Appendix C: Core Logs and Well Construction Diagrams: Wells Installed In 2004 And 2005

When a well was installed at the Site, the standard practice was to collect and describe geologic samples recovered during the drilling process. Most typically these samples were in the form of core, a cylindrical representation of the geology being penetrated, but occasionally only cuttings were available. The resulting description is referred to as a core log (using the Borehole Log form). Following determination that the borehole would meet the construction objectives of the proposed monitoring well, a monitoring well was constructed within the borehole. Documentation generated as a part of this activity is referred to as a well construction diagram (using the Monitoring Well Installation Report form). These forms were generally completed in the field.

Upon returning to the office, information on these forms was input and a computer-generated form including selected material from each field form was generated.

All three of these components are represented in this appendix.
C.1 Calendar Year 2004
<table>
<thead>
<tr>
<th>Elev. (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5817</td>
<td>Protective Casing, Stainless Steel, 6 in. ID. Casing, Sch 40-PVC, 2 in. ID.</td>
<td>3</td>
<td>Quakertown</td>
<td>OL/CL: Organic-rich Clay, dark brown (7.5YR3/2), trace sand. Roots common, very dense and firm, moist.</td>
<td></td>
</tr>
<tr>
<td>5816</td>
<td>Quakertown Paf</td>
<td>2</td>
<td></td>
<td>GW: Gravel, red (2.5Y4/8). 1&quot; - 1-1/2&quot; diameter angular clasts. Possibly broken cobble of Fountain Formation (fluvial sandstone).</td>
<td></td>
</tr>
<tr>
<td>5815</td>
<td>Bentorite Chips</td>
<td>1</td>
<td></td>
<td>GM/SM: Silty, Sandy Gravel, brown (7.5YR5/4). ~55% gravel (1/2&quot; - 1&quot; diameter, subangular, predominately quartzite), ~30% sand (medium grained to coarse grained, subrounded to subangular), some calcite disseminated throughout interval, moist.</td>
<td></td>
</tr>
<tr>
<td>5814</td>
<td>Filter Pack, 16/40 Silica Sand</td>
<td>3</td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5813</td>
<td></td>
<td>2</td>
<td>Bentorite Chips</td>
<td>GM/SM: Silty, Sandy Gravel, brown (7.5YR5/4). ~55% gravel (1/2&quot; - 1.5&quot; diameter, subangular to subrounded). ~30% sand (medium grained to coarse grained, subangular to subrounded), wet.</td>
<td></td>
</tr>
</tbody>
</table>
### Log of Boring Number: 10304

**Lithology**

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>SM/SC: Clayey, Silty Sand, yellowish brown (10YR5/4). 60 - 70% sand (very fine grained to fine grained, subrounded), 30 - 40% silt/clay, very uniform, poorly graded, wet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5809</td>
<td>No recovery.</td>
</tr>
<tr>
<td>5808</td>
<td>CLAYSTONE: TOP OF BEDROCK - Silty Claystone, yellowish brown (10YR5/8), mottled with light brownish gray (10YR6/2). Iron oxidized claystone bedrock. 3 - 8% black organic stringers throughout and patchy bleaching. Weak to moderately friable. Fairly dense and firm, wet.</td>
</tr>
<tr>
<td>5807</td>
<td>CLAYSTONE: Silty Claystone, dark grayish brown (10YR4/2) mottled with yellowish brown (10YR5/8). Iron oxidized claystone bedrock. Color of un-oxidized claystone is slightly darker than interval above from 7.5' to 9.0'. Slight decrease in silt. Weakly friable, iron nodules and fragments at 12.8'. Wet.</td>
</tr>
<tr>
<td>5806</td>
<td>CLAYSTONE: Claystone, dark grayish brown (10YR4/2) with yellowish brown (10YR5/8). Iron oxidation mottled throughout. Decreased overall iron oxidation to patchy/weak, dense/firm,</td>
</tr>
<tr>
<td>5805</td>
<td></td>
</tr>
<tr>
<td>5804</td>
<td></td>
</tr>
<tr>
<td>5803</td>
<td></td>
</tr>
<tr>
<td>5802</td>
<td></td>
</tr>
<tr>
<td>5801</td>
<td></td>
</tr>
<tr>
<td>5800</td>
<td></td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>Lithology</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>15</td>
<td>wet/moist</td>
</tr>
<tr>
<td>16</td>
<td>CLAYSTONE</td>
</tr>
<tr>
<td>18</td>
<td>CLAYSTONE</td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
GROUNDWATER MONITORING WELL AND PIEZOMETER INSTALLATION REPORT: Form PRO.118A

LOCATION CODE: 10304 PROJECT NAME: CVSP Well Installations PROGRAM: Water Program
SCREENED FORMATION: O/C Drilling Contractor: NWI BORING METHOD: geoprobe auger overdrill
DATE DRILLED: 4/1/04 Date Completed: 4/1/04 TOTAL DEPTH: 21.0' COMPLETED DEPTH: 19.75'
ESTIMATED DEPTH TO BEDROCK: 9.5' RIG GEOLOGIST: E. Wap LOGGING GEOLOGIST: E. Wap
BOREHOLE DIAMETER IN SCREENED INTERVAL: 6.0' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 5.78' on 7/20/04 COMPLETED WATER LEVEL (FT, DATE): 6.05' on 7/20/04
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0' I.D. SCH. 40 - PVC
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEQIC, ETC.): 6.0'I.D. Steel Protective casing - Stick-up

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR Flush-MOUNT): 2.8'gs
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.5'gs ID (IN): 2.0'
SURFACE SEAL TOP: N/A BOTTOM: N/A TYPE: N/A
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.2'Ips - 60' ID
*WELL PAD DIMENSIONS, TYPE: 3' X 3' Quickcrete Pad
*ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: Quickrete
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEQIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: 9.3' DEPTH: 0.00' TYPE: Bentonite Chips - PDSCO
*BENTONITE SEAL TOP: N/A TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (FILTER PACK TOP): 3.8'
FILTER PACK TYPE: 16/40 Silica Sand BRAND: CSSI
SURFACE CASING BOTTOM (=SCREEN TOP): 4.3' TYPE: SCH. 40 - PVC
SCREEN ID (IN): 2.0' SLOT SIZE (IN): 0.01' TYPE: SCH. 40 - PVC
SCREEN BOTTOM (= SUMP, TOP): 19.3' SUMP TYPE: Threaded, conical end-cap
FILTER PACK BOTTOM (= "BACKFILL TOP": 19.75' "BACKFILL TYPE: Netline material"
SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.75' "PILOT HOLE TOP, DIAMETER: 6.0"
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM": 21.0'

REMARKS: 25' geoprobe for core logging, then overdrill w/6.0' Augers, glad to auger twice to recover top end, weld plug initially stuck w/in augers, V.W.T. during well installation
COMPLETED BY: E. Wap DATE: 4/1/04
CHECKED BY: J. Rosen DATE: 10/21/04

Installed protective casing (6.0" Steel Stick-up) and well pad on 7/6/04
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 1.1'</td>
<td>Organic Rich CLAY - Dk. Brn. (9.5 YR 3/4) &amp; sand. Roots common. V.dense and firm. MOIST.</td>
</tr>
<tr>
<td>1.1 - 1.3'</td>
<td>General - Red (2.5 YR 3/4) &amp; 1.0 - 1.5&quot; dia. - qa, qa, qa, possibly broken. Limestone at 1.0&quot; dia. (Bluish So).</td>
</tr>
<tr>
<td>1.3 - 1.9'</td>
<td>Silty, Sandy GRAVEL - Brn. (7.5YR 3/4), ~55% gravel, 1/2 - 1 1/2&quot; dia, sub-angle to sub-rounded, ~55% sand, m.g. to c.g. Sub-rounded to sub-angular. Some caliche ciss throughout interval. MOIST.</td>
</tr>
<tr>
<td>1.9 - 3.5'</td>
<td>No Recovery</td>
</tr>
<tr>
<td>3.5 - 5.3'</td>
<td>Silty Sandy GRAVEL (7.5YR 3/4), ~55% gravel, 1/2 - 1 1/2&quot; dia, sub-angle to sub-rounded, ~50% sand, m.g. to c.g. Sub-rounded to sub-rounded. WET.</td>
</tr>
<tr>
<td>5.3 - 5.5'</td>
<td>Clayey, Silty SAND - Yellow Brn (10YR 7/4), 40-70% Sand, v.f. to f.q., sub-rounded to sub-rounded. WET.</td>
</tr>
<tr>
<td>5.5 - 7.5'</td>
<td>No Recovery</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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Date: 7/22/04

Sample Type: Push-quarter inch Core
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 10304
Location - North: E
Location - East: 290.0
Date: 7/11/94
Geologist: E. Wiese
Drilling Equip.: AMS Power Probe

Surface Elevation:
Area:
Total Depth: 290.0
Company: NRS
Sample Type: Continuous Core - Push

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 7/22/94

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0-14.0' Silty Claystone - Dk Grysh. Brn (10YR 4/2) mottled with Yelsh. Brn (10YR 4/6). Foux claystone bedrock. Color of un-old claystone is slightly darker than interval above, 9.5-9.0'. St. dear. in silh. Weakly nodular, Fe nodules and frags @ 12.6', WET.</td>
</tr>
<tr>
<td>148-155' = No Recovery</td>
</tr>
<tr>
<td>155-17.8' Claystone - V. dk. Grysh. Brn. (10YR 4/6). Unweathered claystone bedrock. V. dense and firm. Uniform, Tr. Foux stringers @ 17.4' and 17.9'. Deor. overall moisture to moist.</td>
</tr>
<tr>
<td>19.7-20.0' = No Recovery</td>
</tr>
<tr>
<td>20.0 = T.D.</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

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<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5924</td>
<td>Protective Casing, PVC with locking steel lid, 8 in. ID</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5923</td>
<td>Casing, Sch 80-PVC, 1 in. ID</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5922</td>
<td>Quicksand Pad</td>
<td>1</td>
<td>OL/CL: Silty Clay with trace sand and trace gravel, very dark brown (7.5YR2.5/2). Trace sand (coarse grained, subangular to subrounded), trace - 2% gravel (1/8&quot; - 1/4&quot; diameter, subangular to subrounded) of granitic and quartzite composition. Roots common/organic rich. Trace caliche (disseminated and stringers). Moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5921</td>
<td>Granular Bentine</td>
<td>0</td>
<td>GM: Silty Gravel with trace to some sand. Matrix is very dark brown (7.5YR2.5/2). 60 - 75% gravel (1/4&quot; - 2&quot; diameter, subangular to subrounded, predominately pegmatitic granite and quartzite, moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5920</td>
<td></td>
<td>2</td>
<td>CL: Silty Clay with trace sand and trace gravel, very dark brown (10YR2/2) to dark grayish brown (10YR4/2). Trace disseminated caliche, moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5919</td>
<td>Filter Pack, 16/40 Silica Sand</td>
<td>3</td>
<td>CL: Clay with trace to some gravel, trace to some silt, and trace sand. Brown (10YR4/3) to dark yellowish brown (10YR4/4). Trace to 5% gravel (1/4&quot; - 3/4&quot; diameter, subangular to subrounded, predominately quartzite and granite composition). Sandy lense at 4.0'. Trace white caliche stringers from 4.0' to 4.5'. Possibly reworked claystone. 1&quot; diameter quartzite cobble at 4.5'. Moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5918</td>
<td></td>
<td>4</td>
<td>GC/CL: Clayey Gravel, yellowish brown (10YR5/4) to light olive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
brown (2.5Y5/3). 45 - 60% gravel (1/8" - 1.5" diameter, subangular to subrounded, quartzite). Large angular clasts of pink fine-grained sandstone (Fountain Formation?), 3/4" - 1.5" diameter. From 4.9' to 5.5' is definitely re-worked claystone. Moderate pervasive iron oxidation from 4.5' to 4.7'. Black organics common in claystone clasts from 5.7' to 5.8'. Gravelly basal contact with claystone bedrock, iron oxidized, moist.


SILTY CLAYSTONE: Silty Claystone (iron oxidized), light yellowish brown (10YR5/6) to dark yellowish brown (10YR4/6). Trace black organic stringers. Competent to 7.2', then moderately friable to 8.0' with moderate pervasive iron oxidation. Strong pervasive iron oxidation and extremely friable between 8.0' and 8.9'. Weak to moderate iron oxidation from 8.9' to 11.2'. Moderately friable between 10.5' and 10.8', otherwise fairly competent between 8.9' and 11.2'. Black organic material at 11.1'. Between 11.2' and 11.3', at base of interval, increased iron oxidation (pervasive). Increased moisture from very moist to wet at 11.3'.

SILTY CLAYSTONE: Silty Claystone, yellowish brown (10YR5/6) to dark yellowish brown (10YR4/6). Strong pervasive iron oxidation. Strongly weathered, crumbly/friable. Possible fluvial channel in claystone or incipient ironstone, wet.

SILTY CLAYSTONE: Silty Claystone, yellowish brown (10YR5/6). Weak to moderate pervasive iron oxidation. Black organic nodules (~1/4" diameter) and stringers common. Weakly friable but crumbly at base (12.4'). Moist, but no free water.

CLAYSTONE: Claystone, grayish brown (10YR5/2) to gray (10YR5/1). Organic-rich, black nodules very common. Extremely friable and crumbly. Slightly moist.

