943	-1.7959
88	1339	4.638	-3.2133	-2.887	-2.1152
88	1339	4.9037	-3.3168	-3.0418	-2.2879
88	1340	5.0128	-3.2825	-3.1401	-2.3709
88	1340	5.0153	-3.1027	-3.181	-2.399
88	1340	4.9357	-2.8804	-3.1787	-2.3818
88	1340	4.8274	-2.6322	-3.1504	-2.3276
88	1340	4.6794	-2.391	-3.0988	-2.2493
88	1340	4.517	-2.1493	-3.0362	-2.1682
88	1340	4.3473	-1.9043	-2.9681	-2.0861
88	1340	4.1778	-1.7093	-2.8852	-1.9922
88	1340	4.0119	-1.5285	-2.8097	-1.9058
88	1340	3.851	-1.3691	-2.7352	-1.8268
88	1340	3.699	-1.2317	-2.6577	-1.7469
88	1340	3.5558	-1.1107	-2.5811	-1.6844
88	1341	3.4208	-1.0075	-2.5068	-1.5957
88	1341	3.2939	-0.91754	-2.4347	-1.528
88	1341	3.1754	-0.84001	-2.3639	-1.4628
88	1341	3.0552	-0.77939	-2.2945	-1.3951
88	1341	2.9527	-0.7213	-2.2313	-1.3373
88	1341	2.8655	-0.65993	-2.1725	-1.2885
88	1341	2.7768	-0.63291	-2.1129	-1.2327
88	1341	2.6915	-0.58745	-2.0578	-1.1855
88	1341	2.6122	-0.54704	-2.0046	-1.1428
88	1341	2.5395	-0.52077	-1.9543	-1.1027
88	1341	2.4687	-0.50182	-1.9053	-1.0582
88	1341	2.4043	-0.48038	-1.8598	-1.0246
88	1342	2.3434	-0.45588	-1.8161	-0.98294
88	1342	2.2854	-0.44601	-1.7732	-0.94733

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10682N1

DATE: 03-29-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
88	0	0	0	0	0
88	5	0.01843	0.00303	-0.00959	-0.00808
88	10	0.11163	-0.04117	-0.06339	-0.05455
88	15	0.38182	-0.24018	-0.22401	-0.20483
88	20	0.84912	-0.58893	-0.49878	-0.45582
88	25	1.45652	-1.05543	-0.84728	-0.72408
88	30	2.09342	-1.55883	-1.23858	-1.0981
88	35	2.73092	-2.06743	-1.64418	-1.4969
88	40	3.31812	-2.49453	-2.00028	-1.855
88	45	3.76842	-2.76223	-2.27298	-2.1743
88	50	4.03212	-2.86573	-2.44778	-2.347
88	55	4.14122	-2.81143	-2.54608	-2.439
88	60	4.14372	-2.65163	-2.58698	-2.4581
88	65	4.08412	-2.42833	-2.58468	-2.4407
88	70	3.95582	-2.18113	-2.55838	-2.3887
88	75	3.80782	-1.93993	-2.50458	-2.3084
88	80	3.64542	-1.69823	-2.44218	-2.2273
88	85	3.47572	-1.45323	-2.37408	-2.1452
88	90	3.30602	-1.25823	-2.29118	-2.0513
88	95	3.14032	-1.07743	-2.21568	-1.9849
88	100	2.87942	-0.91803	-2.14118	-1.8859
88	105	2.82742	-0.78063	-2.06368	-1.808
88	110	2.68422	-0.65863	-1.98708	-1.7235
88	115	2.54902	-0.55843	-1.91258	-1.6548
88	120	2.42232	-0.46847	-1.84068	-1.5851
88	125	2.30382	-0.38894	-1.78088	-1.5219
88	130	2.18362	-0.32832	-1.70048	-1.4542
88	135	2.08112	-0.27023	-1.63728	-1.3964
88	140	1.99392	-0.20888	-1.57848	-1.3478
88	145	1.90502	-0.18184	-1.51888	-1.2918
88	150	1.81092	-0.13638	-1.46378	-1.2446
88	155	1.74082	-0.09597	-1.41058	-1.2017
88	160	1.68782	-0.0697	-1.36028	-1.1618
88	165	1.59712	-0.05075	-1.31128	-1.1153
88	170	1.53272	-0.02929	-1.26578	-1.0837
88	175	1.47182	-0.00479	-1.22208	-1.04204
88	180	1.41382	0.00508	-1.17918	-1.00843

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10682S1

DATE: 03-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE 1 +N/S	mV PROBE 2 +NE/-SW	mV PROBE 3 +E/-W	mV PROBE 4 +SE/-NW
88	1440	0.84708	-0.4428	-0.59544	0.03613
88	1440	0.85261	-0.45069	-0.59898	0.04398
88	1440	0.8332	-0.49894	-0.65102	-0.01364
88	1440	1.1717	-0.71064	-0.81295	-0.15537
88	1440	1.5569	-1.0888	-1.0828	-0.39031
88	1440	2.0218	-1.8128	-1.42	-0.67428
88	1440	2.4959	-2.1858	-1.7818	-0.97009
88	1440	2.9552	-2.788	-2.1428	-1.2558
88	1440	3.3791	-3.3241	-2.452	-1.4748
88	1440	3.6984	-3.6825	-2.6738	-1.5915
88	1440	3.8528	-3.8629	-2.8122	-1.6178
88	1441	3.8778	-3.8894	-2.885	-1.5802
88	1441	3.8154	-3.7881	-2.8065	-1.4834
88	1441	3.6967	-3.629	-2.8938	-1.3725
88	1441	3.5418	-3.4201	-2.8582	-1.2401
88	1441	3.3657	-3.2041	-2.8024	-1.1328
88	1441	3.1826	-2.9964	-2.7367	-1.0105
88	1441	3.0012	-2.785	-2.6657	-0.89935
88	1441	2.8238	-2.6005	-2.5897	-0.79451
88	1441	2.6541	-2.4207	-2.5136	-0.697
88	1441	2.4854	-2.2658	-2.4373	-0.61944
88	1441	2.3454	-2.1312	-2.361	-0.53582
88	1441	2.1973	-2.0074	-2.288	-0.4613
88	1442	2.0796	-1.8987	-2.2158	-0.40117
88	1442	1.9819	-1.7939	-2.1458	-0.34888
88	1442	1.8442	-1.7128	-2.0771	-0.28648
88	1442	1.7552	-1.6367	-2.0149	-0.2463
88	1442	1.6658	-1.5622	-1.9553	-0.20563
88	1442	1.5728	-1.5124	-1.8944	-0.16092
88	1442	1.4965	-1.4495	-1.8355	-0.1258
88	1442	1.4377	-1.3955	-1.7878	-0.10004
88	1442	1.3732	-1.3561	-1.738	-0.07478
88	1442	1.3159	-1.3093	-1.6905	-0.04522
88	1442	1.2628	-1.281	-1.6461	-0.02248
88	1442	1.1929	-1.2416	-1.6006	0.00556
88	1443	1.1598	-1.2128	-1.5602	0.02223
88	1443	1.1282	-1.1863	-1.5248	0.03309

