BHI-01101
Rev. 0

# Borehole Summary Completion Report for the Chromium Plume West of the 100-D/DR Reactors

Environmental Excellence
HANFORD

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

**Bechtel Hanford, Inc.**
Richland, Washington

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National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Printed in the United States of America

DISCLM-5.CHP (8-91)

BHI-01101
REV: 0
OU: 100-HR-3
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title of Document: BOREHOLE SUMMARY COMPLETION REPORT FOR THE CHROMIUM PLUME WEST OF THE 100-D/DR REACTORS

Author(s): D. C. Weekes

Approval: A. J. Knepp, Groundwater Project Task Lead

Signature 12-1-97 Date

J. D. Isaacs, Groundwater Project Engineer

Signature 12-4-97 Date

The approval signature on this page indicates that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

BHI-DIS DEC 05 1997

TOTAL PAGES:

BHI-DC-010 (10/94)

BHI-01101
Rev. 0

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Author
D. C. Weekes

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# Metric Conversion Chart

| Into Metric Units | | | Out of Metric Units | | |
|---|---|---|---|---|---|
| *If You Know* | *Multiply By* | *To Get* | *If You Know* | *Multiply By* | *To Get* |
| **Length** | | | **Length** | | |
| inches | 25.4 | millimeters | millimeters | 0.039 | inches |
| inches | 2.54 | centimeters | centimeters | 0.394 | inches |
| feet | 0.3048 | meters | meters | 3.281 | feet |
| yards | 0.914 | meters | meters | 1.094 | yards |
| miles | 1.609 | kilometers | kilometers | 0.621 | miles |
| **Area** | | | **Area** | | |
| sq. inches | 6.452 | sq. centimeters | sq. centimeters | 0.155 | sq. inches |
| sq. feet | 0.093 | sq. meters | sq. meters | 10.76 | sq. feet |
| sq. yards | .0836 | sq. meters | sq. meters | 1.196 | sq. yards |
| acres | 0.405 | hectares | hectares | 2.47 | acres |
| **Mass (weight)** | | | **Mass (weight)** | | |
| ounces | 28.35 | grams | grams | 0.035 | ounces |
| pounds | 0.454 | kilograms | kilograms | 2.205 | pounds |
| **Volume** | | | **Volume** | | |
| teaspoons | 5 | milliliters | milliliters | 0.033 | fluid ounces |
| tablespoons | 15 | milliliters | liters | 2.1 | pints |
| fluid ounces | 30 | milliliters | liters | 1.057 | quarts |
| pints | 0.47 | liters | liters | 0.264 | gallons |
| quarts | 0.95 | liters | cubic meters | 35.315 | cubic feet |
| gallons | 3.8 | liters | cubic meters | 1.308 | cubic yards |
| cubic feet | 0.028 | cubic meters | | | |
| cubic yards | 0.765 | cubic meters | | | |
| **Temperature** | | | **Temperature** | | |
| Fahrenheit | subtract 32, then multiply by 5/9 | Celsius | Celsius | multiply by 9/5, then add 32 | Fahrenheit |
| **Radioactivity** | | | **Radioactivity** | | |
| picocuries | 37 | millibecquerel | millibecquerel | 0.027 | picocuries |

# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

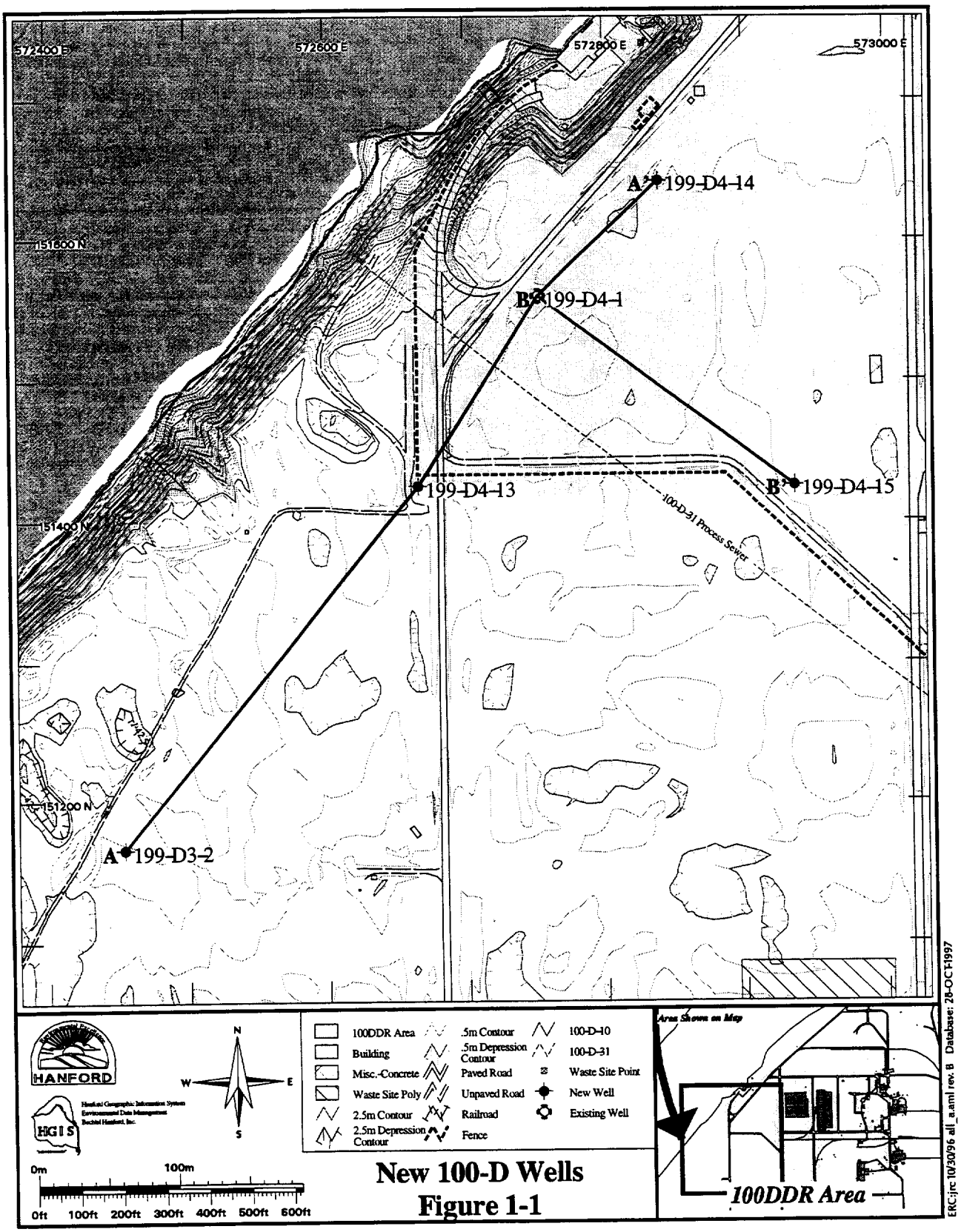
The four wells described in this summary completion report were drilled to define the extent of the chromium "hot spot" west of the 100-D Area chromium plume, quantify chromium concentrations in the aquifer, support the technology deployment initiative, and support future remedial action decisions associated with the 100-HR-3 Operable Unit (Figure 1-1). The work scope is described in *Description of Work for the Drilling Within the Chromium Plume West of 100-D/DR Reactors* (Peterson and Walker 1997) and the Baseline Change Proposal entitled "Phase 2 Characterization of the 100-D Area Hot Spot" (BCP-97211, Rev. 0). The strategy for placement of the new wells and their design is presented in *Assessment of the Chromium Plume West of the 100-D/DR Reactors* (Connelly 1997) and based on experience gained during the installation of well 199-D4-1 (Myers et al. 1996). The remediation activities are fully described in the interim action record of decision issued in April 1996 by the U.S. Environmental Protection Agency and the Washington State Department of Ecology (EPA 1996). The full description of actions to be taken in these operable units is contained in DOE-RL (1996).

This document provides a summary of data obtained from the four wells drilled to define the extent of the 100-D Area chromium "hot spot." The information is summarized in the following sections:

- Section 2.0 - Drilling, Construction, and Development
- Section 3.0 - Subsurface Description

Geologic cross sections are included in Section 3.0 to support discussions of site geology. Detailed test data and field logs are included as appendices. Data in this report are presented in the units in which they were measured.

**Figure 1-1. Newly Drilled Well and Geologic Cross-Section Locations.**



# 2.0 TECHNICAL DATA

This section contains descriptions of how the wells were drilled, where samples were collected, and the analyses performed on those samples. Additionally, the section discusses the conduct of well completion and development activities.

## 2.1 DRILLING AND FIELD SCREENING

The borehole drilling for this effort was performed by Layne Christensen Co. (LCC) in accordance with a description of work (Peterson and Walker 1997). Using TUBEX™ (TUBEX is the trademark of the Sandvik Metals Corp.) air rotary drilling technology, the boreholes were drilled using a 12-in. (30.48-cm) bit with 10.75-in. (27.3-cm) diameter carbon steel temporary casing to allow completion with 6.625-in. (16.8-cm) diameter permanent casing. After drilling below the water table in each borehole, the intent was to collect three split-spoon soil samples to verify that the preselected screen size and filter pack were appropriate, and to continue drilling until encountering the Ringold Upper Mud (RUM). The first split-spoon samples were to be collected 5 ft (1.5 m) below the water table, with the second and third being collected at subsequent 5-ft (1.5 m) deeper intervals. However, actual sampling, as outlined in Tables 2-1 and 2-2, differs from the plan, because of field conditions that were encountered.

All four wells were drilled in the 100-D/DR Area (Figure 1-1) and constructed as water production/protection wells. They are numbered 199-D3-2, 199-D4-13, 199-D4-14, and 199-D4-15.

Tables 2-1 and 2-2 show the split-spoon sample intervals, sieve/chemical analysis intervals, and the drilling dates for each well. All drilling activities were documented in accordance with BHI-EE-01, *Environmental Investigation Procedure* (EIP) 6.0, "Documentation of Well Drilling and Completion Operations." A borehole log was prepared for each well in accordance with EIP 7.0, "Geologic Logging." These logs are in Appendix A.

Drilling spoils and fluids were handled according to the *Waste Management Plan for the Drilling Within the Chromium Plume West of the 100-D/DR Reactors* (DOE-RL 1997). Drilling spoils approximately 3.3 ft (1 m) above the water table were sampled for field screening analysis (hexavalent chromium, nitrate, and sulfate). Groundwater samples were collected when the water table was first encountered during drilling and analyzed for hexavalent chromium. All analyses were below the release criterion for hexavalent chromium (80 μg/L) so the drilling spoils and fluids were discharged to the ground. Field screening results for waste management are provided in Table 2-2.

## 2.2 SAMPLING AND ANALYSIS

Split-spoon samples were collected from each borehole to verify that the preselected screen size and filter pack were appropriate. In two boreholes (199-D4-14 and 199-D3-2), the formation was

significantly finer than expected and different well screens and filter pack materials were selected. A sample from 199-D4-14 was selected for grain size analysis (Appendix B), the results of which were used to select well screens and filter pack material (Table 2-4). The screen and filter packs for well 199-D3-2 were based on observations made during drilling and visual examination of drilling spoils. The intent was to collect three split-spoon samples in each borehole; the first split-spoon sample was to be collected 5 ft (1.5 m) below the water table, with the second and third being collected at subsequent 5 ft (1.5 m) deeper intervals. In some boreholes, fewer than three samples were collected due to the nature of the formation, the inferior quality of the material being sampled (slough), or insufficient thickness of the saturated zone (RUM intercepted earlier than anticipated).

## 2.3 WELL COMPLETION AND DEVELOPMENT

All wells were completed with 6-in. (15-cm) inside diameter carbon steel casing from the top of the screen to the surface, 6-in. (15-cm) inside diameter wire-wrap stainless steel screen, and a 6 in. by 3 ft (15 cm by 0.915 m) stainless steel tailpipe with welded endcap. The slot size of the well screen and size of filter pack material were verified after reviewing the results of the sieve analyses and the well-site geologist's notes for each well. Table 2-3 presents drilling and completion summary data, and Table 2-4 provides a summary of well completion materials.

Well development was completed in two stages. The first stage was to develop the wells with a surge block after placing the sand filter pack, and before pumping cement grout, as the temporary drill casing was removed. Well 199-D4-15 was developed using a bailer only. The level of the filter pack was monitored with a steel tape, and filter pack material was added between the temporary and permanent casings as needed to maintain the desired level. Depth to bottom within the permanent screen was also monitored to determine if any fine material had entered the well screen during the surging. This information was recorded on the Well Construction Logs and is summarized in Appendix C.

The second stage of well development was performed by pumping the well with an electric submersible pump until turbidity of the pumped water was less than or equal to 5 nephelometric turbidity units (NTU). Pumping rates were less than 70 gal/min (266 L/min). All well development water was collected in a purgewater truck. A pressure transducer placed above the pump intake monitored the drawdown and recovery during and after the pumping. Measurements of drawdown taken during final well development provide an initial indication of expected well response during operation (Table 2-5). After the pump was removed, the depth to bottom was measured to see if any fine material had entered the well and settled into the tailpipe. Samples were collected for $Cr^{+6}$, pH, specific conductance, temperature, and turbidity during pumping and were analyzed using field instruments. See Appendix D for a summary of this information.

## 2.4 SURVEYING

A final well location and elevation survey was performed by Rogers Surveying. The results of this survey reside in the project file and are summarized in Table 2-3.

**Table 2-1. Soil Sampling Summary.**

| Well Number | Split Spoon Interval (fbls) | Split Spoon Recovery and Comments | Drilling Dates | |
|---|---|---|---|---|
| | | | Start | Finish |
| 199-D3-2 | 80.1 to 82.7<br>84.3 to 89.1<br>90.9 to 94.1 | 69%; not sieved<br>41%; slough; not sieved<br>43%; not sieved | 8/18/97 | 8/21/97 |
| 199-D4-13 | 80.8 to 84.2<br>85.3 to 88.8<br>91.3 to 93.9 | 100%; 65% slough; not sieved<br>62%; 80% slough; sieved<br>58%; 75% slough; not sieved | 8/11/97 | 8/13/97 |
| 199-D4-14 | 80.7 to 83.2<br>87.6 to 90.1<br>93 | 100%; 60% slough; not sieved<br>100%; 48% slough; not sieved<br>Cyclone sample; sieved | 7/31/97 | 8/2/97 |
| 199-D4-15 | 84.8 to 87.4<br>90.3 to 92.8 | 100%; 35% slough; not sieved<br>100%; 24% slough; not sieved | 8/5/97 | 8/7/97 |

fbls = feet below land surface

**Table 2-2. Waste Management Soil and Groundwater Sampling Summary.**

| Well (199-) | Sample No. | Date | Sample Depth (ft) | $Cr^{6+}$ (mg/Kg ) | $NO_3$ (mg/Kg ) | $SO_4$ (mg/Kg) | $Cr^{6+}$ (mg/L)[a] | Sample Matrix | Comments |
|---|---|---|---|---|---|---|---|---|---|
| D3-2 | B0LNB0 | 8/19/97 | 64.9 | ND | 120 | 8 | -- | Soil | |
| | B0LNB5 | 8/20/97 | 80.7 | -- | -- | -- | 0.001 | Water | WL at 77.4 ft |
| D4-13 | B0LNB1 | 8/12/97 | 76 | ND | 216 | 96 | -- | Soil | |
| | B0LNB6 | 8/12/97 | 81.4 | -- | -- | -- | 0.01 | Water | WL at 76.8 ft |
| D4-14 | B0LNB2 | 7/30/97 | 74 | 0.4 | 536 | 208 | -- | Soil | |
| | B0LNB7 | 7/30/97 | 81 | -- | -- | -- | 0.017 | Water | WL at 78 ft |
| D4-15 | B0LNB3 | 8/6/97 | 78 | 0.08 | 200 | 256 | -- | Soil | |
| | B0LNB8 | 8/6/97 | 80.3 | -- | -- | -- | 0.01 | Water | WL at 78.1 ft |

[a] Waste can be disposed to ground if concentration is less than 0.08 mg/L.
ND = not detectable
WL = water level
All samples collected during drilling; analyses used to guide soil and water disposal.

**Table 2-3. Drilling and Completion Summary.**

| Well | Drill Depth (fbls) | Finish Depth (fbls) | Casing Size (in.) | Screen[b] Slot Size (in.) | Screen Interval (ft) | Water Level at Completion | | Surface Elevation[c] (brass cap) (m) | North/East Coordinates[d] (Center of casing) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | fbls | Date | | |
| 199-D3-2 | 110.5 | 105.1 | 6.625[a] | 0.02 | 82.1-102.1 | 77.4 | 8/28/97 | 142.845 | 151166/572454 |
| 199-D4-13 | 101 | 94.8 | 6.625[a] | 0.04 | 71.8-91.8 | 76.78 | 8/16/97 | 142.942 | 151424/572666 |
| 199-D4-14 | 101.9 | 99.1 | 6.625[a] | 0.02 | 76.1-96.1 | 78.03 | 8/2/97 | 143.467 | 151642/572840 |
| 199-D4-15 | 105 | 100.6 | 6.625[a] | 0.04 | 77.6-97.6 | 78.08 | 8/9/97 | 143.658 | 151425/572937 |

[a] Carbon steel
[b] Stainless steel wire wrap
[c] NAVD88 (values rounded to 0.001 m)
[d] Washington State Plane Coordinates, NAD83(91) (value rounded to 1 m)
fbls = feet below land surface
NS=not surveyed

**Table 2-4. Completion Material Summary**

| Well (199-) | Cement Depth[a] | Secondary Filter Pack | | | Primary Filter Pack | | |
|---|---|---|---|---|---|---|---|
| | | Depth[a] | Size[b] | Bags[c] | Depth[a] | Size[b] | Bags[c] |
| D3-2 | 0-71.9 | NA | NA | NA | 71.9-108.9 | 10-20 | 54 |
| D4-13 | 0-56.6 | 56.6-61.8 | 10-20 | 2.5 | 61.8-90.2<br>90.2-100.3 | 8-16<br>8-12 | 38.5<br>6 |
| D4-14 | 0-60.9 | NA | NA | NA | 60.9-100.1 | 10-20 | 44.75 |
| D4-15 | 0-62.6 | 62.6-68 | 10-20 | 2.5 | 68-104.5 | 8-16 | 34.5 |

[a] All measurements in feet below land surface
[b] Sieve sizes are U.S. Standard
[c] One bag of sand is approximately equal to one cubic foot
NA = not applicable

**Table 2-5. Drawdown Measurements and Field Screening During Final Well Development. (Page 1 of 2)**

| Well | Pump Time (min) | Drawdown (ft) | Pump Rate (gal/min) | $Cr^{+6}$ (µg/L) | Specific Conductance (µS/cm) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| 199-D3-2 | 0 | -- | 30 | -- | -- | -- |
| | 1 | 0.038 | 30 | 28 | 290 | 7.92 |
| | 26 | 0.079 | 60 | 20 | 287 | 0.46 |
| | 41 | 0.079 | 60 | 19 | 286 | 0.53 |

Depth to bottom from top of casing: 108.6 ft top of casing (TPC)
Starting water level: 81.08 ft TPC
Pump intake: 99.7 ft TPC
Stickup: 3.7 ft
Saturated screen: 20 ft
Total volume pumped: 2,220 gallons
NTU = nephelometric turbidity units

| Well | Pump Time (min) | Drawdown (ft) | Pump Rate (gal/min) | $Cr^{+6}$ (µg/L) | Specific Conductance (µS/cm) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| 199-D4-13 | 0 | -- | 26 | -- | -- | -- |
| | 15 | 11.2 | 26 | 519 | 506 | 56.6 |
| | 26 | 8.0 | 20 | 841 | 507 | 1.5 |
| | 41 | 9.2 | 20 | 790 | 507 | 1.0 |

Depth to bottom from top of casing: 98.42 ft top of casing (TPC)
Starting water level: 80.74 ft TPC
Pump intake: 94.2 ft TPC
Stickup: 3.1 ft
Saturated screen: 14.28 ft
Total volume pumped: 1,550 gallons
NTU = nephelometric turbidity units

**Table 2-5. Drawdown Measurements and Field Screening During Final Well Development. (Page 2 of 2)**

| Well | Pump Time (min) | Drawdown (ft) | Pump Rate (gal/min) | $Cr^{+6}$ (µg/L) | Specific Conductance (µS/cm) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| 199-D4-14 | 0 | -- | 26 | -- | -- | -- |
| | 1 | 3.75 | 26 | 438 | 415 | 3.56 |
| | 32 | 6.5 | 35 | 553 | 410 | 1.18 |
| | 52 | 7.4 | 35 | 610 | 410 | 1.30 |

Depth to bottom from top of casing: 102.59 ft top of casing (TPC)
Starting water level: 82.66 ft TPC
Pump intake: 99.0 ft
Stickup: 3.5 ft
TPC saturated screen: 16.94 ft
Total volume pumped: 1,716 gallons
NTU = nephelometric turbidity units

| Well | Pump Time (min) | Drawdown (ft) | Pump Rate (gal/min) | $Cr^{+6}$ (µg/L) | Specific Conductance (µS/cm) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| 199-D4-15 | 0 | -- | 25 | -- | -- | -- |
| | 1 | 0.35 | 25 | 2,190 | 540 | 5.37 |
| | 25 | 1.3 | 60 | 1,974 | 624 | 1.30 |
| | 71 | 1.3 | 60 | 2,040 | 641 | 0.83 |

Depth to bottom from top of casing: 104.15 ft top of casing (TPC)
Starting water level: 82.35 ft TPC
Pump intake: 98.5 ft TPC
Stickup: 3.5 ft
Saturated screen: 18.85 ft
Total volume pumped: 3,695 gallons
NTU = nephelometric turbidity units

# 3.0 SUBSURFACE DESCRIPTION

## 3.1 100-D GEOLOGY

Geologic data were obtained from five borings located in the 100-D Area: 199-D3-2, 199-D4-1, 199-D4-13, 199-D4-14, and 199-D4-15 (Figure 1-1). The Hanford formation, Ringold Unit E, and the RUM unit are the three stratigraphic units encountered at 100-D (Figure 3-1). The RUM was not found in boring 199-D3-2, either due to not drilling deep enough or not being present. A thin veneer of eolian sand overlies the Hanford formation at wells 199-D3-2 and 199-D4-13. The ground surface at wells 199-D4-14 and 199-D4-15 consists of backfill material from previous construction activities. For further geologic information on the 100-D Area see Lindsey (1993).

The Hanford formation ranges in thickness from 43 to 62.5 ft (13.1 to 19.1 m) in the 100-D Area where the subject wells were installed. Generally, the Hanford formation thickens to the southwest as shown in Figure 3-1. The Hanford formation consists of clast supported unconsolidated sandy gravels, silty sandy gravels, gravelly sands, and sands. Occasional sand lenses and silt stringers are intercalated with the gravel deposits of the Hanford formation. Caliche was observed on gravels occasionally. The Hanford formation is moderately to very poorly sorted. Coarser sediments such as pebbles, gravels, and cobbles are approximately 50-90 percent basalt; the remaining percentage consists of granitics, felsics, and various metamorphics. Hanford formation sand fractions are high in basalt with the remaining being feldspar, quartzite, and traces of mica.

Directly and unconformably underlying the Hanford formation at 100-D is the Ringold Unit E (Figure 3-1). The unit consists of fluvial gravels with minor silt and sand. It typically contains 20 to 45 percent basalt in the gravel fraction with the remaining percentage consisting of granites, felsics, and various metamorphics. Occasionally, micaceous sand lenses are encountered. A 2-ft (0.6-m) thick silty clay layer was encountered in well 199-D3-2. The calcium carbonate content of the unit varies substantially vertically. Some areas exhibit paleosol development with caliche present.

The RUM is found throughout the 100-D but was not penetrated in well 199-D3-2. In the vicinity of the other new wells, it is nearly flat lying. The RUM is a silt- and clay-rich unit formed by overbank and paleosol deposits. The RUM at 100-D is characterized by a moderately plastic, usually non-calcareous, massive silt or clay. The upper part of the layer sometimes contains gravel in a silt/clay matrix which may represent a transition zone to the massive silt or clay. The wells penetrated a maximum of 7 ft (2.1 m) into the RUM; therefore, a total unit thickness of the RUM was not determined.

## 3.2 HYDROGEOLOGY OF THE 100-HR-3 CHROMIUM PLUME

The unconfined aquifer in the 100-D Area lies entirely within sediments of the Ringold Formation. Depth to water ranged from 76.78 to 78.08 ft (23.4 to 23.8 m) below land surface during drilling. Except near well 199-D3-2, the aquifer is relatively thin, ranging from approximately 18 to 22+ ft (5.5 to 6.7+ m) thick in the wells drilled under this project. The bottom of the aquifer (top of the RUM) was not encountered at well 199-D3-2 due either to not drilling deep enough or not being present. Table 3-1 provides the stratigraphic/hydrogeologic summary of the 100-D wells.

**Figure 3-1. Geologic Cross-Sections A-A', B-B'.**

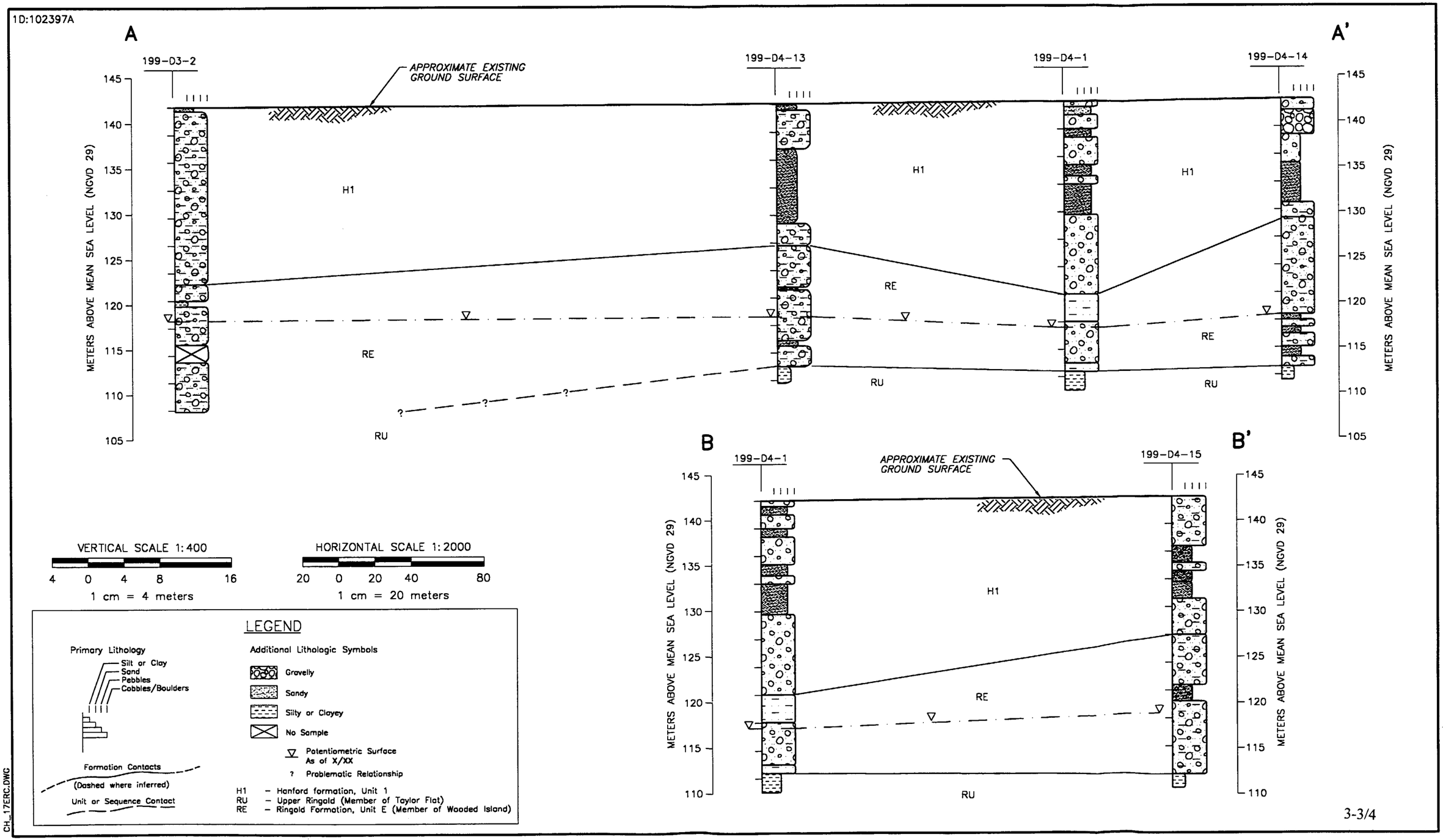


**Table 3-1. 100-HR-3 Stratigraphic - Hydrogeologic Summary.**

| Well | Elevation[a] (meters) | Hanford/ Ringold E Contact (fbls) | Ringold E/ Ringold Upper Mud Contact (fbls) | Water Table | | Total Depth (fbls) |
|---|---|---|---|---|---|---|
| | | | | fbls | date | |
| 199-D3-2 | 142.845 | 64 | NA | 77.4 | 8/28/97 | 110.5 |
| 199-D4-1 | 143.247 | 55 | 98 | 77.27 | 7/30/97 | 105 |
| 199-D4-13 | 142.942 | 51 | 95 | 76.78 | 8/16/97 | 101 |
| 199-D4-14 | 143.467 | 43 | 97 | 78.03 | 8/2/97 | 101.9 |
| 199-D4-15 | 143.658 | 50 | 100 | 78.08 | 8/9/97 | 105 |

[a] Elevation of brass cap (NAVD88)
fbls = feet below land surface

**WELL SUMMARY SHEET**

Boring or Well No. 199-D4-15 (B8073)

Sheet 1 of 1

Location 2600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Reviewed By L.D. Walker / L.D. Walker 9-26-97

Prepared by [illegible] 8/9/97

| CONSTRUCTION DATA | | Depth in Feet | GEOLOGIC/HYDROLOGIC DATA | |
|---|---|---|---|---|
| Description | Diagram | | Graphic Log | Lithologic Description |
| | | | | 0'-18' Silty Sandy GRAVEL |
| Cement Grout: 0'-62.6' | | 10 | | |
| | 10.00 | | | |
| 6" carbon steel casing: +2.3 — 77.64' | | 20 | | 18'-24' Gravelly SAND |
| | 9.98 | | | 24'-27' Silty Sandy GRAVEL |
| | | | | 27'-31' Gravelly SAND |
| | 9.99 | 30 | | 31'-37' SAND |
| 10-20 mesh Colorado Silica Sand: 62.6'-68' | | | | 37'-50' Silty Sandy GRAVEL |
| 8-16 mesh sand: 68'-104.5' | 10.00 | 40 | | |
| Sluff 104.5'-105' | | 50 | | Hanford/Ringold contact ≈ 50' |
| | 10.01 | | | 50'-68' Silty Sandy GRAVEL |
| | | 60 | | |
| | 10.00 | | | |
| | | 70 | | 68'-74' Gravelly SAND |
| | 9.98 | | | 74'-100' Silty Sandy GRAVEL |
| 6" Type 304 stainless steel continuous wire wrap 0.040-in slot screen: 77.64'-97.64' | | 80 | | |
| | | 90 | | |
| Bottom of 6" stainless steel tailpipe @ 100.63'. | 2.99 | 100 | | 100'-105' CLAY |
| | | | TD=105' | Water level = 78.08' (8-9-97) |
| 12" borehole to 105 ft. 10¾" carbon steel casing to 104.5 ft maximum depth. All temporary casing removed from the ground. | | | | |
| Depths are measured from ground surface. | | | | |

A-6000-384 (01/93)

# WELL SUMMARY SHEET

Boring or Well No. 199-D4-14 (B8072)

Sheet 1 of 1

Location West of 100 D/DR Reactors

Project 100-HR-3 Hot Spot Phase II Drilling

Reviewed By L.D. Walker / L.D. Walker 9-26-97

Prepared by [illegible] 8/2/97

## CONSTRUCTION DATA

**Description**

Cement Grout: 0'-60.9'

6" carbon steel casing: +3.1' — 76.08'

10-20 mesh Colorado Silica Sand: 60.9' — 100.1'

Sluff 100.1' - 101.9'

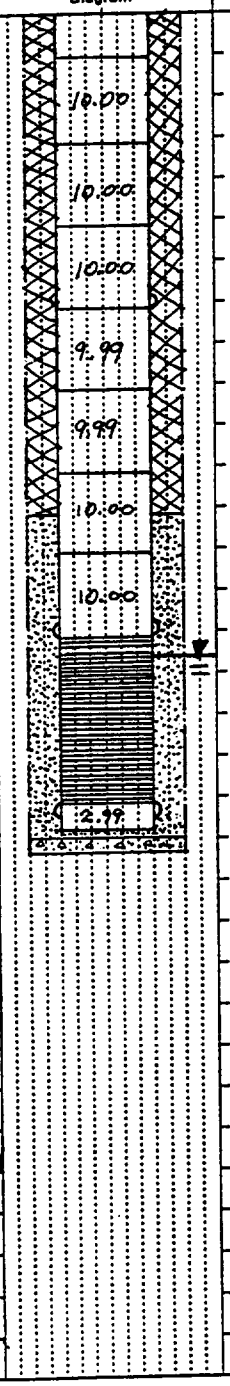
6" Type 304 stainless steel continuous wire wrap 0.020-in slot screen: 76.08'-96.12'

Bottom of 6" stainless steel tailpipe @ 99.11 ft.