CLAYSTONE: Claystone, grayish brown (10YR5/2) to dark gray (10YR4/1). Decreased black organics to trace (blebs and stringers). Trace iron oxidation as fracture filling at 14.0'. Weakly to moderately
<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>friable, very uniform, massive texture, very slightly moist.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>CLAYSTONE: Claystone, grayish brown (10YR5/2) to dark gray (10YR4/1). Decreased black organics to trace (bles and stringers). Trace iron oxidation as fracture filling at 17.4'. Weakly to moderately friable, very uniform, massive texture, very slightly moist.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>CLAYSTONE: Claystone, brown (10YR4/3) with yellowish brown (10YR5/4) mottling. Patchy iron oxidation throughout. Iron oxidation as fracture fill along vertical internal fractures between 18.5' and 18.6'. Moderately friable and crumbly, trace moisture.</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>CLAYSTONE: Claystone, very dark grayish brown (10YR3/1), trace iron oxidation along internal fractures. Moderately friable/crumbly. Trace moisture.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>CLAYSTONE: Claystone, very dark gray (10YR3/1), very friable/crumbly. Iron oxidation along vertical, internal fractures between 19.8' and 20.0'.</td>
<td></td>
</tr>
</tbody>
</table>
GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT: Form PRO.118A

LOCATION CODE: 1104
PROJECT NAME: CW84 Well Installation
PROGRAM: Water Programs
SCREENED FORMATION: W-1
DRILLING CONTRACTOR: RTG
BORING METHOD: Geoprobe
DATE DRILLED: 7/2/04
DATE COMPLETED: 7/20/04
TOTAL DEPTH: 20.0'
COMPLETED DEPTH: 19.5'
ESTIMATED DEPTH TO BEDROCK: 5.9'
RIG GEOLOGIST: E. W. Waage
LOGGING GEOLOGIST: E. W. Waage
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.25
QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 7/20/04
DRIED
COMPLETED WATER LEVEL (FT, DATE): 13.72 (7/20/04)
Diameter & Type of Installation (Well/Peizometer/Well Point/etc.): 1.0" PVC Well
Type of Protection (Flush-Mount vs. Above Ground, Aseptic, etc.): Above ground - 8.0' PVC w/ Locking Steel

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.0'
- SECONDARY CASING TOP: N/A
- BOTTOM: N/A
- TYPE: N/A
- SURFACE CASING: 2.75'
- ID (IN): 1.0'
- SURFACE SEAL TOP: N/A
- BOTTOM: N/A
- TYPE: N/A
- PROTECTIVE CASING BOTTOM (ID, TYPE): N/A
- WELL PAD DIMENSIONS, TYPE: 25' x 25' - Quikrdrk
- ADD'L CASING FILL TOP: N/A
- BOTTOM: N/A
- TYPE: N/A
- SURFACE ISOLATION CASING TOP: N/A
- BOTTOM: N/A
- SURFACE ISOLATION CASING ID (IN): N/A
- TYPE: N/A
- OTHER (E.G., ASEPTIC) CASING TOP: N/A
- BOTTOM: N/A
- OTHER CASING ID (IN): N/A
- TYPE, PURPOSE: N/A
- CENTRALIZER(S) OD (IN): N/A
- NUMBER USED: N/A
- TYPE: N/A
- CENTRALIZER(S) DEPTH (S): N/A
- GROUT: N/A
- MEASURED DENSITY (LBS/GAL): N/A
- TYPE:
- GRANULAR BENTONITE TOP: 0.0
- TYPE: Granular Bentonite
- BENTONITE SEAL TOP: N/A
- TYPE: N/A
- BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 3.8'
- FILTER PACK TYPE: 1/4/80 Silica Sand
- BRAND: CSSI
- SURFACE CASING BOTTOM (= SCREEN TOP): 1.35
- TYPE: 1.0" Sch. 80 - PVC
- SCREEN ID (IN): 1.0
- SLOT SIZE (IN): 0.01
- TYPE: Sch. 80 - PVC
- SCREEN BOTTOM (= SUMP TOP): 19.4
- SUMP TYPE: Threaded End Cap
- FILTER PACK BOTTOM (= "BACKFILL TOP"): 19.5
- "BACKFILL TYPE: Granular Bentonite
- SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.5'
- "PILOT HOLE TOP, DIAMETER: 3.25"
- TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND BACKFILL BOTTOM"): 20.0'

REMARKS:
This was the 2nd offset from 1104 T.H. "A." Completed well N East and S North of 1104 T.H. "A." Dry during well installation. (core well fm 11.30 ft)
COMPLETED BY: E. W. Waage
DATE: 7/20/04
CHECKED BY: __________________________
DATE: __________________________
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 1104
Location: North: __________ East: __________
Date: 9/19/04
Geologist: [Signature]
Drilling Equip.: [Signature]

Surface Elevation: 20.0
Area: Replacement for 00197, Woman Crk - E, Orme Level 1
Total Depth: 20.0
Company: [Signature]
Project No.: [Signature]
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL [Signature] DATE 7/21/04

SAMPLE DESCRIPTION

0.0-2.1' 3.5% Clay 75% sand and 25% gravel, V. Dr. Bn. (75%YR 2.5L)
2.1-3.2' 2% gravel (20% Y6 2.5L), sub-rounded to sub-rounded. Clayey sand, coarse sand, and gravel with a grayish cementation. Roots common. Moist.
3.0-4.5' 2.5% gravel (40% Y6 2.5L), sub-rounded to sub-rounded, limestone and granite composition. Sand not visible. Moist.
4.5-6.9' Clayey gravel, 2% gravel, 3% sand, 50% clay, 25% silt, 25% sand, 5% gravel, (25% Y6 2.5L), sub-rounded to sub-rounded, fine sand. Large angular chert as well as leached claystone, 5% sandstone, 25% gravel, 40% sand. Moist.
5.9-6.9' Claystone 5% gravel, 5% silt, 90% clay
6.9-7.1' Silty claystone 5% gravel, 90% clay
7.1-8.0' Silty claystone 5% gravel, 90% clay
8.0-10.0' Claystone 5% gravel, 90% clay

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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Between 11.2-1.3' at base of interval, hard rock, not hard rock, extremely friable and main moisture 11.2, moist to wet at 11.3.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 11104
Surface Elevation: Woman Creek E. of Original Landfill
Location - North: 200.0
Date: 7/17/04
Total Depth: 20.0
Geologist: E. Waap
Company: UST/TEC
Drilling Equip.: FDP Geoprobe
Sample Type: Continuous Air-Pick

RMRMS LOGGING SUPERVISOR
APPROVAL
J. Koen
DATE 7/1/04

Sample Description


13.9'-14.9' - Claystone - Grysk Brn. (10YR 5/2) to Dr. Gry (10YR 4/4). Decr. blk. organics to Te (blebs & stringers). Te FeOx as fres. Filling @ 14.0' and 17.4'. W/H Friable. V. uniform massive texture. V. sl. moist.

11.9'-18.9' - Claystone - Brn. (10YR 5/3) w/yellow Brn. (10YR 5/4) motting. Patchy FeOx throughout. FeOx as fres. fill a long vertical internal frac. between 18.5'-18.6', Med. friable and crumbly, Te moisture.

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 11109-TEST HOLE "A"
Location: North:
Geologist: E. Wamp
Drilling Equip.: 40 ft Geoprobe

Surface Elevation: 210'
Area: TEST HOLE REFERENCE PROJECT No. 1
Total Depth: 80 ft G.Y.
Company: USGS Project No. HA057380
Sample Type: Continuous core - Push

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 7-7-04

SAMPLE DESCRIPTION

0.0-18'-CLAY w/Te to some s.g. sand and gravel. V. Dr. Ben (7.5 YR 2.5/2), Organic-rich roots common. 5-10% gravel (2'-1" dia., subang. predominately gravite) fm. 1.3 to 1.6'. V. sil. damp.

1.8-2.4'-CLAY w/ some sand and gravel. Brn. (7.5 YR 6/2), 5-10% sand (6.g. subang), 3-5% gravel (1/2 - 1" dia., subang. Sweden) (sandy)

2.4-2.7'-GRAVEL 2.0-2.5" dia., subang. Clasts of gravel - tumbled by geoprobe. Top of bedrock at 3.7" (?). V. sil. damp.

2.9-3.1'-CLAY (Freestone) L.T. Yellow Brn. (2.5 Y 5/2) to Grassy Brn. (2.5 Y 5/2). Mothy. F. blk. organic stringers. T. patchy caliche. vivid. stringers re-worked (?) claystone. V. sil. damp.

3.1-4.0'-NO RECOVERY


7.5-8.0'-CLAYSTONE - Lt. Yellow Brn (10YR 4/4) to Yellow Brn. (10YR 6/4). Mothy. Wk to Moth. FeOx. Silty lens @ 7.9'. Moist.

8.0-10.0'-Silty CLAYSTONE (Re-worked?). DK Yellow Brn. (10YR 4/4). Strong prev. FeOx. Strongly weathered and crumbly. WET. Possible fluvial channel in claystone? Re-worked claystone? Appears to be incipient ironstone, massive.
<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
</table>
| 10.0 - 11.5' | Siltstone (0%)- Lt. yellowish brown (10YR 4/4), Wk/perv., FeOx
|          | Patchy bleaching & blk. organic stringers. Moist. To clayey siltstone |
| 11.5 - 14.8' | Claystone, Lt. Brownish gray (10YR 4/2) w/Lesser Brownish Yellow (10YR 4/6) motting. Organic blk stringers common, Wk/perv. FeOx in fl. II.8 - 12.0', Interval fairly dense. Moist. |
| 14.3 - 16.4' | Silt Claystone. Lt. Brownish Gray (10YR 4/6) to Gray (10YR 6/6). Intermittent blk. To patchy Wk. FeOx. To some blk. organic stringers. Friable, crumbly. Nodule (~4" dia.) of blk. organic material @ 15.2", and FeOx on frac. To moisture. |

**NOTES:**
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
### Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 1104-1/8 Test Hole 'B'

**Location - North:** 1104-1/8 Test Hole 'B'

**Date:** 7/1/04

**Geologist:** E. Wright

**Drilling Eqpt.:** 66 ft GаPпрL5E5F

**Surface Elevation:** (Notable)

**Area:** Original Landfill Sitemap

**Total Depth:** 21.5 ft

**Company:** USRS/72

**Project No.:** HAP5720

**Sample Type:** Continuous Core - Rush

---

### RMRS Logging Supervisor Approval

**Approval:** [Signature]

**Date:** 7/1/04

---

### Sample Description

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-0.8</td>
<td>Clay w/ some gravel, v. dry, dense (10%-20%). 5-10% gravel (0.1-1&quot; dia., sub-rounded, predominantly quartzite), organic rich, roots common. v. slightly damp.</td>
<td></td>
</tr>
<tr>
<td>0.8-1.1</td>
<td>Gravel - large cobble of quartzite shatterred by geophone.</td>
<td></td>
</tr>
<tr>
<td>1.1-2.1</td>
<td>Clay w/Fe to some gravel, lt. olive Bn. (2.5% Fe). E. 7% gravel (0.5-1&quot; dia., sub-rounded, sub-rounded, pred. quartzite).</td>
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<tr>
<td>2.1-4.0</td>
<td>No recovery</td>
<td></td>
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<tr>
<td>4.0-5.0</td>
<td>Clay w/Fe, sand and gravel. Bn. (10% Fe). E. caliche disseminated throughout intercal. E. org. blk. stringers. Caliche w/ some 6.9% sand and gravel fill. 6.8-6.5, 2&quot; dia. quartzite cobble. C. 6.3 and 6.9.</td>
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<tr>
<td>6.9-7.8</td>
<td>Gravel / Silty clay mixture Bn. (10% Fe) to yellow Bn. (10% Fe). 60% gravel and cobble (0.5-2&quot; dia., sub-rounded, sub-rounded, pred. quartzite and granite composition) E. patchy Fe Ox. v. slightly damp. Bedrock contact @ 7.8</td>
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<tr>
<td>7.8-11.2</td>
<td>Silty Claystone - Grysh Bn. (10% Fe) to yellow Bn. (10% Fe). Patchy Fe Ox. Mosaic textured, v. uniform claystone, friable humanly, E. bleached w/ stringers, less friable between 10.8-11.2</td>
<td></td>
</tr>
</tbody>
</table>

---

### Notes:

- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101

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<table>
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<th>TOPOGRAPHIC INCLINE</th>
<th>TRUE LATITUDE (N)</th>
<th>TRUE LONGITUDE (W)</th>
<th>LATITUDE OF SURFACE INFEET</th>
<th>DECLINATION</th>
<th>TRUE DEGREES</th>
<th>SURFACE DISTANCE</th>
<th>SURFACE DEGREES</th>
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</table>

**Sample Description**

- **118'-118'** - Silty CLAYSTONE, Yellowish Brn. (10YR 7/6) - Oxidized claystone. Weakly to moderately firm, clayey, poorly to moderately well graded. **V. slightly clumpy**.

- **118'-119'** - Silty CLAYSTONE, Grn'ish Brn. (10YR 7/4). Weakly to moderately firm, clayey, poorly to moderately well graded. **V. slightly clumpy**.

- **119'-123'** - CLAYSTONE - V. Dk. Brn (10YR 7/4). Dense, very friable, clayey, poorly to moderately well graded. **V. slightly clumpy**.

- **123'-131'** - Silty CLAYSTONE, Ch. Brn (10YR 7/4). V. uniform claystone, massive. **V. friable**.

- **131'-135'** - Silty CLAYSTONE, Ch. Brn (10YR 7/4). V. uniform claystone, massive. **V. friable**.

- **135'-139'** - Silty CLAYSTONE, Ch. Brn (10YR 7/4). V. uniform claystone, massive. **V. friable**.