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10682S1

DATE: 03-29-94

(BASE TIME 0 SUBTRA

JULIAN DAY	5 SEC INTERVAL	mV PROBE 1 +N/S	mV PROBE 2 +NE/-SW	mV PROBE 3 +E/-W	mV PROBE 4 +SE/-NW
0	0	0	0	0	0
5	0.00555	-0.00809	-0.00354	0.00783	
10	0.08614	-0.05634	-0.05558	-0.04977	
15	0.32464	-0.26804	-0.21751	-0.1915	
20	0.70984	-0.6482	-0.48738	-0.42644	
25	1.17474	-1.1702	-0.82458	-0.71039	
30	1.64884	-1.7532	-1.18638	-1.00622	
35	2.10814	-2.3454	-1.54738	-1.29173	
40	2.53204	-2.8815	-1.85858	-1.51073	
45	2.84834	-3.2399	-2.07838	-1.62783	
50	3.00574	-3.4203	-2.21878	-1.65393	
55	3.03074	-3.4468	-2.28958	-1.61633	
60	2.96834	-3.3455	-2.31108	-1.51953	
65	2.84984	-3.1864	-2.29838	-1.40883	
70	2.69454	-2.9775	-2.26078	-1.27823	
75	2.51884	-2.7815	-2.20698	-1.16893	
80	2.33554	-2.5538	-2.14128	-1.04683	
85	2.15414	-2.3424	-2.07028	-0.93548	
90	1.97654	-2.1579	-1.99428	-0.83064	
95	1.80704	-1.9781	-1.91818	-0.73313	
100	1.64834	-1.823	-1.84188	-0.65557	
105	1.49834	-1.6888	-1.76558	-0.57185	
110	1.35024	-1.5848	-1.69058	-0.49743	
115	1.23254	-1.4581	-1.62038	-0.4373	
120	1.11484	-1.3513	-1.55038	-0.38299	
125	0.99714	-1.27	-1.48168	-0.32261	
130	0.90814	-1.1941	-1.41948	-0.28243	
135	0.81874	-1.1198	-1.35988	-0.24178	
140	0.72554	-1.0698	-1.29898	-0.19705	
145	0.64944	-1.0069	-1.24008	-0.16183	
150	0.59064	-0.9529	-1.18238	-0.13617	
155	0.52614	-0.9135	-1.14258	-0.11091	
160	0.46884	-0.8667	-1.09508	-0.08135	
165	0.41574	-0.8384	-1.05068	-0.05881	
170	0.34584	-0.799	-1.00518	-0.03057	
175	0.31274	-0.7702	-0.96478	-0.0139	
180	0.28114	-0.7437	-0.92938	-0.00304	

D-46

WHC-SD-EN-DP-090, Rev. 0

WELL NO. 199-K-106A (106N1-82)-(106S1-82)/2

12 OF CONT'D

PROBE 1 + N/-S
 PROBE 2 + NE/-S
 PROBE 3 + E/-W
 PROBE 4 + SE/-N

WELL NO. 199-K-106A

Test 106A-82NS1

CURVE SUM

ANGLE

31° WEST OF NORTH

FLOW CALCULATION

 $(\text{mVOLTS} \times 0.031144) + 0.026505$

POROSITY

3.73 ft/day @ 20% porosity

mVOLTS = 19.2253

WHC-SD-EN-DP-090, Rev. 0

VECTOR FIT RATIO

$$100 - (((.1380 + .4662 + .1212 + .4493) / 19.2253) * 100) = 93.9\%$$

WELL NO. 199-K-106A

Test 106A-82NS1

CURVE SUM

ANGLE

31° WEST OF NORTH

FLOW CALCULATION

(mVOLTS = 0.031144) + 0.026505

POROSITY

3.73 ft/day @ 20% porosity

mVOLTS = 19.2253

WHC-SD-EN-DP-090, Rev. 0

D-49

D-50

WELL NO. 199-K-106A

106A-82

Plot Point 140

(DECLINATION)

ANGLE CORRECTION

$$10^{\circ} + 21^{\circ} = 31^{\circ} \text{ WEST OF NORTH}$$

FLOW CALCULATION

$$\frac{(\text{mVOLTS} * 0.781113) + 0.01765}{\text{POROSITY}}$$

POROSITY

2.76 ft/day @ 20% porosity

$$\text{mV} = 0.6835$$

FIT RATIO :

$$100 - \langle \langle (0.0379 + 0.0231 + 0.0115 + 0.0033) * 100 \rangle / 0.6835 \rangle = \boxed{88.9\%}$$

WELL NO. 199-K-106A

106A-82

Plot Point 140

ANGLE CORRECTION < DECLINATION >
 $10^{\circ} + 21^{\circ} = 31^{\circ}$ WEST OF NORTH