12" borehole to 101.9 ft. 10¾" carbon steel casing to 101.9 ft maximum depth. All temporary casing removed from the ground.

Depths are measured from ground surface.

**Diagram**

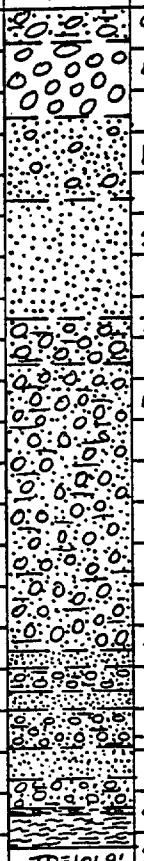



**Depth in Feet**

10, 20, 30, 40, 50, 60, 70, 80, 90, 100

## GEOLOGIC/HYDROLOGIC DATA

**Graphic Log**




**Lithologic Description**

0'-4' Fill- Silty Sandy GRAVEL

4'-13' GRAVEL

13'-23' Gravelly SAND

23'-37½' SAND

37½'-43' Silty Sandy GRAVEL

Hanford/Ringold contact = 43'

43'-78' Silty Sandy GRAVEL

78'-80' Sand

80'-82.7' Silty Sandy GRAVEL : 82.7-85' SAND : 85'-89.8' Silty Sandy GRAVEL : 89.8'-93.5' SAND : 93.5'-97' Silty Sandy GRAVEL : 97'-98'

Silty GRAVEL : 98'-101.9' CLAY

Water level = 78.03' (8-2-97)

A-6000-384 (01/93)

# WELL SUMMARY SHEET

Boring or Well No. 199-D4-13 (B8071)

Sheet 1 of 1

Location 3700' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase 2 Drilling

Reviewed By L.D. Walker / L.D. Walker 9-26-97

Prepared by [illegible] 8/16/97

## CONSTRUCTION DATA

**Description**

Cement Grout: 0'-56.6'

6" carbon steel casing: +3.2' - 71.8'

10-20 mesh Colorado Silica Sand: 56.6' - 61.8'

8-16 mesh Colorado Silica Sand: 61.8' - 90.2'

8-12 mesh Colorado Silica Sand: 90.2' - 100.3'

Slough: 100.3' - 100'

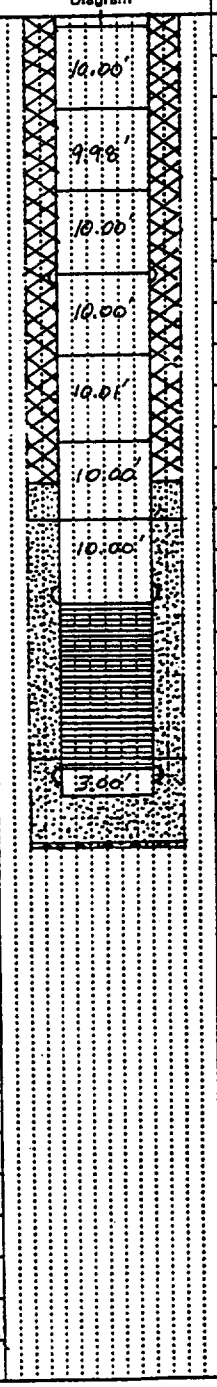
6" Type 304 stainless steel continuous wire wrap 0.040-in slot screen: 71.8'-91.8', (6 5/8" OD)

Bottom of 6" stainless steel tailpipe @ 94.8'.

12" borehole to 101 ft. All 10 3/4" carbon steel casing removed - maximum depth was 100.6 ft.

Depths are measured from ground surface.

**Diagram**

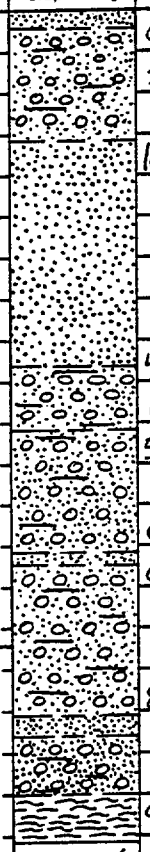



**Depth in Feet**

10, 20, 30, 40, 50, 60, 70, 80, 90, 100

## GEOLOGIC/HYDROLOGIC DATA

**Graphic Log**




**Lithologic Description**

0'-2' Slightly Silty SAND

2'-16' Silty Sandy GRAVEL

16'-43' SAND

43'-51' Silty Sandy GRAVEL

Hanford/Ringold contact @ 51'.

51'-66' Silty Sandy GRAVEL

66'-67' Gravelly Silty SAND

67'-85.5' Silty Sandy GRAVEL

85.5'-87.5' SAND

87.5'-95' Silty Sandy GRAVEL

95'-101' CLAY

Water level = 76.78' (8/16/97)

A-6000-384 (01/93)

## WELL SUMMARY SHEET

Boring or Well No. 199-D3-2 (B8c7-

Sheet 1 of 1

Location ~4600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Reviewed By L.D. Walker / L.D. Walker 9-26-97

Prepared by [illegible] 8/28/97

### CONSTRUCTION DATA

**Description**

Cement Grout: 0'-71.9'

6 5/8" OD (6" ID) Carbon steel casing: +2.9'-82.1'

10-20 mesh Colorado Silica Sand: 71.9'-108.9'

Slough: 108.9'-110.5'

6 5/8" OD (6" ID) Type 304 Stainless steel continuous wire wrap 0.020-in slot screen: 82.1'-102.1'

Bottom of 6 5/8" OD (6" ID) Stainless steel tailpipe @ 105.1'.

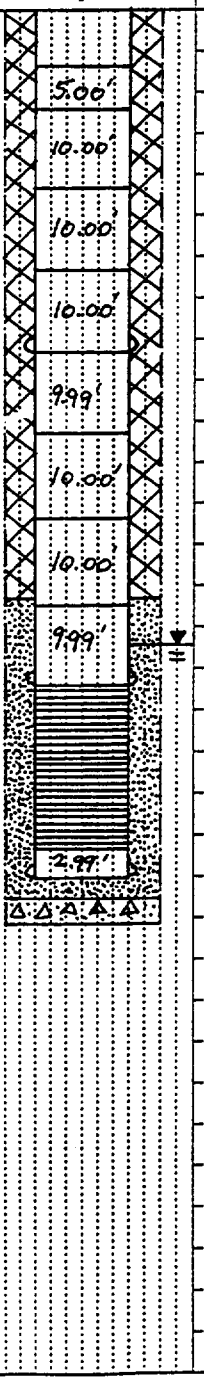
12" borehole to 110.5 ft.

10 3/4" carbon steel casing to 110 ft maximum depth.

All temporary casing removed from the ground.

Depths are measured from ground surface.

**Diagram**

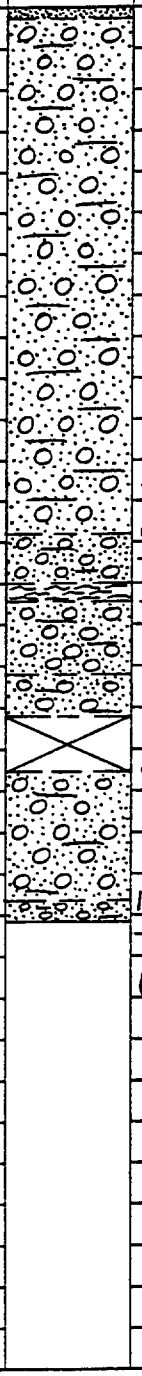



**Depth in Feet**

10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110

### GEOLOGIC/HYDROLOGIC DATA

**Graphic Log**



**Lithologic Description**

0'-1.5' SAND

1.5'-64' Silty Sandy GRAVEL

Hanford/Ringold contact @ 64'

64'-70' Silty Sandy GRAVEL

70'-72' Silty CLAY

72'-81' Silty Sandy GRAVEL w/ Caliche

81'-86' Silty Sandy GRAVEL

86'-92.5' No to Poor Returns

92.5'-109 Silty Sandy GRAVEL

109'-110.5' Silty Sandy GRAVEL w/ Calic.

TD = 110.5 ft

Water level = 77.4' (8/28/97)

A-6000-384 (01 93)

# BOREHOLE LOG

Boring or Well No. 199-D4-15 (B8073)

Sheet 3 of 3

Location 2600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 8/7/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl | Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level |
|---|---|---|---|---|---|
| 80 | Air Rotary | NA | | See previous page for description | Added 5 ft of 10¾" casing |
| | | | | | Total casing is 89.75 ft |
| | | | | | Water sample BOLNBE |
| | | | | Description of ss sample (still silty sandy | collected at 1110 hrs at |
| | | | | gravel) 65% gravel, 25% sand, 10% silt, | ~80.3 ft. Sample to |
| 85 | 5" OD SS 84.8'-87.4' | 100% rcd | | Gravels are 10-20% bas, 80-90% qtz, granite, | be analyzed for hexchrome. |
| | | | | and other, SR-R; Sands are mostly m-f, | Drove SS 1434-1436 hrs |
| | | | | 20% bas, 80% qtz, felds, A to SR; 2.5Y | 8/6/97 (slough 85.7-84.8) |
| | A.R. | NA | | 6/2 light brownish gray (dry), saturated, | End of Shift 8/6/97 |
| | | | | v poorly sorted, max part size 7cm, strong | Depth to water 8/7/97 is 78.05 |
| 90 | 5" OD SS 90.3'-92.8' | 100% rcd | | rxn to HCl, tr mica | Added 5 ft of 10¾" casing. |
| | | | | | Total casing 94.75 ft. |
| | | | | Same as above; up to 75% gravel, max | Drove SS 0914-0917 hrs 8/7/97 |
| | A.R. | NA | | part 8cm | (slough 90.3'-90.9') |
| 95 | | | | | Intended to take SS at |
| | | | | | 95 ft however 2' of fill in casing |
| | | | | | Continued drilling after |
| | | | | | adding 10 ft of 10¾" casing. |
| | | | | | Total casing is 104.75 ft. |
| | | | | | Ringold Upper Mud @ |
| 100 | | | | 100'-105' CLAY: Mostly clay, some | 100 ft. |
| | | | | minor at the top probably from the unit | |
| | | | | above, 5Y 6/2 light olive gray (dry), saturated, | |
| | | | | high plasticity, strong rxn | |
| 105 | | | | | TD @ 105' 8/7/97 |

A-6000-382 (01/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-15 (B8073)

Sheet 2 of 3

Location 2600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes / DC Weekes (Sign/Print Name) Date 8/6/97

Reviewed By L.D. Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl | Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level |
|---|---|---|---|---|---|
| 40 | Air Rotary | NA | | See p.1 for description of this interval | |
| 45 | | | | | |
| | | | | | Possible Hanford/Ringold contact at 50 ft. |
| 50 | | | | Starting at about 50 ft the fines become lighter in color. | |
| | | | | 50'-68' Silty Sandy GRAVEL (msG): 70% Gravel, 15% Sand, 15% Silt, transition between N4 dark gray and 2.5Y6/2 light brownish gray, dry, poorly sorted; Gravels are A to R, 30% bas, 70% other; Sands are A to SR, 50% bas, 50% other, max size 4cm, tr mica | Added 10 ft of 10 3/4" casing. Total casing is 64.75 ft |
| 55 | | | | | |
| | | | | | End of Shift 8/5/97 |
| 60 | | | | Strong rxn to HCl | Casing @ 59.7' |
| | | | | | Added 10 ft of 10 3/4" casing. Total casing is 74.75 ft. Start at 59.7 ft 8/6/97 |
| 65 | | | | Color 2.5Y6/2 light brownish gray (dry) | |
| | | | | 68'-74' Gravelly SAND (gS): 25% Gravel, 65% Sand (mostly m-f), 10% silt; 2.5Y6/2 light brownish gray, dry, Gravels are 30% bas, 70% other, A to R; Sands are 20% bas, 80% qtz, fld, and other, max size 4cm, strong rxn, tr mica | Fast drilling 68'-74' |
| 70 | | | | | Added 5 ft of 10 3/4" casing. Total casing is 79.75 ft. |
| 75 | | | | At 74' ~10% gravel, mostly m sand, 10% silt, mod to well sorted | Added 5 ft of 10 3/4" casing Total casing is 84.75 ft. |
| | BOLNB3 | | | 74'-100' Silty Sandy GRAVEL (msG): 65% Gravel, 25% Sand (m-f mostly), 10% silt, 2.5Y6/2 light brownish gray, dry, Gravel + sand as above comp, | @78' Sample collected from cyclone for nitrate, hexchrom, + sulfate determination |

A-6000-382 (01/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-15 (B8073

Sheet 1 of 3

Location 2600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 8/5/97

Reviewed By L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| | Air Rotary | NA | | 0-18' Fill- Silty Sandy GRAVEL: 40% Gravel, 30% Sand, 30% silt, 2.5Y5/3 light olive brown, dry, v poorly sorted, SA to R, 90% basalt, 10% other, slight to strong rxn, max size 3cm in cutting; white $CaCO_3$ coatings on some clasts | Maximum size boulder seen near drill hole 40 cm. Started with 12" hole and 14.75 ft of 10¾" carbon steel casing @ 1020 hrs 8/5/97. Odex air rotary method |
| 5 | | | | Fill bottom indistinguishable from in situ formation. | |
| | | | | Decreasing silt content and increasing gravel content with depth | |
| 10 | | | | | Added 10 ft of 10¾" casing. Total casing is 24.75 ft. |
| 15 | | | | | |
| | | | | 18'-24' Gravelly SAND (gS): 15% Gravel, 80% sand, 5% silt; Gravel is mostly vfp, 80% bas 20% other; Sand is mostly m-c, "sand + pepper", 60% bas, 40% qtz, feld, + other, A to SR; N3, dry, very dark gray, max part size 3cm, no to strong rxn, tr caliche, mod sorted | Driller indicates sand hit at 18 ft. Added 10 ft of 10¾" casing. Total casing is 34.75 ft. |
| 20 | | | | | |
| 25 | | | | 24'-27' Silty Sandy GRAVEL (msG): 60% Gravel, 25% sand; Gravel is 70% bas, 30% other, SR-R; Sand is vf-vc, 50% bas, 50% other, A to SR; N4 dark gray, dry, v poorly sorted, max 4cm, | Decrease in gravel content 25' to 27' |
| 30 | | | | 27'-31' Gravelly SAND (gS) similar to 18'-24' except up to 25% gravel and 10% silt. | Added 10 ft of 10¾" casing. Total casing is 44.75 ft. |
| | | | | 31'-38' SAND (S): 5% Gravel, 85% sand, 10% silt; N4 dark gray, dry, mod sorted, A to SA, no to slight rxn, 60% bas, 40% other | |
| 35 | | | | 38'-50' Silty Sandy GRAVEL (msG): similar to 24' to 27' except increasing amount of gravel with decreasing basalt content | Added 10 ft of 10¾" casing. Total casing is 54.75 ft. |

A-6000-382 (2/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-14 (B8072

Sheet 3 of 3

Location West of 100D/DR Reactors

Project 100-HR-3 Hot Spot Phase II Dri[illegible]

Prepared By DC Weekes DC Weekes (Sign/Print Name) Date 7/31/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-[illegible]

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl | Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level |
|---|---|---|---|---|---|
| 80 | Air Rot. | NA | | saturated, well sorted, mostly m-f | |
| | 80.7'-83.2' SS 100% rcd | 100% | | sand, A to SR, 20% basalt, 80% qtz + feld, max part size 1cm, no rxn to HCl, tr mica | Split spoon taken at 15[illegible] (5" OD w/lexan liners) Added 5 ft of 10¾" [illegible] |
| 85 | Air Rotary | NA | | 80'-82.7' Silty Sandy GRAVEL: 75% Gravel, 10% Sand, 15% silt, 2.5Y6/2 light brownish gray (dry), saturated, poorly sorted; gravels are SR to R, 30% basalt, 70% other including granite, quartzite, volcanics, max size 8cm, no to slight rxn to HCl | Total casing is 90.2 ft |
| | 87.6-90.1' SS | 100% | | | Split spoon taken at [illegible] (5" OD w/Lexan liners) slough 87.6'-88.8' |
| 90 | Air Rotary | NA | | 82.7'-85' SAND: 100% sand, tr silt; mostly medium, 2.5Y7/2 light gray (dry), saturated, A to SA, 20% basalt, 80% qtz + feld, 2mm max, no rxn, tr mica | 93' Sample for sieving |
| | Sieve Cam | | | | |
| 95 | | | | 85'-89.8' Silty Sandy GRAVEL: 40-60% Gravel, 45-25% sand, 15% silt, 2.5Y6/2 light brownish gray (dry), saturated, no to slight rxn to HCl. 5cm max size | 85'-89.8' Probably poor water producer due to silt and slightly consolidated |
| 100 | | | | 89.8'-93.5' SAND: 100% Sand, tr gravel, c-f, 2.5Y7/2 light gray (dry), saturated, well sorted, 20% bas, 80% qtz + feld, max size 2cm, tr mica | End of shift 1800 hrs 7/30/97 90.1 ft |
| | | | TD = 101.9' | 93.5'-97' Silty Sandy GRAVEL: 60% Gravel, 25% sand, 15% silt, 2.5Y7/2 light gray (dry), saturated, poorly sorted, Gravels are poorly sorted, SR-R, 40% bas, 60% qtz, granite, other; Sand is SA-A, 20% bas, 80% qtz + feld; max size 5cm, no rxn | Added 5 ft of 10¾" casing when split spoon was dong[illegible] Total casing 95.2 ft 7/31/97 |
| 105 | | | | | Added 10 ft of 10¾" casing 1500 hrs 7/31/97. Total casing 105.2 ft. |
| 110 | | | | 97'-98' ~~Silty~~ GRAVEL: 30% gravel, 40% silt/clay, 30% sand; 2.5Y7/2 light gray (dry), sat, lithology as above, no rxn, 4cm max, transition to unit below | Medium plasticity, Rinder. Upper mud at 97 ft. gravel may be from above |
| 115 | | | | 98'-101.9' Clay: 10YR7/3 Very Pale Brown (dry), sat, no rxn to HCl, plastic | Total depth 101.9' 7/31/97; Bottom casing at 101.9'. |

A-6000-392

# BOREHOLE LOG

Boring or Well No. 199-D4-14 (B8572

Sheet 2 of 3

Location West of 100D/DR Reactors

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 7/29/97 + 7/30/97

Reviewed By L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| 40 | Air Rotary | N/A | | | |
| | | | | 43'-44.5' Silty Sandy GRAVEL: as above with higher percentage of silt 2.5Y 6/2 light brownish gray | Hanford fm/Ringold "E" contact @ 43 ft based on higher silt, change in color Fe Ox, trace mica |
| 45 | | | | 44.5'-78' Silty Sandy GRAVEL: same as 37½'-43' except lighter color, more silt, less basalt. 60% Gravel, 20% Sand, 20% silt. 2.5Y6/2 light brownish gray, dry, poorly sorted, A to R; Gravels are 45% basalt, 55% qtz, granite, + other, max part size 3 cm, slight rxn to HCl | |
| 50 | | | | Gravel content increased to 70% @ ~50 ft. | 1520 hrs Added 10' of 10¾" casing |
| 55 | | | | | |
| 60 | | | | | End of shift 7/29/97 0750 hrs Added 10' of 10¾" casing (Total is 75.2 ft) on 7/30/97 |
| 65 | | | | As Above, no rxn to HCl | 66'-68' Driller says drilling is "ratty". Loose sand and gravel. |
| 70 | | | | As Above, Strong rxn to HCl | 0955 Added 5' of 10¾" casing. Total is 80.2 ft. |
| | | | | As Above, Strong rxn to HCl, tr caliche | At 74'-2 soil samples were collected for hex chrome, sulfate, and nitrate. |
| | | | | As Above, Strong rxn to HCl | |
| 75 | BOLNB2 | | | As Above, Strong rxn to HCl, tr caliche | 1110 Added 5' of 10¾" casing. |
| | | | | 78'-80' SAND: 98% SAND, 2% Gravel, 10% silt, 2.5Y6/2 light brownish gray (dry) | Water @ 78.08 ft bgs @ 1458 hrs 7/30/97 |

A-6000-382

# BOREHOLE LOG

Boring or Well No. 199-D4-14 (BEOTT)

Sheet 1 of 3

Location West of 100D/DR Reactors

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 7/29/97

Reviewed By L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| | Air Rotary | NA | | Fill - Silty Sandy GRAVEL (msG): 40% Gravel, 45% Sand, 15% silt, 2.5Y4/2 dark grayish brown, dry, v poorly sorted, SA to R, 90% basalt, 10% other, strong rxn, 8cm max part size | 15.2' of 10¾" casing (ED) ODEX air rotary method with casing shoe 12" Borehole |
| 5 | | | | @4 ft large cobble | |
| | | | | @5.5 ft basalt boulder (1 foot thick) | |
| | | | | 4-13' GRAVEL: 80% Gravel, 15% sand, 5% silt, 2.5Y4/1 dark gray, dry, poorly sorted, A to SA, 95% basalt, 5% other, max part size 3cm, no rxn | |
| 10 | | | | | Added 10' of 10¾" casing @ 1145 hrs. |
| 15 | | | | 13-23' Gravelly SAND: 25% Gravel, 65% sand, 10% silt; 2.5Y4/1 dark gray, dry, moderately sorted, A to SR, 80% basalt, 20% other, max part size 2cm, no rxn, loose; sand is mostly c-vc, SR, 70% basalt, 30% qtz+feld | |
| 20 | | | | 23-37½' SAND: 5% Gravel, 85% sand, 10% silt, grades from gravelly sand above, same lithology except well sorted and mostly c | Added 10' of 10¾" casing @ 1312 hrs. |
| 25 | | | | | |
| 30 | | | | | Added 10' of 10¾" casing @ 1350 hrs. |
| 35 | | | | 37½-43' Silty Sandy GRAVEL: 60% Gravel, 25% sand, 15% silt; 2.5Y4/1 dark gray, dry, v poorly sorted, Gravels are A to SR, 60% basalt, 40% other; Sands are 50% basalt, 50% qtz+feld, A to SA, max size ~3cm; no rxn | Added 10' of 10¾" casing @ 1425 |

A-6000-382 (10/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-13 (BEC)

Sheet 3 of 3

Location 3700' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes / DC Weekes (Sign/Print Name) Date 8/13/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| ~~80~~ | Air Rot. | NA | | | Drove splitspoon 1517-1528 hrs 8/12/97 |
| | 5"OD SS 80.8'-84.2' | 100% | | Split spoon sample verifies silty sandy gravel, max part size 10cm, gravel is between 60-70% of sample; saturated | slough in SS from 80.8'-83' |
| 85 | A.R. | NA | | | |
| | 5"OD SS 85.3'-88.8 | 62% | | 85.5'-~~85.7~~ 87.5' SAND: Mostly vf-m sand, gravel in interval is from overlying and/or underlying gravel, 2.5Y 6/3 light yellowish brown (dry), saturated, moderately sorted | 2 jars of sand collected for sieve analysis from cyclone 85.5'-87.5' End of shift 8/12/97 Start 8/13/97 |
| 90 | A.R. ↓ | NA ↓ | | 87.5'-95' Silty Sandy GRAVEL (MSG): same 95 67'-85.5' interval. | Drove splitspoon (double) 85.5'-88.8' Most material is slough. The bottom 0.7' may be in situ formation and is silty sandy gravel although it could be drilled material. Bottom of casing was at 87.8 ft. Material collected from shoe and 1st liner for sieve analysis (about 88.1'-88.8'). |
| | 5"OD SS 91.3'-93.9' | 58% | | SS Verified silty sandy gravel | |
| 95 | Air Rotary (ODEX) ↓ | NA ↓ | | 95'-101' CLAY: 100% clay, 2.5Y5/4 light olive brown (dry), saturated, high plasticity | |
| 100 | | | | TD=101 ft. | Drove SS from 91.3'-93.9' 8/13/97 Added 5' of 10¾" casing @ 87.8 ft. Total of 89.75+5=94.75'. Slough in SS from 91.3'-93.9' Added 10' of 10¾" casing @ 92.7'. Total casing = 104.75'. Ringold Upper Mud @ 95. Bottom of casing @ 100.3' @ TD. Best depth to water measurement: 79.37' on 8/12/97 prior to installation of screen. |

A-6000-382 (12/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-13 (B807)

Sheet 2 of 3

Location 3700' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 8/12/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| 40 | Air Rotary (ODEX) | NA | | | Added 10 ft of 10¾" casing Total casing is 54.75 ft. |
| | | | | 43'-51' Silty Sandy GRAVEL (msG): 40% gravel, 45% sand (m-vc), 15% silt; N4 (dry), v poorly sorted, gravels are 40% bas, 60% other, A to R; Sands are 60% bas, 40% other, A to SR; max size 5cm | at 46' quite a lot of gravel |
| 45 | | | | | |
| 50 | | | | 51'-67' Silty Sandy GRAVEL (msG) 60% gravel, 25% sand, 15% silt, 2.5Y 5/3 light olive brown (dry), v poorly sorted; gravels are SR-R, 25% bas, 75% other; sands are A to SR, 50% bas, 50% other; max size 5cm. | Hanford/Ringold contact @ ~51 ft. Losing air to formation End of shift 8/11/97 @ 52.1 ft. Added 10 ft of 10¾" casing at 52.1 ft. Total 10¾" casing is 64.75 ft (8/12) |
| 55 | | | | | |
| 60 | | | | 66-67' Gravelly Silty SAND (gmS): 25% gravel, 50% sand (mostly m-c), 25% silt; 2.5Y 6/3 light olive brown (dry), poorly sorted, gravels are A to R, 25% bas, 75% other; sand is A to SA, 25% bas, 75% qtz, feld, max size is 5cm, loose | Added 10 ft of 10¾" casing @ 61 ft. Total 10¾" casing 74.75 62'-66' Occasional thin lens of sand |
| 65 | | | | 67'-85.5' Silty Sandy GRAVEL (msG): similar to 51'-67' except sand has 25% bas, 75% qtz, feld | |
| 70 | | | | | Added 5 ft of 10¾" casing @ 70.5 ft. Total casing 79.75 ft. |
| 75 | BOLNBI A.R | | | | "Tight" drilling ~74'. Added 5 ft of 10¾" casing @ 74.8 ft. Total casing is 84.75 ft. Collected 2 amberglass 6cm jars for hexchrome, nitrate + sulfate analyses @ 76 ft. |

A-6000-382 (01/93)

# BOREHOLE LOG

Boring or Well No. 199-D4-13 (3ECT

Sheet 1 of 3

Location 3700' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes DC Weekes (Sign/Print Name) Date 8/11/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| | Air Rotary (ODEx) | NA | | 0-2' Silty SAND: 5% Gravel, 80% Sand (vf-vc, most f-m), 15% silt; 2.5Y 6/3 light yellowish brown (dry), moderately sorted, A to SA, 75% qtz, 10% bas, 15% other, loess | Drilling 12" hole w/ODex. Installing 10¾" OD carbon steel casing. Started with 14.75 ft of 10¾" casing |
| 5 | | | | 2'-16' Silty Sandy GRAVEL (msG): 65% gravel, 20% sand, 15% silt; N4 (dry), v poorly sorted; gravels are boulder to 2mm, A to R, 75% bas, 25% other; sand is 60% bas, 40% other, A to SR; max part size 30 cm, becoming less bouldery with depth | |
| 10 | | | | | Added 10 ft of 10¾" casing. Total casing is 24.75 ft |
| 15 | | | | 16'-43' SAND (S): 5-10% gravel, 80-90% sand (m-vc), 5-10% silt; N4 (dry), well sorted; gravels are A to R, sands are A to SA, 75% bas, 25% other, gravels are 80-90% bas, max part ~4cm occasional gravel | |
| 20 | | | | | Added 10 ft of 10¾" casing. Total casing is 34.75 ft. |
| 25 | | | | | Fast drilling through this sand. |
| 30 | | | | | Added 10 ft of 10¾" casing. Total casing is 44.75 ft |
| 35 | | | | Gravelly lens from ~39.8'-40.8'. | |

A-6000-392

# BOREHOLE LOG

Boring or Well No. 199-D3-2 (B8074)

Sheet 3 of 3

Location ~4600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase 2 Drilling

Prepared By DC Weekes / DC Weekes (Sign/Print Name) Date 8/21/97

Reviewed By LD Walker / L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| 80 | SS 80.1-82.7' | Rcd 69% | | 72'-81' Silty Sandy GRAVEL with Caliche: Similar to 64'-70' except very common caliche | Added 5 ft of 10¾" cas @ 80.7'. Total casing = 89.75. Drove SS (5" OD) 1230-1242 hrs 8/20/97 |
| | A.R. ↓ | NA ↓ | | 81'-86' Silty Sandy GRAVEL (msG): As above except no caliche; max part size 11cm in ss. | Drove SS (5" OD) 1425-1429 hrs only recovered previously drilled mat'l. Last 2 ft drove easily |
| 85 | SS 84.3'-89.1' | Rcd 41% (slough) | | 86'-92.5' Very poor returns/ poor recovery, drills like sand, water returns in cyclone | Added 5 ft of casing @ 85.5'. Total casing is 94.75 ft. Drove SS 90.9'-94.1' @ 1658-1700 hrs |
| 90 | A.R. ↓ | NA ↓ | | 92.5-109' Silty Sandy GRAVEL (msG) As 81'-86' interval | |
| | SS 90.9'-94.1' | Rcd 43% | | | End of shift 8/20/97 |
| 95 | Air Rotary (ODEX) | NA | | | WL @ beginning of shift 8/21/97 @ 76.77 ft bgs. Added 10 ft of casing @ 90.5'. Total = 104.75'. |
| 100 | | | | Note: When the driller stopped drilling at ~100.5 ft the casing filled up about 5 ft with sand and some gravel. This may be the material from 86'-92.5'. | Added 5 ft of casing @ 101'. Total casing = 109.75'. |
| 105 | | | | | |
| 110 | | | | 109'-110.5' Silty Sandy GRAVEL with Caliche: Similar to 72'-81'; Gravel is 20-40% caliche, rest is basalt and other. Angular to R. Strong rxn to HCl | Bottom of casing @ 110' at maximum depth. TD = 110.5 ft. |

A-6000-382 (01/93)

# BOREHOLE LOG

Boring or Well No. 199-D3-2 (B8074)

Sheet 2 of 3

Location ~4600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 8/20/97

Reviewed By L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description (Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl) | Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level) |
|---|---|---|---|---|---|
| 40 | Air Rotary (ODEX) | NA | | Silty Sandy GRAVEL from p. 1 | 12" drilled hole |
| 45 | | | | | |
| 50 | | | | | Added 10 ft of 10¾" casing. |
| | | | | Subtle decrease in basalt content starting about 52 ft. May be in reworked Ringold gravel. | Total = 64.75'. BOC @ 50.5'. Cobbles at 51' |
| 55 | | | | | |
| 60 | | | | | Added 10 ft of casing. Total = 74.75'. BOC @ 60.8'. |
| | | | | Sandy material in the lower 2 ft. | |
| 65 | BOC/NBO | | | 64'-70' Silty Sandy GRAVEL (msG): 65% gravel, 20% sand, 15% silt, v poorly sorted, 2.5Y6/2 light brownish gray (dry). Gravel is SR-R, 45% bas, 55% other (qtzite, granite, ect.); sand is 45% bas, 55% other, SA to R, slight rxn to HCl, max part ~4cm, much lighter color and less basalt than previous msG, drilling is more solid | Hanford/Ringold contact at 64 ft. Grab sample for hex chrome. End of shift 8/19/97 @ 64.9'. Cuttings are slightly damp at 66.3 ft. Possible perched water starting at 67'-68'. Added 5 ft of casing @ 71.8'. Total casing is 79.75 ft. |
| 70 | Air Rotary (ODEX) | | | | |
| 75 | | | | 70'-72' Silty CLAY: Poor sample due to carrydown. Small gravel and sand from above. Assumed layer is silty clay, 2.5Y6/2 light brownish gray (dry), low plasticity, strong rxn to HCl | Added 5 ft of casing @ 76'. Total casing is 84.75 ft. |

A-6000-382 (01/93)

# BOREHOLE LOG

Boring or Well No. 199-D3-2 (B&C)

Sheet 1 of 3

Location ~4600' West of 100-DR Reactor

Project 100-HR-3 Hot Spot Phase II Drilling

Prepared By DC Weekes (Sign/Print Name) Date 8/19/97

Reviewed By L.D. Walker (Sign/Print Name) Date 9-26-97

| Depth (ft) | Sample Type and No. | Sample Blows or Recovery | Graphic Log | Sample Description: Group Name, Group Symbol, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl | Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level |
|---|---|---|---|---|---|
| | Air Rotary (ODEX) | NA | | 0'-1.5' Sand: up to 10% Gravel, 80% sand (mostly vf-m), 10% silt, gravel is 80+% basalt, 20% other, SR-R; sand is A to SA, basalt-rich; | Drilling 12" hole w/ 10¾" OD carbon steel casing. Initial piece is 4.75' w/ shoe. |
| 5 | | | | 2.5Y5/4 light olive brown (dry), moderately sorted, max size 1cm, no rxn to HCl, less | 2nd piece is 10.0'. Start 8/18/97 |
| | | | | 1.5' – 64' Silty Sandy GRAVEL (msG): 75% Gravel, 10% sand, 15% silt, Gravel is 80% bas, 20% other, SR-R; Sand | |
| 10 | | | | is A-SR, 80% bas, 20% other; N4 (dry) dark gray, max part size 40cm?, no rxn to HCl | Drilling rate from 1.5'-13' was about 7.6 min/ft. |
| | | | | | Added 10 ft of 10¾" casing @ 13 ft. Total = 24.75' |
| 15 | | | | | Drilling rate 13' to 20' was about 7 ~~ft/min~~ min/ft. (KCW 8/18/97) |
| 20 | | | | | Added 10 ft of 10¾" casing @ 20 ft. Total = 34.75' |
| 25 | | | | | |
| 30 | | | | from 29'-31' much sandier, less gravel, poor drilling returns, still group as silty sandy GRAVEL | End of shift 8/18/97 Added 10' of casing. Total = 44.75'. Bottom of casing @ 30.5'. |
| | | | | from 31'-32' regular silty sandy GRAVEL | |
| | | | | from 32'-35' more gravelly, poor returns | |
| 35 | | | | from 36'-38(?) poor returns | |
| | | | | | Bottom of casing @ 40'. Added 10 ft of casing. Total = 54.75' |

A-6000-382 (01/93)

# APPENDIX A

# BOREHOLE LOGS AND WELL SUMMARY REPORTS

# 4.0 REFERENCES

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Connelly, M. P., 1997, *Assessment of the Chromium Plume West of the 100-D/DR Reactors*, BHI-00967, Rev. 1, Bechtel Hanford Company, Richland, Washington.