**Notes:**

- General: USCS is modified for this log as follows: Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
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### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 11/04 (498-Test Hole "B")
**Surface Elevation:**
**Area:** Original Landfill
**Total Depth:** 21.5'
**Company:** USEF/EPRI

**Location - North:**
**East:**
**Date:** 5/6/04
**Geologist:** E. Waid
**Company:** USEF/EPRI
**Project No.:** H10.51381
**Drilling Equip.:** 460T GEOPROBE

**Sample Type:** Continuous Core - PUSH

### RMRS LOGGING SUPERVISOR
**APPROVAL**

### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0 - 21.5'</td>
<td>Silty Claystone, Gray (10YR 4/1), Massive textured, E. patchy Feoxn. Crumbly, friable, Dry.</td>
</tr>
</tbody>
</table>

**T.D. 021.5'**

### NOTES:
- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101

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<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 1.2' - Clay w/lt. Sand and gravel</td>
</tr>
<tr>
<td>Brn (7.5 YR 4.5/2), E. 5% gravel (1/4 - 1/8&quot; dia),</td>
</tr>
<tr>
<td>sub-rounded to sub-angular. E. 3% sand (e.g.,</td>
</tr>
<tr>
<td>sub-angular). Organic matter, roots common.</td>
</tr>
<tr>
<td>Damp.</td>
</tr>
<tr>
<td>1.2 - 2.6' - Gravelly, sandy, silt clay</td>
</tr>
<tr>
<td>S Lyons Brn (7.5 YR 4.5/6), 2-10% sand (e.g., sub-angular).</td>
</tr>
<tr>
<td>3-5% gravel (1/2 - 1/2&quot; dia), sub-angular, to sub-rounded,</td>
</tr>
<tr>
<td>gravel and granite comp.). Spotty opaque,</td>
</tr>
<tr>
<td>roots to moist.</td>
</tr>
<tr>
<td>2.6 - 3.4' - Silt clay - lt. Yellowish Brn (2.5 Y 4/6)</td>
</tr>
<tr>
<td>Re-worked claystone, Spotty bleaching and</td>
</tr>
<tr>
<td>Caliche, Bleached w/ stringers. Wet.</td>
</tr>
<tr>
<td>friable to moist.</td>
</tr>
<tr>
<td>3.4 - 4.0' - No Recovery.</td>
</tr>
<tr>
<td>4.0 - 4.2' - Silt clay, as above 2.6 - 3.4',</td>
</tr>
<tr>
<td>C. q. Sand @ 1.5' - Bedrock contact.</td>
</tr>
<tr>
<td>To moisten to VSI. Damp.</td>
</tr>
<tr>
<td>Top of Bedrock.</td>
</tr>
<tr>
<td>4.2 - 6.0' - Claystone - lt. Brown Gry</td>
</tr>
<tr>
<td>(2.5 Y 4/6). Possibly re-worked bedrock.</td>
</tr>
<tr>
<td>Caliche dill. throughout and on internal</td>
</tr>
<tr>
<td>faces. NSF Feinbl. crumbly. To moisten.</td>
</tr>
<tr>
<td>VSI. Damp.</td>
</tr>
<tr>
<td>6.0 - 8.3' - Silt Claystone - Brown Yellow</td>
</tr>
<tr>
<td>(10 YR 8/4). Wet pow. Fordn. E Fe-2ore</td>
</tr>
<tr>
<td>nodules and fragments. Spotty bleaching.</td>
</tr>
<tr>
<td>To moisten. Stratified b/Carbonate beds.</td>
</tr>
<tr>
<td>8.3 - 9.8' - Silt Claystone - Gry (10 YR 6/4).</td>
</tr>
<tr>
<td>To Fordn. Strongly friable, crumbly.</td>
</tr>
<tr>
<td>Caliche @ 8.3' - To moisten. NSF Feinbl.</td>
</tr>
<tr>
<td>9.8' - 15.9' - Occrequently Pale yellow (2.5 Y 7/8)</td>
</tr>
<tr>
<td>Fordn. along west faces @ 9.8' and 15.9' To moisten.</td>
</tr>
</tbody>
</table>

**NOTES:**

- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
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### Sample Description

(cont.) Claystone w/te-some silt.

(see description on previous page)

15.9-20.0' - Claystone w/te silt.

Gly's sh (104R &2), Med.

Friable. Te-some blk organic blebs between 18.0 and 19.0.

To moisture.

### Notes

General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>TOP SEVEN</th>
<th>CARBONATE</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0 - 21.0</td>
<td>CLAYSTONE</td>
<td>V. DK. Gravel (10% Gravel)</td>
</tr>
<tr>
<td>21.0 -</td>
<td></td>
<td>Bulk organic material throughout</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 1104 - Test Hole "D"
Location - North: East:
Date: 1/13/94
Geologist: E. WARP
Drilling Equip.: GL DT Geoprobe

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 2-21-04

SAMPLE DESCRIPTION

0.0-10'- Silty clay w/ teal sand, Dr. Brn.(2.5 YR 4/3). 62% sand (sub-base).
To gravel (40-44 dia., sub-rounded). Roots column 1/0.0-0.35'. Fe Ox butters 5
R @ base 6. 0-1-10' mud - perv. Fairly
Dense An. 0.8-0.8. Silt moist.

1.8-2.8' - Clary w/some silt. Dr. gravel and silt.
Grmul Brn. (2.5 YR 4/3) to Lr. Olive Brn. (2.5 YR 4/3).
Fe Ox. & caliche (diss. and stringers).
Crumbly Silt moist.

2.8-4.0' = No Recovery

4.0-4.2' - Clary w/some sand. Olive Brn.
(2.5 YR 4/3) to Dk. Grmul Brn. (2.5 YR 4/3).
3 5% sand (c. g. sub-base). Undulating bedrock
Contact @ 4.2'. Top of bedrock @ 4.2'.

4.2-6.5' - Claystone Wt. to some silt.
Br. Grmul Brn. (10YR 3/2) to Grmul Brn.
(10YR 4/4). Mottled throughout.
Fe Ox n mud. Throughout. Fairly dense, Silt moist.

6.5-9.5' - Claystone Wt. Silt. V. Dk.
Grmul Brn. (10YR 3/2) to Grmul Brn.
(10YR 4/4). Mottled. Dear Fe Ox to Fe Ox.
T. Bk. Organic fragl. Wkly. Friable,
Fairly dense, Silt moist.

fm. 8.2-9.0'. Weathered. Mod. Friable.
Silt moist.

F. Fe Ox n internal fragl. Spotty
Caliche @ 9.5 and 10.8. H/S Friable
Crumbly Silt moist.

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 1100A - Test Hole "D"
Location - North: 
East: 
Date: 7/18/94
Geologist: E. W. W. P.
Drilling Equip.: 

RMRS LOGGING SUPERVISOR
APPROVAL 

DATE 

SAMPLE DESCRIPTION

10.8' - Claystone (cont. 9.0 - see previous page for description).

10.8' - 13.2' - Claystone - Gray Shale Ben. (10 yr. 6%) Massive Texture. M/S friable. V. Crumbly. T. to moisture


15.6' - 19.8' - Claystone - V. Dr. Grysh Ben (10 yr. 6%). To clay. F.OX. Caliche as frac. fill @ 16.5'. Mod. Friable. T. to sl. moist.

17.8' - 18.1' - Claystone. Yellow Shale Ben. (10 yr. 6%). M/S pov. F.ox. Wt. friable. T. to sl. moist.

18.1' - 20.5' - Claystone - V. Dr. Grysh Ben. (10 yr. 6%). Decr. F.ox. to T. which occurs along internal fracs. Wt. friable. Wt. Caliche stringers @ 19.5 to 19.6'. F.ox. along internal fracs @ 19.9'. Slight color change between 20.0 to 20.5' to gray Shale Ben (10 yr. 6%). T. to moisture

NOTES: General: USCS is modified for this log as follows:
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(1) Badly broken core, accurate footage measurements not possible.
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Procedure No. RMRS/OPS-PRO.101
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# ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 11104- Test Hole "D"

**Location - North:**

**Date:** 7/13/04

**Geologist:** E. Whap

**Drilling Equip.:** IC Dr Geode

**Surface Elevation:**

**Area:** Test Hole for 20019 Replacement, Workmap Sector

**Total Depth:** 21.9'

**Company:** USRS/RTC

**Project No.:** HAD 51800

**Sample Type:** Continuous Core - Mesh

---

## RMRS LOGGING SUPERVISOR

**Approval:**

**DATE:** 7-21-04

---

### SAMPLE DESCRIPTION

- 20.5-21.0 - Claystone - V. Drk. Yell/sh Brn. (10% 4%). Mobil: Perv, Floc
  - Wet friable, E moisture


- 21.5-21.9 - Claystone - Qd - Dk. Yell/sh Brn (10% 4%). Mottled
  - Wet: Friable, E moisture.

  TD @ 21.9'

---

**NOTES:**

- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

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<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6016</td>
<td></td>
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<td>Protective Casing, 3/4 in. ID.</td>
<td>Core not logged. See well 33603 for lithology.</td>
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<td>Hydrated Granular Bentonite</td>
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<tr>
<td>6012</td>
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<td>4</td>
<td>Fiber Pack, 1540 Silica Sand</td>
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<td>Screen, Stainless Steel, 1 in. ID.</td>
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</tbody>
</table>
PRO-1059-WELL-118
Page 3
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 33604 PROJECT NAME: N.Y. WARD PROGRAM: '04 WARD
SCREENED FORMATION: VFA/HIL DRILLING CONTRACTOR: RTG BORING METHOD: Geoprobe
DATE DRILLED: 6/18/04 DATE COMPLETED: 6/18/04 TOTAL DEPTH: 29.5 COMPLETED DEPTH: 29.3
ESTIMATED DEPTH TO BEDROCK: 20-33' RIG GEOLOGIST: J. Rosen LOGGING GEOLOGIST: None
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.75" QUANTITY OF FLUIDS LOST DURING DRILLING: None
INITIAL WATER LEVEL (FT, DATE): Not measured COMPLETED WATER LEVEL (FT, DATE): Not measured
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 1" Stainless steel well
TYPE OF PROTECTION (FLUSH-MOUNT vs. ABOVE GROUND, ASEP'TIC, ETC.): Flush mount

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

*SECONDARY CASING TOP: -1' BOTTOM: -2' TYPE: 2' PVC
SURFACE CASING TOP: 1' ID (IN): 0.3' BPS
SURFACE SEAL TOP: 63/4' BOTTOM: -1' TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 8' Flush mount -1'
WELL PAD DIMENSIONS, TYPE: Flush mount annular space
ADD'L CASING FILL TOP: X BOTTOM: X TYPE: X
SURFACE ISOLATION CASING TOP: X BOTTOM: X
SURFACE ISOLATION CASING ID (IN): X TYPE: X
OTHER (E.G., ASEPTIC) CASING TOP: X BOTTOM: X
OTHER CASING ID (IN): X TYPE, PURPOSE: X
CENTRALIZER(S) OD (IN): X NUMBER USED: X TYPE: X
CENTRALIZER(S) DEPTH(S): X
GROUT TOP: NA MEASURED DENSITY (LBS/GAL): X TYPE: X
GRANULAR BENTONITE TOP: X TYPE: X
BENTONITE SEAL TOP: 16.89 TYPE: Granular (hydrated)
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.89
FILTER PACK TYPE: 16-40 BRAND: CO silica
SURFACE CASING BOTTOM (= SCREEN TOP): 73 TYPE: Stainless steel 1'
SCREEN ID (IN): 1' SLOT SIZE (IN): 0.010 TYPE: Stainless steel 1'
SCREEN BOTTOM (= SUMP TOP): 29.3 SUMP TYPE: None, threaded bottom cap
FILTER PACK BOTTOM (= *BACKFILL BOTTOM): 29.6 *BACKFILL TYPE: Gran. bent.
SUMP BOTTOM (= WELL COMPLETED DEPTH): 29.4 *PILOT HOLE TOP, DIAMETER: NA
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 30'

REMARKS: Did not have 25' of screen as WP specified.

COMPLETED BY: Josh Rosen DATE: 6/19/04
CHECKED BY: DATE:
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 33604  PROJECT NAME: CY44 well  PROGRAM: Water Programs
SCREENED FORMATION: D/hrk  DRILLING CONTRACTOR: RT6  BORING METHOD: Re Proper
DATE DRILLED: 6/10/04  DATE COMPLETED: 6/10/04  TOTAL DEPTH: 30.0'  COMPLETED DEPTH: 29.4'
ESTIMATED DEPTH TO BEDROCK: 25.3'  RIG GEOLIGIST: J. Rosen  LOGGING GEOLIGIST: Not Logged
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.75'  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 8.55' 6/10/04  COMPLETED WATER LEVEL (FT, DATE): 4.05' 9/10/04
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1.0'' I.D. Stainless Steel Well
TYPE OF PROTECTION (FLUSH-MOUNT) vs. ABOVE GROUND, ASEPTIC, ETC.: Flush Mount, Prot. Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

---

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 0.0'
*SECONDARY CASING TOP: 0.1'  BOTTOM: 2.0'  TYPE: PVC
SURFACE CASING TOP: 0.3'  ID (IN.): 1.0''
SURFACE SEAL TOP: 1/16'  BOTTOM: TYPE:
PROTECTIVE CASING BOTTOM, ID (IN.): 1.0''  BAGS: 8''  Type: Flushmount
*ADD'L CASING FILL TOP: 1/16'  BOTTOM: TYPE:
*SURFACE ISOLATION CASING TOP: 1/16'  BOTTOM:
*SURFACE ISOLATION CASING ID (IN.): 1/16'  TYPE:
*OTHER (E.G., ASEPTIC) CASING TOP: 1/16'  BOTTOM:
*OTHER CASING ID (IN.): 1/16'  TYPE, PURPOSE:
*CENTRALIZER(S) OD (IN.): 1/16'  NUMBER USED:  TYPE:
*CENTRALIZER(S) DEPTH(S): 1/16'
GROUT TOP: 1/16'  MEASURED DENSITY (LBS/GAL.): TYPE:
GRANULAR BENTONITE TOP: 1/16'  TYPE:
BENTONITE SEAL TOP: 1.0''  BAGS: 6.0'  Type: Granular Bentonite (hydrated)
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.0'
FILTER PACK TYPE: 1/4'' Silica Sand  BRAND: CSEE
SURFACE CASING BOTTOM (=SCREEN TOP): 7.3''  TYPE: Stainless Steel
SCREEN ID (IN.): 1.0''  SLOT SIZE (IN.): 0.01''  TYPE: Stainless Steel
SCREEN BOTTOM (= SUMP, TOP): 29.3'  SUMP TYPE: Stainless Steel - Threaded end cap
FILTER PACK BOTTOM (= *BACKFILL TOP): 29.4'  BACKFILL TYPE: Granular Bentonite
SUMP BOTTOM (= WELL COMPLETED DEPTH): 29.4'  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND *BACKFILL BOTTOM): 30.0'

REMARKS: Well # 33604 is a 1.0'' I.D. Stainless Steel replacement of Well # 33603 (Prev. installed 1.0'' I.D. PVC). Geoprobe w/a solid pt. - Notored (no log). See 33603 for log.