D-51

FLOW CALCULATION

$$\langle mV \rangle LTS * 0.781113 \rangle + 0.01765$$

POROSITY

2.76 ft/day @ 20% porosity

INSITU FLOW MEASUREMENTS

WELL NO 199-K-106A

10687N1 - 10687S1

DATE: 03-29-94

2

5 SEC	mV PROBE 1	mV PROBE 2	mV PROBE 3	mV PROBE 4
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW
0	0	0	0	0
5	-0.003405	0.00025	0.00152	-0.002775
10	-0.0174	0.01767	0.0178	0.015655
15	-0.074425	0.07608	0.056645	0.013085
20	-0.096085	0.143115	0.10087	0.02751
25	-0.074185	0.2017	0.142865	0.04705
30	-0.020085	0.2724	0.192715	0.024555
35	0.062015	0.35645	0.247065	-0.00454
40	0.167515	0.4414	0.298715	-0.03965
45	0.299765	0.51815	0.339365	-0.0755
50	0.426215	0.59175	0.375815	-0.108
55	0.534165	0.6572	0.403465	-0.12825
60	0.613765	0.72305	0.427415	-0.1398
65	0.678015	0.78265	0.441115	-0.14705
70	0.713765	0.8323	0.451665	-0.1556
75	0.732565	0.8731	0.455765	-0.1567
80	0.757065	0.90455	0.455765	-0.15995
85	0.764815	0.9253	0.451015	-0.1614
90	0.768815	0.93925	0.444465	-0.159865
95	0.767165	0.9446	0.436265	-0.15891
100	0.762815	0.94635	0.429865	-0.1585
105	0.754765	0.93993	0.416615	-0.157215
110	0.747415	0.93472	0.404415	-0.1592
115	0.733865	0.91874	0.394465	-0.15298
120	0.720765	0.905895	0.384815	-0.148785
125	0.707965	0.8889	0.372565	-0.148505
130	0.694565	0.8735	0.361865	-0.15138
135	0.680065	0.85434	0.351165	-0.1429
140	0.655115	0.840645	0.341715	-0.144135
145	0.653315	0.817645	0.332665	-0.134775
150	0.639265	0.7999	0.323865	-0.13778
155	0.625115	0.78195	0.315515	-0.131705
160	0.610015	0.76328	0.307465	-0.12714
165	0.597215	0.746265	0.298915	-0.125485
170	0.584435	0.73034	0.291215	-0.11561
175	0.56065	0.71421	0.285665	-0.11876
180	0.559355	0.69692	0.277365	-0.119755
PT SUM	18.28636	24.354495	11.630265	-3.841645

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

10687N1 - 10687S1

DATE: 03-29-94

2

(5 POINT RUNNING AVERAGE)

5 SEC	mV PROBE 1			
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW
0	0	0	0	0
5	-0.04783	0.059279	0.04420875	0.01336875
10	-0.06552	0.109641	0.079545	0.02605
15	-0.0662	0.173324	0.12327375	0.028275
20	-0.03209	0.243416	0.17087875	0.02386875
25	0.033815	0.317988	0.22034	0.00707875
30	0.127303	0.3971	0.269465	-0.02378375
35	0.238877	0.476937	0.31519	-0.0564225
40	0.356915	0.552125	0.35429	-0.08735
45	0.468478	0.622538	0.386465	-0.1123375
50	0.56304	0.688682	0.4119025	-0.130225
55	0.634928	0.7488	0.430815	-0.142825
60	0.684528	0.802775	0.44399	-0.1497375
65	0.720353	0.84815	0.4510775	-0.154825
70	0.742053	0.883813	0.4535525	-0.1584125
75	0.755785	0.91055	0.4517525	-0.15947875
80	0.764415	0.928425	0.4468775	-0.16003125
85	0.765803	0.938875	0.4404025	-0.15966875
90	0.76329	0.942532	0.4318025	-0.1586225
95	0.75799	0.9414	0.42179	-0.15845625
100	0.749665	0.934935	0.41134	-0.15697375
105	0.739203	0.924821	0.4000775	-0.154545
110	0.727503	0.912064	0.389065	-0.1523675
115	0.71429	0.896759	0.3784275	-0.1504125
120	0.70084	0.880659	0.3676025	-0.1478925
125	0.684428	0.864346	0.3568275	-0.14673
130	0.670785	0.846533	0.3468525	-0.1432975
135	0.65694	0.828133	0.3373525	-0.1398975
140	0.643203	0.810035	0.32844	-0.13709875
145	0.631928	0.790694	0.3198775	-0.13285
150	0.617903	0.772849	0.31144	-0.1305275
155	0.604195	0.755459	0.3032775	-0.124985
160	0.588079	0.738524	0.295815	-0.12174875
165	0.575414	0.721934	0.28829	-0.1199025
170	0.568147	0.713823	0.284748333	-0.11804167
175	0.560003	0.705565	0.281515	-0.1192575
180	0.559355	0.69692	0.277365	-0.119755
PT SUM	19.15777	25.38038	12.02603208	-4.02961792