DOE-RL, 1996, *Remedial Design Report and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Operable Units' Interim Action*, DOE/RL-96-84, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1997, *Waste Management Plan for the Drilling Within the Chromium Plume West of 100-D/DR Reactors*, DOE/RL-97-53, Rev. 0, U.S. Department of Energy, Richland, Washington.

EPA, 1996, *Declaration of the Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units,* U.S. Environmental Protection Agency, Richland, Washington.

Lindsey, K. A., 1993, *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington*, WHC-SD-EN-TI-132, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Myers, D. A., V. M. Johnson, M. Mehlhorn, L. D. Walker, 1996, *Well Summary Report: 100-HR-3 and 100-KR-4 Interim Remedial Action Wells*, BHI-00953, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Peterson, R. E. and L. D. Walker, 1997, *Description of Work for the Drilling within the Chromium Plume West of 100-D/DR Reactors*, BHI-01043, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

# APPENDIX B

# PHYSICAL PROPERTIES - SIEVE ANALYSES

Un-normalized

199-D4-14

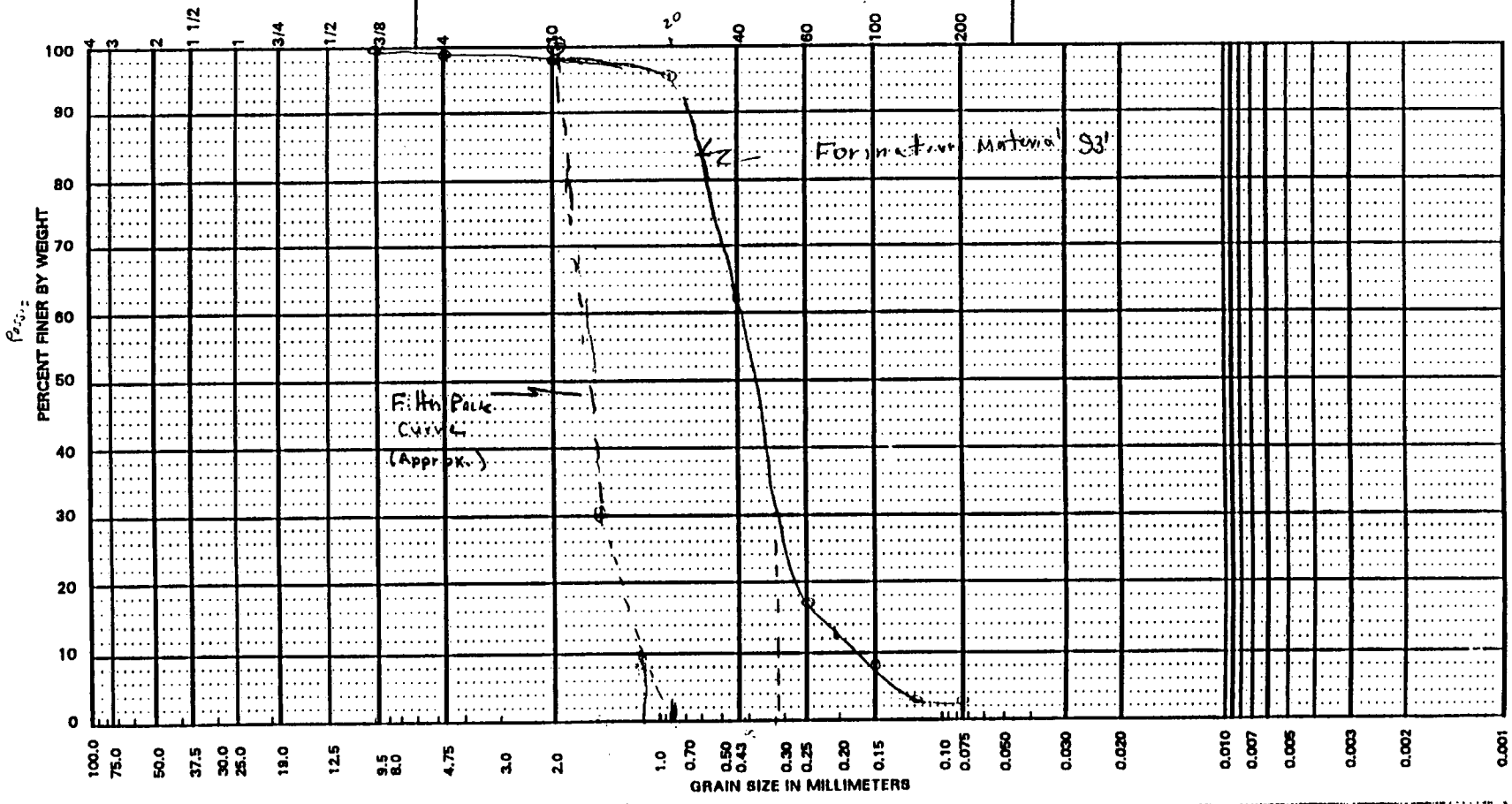
# GEL-07 GRAIN SIZE ANALYSIS PLOT

Originator RL Jack
Date 8/1/97
Calculation No. 0100D-CA-V003
Revision No. Ø
Checker RFR
Date Checked 1 AUG 97
Sheet 4 of 9
Project Groundwater
Subject Well Design 199-D4-14

Sample No. Grab 0193 61

Page 4 of

Remarks Initial wt = 234.5 g/.
Sample taken from Cyclone

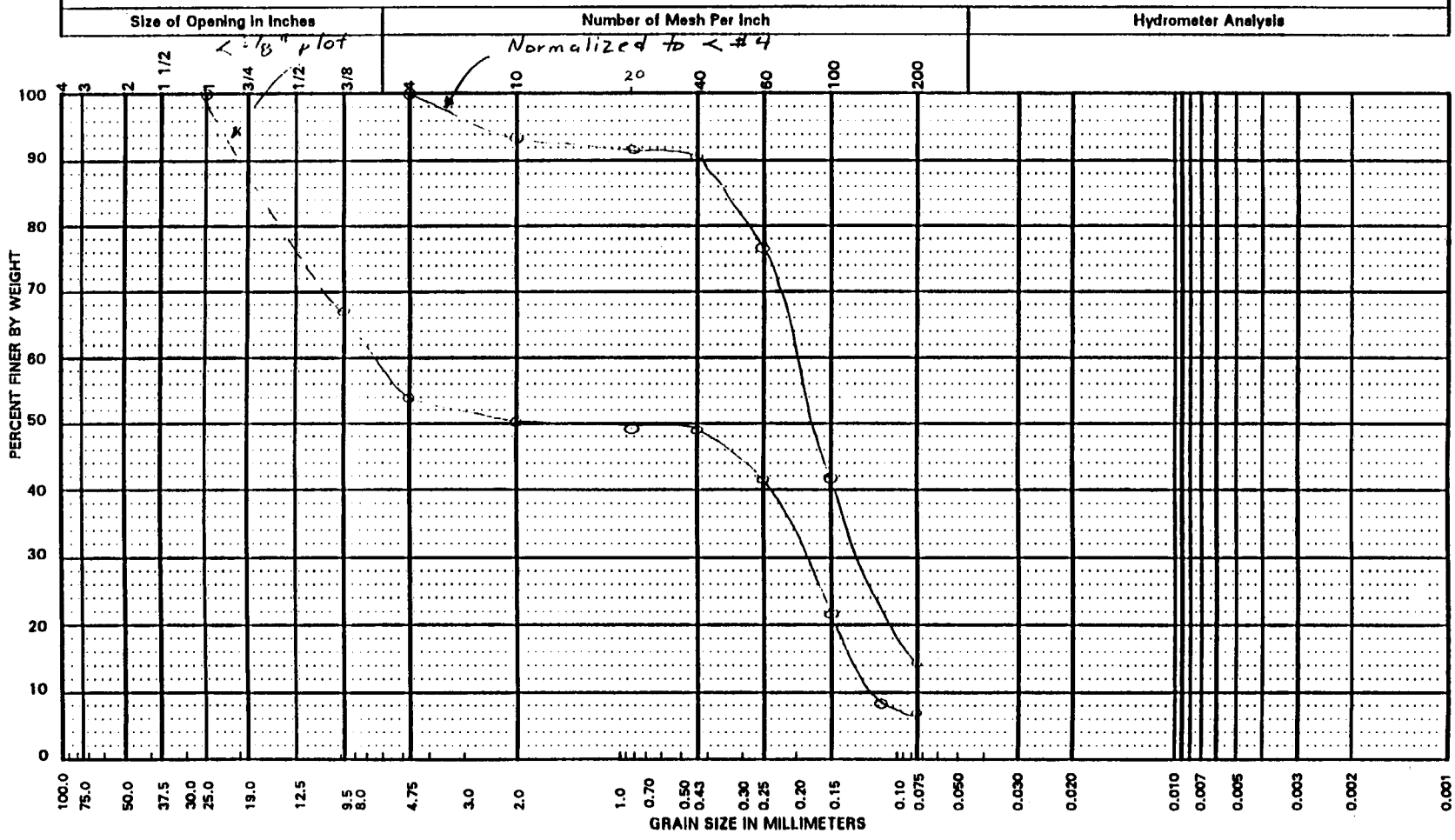


# GEL-07 GRAIN SIZE ANALYSIS PLOT

Attachment #1
Orig. RL Jackson Date 8/14/97
Chk'd by RFRaidl Date 14AUG97
Calc. No. 01DOD-CA-V0017
Rev. No. 0 Sheet No. 1/2

Sample No. —
Page — of —

Remarks D'1-13 85.5 87.5 bgs

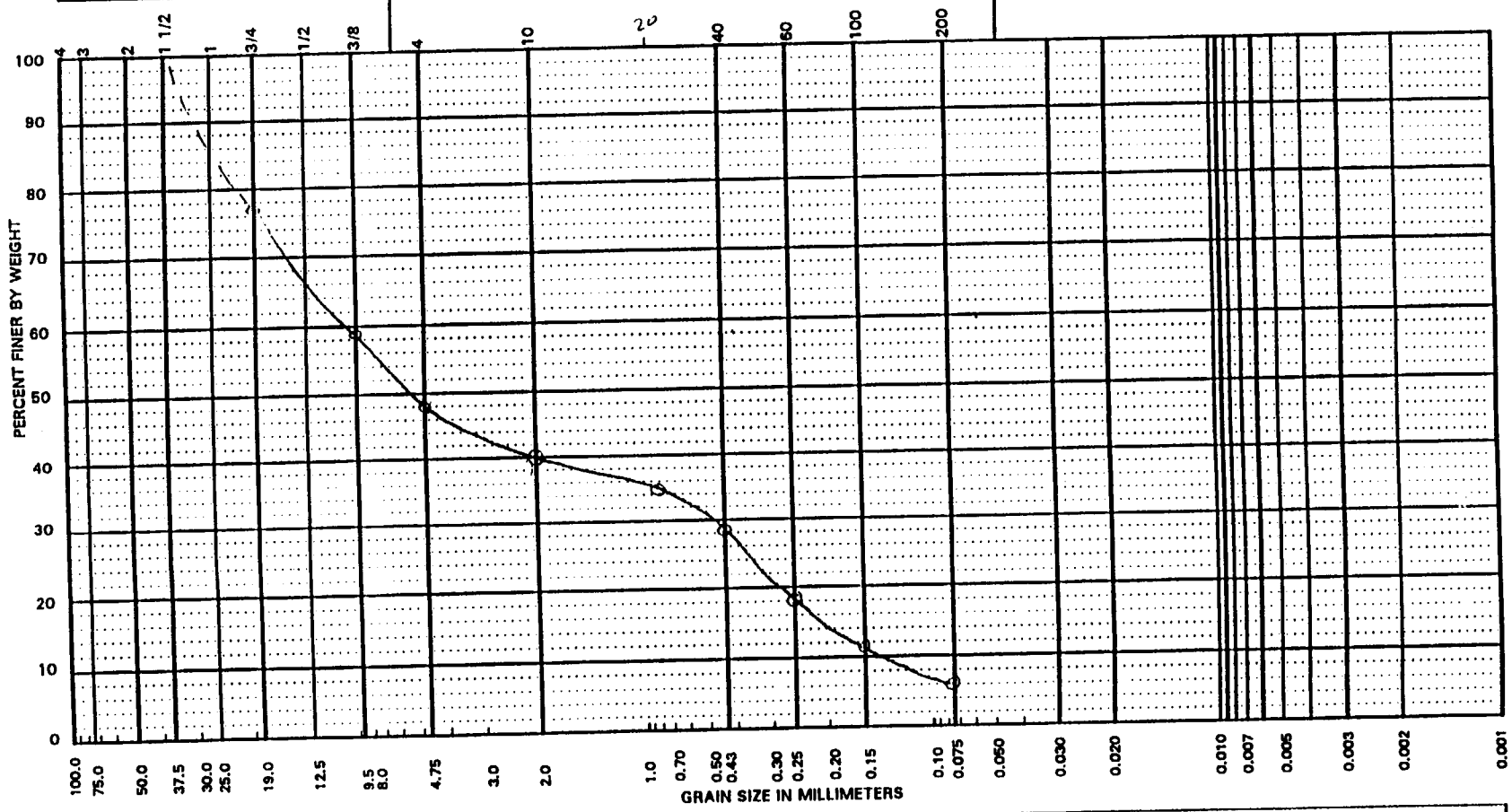


Attachment #1
Orig. RYoch Date 8/14/97
Chk'd by RF Raial Date 14AUG97
Calc. No. D100D-CA-V0017
Rev. No. Ø Sheet No. 2/2

# GEL-07 GRAIN SIZE ANALYSIS PLOT

Sample No. —
Page — of —

Remarks D1-13 88.1-88.8 ft bgs



# APPENDIX C

## WELL CONSTRUCTION AND COMPLETION SUMMARIES, WELL CONSTRUCTION SUMMARY REPORTS, AND WELL COMPLETION FIELD LOGS

# WELL CONSTRUCTION AND COMPLETION SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Air Rotary - TUBEX | Sample Method: | Grab/Split Spoon | WELL NUMBER: 199-D3-2 B8074 | TEMPORARY WELL NO: None |
| Drilling Fluid Used: | Air | Additives Used: | None | Coordinates: N 151,165.65 | |
| Driller's Name: | Willie Franklin | WA State Lic Nr: | 1429 | Coordinates: E 572,453.96 | |
| Drilling Company: | Layne Christensen | Company Location: | Salt Lake City, Ut | Start Card #: R19375 | |
| Date Started: | 18Aug97 | Date Completed: | 02Sep97 | Elevation Ground Surface: 142.845 m Brass Marker | |

Depth to Water: 77.4 ft 28Aug97
(Ground surface)

Elevation of Reference Point: 143.79 m
(top of casing) 01Oct97

Height of Reference Point Above Ground Surface: 0.94 m

Depth of Surface Seal: 71.9 ft.

Type of Surface Seal: 4x4 Concrete Pad

GENERALIZED STRATIGRAPHY Geologist's Log

0 - 1.5 ft : Sand
1.5 - 64 ft : Silty Sandy Gravel - Hanford/Ringold Contact at 64 ft.

64 - 70 ft : Silty Sandy Gravel

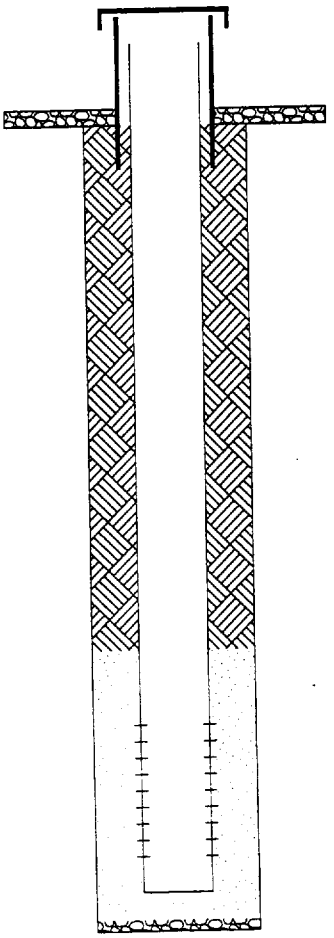
70 - 72 ft : Silty Clay
72 - 81 ft : Silty Sandy Gravel w/ caliche

81 - 86 ft : Silty Sandy Gravel

86 - 92.5 ft : Poor Cuttings Returns - No Data

92.5 - 109 ft : Silty Sandy Gravel

109 - 110.5 ft : Silty Sandy Gravel w/caliche



110.5 ft : Borehole drilled depth

0 - 110 ft : 12.25-in. 10-3/4" TUBEX Sys. (4.5" x 2" Reverse Cir.) - 10-3/4" C.S. thd. Csg.

| *Fill* | *Casing* | *Screen* |
|---|---|---|
| | 0 - 82.1 ft : 6 inch 6" Carbon Steel Thd FJ Csg. 0 - 110.5 ft : 10 inch 10-5/8" Carbon Steel Temp. Csg. Thd. | |
| 0 - 71.9 ft : 12.25-inch hole Cement Grout | | |
| 71.9 - 105.1 ft : 12.25-inch hole 10-20 Silica Sand | | 82.1 - 102.1 ft : 6 inch 6" Wire Wrap SS x .020 Slot - Pipe Size |
| 105.1 - 108.9 ft : 12.25-inch hole 10-20 Silica Sand 108.9 - 110.5 ft : 12.25-inch hole | 102.1 - 105.1 ft : 6 inch 6" 304 SS FJ Csg. 105.1 - 110.5 ft : 10 inch | |

Drawing By: JEA
Reference: Hanford Wells
Revision: 0
Revision Date: 24Oct97
Print Date: 29Oct97

Report Form: WELLS Project File: WELLS.GPJ

BECHTEL

# WELL CONSTRUCTION AND COMPLETION SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Air Rotary - TUBEX | Sample Method: | Grab/Split Spoon | WELL NUMBER: | 199-D4-13 B8071 |
| Drilling Fluid Used: | Air | Additives Used: | None | TEMPORARY WELL NO: | none |
| Driller's Name: | Willie Franklin | WA State Lic Nr: | 1429 | Coordinates: N | 151,424.47 |
| Drilling Company: | Layne Christensen | Company Location: | Salt Lake City, Ut | Coordinates: E | 572,665.86 |
| Date Started: | 11Aug97 | Date Completed: | 02Sep97 | Start Card #: | R19375 |
| | | | | Elevation Ground Surface: | 142.942 m Brass Marker |

Depth to Water: 76.78 ft 16Aug97
(Ground surface)

GENERALIZED STRATIGRAPHY Geologist's Log

Elevation of Reference Point: 143.83 m
(top of casing) 01Oct97

Height of Reference Point Above Ground Surface: 0.89 m

Depth of Surface Seal: 56.6 ft.

Type of Surface Seal: 4x4 Concrete Pad

0 - 2 ft : Slightly Silty Sand
2 - 16 ft : Slity Sand Gravel

16 - 43 ft : Sand

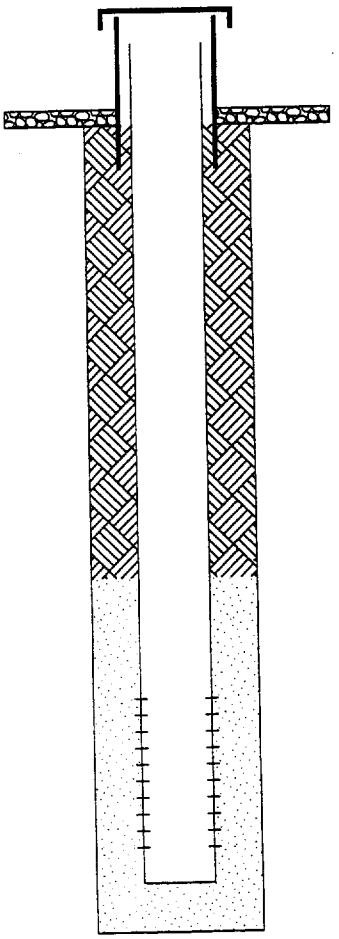
43 - 51 ft : Silty Sandy Gravel - Hanford/Ringold Contact at 51 ft.

51 - 66 ft : Silty Sandy Gravel

66 - 67 ft : Gravelly Slity Sand
67 - 85.5 ft : Silty Sandy Gravel

85.5 - 87.5 ft : Sand
87.5 - 95 ft : Slity Sand Gravel

95 - 101 ft : Clay



101 ft : Borehole drilled depth

0 - 101 ft : 12.25-in. 10-3/4" TUBEX Sys. (4.5" x 2" Reverse Cir.) - 10-3/4" C.S. Thd.Csg.

| *Fill* | *Casing* | *Screen* |
|---|---|---|
| | 0 - 101 ft : 10 inch 10-3/4" Carbon Steel Thd. Temp. Csg. | |
| | 0 - 71.8 ft : 6 inch 6-5/8" Carbon Steel Thd. Perm. Csg. | |
| 0 - 56.6 ft : 12.25-inch hole Cement Grout | | |
| 56.6 - 61.8 ft : 12.25-inch hole 10-20 Colo. Silica Sand | | |
| 61.8 - 90.2 ft : 12.25-inch hole 8-12 Colo. Silica Sand | | 71.8 - 91.8 ft : 6 inch 6" SS Wire Wrap x .040 slot Pipe Size |
| 90.2 - 94.8 ft : 12.25-inch hole 8-12 Colo. Silica Sand | 91.8 - 94.8 ft : 6 inch 6-5/8" 304 SS | |
| 94.8 - 101 ft : 12.25-inch hole 8-12 Colo. Silica Sand | | |

Drawing By: JEA
Reference: Hanford Wells
Revision:
Revision Date: 24Oct97
Print Date: 29Oct97

Report Form: WELLS Project File: WELLS.GPJ

# WELL CONSTRUCTION AND COMPLETION SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Air Rotary - TUBEX | Sample Method: | Grab/Split Spoon | WELL NUMBER: | 199-D4-14 B8072 |
| Drilling Fluid Used: | Air | Additives Used: | None | TEMPORARY WELL NO: | None |
| Driller's Name: | Willie Franklin | WA State Lic Nr: | 1429 | Coordinates: N | 151,641.64 |
| Drilling Company: | Layne Christensen | Company Location: | Salt Lake City, Ut | Coordinates: E | 572,839.81 |
| Date Started: | 28Jul97 | Date Completed: | 02Sep97 | Start Card #: | R19375 |
| | | | | Elevation Ground Surface: | 143.467 m Brass Marker |

Depth to Water: 78.03 ft 02Aug97
(Ground surface)

Elevation of Reference Point: 144.34 m
(top of casing) 01Oct97

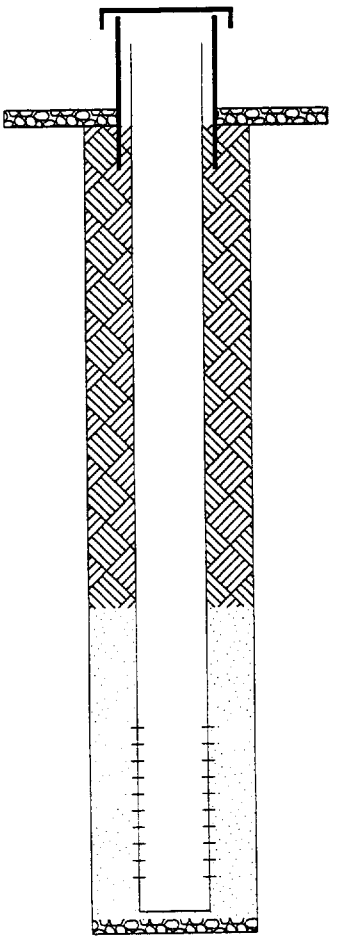
Height of Reference Point Above Ground Surface: 0.87 m

Depth of Surface Seal: 60.9 ft

Type of Surface Seal: 4x4 Concrete Pad

GENERALIZED STRATIGRAPHY Geologist's Log

0 - 4 ft : Silty Gravel (fill mat'l.)
4 - 13 ft : Gravel
13 - 23 ft : Gravelly Sand
23 - 37.5 ft : Sand
37.5 - 43 ft : Silty Sandy Gravel - Hanford/Ringold contact @ 43 ft.
43 - 78 ft : Silty Sandy Gravel
78 - 80 ft : Sand
80 - 82.7 ft : Silty Sandy Gravel
82.7 - 85 ft : Sand
85 - 89.8 ft : Silty Sand
89.8 - 93.5 ft : Sand
93.5 - 97 ft : Silty Sandy Gravel
97 - 98 ft : Silty Gravel
98 - 101.9 ft : Clay



101.9 ft : Borehole drilled depth

0 - 101.9 ft : 12.25-in. 10-3/4" TUBEX Sys. (4.5" x 2" Reverse Cir.) - 10-3/4" C.S. Thd.Csg.

| Fill | Casing | Screen |
|---|---|---|
| | 0 - 101.9 ft : 6 inch 10-3/4" Carbon Steel Thd. Temp. Csg. | |
| | 0 - 76.08 ft : 6 inch 6-5/8" Carbon Steel Thd. Perm. Csg. | |
| 0 - 60.9 ft : 12.25-inch hole | | |
| 60.9 - 96.12 ft : 12.25-inch hole 10-20 Colo. Silica Sand | | 76.08 - 96.12 ft : 6 inch 6" SS Wire Wrap x .020 slot Pipe Size |
| 96.12 - 99.11 ft : 12.25-inch hole 10-20 Colo. Silica Sand | 96.12 - 99.11 ft : 6 inch 6-5/8" 304 SS | |
| 99.11 - 101.1 ft : 12.25-inch hole 10-20 Colo. Silica Sand | | |
| 100.1 - 101.9 ft : 12.25-inch hole Fill | | |

Drawing By: JEA
Reference: Hanford Wells
Revision: 0
Revision Date: 24Oct97
Print Date: 29Oct97

Report Form: WELLS Project File: WELLS.GPJ

# WELL CONSTRUCTION AND COMPLETION SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| Drilling Method: | Air Rotary - TUBEX | Sample Method: | Grab/Split Spoon | WELL NUMBER: | 199-D4-15 B8073 |
| Drilling Fluid Used: | Air | Additives Used: | None | TEMPORARY WELL NO: | None |
| Driller's Name: | Willie Franklin | WA State Lic Nr: | 1429 | Coordinates: N | 151,424.86 |
| Drilling Company: | Layne Christensen | Company Location: | Salt Lake City, Ut | Coordinates: E | 572,936.64 |
| Date Started: | 05Aug97 | Date Completed: | 02Sep97 | Start Card #: | R19375 |
| | | | | Elevation Ground Surface: | 143.658 m Brass Marker |

Depth to Water: 78.08 ft 09Aug97
(Ground surface)

Elevation of Reference Point: 144.57 m
(top of casing) 01Oct97

Height of Reference Point Above Ground Surface: 0.91 m

Depth of Surface Seal: 62.6 ft

Type of Surface Seal: 4x4 Concrete Pad

GENERALIZED STRATIGRAPHY Geologist's Log

0 - 18 ft : Silty Sandy Gravel

18 - 24 ft : Gravelly Sand

24 - 27 ft : Silty Sandy Gravel

27 - 31 ft : Gravelly Sand

31 - 37 ft : Sand

37 - 50 ft : Silty Sandy Gravel

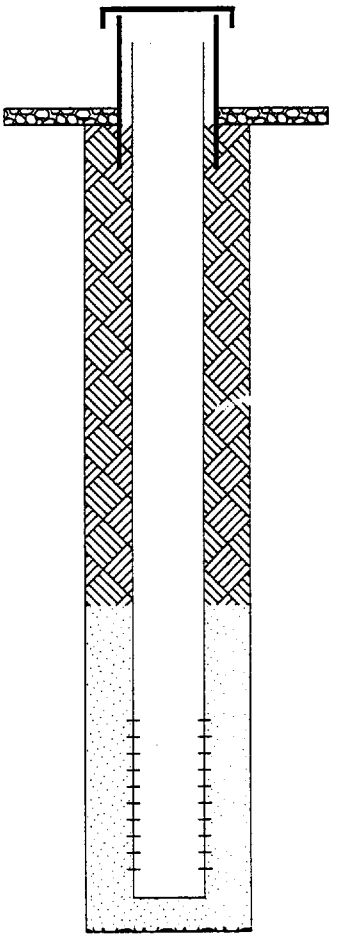
50 - 50 ft : Hanford/Ringold Contact

50 - 68 ft : Silty Sandy Gravel

68 - 74 ft : Gravelly Sand

74 - 100 ft : Silty Sandy Gravel

100 - 105 ft : Clay



105 ft : Borehole drilled depth

0 - 105 ft : 12.25-in. 10-3/4" TUBEX Sys. (4.5" x 2" Reverse Cir.) - 10-3/4" C.S. Thd.Csg.

| *Fill* | *Casing* | *Screen* |
|---|---|---|
| | 0 - 105 ft : 6 inch 10-3/4" Carbon Steel Thd. Temp. Csg. | |
| | 0 - 77.64 ft : 6 inch 6-5/8" Carbon Steel Thd. Perm. Csg. | |
| 0 - 62.6 ft : 12.25-inch hole Cement Grout | | |
| 62.6 - 68 ft : 12.25-inch hole 10-20 Colo. Silica sand | | |
| 68 - 97.64 ft : 12.25-inch hole 8-16 Colo. Silica sand | | 77.64 - 97.64 ft : 6 inch 6" SS Wire Wrap x .040 slot Pipe Size |
| 97.64 - 100.63 ft : 12.25-inch hole 8-16 Colo. Silica sand | 97.64 - 100.63 ft : 6 inch 6-5/8" 304 SS | |
| 100.63 - 104.5 ft : 12.25-inch hole 8-16 Colo. Silica sand | | |
| 104.5 - 105 ft : 12.25-inch hole Fill | | |

Drawing By: JEA
Reference: Hanford Wells
Revision: 0
Revision Date: 24Oct97
Print Date: 29Oct97

Report Form: WELLS Project File: WELLS.GPJ

# WELL CONSTRUCTION SUMMARY REPORT

Start Date 8/18/97
Finish Date 9/2/97
Page 1 of 1

Specification No. 0100G-SC-G004 Rev. No. _____

Well No. B8074 Temp. Well No. 199-D3-2

ECNs: NA
Project: 100-HR-3 Hot Spot Phase II Drilling
Drilling Company: Layne Christensen Co.
Driller: Wilburn Franklin

Approximate Location: 4600' W of 100-DR Reactor
Other Companies: CH
Geologist (s): D.C. Weekes

## Temporary Casing and Drill Depth

| *Size/Grade/Lbs per Ft. | Interval | Shoe O.D./I.D. |
|---|---|---|
| CS-FJ | 0'-110' | 10¾"/10" |

*Indicate Welded (W) - Flush Joint (FJ) - Coupled (C) & Thread Design

Total Drilled Depth 110.5' Hole Dia. @ TD 12"
Well Straightness Test Result NA

## Drilling Method/Hole Diameter

| | | | |
|---|---|---|---|
| Auger: | | Dia. From | to |
| Cable Tool: | | Dia. From | to |
| Air Rotary: Tubex | ✓ | Dia. From 0 | to 110.5' |
| A.R. w/Sonic: | | Dia. From | to |
| | | Dia. From | to |
| | | Dia. From | to |
| | | Dia. From | to |

Drilling Fluid: Air
Total Amt. of Water Added During Drilling: 200 gallons
Static Water Level: 77.4' Date: 8/28/97

## Geophysical Logging

| Sondes (type) | Interval | Date | Sondes (type) | Interval | Date |
|---|---|---|---|---|---|
| NA | | | | | |

## Completed Well

| Size/Wt./Material | Depth | Thread | Slot Size |
|---|---|---|---|
| 6" ID CS | +2.9'-82.1' | FJ | NA |
| 6" ID wire wrap SS | 82.1'-102.1' | FJ | 0.020-in |
| 6" ID SS | 102.1'-105.1' | FJ | NA |

| Type | Interval | Volume | Mesh Size |
|---|---|---|---|
| Cement Grout | 0'-71.9' | 84x94# | NA |
| Silica sand | 71.9'-108.9' | 54x100# | 10-20 |

Annular Seal/Filter Pack

## Other Activities

Aquifer Test: Well Development Date: 8/28/97
Description: Pumped at 30gpm for 10 minutes with 0.038' drawdown, stepped to 60gpm for 32 minutes with 0.079' drawdown.

