

APPENDIX C

MONITORING WELL DIAGRAMS

FOR THE REPORT

CHARACTERIZATION OF GROUND WATER FLOW IN THE LOWER BOISE RIVER BASIN

prepared for and in cooperation with the

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IDAHO WATER RESOURCES RESEARCH INSTITUTE
RESEARCH REPORT

IWRRI-2003-09



Appendix C: Construction Details for Dedicated, Multi-Level Piezometers

This section provides well construction diagrams for the four dedicated monitoring wells constructed in conjunction with the Treasure Valley Hydrologic Project.

Diagram for TVHP #1 taken from United Water Idaho report “Hydrogeology, Geochemistry, and Well Construction of the Treasure Valley Hydrologic Project Monitoring Well #1, Ada County, Idaho (Dittus, Allred and Squires, 1999). Diagram for TVHP #2 provided by Ed Squires, Hydrologic, Inc. Diagram for TVHP #3 provided by Terry Scanlan, Scanlan Engineering. Diagram for TVHP #4 created by Scott Urban, IDWR.

Treasure Valley Hydrologic Project Monitoring Well #1

Comparison of Water Chemistry in Piezometer Completion Zones

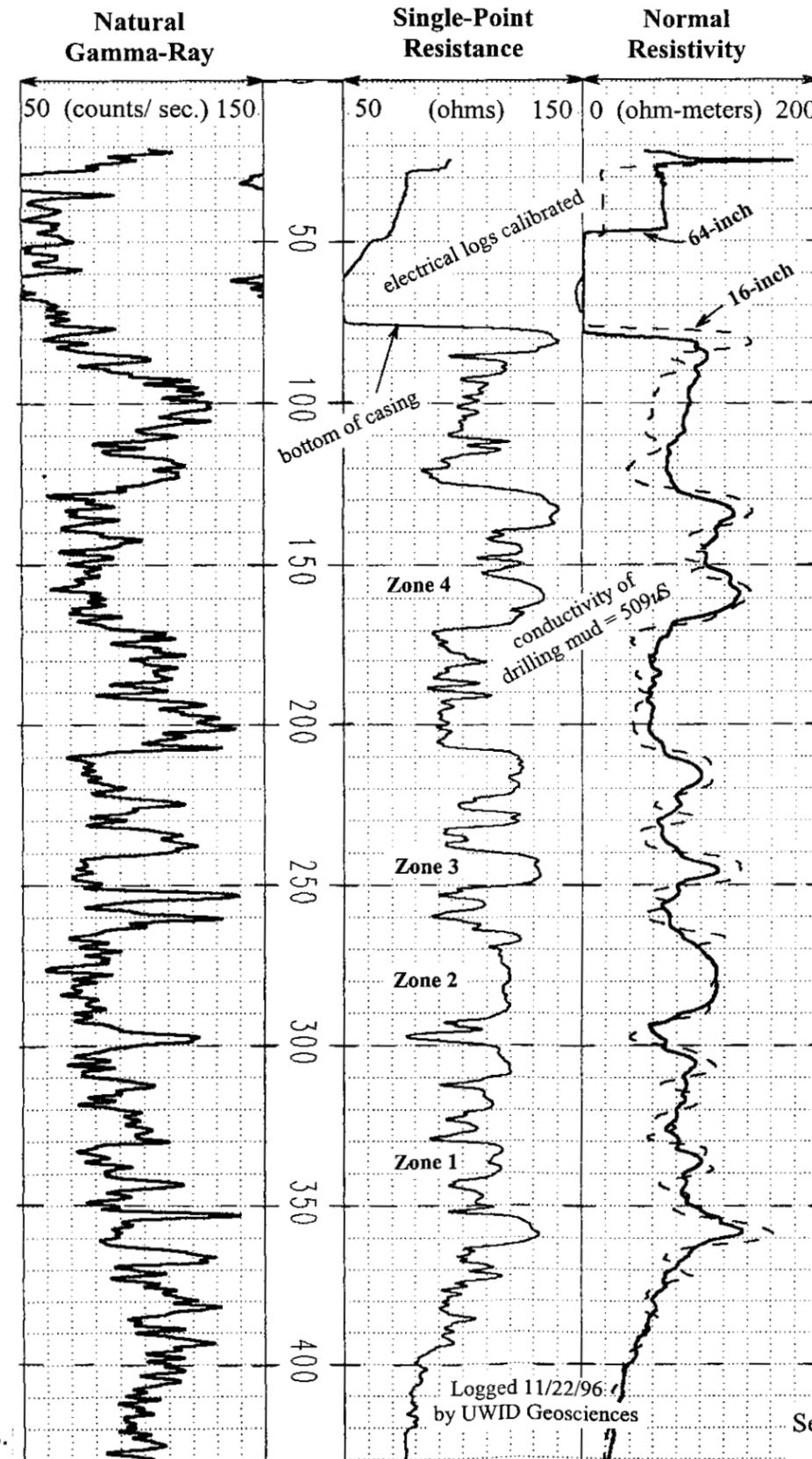
(Analyses in mg/l unless note otherwise.)