WHC-SD-EN-DP-090, Rev. 0

D-52

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10687N1

DATE: 03-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE +N/S	mV PROBE +NE/SW	mV PROBE +E/W	mV PROBE 4 +SE/NW
88	1544	0.74098	-0.44847	-0.58271	0.17721
88	1544	0.73869	-0.44569	-0.58296	0.18
88	1544	0.78065	-0.45504	-0.59408	0.17191
88	1544	0.88632	-0.53341	-0.66411	0.10415
88	1544	1.2048	-0.76877	-0.83770	-0.06194
88	1545	1.6579	-1.1571	-1.0906	-0.30791
88	1545	2.1898	-1.6286	-1.373	-0.59535
88	1545	2.758	-2.1157	-1.6675	-0.89568
88	1545	3.3299	-2.569	-1.941	-1.172
88	1545	3.8532	-2.8953	-2.1637	-1.3783
88	1545	4.2308	-3.043	-2.3149	-1.5029
88	1545	4.4309	-3.021	-2.4052	-1.5562
88	1545	4.5037	-2.8718	-2.4502	-1.5575
88	1545	4.4842	-2.6476	-2.4625	-1.509
88	1545	4.3987	-2.3875	-2.4522	-1.4662
88	1545	4.2582	-2.1195	-2.4266	-1.397
88	1545	4.1204	-1.8634	-2.388	-1.3222
88	1546	3.9579	-1.628	-2.348	-1.2463
88	1546	3.7925	-1.4175	-2.3005	-1.172
88	1546	3.6295	-1.2329	-2.2507	-1.0999
88	1546	3.4727	-1.0736	-2.1936	-1.0357
88	1546	3.3228	-0.93764	-2.1463	-0.96823
88	1546	3.1797	-0.82188	-2.0937	-0.90882
88	1546	3.046	-0.72352	-2.0419	-0.85219
88	1546	2.9201	-0.64161	-1.989	-0.79938
88	1546	2.8033	-0.5726	-1.9405	-0.74981
88	1546	2.6939	-0.5147	-1.8922	-0.7043
88	1546	2.5917	-0.46692	-1.8457	-0.66133
88	1546	2.4762	-0.42521	-1.7974	-0.62214
88	1547	2.412	-0.39381	-1.7557	-0.58372
88	1547	2.3298	-0.3658	-1.7137	-0.54883
88	1547	2.2525	-0.3433	-1.6728	-0.51572
88	1547	2.1768	-0.32434	-1.6331	-0.48462
88	1547	2.1099	-0.30867	-1.5972	-0.4558
88	1547	2.0472	-0.29502	-1.5613	-0.4151
88	1547	1.9668	-0.28288	-1.5244	-0.40271
88	1547	1.9329	-0.27658	-1.4941	-0.37844

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10687N1

DATE: 03-29-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/S	mV PROBE +NE/SW	mV PROBE +E/W	mV PROBE 4 +SE/NW
88	0	0	0	0	0
88	5	-0.00227	0.00278	-0.00025	0.00279
88	10	0.03969	-0.00657	-0.01137	-0.0053
88	15	0.14536	-0.08494	-0.0814	-0.07306
88	20	0.46364	-0.3203	-0.25508	-0.23915
88	25	0.91694	-0.70863	-0.50789	-0.48512
88	30	1.44884	-1.18013	-0.79029	-0.77256
88	35	2.01504	-1.66723	-1.08479	-1.07289
88	40	2.58894	-2.12053	-1.35829	-1.34921
88	45	3.11224	-2.44683	-1.58099	-1.55551
88	50	3.48984	-2.69453	-1.73219	-1.68011
88	55	3.68994	-2.57253	-1.82249	-1.73341
88	60	3.76274	-2.42333	-1.86749	-1.73471
88	65	3.74324	-2.19913	-1.87979	-1.68621
88	70	3.65774	-1.93903	-1.86949	-1.64341
88	75	3.51524	-1.67103	-1.84389	-1.57421
88	80	3.37944	-1.41493	-1.80529	-1.49941
88	85	3.21694	-1.17853	-1.76529	-1.42351
88	90	3.05154	-0.96903	-1.71779	-1.34921
88	95	2.88854	-0.78443	-1.66789	-1.27711
88	100	2.73174	-0.62513	-1.61089	-1.21291
88	105	2.58164	-0.48917	-1.56359	-1.14544
88	110	2.43874	-0.37339	-1.51099	-1.08803
88	115	2.30504	-0.27505	-1.45919	-1.0294
88	120	2.17914	-0.19314	-1.40829	-0.97657
88	125	2.06234	-0.12413	-1.35779	-0.92702
88	130	1.95294	-0.06823	-1.30949	-0.88161
88	135	1.85074	-0.01845	-1.26299	-0.83854
88	140	1.73524	0.02320	-1.21469	-0.79935
88	145	1.67104	0.05486	-1.17289	-0.76083
88	150	1.58884	0.08267	-1.13099	-0.72604
88	155	1.51154	0.10517	-1.09009	-0.69293
88	160	1.43564	0.12413	-1.05039	-0.66183
88	165	1.36894	0.1398	-1.01449	-0.63301
88	170	1.30624	0.15345	-0.97859	-0.59231
88	175	1.22584	0.16559	-0.94169	-0.57992
88	180	1.19184	0.17191	-0.91139	-0.55565

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10687S1

DATE: 03-29-94

JULIAN DAY	HOUR MINUTE	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
89	600	0.84339	-0.45907	-0.59668	0.04671
89	600	0.84793	-0.45679	-0.59997	0.05505
89	600	0.91788	-0.50098	-0.64365	0.0101
89	600	1.1378	-0.69617	-0.79137	-0.05252
89	600	1.4992	-1.0656	-1.0535	-0.24746
89	600	1.9087	-1.5711	-1.3903	-0.53431
89	600	2.3324	-2.184	-1.7724	-0.77498
89	600	2.7344	-2.8392	-2.1758	-1.0171
89	600	3.0973	-3.4824	-2.5524	-1.2232
89	600	3.3581	-3.9422	-2.8564	-1.3578
89	600	3.4808	-4.2371	-3.0801	-1.4214
89	600	3.465	-4.346	-3.2261	-1.4302
89	601	3.3788	-4.3285	-3.319	-1.4088
89	601	3.2308	-4.2235	-3.3587	-1.3454
89	601	3.0738	-4.0627	-3.3695	-1.2855
89	601	2.8935	-3.8763	-3.3521	-1.2141
89	601	2.7087	-3.6831	-3.3135	-1.1328
89	601	2.5307	-3.4892	-3.264	-1.054
89	601	2.3577	-3.3068	-3.2034	-0.98277
89	601	2.1978	-3.1327	-3.1372	-0.91258
89	601	2.0499	-2.9769	-3.0673	-0.8492
89	601	1.9155	-2.8281	-2.9935	-0.7843
89	601	1.7873	-2.7019	-2.9165	-0.72092
89	601	1.6807	-2.5716	-2.8448	-0.67673
89	602	1.581	-2.464	-2.7726	-0.63229
89	602	1.4898	-2.381	-2.6998	-0.5833
89	602	1.4072	-2.2723	-2.6299	-0.53204
89	602	1.334	-2.1862	-2.582	-0.50603
89	602	1.2684	-2.1171	-2.4948	-0.46437
89	602	1.2078	-2.0395	-2.435	-0.44467
89	602	1.1537	-1.9762	-2.3754	-0.40377
89	602	1.1047	-1.9178	-2.3178	-0.38281
89	602	1.059	-1.8615	-2.262	-0.36084
89	602	1.0179	-1.8118	-2.209	-0.33533
89	602	0.98078	-1.7663	-2.1577	-0.31438
89	602	0.94793	-1.7219	-2.1097	-0.29569
89	603	0.91662	-1.681	-2.0628	-0.26943