COMPLETED BY: EDDIE S. WALK Date: 3/14/05
CHECKED BY: J. BRYAN Date: 3/14/05
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
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</tbody>
</table>

- **GC/CL**: Sandy Gravel/Clay mixture, strong brown (7.5YR5/6). ~50% clay, 30 - 40% gravel (1/8 - 3/4" diameter, subangular to angular), 10 - 20% sand (medium grained to coarse grained, angular to subrounded), slightly moist. Increased gravel to 60% from 1.0' to 2.0' (1-2" diameter, predominately quartzite with lesser granite. 2.0" diameter quartzite cobble at 2.0'.

- **SC/ML**: Sand/Silt and Clay mixture with trace to some gravel, strong brown (7.5YR5/6). ~65% silt/clay, 20 - 30% sand (fine grained to coarse grained, subangular to subrounded), trace to 10% gravel (1/4" to 1" diameter, predominately quartzite), slightly moist.

No recovery.

- **SC/ML**: Sand/Silt and Clay with trace gravel, as above from 2.0' to 3.0', slightly moist.

- **CL**: Silty Clay with some gravel and sand, dark yellowish brown (10YR4/4). Predominately re-worked claystone with 5-7% sand and 5% gravel (1/4" to 1" diameter, subangular to subrounded), slightly moist.
LOG OF BORING NUMBER: 33904

Elev (Fl) | Well or Piezometer Construction and Materials | Depth (Fl) | Unified Soils Classification or Rock Type | Lithology | Lithologic Description
---|---|---|---|---|---
6001 | | | | | GC/ML: Sandy Gravel/Silt mixture, very dark grayish brown (10YR3/2) to very dark brown (10YR2/2). 65% silt, 20 - 25% gravel (1/4" to 1/2" diameter, subangular), 10 - 15% sand (subangular). Dark brown to black coating on some gravel clasts - possible asphalt?? Asphalt odor. Moist.
6000 | | | | | CL: Silty Clay with trace to some sand and gravel. Predominately re-worked claystone with black organic stringers. Brown (10YR4/3) with yellowish brown (10YR5/4) motting. Trace to 7% sand (medium grained, subangular). Gravel lenses (clasts are 1/2" diameter, subangular to subrounded) at 6.9' and 7.5'. Moist.
5999 | | | | | GW: Gravel, broken dark gray quartzite and mica schist clasts (1/2" to 1-1/2" diameter, subangular), moist.
5998 | | | | | SC/ML: Gravelly Sand/Silt mixture, strong brown (7.5YR4/6) to brown (7.5YR4/3). 5-15% sand (medium grained to coarse grained, subangular to subrounded). 5-10% gravel (subangular) predominately quartzite. Patchy iron oxidation throughout interval. 1-1/2" quartzite fragment at 8.8'. Note: from 9.4' to 9.6', black manganese oxide (?) coating on fragments and a white, drusy coating also on fragments (possible carbonate?). Moist.
5997 | | | | | CL: Silty Clay with trace sand and gravel, dark grayish brown (10YR4/6) with patchy light olive brown (2.5Y5/6). Iron oxidation throughout, moist. At 10.8': 1.5" diameter iron oxidized sillstone clast, angular. No recovery.
5996 | | | | | CL: Silty Clay with trace sand and gravel, dark grayish brown (10YR4/6) with patchy light olive brown (2.5Y5/6). Iron oxidation throughout, moist.
5995 | | | | | SC/ML: Gravelly Sand/Silt mixture, strong brown (7.5YR4/6). 15 - 20% sand (medium grained to coarse grained, subangular to subrounded), 5 - 10% gravel (1/4" to 1" diameter, subangular) quartzite and schist composition. Pervasive iron oxidation in silt matrix, moist. No recovery.
SC/ML: Gravelly Sand/Silt mixture, same as above from 12.6' to 13.75'. Moist.

ML: Sandy Silt, strong brown (7.5YR5/6). ~70% silt, 25-30% sand (very fine grained to fine grained, subrounded to subangular). At 18.2': patchy reddish brown (5YR4/4) iron oxidation, otherwise pervasive iron oxidation, strong brown.

CL/ML: Sandy Silt/Clay mixture with trace gravel, strong brown (7.5YR5/6). 5-15% sand (medium grained, subangular to subrounded), trace subangular gravel. Pervasive iron oxidation in matrix.
No recovery.

CL/ML: Sandy Silt/Clay mixture with some gravel, strong brown (7.5YR4/6) with lesser patchy light olive brown (2.5Y5/3) mottling, which is probably re-worked claystone clasts. 10-15% sand (medium grained, subangular to subrounded), 5-10% gravel (1/4" to 3/4" diameter, subangular to subrounded), predominately quartzite with lesser K-spar granitic clasts. 1.5" diameter quartzite clasts (subangular) at 22.0', 22.7', and 23.5'. Gravel increasing to 10-15% between 22.0' and 23.5'. Slightly moist.

SC/CL: Clay with some sand, yellowish brown (10YR5/6) with light gray (5Y7/1) mottling. Re-worked claystone. Sandy gravel lense/layer at 23.7'. Slightly moist.

CL: Clay, yellowish brown (10YR5/6) with light olive gray (5Y6/2)
mottling. Re-worked (?) claystone. Trace - 3% black organic stringers. Very competent and dense, moist.


CL/ML: Silty Clay, light olive gray (5Y6/2) with trace to some brownish yellow (10YR6/6) mottling. Re-worked silty claystone. 7-10% black organic stringers.

SC/ML: Sand/Silt mixture with trace gravel, strong brown (7.5YR5/6). 20-25% sand (medium grained to coarse grained, subangular to subrounded). Strong pervasive iron oxidation.

CL/ML: Sandy Silt/Clay, light olive gray (5Y6/2) to strong brown (7.5YR5/8). 15% sand (fine grained to medium grained, subrounded). Patchy iron oxidation. At 27.5°: 2.0" granitic clast (subrounded).

SC/ML: Clayey Sand/Silt with gravel, strong brown (7.5YR4/6) to yellowish brown (10YR5/6). 30-35% sand (fine grained to medium grained, subrounded to subangular), trace to 7% gravel (1/4" to 1/2" diameter, subrounded), granitic and quartzite composition. Pervasive iron oxidation, moist to wet.

CL: Clay, yellowish brown (10YR5/8). Re-worked claystone (oxidized). 5-8% black organic stringers, very soft and pliable. Rock in Geoprobe shoe, so sample appears as "ribbons" of oxidized claystone.

No recovery.

No recovery.

CL: Clay with trace gravel, brownish yellow (10YR6/6). Re-worked claystone. Pervasive iron oxidation. Soft, pliable, and very moist. Note: Geoprobe is pushing a rock from 31.2' to 33.0'. Bedrock contact is estimated.

CLAYSTONE: TOP OF BEDROCK - Claystone, brownish yellow (10YR6/8). Pervasive iron oxidation. Soft, pliable, and moist. Pushing a rock in Geoprobe shoe until 33.0'.

<table>
<thead>
<tr>
<th>Elevation (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
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<td>5972</td>
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<td>35</td>
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<td>CLAYSTONE: Claystone, brownish yellow (10YR4/6) with dark grayish brown (10YR4/2) mottling. Oxidized claystone, moderately friable, moisture decreases to slightly moist.</td>
<td></td>
</tr>
<tr>
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<td>CLAYSTONE: Claystone, very dark grayish brown (10YR3/2). Iron oxidation, yellow brown (10YR5/8) along internal fractures only. Friable and crumbly, decreasing moisture to slightly damp.</td>
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</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 33904  PROJECT NAME: CY04 Well Program
SCREENED FORMATION: AI/Blk. DRILLING CONTRACTOR: RTG
DATE DRILLED: 4/14/04  DATE COMPLETED: 4/15/04  TOTAL DEPTH: 35.4'  COMPLETED DEPTH: 34.9'
ESTIMATED DEPTH TO BEDROCK: 32.0'  RIG GEOLOGIST: E. Wang
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.75'  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 4/15/04  COMPLETED WATER LEVEL (FT, DATE): 19.48' fm RO 4/30/04
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WEIR POINT/ETC.): 1.0" SCH 80 PVC - WEL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPIC, ETC.): 4.0" above ground PVC & locking steel lid.

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.5' GFS
"SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.2" PIPE (IN): 1.0"
SURFACE SEAL TOP: N/A BOTTOM: N/A TYPE: N/A
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 0.35" SCH 40 PVC Grout, 10' Below Sealed Top
WELL PAD DIMENSIONS, TYPE: Temporarily (-15 years) - 6' x 6'
"ADD'L CASING FILL TOP: 0.3" PIPE (BOTTOM: 0.35" Type: 16/40 Silica Sand
"SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
"SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
"OTHER (E.G., ASEPIC) CASING TOP: N/A BOTTOM: N/A
"OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
"CENTRALIZER(S) OD (IN): N/A NUMBER USED: TYPE:
"CENTRALIZER(S) DEPTH(S): N/A
"GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): TYPE:
"GRANULAR BENTONITE TOP: N/A TYPE:
"BENTONITE SEAL TOP: 0.35' TYPE: Granular Bentonite
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 7.55'
FILTER PACK TYPE: 16/40 Silica Sand BRAND: CSSI
"SURFACE CASING BOTTOM (=SCREEN TOP): 9.65' TYPE: PVC - SCH 80
SCREEN ID (IN): 1.0" SLOT SIZE (IN): 0.01" TYPE: PVC - SCH 80
SCREEN BOTTOM (= SUMP, TOP): 34.8' SUMP TYPE: Theoretical Cap. Sch. 80 PVC
FILTER PACK BOTTOM (= BACKFILL TOP): 34.9' BACKFILL TYPE: Bentonite Pellets
SUMP BOTTOM (= WELL COMPLETED DEPTH): 34.9' PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND "BACKFILL BOTTOM") 35.4'

REMARKS: Depth to bedrock contact estimated C 32.0' due to flushing a rock fragment in 29.7 -33.0' causing poor recovery. Well installation went smooth.
COMPLETED BY: Ewen S. Wang  DATE: 4/16/04
CHECKED BY:  DATE: 
# ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
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<th>Borehole Number:</th>
<th>33904</th>
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<td>Surface Elevation:</td>
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<td>Location - North:</td>
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<tr>
<td>Date:</td>
<td>4/16/98</td>
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<tr>
<td>Geologist:</td>
<td>E. W. Roep</td>
</tr>
<tr>
<td>Drilling Equip.:</td>
<td>660 DT Geoprobe</td>
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<tr>
<td>RMRS LOGGING SUPERVISOR:</td>
<td></td>
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<tr>
<td>DATE:</td>
<td>4/23/98</td>
</tr>
</tbody>
</table>

**SAMPLE DESCRIPTION**

- 10.8-10.9 - Silty clay W/Sand and gravel (see description below for 12.0-12.6)
  - C 10.8'-1.5' dia, Fec Ox'd Silstone clast - Avg. 80% 12.6 - 12.0' No Recovery
- 12.6-15.75' - Gravelly SAND/SILT Mixture
  - Strong Bn (7.5 YR 8%), 15-20% Sand (mg.: tough, sub-angular, to sub-rounded), 5-10% Gravel (6-1 dag) granite and schist composition, Prev. Fec Ox'd in silt matrix - MOIST
- 15.75-16.0' No Recovery
- 16.0-18.0' - Gravelly SAND/SILT Mixture
  - Same as above from 12.6-13.75, MOIST

**NOTES:**
General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

<table>
<thead>
<tr>
<th>Procedure No.</th>
<th>RMRS/OPS-PRO.101</th>
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</thead>
<tbody>
<tr>
<td>Revision</td>
<td>0</td>
</tr>
<tr>
<td>Date effective</td>
<td>12/31/98</td>
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</tbody>
</table>
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 3320
Location - North: 41°14'0"  East: 105°44'32"
Date: 6/1/94
Geologist: E. Waag
Drilling Equip: Log Master

RMRS LOGGING-SUPERVISOR
APPROVAL

DATE 6/23/04

SAMPLE DESCRIPTION

300 - 31.2 = No Recovery

31.2 - 32.0 = Clay, Yellow. Permeability. Soft, pliable and moist.

32.0 - 33.2 = Claystone, Brown. Soft, pliable, moist.


33.9 - 34.1 = Siltstone, Yellow (10YR 6/6), strong per. Moderately friable. Moist.


35.4 = T.D.

NOTES: General: USCS is modified for this log as follows:
Materials are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
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<tbody>
<tr>
<td>0</td>
<td>Concrete Pad</td>
<td>1040 Silica Sand</td>
<td>CL: Silty Clay with trace gravel, brown (7.5YR4/2). Abundant roots, 1/4&quot; diameter, angular clast of Fountain Formation. 1.5&quot; subrounded clast of quartzite at 0.3'. Medium to high plasticity, very moist.</td>
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<td>Casing, Sch 60/PVC, 2 in. ID.</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Silt/Clay mixture, yellowish brown (10YR5/4) with light brownish gray (10YR6/2) mottling. Sub-horizontal lenses of silt throughout interval. Black organic material along internal bedding planes at 1.2'. Medium plasticity, moist.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Bentinite Chips</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Silt/Clay mixture as from 0.3' to 1.6'.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Filter Pack, 1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt, light yellowish brown (10YR6/4) with some gray (10YR6/1) mottling. 70 - 75% silt. Weak pervasive iron oxidation throughout interval. Un-oxidized silt lens from 2.4' to 2.7'. Black organic material (bleb) along bedding planes at 2.8', moist.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Screen, Sch 60/PVC, 2 in. ID, 0.013 in. Filter</td>
<td>1040 Silica Sand</td>
<td>ML: Sandy Silt, light yellowish brown (10YR6/4). 30 - 35% sand, very fine grained, subrounded to subangular, crumbly, moist.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Filter Pack, 1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>9.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1040 Silica Sand</td>
<td>1040 Silica Sand</td>
<td>CL/ML: Clayey Silt with some sand, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~15% sand, very fine grained, subrounded. Cohesive, moist.</td>
<td></td>
</tr>
<tr>
<td>10.5</td>
<td>CL: Clay with trace to some silt, brown (10YR5/3) to yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Decreased silt to trace, possibly re-worked claystone. Slightly mottled texture, trace black stringers. White caliche blebs at 5.1'. Moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CLAYSTONE: TOP OF BEDROCK - Claystone, grayish brown (10YR5/2). Trace white stringers, competent, slightly moist.
No recovery.