| Constituent screen setting (ft below ground) | Zone 4 130-140 ft. 150-170 ft. | | Zone 3 210-220 ft. 240-250 ft. | | Zone 2 270-290 ft. | | Zone 1 300-310 ft. 330-340 ft. | |
|--|--------------------------------------|-------|--------------------------------------|-------|-----------------------|-------|--------------------------------------|-------|
| | X | Y | X | Y | X | Y | X | Y |
| Laboratory X: Alchem Y: Analytical | | | | | | | | |
| Date sampled | 12/13/98 | | 12/13/98 | | 12/13/98 | | 12/13/96 | |
| Chloride | 3.20 | 3 | 2.63 | 3 | 1.73 | 2 | 2.05 | 2 |
| Fluoride (direct) | 0.33 | 0.75 | 0.37 | 0.05 | 0.36 | 0.66 | 0.34 | 0.57 |
| Nitrate (N) | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.13 | 0.16 |
| Sodium | 24.9 | 24.2 | 20.3 | 19.4 | 15.2 | 14.2 | 17.3 | 15.8 |
| Sulfate | 10.2 | 11 | 22.5 | 22 | 11.4 | 12 | 14.4 | 14 |
| Sulfide | <0.05 | 0.19 | <0.05 | 0.16 | <0.05 | 0.23 | <0.05 | 0.07 |
| Calcium | 37.5 | 33.3 | 39.0 | 35.1 | 28.1 | 25.8 | 28.9 | 29.2 |
| Potassium | 2.17 | 1.64 | 2.55 | 2.06 | 2.07 | 1.63 | 2.00 | 1.58 |
| Magnesium | 4.16 | 3.62 | 7.22 | 6.55 | 3.94 | 3.70 | 4.54 | 4.58 |
| Iron-total | 0.03 | <0.05 | 0.63 | 0.50 | 0.05 | <0.05 | 0.06 | <0.05 |
| Iron-dissolved * | 0.01 | <0.05 | 0.57 | 0.45 | 0.01 | <0.05 | 0.02 | <0.05 |
| Manganese-total | 0.01 | <0.05 | 0.06 | 0.05 | 0.04 | <0.05 | 0.03 | <0.05 |
| Manganese-dissolved * | 0.01 | <0.05 | 0.05 | 0.05 | 0.04 | <0.05 | 0.03 | <0.05 |
| Silica | 28.7 | 30.6 | 31.5 | 32.9 | 33.6 | 33.6 | 32.5 | 29.9 |
| Alkalinity | 139.0 | 143 | 132.0 | 138 | 101.0 | 103 | 112.0 | 114 |
| Conductivity-lab (uS) | 299 | 294 | 313 | 305 | 224 | 237 | 260 | 255 |
| Conductivity-field (uS) | 262 | | 273 | | 213 | | 247 | |
| Corrosivity (Langlier) | -0.33 | -0.7 | -0.35 | -0.8 | -0.54 | -0.8 | -0.87 | -1.1 |
| Hardness | 111.0 | 108 | 129.0 | 125 | 86.4 | 93.7 | 90.9 | 99.9 |
| Phosphorus (total) | 0.05 | 0.08 | 0.04 | 0.06 | 0.03 | 0.07 | 0.04 | 0.07 |
| Total dissolved solids | 248.0 | 188 | 173.0 | 200 | 188.0 | 164 | 218.0 | 182 |
| pH-lab (standard units) | 7.70 | 8.0 | 7.65 | 7.9 | 7.70 | 8.1 | 7.30 | 7.6 |
| pH-field (standard units) | 7.36 | | 7.18 | | 7.42 | | 7.03 | |
| Temperature | 54.8 °F | | 56.6 °F | | 58.0 °F | | 58.4 °F | |

* Samples for dissolved Iron and Manganese were filtered in the field

Location: NW ¼, SW ¼, SW ¼, Section 14, T4N, R1E, B.M., Ada County, Idaho
Well design by United Water Idaho Geosciences
Well completed 12/5/96 by Stevens & Sons Well Drilling, Boise, ID.

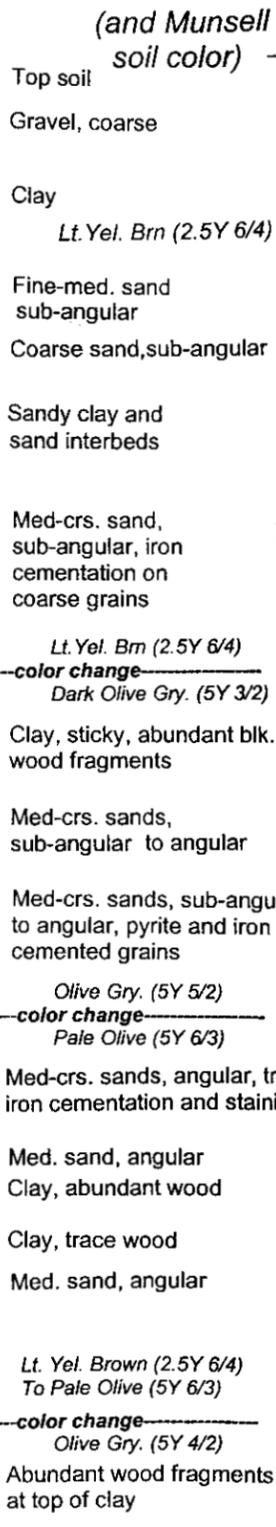
Geophysical Logs



Logged 11/22/96 by UWID Geosciences

Depth ft. bgl

Lithologic Log (and Munsell soil color)