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10687S1

DATE: 03-29-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
	0	0	0	0	0
	5	0.00454	0.00228	-0.00329	0.00834
	10	0.07449	-0.04191	-0.04697	-0.03681
	15	0.29421	-0.2371	-0.19469	-0.09923
	20	0.65581	-0.60653	-0.45882	-0.29417
	25	1.06531	-1.11203	-0.79362	-0.58102
	30	1.48901	-1.72493	-1.17572	-0.82167
	35	1.89101	-2.38013	-1.57892	-1.06381
	40	2.25391	-3.00333	-1.95572	-1.26991
	45	2.51271	-3.48313	-2.25972	-1.40451
	50	2.63721	-3.77803	-2.48342	-1.46811
	55	2.82161	-3.88693	-2.82942	-1.47691
	60	2.53521	-3.86943	-2.72232	-1.45551
	65	2.38721	-3.76443	-2.78202	-1.39211
	70	2.23021	-3.60363	-2.77282	-1.33221
	75	2.05011	-3.41723	-2.75542	-1.26081
	80	1.86531	-3.22403	-2.71682	-1.17951
	85	1.68731	-3.03013	-2.66732	-1.10071
	90	1.51431	-2.84753	-2.60672	-1.02948
	95	1.35421	-2.67363	-2.54052	-0.95929
	100	1.20651	-2.51783	-2.47062	-0.89591
	105	1.07211	-2.36903	-2.39882	-0.83101
	110	0.94391	-2.24283	-2.31882	-0.76763
	115	0.83731	-2.11253	-2.24812	-0.72344
	120	0.73781	-2.00493	-2.17592	-0.679
	125	0.64641	-1.90193	-2.10292	-0.63001
	130	0.56381	-1.81323	-2.03322	-0.57875
	135	0.49081	-1.72713	-1.96532	-0.55274
	140	0.42501	-1.65803	-1.89812	-0.51108
	145	0.36441	-1.58043	-1.83832	-0.49138
	150	0.31031	-1.51713	-1.77872	-0.45048
	155	0.26131	-1.45873	-1.72112	-0.42952
	160	0.21561	-1.40243	-1.66532	-0.40755
	165	0.17451	-1.35273	-1.61232	-0.38204
	170	0.13737	-1.30723	-1.56102	-0.36109
	175	0.10454	-1.26283	-1.51302	-0.3424
	180	0.07323	-1.22193	-1.46812	-0.31614

D-54

WHC-SD-EN-DP-090, Rev. 0

WELL NO. 199-K-106A (106AN1-87)-(106AS1-87)/2

20 OF CONT'D

WHC-SD-EN-DP-090, Rev. 0

—■— PROBE 1 + N/-S —+— PROBE 2 + NE/-S —*— PROBE 3 + E/-W —□— PROBE 4 + SE/-N

WELL NO. 199-K-106A

Test 106A-87NS1

CURVE SUM

DECLINATION CORRECTION

34° EAST + 21° WEST = 13° EAST OF NORTH

FLOW CALCULATION

 $(mVOLTS = 0.031144) + 0.026305$

POROSITY

3.74 ft/day @ 20% porosity

mVOLTS = 23.1523

VECTOR FIT RATIO

$$100 - (((0.156 + 0.8112 + 1.5726 + 0.6816) / 23.1523) 100) = \boxed{86.1\%}$$

WELL NO. 199-K-106A

Test 106A-87NS1

CURVE SUMDECLINATION CORRECTION

34° EAST + 21° WEST = 13° EAST OF NORTH

FLOW CALCULATION(mVOLTs = 0.031144) + 0.026505

POROSITY

3.74 ft/day @ 20% porosity

mVOLTs = 23.1523

D-57

WELL NO. 199-K-106A

106A-87

Plot Point 140

D-58

ANGLE CORRECTION < DECLINATION >
 $32^{\circ} + 21^{\circ} = 10^{\circ}$ WEST OF NORTH

FLOW CALCULATION

$(mVOLTS * 0.781113) + 0.01765$

POROSITY

3.19 ft/day @ 20% porosity

mV - 0.7941

24 OF CONT'D

FIT RATIO :

$$100 - \langle \langle \langle 0.0175 + 0.00661 + 0.0089 + 0.0396 \rangle * 100 \rangle / 0.7941 \rangle = \boxed{83.4\%}$$

WELL NO. 199-K-106A
106A-87

Plot Point 140

$$\frac{\text{ANGLE CORRECTION (DECLINATION)}}{32^{\circ} + 21^{\circ} = 10^{\circ} \text{ WEST OF NORTH}}$$