CLAYSTONE: Claystone, oxidized, grayish brown (10YR5/2) with brownish yellow (10YR6/6) mottling. Black organic stringers along internal bedding, competent, moist.

CLAYSTONE: Claystone, light brownish gray (10YR6/2) to grayish brown (10YR5/2). Black organic stringers throughout. Moist to slightly moist.

No recovery.

CLAYSTONE: Claystone, light brownish gray (10YR6/2) to grayish brown (10YR5/2), same as above from 7.2’ to 8.4’. Iron oxidized zone from 9.7’ to 9.9’ with black organic stringers and blebs. Competent and firm, slightly moist.

No recovery.

CLAYSTONE: Claystone, dark grayish brown (10YR4/2). Iron oxide, strong brown (7.5YR5/8) coating vertical fractures from 11.8’ to 12.6’. Bleached white stringers and trace black stringers. Dense interval except for zone with vertical fractures, slightly moist.

No recovery.

CLAYSTONE: Claystone, dark grayish brown (10YR4/2) to light olive brown (2.5Y5/3). 45 deg open fractures with iron oxide coating, strong brown (7.5YR5/8), otherwise interval is dense and competent, very slightly moist.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5944</td>
<td>CLAYSTONE: Claystone, grayish brown (10YR5/2), massive texture, competent. Trace iron oxide along internal fractures only. Very slightly moist to dry.</td>
<td></td>
</tr>
<tr>
<td>5943</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5942</td>
<td>CLAYSTONE: Claystone, dark grayish brown (10YR4/2). Vertical fractures with iron oxide coating, strong brown (7.5YR5/8). Interval broken along vertical fractures otherwise is dense and competent, very slightly moist to dry.</td>
<td></td>
</tr>
<tr>
<td>5941</td>
<td>CLAYSTONE: Claystone, grayish brown (10YR5/2) to brown (10YR5/3). Trace spotty iron oxidation, trace black organic stringers. Interval fairly competent, trace moisture to dry.</td>
<td></td>
</tr>
</tbody>
</table>

CLAYSTONE: Claystone, dark grayish brown (10YR4/2). Trace iron oxidation along internal fracture surfaces, massive textured, weakly friable, trace moisture.

Not cored between 30.0' and 30.6'.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: BB1094 PROJECT NAME: 044 Well Replacement PROGRAM: Water Programs Project
SCREENED FORMATION: 59 DRILLING CONTRACTOR: High Plains BORING METHOD: Hells Stem Auger
DATE DRILLED: 11/16/05 DATE COMPLETED: 11/16/05 TOTAL DEPTH: 30.0' COMPLETED DEPTH: 30.0'
ESTIMATED DEPTH TO BEDROCK: 51 RIG GEOLOGIST: E. Wernp LOGGING GEOLOGIST: E. Wernp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0'' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): DEEP IN 11/16/05 COMPLETED WATER LEVEL (FT, DATE): 32.0' 2/22/06 Development
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above Ground, 6.0" Steel Prot, Casing, Locking

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): N/A'
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.35' ID (IN): 2.0"
SURFACE SEAL TOP: 1.0' BOTTOM: 1.0' TYPE: 1/4" corrosion pad 0.5' 0.25' type: 1/4" 0.35' type: 1/4"

*ADD'L CASING FILL TOP: BOTTOM: N/A TYPE: 1/4" 0.35' type: 1/4"
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): TYPE: N/A NUMBER USED: N/A
*CENTRALIZER(S) OD (IN): N/A TYPE: N/A
*CENTRALIZER(S) DEPTH (S): N/A

*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: N/A TYPE: N/A
*BENTONITE SEAL TOP: N/A TYPE: N/A
*BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): N/A

FILTER PACK TYPE: 1/4" corrosion pad BRAND: Norton Daglebay
SURFACE CASING BOTTOM (=SCREEN TOP): 4.75' TYPE: SCH. 80 PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.010" TYPE: SCH. 80 PVC
SCREEN BOTTOM (= SUMP TOP): 29.75' SUMP TYPE: SCH. 80 PVC-Threaded End Cap
FILTER PACK BOTTOM (= BACKFILL TOP): 30.0' BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 30.0' PILOT HOLE TOP, DIAMETER: 8.0"
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 30.6'

REMARKS: Routine Well Installation - No Problems

COMPLETED BY: Edwin S. Wernp DATE: 11/16/05
CHECKED BY: ___________________________ DATE: ___________________________
<table>
<thead>
<tr>
<th>Depth (in)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.3</td>
<td>Silty Clay with gravel, Brn. (10½%)</td>
</tr>
<tr>
<td>0.8 - 1.6</td>
<td>Silt / clay mixture - yellow Brn (10½%)</td>
</tr>
<tr>
<td>1.6 - 2.3</td>
<td>Silt / clay mixture - as above 0.3 - 1.6&quot;</td>
</tr>
<tr>
<td>2.3 - 3.3</td>
<td>Clayey silt, H, yellow Brn (10½%)</td>
</tr>
<tr>
<td>0.3 - 3.95</td>
<td>Sandy silt - H, yellow Brn (10½%)</td>
</tr>
<tr>
<td>3.75 - 4.44</td>
<td>Clayey silt, Wth some sand, yellow Brn (10½%)</td>
</tr>
<tr>
<td>4.4 - 5.11</td>
<td>Clayey silt, Wth some silt, Brn (10½%)</td>
</tr>
<tr>
<td>5.11 - 5.35</td>
<td>Siltstone - Grysh Brn (10½%)</td>
</tr>
<tr>
<td>5.35 - 6.0</td>
<td>No Recovery</td>
</tr>
<tr>
<td>6.0 - 6.2</td>
<td>Silty claystone - Oxid. yellow Brn (10½%)</td>
</tr>
<tr>
<td>6.2 - 7.2</td>
<td>Claystone - Oxid. Grysh Brn (10½%)</td>
</tr>
<tr>
<td>7.2 - 8.4</td>
<td>Claystone - Grysh Brn (10½%)</td>
</tr>
<tr>
<td>8.4 - 9.0</td>
<td>No Recovery</td>
</tr>
</tbody>
</table>
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 88164
Surface Elevation:
Location - North: East:
Date: 7/05
Geologist: WARD
Total Depth: 30.6'
Drilling Equip. HILLSTROM AUGER-CME-75-H1
Company: URS
Sample Type: Spc. Spaw

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 3/21/05

SAMPLE DESCRIPTION

9.0-10.8'  - claystone, 1.3' brackenphy (10yR 2/1)
Grysh Brn (10yR 2/1), Same as above 7.2 to 8.4'
W purple zone fn 7.7-9.9 wth blk organic stringers
and blebs, competent and firm, Mt Stl moist, 1.7'

10.8-11.0' No Recovery

11.0-13.3'  - claystone, Dk. Grysh Brn (10yR 2/1)
FedX (strong brn-7.5yR 2/8) coating vertical fractures
fn 11.8 to 12.6'. Bleached w/ stringers and Fe blk stringers
Dense interval except for zone w/ vertical fractures
Sl moist, 1.7'

13.3-14.0' No Recovery

14.0-14.9'  - claystone - Grysh Brn (10yR 2/1)
(6yR 2/1) to 1/4', Olive Brn (2.5yR 2/8)
45° open fractures, W FedX coating (strong
brn-7.5yR 2/8) otherwise interval is dense
and competent. V. Slightly moist, 1.7'

14.9-16.7'  - claystones - Grysh Brn (10yR 2/1)
Massive texture, Competent, W FedX along
internal fractures only, V. Stl moist today,

16.7-17.0' No Recovery

17.0-18.7'  - claystone - Grysh Brn (10yR 2/1)
 vertically fractured W FedX
(strong brn-7.5yR 2/8) coating, Interval broken
along vertical fractures otherwise is dense
and competent. V. Stl moist today,

18.7-25.2'  - claystone, Grysh Brn (10yR 2/1) to brn (10yR 2/8)
Spotty FedX, W blk. organic stringers, Interval fairly
competent, W moisture to dry.

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
RMRS LOGGING SUPERVISOR
APPROVAL

DATE 3/21/05

SAMPLE DESCRIPTION

(cont. CLAYSTONE - see previous page for description)

26.0' 26.1' 26.2-26.9' CLAYSTONE, greyish Brn. (10YR 8/8). Moderate pervasive FeOxN.
" ironstone fragments. Wkly. Frlble. Tl moisture. Caliche lens @26.4-26.5', and traces disseminated
clastic elsewhere.

29.9' - 30.0' CLAYSTONE, DK. Grn'sh. Brn (10YR 2/8). 2 FeOxN along internal fracture surfaces.

T.D. of borehole = 30.6' (Not cored between 30.0' - 30.6').

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
5858

5857

5856

5855

5854

5853

5852

5851

<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5858</td>
<td>Protective Casing, 6 in. ID, Steel</td>
<td>2</td>
<td>CL</td>
<td>Silty Clay with trace sand and gravel, dark brown (7.5YR3/2). Sand is coarse grained, subangular, gravel is ~1/8&quot; diameter, subangular. Trace disseminated caliche, roots common. Medium plasticity, 1/2&quot; - 1&quot; diameter, angular quartzite and granite clasts at 0.9'. Moist.</td>
<td></td>
</tr>
<tr>
<td>5857</td>
<td>Casing, Steel 48 in. ID.</td>
<td>1</td>
<td>CL</td>
<td>Silty Clay with trace sand, very dark brown (7.5YR2.5/2). Sand is coarse grained, subangular. Medium plasticity, decreasing roots to trace, moist</td>
<td></td>
</tr>
<tr>
<td>5856</td>
<td>10/42 Silica Sand</td>
<td>0</td>
<td>CL</td>
<td>Silty Clay with trace sand and trace gravel, brown (7.5Y4/2). Sand is coarse grained to medium grained, subangular. Gravel is subangular, trace disseminated caliche. 1/2&quot; to 3/4&quot; subangular clasts of granite and quartzite at 2.9'. Medium plasticity, moist.</td>
<td></td>
</tr>
<tr>
<td>5855</td>
<td>Bentonite Chips</td>
<td>1</td>
<td>No recovery.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5854</td>
<td>20/40 Silica Sand</td>
<td>2</td>
<td>CL</td>
<td>Silty Clay with trace sand and gravel, brown (7.5Y4/2). Sand is coarse grained to medium grained, subangular. Gravel is subangular, trace disseminated caliche. 1/2&quot; to 3/4&quot; subangular clasts of granite and quartzite at 2.9'. Medium plasticity, moist.</td>
<td></td>
</tr>
<tr>
<td>5853</td>
<td>Fiber Pack 10/42 Silica Sand</td>
<td>3</td>
<td>No recovery.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5852</td>
<td>SC/CL: Sandy Clay with some gravel, light olive brown (2.5Y5/4), ~20% sand (fine grained, subangular to subrounded), 5 - 10% gravel (1/4&quot; - 3/4&quot; diameter, subrounded). Gravel predominately quartzite, patchy caliche, slightly moist.</td>
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</tr>
<tr>
<td>5851</td>
<td>CL: Clay with trace gravel, light olive brown (2.5Y5/4) to grayish brown (2.5Y5/2). Gravel is 1/8&quot; - 1/4&quot; diameter, subangular. Weak iron oxidation mottled throughout, trace to 5% disseminated caliche nodules, slightly moist.</td>
<td></td>
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</tr>
</tbody>
</table>
CLAYSTONE: Claystone, same as from 11.2 to 13.6. No recovery.


CLAYSTONE: Claystone, oxidized brownish yellow (10YR6/6). Weak pervasive iron oxidation, trace patey iron oxidation, lichens throughout, slightly moist.

CLAYSTONE: Claystone, oxidized, brownish yellow (10YR5/4) with yellowish brown (10YR5/6) stringers throughout, slightly moist.

CLAYSTONE: Claystone, un-oxidized, dark grayish brown (10YR4/2) with yellowish brown (10YR5/4) stringers throughout, slightly moist.

CLAYSTONE: Claystone, oxidized bedrock, yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation, trace black organic stringers, slightly moist.

CLAYSTONE: Claystone, oxidized, yellowish brown (10YR5/4) with yellowish brown (10YR5/4) stringers throughout, slightly moist.

CLAYSTONE: Claystone, un-oxidized, dark grayish brown (10YR4/2) with yellowish brown (10YR5/4) stringers throughout, slightly moist.
CLAYSTONE: Claystone, grayish brown (10YR5/2), abundant black organic stringers and blebs throughout. Black organics common along internal bedding planes, slightly moist to dry.

5841 - 15

No recovery.

5839 - 17

CLAYSTONE: Claystone, grayish brown (10YR5/2) with brown (10YR5/3) mottling. Some black organic stringers and blebs throughout interval. Occasional 1/8" thick black organic coating along internal bedding planes. Patchy weak iron oxidation. Moderately friable, slightly moist to dry.