Monitoring Well Construction

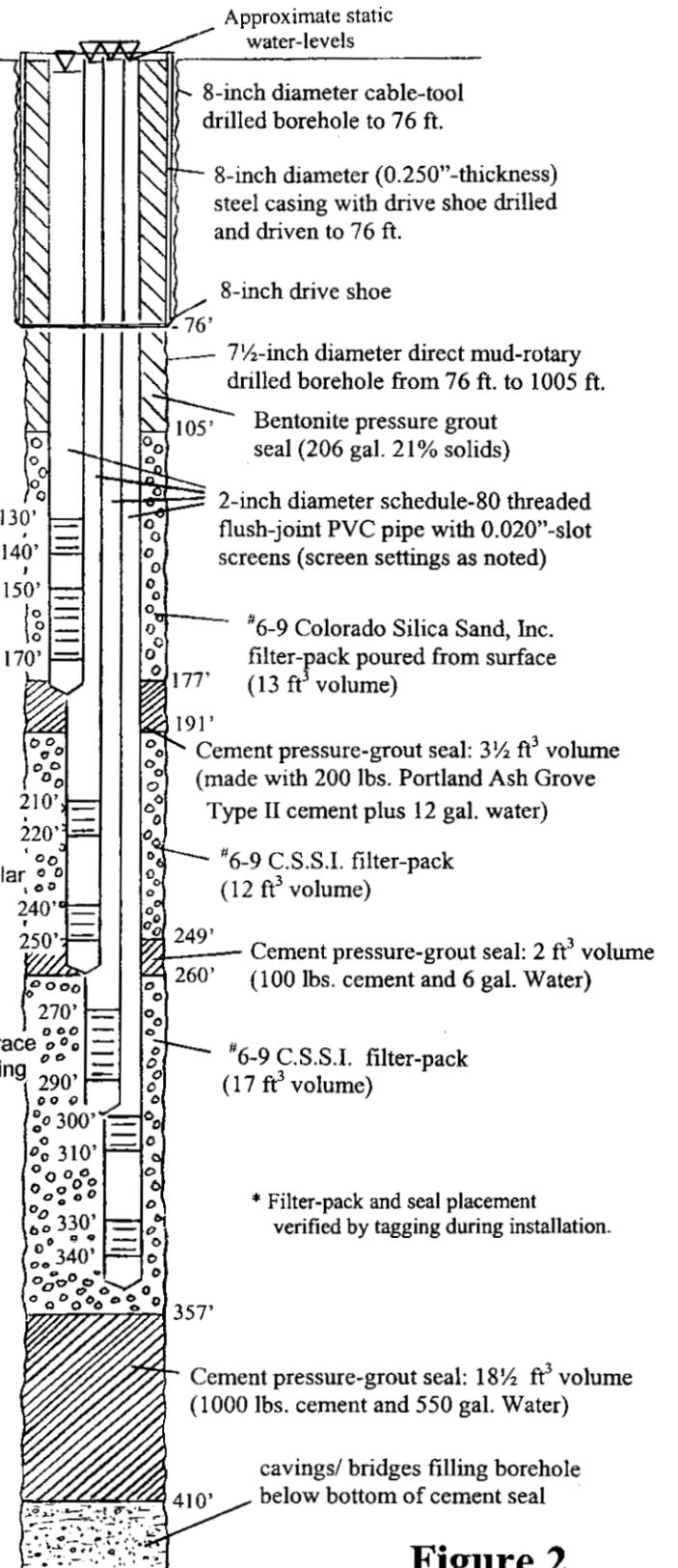


Figure 2.

See Figure 3 for complete lithologic and geophysical logs to 1005 ft.

Figure 2. Composite diagram showing well construction, lithologic log, geophysics and water chemistry at various depths.