FLOW CALCULATION

$$\frac{\langle \text{mVOLTS} * 0.781113 \rangle + 0.01765}{\text{POROSITY}}$$

POROSITY

3.19 ft/day @ 20% porosity

mV - 0.7941

INSITU FLOW MEASUREMENTS

WELL NO 199-K-106A

10692N2 - 10692S1

DATE: 03-30-94

2

5 SEC	mV PROBE 1	mV PROBE 2	mV PROBE 3	mV PROBE 4
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW

0	0	0	0	0
5	0.00042	0.002095	0	0.00410
10	0.00837	-0.00376	-0.00376	-0.00083
15	0.029635	-0.013365	-0.011695	-0.01337
20	0.066885	-0.027545	-0.020455	-0.032175
25	0.117435	-0.031665	-0.029205	-0.06311
30	0.180985	-0.018215	-0.031305	-0.098645
35	0.252935	0.010735	-0.037105	-0.14798
40	0.322285	0.047235	-0.039155	-0.19737
45	0.376235	0.111735	-0.044555	-0.25047
50	0.404235	0.160285	-0.046205	-0.28102
55	0.435235	0.212185	-0.052055	-0.31322
60	0.434385	0.252385	-0.057055	-0.32832
65	0.444035	0.284985	-0.061705	-0.34802
70	0.434435	0.302535	-0.067955	-0.34967
75	0.431535	0.320885	-0.073805	-0.35347
80	0.419435	0.328835	-0.079655	-0.35305
85	0.406885	0.332585	-0.083055	-0.338825
90	0.391835	0.330835	-0.087205	-0.3376
95	0.378485	0.326235	-0.090605	-0.332165
100	0.362985	0.319535	-0.091855	-0.318765
105	0.349235	0.308235	-0.094805	-0.30707
110	0.340035	0.306935	-0.096455	-0.30749
115	0.322035	0.2948	-0.096455	-0.290745
120	0.309085	0.285145	-0.096055	-0.281125
125	0.290685	0.27008	-0.095655	-0.267755
130	0.283585	0.264625	-0.099005	-0.26316
135	0.275185	0.259145	-0.099405	-0.25814
140	0.258085	0.24492	-0.098205	-0.243495
145	0.247635	0.23403	-0.098155	-0.236805
150	0.235035	0.22441	-0.096905	-0.235965
155	0.227535	0.216035	-0.097705	-0.22048
160	0.212885	0.2018	-0.094405	-0.20584
165	0.208685	0.19761	-0.094405	-0.203325
170	0.199935	0.192165	-0.094405	-0.20333
175	0.187385	0.17877	-0.091905	-0.18785
180	0.184035	0.174585	-0.090705	-0.18283

PT SUM 10.02973 7.101805 -2.54302 -8.34929

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

10692N2 - 10692S1

DATE: 03-30-94

2

5 SEC	mV PROBE 1	(5 POINT RUNNING AVERAGE)		
INTERVAL	+N/-S	+NE/-SW	+E/-W	+SE/-NW

0	0	0	0	0
5	0.026327	-0.01064	-0.0089775	-0.01054625
10	0.055581	-0.01908	-0.01627875	-0.02737125
15	0.098735	-0.0227	-0.023165	-0.051825
20	0.15458	-0.01667	-0.0295175	-0.0854775
25	0.21841	0.002023	-0.0341925	-0.12677625
30	0.28311	0.037873	-0.03803	-0.17381625
35	0.338923	0.082498	-0.041755	-0.21921
40	0.384498	0.13288	-0.0454925	-0.26052
45	0.412523	0.184147	-0.0499875	-0.2932575
50	0.429473	0.22748	-0.054255	-0.317645
55	0.437023	0.263023	-0.0596925	-0.3348075
60	0.436097	0.290197	-0.06513	-0.34487
65	0.43238	0.30931	-0.07078	-0.3510525
70	0.423072	0.32121	-0.0781175	-0.34875375
75	0.412422	0.328285	-0.08093	-0.34573825
80	0.39918	0.329823	-0.08513	-0.34041
85	0.385047	0.327298	-0.08818	-0.33183875
90	0.370635	0.32121	-0.0911175	-0.3239
95	0.357685	0.315235	-0.09343	-0.3163725
100	0.343573	0.307378	-0.0948925	-0.3060175
105	0.330098	0.298779	-0.0959425	-0.2966075
110	0.31548	0.289235	-0.098165	-0.28877875
115	0.301347	0.278858	-0.0987925	-0.27569625
120	0.289635	0.269744	-0.09753	-0.267545
125	0.278885	0.259688	-0.0980675	-0.2581375
130	0.266122	0.25068	-0.0986925	-0.2504
135	0.253985	0.240628	-0.0981675	-0.24360125
140	0.242072	0.229849	-0.0977425	-0.23418625
145	0.230773	0.219069	-0.0967925	-0.2247725
150	0.221035	0.209964	-0.095855	-0.2164025
155	0.21228	0.201903	-0.09523	-0.20824375
160	0.202222	0.192588	-0.09378	-0.20008625
165	0.19501	0.185783	-0.092855	-0.19433375
170	0.190452	0.18184	-0.09233833	-0.19133667
175	0.18571	0.176678	-0.091305	-0.18534
180	0.184035	0.174585	-0.090705	-0.18283