5836 - 20

Not cored between 20.0' and 20.5'.
GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT: Form PRO.118A

LOCATION CODE: B2104  PROJECT NAME: NEW WELL REPLACEMENT  PROGRAM: WARP
SCREENED FORMATION: WATER PERMIT:  WARP
DRILLING CONTRACTOR: HOLLOW STONE AUGER
DATE DRILLED: 6/16/05  DATE COMPLETED: 6/16/05  TOTAL DEPTH: 20.5'  COMPLETED DEPTH: 20.0'
ESTIMATED DEPTH TO BEDROCK: 6.3'  RIG GEOLOGIST: E. WARP
LOGGING GEOLOGIST: E. WARP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dug on 6/16/05  COMPLETED WATER LEVEL (FT, DATE): 20.7' on 6/16/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/Etc.): 2.0" SCH. 80 PVC
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): 6.0" Steel Protective Casing - Stick-Up

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.5' D.G.
SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.1' ID (IN): 2.0"
SURFACE SEAL TOP: 1.0'  BOTTOM: 0.0'  TYPE: 1/4" Stainless Steel
PROTECTIVE CASING BOTTOM, ID (IN): N/A  TYPE: N/A
WELL PAD DIMENSIONS, TYPE: 2'X3' concrete (0.3' thick)
ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
CENTRALIZER(S) DEPTH(S): N/A
GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
GRANULAR BENTONITE TOP: N/A  TYPE: N/A
BENTONITE SEAL TOP: 0.0'  TYPE: CECO Bentonite Chips
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0'
FILTER PACK TYPE: 1/4" 40 silica sand  BRAND: Norton Oglebay
SURFACE CASING BOTTOM (= SCREEN TOP): 4.75'  TYPE: SCH. 80 PVC
SCREEN ID (IN): 2.0"  SLOT SIZE (IN): 8"  TYPE: SCH. 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 12.0'  SUMP TYPE: SCH. 80 PVC threaded end cap
FILTER PACK BOTTOM (= "BACKFILL TOP"): 20.0'  "BACKFILL TYPE": Bentonite Chips
SUMP BOTTOM (= WELL COMPLETED DEPTH): 20.5'  "PILOT HOLE TOP, DIAMETER": ~8"
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM"): 20.5'
REMARKS: Smooth well installation. No free water encountered.
H.P. Drilling crew borrowed 16 bags of 1/40 Silica Sand from Water Programs.
COMPLETED BY: __________ Kellen S. WARP  Ellin J. WARP  DATE: 6/16/05
CHECKED BY: ____________  DATE: ____________
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 89104
Location - North: 406
Location - East: 2192
Date: 7/18/84
Geologist: E. W. R.
Drilling Equip.: Yellow Storm Auger - CME-75-HT

Surface Elevation: 8494 ft
Area: 40 acres
Total Depth: 120 ft
Company: URS
Sample Type: Split Spoon
Project No.: HAD-51300

RMRS LOGGING SUPERVISOR
APPROVAL

DATE

SAMPLE DESCRIPTION

6.0 - 1.6' Silty Clay w/Fe sand and gravel.
Dark brown (10YR 5/3), Sand is 8%, Sub-angular,
gravel is 1/8" dia. sub-angular, Feldspar, calcite.
Roots common, Med. plasticity, 1/4 to 1/8" dia.
g, gale and granite clasts at 0.5% moist.

1.8 - 2.0' No Recovery

2.0 - 2.2' Silty Clay w/Fe sand, V. DK Brn.
(10YR 3/2), Sand is e.g., Sub-angular, Mod.
plasticity, Dec. roots at E. Moist.

2.2 - 3.2' Silty Clay w/Fe sand and Fe gravel.
Brn (10YR 3/2), Sand is e.g., To mod. gravel/Fe.
Gravel is sub-rounded, E. Fe, calcite, 1/8" to 1/4"
Sub-angular, clasts of granite and gale at 2.0'
Medium plasticity, Mott.

3.2 - 4.6' No Recovery

4.0 - 4.25' Sandy Clay w/Some gravel.
Lit. Olive Brn (2.5Y 5/4), ~20% sand (Fe2+),
Sub-angular sub-rounded, 5 -10% gravel (4 - 3/4" dia.),
Sub-rounded, gravel predominately gale.
Patchy calcite, S1 moist.

4.25 - 5.7' Clay w/Fe gravel, Lit. Olive Brn.
(2.5Y 5/4) to greyish Brn (2.5Y 1/2), gravel is
1/8" dia., sub-angular, Wk. oxidized throughout.
E - 5% diss. calcite nodules, S1 moist.

5.7 - 6.0' No Recovery

6.0 - 6.3' Clay w/Fe gravel. Same as 4.25 - 5.7'

6.3 - 7.6' Claystone (poorly remolded), greyish
Brn (10YR 5/4), Massive textured, T E. calcite
Stringers, Wk. Mod. Friable, S1 moist.

7.6 - 8.1' Claystone - Oxidized Bedrock. Yell.
Brn (10YR 5/4), Wk. Peroxidation.

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 89104  
**Location - North:**  
**East:**  
**Date:** 9/6/05  
**Geologist:** E. WARP  
**Drilling Equip.:**  

**RMRS LOGGING SUPERVISOR**

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost. fm. page 9-8.7-8.9: <strong>Claystone (old).</strong></td>
</tr>
</tbody>
</table>
| Yeolsh Bn. (10YR Y/4)  
**Loess Bn. (10YR Y/2)**  
**Mothllg. To blk. org. nodules, SL moist.**  
8.9 - 9.0 = No Recovery  
9.0 - 9.8: **Claystone - Claysly Bn. (10YR Y/2)**  
**Yellow Bn. (10YR Y/4) Mothllg., SL friable.**  
**Blk. org. nodules and stringers throughout SL moist.**  
|  
|  
| 9.8 - 11.2: **Silty Claystone (old) - Beash**  
**Yellow (10YR Y/6).** Wk. pnr. FdOXn. Epatichy  
**FDOXn (Strong Bn. - 7.5% Y/6)** fm. 10.1 to 10.3.**  
**Deep, blk. organic stringers to E.**  
**Interval competent. Spotty patechy bleaching @ 11.2.** SL moist.  
|  
|  
| 11.2 - 13.6: **Claystone - Drysh Bn. (10YR Y/2)**  
**Massive textured. SL pnr. bleaching @ 12.4 to 12.7.**  
**Wk. FDOXn fm. 12.7 - 13.6.** Blk. org. nodules  
**@ 13.9.** SL moist to dry.  
|  
|  
| 13.6 - 14.0 = No Recovery  
|  
| 9.0 - 15.3: **Claystone - somolac 11.2 - 13.6**  
**Abundant blk. org. stringers and blebs throughout.**  
**Blk. org. common along internal bedding planes.**  
**SL moist to dry.**  
|  
|  
| 16.8 - 17.0 = No Recovery  
|  
| 17.0 - 20: **Claystone - Drysh Bn. (10YR Y/2)** with  
**Bn. (10YR Y/2) Mothllg. Some blk. org. stringers and**  
**Blebs throughout interval, occasional 1/8" thick**  
**blk. org. coating along internal bedding planes. Patechy Wk. FDOXn. Mod. friable.**  
**SL moist to dry.**  

**T.D. 20.0 S5'**  
**Boring 20.0 5' P.**

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98**
CL: Clay with some gravel, dark brown (7.5YR3/3), 5 - 7% gravel (1/2" - 1-1/2" diameter, subangular), predominately quartzite. Roots abundant from 0.0' to 0.2'. Moist.

ML: Gravelly Silt, brown (7.5YR5/3), ~10% gravel (1/4" - 1" diameter, subangular, predominately quartzite). Some disseminated caliche, moist.

No recovery.

ML: Gravelly Silt, brown (7.5YR5/3), 5 - 10% gravel (1/4" - 1-1/2" diameter, subangular to subrounded, predominately quartzite. ~10% caliche as spotty blebs and stringers throughout, slightly moist.

ML: Silt with trace gravel, brown (7.5YR5/3). Very similar to above interval except decreased gravel to trace to 3%. Gravel is 1/4" diameter and subrounded. 10 - 15% caliche as stringers and blebs. Broken at 3.5' with abundant powdery white caliche. Also fractured between 4.6' to 4.8' with 1" subrounded quartzite clasts coated with powdery white caliche. Slightly moist.
<table>
<thead>
<tr>
<th>Elv. (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
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<tbody>
<tr>
<td>5886</td>
<td></td>
<td>6</td>
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<td>No recovery</td>
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<tr>
<td>5885</td>
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<td>5884</td>
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<td>8</td>
<td></td>
<td></td>
<td>No recovery</td>
</tr>
<tr>
<td>5883</td>
<td></td>
<td>9</td>
<td>ML: Silt with some gravel, brown (7.5YR5/3). 3 - 7% gravel (1/4&quot; - 1/2&quot; diameter, subrounded to subangular). Abundant white stringers and disseminated caliche throughout. Powdery, white caliche in broken/fractured zones from 6.7' to 6.9'. and 7.5' to 8.1'. Slightly moist.</td>
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<tr>
<td>5882</td>
<td></td>
<td>10</td>
<td>ML: Silt with trace some gravel and sand, brown (7.5YR5/4). Gravel is 1/4&quot; - 1/2&quot; diameter, subrounded. Sand is coarse grained, subrounded. Abundant white disseminated caliche (tiny white fragments) and white stringers. Strong fracturing from 10.0' to 10.4' (~80 deg from horizontal), fracture surfaces coated with powdery white caliche. Slightly moist.</td>
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<td>5881</td>
<td></td>
<td>11</td>
<td>ML: Silt with trace gravel, strong brown (7.5YR4/6). Decrease gravel to trace to 5% (1/8&quot; - 1/4&quot;, subrounded, quartzite and granite composition). Abundant white caliche disseminated and as stringers throughout. Trace black organic nodules (1/8&quot; - 1/4&quot; in length). Fairly competent interval, trace moisture.</td>
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<td>5880</td>
<td></td>
<td>12</td>
<td>No recovery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5879</td>
<td></td>
<td>13</td>
<td>ML: Silt with trace gravel, same as interval from 10.4' to 10.7'.</td>
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<tr>
<td>5878</td>
<td></td>
<td>14</td>
<td>GM/ML: Silt/Gravel mixture, same as interval from 10.4' to 10.7', except increase gravel to 50%. Gravel is up to 1-1/2&quot; diameter, predominately quartzite. Gravel clasts coated with caliche. Trace moisture.</td>
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<td>5877</td>
<td></td>
<td>15</td>
<td>No recovery</td>
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<td></td>
<td></td>
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<td>GM/ML: Sandy, Silty Gravel, light brown (7.5YR6/4). ~50% gravel (1/4&quot; - 1-1/2&quot; diameter, subrounded to subangular, composed of quartzite or K-spar-rich granite), ~30% silt and ~20% sand. ~10% caliche coating gravel and in patchy zones throughout interval. Very crumbly and unconsolidated, very slightly moist.</td>
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<td>CL: Clay with trace gravel, light brownish gray (2.5Y6/2) to light olive brown (2.5Y5/3) with olive yellow (2.5Y6/6) motting. Appears to be re-worked claystone. 5 - 10% black organic stringers, 5 - 7% caliche (disseminated and as stringers). Patchy weak iron oxidation. Very</td>
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<td>Elev (ft)</td>
<td>Depth (ft)</td>
<td>Well or Pleizometer Construction and Materials</td>
<td>Unified Soils Classification or Rock Type</td>
<td>Lithology</td>
<td>Lithologic Description</td>
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<td>5873</td>
<td>5873</td>
<td>Filter Pack, steel shot, sand</td>
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<td>CL:</td>
<td>Clay with trace gravel, same as from 14.75' to 16.4' and 17.0' to 18.7'. Re-worked claystone. Lense of powdery white caliche from 19.2' to 19.4'. Very slightly moist.</td>
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<td>5872</td>
<td>5872</td>
<td>Screen, 2 in. Od. 0.01 in. Id.</td>
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<td>ML:</td>
<td>Silt with trace gravel, clay and trace sand, brown (7.5YR5/3). Gravel is 1/4&quot; - 3/4&quot; diameter, subangular to subrounded. Sand is medium grained and subrounded to subangular. Abundant white caliche stringers throughout interval. ~5% black manganese oxide (?) nodules (possibly organics). Black nodules are 1/8&quot; - 1/4&quot; diameter, frequent square to rectangular and easily smeared. Low to medium plasticity, slightly moist.</td>
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<td>5871</td>
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<td>No recovery.</td>
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<td>5870</td>
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<td>ML:</td>
<td>Silt, same as interval from 19.5' to 21.7'. Moist.</td>
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<td>5869</td>
<td>5869</td>
<td></td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5868</td>
<td>5868</td>
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<td></td>
<td>ML:</td>
<td>Silt, same as interval from 19.5' to 21.7'. Moist. Very plastic and broken from 25.8' to 26.3', otherwise interval is cohesive. 2.0&quot; diameter elongate quartzite clast at 26.3'. 1.0&quot; diameter, subangular quartzite clast at 29.4'. 1.5&quot; diameter, subangular quartzite clast at 29.8'.</td>
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<td>5867</td>
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<td></td>
<td></td>
<td>No recovery.</td>
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</table>

- Slightly moist.
GM/MH: Silt/Gravel mixture with clay and some sand, reddish brown (5YR5/4). 30 - 40% gravel (1/4" - 3/4" diameter, subangular to subrounded, predominately quartzite with lesser granite composition), 5 - 10% sand, coarse-grained. Silt is moist with medium to high plasticity. Spotty and patchy caliche throughout interval. 1.5" diameter angular clasts of quartzite at 30.1'.

No recovery.

GM/MH: Silt/Gravel mixture, reddish brown (5YR5/4) with some clay and sand. 50% gravel (1/2" - 2" diameter, subrounded to subangular), 10 - 20% sand (coarse-grained, subangular to subrounded). Silt is moist with medium to high plasticity.

No recovery.

GM/MH: Silt/Gravel mixture with some sand, same as interval from 32.0' to 33.5'. Gravel at base of interval appears to be red Fountain Formation.

CL: Clay, light brownish gray (2.5Y6/2) to light yellowish brown

MH: Silt with trace gravel, brown (7.5YR4/4). ~5% gravel (1/2" diameter, subrounded). Disseminated white caliche, moist.