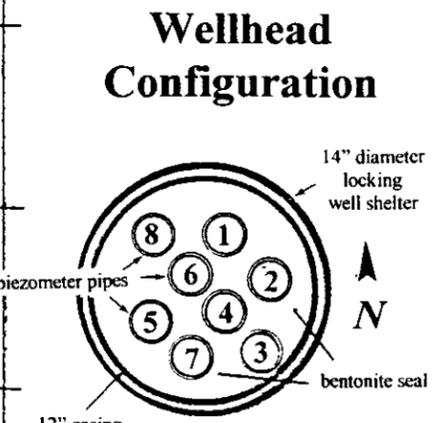
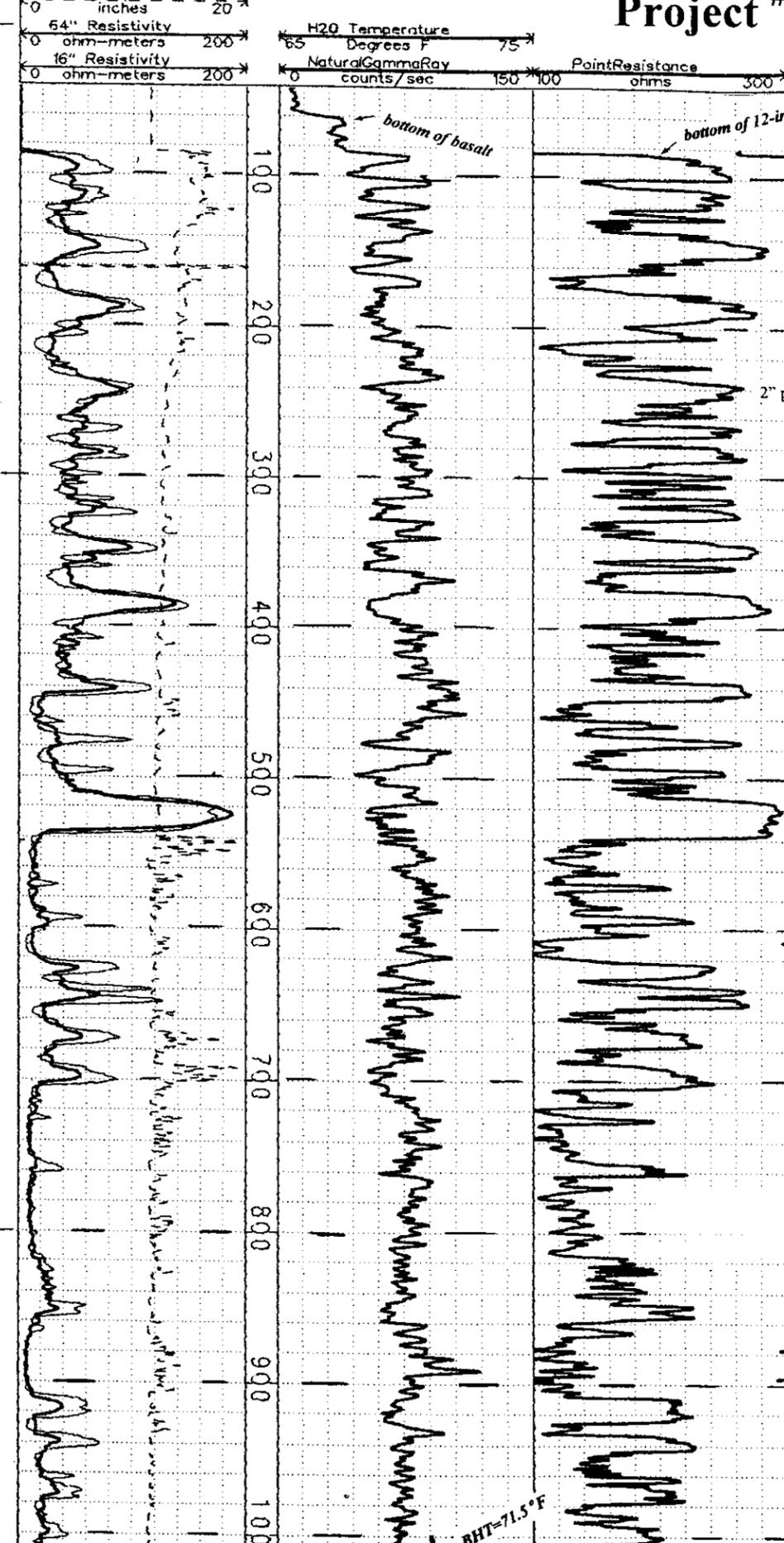