Well Abandoned: Y ___ N ✓ Date: _____
Description: _____

## Well Survey Data

Date: 10/1/97
Protective Casing Elevation: 143.789 m (NAVD 88)
Washington State Plane Coordinates: N 151,165.653 m E 572,453.955 m
Brass Cap Elevation: 142.845 m (NAVD88)

Comments/Remarks: CS = carbon steel, SS = stainless steel
Volume calculations: cement grout = 1.285 ft³ x 84 = 107.94 ft³
10-20 sand = 1.07 ft³ x 54 = 57.78 ft³
Pad + posts 9/2/97

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 10/22/97

Reported By: John Inter
Title: Sr. Dir. Engr
Signature: [signature]
Date: 10/28/97

BHI-EE-181 (2/97)

# WELL CONSTRUCTION SUMMARY REPORT

Start Date 8/11/97
Finish Date 9/2/97
Page 1 of 1

Specification No. 0100G-SC-G004 Rev. No. _____

Well No. B8071 Temp. Well No. 199-D4-13

ECNs: NA
Project: 100-HR-3 Hot Spot Phase II Drilling
Drilling Company: Layne Christensen Co.
Driller: Wilburn Franklin

Approximate Location: 3700' West of 100-DR Reactor
Other Companies: CH
Geologist (s): D.C. Weekes

## Temporary Casing and Drill Depth

| *Size/Grade/Lbs per Ft. | Interval | Shoe O.D./I.D. |
|---|---|---|
| CS-FJ | 0' - ~~100.3~~ 100.6 per 9/2/97 | 10¾"/10" |

*Indicate Welded (W) - Flush Joint (FJ) - Coupled (C) & Thread Design

Total Drilled Depth 101' Hole Dia. @ TD 12"
Well Straightness Test Result NA

## Drilling Method/Hole Diameter

| | | Dia. From | to |
|---|---|---|---|
| Auger: | | | |
| Cable Tool: | | | |
| Air Rotary: Tubex | ✓ | 0' | 101' |
| A.R. w/Sonic: | | | |

Drilling Fluid: Air
Total Amt. of Water Added During Drilling: 550 gallons
Static Water Level: 76.78 Date: 8/16/97

## Geophysical Logging

| Sondes (type) | Interval | Date | Sondes (type) | Interval | Date |
|---|---|---|---|---|---|
| NA | | | | | |

## Completed Well

| Size/Wt./Material | Depth | Thread | Slot Size |
|---|---|---|---|
| 6" ID CS | +3.2' - 71.8' | FJ | NA |
| 6" ID wire wrap SS | 71.8' - 91.8' | FJ | 0.040-in |
| 6" ID SS | 91.8' - 94.8' | FJ | NA |

| Type | Interval | Volume | Mesh Size |
|---|---|---|---|
| Annular Seal/Filter Pack | | | |
| Colorado Silica Sand | 90.2' - 100.3' | 6x100# | 8-12 |
| Colorado Silica Sand | 61.8' - 90.2' | 38.5x100# | 8-16 |
| Colorado Silica Sand | 56.6' - 61.8' | 2.5x100# | 10-20 |
| Portland cement | 0' - 56.6' | 43x94# | NA |

## Other Activities

Aquifer Test: Well Development Date: 8/26/97
Description: Pumped at 26 gpm for 19 minutes with 11.2' drawdown, then stepped to 15 gpm for 30 minutes with 5.8' drawdown, then stepped to 20 gpm for 31 min (9.2' drawdown)

Well Abandoned: Y ___ N ✓ Date: _____
Description: _____

## Well Survey Data

Date: 10/1/97
Washington State Plane Coordinates: N 151,424.474 m E 572,665.855 m

Protective Casing Elevation: 143.831 m (NAVD88)
Brass Cap Elevation: 142.942 m (NAVD88)

Comments/Remarks: CS = carbon steel, SS = stainless steel
Volume calculations: Portland cement = 1.285 ft³ x 43 = 55.255 ft³
10-20 sand = 1.07 ft³/sack x 2.5 = 2.675 ft³
Pad & Posts 9/2/97 8-12 + 8-16 sand = 1.01 ft³/sack x 44.5 = 44.945 ft³

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 10/22/97

Reported By: [illegible]
Title: Sr. Dr. [illegible]
Signature: [illegible]
Date: 10/28/97

BHI-EE-181 (2/97)

# WELL CONSTRUCTION SUMMARY REPORT

Start Date 7/28/97
Finish Date 9/2/97
Page 1 of 1

Specification No. 01000-SC-G004 Rev. No. _____

Well No. 199-D4-14 Temp. Well No. B8072

ECNs: NA
Project: 100-HR-3 Hot Spot Phase II Drilling
Drilling Company: Layne Christensen Co.
Driller: Willie Franklin

Approximate Location: West of 100 D/DR Reactors
Other Companies: CH
Geologist (s): D.C. Weekes

## Temporary Casing and Drill Depth

| *Size/Grade/Lbs per Ft. | Interval | Shoe O.D./I.D. |
|---|---|---|
| 10¾" FJ - CS | 0' - 101.9' | 10¾"/10" |

*Indicate Welded (W) - Flush Joint (FJ) - Coupled (C) & Thread Design

Total Drilled Depth 101.9' Hole Dia. @ TD 12"
Well Straightness Test Result _____

## Drilling Method/Hole Diameter

| | | | |
|---|---|---|---|
| Auger: | Dia. From | to | |
| Cable Tool: | Dia. From | to | |
| Air Rotary: | Dia. From | to | |
| A.R. w/Sonic: | Dia. From | to | |
| Tubex - Air | Dia. From 0' | to 101.9' | |

Drilling Fluid: Air
Total Amt. of Water Added During Drilling: 340 gallons
Static Water Level: 78.03' Date: 8/2/97

## Geophysical Logging

| Sondes (type) | Interval | Date |
|---|---|---|
| NA | | |

## Completed Well

| Size/Wt./Material | Depth | Thread | Slot Size |
|---|---|---|---|
| 6" Type 304 SS | 96.12' - 99.11' | FJ | NA |
| 6" Type 304 SS | 76.08' - 96.12' | FJ | 0.020-in |
| 6" Carbon Steel | +3.1' - 76.08' | FJ | NA |

| Type | Interval | Volume | Mesh Size |
|---|---|---|---|
| Annular Seal/Filter Pack 47.9 | | | |
| Colorado Silica | 60.9' - 100.1' | ~~54 ft³~~ | 10-20 |
| Cement | 0' - 60.9' | 35 ft³ | NA |

## Other Activities

Aquifer Test: Well Development Date: 8/27/97
Description: Pumped at 26 gpm for 31 minutes with 4.7' drawdown, then stepped to 35 gpm for 26 minutes with 7.4' drawdown.

Well Abandoned: Y __ N ✓ Date: _____
Description: _____

## Well Survey Data

Date: 10/1/97
Washington State Plane Coordinates: N 151,641.640 m E 572,839.812 m

Protective Casing Elevation: 144.338 m (NAVD88)
Brass Cap Elevation: 143.467 m (NAVD88)

Comments/Remarks: SS = Stainless steel CS = carbon steel
Volume calculations: Portland cement = 1.285 ft³/sack x 27¼ = 35 ft³
10-20 sand = 1.07 ft³/sack x 44¾ = 47.9 ft³

Pad & Posts 9/2/97

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 10/22/97

Reported By: John Hutter
Title: Sr. Drl. Engr.
Signature: [illegible]
Date: 10/28/97

BHI-EE-181 (2/97)

# WELL CONSTRUCTION SUMMARY REPORT

Start Date 8/5/97
Finish Date 9/2/97
Page 1 of 1

Specification No. 01006-SC-G004 Rev. No. _____

Well No. B8073 Temp. Well No. 199-D4-15

ECNs: NA
Project: 100-HR-3 Hot Spot Phase II Drilling
Drilling Company: Layne Christensen Co.
Driller: Wilburn Franklin

Approximate Location: 2600' W of 100-DR Reactor
Other Companies: CH
Geologist (s): D.C. Weekes

## Temporary Casing and Drill Depth

| *Size/Grade/Lbs per Ft. | Interval | Shoe O.D./I.D. |
|---|---|---|
| CS-FJ | 0'-104.5' | 10¾"/10" |

*Indicate Welded (W) - Flush Joint (FJ) - Coupled (C) & Thread Design

Total Drilled Depth 105 ft Hole Dia. @ TD 12"
Well Straightness Test Result NA

## Drilling Method/Hole Diameter

| | | | |
|---|---|---|---|
| Auger: | Dia. From | to | |
| Cable Tool: | Dia. From | to | |
| Air Rotary: Tubex ✓ | Dia. From 0' | to 105' | |
| A.R. w/Sonic: | Dia. From | to | |

Drilling Fluid: Air
Total Amt. of Water Added During Drilling: 600 gallons
Static Water Level: 78.08 Date: 8/9/97

## Geophysical Logging

| Sondes (type) | Interval | Date | Sondes (type) | Interval | Date |
|---|---|---|---|---|---|
| NA | | | | | |

## Completed Well

| Size/Wt/Material | Depth | Thread | Slot Size |
|---|---|---|---|
| 6" ID CS | +2.3'-77.64' | FJ | NA |
| 6" ID wire wrap SS | 77.64'-97.64' | FJ | 0.040-in |
| 6" ID SS | 97.64'-100.63' | FJ | NA |

| Type | Interval | Volume | Mesh Size |
|---|---|---|---|
| Annular Seal/Filter Pack | | | |
| Cement grout | 0'-62.6' | 48 x 94# | NA |
| Colorado Silica Sand | 62.6'-68' | 2½ x 100# | 10-20 |
| Colorado Silica Sand | 68'-104.5' | 34½ x 100# | 8-16 |

## Other Activities

Aquifer Test: Well Development Date: 8/27/97
Description: Pumped at 25 gpm for 23 minutes with 0.48' drawdown, then stepped to 60 gpm for 52 minutes with 1.3' drawdown.

Well Abandoned: Y ___ N ✓ Date: _____
Description: _____

## Well Survey Data

Date: 10/1/97
Washington State Plane Coordinates: N 151,424.862 m, E 572,936.636 m

Protective Casing Elevation: 144.565 m (NAVD88)
Brass Cap Elevation: 143.658 m (NAVD88)

Comments/Remarks: CS = carbon steel, SS = stainless steel

Volume calculations: Portland cement = 1.285 ft³ x 48 = 61.68 ft³
10-20 sand = 1.07 ft³/sack x 2.5 = 2.675 ft³
Pad + Posts 9/2/97 8-16 sand = 1.01 ft³/sack x 34.5 = 34.845 ft³

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 10/22/97

Reported By: John Auren
Title: Sr. Drl Engr
Signature: [illegible]
Date: 10/28/97

BHI-EE-181 (2/97)

# WELL COMPLETION LOG

Date: 8/21/97
Page 1 of 6

Well No.: 199-D3-2 | Project: 100-HR-3 Hot Spot Phase 2 | Location: ~4600' West of 100-DR | Drilling Contractor: Layne Christensen

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth (bgs) | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments Note: Total casing usually includes lifting bail |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1420 | 110.8 | 1.4 | 109.4 | 108.8 | — | 108.8 | 107.4 | 2.0 | 10-20 sand | 1/2 | 100# sack | WL @ 76.54' bgs Initial reading showed Added sand Depth to bot. 108.9'. |
| 1422 | 110.8 | 2.7 | 108.1 | 110.8 | — | 110.8 | 108.1 | 0 | — | — | — | Backpulled 1.3 ft |
| 1425 | 110.8 | 2.7 | 108.1 | 109.3 | — | 109.3 | 106.6 | 1.5 | 10-20 sand | 1/2 | 100# sack | Added sand |
| 1543 | 110.8 | 2.7 | 108.1 | 106.6 | — | 106.6 | 103.9 | 4.2 | 10-20 sand | 1 | 100# sack | installed screen assembly Added sand |
| 1550 | 110.8 | 4.8 | 106 | 109.9 | — | 109.9 | 105.1 | 0.9 | — | — | — | Backpulled 2.1 ft |
| 1552 | 110.8 | 4.8 | 106 | 107.1 | — | 107.1 | 102.3 | 3.7 | 10-20 sand | 1 | 100# sack | Added sand |
| 1554 | 110.8 | 6.4 | 104.4 | 109.9 | — | 109.9 | 103.5 | 0.9 | — | — | — | Backpulled 1.6 ft |
| 1555 | 110.8 | 6.4 | 104.4 | 107 | — | 107 | 100.6 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1557 | 110.8 | 8.6 | 102.2 | 110 | — | 110 | 101.4 | 0.8 | — | — | — | Backpulled 2.2 ft |
| 1558 | 110.8 | 8.6 | 102.2 | 106.7 | — | 106.7 | 98.1 | 4.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1559 | 110.8 | 9.3 | 101.5 | 108 | — | 108 | 98.7 | 2.8 | — | — | — | Backpulled 0.7 ft |
| 1617 | 105.8 | 5.6 | 100.2 | 105.1 | — | 105.1 | 99.5 | 0.7 | — | — | — | Removed 5 ft of casing Backpulled 1.3 ft |
| 1618 | 105.8 | 5.6 | 100.2 | 101.7 | — | 101.7 | 96.1 | 4.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1620 | 105.8 | 8.2 | 97.6 | 105 | — | 105 | 96.8 | 0.8 | — | — | — | Backpulled 2.6 ft Dropped 3.3 ft |
| 1621 | 105.8 | 8.2 | 97.6 | 101.8 | — | 101.8 | 93.6 | 4.0 | 10-20 sand | 1 | 100# sack | Added sand |
| 1625 | 105.8 | 10.2 | 95.6 | 104.3 | — | 104.3 | 94.1 | 1.5 | — | — | — | Backpulled 2.0 ft Dropped 2.5 ft |
| 1629 | 105.8 | 10.2 | 95.6 | 101 | — | 101 | 90.8 | 4.8 | 10-20 sand | 1 | 100# sack | Added sand |
| 1632 | 105.8 | 13 | 92.8 | 104.7 | — | 104.7 | 91.7 | 1.1 | — | — | — | Backpulled 2.8 ft |
| 1644 | ~~95~~ 94.8 8/28/97 | 1.9 | 92.9 | 93.8 | — | 93.8 | 91.9 | 1.0 | 10-20 sand | 0 | 100# sack | Added sand (none added) Removed 10 ft |
| 1650 | 94.8 | 1.9 | 92.9 | 93.8 | — | 93.8 | 91.9 | 1.0 | — | — | — | WL = 76.7 ft bgs Bottom of 6" tail = 105.29' bgs |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9 8 sacks of 10-20 mesh sand used today.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/22/97
Page 2 of 6

Well No.: 199-D3-2 | Project: 100-HR-3 Hot Spot Phase 2 | Location: ~4600' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1030 | 94.8 | 1.9 | 92.9 | 93.7 | — | 93.7 | 91.8 | 1.1' | — | — | — | WL = 76.75' @ 1015 hrs Initial reading tailpipe clean |
| 1040 ~~1100~~ | 94.8 | 1.9 | 92.9 | 92.9 | — | 92.9 | 91.0 | 1.9 | 10-20 sand | 1/2 | 100# sack | |
| 1100 | 94.8 | 1.9 | 92.9 | 92.9 | — | 92.9 | 91.0 | 1.9 | 10-20 sand | 1/2 | 100# sack | Surged 20 minutes and added sand |
| 1145 | 94.8 | 1.9 | 92.9 | 92.9 | — | 92.9 | 91.0 | 1.9 | 10-20 sand | 1/2 | 100# sack | Surged 45 minutes and added sand |
| 1304 | 95.8 | 3.0 | 92.8 | 95.1 | — | 95.1 | 92.1 | 0.7 | — | — | — | Total casing includes bail |
| 1307 | 95.8 | 3.2 | 92.6 | 95.4 | — | 95.4 | 92.2 | 0.4 | — | — | — | Backpulled 0.2 ft |
| 1308 | 95.8 | 3.2 | 92.6 | 91.7 | — | 91.7 | 88.5 | 4.1 | 10-20 sand | 1 | 100# sack | |
| 1310 | 95.8 | 5.0 | 90.8 | 95.7 | — | 95.7 | 90.7 | 0.1 | — | — | — | Backpulled |
| 1313 | 95.8 | 5.0 | 90.8 | 92.7 | — | 92.7 | 87.7 | 3.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1314 | 95.8 | 6.7 | 89.1 | 95.3 | — | 95.3 | 88.6 | 0.5 | — | — | — | Backpulled 1.7 ft |
| 1317 | 95.8 | 6.7 | 89.1 | 92.0 | — | 92 | 85.3 | 3.8 | 10-20 sand | 1 | 100# sack | Added sand |
| 1328 | 89.8 | 2.7 | 87.1 | 88.9 | — | 88.9 | 86.2 | 0.9 | — | — | — | Backpulled 2.0 ft Removed 3 ft of casing tail |
| 1330 | 89.8 | 2.7 | 87.1 | 85.7 | — | 85.7 | 83 | 4.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1350 | 89.8 | 2.7 | 87.1 | 89.2 | — | 89.2 | 86.5 | 0.6 | — | — | — | Surged 13 mins |
| 1355 | 89.8 | 2.7 | 87.1 | 85.9 | — | 85.9 | 83.2 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1413 | 89.8 | 2.7 | 87.1 | 89.1 | — | 89.1 | 86.4 | 0.7 | — | — | — | Surged 13 mins. |
| 1419 | 89.8 | 2.7 | 87.1 | 85.7 | — | 85.7 | 83 | 4.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1444 | 89.8 | 2.7 | 87.1 | 89.8 | — | 89.8 | 87.1 | 0 | — | — | — | Surged 25 mins |
| 1448 | 89.8 | 2.7 | 87.1 | 86.5 | — | 86.5 | 83.8 | 3.3 | 10-20 sand | 1 | 100# sack | Added sand |
| 1458 | 89.8 | 2.7 | 87.1 | 89.2 | — | 89.2 | 86.5 | 0.6 | — | — | — | Surged 10 mins. |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

8 1/2 Sacks of 10-20 mesh sand used today (on this page)

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/22/97
Page 3 of 6

Well No.: 199-D3-2 | Project: 100-HR-3 Hot Spot Phase 2 | Location: ~4600' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1542 | 89.8 | 2.7 | 87.1 | 85.9 | — | 89 | 83.2 | 3.9 | 10-20 Sand | 1 | 100# sack | Added sand |
| 1609 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 26 min. |
| 1614 | 89.8 | 2.7 | 87.1 | 85.9 | — | 85.9 | 83.2 | 3.9 | 10-20 Sand | 1 | 100# sack | Added sand |
| 1624 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 10 min |
| 1626 | 89.8 | 2.7 | 87.1 | 86.1 | — | 86.1 | ~~87.1~~ 83.4 | 3.7 | 10-20 Sand | 1 | 100# sack | Added sand |
| 1636 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 10 min |
| 1641 | 89.8 | 2.7 | 87.1 | 85.7 | — | 85.7 | 83 | 4.1 | 10-20 Sand | 1 | 100# sack | Added sand |
| 1650 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 6 min |
| | ↓ | ↓ | ↓ | ~~85.7~~ 85.4 | — | 85.7 | 83 | 4.1 | 10-20 Sand | 1 | 100# | Added sand |
| | | | | 89.2 | — | 89.2 | 86.5 | 0.6 | — | — | — | Surged 8 min |
| 1701 | ↓ | ↓ | ↓ | 86 | — | 86 | 83.3 | 3.8 | 10-20 Sand | 1 | 100# | Added sand |
| 1709 | 89.8 | 2.7 | 87.1 | 89.0 | — | 89.0 | 86.3 | 0.8 | — | — | — | Surged 8 min |
| 1713 | 89.8 | 2.7 | 87.1 | 85.6 | — | 85.6 | 82.9 | 4.2 | 10-20 Sand | 1 | 100# | Added sand |
| | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 11 min. |
| 1728 | 89.8 | 2.7 | 87.1 | 85.8 | — | 85.8 | 83.1 | 4.0 | 10-20 Sand | 1 | 100# | Added sand |
| 3/23 0755 | 89.8 | 2.7 | 87.1 | 85.8 | — | 85.8 | 83.1 | 4.0 | — | — | — | Initial reading WL = 76.75' bgs |
| 0814 | 89.8 | 2.7 | 87.1 | 89.2 | — | 89.2 | 86.5 | 0.6 | — | — | — | Surged 17 min. |
| 0820 | 89.8 | 2.7 | 87.1 | 85.9 | — | 85.9 | 83.2 | 3.9 | 10-20 Sand | 1 | 100# sack | Added sand |
| 0837 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 15 min. |
| 0845 | 89.8 | 2.7 | 87.1 | 85.9 | — | 85.9 | 83.2 | 3.9 | 10-20 Sand | 1 | 100# sack | Added sand |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9 10 sacks of 10-20 mesh sand used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L. D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/23/97
Page 4 of 6

Well No.: 199-D3-2 | Project: 100-HR3 Hot Spot Phase 2 | Location: ~4600' W of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0904 | 89.8 | 2.7 | 87.1 | 89.3 | — | 89.3 | 86.6 | 0.5 | — | — | — | Surged 22 min. |
| 0912 | 89.8 | 2.7 | 87.1 | 85.8 | — | 85.8 | 83.1 | 4.0 | 10-20 sand | 1 | 100# sack | Added sand |
| 0938 | 89.8 | 2.7 | 87.1 | 85.8 | — | 85.8 | 83.1 | 4.0 | 10-20 sand | 1 | 100# sack | Surged 22 min + added sand |
| 1011 | 89.8 | 2.7 | 87.1 | 85.8 | — | 85.8 | 83.1 | 4.0 | 10-20 sand | 1 | 100# sack | Surged 27 min + added sand |
| 1147 | 90.8 | 3.7 | 87.1 | 88.9 | — | 88.9 | 85.2 | 1.9 | 10-20 sand | 1/3 | 100# sack | Surged 77 min + added sand, added lift bail |
| 1150 | 90.8 | ~~3.7~~ 4.6 | 86.2 | 90.6 | — | 90.6 | 86 | 0.2 | — | — | — | Backpulled 0.9 ft |
| 1151 | 90.8 | 4.6 | 86.2 | 88.5 | — | 88.5 | 83.9 | 2.3 | 10-20 sand | 2/3 | 100# sack | Added sand |
| 1152 | 90.8 | 5.6 | 85.2 | 90.2 | — | 90.2 | 84.6 | 0.6 | — | — | — | Backpulle d1.0 ft |
| 1153 | 90.8 | 5.6 | 85.2 | 87.3 | — | 87.3 | 81.7 | 3.5 | 10-20 sand | 1 | 100# sack | Added sand |
| 1154 | 90.8 | 7.7 | 83.1 | 90.3 | — | 90.3 | 82.6 | 0.5 | — | — | — | Backpulled 2.1 ft |
| 1156 | 90.8 | 7.7 | 83.1 | 86.9 | — | 86.9 | 79.2 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1158 | 90.8 | 8.7 | 82.1 | 88.6 | — | 88.6 | 79.9 | 2.2 | — | — | — | Backpulled 1.0 ft |
| 1250 | 84.8 | 2.7 | 82.1 | 79.2 | — | 79.2 | 76.5 | 5.6 | 10-20 sand | 1 | 100# sack | Removed 5 ft of casing, Added sand |
| 1300 | 84.8 | 2.7 | 82.1 | 80 | — | 80 | 77.3 | 4.8 | 10-20 sand | 1 | 100# sack | Surged 4 min + added sand |
| 1309 | 84.8 | 2.7 | 82.1 | 80.3 | — | 80.3 | 77.6 | 4.5 | 10-20 sand | 1 | 100# sack | Surged 5 min + added sand |
| 1320 | 84.8 | 2.7 | 82.1 | 80 | — | 80 | 77.3 | 4.8 | 10-20 sand | 1 | 100# sack | Surged 8 min + added sand |
| 1333 | 84.8 | ~~2.7~~ 2.2 | 82.1 | 80.6 | — | 80.6 | 77.9 | 4.2 | 10-20 sand | 1 | 100# sack | Surged 8 min + added sand |
| 1338 | 84.8 | 2.7 | 82.1 | 80.7 | — | 80.7 | 78 | 4.1 | 10-20 sand | 1 | 100# sack | Surged 3 min + added sand |
| 1428 | 85.8 | 3.7 | 82.1 | 85.3 | — | 85.3 | 81.6 | 0.5 | — | — | — | Added lift bail after surging for 52 minutes. |
| 1442 | 85.8 | 3.7 | 82.1 | 89.7 | — | 89.7 | 86 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9 13 sacks of 10-20 sand used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/23/97
Page 5 of 6

Well No.: 199-D3-2 | Project: 100-HR-3 Hot Spot Phase 2 | Location: ~4600' W of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1443 | 85.8 | 4.7 | 81.1 | 86 | — | 86 | 81.3 | 0.2 open | — | — | — | Backpulled 1.0 ft Prob. stayed open |
| 1445 | 85.8 | 4.7 | 81.1 | 83 | — | 83 | 78.3 | 2.8 | 10-20 sand | 2 | 100# sack | Added sand |
| 1446 | 85.8 | 4.9 | 80.9 | 85.5 | — | 85.5 | 80.6 | 0.3 | — | — | — | Backpulled 0.2 ft |
| 1448 | 85.8 | 4.9 | 80.9 | 81.9 | — | 81.9 | 77 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1449 | 85.8 | 5.3 | 80.5 | 85.3 | — | 85.3 | 80 | 0.5 | — | — | — | Backpulled 0.4 ft |
| 1453 | 85.8 | 5.3 | 80.5 | 79.9 | — | 79.9 | 74.6 | 5.9 | 10-20 sand | 2 | 100# sack | Added sand |
| 1454 | 85.8 | 6.1 | 79.7 | 85.9 | — | 85.9 | 79 | 0.1 open | — | — | — | Backpulled 0.8 ft Prob. stayed open |
| 1456 | 85.8 | 6.1 | 79.7 | 80.8 | — | 80.8 | 74.7 | 5.0 | 10-20 sand | 2 | 100# sack | Added sand |
| 1457 | 85.8 | 7.1 | 78.7 | 86.1 | — | 86.1 | 79 | 0.3 open | — | — | — | Backpulled 1.0 ft no |
| 1458 | 85.8 | 7.1 | 78.7 | 82.7 | — | 82.7 | 75.6 | 3.1 | 10-20 sand | 2 | 100# sack | Added sand |
| 1500 | 85.8 | 7.4 | 78.4 | 84 | — | 84 | 76.6 | 1.8 | — | — | — | Backpulled 0.3 ft |
| 1502 | 85.8 | 7.4 | 78.4 | 81.1 | — | 81.1 | 73.7 | 4.7 | 10-20 sand | 1 | 100# sack | Added sand |
| 1502 | 85.8 | 8.0 | 77.8 | 84.8 | — | 84.8 | 76.8 | 1.0 | — | — | — | Backpulled 0.6 ft |
| 1505 | 85.8 | 8.0 | 77.8 | 78.4 | — | 78.4 | 70.4 | 7.4 | 10-20 sand | 2 | 100# sack | Added sand |
| 1512 | 80.8 | 4.0 | 76.8 | 79.3 | — | 79.3 | 75.3 | 1.5 | — | — | — | Backpulled 1.0 ft and removed 5 ft of casing |
| 1515 | 80.8 | 4.0 | 76.8 | 73 | — | 73 | 69 | 7.8 | 10-20 sand | 2 | 100# sack | Added sand |
| 1525 | 75.8 | 2.7 | 73.1 | 74.5 | — | 74.5 | 71.8 | 1.3 | — | — | — | Backpulled ft & removed 5 ft of casing + |
| 1527 | 75.8 | 2.7 | 73.1 | 73.3 | — | 73.3 | 70.6 | 2.2 | 10-20 sand | 1/2 | 100# sack | Added sand |
| 1710 | 75.8 | 2.7 | 73.1 | 74.5 | — | 74.5 | 71.8 | 1.3 | — | — | — | Bailed out ~350 gallons of water |
| 1052 | 75.8 | 3.9 | 71.9 | 71.9 | — | 71.9 | 71.9 | 0 | 70/30 grit | 70# | # | Added sand & backpulled 1.2 ft Top of sand at 71.9 ft. |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