No recovery.

CL: Clay, gray (2.5Y5/1) to light olive brown (2.5Y5/4) with yellow brown (10YR5/6) mottling. Black organic stringers common. Tiny white caliche blebs throughout, abundant caliche at base from 39.1' to 39.5'. 1/2" diameter subangular gravel clast at 39.3'. Interval is firm and dense. Re-worked claystone. Slightly moist. Base of slump block.

CLAYSTONE: TOP OF BEDROCK - Claystone, grayish brown (10YR5/2). Trace black stringers (organic material), trace patchy iron oxidation, dense and firm. Caliche coating fracture surfaces at 40.0' (fracture at ~ 10 deg from horizontal). Slightly moist.

CLAYSTONE: Claystone, yellowish brown (10YR5/6) with brown (10YR5/3) mottling. Oxidized claystone bedrock, dense and firm, slightly moist. Caliche blebs and stringers at 42.7' to 42.8'. Subhorizontal caliche (possible fracture fill) at 44.4' to 44.5'.

SANDSTONE: Silty Sandstone, very pale brown (10YR7/3). ~60% sandstone (very fine grained, subrounded), ~40% silt, friable. Silty, sandy lense within the Laramie. Slightly moist, friable.
No recovery.

SILTSTONE: Sandy Siltstone with some interbedded claystone. 
~65% siltstone, ~30% sand (very fine grained, subrounded). Weak pervasive iron oxidation, slightly moist.

No recovery.

SILTSTONE: Sandy Siltstone, same as interval from 46.0' to 47.8', slightly moist.

SILTY CLAYSTONE: Silty Claystone, gray (10YR6/1) to grayish brown (10YR5/2) with patchy yellowish brown (10YR5/4) iron oxidation. Firm, dense, slightly moist.

Boring extended to 50.6' to pick up auger cutting shoe. Not sampled, or cored, or logged.
MONITORING WELL AND PIEZOMETER INSTALLATION

GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT: Form PRO.118A

LOCATION CODE: 90804  PROJECT NAME: C404 Well Replacement PROGRAM: WATER PIPING/WRAP
SCREENED FORMATION: AIL/BLK DRILLING CONTRACTOR: HIGH PEAKS BORING METHOD: Open Stem Auger
DATE DRILLED: 1/12/05  DATE COMPLETED: 4/13/05  TOTAL DEPTH: 50.0'  COMPLETED DEPTH: 50.0'
ESTIMATED DEPTH TO BEDROCK: 39.5'  RIG GEOLOGIST: E. W. REPP  LOGGING GEOLOGIST: E. W. REPP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8'  QUANTITY OF FLUIDS LOST DURING DRILLING: 0
INITIAL WATER LEVEL (FT, DATE): 45.35' MGS 11/3/05  COMPLETED WATER LEVEL (FT, DATE): 43.23' on 11/3/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): WELL - 2.0" PVC Stick-up
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Steel - 6.0" above ground level casing.

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.0 gage
SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.75" gage ID (IN): 2.0
SURFACE SEAL TOP: 1.5" gage BOTTOM: 1.5" gage TYPE: 1/4" Silica Sand
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.65 gage 6.0" Steel
WELL PAD DIMENSIONS, TYPE: 3'X3' concrete pad 6/0.3 gage
ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
OTHER (E.G., ASEPCTIC) CASING TOP: N/A BOTTOM: N/A
OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
CENTRALIZER(S) DEPTH (S): N/A
GROUT TOP: 0.0' MEASURED DENSITY (LBS/GAL): N/A TYPE: 7.5' pre-mixed Portland cement W/5% bentonite
GRANULAR BENTONITE TOP: N/A TYPE: N/A
BENTONITE SEAL TOP: 16.0' TYPE: Cetco Leo Bentonite Chips
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 19.0
FILTER PACK TYPE: 16/40 Silica Sand BRAND: Norton-Oakley
SURFACE CASING BOTTOM (=SCREEN TOP): 19.75' TYPE: Sch. 80 PVC
SCREEN ID (IN): 2.0' SLOT SIZE (IN): 0.010' TYPE: Sch. 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 49.75' SUMP TYPE: Sch. 80 PVC Threaded End Cap
FILTER PACK BOTTOM (= BACKFILL TOP): 50.0' BACKFILL TYPE: Cetco Leo Bentonite Chips
SUMP BOTTOM (= WELL COMPLETED DEPTH): 50.0' PILOT HOLE TOP, DIAMETER: 8.0'
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 50.0'

REMARKS: Well 90804 WREPP penetrates a slump block. Most plastic silt/gravel mixture (min. 30.0 to 35.6') is probable slump block 'goose' material.

COMPLETED BY: Edwin S. Wrepp DATE: 4/13/05
CHECKED BY: DATE:

Drilled and installed well and protective casing on 4/13/05. Concrete well pad installed on 4/13/05.
**Rocky Flats Environmental Technology Site Borehole Log**

**Borehole Number:** 90804  
**Location - North:**  
**East:**  
**Date:**  
**Geologist:** E. Moore  
**Drilling Equip:** Yellow Stream Auger - OME '95-H

**Surface Elevation:**  
**Area:** Downgradient of Ryan's Pk  
**Total Depth:** 60.0'  
**Company:** URS/Hubbard  
**Project No:** 960-57300  
**Sample Type:** Split Spang

---

**RMRS Logging Supervisor**  
**Approval:**  
**Date:** 3/21/98

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.9'</td>
<td>Clay w/some gravel. dk. brn. (7.5 yr 5%)</td>
</tr>
<tr>
<td>0.9 - 1.2'</td>
<td>Gravel: 0.25 - 1.5&quot; dia., sub-angular, predominately &quot;silt.&quot; Roots abundant from 0.0&quot; to 0.2&quot;. Moist.</td>
</tr>
<tr>
<td>1.2 - 1.8'</td>
<td>No Recovery</td>
</tr>
<tr>
<td>1.8 - 2.5'</td>
<td>Gravelly Silt, Brn. (7.5yr 5%), 10% gravel (0.25 - 1.5&quot; dia., sub-angular, predominately &quot;silt&quot;), 5% calcite, some disseminated calcite. Moist.</td>
</tr>
<tr>
<td>2.5 - 4.0'</td>
<td>Gravel, Brn. (7.5yr 5%), similar to above, except increased gravel to 40% - 53%. Gravel is 0.25 - 1.5&quot; dia. and sub-rounded. 5% calcite as stringers and blobs.</td>
</tr>
<tr>
<td>4.0 - 5.0'</td>
<td>Fractured from 4.4&quot; to 4.8&quot; with 1.0&quot; sub-rounded gravel. Clasts coated w/powder, whites calcite, Silt. moist.</td>
</tr>
<tr>
<td>5.0 - 6.0'</td>
<td>No Recovery</td>
</tr>
<tr>
<td>6.0 - 8.1'</td>
<td>Silt w/some gravel. Brn. (7.5yr 5%), 3% gravel (0.25 - 0.5&quot; dia., sub-rounded, no sub-angular). Abundant wet stringers and diiss. Calcite throughout. Powder, whites calcite in broken</td>
</tr>
<tr>
<td>8.1 - 9.0'</td>
<td>Fractured zones from 6.7 to 6.9&quot; and 7.5 to 8.1&quot;, Silt. moist.</td>
</tr>
<tr>
<td>9.0 - 10.4'</td>
<td>Silt w/some gravel and sand. Brn. (7.5yr 5%), gravel is 0.25 - 0.5&quot; dia., sub-rounded. Sand is c.q., sub-rounded. Abundant wet, disseminated calcite (dolomite with fangs) and calcite stringers. Fracture zones from 10.0 to 10.4&quot; (180° from horizontal)</td>
</tr>
</tbody>
</table>

**Notes:**  
General: USCS is modified for this log as follows:  
Materials amount are estimated by % volume instead of % weight.  
1. Badly broken core, accurate footage measurements not possible.  
2. Lost breaks cannot be matched, accurate footage measurements not possible.  

**Procedure No:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
**Page:** 27 of 28
# ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 90804

**Location - North:** Y2105

**Geologist:** E. Wrange

**Drilling Equip.:** Hollow Stem Auger - One - Two T

**Elevation:**

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Sample Number</th>
<th>Fracture</th>
<th>Beacon Angle</th>
<th>Gravel Distribution</th>
<th>Sample Type</th>
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**Sample Description:**

- 10.4-10.7' - Silty clayey silt, gravel, Strong Bottom. (95% gravel, 5% clay), decrease gravel to 2-5% (1½-½" sub-rounded stone and granite), Abundant with caliche, disseminated and as stringers throughout. A bit of organic mud, (½-¼" in length), fairly coarse in interval. E moisture.
- No Recovery

- 11.0-11.6' - Silty clayey silt, gravel (same as above interval from 10.4 to 10.7').

- 12.8-13.0' - Silt-gravel mixture same as 10.4-10.7 except increase gravel to 50%, gravel is up to 1.5" dia., predominately gravel, clasts coated with caliche, E moisture.
- No Recovery

- 13.0-14.0' - Silty clayey silt with gravel, very sandy, Siltiest gravel, L.t., 75% (95% gravel), ~50% gravel, (0.25-0.5" dia., sub-rounded to sub-rounded), composed of feldspar - K-sporthrich & quartz.
- 30% silt, and ~20% sand, ~10% caliche, $^{2+}$ dikes, coating gravel and in patchy zones throughout interval, V, sandy, unconsolidated, V, silt, moist.

- 14.0-14.25' - Clayey silt, gravel, L.t., 75% (95% gravel, 0.5-0.25") yellow, olive green, (0.5-0.25") yellow, olive yellow, (0.1-0.5") yellow, Olive yellow, gravel, appears to be re-worked claystone, 5-10% bit, organic stringers, 5% caliche (disseminated and as stringers), Patchy with 10% sh, V, silt, moist, S, fracturing and caliche lenses @ 18.3', 10'.
- No Recovery

- 18.1-19.0' - Silty clayey silt, gravel (same as above), 18.7', L. top, 19.3', 19.7', 19.9', V, silt, moist.

**NOTES:** General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

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**Procedure No.** RMRS/OPS-PRO.101

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**Lenses:**

- 19.2 to 19.9' - Silt, clayey silt, 19.5-21.7' - Silty clayey silt, (see next page for description).
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 90804  
**Location - North:**  
**East:**  
**Date:** 3/21/05  
**Geologist:** E. Waup  
**Drilling Equip:** HOBNO 20 ft augur - CME - 75 ft  
**Surface Elevation:**  
**Area:** Downgradient of Ryan's Pit  
**Total Depth:** 50.0  
**Company:** NFRS  
**Sample Type:** Sour Soon  
**Project No:** NAD5300

**RMRS LOGGING SUPERVISOR APPROVAL**

<table>
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<tr>
<th>TOP ORIGIN</th>
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**SAMPLE DESCRIPTION**

19.5 - 21.7" - SILT w/ gravel/dirt and TE sand. Waste (?%YR%5). Gravel is 1/4 to 3/4" dia, sub-angular to sub-rounded. Sand is m.g. and sub-rounded to sub-angular. Abundant white calcite stringers throughout interval. ~5% blk. Mn Ox (?), nodules (possibly organics). Blk nodules are 1/4 - 1/2" dia, irregular to rectangular and easily smeared, medium plasticity, Si. moist.

21.7 - 22.0 = No Recovery

22.0 - 23.7" - SILT (same as above from 19.5 - 21.7). Moist.

23.7 - 24.0 = No Recovery

24.0 - 30.0" - SILT (same as above from 19.5 to 21.7). Moist. V. plastic and broken between 25.8 to 26.3, otherwise intact and cohesive. 2.0" dia, elongate gneissic clast @ 26.3.

1.0" dia, sub-angular gneissic clast @ 29.4.

1.5" dia, sub-angular gneissic clast @ 29.8.

**NOTES:** General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.

(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
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## ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 90804  
**Location - North:**  
**East:**  
**Date:** 6/25/05  
**Geologist:** E. W. W.  
**Drilling Equip.:** Hollow Stem Auger-CME-75HT  
**Surface Elevation:**  
**Area:** Downgradient of Ryan's Pit  
**Total Depth:** 30 ft (core to only 30 ft)  
**Company:** URS  
**Project No.:** UAS03800  
**Sample Type:** Split Spoon

### RMRS Logging Supervisor Approval  
**DATE:** 3/2/05

<table>
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<tr>
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<th>Depth (Ft)</th>
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<th>Fracture Angle</th>
<th>Bedding Angle</th>
<th>Grain Size Distribution</th>
<th>Lacs Symbol</th>
<th>Oros H Feet</th>
<th>SOC/CL H LITHOLOGIC LOG</th>
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**Sample Description:**

- **30.0-31.3:** SILT/GRavel Mixture w/some sand, 30-40% gravel (1/4-7/8" dia.), Sub-rounded, predominately gneiss with lesser granite composition. 5-10% sand. 0.1 ft thick. High plasticity. Spotty and patchy caliche throughout interval. 0.1 ft thick. Angular clasts of gneiss @ 31.

- **31.3-32.0:** No Recovery  

- **32.0-33.5:** SILT/GRavel Mixture w/some sand, 50% gravel (0.5-2" dia.), Sub-rounded to sub-rounded. 10-20% sand (a) Sub-rounded to sub-rounded. 0.1 ft thick. High plasticity. Gravel at base of interval appears to be red Fontain. 3/2/05  

- **33.5-34.0:** No Recovery  

- **34.0-35.6:** SILT/GRavel Mixture w/some sand (Same as above 32.0-33.5)  

- **35.6-36.1:** Clay-kt. Brnd grdy. (2.5)  

- **36.1-36.2:** SILT w/ gravel. Brnd. (1.5 yr. 0%) ~5% gravel (1/6" dia., sub-rounded). Disseminated wth. caliche. Moist  

- **36.2-37.0:** No Recovery  

- **37.0-39.5:** Clay-grdy (2.5 yr.) to ht. Olmbr. (2.5 year) Yellow brnd. (10 yr) Pitted. Blk. organic Strings common. Tiny wth. caliche blebs throughout. Abundant caliche @ Base. 39.1-39.5 0.5 ft dia.  