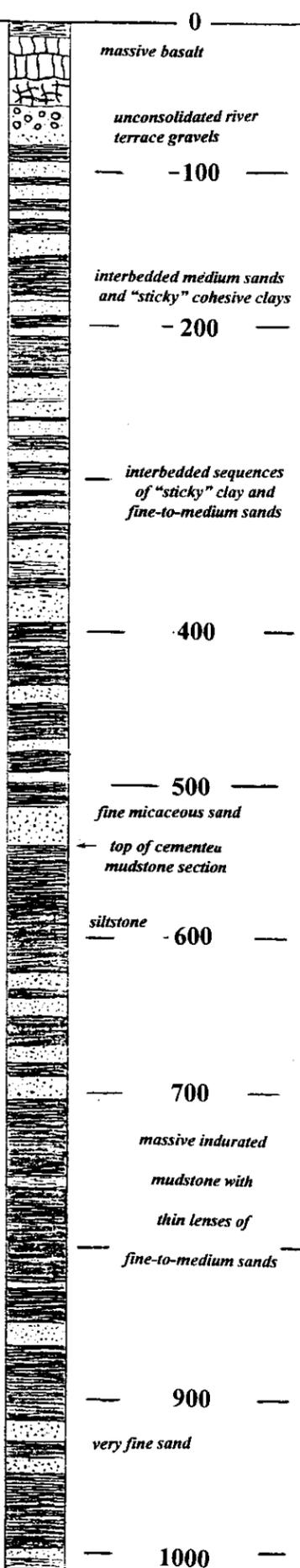
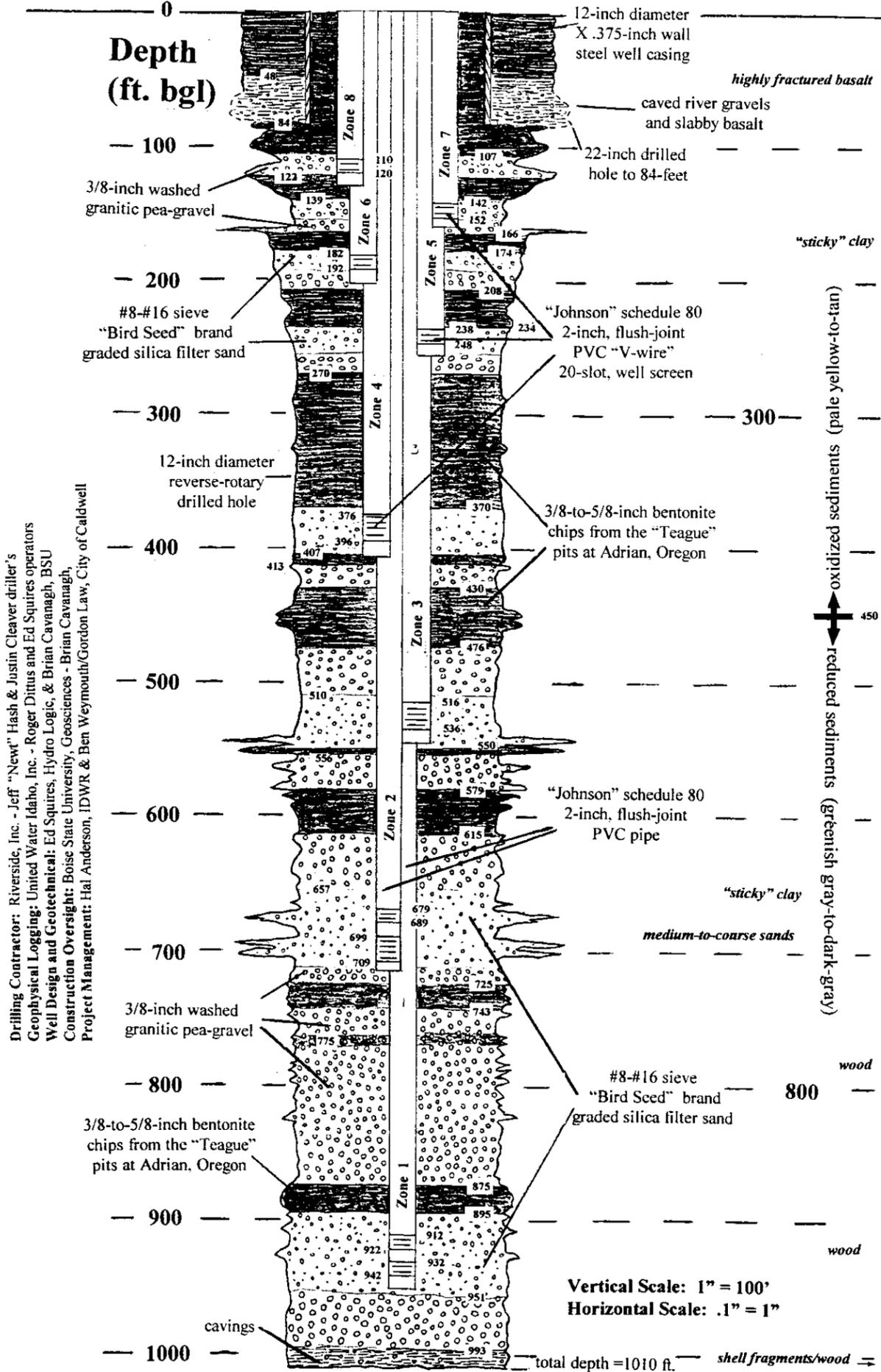
Well Construction