14 1/2 sacks of 10-20 mesh sand used on this sheet.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/25/97
Page 6 of 6

Well No.: 199-D3-2 | Project: 100-HR-3 Hotspot Ph. 2 | Location: ~4600' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor. Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1115 | 75.8 | 3.9 | 71.9 | 50.8 [illegible] 8/25/97 | — | 50.8 from est | 46.9 | 25 | PC I-II | 7 | 94# sack | Mud wt = 16.1 #/gal |
| 1210 | 65.8 | 4.5 | 61.3 | 60.7 | — | 60.7 | 56.2 | 5.1 | — | — | — | Back pulled 10.6 ft + removed 10 ft of casing |
| 1221 | 65.8 | 4.5 | 61.3 | 35.8 | — | 35.8 from est. | 31.3 | 30 | PC I-II | 9 | 94# sack | Mud wt = 16 #/gal. |
| 1245 | 45.8 | 5.3 | 40.5 | 44 | — | 44 | 38.7 | 1.8 | — | — | — | Backpulled 20.8 ft and removed 20 ft of casing |
| 1257 | 45.8 | 5.3 | 40.5 | 20 est. | — | 20 est. | 14.7 | 25.8 | PC I-II | 8 | 94# sack | Mud wt = 16 #/gal |
| 1315 | 25.8 | 4.1 | 21.7 | 30 est. | — | 30 est. | 25.9 | 4.2 open (no collapse) | — | — | — | Backpulled 8.8 ft and removed 20 ft of casing |
| 1338 | 25.8 | 4.1 | 21.7 | 9.8 est | — | 9.8 est | 5.7 | 11.9 | PC I-II | 8 | 94# sack | Mud wt = 15.8 #/gal |
| 1355 | 15.8 | 4.3 | 11.5 | 15.9 | — | 15.9 | 11.6 | 0.1 open | — | — | — | Backpulled 10.2 ft and removed 10 ft of casing |
| 1410 | 15.8 | 4.3 | 11.5 | 15.9 | — | 15.9 | 11.6 | 0.1 open | PC I-II | 8 | 94# sack | Mud wt = 15.8 #/gal |
| 1425 | 15.8 | 4.3 | 11.5 | 10 est | — | 10 est | 5.7 | 5.8 | PC I-II | 7 | 94# sack | Mud wt = 15.8 #/gal |
| 1459 | 15.8 | 4.3 | 11.5 | 8 est | — | 8 est | 3.7 | 7.8 | PC I-II | 8 | 94# sack | Mud wt = 15.6 #/gal |
| 1520 | 0 | 0 | 0 | 7.5 | — | 7.5 | 7.5 | 7.5 open | — | — | — | Backpulled 11.5 ft + remoted 15.8 ft (no collapse) |
| 1538 | 0 | 0 | 0 | 7.5 | — | 7.5 | 7.5 | 7.5 open | PC I-II | 7½ | 94# sack | All temp casing out of hole Mud wt = 15.8 #/gal. |
| 1554 | 0 | 0 | 0 | 8.0 | — | 8.0 | 8.0 | 8.0 open | PC I-II | 4½ | 94# sack | No collapse Mud wt not measured |
| 1606 | 0 | 0 | 0 | 7.5 | — | 7.5 | 7.5 | 7.5 open | PC I-II | 7 | 94# sack | No collapse Mud wt = 15.6 #/gal |
| 1620 | 0 | 0 | 0 | 6 | — | 6 | 6 | 6 open | PC I-II | 3 | 94# sack | Mud wt not measured |
| 8/27 0920 | 0 | 0 | 0 | — | — | — | — | — | PC I-II | 7 | 94# sack | Mud wt not measured |
| | | | | | | | | | | | | Well cemented to surface. |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9 84 sacks of Portland cement used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/28/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/14/97
Page 1 of 5

Well No.: 199-D4-13 (B8071) Project: 100-HR-3 Location: 3700' West of 100-DR Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth (bgs) | 9. Ovelap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0805 | 104.8 | 4.2 | 100.6 | 104.5 | 0 | 104.5 | 100.3 | 0.3 | — | — | — | Initial reading WL=76.5' Screen set at depth |
| 0833 | 105.8 | ~~4.2~~ 5.2 | 100.6 | 99.7 | 0 | 99.7 | 94.5 | 6.1 | 8-12 sand | 3 | 100# sack | Added bail to casing |
| 0841 | 105.8 | 8.7 | 97.1 | 104.9 | 0 | 104.9 | 96.2 | 0.9 | — | — | — | Backpulled 3.5 ft |
| 0847 | 105.8 | 8.7 | 97.1 | 102 | 0 | 102 | 93.3 | 3.8 | 8-12 sand | 1 | 100# sack | Added sand |
| 0849 | 105.8 | 10.0 | 95.8 | 104.3 | 0 | 104.3 | 94.3 | 1.5 | — | — | — | Backpulled 1.3 ft |
| 0852 | 105.8 | 10.0 | 95.8 | 100.9 | 0 | 100.9 | 90.9 | 4.9 | 8-12 sand | 1 | 100# sack | Added sand |
| 0854 | 105.8 | 11.9 | 93.9 | 104.3 | 0 | 104.3 | 92.4 | 1.5 | — | — | — | Backpulled 1.9 ft |
| 0859 | 105.8 | 11.9 | 93.9 | 100.8 | 0 | 100.8 | 88.9 | 5.0 | 8-12 sand | 1 | 100# sack | Added sand |
| 0901 | 105.8 | 13.6 | 92.2 | 103.3 | 0 | 103.3 | 89.7 | 2.2 | — | — | — | Backpulled 1.7 ft |
| 0915 | 95.8 | 3.6 | 92.2 | 93.5 | 0 | 93.5 | ~~93.5~~ 89.7 | 2.2 | — | — | — | Removed 10 ft of casing |
| 0919 | 95.8 | 5.0 | 90.8 | 95.2 | 0 | 95.2 | 90.2 | 0.6 | — | — | — | Backpulled 1.4 ft |
| 0925 | 95.8 | 5.0 | 90.8 | 92.5 | 0 | 92.5 | 87.5 | 3.3 | 8-16 sand | 1 | 100# sack | Added sand |
| 0926 | 95.8 | 7.3 | 88.5 | 95.3 | 0 | 95.3 | 88 | 0.5 | — | — | — | Backpulled 2.3 ft |
| 0928 | 95.8 | 7.3 | 88.5 | 91.9 | 0 | 91.9 | 84.6 | 3.9 | 8-16 sand | 1 | 100# sack | Added sand |
| 0930 | 95.8 | 9.2 | 86.6 | 94.2 | 0 | 94.2 | 85 | 1.6 | — | — | — | Backpulled 1.9 ft |
| 0948 | ~~90.8~~ 89.8 | 3.0 | 86.8 | 85.8 | 0 | 85.8 | 82.8 | 4.1 | 8-16 sand | 1 | 100# sack | Removed 5 ft of casing & head WL=76.56 ft bgs see surge log |
| 1042 | 90.8 | 4.0 | 86.8 | 87.4 | 0 | 87.4 | 83.4 | 3.4 | — | — | — | Backpulled 2.5 ft |
| 1047 | 90.8 | 6.5 | 84.3 | 90.2 | 0 | 90.2 | 83.7 | 0.6 | — | — | — | Added sand |
| 1050 | 90.8 | 6.5 | 84.3 | 86.6 | 0 | 86.6 | 80.1 | ~~2.3~~ 4.3 | 8-16 sand | 1 | 100# sack | Backpulled 0.8 ft |
| 1051 | 90.8 | 7.3 | 83.5 | 89 | 0 | 89 | 81.7 | 1.8 | — | — | — | |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

6 sacks of 8-12 used on this page
4 sacks of 8-16 " " " "

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/16/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/14/97
Page 2 of 5

Well No.: 199-D4-13(B8071) | Project: 100-HR-3 | Location: 3700' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1100 | 90.8 | 7.3 | 83.5 | 85.5 | 0 | 85.5 | 78.2 | 5.3 | 8-16 sand | 1 | 100# sack | Removed 5 ft of casing Add sand |
| 1105 | 90.8 | 8.9 | 81.9 | 86.2 | 0 | 86.2 | 77.3 | 4.6 | — | — | — | Backpulled 1.6 |
| 1109 | 84.8 | 2.7 | 82.1 | 80.3 | 0 | 80.3 | 77.6 | 4.5 | — | — | — | |
| 1200 | 85.8 | 5.3 | 80.5 | 85.4 | 0 | 85.4 | 80.1 | 0.4 | — | — | — | see surge block dev. log Backpulled 1.6 |
| 1203 | 85.8 | 5.3 | 80.5 | 82.1 | 0 | 82.1 | 76.8 | 3.7 | 8-16 sand | 1 | 100# sack | Added sand |
| 1254 | 85.8 | 6.4 | 79.4 | 85.9 | 0 | 85.9 | 79.5 | 0.1 open | — | — | — | Backpulled ft |
| 1257 | 85.8 | 6.4 | 79.4 | 80.1 | 0 | 80.1 | 73.7 | 5.7 | 8-16 sand | 2 | 100# sack | Added sand |
| 1259 | 85.8 | 6.9 | 78.9 | 85.5 | 0 | 85.5 | 78.6 | 0.3 | — | — | — | Backpulled 0.5 ft |
| 1301 | 85.8 | 6.9 | 78.9 | 81.2 | 0 | 81.2 | 74.3 | 4.6 | 8-16 sand | 2 | 100# sack | Added sand |
| 1304 | 85.8 | 7.3 | 78.5 | 85.9 | 0 | 85.9 | 78.6 | 0.1 open | — | — | — | Backpulled 0.4 ft |
| 1306 | 85.8 | 7.3 | 78.5 | 76.2 | 0 | 76.2 | 68.9 | 9.6 | 8-16 sand | 3 | 100# sack | Added sand |
| 1309 | 85.8 | 8.1 | 77.7 | 85.1 | 0 | 85.1 | 77 | 0.7 | — | — | — | Backpulled 0.8 ft |
| 1313 | 85.8 | 8.1 | 77.7 | 78.0 | 0 | 78.0 | 69.9 | 7.8 | 8-16 sand | 3 | 100# sack | Added sand |
| 1315 | 85.8 | 8.8 | 77.0 | 84.4 | 0 | 84.4 | 75.6 | 1.4 | — | — | — | Backpulled 0.7 ft |
| 1327 | 79.8 | 2.6 | 77.2 | 78.3 | 0 | 78.3 | 75.7 | 1.5 | 8-16 sand | — | — | Removed 5 ft of casing moved ~0.8 ft |
| 1329 | 79.8 | 2.6 | 77.2 | 77.1 | 0 | 77.1 | 74.5 | 2.7 | 8-16 sand | 1/2 | 100# sack | Added sand |
| 1337 | 79.8 | 2.6 | 77.2 | 78.6 | 0 | 78.6 | 76 | 1.2 | — | — | — | Lowered surge block to bottom Fell 1.5 ft |
| 1337 | 79.8 | 2.6 | 77.2 | 76.6 | 0 | 76.6 | 74 | 3.2 | 8-16 sand | 1/2 | 100# sack | Added sand |
| 1341 | 79.8 | 2.6 | 77.2 | 79.2 | 0 | 79.2 | 76.6 | 0.6 | — | — | — | Surged hole Fell 2.6 ft |
| 1343 | 79.8 | 2.6 | 77.2 | 78 | 0 | 78 | 75.4 | 1.8 | 8-16 sand | 1/2 | 100# sack | Added sand |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

13 1/2 sacks of 8-16 sand used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/16/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/14/97
Page 3 of 5

Well No.: 199-D4-13 | Project: 100-HR-3 | Location: 3700' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1348 | 79.8 | 2.6 | 77.2 | 79.9 | 0 | 79.9 | 77.3 | 0.1 open | — | — | — | Surged hole Fell 1.9 ft |
| 1351 | 79.8 | 2.6 | 77.2 | 76.6 | 0 | 76.6 | 74 | 3.2 | 8-16 sand | 1 | 100# sack | Added sand |
| 1356 | 79.8 | 2.6 | 77.2 | 79.7 | 0 | 79.7 | 77.1 | 0.1 | — | — | — | Surged hole Fell 3.1 ft |
| 1358 | 79.8 | 2.6 | 77.2 | 76.4 | 0 | 76.4 | 73.8 | 3.4 | 8-16 sand | 1 | 100# sack | Added sand |
| 1407 | 79.8 | 2.6 | 77.2 | 79.5 | 0 | 79.5 | 76.9 | 0.3 | — | — | — | Surged hole Fell 3.1 ft |
| 1409 | 79.8 | 2.6 | 77.2 | 76.4 | 0 | 76.4 | 73.8 | 3.4 | 8-16 sand | 1 | 100# sack | Added sand |
| 1427 | 79.8 | 2.6 | 77.2 | 79.3 | 0 | 79.3 | 76.7 | 0.5 | — | — | — | Surged hole Fell 2.9 ft in 18 min. |
| 1442 | 80.8 | 3.6 | 77.2 | 77.2 | 0 | 77.2 | 73.6 | 3.6 | 8-16 sand | 1 | 100# sack | Added sand |
| 1444 | 80.8 | 5.1 | 75.7 | 80.6 | 0 | 80.6 | 75.5 | 0.2 | — | — | — | Backpulled 1.5 ft |
| 1446 | 80.8 | 5.1 | 75.7 | 74.4 | 0 | 74.4 | 69.3 | 6.4 | 8-16 sand | 2 | 100# sack | Added sand |
| 1447 | 80.8 | 6.4 | 74.4 | 80.3 | 0 | 80.3 | 73.9 | 0.5 | — | — | — | Backpulled 1.3 ft |
| 1451 | 80.8 | 6.4 | 74.4 | 74.1 | 0 | 74.1 | 67.7 | 6.7 | 8-16 sand | 2 | 100# sack | Added sand |
| 1452 | 80.8 | 8.1 | 72.7 | 80.2 | 0 | 80.2 | 72.1 | 0.6 | — | — | — | Backpulled 1.7 ft |
| 1454 | 80.8 | 8.1 | 72.7 | 78.6 | 0 | 78.6 | 70.5 | 2.2 | 8-16 sand | 1 | 100# sack | Added sand |
| 1455 | 80.8 | 8.6 | 72.6 | 80.2 | 0 | 80.2 | 71.6 | 0.6 | — | — | — | Backpulled 0.5 ft |
| 1508 | 74.8 | 2.5 | 72.3 | 71.1 | 0 | 71.1 | 68.6 | 3.7 | 8-16 sand | 1 | 100# sack | Removed 5 ft of casing 96.5' for sand (1.5' fill in tail) |
| 1547 | 74.8 | 2.5 | 72.3 | 71.3 | 0 | 71.3 | 68.8 | 3.5 | — | — | — | Surged & bailed w/ bailer Took out ~100 gallons of water |
| 1700 | 74.8 | 2.5 | 72.3 | 72.4 | 0 | 72.4 | 69.9 | 2.4 | 8-16 sand | 1 | 100# sack | Surged then added sand |
| 8/15/97 0740 | 74.8 | 2.5 | 72.3 | 72.7 | 0 | 72.7 | 70.2 | 2.1 | — | — | — | INITIAL Reading |
| 0940 | 74.8 | 2.5 | 72.3 | ~~72.6~~ 74.6 JCW 8/15/97 | 0 | ~~72.6~~ 74.6 JCW 8/15/97 | 72.1 | 0.2 | — | — | — | Surged well w/ surge block for 103 min. |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

11 sacks of 8-16 sand used on this page

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/16/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/15/97
Page 4 of 5

Well No.: 199-D4-13 | Project: 100-HR-3 | Location: 3700' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0954 | 75.8 | 3.5 | 72.3 | 70.5 | 0 | 70.5 | 67 | 5.3' | 8-16 sand | 2 | 100# sack | Added lifting bail, added sand |
| 0955 | 75.8 | 4.5 | 71.3 | 75.5 | 0 | 75.5 | 71 | 0.3' | — | — | — | Backpulled 1 ft |
| 0957 | 75.8 | 4.5 | 71.3 | 72.2 | 0 | 72.2 | 67.7 | 3.6 | 8-16 sand | 1 | 100# sack | Added sand |
| 0958 | 75.8 | 5.3 | 70.5 | 75.4 | 0 | 75.4 | 70.1 | 0.4 | — | — | — | Backpulled 0.8 ft |
| 1000 | 75.8 | 5.3 | 70.5 | 72.2 | 0 | 72.2 | 66.9 | 3.6 | 8-16 sand | 1 | 100# sack | Added sand |
| 1001 | 75.8 | 6.1 | 69.7 | 75.3 | 0 | 75.3 | 69.2 | 0.5 | — | — | — | Backpulled 0.8 ft |
| 1003 | 75.8 | 6.1 | 69.7 | 72.2 | 0 | 72.2 | 66.1 | 3.6 | 8-16 sand | 1 | 100# sack | Added sand |
| 1004 | 75.8 | 7.2 | 68.6 | 75.9 | 0 | 75.9 | 68.7 | 0.1 open | — | — | — | Backpulled 1.1 ft |
| 1006 | 75.8 | 7.2 | 68.6 | 72.8 | 0 | 72.8 | 65.6 | 3.0 | 8-16 sand | 1 | 100# sack | Added sand |
| 1008 | 75.8 | 8.0 | 67.8 | 75.5 | 0 | 75.5 | 67.5 | 0.3 | — | — | — | Backpulled 0.8 ft |
| 1010 | 75.8 | 8.0 | 67.8 | 72.3 | 0 | 72.3 | 64.3 | 3.5 | 8-16 sand | 1 | 100# sack | Added sand |
| 1012 | 75.8 | 9.5 | 66.3 | 75.2 | 0 | 75.2 | 65.7 | 0.6 | — | — | — | Backpulled 1.5 ft |
| 1015 | 75.8 | 9.5 | 66.3 | 71.9 | 0 | 71.9 | 62.4 | 3.9 | 8-16 sand | 1 | 100# sack | Added sand |
| 1016 | 75.8 | 11.3 | 64.5 | 75.1 | 0 | 75.1 | 63.8 | 0.7 | — | — | — | Backpulled 1.8 ft |
| 1019 | 75.8 | 11.3 | 64.5 | 72.1 | 0 | 72.1 | 60.8 | 3.7 | 8-16 sand | 1 | 100# sack | Added sand |
| 1022 | 75.8 | 13.0 | 62.8 | 75.0 | 0 | 75.8 | 62 | 0.8 | — | — | — | Backpulled 2.9 ft |
| 1022 | 75.8 | ~~13.9~~ 13.0 | ~~61.9~~ 62.8 | 74.5 | 0 | 74.5 | 61.5 | 1.3 | 8-16 sand | 1/3 | 100# sack | Added sand |
| 1024 | 64.8 | 2.7 | 62.1 | 64.6 | 0 | 64.6 | 61.9 | 0.2 | — | — | — | Backpulled 0.7 ft, removed 10 ft of casing |
| 1043 | 64.8 | 2.7 | 62.1 | 63.8 | 0 | 63.8 | 61.1 | 1.0 | 8-16 sand | 1/3 | 100# sack | Added sand |
| 1443 | 64.8 | 2.7 | 62.1 | 64 | 0 | 64 | 61.3 | 0.8 | 8-16 sand | 1/3 | 100# sack | Added sand after surging & before bail & surging |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

10 sacks of 8-16 sand used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/16/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/15/97
Page 5 of 5

Well No.: 199-D4-13 | Project: 100-HR-3 | Location: 3700' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correct-ion | 7. Cor. Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material No Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1620 | 65.8 | 4.1 | 61.7 | 65.9 | 0 | 65.9 | 61.8 | 0.1 open | 8-16 sand | <1/4 | 100# sack | Added sand + backpulled 0.4 ft Top of 8-16 sand @ 61.8' |
| 1623 | 65.8 | 4.1 | 61.7 | 62.1 | 0 | 62.1 | 58 | 3.7 | 10-20 sand | 1 1/4 | 100# sack | Added sand |
| 1624 | 65.8 | 6.2 | 59.6 | 65.6 | 0 | 65.6 | 59.4 | 0.2 | — | — | — | Backpulled 2.1 ft |
| 1626 | 65.8 | 6.2 | 59.6 | 62.7 | 0 | 62.7 | 56.5 | 3.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1628 | 65.8 | 8.6 | 57.2 | 65.8 | 0 | 65.8 | 57.2 | 0 | — | — | — | Backpulled 2.4 ft |
| 1630 | 65.8 | 8.6 | 57.2 | 64.8 | 0 | 64.8 | 56.2 | 1.0 | 10-20 sand | 1/4 | 100# sack | Added sand |
| 1631 | 65.8 | 9.2 | 56.6 | 65.8 | 0 | 65.8 | 56.6 | 0 | — | — | — | Backpulled 0.6 ft Top of 10-20 sand @ 56.6' |
| 8/14/97 0745 | 55.8 | 3.6 | 52.2 | 60.2 | 0 | 60.2 | 56.6 | 4.4' open | — | — | — | Backpulled and removed 10 ft of casing - no hole collapse |
| 0810 | 55.8 | 3.6 | 52.2 | Treme Pipe meas. | 0 | Trem. Pipe meas. | 32.2 | 20 | PC I-II | 8 | 94# sack | No Bentonite added Mud weight = 15.5#/gal. |
| 0825 | 45.8 | 4.3 | 41.5 | 44 | 0 | 44 | 39.7 | 1.8 | — | — | — | Backpulled 10.7 ft and removed 10 ft of casing |
| 0845 | 45.8 | 4.3 | 41.5 | Visual est. reading | 0 | Vis. est. Reading | 7 | 34.5 | PC I-II | 9 1/2 | 94# sack | No Bentonite added Mud weight = 15.7 #/gal. |
| 0900 | 25.8 | 6.2 | 19.6 | Visual est. | — | Visual est. | 21.6 | 2' open | — | — | — | Backpulled 21.9 ft and removed 20 ft of casing |
| 0920 | 25.8 | 6.2 | 19.6 | Vis. est. | — | Vis. est | ~1' above ground | 20.8 | PC I-II | 8 1/2 | 94# sack | mud weight = 16.1 #/gal. |
| 0940 | — | — | — | — | — | — | 10 | open | — | — | — | Backpulled and removed the remaining casing |
| 0957 | — | — | — | — | — | — | 5 | open | PC I-II | 4 | 94# sack | mud weight = 16.2#/gal. |
| 1012 | — | — | — | — | — | — | 3 | open | PC I-II | 7 | 94# sack | mud weight = 16.1 #/gal. |
| 1021 | — | — | — | — | — | — | 0 | 0 | PC I-II | 6 | 94# sack | mud weight = 15.7#/gal. |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

2 1/2 sacks of 10-20 sand used on this page.
43 sacks of Portland cement used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 9/2/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/1/97
Page 1 of 5

Well No.: 199-D4-14 | Project: 100-HR-3 | Location: West of 100D/DR | Drilling Contractor: Layne Christensen

| 1. Time | 2. Total Casing | 3. Stkup (above g.s.) | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth (bgs) | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Readings taken from ref pt 5' above g.s. and adjusted |
| 0840 | 105.2 | 3.3 | 101.9 | 102.8 | -2.7 | 100.1 | 100.1 | 1.8 | — | — | — | WL@ 69.83' initial reading |
| 1038 | 105.2 | — | 101.9 | — | — | — | 98 | 3.9 | 10-20 | 1 | 100# sack | |
| 1046 | 106.2* | — | 101.4 | 101.2 | -2.7 | 98.5 | 98.5 | 2.9 | — | — | — | Backpulled 0.5' *Added 1 ft for lift starting here |
| 1055 | 106.2 | 6.5 | 99.7 | 103 | — | — | 98.8 | 1.1 | — | — | — | Backpulled 1.7' |
| 1102 | 106.2 | 6.5 | 99.7 | 100.1 | +2.3 | 102.4 | 95.9 | 3.8 | 10-20 | 1 | 100# sack | Added sand |
| 1104 | 106.2 | 8.3 | 97.9 | 103.1 | +2.3 | 105.4 | 97.1 | 0.8 | — | — | — | Backpulled 1.8' |
| 1108 | 106.2 | 8.3 | 97.9 | 99.6 | +2.3 | 101.9 | 93.6 | 4.3 | 10-20 | 1 | 100# sack | Added sand |
| 1111 | 106.2 | 9.4 | 96.8 | 102.6 | +2.3 | 104.9 | 95.5 | 1.3 | — | — | — | Backpulled 1.1' |
| 1115 | 106.2 | 9.4 | 96.8 | 99.3 | +2.3 | 101.6 | 92.2 | 4.6 | 10-20 | 1 | 100# sack | Added sand |
| 1118 | 106.2 | 13.4 | 92.8 | 103 | +2.3 | 105.3 | 91.9 | 0.9 | — | — | — | Backpulled 4' |
| 1122 | 106.2 | 13.4 | 92.8 | 99.7 | +2.3 | 102 | 88.6 | 4.2 | 10-20 | 1 | 100# sack | Added sand |
| 1145 | 96.2 | 5.0 | 91.2 | 92.2 | +2.3 | 94.5 | 89.5 | 1.7 | — | — | — | Backpulled 1.6' Removed 10 ft of casing |
| 1147 | 96.2 | 6.2 | 90 | 93.5 | +2.3 | 95.8 | 89.6 | 0.4 | — | — | — | Backpulled 1.2' |
| 1149 | 96.2 | 6.2 | 90 | 90.2 | +2.3 | 92.5 | 86.3 | 3.7 | 10-20 | 1 | 100# sack | Added sand |
| 1151 | 96.2 | 8.4 | 87.8 | 93 | +2.3 | 95.3 | 86.9 | 0.9 | — | — | — | Backpulled 2.2 ft |
| 1153 | 96.2 | 8.4 | 87.8 | 89.9 | +2.3 | 92.2 | 83.8 | 4.0 | 10-20 | 1 | 100# sack | Added sand |
| 1155 | 96.2 | 10.3 | 85.9 | 92.2 | +2.3 | 94.5 | 84.2 | 1.7 | — | — | — | Backpulled 1.9 ft |
| 1258 | 91.2 | 5.2 | 85.9 | 87.2 | +2.3 | 89.5 | 84.2 | 1.7 | — | — | — | Removed 5 ft of casing |
| 1258 | 91.2 | 6.1 | 85.1 | 88.3 | +2.3 | 90.6 | 84.5 | 0.6 | — | — | — | Backpulled 0.8 ft |
| 1300 | 91.2 | 6.1 | 85.1 | 85 | +2.3 | 87.3 | 81.2 | 4.1 | 10-20 | 1 | 100# sack | Added sand |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/1/97

Reviewed By: L.D. Walker
Title: LW 9-26-97 Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/1/97
Page 2 of 5

Well No.: 199-D4-14 B8072 | Project: 100-HR-3 | Location: West of 100D/DR | Drilling Contractor: Layne Christensen

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correct-ion | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1303 | 91.2 | 8.6 | 82.6 | 88.1 | +2.3 | 90.4 | 81.8 | 0.8 | — | — | — | Backpulled 2.5 ft |
| 1304 | 91.2 | 8.6 | 82.6 | 85.8 | +2.3 | 88.1 | 79.5 | 3.1 | 10-20 sand | 1 | 100# sack | Added sand |
| 1306 | 91.2 | 9.9 | 81.3 | 87.5 | +2.3 | 89.8 | 79.9 | 1.4 | — | — | — | Backpulled 1.3 ft |
| 1327 | 86.2 | 5.5 | 80.7 | 83.2 | +2.3 | 85.5 | 80 | 0.7 | — | — | — | Removed 5 ft of casing Backpulled 0.6 ft |
| 1331 | 86.2 | 5.5 | 80.7 | 80.1 | +2.3 | 82.4 | 76.9 | 3.8 | 10-20 sand | 1 | 100# sack | Added sand |
| 1332 | 86.2 | 8.0 | 78.2 | 83 | +2.3 | 85.3 | 77.3 | 0.9 | — | — | — | Backpulled 2.5 ft |
| 1334 | 86.2 | 8.0 | 78.2 | 80 | +2.3 | 82.3 | 74.3 | 3.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1336 | 86.2 | 9.0 | 77.2 | 83.5 | +2.3 | 85.8 | 76.8 | 0.4 | — | — | — | Backpulled 1.0 ft |
| 1339 | 86.2 | 9.0 | 77.2 | 80.2 | +2.3 | 82.5 | 73.5 | 3.7 | 10-20 sand | 1 | 100# sack | Added sand |
| 1340 | 86.2 | 9.2 | 77 | 84 | +2.3 | 86.3 | 77.1 | 0.1 open | — | — | — | Backpulled 0.2 ft Should be ok because of silty sandy G |
| 1348 | 86.2 | 9.2 | 77 | >81 | +2.3 | >83.3 | 74.1 | >2.9 | 10-20 sand | 3 | 100# sack | Added sand |
| 1349 | 86.2 | 10.2 | 76 | 84.2 | +2.3 | 86.5 | 76.3 | 0.3 open | — | — | — | Backpulled 1.0 ft |
| 1401 | 81.2 | 5.2 | 76 | ~~76.4~~ | ~~+2.3~~ | ~~78.7~~ | 8/1/97 — | — | — | — | — | Removed 5 ft of casing no reading taken as above |
| 1412 | 81.2 | 5.2 | 76 | 76.4 | +2.3 | 78.7 | 73.5 | 2.7 | 10-20 sand | 2 | 100# sack | Added sand |
| 1413 | 81.2 | 6.0 | 75.2 | 78.9 | +2.3 | 81.2 | 75.2 | 0 | — | — | — | Backpulled 0.8 ft |
| 1417 | 81.2 | 6.0 | 75.2 | 72.8 | +2.3 | 75.1 | 69.1 | 6.1 | 10-20 sand | 2 | 100# sack | Added sand |
| 1419 | 81.2 | 8.1 | 73.1 | 78.1 | +2.3 | 80.4 | 72.3 | 0.8 | — | — | — | Backpulled 2.1 ft |
| 1423 | 81.2 | 8.1 | 73.1 | 71.9 | +2.3 | 74.2 | 66.1 | 7.0 | 10-20 sand | 2 | 100# sack | Added sand |
| 1425 | 81.2 | 9.8 | 71.4 | 77.5 | +2.3 | 79.8 | 70 | 1.4 | — | — | — | Backpulled 1.7 ft |
| 1440 | 75.2x | 3.7 | 71.5 | 73.2 | +2.3 | 75.5 | 71.8 | 0.3 open | — | — | — | Removed 5 ft of casing x total casing w/o lift bailed a little |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/1/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/1/97
Page 3 of 5

Well No.: 199-D4-14 | Project: 100-HR-3 | Location: | Drilling Contractor: Layne Christensen