PT SUM 10.29632 7.370193 -2.87498208 -8.62630187

D-60

WHC-SD-EN-DP-090, Rev. 0

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10692N2

DATE: 03-30-94

JULIAN DAY	HOURL MINUTE	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
89	803	0.86967	-0.48548	-0.58927	0.2645
89	803	0.87302	-0.48631	-0.59178	0.2645
89	803	0.95087	-0.52817	-0.63028	0.228
89	803	1.2103	-0.70227	-0.76086	0.09542
89	803	1.6657	-1.058	-0.98351	-0.14481
89	803	2.2407	-1.5259	-1.2555	-0.45451
89	803	2.8626	-2.034	-1.5293	-0.79434
89	803	3.5097	-2.5329	-1.8164	-1.1534
89	803	4.1374	-2.9648	-2.0708	-1.4615
89	803	4.6078	-3.2	-2.2767	-1.6933
89	803	4.8581	-3.2638	-2.4215	-1.818
89	804	4.9812	-3.1665	-2.5253	-1.8858
89	804	4.948	-2.9723	-2.5881	-1.8724
89	804	4.8665	-2.7212	-2.6258	-1.844
89	804	4.7075	-2.4634	-2.6425	-1.7703
89	804	4.5417	-2.1922	-2.6433	-1.7
89	804	4.3484	-1.9511	-2.6299	-1.6213
89	804	4.1525	-1.7301	-2.6057	-1.5175
89	804	3.9583	-1.5385	-2.573	-1.4484
89	804	3.7725	-1.3719	-2.5354	-1.3652
89	804	3.5987	-1.2304	-2.491	-1.2823
89	804	3.431	-1.1174	-2.4475	-1.2003
89	804	3.277	-1.0069	-2.3998	-1.1417
89	805	3.1338	-0.92157	-2.3487	-1.0722
89	805	2.9999	-0.84958	-2.2985	-1.0111
89	805	2.8668	-0.79885	-2.2466	-0.9425
89	805	2.7605	-0.73742	-2.2008	-0.8973
89	805	2.6542	-0.69808	-2.1503	-0.84373
89	805	2.5538	-0.66293	-2.1035	-0.79685
89	805	2.4609	-0.63531	-2.0557	-0.75082
89	805	2.3671	-0.61688	-2.0105	-0.70309
89	805	2.2968	-0.59093	-1.9661	-0.66208
89	805	2.2122	-0.58424	-1.9209	-0.61521
89	805	2.1528	-0.56331	-1.8818	-0.59344
89	805	2.0892	-0.55578	-1.8414	-0.55998
89	806	2.0197	-0.55159	-1.8021	-0.51728
89	806	1.9712	-0.53736	-1.7653	-0.49049

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10692N2

DATE: 03-30-94

(BASE TIME 0 SUBTRACTED)

JULIAN DAY	5 SEC INTERVAL	mV PROBE +N/-S	mV PROBE +NE/-SW	mV PROBE +E/-W	mV PROBE 4 +SE/-NW
89	0	0	0	0	0
89	5	0.00335	-0.00083	-0.00251	0
89	10	0.0812	-0.04269	-0.04101	-0.0385
89	15	0.34063	-0.21679	-0.17159	-0.16908
89	20	0.79603	-0.57252	-0.39424	-0.40931
89	25	1.37103	-1.04042	-0.66623	-0.71901
89	30	1.99293	-1.54852	-0.94003	-1.05884
89	35	2.64003	-2.04742	-1.22713	-1.4179
89	40	3.26773	-2.47932	-1.48153	-1.728
89	45	3.73813	-2.71452	-1.68743	-1.9578
89	50	3.98843	-2.77812	-1.83223	-2.0825
89	55	4.11153	-2.68102	-1.93603	-2.1503
89	60	4.07633	-2.48682	-1.99883	-2.1369
89	65	3.99683	-2.23572	-2.03653	-2.1085
89	70	3.83783	-1.97792	-2.05323	-2.0348
89	75	3.67203	-1.70672	-2.05403	-1.9845
89	80	3.47873	-1.46562	-2.04063	-1.8858
89	85	3.28283	-1.24462	-2.01643	-1.782
89	90	3.08863	-1.05302	-1.98373	-1.7109
89	95	2.90283	-0.88842	-1.94613	-1.6297
89	100	2.72703	-0.74492	-1.90173	-1.5468
89	105	2.56133	-0.63192	-1.85823	-1.4648
89	110	2.40733	-0.52142	-1.81053	-1.4082
89	115	2.26413	-0.43609	-1.75943	-1.3367
89	120	2.13023	-0.3641	-1.70923	-1.2756
89	125	1.99713	-0.31137	-1.65733	-1.207
89	130	1.89083	-0.25184	-1.61133	-1.1618
89	135	1.78453	-0.2128	-1.56103	-1.10823
89	140	1.68413	-0.17745	-1.51423	-1.06135
89	145	1.59123	-0.14983	-1.46643	-1.01532
89	150	1.49743	-0.1314	-1.42123	-0.96759
89	155	1.42713	-0.10545	-1.37683	-0.92658
89	160	1.34253	-0.09876	-1.33163	-0.87971
89	165	1.28313	-0.07783	-1.29233	-0.85794
89	170	1.21953	-0.0703	-1.25213	-0.82448
89	175	1.15003	-0.06611	-1.21283	-0.78178
89	180	1.10153	-0.05188	-1.17603	-0.75499

D-61

WHC-SD-EN-DP-090, Rev. 0

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10692S1

DATE: 03-30-94

JULIAN DAY	HOUR MINUTE	mV PROBE 1 +N/-S	mV PROBE 2 +NE/-SW	mV PROBE 3 +E/-W	mV PROBE 4 +SE/-NW
89	903	0.97374	-0.40691	-0.59948	0.10678
89	903	0.97625	-0.41193	-0.60199	0.18838
89	903	1.0382	-0.44208	-0.63297	0.15992
89	903	1.2551	-0.59697	-0.74768	0.05442
89	903	1.638	-0.92434	-0.95281	-0.1482
89	903	2.1099	-1.384	-1.2073	-0.39603
89	903	2.6047	-1.919	-1.4769	-0.66479
89	903	3.1079	-2.4758	-1.7524	-0.92518
89	903	3.5969	-2.9807	-2.0027	-1.1345
89	904	3.9594	-3.3449	-2.1978	-1.2601
89	904	4.1537	-3.5058	-2.3393	-1.3237
89	904	4.2148	-3.5123	-2.4314	-1.3271
89	904	4.1813	-3.3985	-2.4842	-1.2835
89	904	4.0825	-3.2128	-2.5126	-1.2157
89	904	3.9427	-2.9899	-2.5168	-1.1387
89	904	3.7827	-2.7554	-2.5059	-1.0608
89	904	3.6138	-2.5302	-2.4808	-0.98294
89	904	3.4428	-2.3167	-2.4498	-0.90759
89	904	3.2787	-2.1216	-2.4088	-0.83894
89	904	3.1196	-1.9458	-2.3644	-0.76861
89	904	2.9748	-1.7909	-2.3175	-0.71251
89	905	2.8368	-1.6553	-2.2681	-0.6539
89	905	2.701	-1.5422	-2.2171	-0.59446
89	905	2.5938	-1.4328	-2.166	-0.55845
89	905	2.4858	-1.3413	-2.1168	-0.51659
89	905	2.3895	-1.2584	-2.0655	-0.47473
89	905	2.2974	-1.1881	-2.0128	-0.43872
89	905	2.2079	-1.1378	-1.9617	-0.39519
89	905	2.1417	-1.0742	-1.9173	-0.3776
89	905	2.0697	-1.0248	-1.8696	-0.34495
89	905	2.0011	-0.98713	-1.8269	-0.2989
89	905	1.9458	-0.94443	-1.7809	-0.28886
89	905	1.8905	-0.90927	-1.7423	-0.27127
89	906	1.8395	-0.87996	-1.703	-0.25453
89	906	1.7934	-0.86154	-1.6628	-0.22104
89	906	1.749	-0.83056	-1.6285	-0.20932
89	906	1.7072	-0.80796	-1.5941	-0.19257