Lithology

Geophysics

Treasure Valley Hydrologic Project #2 Monitoring Well

11/2/1999



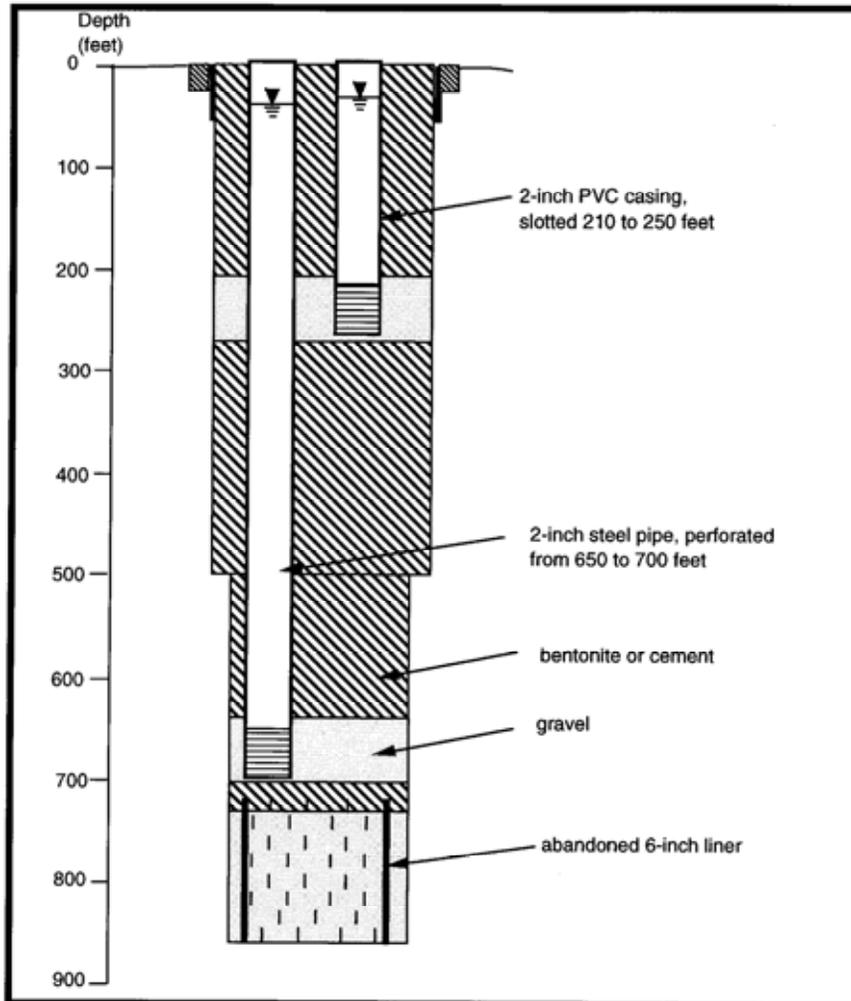
| Parameter (mg/l) | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | Zone 8 |
|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Aluminum | 23.2 | 60.5 | 61.8 | 349.0 | 76.3 | 149.0 | 168 | 168 |
| Ammonia as N | 0.33 | 0.04 | 0.04 | 0.06 | 0.06 | 0.03 | 0.03 | 0.03 |
| Calcium | 10.3 | 24.0 | 10.7 | 18.9 | 62.3 | 62.3 | 62.3 | 62.3 |
| Chloride | 2.44 | 2.80 | 3.06 | 9.81 | 1.15 | 1.15 | 1.15 | 1.15 |
| Cornstarch | -0.25 | -0.62 | -0.42 | 0.44 | 0.43 | 0.16 | 0.16 | 0.16 |
| Fluoride | 28.9 | 30.2 | 31.9 | 31.9 | 31.9 | 31.9 | 31.9 | 31.9 |
| Hardness | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| Iron | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Iron (diss.) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Magnesium | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Manganese (diss.) | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Nitrate as N | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Potassium | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Sulfate | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Sodium | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Sulfate | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Total Dissolved Solids | 167 | 170 | 170 | 170 | 170 | 170 | 170 | 170 |
| Total Phosphorus as P | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Field pH | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 |
| Field Conductance as S | 181 | 181 | 181 | 181 | 181 | 181 | 181 | 181 |
| Field Temperature *F | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| Odor | H2S |
| Gas (volatile) | no |
| Water level (ft. bgl) | 40.82 | 36.38 | 37.77 | 35.25 | 35.16 | 36.06 | 36.26 | 37.45 |
| VOC's | | | | | | | | |