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500 | 75.2 | 3.7 | 71.5 | 70.9 | +2.3 | 73.2 | 69.5 | 1.7 | 10-20 sand | 1 | 100# sack | Added sand after bailing once |
| 1505 | 75.2 | 3.7 | 71.5 | 73.5 | +2.3 | 75.8 | 72.1 | 0.6 open | — | — | — | Bailed & surged w/ bailer |
| 1507 | 75.2 | 3.7 | 71.5 | 71.9 | +2.3 | 74.2 | 70.5 | 1.0 | 10-20 | 1 | 100# sack | |
| 1509 | 75.2 | | 71.5 | 73.3 | +2.3 | 75.6 | 71.9 | 0.4 open | — | — | — | Bailed as above |
| 1510 | 75.2 | | | 71 | +2.3 | 73.3 | 69.6 | 2.1 | 10-20 | 1 | 100# sack | |
| 1512 | 75.2 | | | 73 | +2.3 | 75.3 | 71.6 | 0.1 open | — | — | — | Bailed as above |
| 1514 | 75.2 | | | 70.3 | +2.3 | 72.6 | 68.9 | 2.6 | 10-20 | 1 | 100# sack | |
| 1517 | 75.2 | | | 72.4 | +2.3 | 74.7 | 71 | 0.5 | — | — | — | Bailed as above |
| 1518 | 75.2 | | | 69.5 | +2.3 | 71.8 | 68.1 | 3.4 | 10-20 | 1 | 100# sack | |
| 1524 | 75.2 | | | 72.8 | +2.3 | 75.1 | 71.4 | 0.1 | — | — | — | Bailed as above |
| 1527 | 75.2 | | | 69.7 | +2.3 | 72 | 68.3 | 3.2 | 10-20 | 1 | 100# sack | |
| 1533 | 75.2 | | | 71.2 | +2.3 | 73.5 | 69.8 | ~~4.0~~ 1.7 | — | — | — | Bailed, water very turbid Bailed ~ 50 gals |
| 1538 | 75.2 | | | 71.2 | +2.3 | 73.5 | 69.8 | 1.7 | — | — | — | Bailed out 2 more times water turbid |
| 1551 | 75.2 | | | 72.9 | +2.3 | 75.2 | 71.5 | 0 | — | — | — | Bailed and surged w/ bailer |
| 1553 | 75.2 | | | 70 | +2.3 | 72.3 | 68.6 | 2.9 | 10-20 | 1 | 100# sack | |
| 1610 | 75.2 | | | 71.4 | +2.3 | 73.7 | 70 | 1.5 | — | — | — | Bailed & surged w/ bailer Bailed out ~ 50 gals, cleaner |
| 1635 | 75.2 | | | 70.8 | 0 | 70.8 | 67.1 | 4.4 | 10-20 sand | 1 | 100# sack | Added sand |
| 1656 | 75.2 | | | 73.5 | 0 | 73.5 | 69.8 | 1.7 | — | — | — | Surged entire screen section Dropped 2.1' in 21 min. |
| 1704 | 75.2 | | | 74.3 | 0 | 74.3 | 70.6 | 0.9 | — | — | — | Started surging @ 1659-1704 Dropped 0.8' in 5 min. |
| 1708 | 75.2 | | | 71.2 | 0 | 71.2 | 67.5 | 4.0 | 10-20 sand | 1 | 100# sack | Added sand then Started surging @ 1708 |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/1/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/1/97 + 8/2/97
Page 4 of 5

Well No.: 199-D4-14 | Project: 100-HR-3 | Location: West of 100 D/DR | Drilling Contractor: Layne Christensen

| | 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor. Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 17:21 | 75.2 | 3.7 | 71.5 | 72.1 | 0 | 72.1 | 68.4 | 3.1 | — | — | — | Surged entire interval w/ surge block |
| | 1723 | 75.2 | 3.7 | 71.5 | 72.2 | 0 | 72.2 | 68.5 | 3.0 | — | — | — | Surged entire interval w/ surge block : End of 8/1/97 |
| 8/2/97 | 0742 | 75.2 | 3.7 | 71.5 | 72.1 | 0 | 72.1 | 68.4 | 3.1 | — | — | — | Total length of screens is 33.01' Able to get to 102.98'. Initial. |
| | 0842 | 75.2 | 3.7 | 71.5 | 74.8 | 0 | 74.8 | 71.1 | 0.4 | — | — | — | Surging w/bailer 0810-0842 Dropped 2.7' in 32 min. |
| | 0844 | 75.2 | 3.7 | 71.5 | 72.0 | 0 | 72.0 | 68.3 | 3.2 | 10-20 sand | 1 | 100# sack | Added sand |
| | 0944 | 75.2 | 3.7 | 71.5 | 72.9 | 0 | 72.9 | 69.32 | 2.3 | — | — | — | Surged w/bailer 0844-0944 Dropped 0.9' in 60 min 30 gals |
| | 1000 | 75.2 | 3.7 | 71.5 | 73.0 | 0 | 73.0 | 69.3 | 2.2 | — | — | — | Bailed out ~ 80 gals between 0945-1000 Dropped 0.1 in 15 m. |
| | 1100 | 75.2 | 3.7 | 71.5 | 73.0 | 0 | 73.3 | 69.6 | 1.9 | — | — | — | Surged w/bailer 1000-1100 Bailed ~ 100 gallons 0.3 ft |
| | 1121 | 76.2 | 4.7 | 71.5 | 74.5 | 0 | 74.5 | 69.8 | 1.7 | — | — | — | Tag before adding sand |
| | 1126 | 76.2 | 4.7 | 71.5 | 70.5 | 0 | 70.5 | 65.8 | 5.7 | 10-20 sand | 1 | 100# sack | Added sand |
| | 1140 | 76.2 | 5.7 | 70.5 | 75.6 | 0 | 75.6 | 69.9 | 0.6 | — | — | — | Backpulled 1 ft |
| | 1144 | 76.2 | 5.7 | 70.5 | 69.5 | 0 | 69.5 | 63.8 | 6.7 | 10-20 sand | 2 | 100# sack | Added sand |
| | 1147 | 76.2 | 7.2 | 69 | 75 | 0 | 75 | 67.8 | 1.2 | — | — | — | Backpulled 1.5 ft |
| | 1155 | 76.2 | 7.2 | 69 | 63.9 | 0 | 63.9 | 56.7 | 12.3 | 10-20 sand | 4 | 100# sack | Added sand |
| | 1156 | 76.2 | 9.8 | 66.4 | 74.8 | 0 | 74.8 | 65 | 1.4 | — | — | — | Backpulled 2.6 ft |
| | 1204 | 76.2 | 10.0 | 66.2 | 66.9 | 0 | 66.9 | 56.9 | 9.3 | 10-20 sand | 3 | 100# sack | Bucked casing 0.2 ft then added sand |
| | 1207 | 76.2 | 11.8 | 64.4 | 74.4 | 0 | 74.4 | 62.6 | 1.8 | — | — | — | Backpulled 1.8 ft |
| | 1254 | 76.2 | ~~13.4~~ 11.8 | ~~62.8~~ 64.4 | 71 | 0 | 71 | 59.2 | 5.2 | 10-20 sand | 1 | 100# sack | Added sand |
| | 1257 | 76.2 | 13.4 | 62.8 | 76.3 | 0 | 76.3 | 62.9 | 0.1 often | — | — | — | Backpulled 1.6 ft |
| | 1302 | 76.2 | 13.4 | 62.8 | 73.9 | 0 | 73.9 | 60.5 | 2.3 | 10-20 sand | 1 | 100# sack | Added sand |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

* Note: Water is only slightly turbid with very little sand or silt.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/2/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/2/97
Page 5 of 5

Well No.: 199-D4-14 | Project: 100-HR-3 | Location: West of 100D/DR | Drilling Contractor: Layne Christensen

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1305 | 76.2 | 14.3 | 61.9 | 76.5 | 0 | 76.5 | 62.2 | 0.3' open | — | — | — | Backpulled 0.9 ft |
| 1309 | 76.2 | 14.3 | 61.9 | 74.3 | 0 | 74.3 | 60 | 1.9 | 10-20 sand | 1 | 100# sack | Added sand |
| 1311 | 76.2 | 14.8 | 61.4 | 76.2 | 0 | 76.2 | 61.4 | 0 | — | — | — | Backpulled 0.5 ft |
| 1329 | 66.2 | 4.8 | 61.4 | 64.3 | 0 | 64.3 | 59.5 | 1.9 | 10-20 sand | 1/2 | 100# sack | Removed 10 ft of casing |
| 1329 | 66.2 | 4.8 | 61.4 | 66.2 | 0 | 66.2 | 61.4 | 0 | — | — | — | |
| 1330 | 66.2 | 4.8 | 61.4 | 65.2 | 0 | 65.2 | 60.4 | 1 | 10-20 sand | 1/4 | 100# sack | Added sand |
| 1331 | 66.2 | 6.1 | 60.1 | 67 | 0 | 67 | 60.9 | 0.8 open | — | — | — | Top of filter pack @ 60.9' after backpulling to 60.1' |
| 1417 | 66.2 | 6.1 | 60.1 | Tremie est. | — | — | ~~58.2~~ 52.1 | 8 | Port Cem Type I-II | 3 | 94# sacks | + bentonite mud wt = 12.6 #/gal |
| 1430 | 56.2 | 4.2 | 52.0 | — | — | — | — | — | — | — | — | Backpulled 7.9 ft then removed 10 ft of casing |
| 1458 | 56.2 | 4.2 | 52.0 | Tremie est | — | — | 35 | 17 | PC Type I-II | 6 | 94# sacks | mud wt = 13.4 #/gal |
| 1515 | 46.2 | 5.8 | 40.4 | — | — | — | ~0.3 open (no collapse) | — | — | — | — | Backpulled 11.6 ft + then removed 10 ft of casing |
| 1530 | 46.2 | 5.8 | 40.4 | Tremie est | — | — | 17.4 | 23 | PC Type I-II | 7 | 94# sacks | mud wt = 14.3 #/gal |
| 1550 | 36.2 | 6.0 | 30.2 | not measured | | | JCW 8/2/97 | | — | — | — | Backpulled ft of casing + then removed 10 ft. |
| 1551 | 26.2 | 6.0 | 20.2 | 26.3 | 0 | 26.3 | ~~26.3~~ 20.3 | 0.1 open | — | — | — | Backpulled 10 ft casing + removed 10 ft. |
| 1610 | 26.2 | 6.0 | 20.2 | 11.7 | 0 | 11.7 | 5.7 | 14.5 | PC Type I-II | 6 3/4 | 94# sacks | mud wt = 14.3 #/gal |
| 1625 | 16.2 | 4.9 | 11.3 | 16.8 | 0 | 16.8 | 11.9 | 0.6 open | — | — | — | Backpulled 8.9 ft + (did not removed 10 ft casing collaps.) |
| 1640 | 16.2 | 4.9 | 11.3 | ~2.9 | 0 | 2.9 | 2 ft above gs | 13.3 | PC Type I-II | 4 | 94# sack | mud wt = 15.6 #/gal |
| 1645 | 0 | 0 | 0 | 0 | 0 | 0 | g.s. | g.s. | PC Type I-II | 1/2 | 94# sack | Backpulled 15.2 ft and removed 10 ft casing JCW 8/2/97 |
| | | | | | | | | | | | | All temp casing out of hole. |
| | | | | | | | | | | | | |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/2/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/7/97
Page 1 of 5

Well No.: 199-D4-15 B8073 | Project: 100-HR-3 | Location: 2600' West of 100-DR | Drilling Contractor: Cayne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup above g.s. | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1605 | 105.8* | 2.6 | 103.2 | 107.1 | 0 | 107.1 | 104.5 | 1.3' open hole | — | — | — | *With listing head 8/7/97 Driller backpulled casing |
| 0745 | 105.8 | 2.6 | 103.2 | 100.8 | 0 | 100.8 | 98.2 | 5' | 8-16 sand | 3 | 100# sack | Installed well screen 8/7/97 Added sand 8/8/97 |
| 0757 | 105.8 | 4.2 | 101.6 | 105.1 | 0 | 105.1 | 100.9 | 0.7' | — | — | — | Backpulled 1.6 ft |
| 0758 | 105.8 | 4.2 | 101.6 | 101.5 | 0 | 101.5 | 97.3 | 4.3' | 8-16 sand | 1 | 100# sack | Added sand |
| 0800 | 105.8 | 6.2 | 99.6 | 105.3 | 0 | 105.3 | 99.1 | 0.5 | — | — | — | Backpulled 2.0 ft |
| 0805 | 105.8 | 6.2 | 99.6 | 101.8 | 0 | 101.8 | 95.6 | 4.0 | 8-16 sand | 1 | 100# sack | Added sand |
| 0807 | 105.8 | 8.8 | 97 | 105.2 | 0 | 105.2 | 96.4 | 0.6 | — | — | — | Backpulled 2.6 ft |
| 0810 | 105.8 | 8.8 | 97 | 101.7 | 0 | 101.7 | 92.9 | 4.1 | 8-16 sand | 1 | 100# sack | Added sand |
| 0812 | 105.8 | 11.3 | 94.5 | 104.9 | 0 | 104.9 | 93.6 | 0.9 | — | — | — | Backpulled 2.5 ft. |
| 0815 | 105.8 | 11.3 | 94.5 | 101.3 | 0 | 101.3 | 90 | 4.5 | 8-16 sand | 1 | 100# sack | Added sand |
| 0820 | 105.8 | 12.9 | 92.9 | 103.5 | 0 | 103.5 | 90.6 | 2.3 | — | — | — | Backpulled 1.6 ft |
| 0840 | 95.8 | 2.9 | 92.9 | 93.8 | 0 | 93.8 | 90.9 | 2.0 | — | — | — | Removed 10 ft of casing Raised screen ~0.2' |
| 0842 | 95.8 | 4.2 | 91.6 | 95.4 | 0 | 95.4 | 91.2 | 0.4 | — | — | — | Backpulled 1.3 ft |
| 0844 | 95.8 | 4.2 | 91.6 | 91.7 | 0 | 91.7 | 87.5 | 4.1 | 8-16 sand | 1 | 100# sack | Added sand |
| 0848 | 95.8 | 5.8 | 90 | 95 | 0 | 95 | 89.2 | 0.8 | — | — | — | Backpulled 1.6 ft |
| 0849 | 95.8 | 5.8 | 90 | 91.3 | 0 | 91.3 | 85.5 | 4.5 | 8-16 sand | 1 | 100# sack | Added sand |
| 0851 | 95.8 | 8.6 | 87.2 | 93.8 | 0 | 93.8 | 85.2 | 2.0 | — | — | — | Backpulled 2.8 ft |
| 0904 | 90.8 | 3.6 | 87.2 | 88.9 | 0 | 88.9 | 85.3 | 1.9 | — | — | — | Removed 5 ft of casing |
| 0910 | 90.8 | 5 | 85.8 | 90.6 | 0 | 90.6 | 85.6 | 0.2 | — | — | — | Backpulled ft |
| 0912 | 90.8 | 5 | 85.8 | 87 | 0 | 87 | 82 | 3.8 | 8-16 sand | 1 | 100# sack | Added Sand |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

10 sacks of sand used on this page

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/8/97

Reviewed By: LD Walker L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/8/97
Page 2 of 5

Well No.: 199-D4-15 (B8073)
Project: 100-HR-3
Location: 2600' West of 100-DR
Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. (bgs) Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0913 | 90.8 | 7.5 | 83.3 | 90 | 0 | 90 | 82.5 | 0.8 | — | — | — | Backpulled 2.5 ft |
| 0915 | 90.8 | 7.5 | 83.3 | 86.4 | 0 | 86.4 | 78.9 | 4.4 | 8-16 Sand | 1 | 100# sack | Added sand |
| 0916 | 90.8 | 8.7 | 82.1 | 88.3 | 0 | 88.3 | 79.6 | 2.5 | — | — | — | Backpulled 1.2 ft |
| 0924 | 85.8 | 3.7 | 82.1 | 83.5 | 0 | 83.5 | 79.8 | 2.3 | — | — | — | Removed 5 ft of casing |
| 0928 | 85.8 | 5.0 | 80.8 | 85.1 | 0 | 85.1 | 80.1 | 0.7 | — | — | — | Backpulled 1.3 ft |
| 0930 | 85.8 | 5.0 | 80.8 | 81.8 | 0 | 81.8 | 76.8 | 4.0 | 8-16 Sand | 1 | 100# sack | Added sand |
| 0931 | 85.8 | 5.9 | 79.9 | 85.6 | 0 | 85.6 | 79.7 | 0.2 | — | — | — | Backpulled 0.9 ft |
| 0933 | 85.8 | 5.9 | 79.9 | 84.4 | 0 | 84.4 | 78.5 | 1.4 | 8-16 Sand | 1 | 100# sack | Added sand |
| 0934 | 85.8 | 6.0 | 79.8 | 86 | 0 | 86 | 80 | 0.2 open | — | — | — | Backpulled 0.1 ft |
| 0938 | 85.8 | 6.0 | 79.8 | 80.2 | 0 | 80.2 | 74.2 | 5.6 | 8-16 Sand | 2 | 100# sack | Added sand |
| 0939 | 85.8 | 6.6 | 79.2 | 86 | 0 | 86 | 79.4 | 0.2 open | — | — | — | Backpulled 0.6 ft |
| 0945 | 85.8 | 6.6 | 79.2 | 77.6 | 0 | 77.6 | 71 | 8.2 | 8-16 Sand | 3 | 100# sack | Added sand |
| 0947 | 85.8 | 7.1 | 78.7 | 85.9 | 0 | 85.9 | 78.8 | 0.1 open | — | — | — | Backpulled 0.5 ft |
| 0951 | 85.8 | 7.1 | 78.7 | 76.9 | 0 | 76.9 | 69.8 | 8.9 | 8-16 Sand | 3 | 100# sack | Added sand |
| 0953 | 85.8 | 7.4 | 78.4 | 85.9 | 0 | 85.9 | 78.5 | 0.1 open | — | — | — | Backpulled 0.3 ft |
| 0958 | 85.8 | 7.4 | 78.4 | 78.9 | 0 | 78.9 | 71.5 | 6.9 | 8-16 Sand | 3 | 100# sack | Added sand |
| 1000 | 85.8 | 7.9 | 77.9 | 86 | 0 | 86 | 78.1 | 0.2 open | — | — | — | Backpulled 0.5 ft |
| 1010 | 85.8 | 7.9 | 77.9 | 77.3 | 0 | 77.3 | 69.4 | 8.5 | 8-16 Sand | 3 | 100# sack | Added sand |
| 1012 | 85.8 | 8.8 | 77 | 85.1 | 0 | 85.1 | 76.3 | 0.7 | — | — | — | Backpulled 0.9 ft |
| 1024 | 80.8 | 3.8 | 77 | 80.2 | 0 | 80.2 | 76.4 | 0.6 | — | — | — | Removed 5 ft of casing |

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

17 sacks of sand used on this page.

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/8/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/8/97
Page 3 of 5

Well No.: 199-D4-15 88073
Project: 100-HR-3
Location: 2600' West of 100-DR
Drilling Contractor:

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill Depth (bgs) | 9. Overlap | Fill Material Type | Fill Material Amt | Fill Material Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1028 | 80.8 | 3.8 | 77 | 74 | 0 | 74 | 70.2 | 6.8 | 8-16 sand | 2 | 100# sack | Added sand |
| 1030 | 80.8 | 5.3 | 75.5 | 80.4 | 0 | 80.4 | 75.1 | 0.4 | — | — | — | Backpulled 1.5 ft |
| 1031 | 80.8 | 5.3 | 75.5 | 77.4 | 0 | 77.4 | 72.1 | 3.4 | 8-16 sand | 1 | 100# sack | Added sand |
| 1033 | 80.8 | 6.0 | 74.8 | 80.7 | 0 | 80.7 | 74.7 | 0.1 | — | — | — | Backpulled 0.7 ft |
| 1037 | 80.8 | 6.0 | 74.8 | 75.2 | 0 | 75.2 | 69.2 | 5.6 | 8-16 sand | 2 | 100# sack | Added sand |
| 1038 | 80.8 | 7.6 | 73.2 | 78.7 | 0 | 78.7 | 71.1 | 2.1 | — | — | — | Backpulled 1.6 ft |
| 1049 | 74.8 | 1.6 | 73.2 | 72.6 | 0 | 72.6 | 71.0 | 2.2 | — | — | — | Remove 1.5 ft of casing + lift |
| 1125 | 74.8 | 1.6 | 73.2 | 73.2 | 0 | 73.2 | 70.7 | 1.6 | — | — | — | 1113-1125 hrs Bailed 150. Surged w/ bailer Dropped 0.6 ft |
| 1135 | 74.8 | 1.6 | 73.2 | 73.2 | 0 | 73.2 | 71.6 | 1.6 | — | — | — | 1125-1135 hrs Bailed ~60 g. Fine sand pack in bailed water |
| 1200 | 74.8 | 1.6 | 73.2 | 74.2 | 0 | 74.2 | 72.6 | 0.6 | — | — | — | 1135-1200 Surged w/ bailer Dropped 1 ft. Bailed ~70 gal. |
| 1206 | 74.8 | 1.6 | 73.2 | 74.3 | 0 | 74.3 | 72.7 | 0.5 | — | — | — | 1200-1206 Surged w/bailer |
| 1327 | 74.8 | 1.6 | 73.2 | 74.8 | 0 | 74.8 | 73.2 | 0 | — | — | — | 1315-1327 Surged w/bailer |
| 1330 | 74.8 | 1.6 | 73.2 | 72.9 | 0 | 72.9 | 71.3 | 1.9 | 8-16 sand | 1/2 | 100# sack | Added sand |
| 1404 | 74.8 | 1.6 | 73.2 | 73 | 0 | 73 | 71.4 | 1.8 | — | — | — | 1330-1404 Surged w/bailer |
| 1411 | 74.8 | 1.6 | 73.2 | 73.2 | 0 | 73.2 | 71.6 | 1.6 | — | — | — | 1404-1411 Bailed ~60 gallons |
| 1412 | 74.8 | 1.6 | 73.2 | 71.7 | 0 | 71.7 | 70.1 | 3.1 | 8-16 sand | 1/2 | 100# sack | Added sand |
| 1417 | 74.8 | 1.6 | 73.2 | 71.9 | 0 | 71.9 | 70.3 | 2.9 | — | — | — | 1414-1417 Added ~300 gallons to settle sand pack |
| 1452 | 74.8 | 1.6 | 73.2 | 72.2 | 0 | 72.2 | 70.6 | | — | — | — | 1420-1453 Surged w/bailer |
| 1538 | 74.8 | 1.6 | 73.2 | 72.4 | 0 | 72.4 | 70.8 | 2.4 | — | — | — | Bailing well 1452-1538 Sand recov. About 400 gallons removed |
| 1547 | 75.8* | 2.5 | 73.3 | 73.5 | 0 | 73.5 | 71 | 2.3 | — | — | — | * with lift |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

6 Sacks of sand used

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 9/26/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/8/97
Page 4 of 5

Well No.: 199-D4-15 B8073 | Project: 100-HR-3 | Location: 2600' West of 100-DR | Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg (bgs) | 5. Tape Reading | 6. Correction | 7. Cor Tape Reading | 8. Fill (bgs) Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1553 | 75.8* | 4.1 | 71.7 | 75.7 | 0 | 75.7 | 71.6 | 0.1 | — | — | — | Backpulled 1.6 ft |
| 1555 | 75.8* | 4.1 | 71.7 | 72.7 | 0 | 72.7 | 68.6 | 3.1 | 8-16 sand | 1 | 100# sack | Added sand |
| 1556 | 75.8* | 6.3 | 69.5 | 75.2 | 0 | 75.2 | 68.9 | 0.6 | — | — | — | Backpulled 2.2 ft |
| 8/8/97 1558 | 75.8* | 6.3 | 69.5 | 74.2 | 0 | 74.2 | 67.9 | 1.6 | 8-16 sand | 1/3 | 100# sack | Added sand |
| 1559 ~~1539~~ | 75.8* | 7.6 | 68.2 | 75.7 | 0 | 75.7 | 68.1 | 0.1 | — | — | — | Backpulled 1.3 ft |
| 1559 ~~1539~~ | 75.8* | 7.6 | 68.2 | 75.5 | 0 | 75.5 | 67.9 | 0.3 | 8-16 sand | 1/6 | 100# sack | Added sand |
| 1600 ~~1540~~ | 75.8* | 7.8 | 68 | 75.8 | 0 | 75.8 | 68 | 0 | — | — | — | Backpulled 0.2 ft Top of primary filter pack @ 68' |
| 1607 ~~1547~~ | 75.8* | 7.8 | 68 | 71.7 | 0 | 71.7 | 63.9 | 4.1 | 10-20 sand | 1½ | 100# sack | Added sand |
| 1609 | 75.8* | 10.9 | 64.9 | 75.3 | 0 | 75.3 | 64.4 | 0.5 | — | — | — | Backpulled 3.1 ft |
| 1611 | 75.8* | 10.9 | 64.9 | ~~74~~ NM | 0 | ~~74~~ NM | NM | ~~1.3~~ NM | 10-20 sand | 1/3 | 100# sack | Added sand |
| 1613 | 75.8* | 11.3 | 64.5 | 74.5 | 0 | 74.5 | 63.2 | — | — | — | — | Backpulled 0.4 ft |
| 1614 | 75.8* | 12.2 | 63.6 | 75.7 | 0 | 75.7 | 63.5 | 0.1 | — | — | — | Backpulled 0.9 ft |
| 1615 | 75.8* | 12.2 | 63.6 | 75.1 | 0 | 75.1 | 62.9 | 0.7 | 10-20 sand | 1/3 | 100# sack | Added sand |
| 1616 | 75.8* | 12.7 | 63.1 | 75.8 | 0 | 75.8 | 63.1 | 0 | — | — | — | Backpulled 0.5 ft |
| 1619 | 75.8* | 13.3 | 62.5 | 75.9 | 0 | 75.9 | 62.6 | 0.1 open | 10-20 sand | 1/3 | 100# sack | Backpulled after adding sand |
| 1630 | 64.8* | 2.3 | 62.5 | 64.9 | 0 | 64.9 | 62.6 | 0.1 open | — | — | — | Removed 8 ft of casing + lift 10 AKW 8/8/97 |
| 8/9/97 0837 | 65.8* | 5.5 | 60.3 | 42.8 From tremie | 0 | 42.8 | 62.6 | 23 | PC Type I-II | 5 | 94# sack | Backpulled casing 2.2 ft, then tremied in cement slurry 14.2#/gal |
| 0855 | 55.8* | 6.1 | 49.7 | 53 | 0 | 53 | 46.9 | 2.8 | — | — | — | Backpulled casing, removed 10 ft, installed tremie |
| 0915 | 55.8* | 6.1 | 49.7 | 25.8 From trem. | 0 | 25.8 | 19.7 | 30 | PC Type I-II | 7 | 94# sack | Cement grout 15.2#/gal |
| 0930 | ~~45.8~~ 35.8* | 6.3 | 29.5 | 35.8 | 0 | 35.8 | 29.5 | 0 | — | — | — | Removed 10 ft casing after backpulling |

* with lifting head DCW 8/9/97

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

1½ sacks of 8-16 sand used on this page
2½ sacks of 10-20 sand used on this page

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/9/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# WELL COMPLETION LOG

Date: 8/9/97
Page 5 of 5

Well No.: 199-D4-15 88073
Project: 100-HR-3
Location: 2600' West of 100-DR
Drilling Contractor: Layne Christensen Co.

| 1. Time | 2. Total Casing | 3. Stkup | 4. Btm Csg | 5. Tape Reading | 6. Correction | 7. Cor. Tape Reading | 8. Fill Depth | 9. Overlap | Fill Material Type | Amt | Unit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0945 | 35.8 | 6.3 | 29.5 | 10.3 Tape est. | 0 | 10.3 | 4 | 25.5 | PC I-II | 6 | 94# sack | Cement grout 15.2#/gal |
| 1000 | 15.8 | 6.1 | 9.7 | 18 | 0 | 18 | 8.3 | 2.2 open | — | — | — | Backpulled and removed 20 ft of casing; can see grout. |
| 1015 | 15.8 | 6.1 | 9.7 | 18 | 0 | 18 | 8.3 | 2.2 open | PC I-II | 8 | 94# sack | Cement grout 15.2#/gal Formation took all cement |
| 1028 | 15.8 | 6.1 | 9.7 | 18 | 0 | 18 | 8.3 | 2.2 open | PC I-II | 6 | 94# sack | Cement grout 15.4#/gal |
| 1127 | 15.8 | 6.1 | 9.7 | 11.1 | 0 | 11.1 | 5 | 4.7 ~~10.8~~ | PC I-II | 8 | 94# sack | Cement grout 14.4#/gal |
| 1143 | 0 | 0 | 0 | 7.8 | 0 | 7.8 | 7.8 | 7.8 open | — | — | — | Backpulled + removed 48 ft of casing (all casing out); cement |
| 1245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PC I-II | 8 | 94# sack | Cement grout 15.1#/gal |

Note: Col. 2 - Col. 3 = Col. 4- Col. 5 - weight and attachments = Col. 7; Col. 7 - Col 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 8/9/97

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 9-26-97

# APPENDIX D

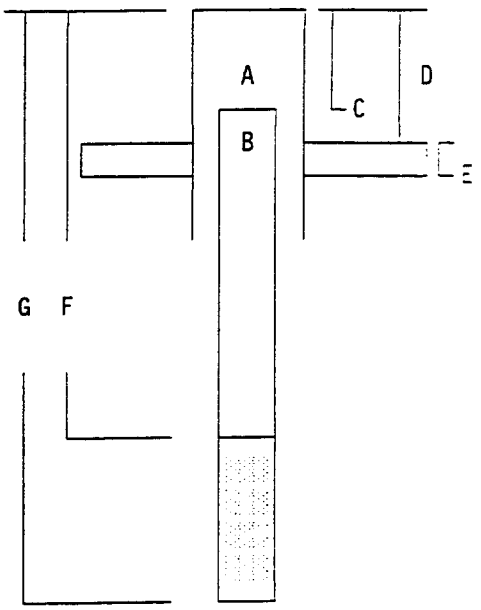
# WELL DEVELOPMENT DATA AND GROUNDWATER SAMPLE REPORTS

For Information Only

# Well Development Information Checklist

Well No. 199-D3-2 Date: 8/2897

## WELL INFORMATION




A. Outer Casing Diameter 10"

B. Inner Casing Diameter 6"

C. Difference in stick-up 0.4'

D. Stick-up of outer casing 2.87'

E. Thickness of well pad N/A

F. Depth to Water (TOC) 81.10'

G. Total depth of Hole (TOC) 108.6'

H. Screened Interval(TOC)85 - 105'

I. Screen length 20.00'

## DEVELOPMENT INFORMATION

J. Depth of Development pump intake. 105.25 '

K. Depth (below water) of Transducer during drawdown/recovery. 17.355'

L. Depth (below water) of Transducer during slug test. N/A

## EQUIPMENT INFORMATION

| | Serial # | Calibration date |
|---|---|---|
| Hermit | 2K-625 | N/A |
| E-Tape | | |
| Transducer | 7441 | |

Comments: Pumped at 30 gpm for 10 minutes with a drawdown of 0.038', stepped to 60 gpm as 30 gpm causing little apparent drawdown. Ran pump at 60 gpm for 32 minutes with a drawdown of 0.079'. 2220 gallons total pumped during development.