INSITU FLOW MEASUREMENTS

WELL NO. 199-K-106A

TEST NO. 10692S1

DATE: 03-30-94

(BASE TIME 0 SUBTRA

JULIAN DAY	5 SEC INTERVAL	mV PROBE 1 +N/-S	mV PROBE 2 +NE/-SW	mV PROBE 3 +E/-W	mV PROBE 4 +SE/-NW
	0	0	0	0	0
	5	0.00251	-0.00502	-0.00251	-0.00838
	10	0.06446	-0.03517	-0.03349	-0.03684
	15	0.28136	-0.19008	-0.1482	-0.14234
	20	0.66228	-0.51743	-0.35333	-0.34498
	25	1.13616	-0.97709	-0.60782	-0.59279
	30	1.63098	-1.51209	-0.87742	-0.88155
	35	2.13416	-2.06889	-1.15292	-1.12194
	40	2.62316	-2.57379	-1.40322	-1.33128
	45	2.98568	-2.93799	-1.59832	-1.45688
	50	3.17998	-3.09869	-1.73982	-1.52048
	55	3.24106	-3.10539	-1.83192	-1.52388
	60	3.20758	-2.99159	-1.88472	-1.48028
	65	3.10878	-2.80569	-1.91312	-1.41246
	70	2.96898	-2.58299	-1.91732	-1.33548
	75	2.80898	-2.34849	-1.90849	-1.25758
	80	2.63988	-2.12329	-1.88132	-1.1797
	85	2.46908	-1.90979	-1.85032	-1.10435
	90	2.30498	-1.71469	-1.80932	-1.0357
	95	2.14588	-1.53889	-1.78492	-0.96537
	100	2.00108	-1.38399	-1.71802	-0.90927
	105	1.86288	-1.24839	-1.66882	-0.85068
	110	1.72728	-1.13529	-1.61782	-0.79122
	115	1.62008	-1.02569	-1.56852	-0.75521
	120	1.51208	-0.93439	-1.51712	-0.71335
	125	1.41578	-0.85149	-1.46602	-0.67149
	130	1.32368	-0.78119	-1.41332	-0.63548
	135	1.23418	-0.73089	-1.36222	-0.59195
	140	1.16796	-0.68729	-1.31782	-0.57438
	145	1.09598	-0.61789	-1.27012	-0.54171
	150	1.02738	-0.58022	-1.22742	-0.49568
	155	0.97208	-0.53752	-1.18142	-0.48582
	160	0.91878	-0.50238	-1.14282	-0.46803
	165	0.86578	-0.47305	-1.10352	-0.45129
	170	0.81968	-0.45463	-1.08332	-0.4178
	175	0.77528	-0.42365	-1.02902	-0.40608
	180	0.73348	-0.40105	-0.99462	-0.38933

D-62

WHC-SD-EN-DP-090, Rev. 0

WELL NO. 199-K-106A (106N2-92)-(106S1-92)/2

28 OF CONT'D

WHC-SD-EN-DP-090, Rev. 0

D-63

-■- PROBE 1 + N/-S -+- PROBE 2 + NE/-S -*-* PROBE 3 + E/-W -□- PROBE 4 + SE/-N

WELL NO. 199-K-106A

106A-92

Plot Point 140

D-64

ANGLE CORRECTION < DECLINATION >
 $9^{\circ} + 21^{\circ} = 30^{\circ}$ WEST OF NORTH

FLOW CALCULATION

(mVOLTS * 0.781113) + 0.01765

POROSITY

1.28 ft/day @ 20% porosity

mV = 0.3056

FIT RATIO

$$100 - \langle \langle 0.0034 + 0.0079 + 0.0386 + 0.0431 \rangle / 0.3056 \rangle * 100 = \boxed{92.7\%}$$

WELL NO. 199-K-106A

106A-92

Plot Point 140

ANGLE CORRECTION (DECLINATION)
 $9^{\circ} + 21^{\circ} = 30^{\circ}$ WEST OF NORTH

FLOW CALCULATION

1.28 ft/day @ 20% porosity

3500 - 13

D-66

WELL NO. 199-K-106A
Test 106A-92NS1

CURVE SUM

DECLINATION CORRECTION

9° WEST + 21° WEST = 30° EAST OF NORTH

FLOW CALCULATION

(mVOLTS * 0.031144) + 0.026505

POROSITY

1.79 ft/day @ 20% porosity

mVOLTS = 10.6167

VECTOR FIT RATIO

$$100 - (((0.4421 + 0.5277 + 0.134 + 0.2196) / 10.6167) \times 100) = \boxed{87.5\%}$$

WELL NO. 199-K-106A

Test 106A-92NS1

CURVE SUMDECLINATION CORRECTION

$$9^{\circ} \text{ WEST} + 21^{\circ} \text{ WEST} = 30^{\circ} \text{ EAST OF NORTH}$$

FLOW CALCULATION

$$(mVOLTS * 0.031144) + 0.026505$$

POROSITY

$$\boxed{1.79 \text{ ft/day @ 20\% porosity}}$$

$$mVOLTS = 10.6167$$

D-67