Water Chemistry

Geophysical logs run in an open, water filled borehole on 10/1/99

ES/BC
11-99

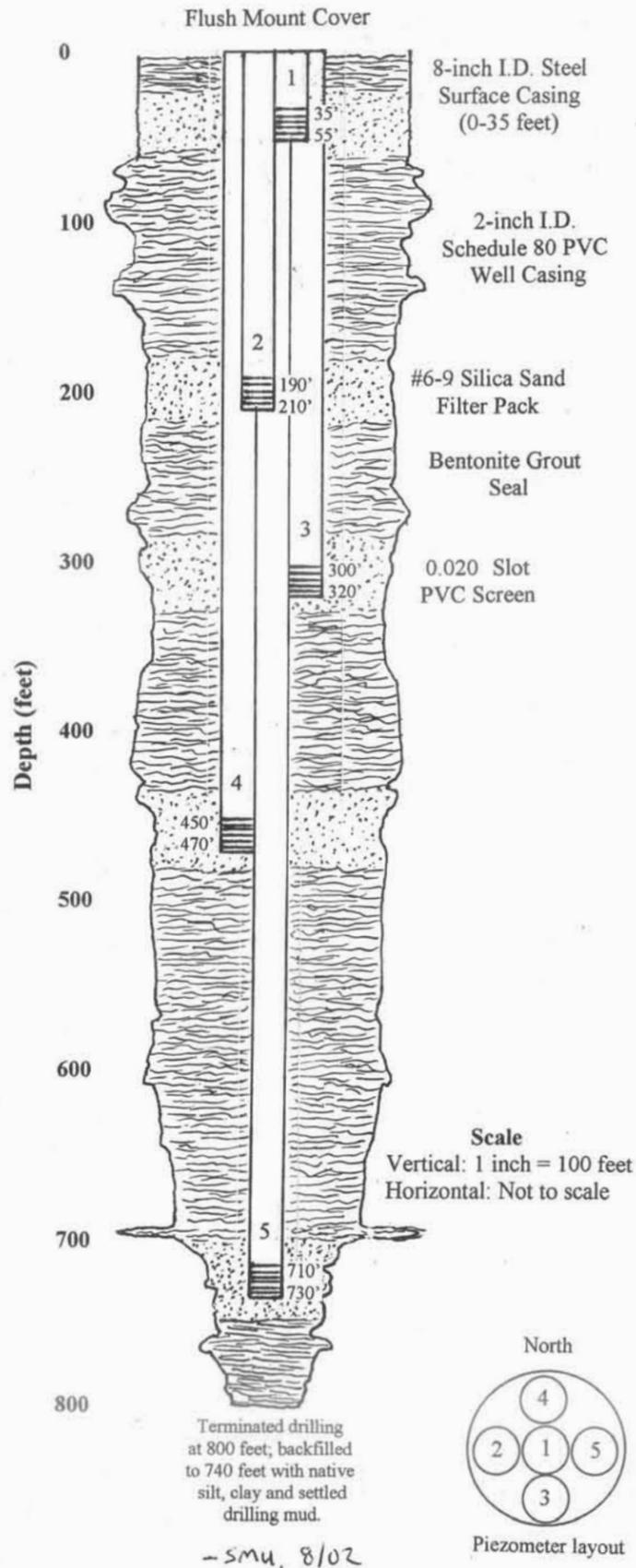
Drilling Contractor: Riverside, Inc. - Jeff "Newt" Hash & Justin Cleaver driller's
Geophysical Logging: United Water Idaho, Inc. - Roger Dittus and Ed Squires operators
Well Design and Geotechnical: Ed Squires, Hydro Logic, & Brian Cavanagh, BSU
Construction Oversight: Boise State University, Geosciences - Brian Cavanagh,
Project Management: Hal Anderson, IDWR & Ben Weymouth/Gordon Law, City of Caldwell



TVHP #3 – Quarry View Park
(diagram by T. Scanlan, Scanlan Engineering)

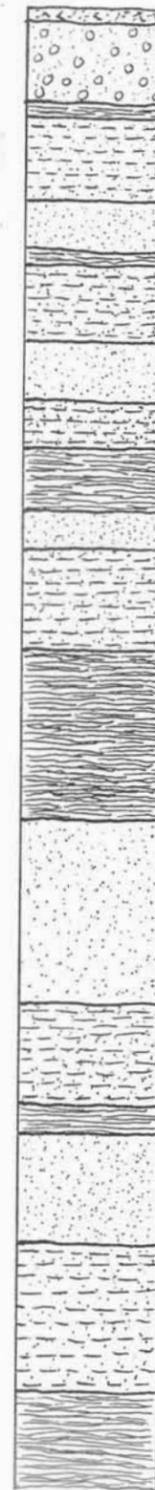
Municipal Park Monitoring Well (TVHP #4)