BTOC = Below Top Of Casing. BLS = Below Land Surface

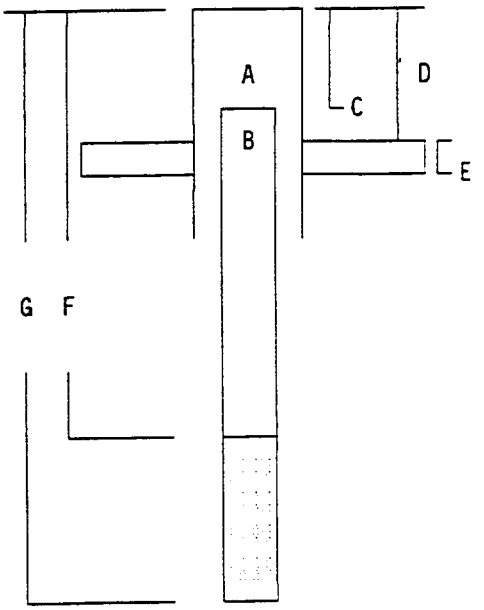
For Information Only

# Well Development Information Checklist

Well No. 199-D4-13

Date: 8/26/97

## WELL INFORMATION




A. Outer Casing Diameter 10"

B. Inner Casing Diameter 6"

C. Difference in stick-up 0.4'

D. Stick-up of outer casing 3.1'

E. Thickness of well pad N/A

F. Depth to Water (TOC) 80.74'

G. Total depth of Hole (TOC) 98.42'

H. Screened Interval(TOC) 75.02 - 95.02'

I. Screen length 20.00'

## DEVELOPMENT INFORMATION

J. Depth of Development pump intake. 94.2'

K. Depth (below water) of Transducer during drawdown/recovery. 17.142'

L. Depth (below water) of Transducer during slug test. N/A

## EQUIPMENT INFORMATION

| | Serial # | Calibration date |
|---|---|---|
| Hermit | 2K-625 | N/A |
| E-Tape | | |
| Transducer | 7441 | |

Comments: Pumped at 26 gpm for 19 minutes with 11.2' of drawdown, stepped to 15 gpm as drawdown had reached pump intake depth. Ran pump at 15 gpm for 30 minutes with a drawdown of 5.8' drawdown, then stepped pump to 20 gpm for 31 minutes with 9.2' of drawdown. 1550 gallons total pumped during development.

BTOC = Below Top Of Casing.

BLS = Below Land Surface

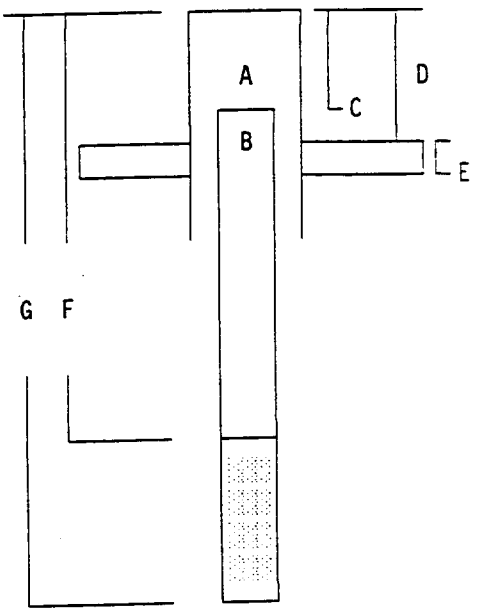
For Information Only

# Well Development Information Checklist

Well No. 199-D4-14

Date: 8/27/97

## WELL INFORMATION




A. Outer Casing Diameter 10"

B. Inner Casing Diameter 6"

C. Difference in stick-up 0.44'

D. Stick-up of outer casing 3.5'

E. Thickness of well pad N/A

F. Depth to Water (TOC) 82.66'

G. Total depth of Hole (TOC) 102.59

H. Screened Interval(TOC) 79.6 - 99.6'

I. Screen length 20.04'

## DEVELOPMENT INFORMATION

J. Depth of Development pump intake. 99.0 '

K. Depth (below water) of Transducer during drawdown/recovery. 12.24 '

L. Depth (below water) of Transducer during slug test. N/A

## EQUIPMENT INFORMATION

| | Serial # | Calibration date |
|---|---|---|
| Hermit | 2K-625 | N/A |
| E-Tape | | |
| Transducer | 7441 | |

Comments: Pumped at 26 gpm for 31 minutes with 4.7' of drawdown, then stepped to 35 gpm for 26 minutes with 7.4' of drawdown. 1720 gallons total pumped during development.

BTOC = Below Top Of Casing.

BLS = Below Land Surface

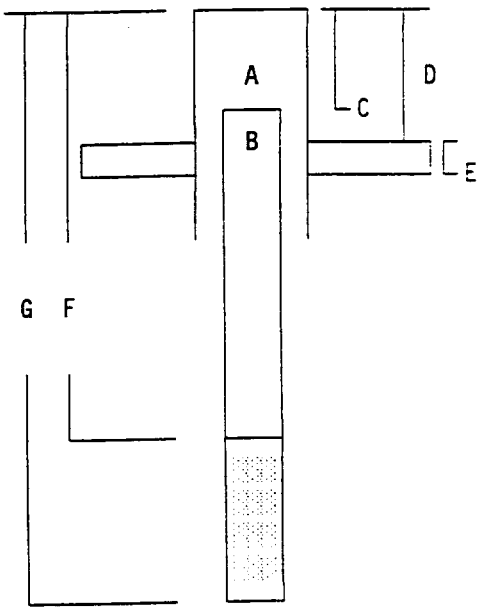
For Information Only

# Well Development Information Checklist

Well No. 199-D4-15

Date: 8/27/97

## WELL INFORMATION




A. Outer Casing Diameter 10"

B. Inner Casing Diameter 6"

C. Difference in stick-up 1.2'

D. Stick-up of outer casing 3.5'

E. Thickness of well pad N/A

F. Depth to Water (TOC) 82.35'

G. Total depth of Hole (TOC) 104.15'

H. Screened Interval(TOC) 81.2 - 101.2'

I. Screen length 20.00'

## DEVELOPMENT INFORMATION

J. Depth of Development pump intake. 98.5 '

K. Depth (below water) of Transducer during drawdown/recovery. 15.72 '

L. Depth (below water) of Transducer during slug test. N/A

## EQUIPMENT INFORMATION

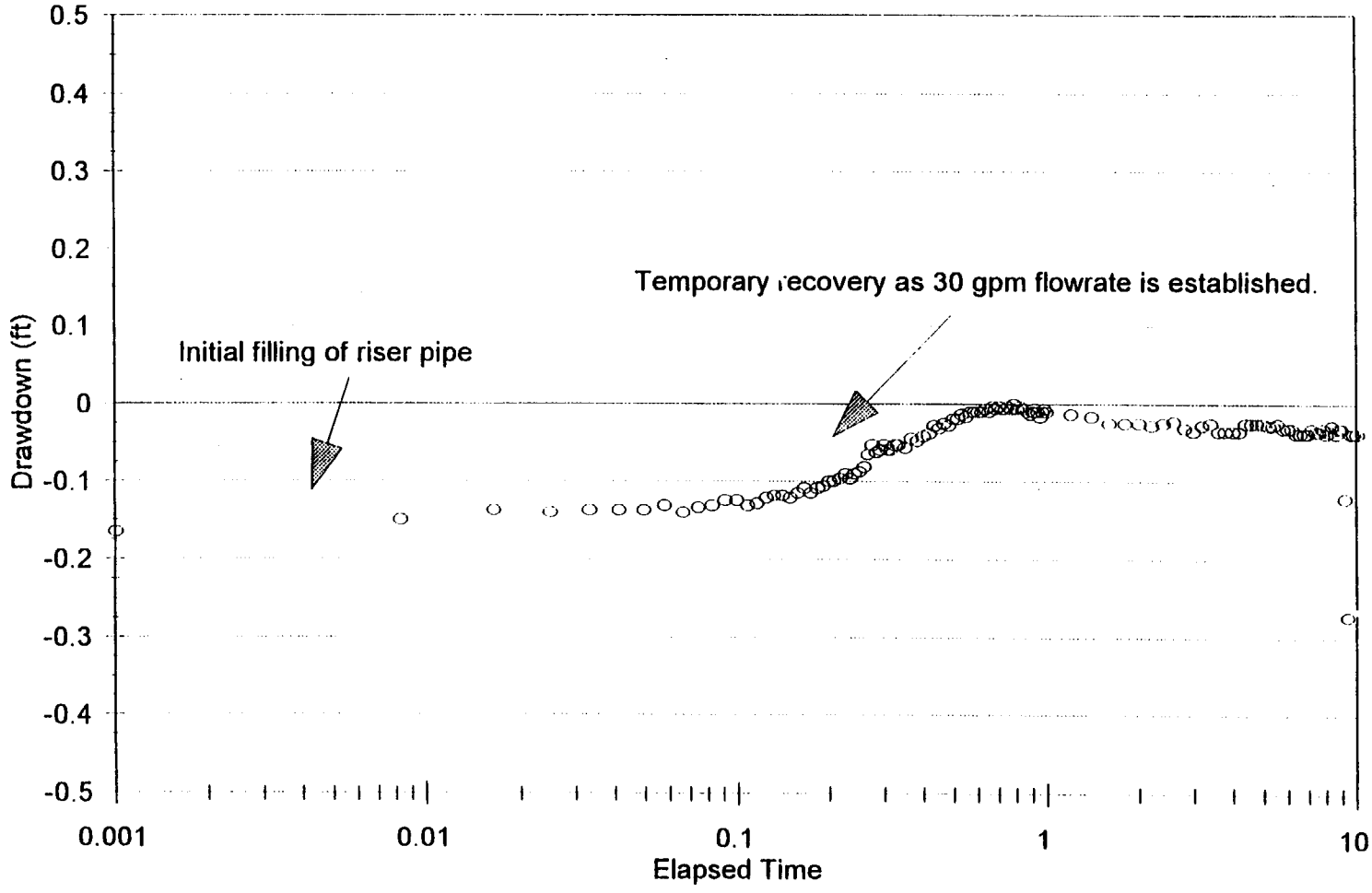
| | Serial # | Calibration date |
|---|---|---|
| Hermit | 2K-625 | N/A |
| E-Tape | | |
| Transducer | 7441 | |

Comments: Pumped at 25 gpm for 23 minutes with 0.48' drawdown, then stepped to 60 gpm for 52 minutes with 1.3' drawdown. 3695 gallons total pumped during development.

BTOC = Below Top Of Casing.

BLS = Below Land Surface

# HR-3/100D Well Development
## Well D3-2 Drawdown at 30 GPM

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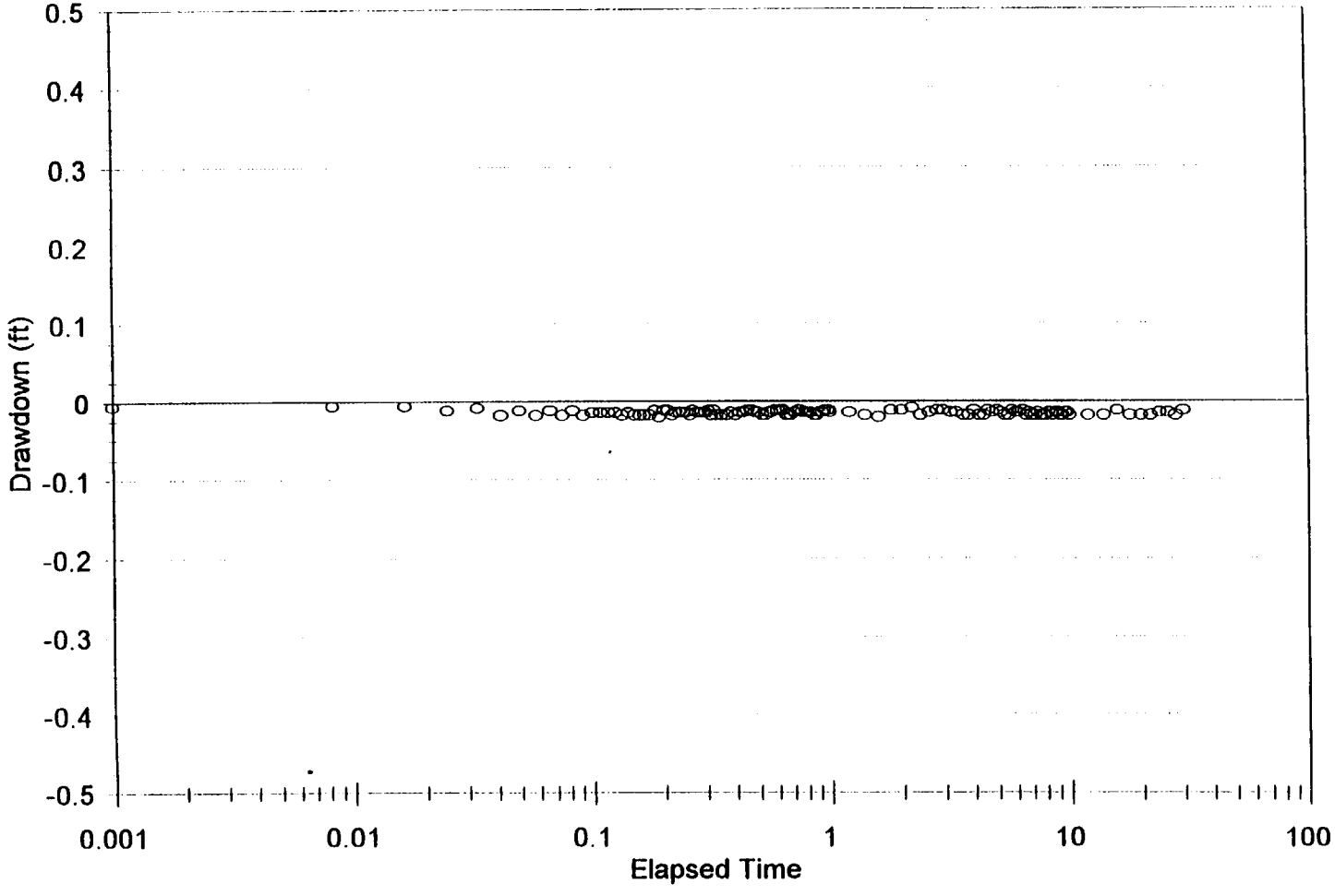
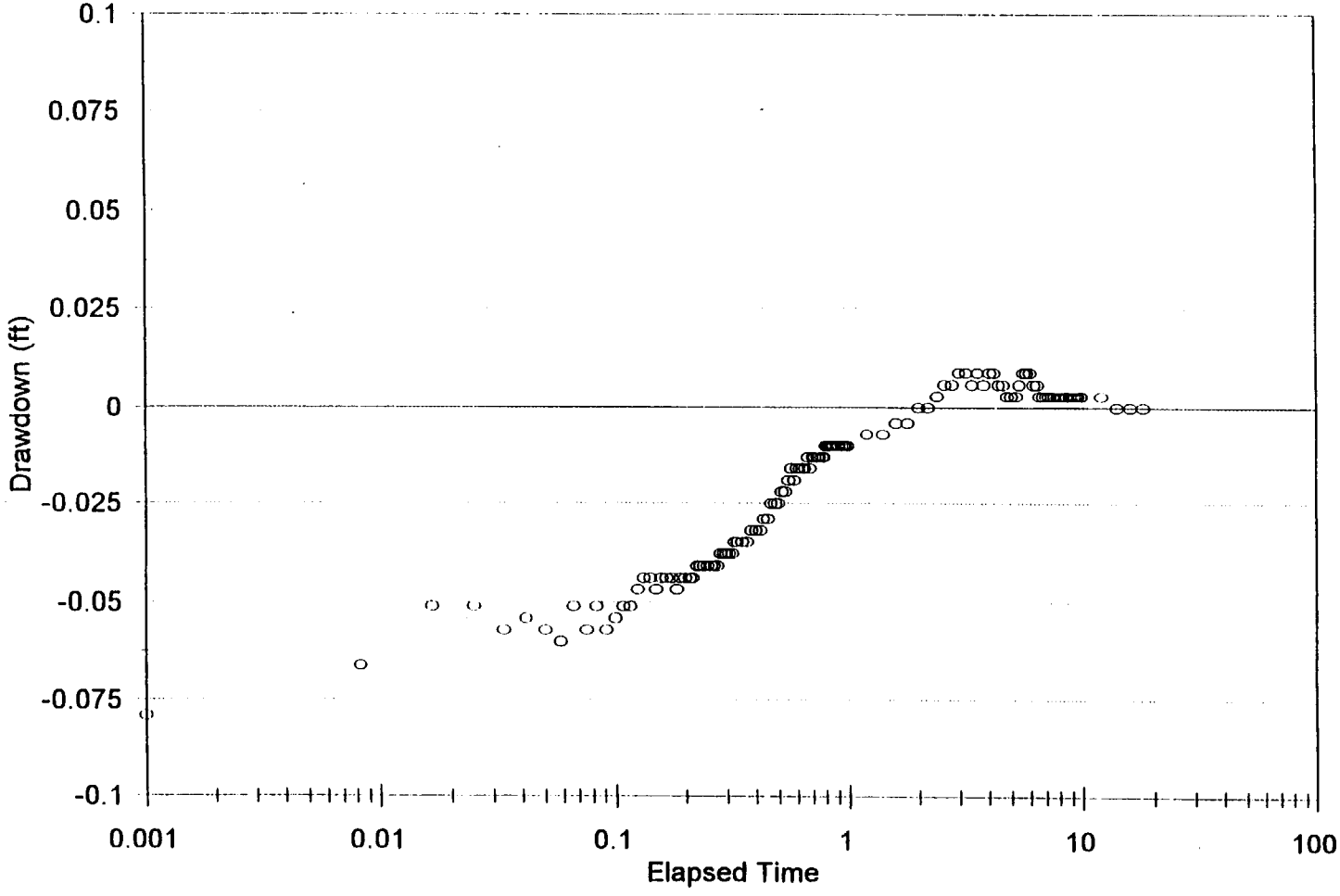
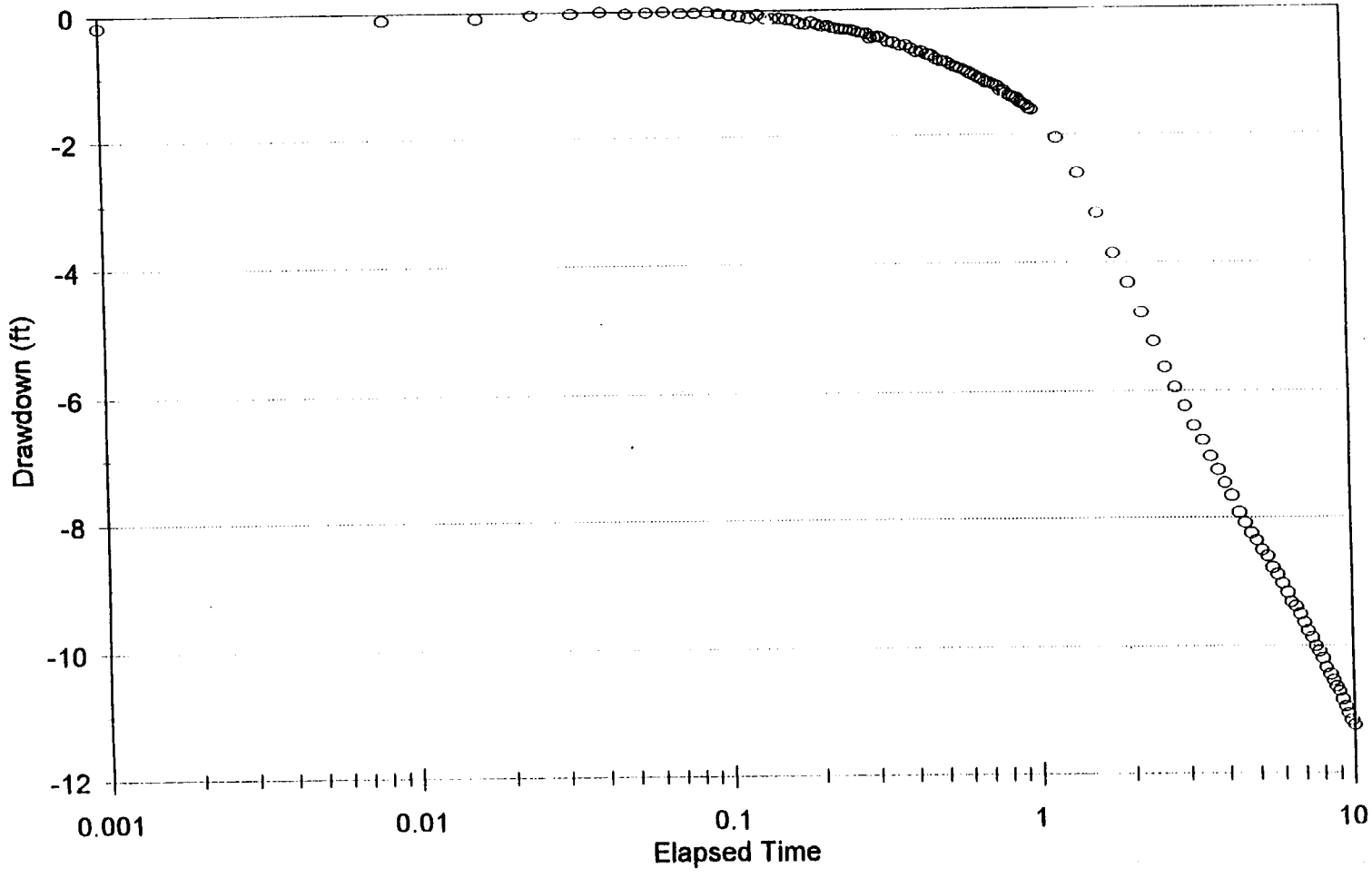
# HR-3/100D Well Development
## Well D3-2 Stepped to 60+ GPM



# HR-3/100D Well Development
## Well D3-2 Recovery



# HR-3/100D Well Development
## Well D4-13 Drawdown at 26 GPM

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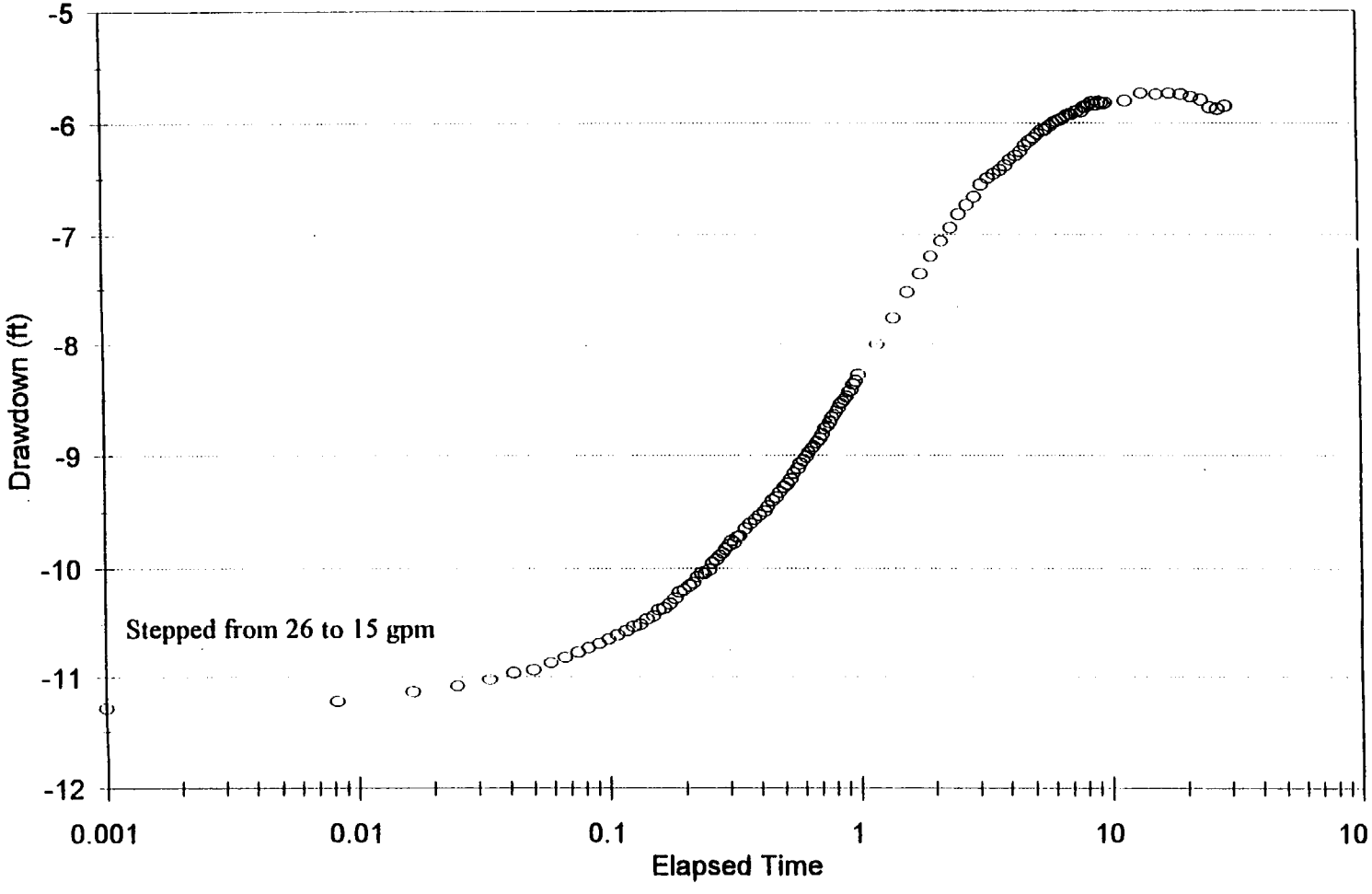
# HR-3/100D Well Development
## Well D4-13 Drawdown at 15 GPM

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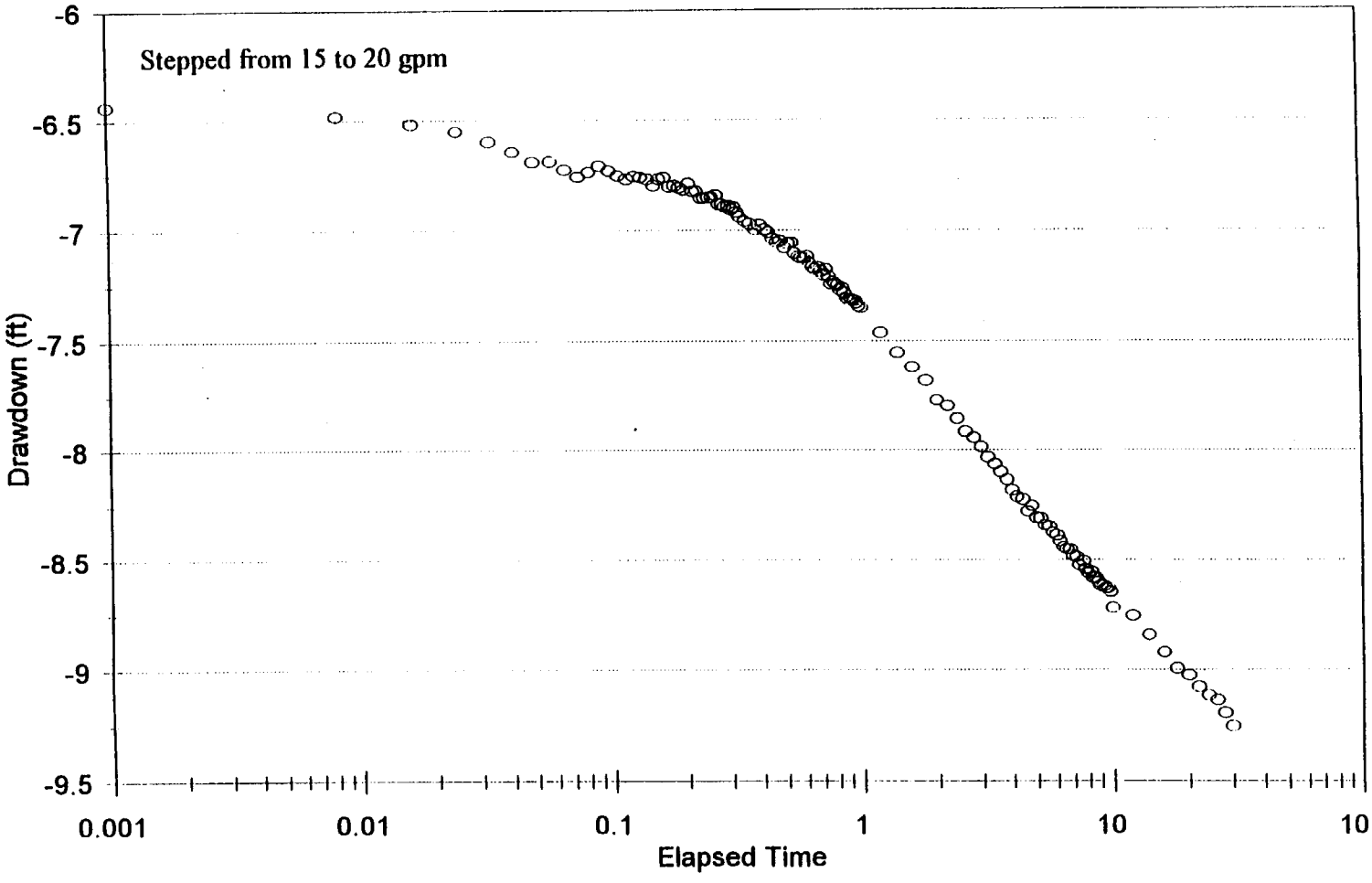
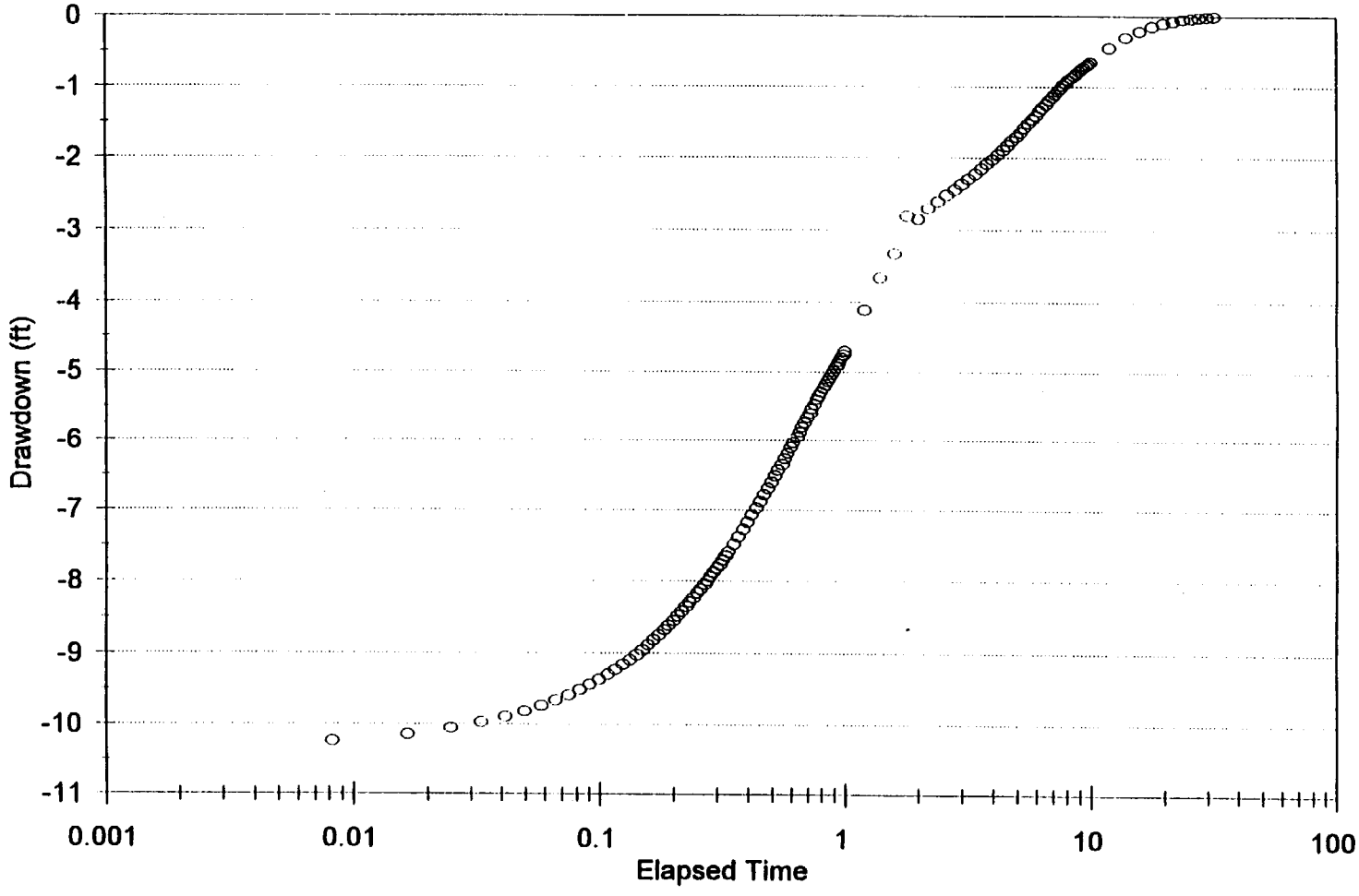
# HR-3/100D Well Development
## Well D4-13 Drawdown at 20 GPM



# HR-3/100D Well Development
## Well D4-13 Recovery

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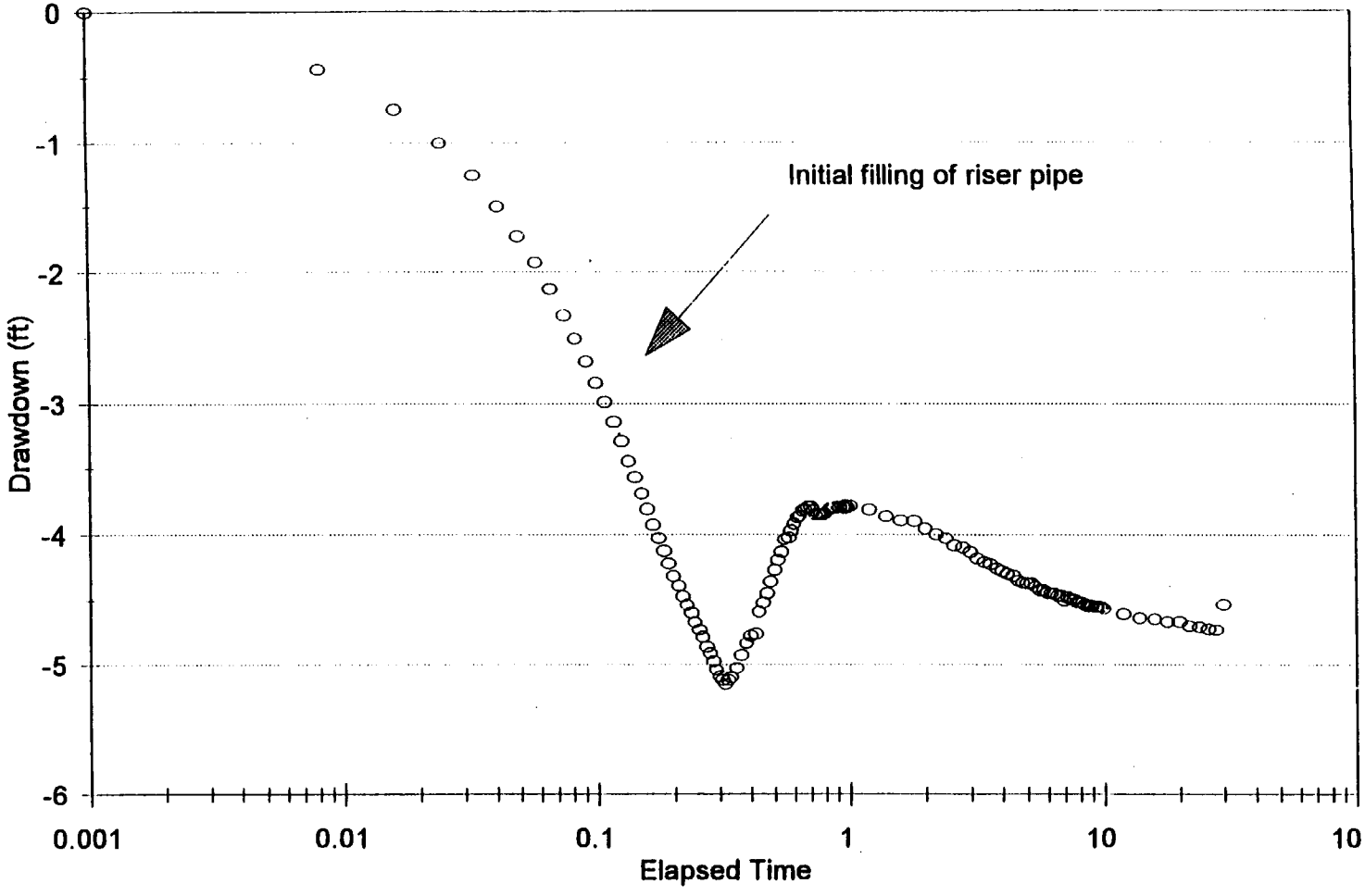
# HR-3/100D Well Development
## Well D4-14 Drawdown at 26 GPM

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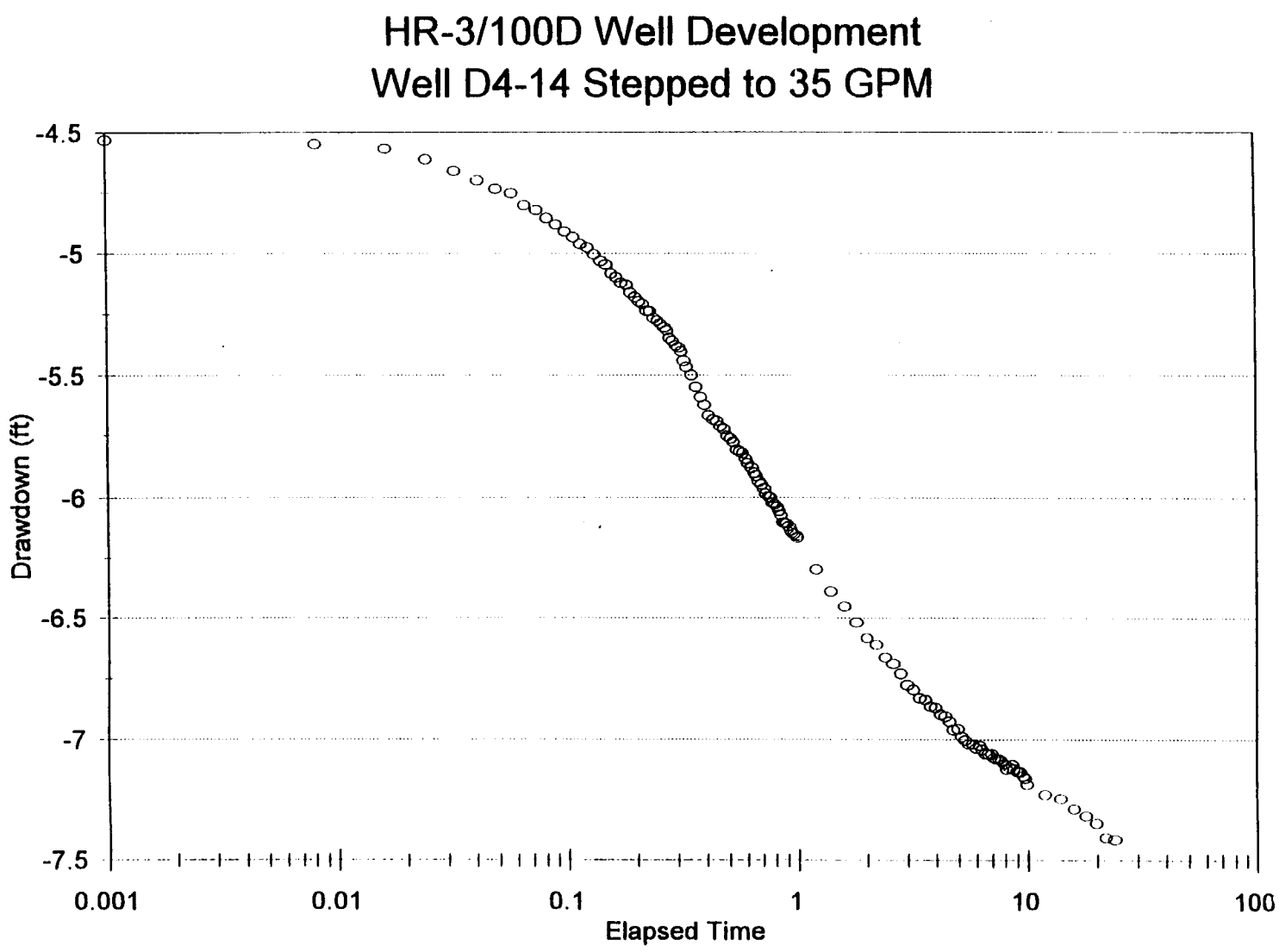


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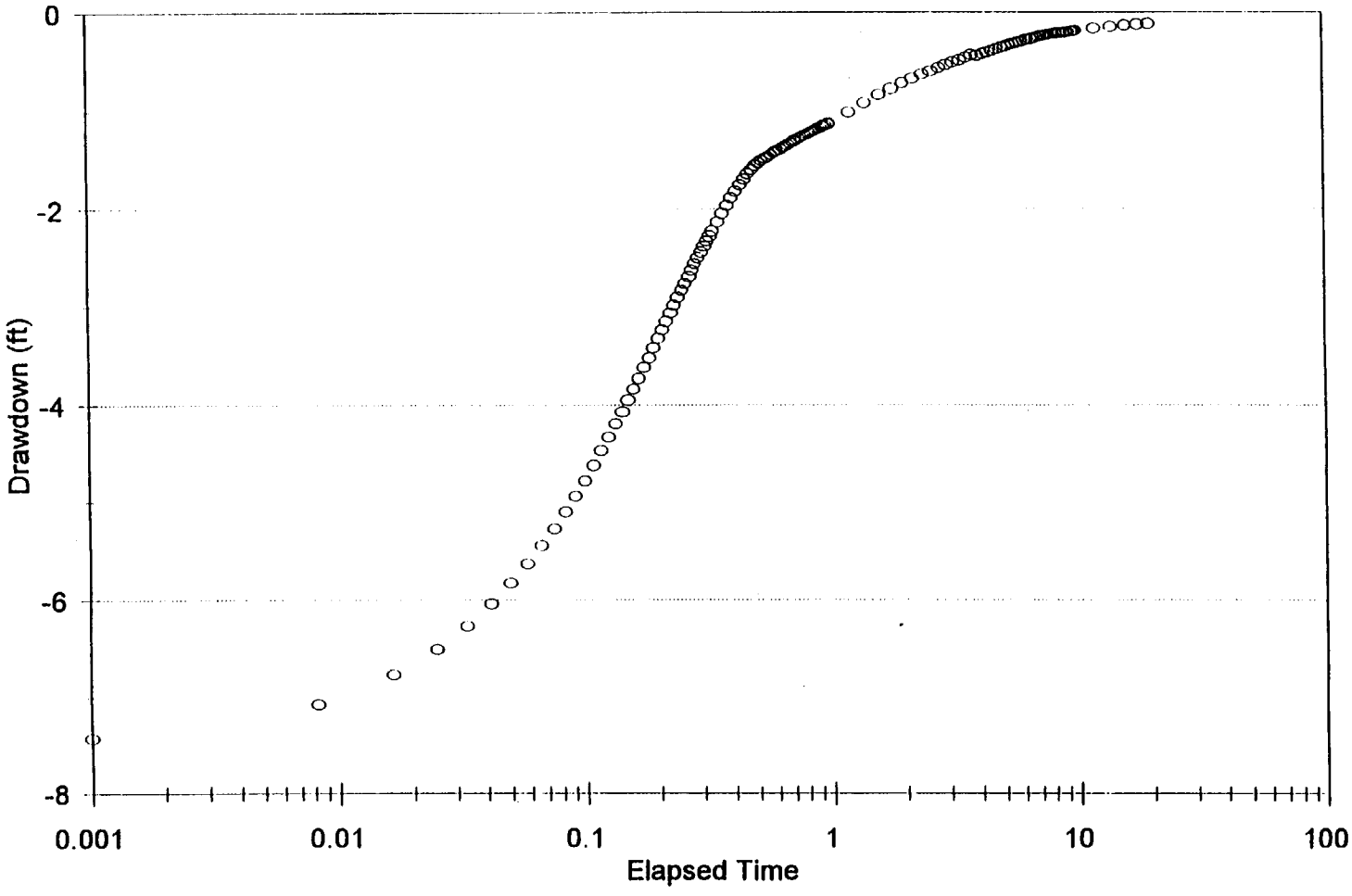
# HR-3/100D Well Development
## Well D4-14 Recovery

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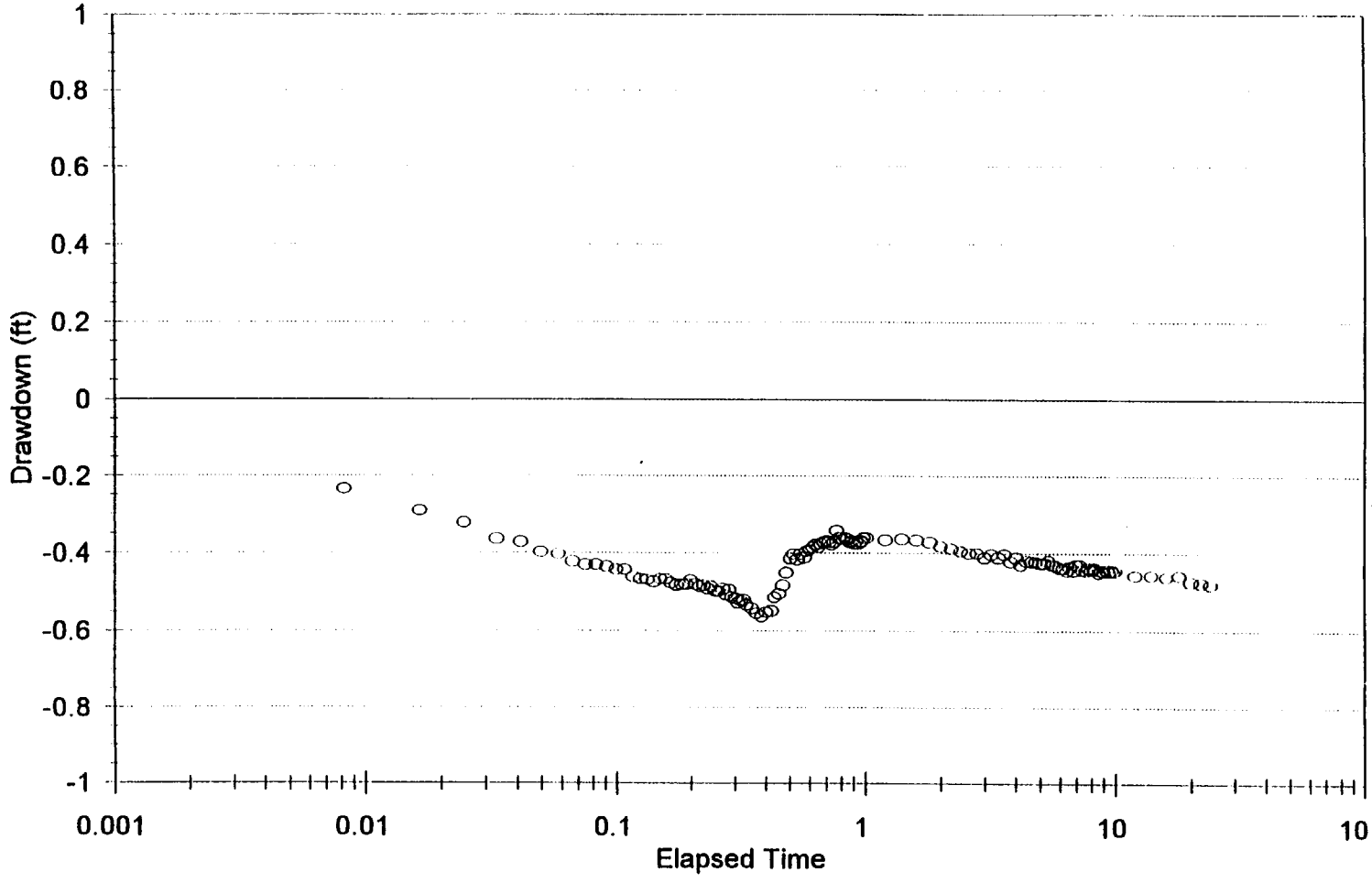
# HR-3/100D Well Development
## Well D4-15 Drawdown at 25 GPM

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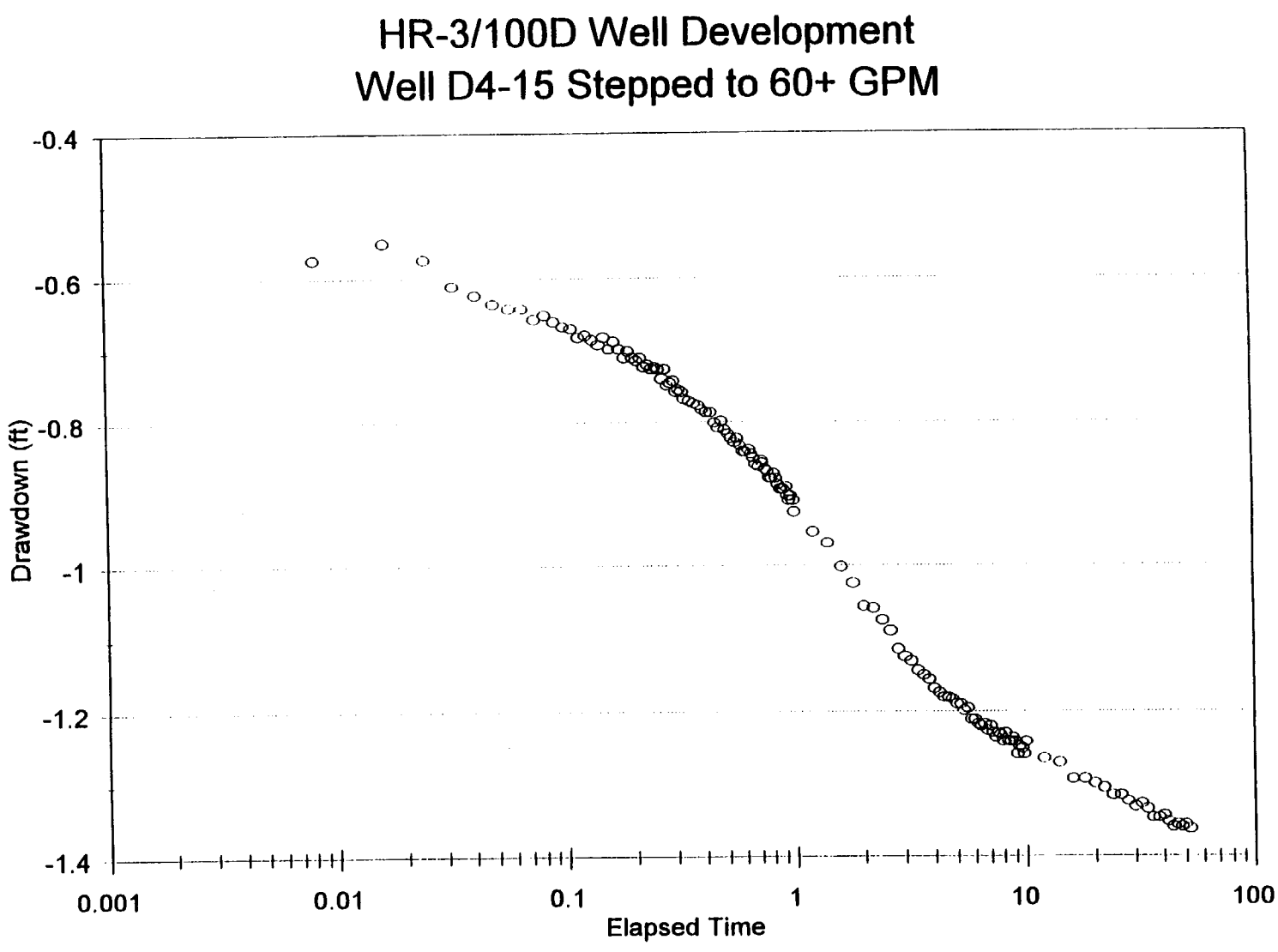


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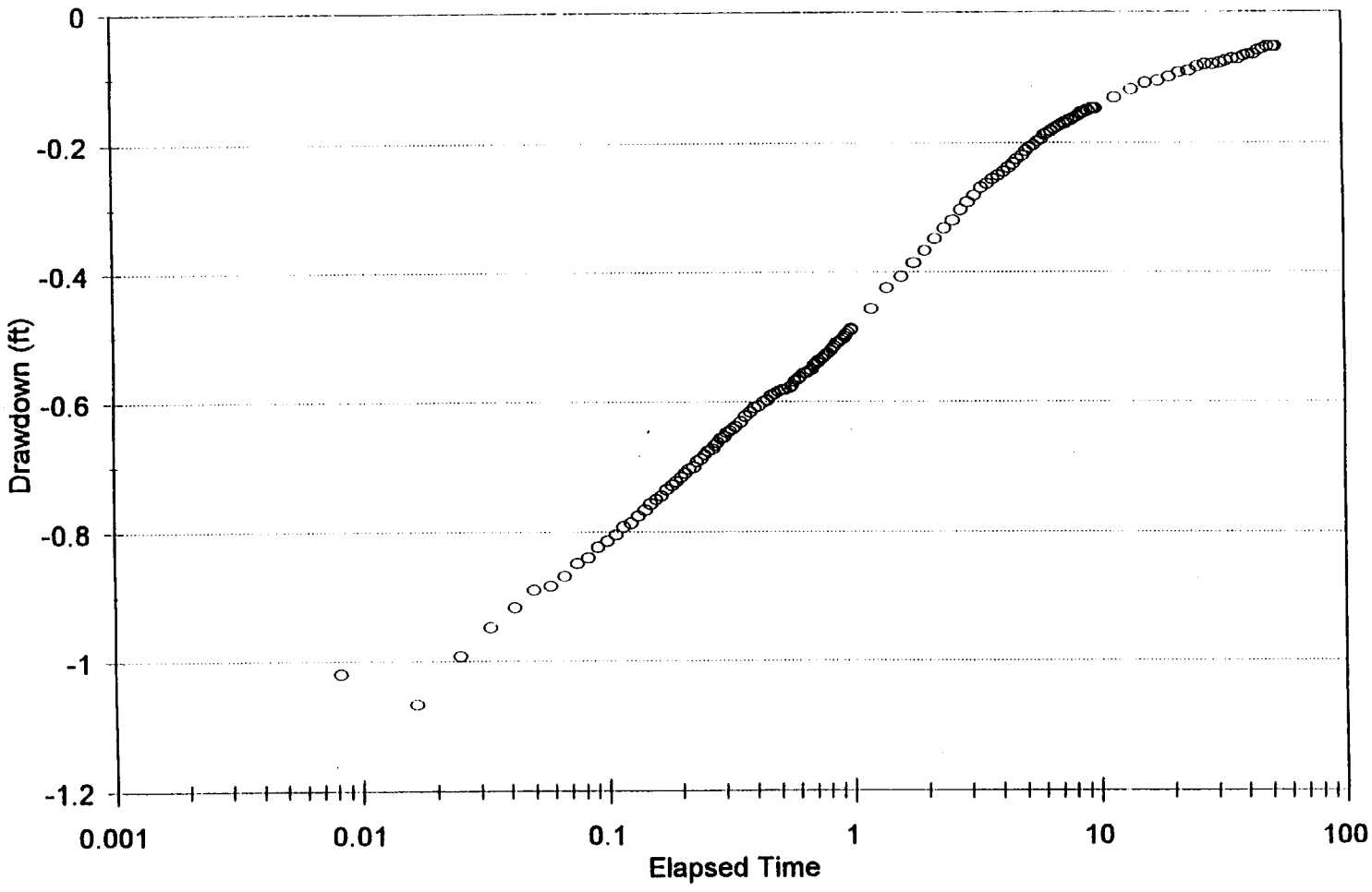
# HR-3/100D Well Development
## Well D4-15 Recovery



# GROUNDWATER SAMPLE REPORT

| | | |
|---|---|---|
| Project: D Area Hot Spot - Water Sampling | Date: 8/28/97 | Page 1 of 1 |
| Sampling CY Quarter: August 1997 | Calculations: NA | |
| Well Number: 199-D3-2 | | |
| Total Purge Volume (gal): NA | Purge Flow Rate (gal/min): NA | |
| Hydrostar ☐ Submersible ☑ Time on: 0954 | | |

## SAMPLES COLLECTED

B0LNB5 Field Analysis
1:125ml/P MS INORGANIC BY TEST KIT (Hexavalent Chromium) (None)

Note:
Chrome VI values provided after this report was issued by M. Stankovitch.

| Time | |
|---|---|
| 0955 | 0.028 mg/L |
| 1020 | 0.020 mg/L |
| 1035 | 0.019 mg/L |

Total No. Bottles 3

## FIELD MEASUREMENTS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water Level (TOC): | | | | | pH Serial No.: 005235 | | | | | |
| Cond./Therm. Serial No.: 51448005 | | | | | D. O. Serial No.: NA | | | | | |
| Time | 0955 | 1020 | 1035 | | | | | | | |
| pH | 7.833 | 7.71 | 7.709 | | | | | | | |
| Temp. (°C) | 16.7 | 16.0 | 16.1 | | | | | | | |
| Cond. (µs/cm) | 290 | 287 | 286 | | | | | | | |
| Turb. (NTU) | 7.92 | 0.46 | 0.53 | | | | | | | |
| ~~D. O. (mg/L)~~ | | | | | | | | | | |
| Chrome VI | | | | | | | | | | |
| | | | | | | | | | | |

## FIELD OBSERVATIONS

Weather: Cloudy Cool 65°F Raining

General Problems/Unusual Events: None

Equipment Irregularities: None

Container Irregularities: None

Comments: None

Well capped ~~and locked~~ MS: ☑ Yes ☐ No Samples preserved with ice: ☐ Yes ☑ No

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☑ No

Data Recorded by: [signature] M. Ko Stankovich 8/28/97
Print and sign name Date

Data Checked by:
Print and sign name Date

# GROUNDWATER SAMPLE REPORT

| | |
|---|---|
| Project: D Area Hot Spot - Water Sampling | Date: 8/26/97 — Page 1 of 1 |
| Sampling CY Quarter: August 1997 | Calculations: Purge volume calculated by R. Edrington on Field Activity log |
| Well Number: 199-D4-13 | |
| Total Purge Volume (gal): NA — Purge Flow Rate (gal/min): NA | |
| Hydrostar ☐ Submersible ☒ Time on: 1130 | |

## SAMPLES COLLECTED

~~B0LN86~~ MS — Field Analysis
1;125ml;P — INORGANIC BY TEST KIT (Hexavalent Chromium) (None)

Total No. Bottles 3

## FIELD MEASUREMENTS

Water Level (TOC): 80.74 — pH Serial No.: 005233

Cond./Therm. Serial No.: 51448005 — D. O. Serial No.: 95537631

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time | 1145 | 1222 | 1254 | | | | | | | |
| pH | 7.92 | 7.72 | 7.71 | | | | | | | |
| Temp. (°C) | 20.3 | 19.0 | 19.0 | | | | | | | |
| Cond. (µs/cm) | 506 | 507 | 507 | | | | | | | |
| Turb. (NTU) | 56.6 | 1.5 | 1.0 | | | | | | | |
| ~~D. O. (mg/L)~~ | NA | NA | NA | | | | | | | |
| Chrome VI | 0.519 | 0.841 | 0.790 | | | | | | | |
| | | | | | | | | | | |

## FIELD OBSERVATIONS

Weather: Clear, partial Clouds 85°F

General Problems/Unusual Events: None

Equipment Irregularities: None

Container Irregularities: None

Comments: S+D 0.025 / Results 0.024 mg/l. Cr+6, No Heis # Assigned

Well capped ~~and locked~~: ☒ Yes ☐ No — Samples preserved with ice: ☐ Yes ☐ No NA

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: Moko Stankovich / [signature] — Print and sign name — Date 8/26/97

Data Checked by: — Print and sign name — Date

# GROUNDWATER SAMPLE REPORT

| | | |
|---|---|---|
| Project: D Area Hot Spot - Water Sampling | Date: 8/27/97 | Page 1 of 1 |
| Sampling CY Quarter: August 1997 | Calculations: NA | |
| Well Number: 199-D4-14 | | |
| Total Purge Volume (gal): NA | Purge Flow Rate (gal/min): NA | |
| Hydrostar ☐ Submersible ☒ Time on: 1346 | | |

## SAMPLES COLLECTED

B0LNB7 ~~1;125mL;P~~ Field Analysis
INORGANIC BY TEST KIT (Hexavalent Chromium) (None)

Total No. Bottles 3

## FIELD MEASUREMENTS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water Level (TOC): 82.66 | | | | | pH Serial No.: 005235 | | | | | |
| Cond./Therm. Serial No.: 5144 8005 | | | | | D. O. Serial No.: 95537631 | | | | | |
| Time | 1347 | 1418 | 1438 | | | | | | | |
| pH | 8.062 | 7.63 | 7.609 | | | | | | | |
| Temp. (°C) | 17.6 | 16.8 | 16.9 | | | | | | | |
| Cond. (µs/cm) | 415 | 410 | 410 | | | | | | | |
| Turb. (NTU) | 3.68 ~~415~~ | 1.18 | 1.30 | | | | | | | |
| ~~D. O. (mg/L)~~ | | | | | | | | | | |
| Chrome VI mg/L | 0.438 | 0.553 | 0.610 | | | | | | | |
| | | | | | | | | | | |

## FIELD OBSERVATIONS

Weather: 80°F Partly Cloudy winds 5-10 mph from west

General Problems/Unusual Events: none

Equipment Irregularities: None

Container Irregularities: None

Comments: None

Well capped and locked: ☒ Yes ☒ No Samples preserved with ice: ☐ Yes ☒ No

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: [signature] Print and sign name — Date: 8/27/97

Data Checked by: Print and sign name — Date

# GROUNDWATER SAMPLE REPORT

| | | |
|---|---|---|
| Project: D Area Hot Spot - Water Sampling | Date: 8/27/97 | Page 1 of 1 |
| Sampling CY Quarter: August 1997 | Calculations: NA | |
| Well Number: 199-D4-15 | | |
| Total Purge Volume (gal): NA | Purge Flow Rate (gal/min): NA | |
| Hydrostar ☐ Submersible ☒ Time on: 0837 | | |

## SAMPLES COLLECTED

B0LNB8 ~~1,125ml,P~~ no Field Analysis
INORGANIC BY TEST KIT {Hexavalent Chromium} (None)

Total No. Bottles 3

## FIELD MEASUREMENTS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water Level (TOC): 82.35 | | | | | pH Serial No.: 005235 | | | | | |
| Cond./Therm. Serial No.: 51448005 | | | | | D. O. Serial No.: ~~95~~ no NA | | | | | |
| Time | 0838 | 0902 ~~0902~~ no | 0948 | | | | | | | |
| pH | 7.73 | 7.46 | 7.37 | | | | | | | |
| Temp. (°C) | 17.0 | 16.7 | 17.1 | | | | | | | |
| Cond. (µs/cm) | 540 | 624 | 641 | | | | | | | |
| Turb. (NTU) | 5.37 | 1.30 | 0.83 | | | | | | | |
| ~~D. O. (mg/L)~~ no | | | | | | | | | | |
| Chrome VI mg/l | 2.190 | 1.974 | 2.040 | | | | | | | |
| | | | | | | | | | | |

## FIELD OBSERVATIONS

Weather: Partly Cloudy 65°F

General Problems/Unusual Events: none

Equipment Irregularities: none

Container Irregularities: none

Comments: NA

Well capped ~~and locked~~: no ☒ Yes ☐ No Samples preserved with ice: ☐ Yes ☒ No

Samples Surveyed for Gamma Radiation by RPTs: ☐ Yes ☒ No

Data Recorded by: [signature] Print and sign name Date 8/27/97

Data Checked by: Print and sign name Date

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