Well Construction Details

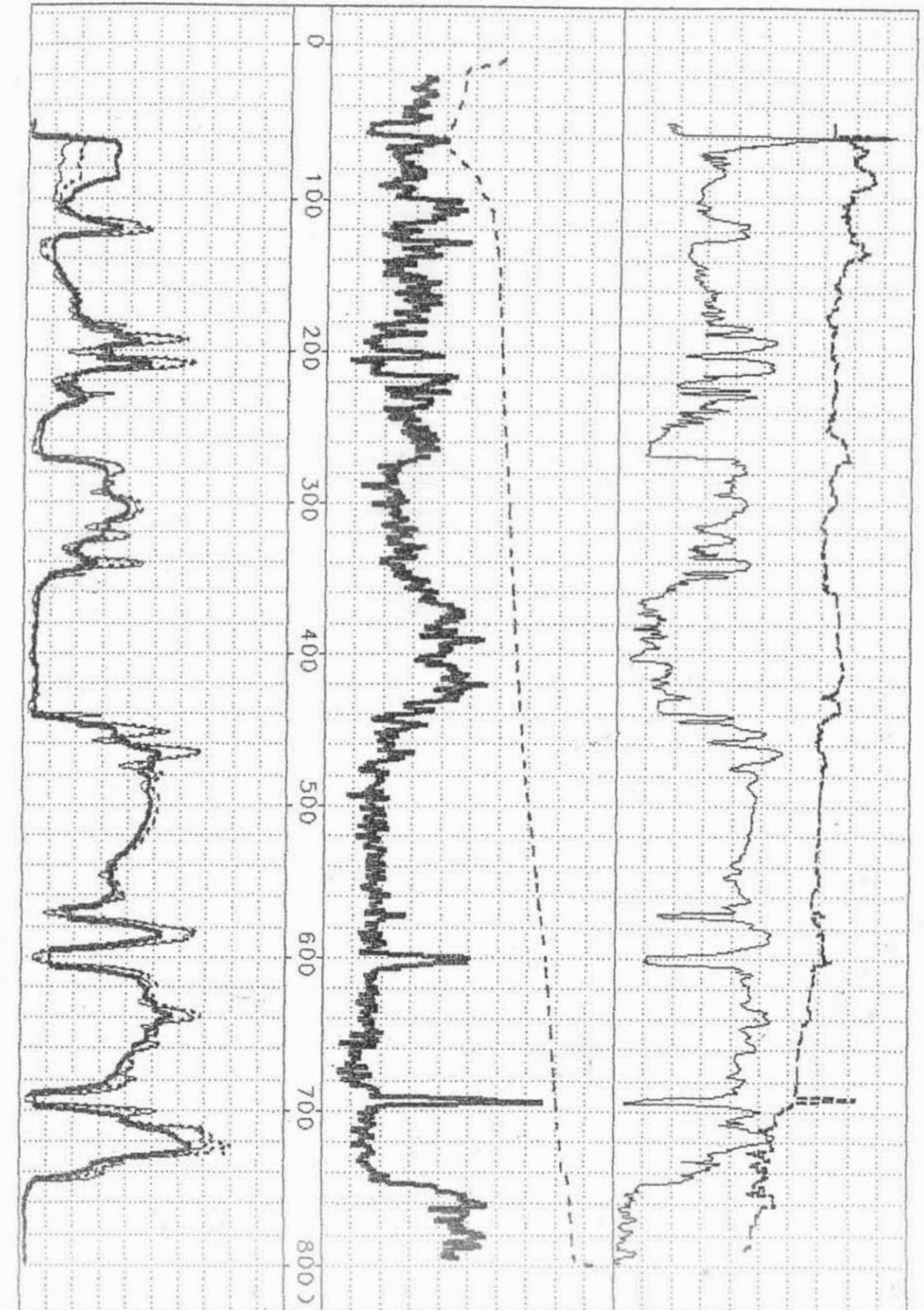


Lithologic Log

| | |
|-----------|--|
| 0 - 8 | Topsoil/fill/sand and gravel; grayish brown (2.5Y 5/2) |
| 8 - 55 | Sand with gravel; light brownish gray (2.5Y 6/2); Possibly cemented at 37 - 38 feet, then >H ₂ O |
| 55 - 60 | V. fine sand (yellowish-brown, 10YR 5/4) interbedded with clay (dark gray, 5Y 4/4). "Brown clay" in driller's report |
| 60 - 105 | Fine to coarse sand with clay; gray (5Y 6/1); Fast drilling (60 feet/hour) |
| 105 - 130 | Fine to coarse sand; light olive-gray (5Y 6/2) |
| 130 - 140 | Clay; v. dark gray (10YR 3/1); some wood fragments; |
| 140 - 180 | Sandy clay, fine to medium; greenish-gray (5GY 5/1) |
| 180 - 215 | Sand, interbedded fine to coarse; olive-gray (5Y 5/2) |
| 215 - 240 | Sandy clay; v. dark gray (5Y 3/1 - 4/1) |
| 240 - 270 | Clay; v. dark gray (5Y 4/1) |
| 270 - 295 | Sand, fine to coarse; olive-gray (5Y 5/2) |
| 295 - 345 | Sand, fine to coarse, interbedded with clay; dark gray (5Y 5/1) Fast drilling (averaging 90 feet/hour from 330 - 530 feet) |
| 345 - 440 | Clay; dark gray (10YR 4/1) |
| 440 - 540 | Sand, fine to coarse; dark gray (5Y 4/1) |
| 540 - 595 | Sand, fine to coarse, interbedded with some clay; dark gray (5Y 4/1); Slower drilling (30 feet/hour) |
| 595 - 610 | Clay/sandy clay; dark gray (5Y 4/1) |
| 610 - 670 | Sand, fine to coarse; dark gray (5Y 4/1) Slow drilling (35 feet/hour); Caliper log suggests evidence of bit wear. |
| 670 - 750 | Sand, sandy clay, possible sandstone/mudstone; dark gray (5Y 4/1); very slow drilling (less than 20 feet/hour) |
| 750 - 800 | Clay; dark gray (5Y 4/1) |



Geophysical Logs



Drilled by Stevens and Son Well Drilling, Inc.
- Started drilling 6/18/02; well completed on 7/29/02
- Cable tool rig 0-59 feet; mud rotary 59-800 feet

Geophysical logging by L. Pearson, Hydro Logic, Inc.
- Well logged on 6/27/02