**NOTES:**  
- General: USCS is modified for this log as follows.  
- Materials amounts are estimated by % volume instead of % weight.  
- (1) Badly broken core, accurate footage measurements not possible.  
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

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**Date effective:** 12/31/98  
**Proc No.** RMRS/OPS-PRO-101  
**Revision:** 0

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**Top of Bedrock @ 39.5" (bottom of slump block)**
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

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<th>Borehole Number:</th>
<th>90804</th>
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<td>Location - East:</td>
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<td>Date:</td>
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<tr>
<td>Geologist:</td>
<td>E. Waap</td>
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<tr>
<td>Drilling Equip.:</td>
<td>Hollow Stem Auger</td>
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<td>RMRS LOGGING SUPERVISOR</td>
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**Surface Elevation:**

- **Area:** Downgradient of Ryan's Pit
- **Total Depth:** 50.6' (cored to 50.0')
- **Company:** 2103
- **Sample Type:** Split Spoon
- **Project No.:** 90057300

**Sample Description**

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<tr>
<th>Depth (Ft)</th>
<th>Description</th>
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<tr>
<td>40.0</td>
<td>(cont'd. from page 4/5)</td>
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<tr>
<td>39.5 - 40.4'</td>
<td>Claystone, Grayish Brown (10YR 5/2), &amp; thin stringers of organic material. To patchy Fe Oxides. Dense and firm. Caliche coating fracture surfaces @ 40.0' (200' @ ~10° in horizontal). St. moist.</td>
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<td>40.4 - 44.8'</td>
<td>Claystone-Yellowish Brown (10YR 5/6) to Brown (10YR 5/8) matrix, Oxidized Claystone Bedrock. Dense and firm, St. moist. Caliche blebs, stringers at 42.7 - 42.8', with thin prints, (post fracture fill), 41H, 41G.</td>
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<td>44.8 - 45.8'</td>
<td>Silty Sandstone - V patchy, (10Y 1/4), ~60% sandstone (v.f.g. Sub-rounded) ~40% Silty. Fe Oxides. Silty, sandy, dense within the Laramie. St. moist, friable.</td>
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<td>45.8 - 46.0'</td>
<td>No Recovery</td>
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<td>46.0 - 47.8'</td>
<td>Sandy Siltstone, Wipe interbedded Claystone, ~65% Siltstone, ~30% Sand (v.f.g. Sub-rounded), weak perr. Fe Oxides. St. moist.</td>
</tr>
<tr>
<td>47.8 - 48.0'</td>
<td>No Recovery</td>
</tr>
<tr>
<td>48.0 - 49.1'</td>
<td>Sandy Siltstone, (some x 3 about 40.0 - 47.8')</td>
</tr>
<tr>
<td>49.1 - 50.0'</td>
<td>Silty Claystone, Grayish Brown (10YR 6/1) to Greenish Brown (10YR 5/4) in patchy, Yellowish Brown (10YR 7/4) Fe Oxides, Firm Dense</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

- Procedure No. RMRS/OPS-PRO.101
- Revision 0
- Date effective: 12/31/98

---

**Remarks:**

- Boring extended to 50.6' to pick up angular cutting. Shale, not sampled or cored or logged.
Core not logged. See well 91103 for lithology.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
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<tbody>
<tr>
<td>5940</td>
<td></td>
<td>16</td>
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<td>5938</td>
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<td>18</td>
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<tr>
<td>5937</td>
<td>Bottom Cap</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Granular Bentonite</td>
<td>20</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

LOG OF BORING NUMBER: 91104
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 9/11/04
PROJECT NAME: 9/11/04
PROGRAM: 9/11/04

SCREENED FORMATION: RFA
DRILLING CONTRACTOR: WARD
BORING METHOD: GeoProbe

DATE DRILLED: 6/11/04
DATE COMPLETED: 6/11/04
TOTAL DEPTH: 19.5' COMPLETED DEPTH: 19.5'

ESTIMATED DEPTH TO BEDROCK: 1'
RIG GEOLOGIST: JDR
LOGGING GEOLOGIST: N/A

BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.75''
QUANTITY OF FLUIDS LOST DURING DRILLING: None

INITIAL WATER LEVEL (FT, DATE): Not measured
COMPLETED WATER LEVEL (FT, DATE): Not measured
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1'' Stainless Steel well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPSTIC, ETC.): 2'' above ground pit

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):

*SECONDARY CASING TOP:
BOTTOM: X
TYPE: X

SURFACE CASING TOP:
1'' ID (IN): 13' ags

SURFACE SEAL TOP:
+3' BOTTOM: -1'
TYPE: concrete

PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1'ag, 2'PVC

WELL PAD DIMENSIONS, TYPE: No pad, concrete mound

*ADD'L CASING FILL TOP:
BOTTOM: X
TYPE:

*SURFACE ISOLATION CASING TOP:
BOTTOM:

*SURFACE ISOLATION CASING ID (IN):
TYPE:

*OTHER (E.G., ASEPSTIC) CASING TOP:
BOTTOM:

*OTHER CASING ID (IN):
TYPE, PURPOSE:

*CENTRALIZER(S) OD (IN):
NUMBER USED:
TYPE:

*CENTRALIZER(S) DEPTH(S):

*GROUT TOP:
NA
MEASURED DENSITY (LBS/GAL):
TYPE:

*GRANULAR BENTONITE TOP:
TYPE:

*BENTONITE SEAL TOP:
1'agg
TYPE: granular (hydrated)

BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4' agg

FILTER PACK TYPE: 16-40
BRAND: 00 silica

SURFACE CASING BOTTOM (= SCREEN TOP):
4.5'' TYPE: stainless steel 1''

SCREEN ID (IN):
1'' SLOT SIZE (IN): 0.10 TYPE: stainless steel 1''

SCREEN BOTTOM (= SUMP TOP): 19.5'' SUMP TYPE: none; bottom cop

FILTER PACK BOTTOM (= BACKFILL TOP): 19.5'' BACKFILL TYPE: gran. bent.

SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.6'' PILOT HOLE TOP, DIAMETER: NA

TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 20'

REMARKS: High Mini-Rae readings, even through sealed drive casing, pegged once screen exposed.

COMPLETED BY: Josh Rosen DATE: 6/19/04
CHECKED BY: DATE:
MONITORING WELL INSTALLATION REPORT: Form PRO-118

LOCATION CODE: 91104 PROJECT NAME: CYOA WAP ASSESSMENT PROGRAM: WE-700Z Contractors
SCREENED FORMATION: Bdrk D R I L L I N G C O N T R A C T O R : R T G B O R I N G M E T H O D : G e o p r o b e
DATE DRILLED: 6/1/04 DATE COMPLETED: 6/1/04 TOTAL DEPTH: 20.0' COMPLETED DEPTH: 19.6'
ESTIMATED DEPTH TO BEDROCK: ~ 1.0' RIG GEOLOGIST: J. Rosen LOGGING GEOLOGIST: N/A
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.75" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): N/A MEASURED COMPLETED WATER LEVEL (FT, DATE): 10.02' on 6/21/04 (below TDC)
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1" I.D. Stainless Steel Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): 2" I.D. PVC

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT) 1.5' a.g.s.
- SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE:
- SURFACE CASING TOP: 1.5' a.g.s. ID (IN): 1.0'
- SURFACE SEAL TOP: 0.3' a.g.s. BOTTOM: 1.0' TYPE: Concrete
- PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.0' a.g.s. 2.5' I.D. PVC
- WELL PAD DIMENSIONS, TYPE: 3' x 3' (15.0' x 15.0') (1.0' A 0.3' to 0.6')
- ADD'L CASING FILL TOP: 0.3' a.g.s. BOTTOM: 1.0' TYPE: 2.5' PVC between 2.0 PVC annulus
- SURFACE ISOLATION CASING TOP: N/A BOTTOM:
- SURFACE ISOLATION CASING ID (IN): N/A TYPE:
- OTHER (E.G., ASEPHTIC) CASING TOP: N/A BOTTOM:
- OTHER CASING ID (IN): N/A TYPE, PURPOSE:
- CENTRALIZER(S) OD (IN): N/A NUMBER USED:
- CENTRALIZER(S) DEPTH(S): N/A
- GROUT TOP: N/A MEASURED DENSITY (LBS/GAL):
- GRANULAR BENTONITE:
- BENTONITE SEAL TOP: 1.0' TYPE: Granular Bentonite
- BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (FILTER PACK TOP): 4.0'
- FILTER PACK TYPE: 15/40 Screen Sand BRAND: C S S T
- SURFACE CASING BOTTOM (SCREEN TOP): 0.5' TYPE: Stainless Steel
- SCREEN ID (IN): 1.0' SLOT SIZE (IN): 0.016' TYPE: Stainless Steel
- SCREEN BOTTOM (= SUMP, TOP): 19.5' SUMP TYPE: Threaded End Cap
- FILTER PACK BOTTOM (= BACKFILL TOP): 19.6' BACKFILL TYPE: Granular Bentonite
- SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.6' PILOT HOLE TOP, DIAMETER: N/A
- TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 20.0'

REMARKS: 91104 REPLACED WELL # 91103. Lithology not logged.

V. HIGH PID READINGS (OFF SCALE)

COMPLETED BY: Ellen S. Waap DATE: 3/14/05
CHECKED BY: J. Baglow DATE: 3/14/05
C.2 Calendar Year 2005
This is a 2" PVC well installed inside existing 12" I.D. Steel 891COLWEL to assumed T.D. of constructed 891COLWEL. Details of lithology and construction of 891COLWEL are estimated from records for "CW001" (February and March 1992).

CL: Dark brown to black Clay with gravels, cobbles, and roots to surface. Topsoil, sandy black.

CL: Dark brown Sandy Clay with gravel, trace caliche scattered throughout; less organic than above.

CL: Sandy Clay, light to red orange brown, scatter limonite stain throughout. Note: Pitless Adapter Unit at 4.5' - 6.0'.
SM: Silty Sand, very fine grained to fine grained, trace mica; some cobbles, trace carbonaceous material. At 7.0' gray green clay with sand, trace organics, scattering of iron stain; abundant cobbles.
**TOP OF BEDROCK.** (Log for "CW001" does not describe bedrock.)
Note: void from 19.87' to 20.5' is not real; either due to errors on CW001 documentation or unrecognized sediment accumulation in sump.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: B9/1WEL PROJECT NAME: CYO5 WELL REPLACEMENTS PROGRAM WATER PROGRAMS: WMP
SCREENED FORMATION: 01/69/1E DRILLING CONTRACTOR: N/A BORING METHOD: N/A
DATE DRILLED: 01/69/1E DATE COMPLETED: 01/69/1E TOTAL DEPTH: 19.87 COMPLETED DEPTH: 19.87
ESTIMATED DEPTH TO BEDROCK: 19.87 RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: N/A
BOREHOLE DIAMETER IN SCREENED INTERVAL: 1.09' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 16.57/70C 1.09'55 COMPLETED WATER LEVEL (FT, DATE): 10.2'THC 2.0' PVC
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0' PVC WELL WITHIN EXISTING 3.5' WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): 2.0' PVC steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* Denotes items that may not be applicable, depending on boring method, well protection & purpose

- PROTECTIVE CASING TOP (STICKUP OR Flush-MOUNT): 2.0' 605
- SECONDARY CASING TOP: 2.0' 605 BOTTOM: 19.87' TYPE: 9/16 C/WEL
- SURFACE CASING TOP: 2.0' ID (IN) BOTTOM: 1.09' ID (IN) TYPE: 2.0' PVC
- SURFACE SEAL TOP: 0.65' ID (IN) BOTTOM: 1.09' ID (IN) TYPE: 2.0' PVC/SAN
- PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.22' 6/10' Steel USE PREDICTION MODEL WHICH IS A 2.0' PVC SECT
- WELL PAD DIMENSIONS, TYPE: N/A
- ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
- SURFACE ISOLATION CASING TOP: 2.5' ID (IN) BOTTOM: N/A TYPE: N/A
- SURFACE ISOLATION CASING ID (IN): N/A 2.5' ID (IN) TYPE: N/A
- OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A TYPE: N/A
- OTHER CASING ID (IN): N/A 2.0'5'05' TYPE: N/A UNKN
- OTHER CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
- CENTRALIZER(S) DEPTH(S): N/A
- GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
- GRANULAR BENTONITE TOP: 1.17' 695 TYPE: COTCO - Granular Bentonite - Hydrated
- BENTONITE SEAL TOP: N/A TYPE: N/A
- BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): N/A
- FILTER PACK TYPE: 14/40 Silica Sand BRAND: E.S.S. E.
- SURFACE CASING BOTTOM (= SCREEN TOP): 4.67' TYPE: Sch. 40 PVC
- SCREEN ID (IN): 2.0' SLOT SIZE (IN): 0.68' TYPE: Sch. 40 PVC
- SCREEN BOTTOM (= SUMP, TOP): 19.72' TYPE: Sch. 40 PVC-Threaded End Cap
- FILTER PACK BOTTOM (= BACKFILL TOP): 19.87' BACKFILL TYPE: N/A
- SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.87' PILOT HOLE TOP, DIAMETER: N/A
- TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): N/A

REMARKS: [Install a 2' PVC well inside existing 1.09' Steel 9/16 C/Wel to TD of constructed B9/1C/Wel. Detailed diagram of drill will not available due to "unlimited" above.
COMPLETED BY: Ellen S. Warp DATE: 01/69/1E
CHECKED BY: John Bowers DATE: 10/18/05

See records for "CW001", Feb-Mar 1992, for lithology and construction information for B9/1C/Wel.
CL: Clay with trace sand and trace gravel, brown (7.5YR5/2) with gray (7.5YR6/1) and trace strong brown (7.5YR5/6) mottling. Medium to high plasticity, soft and very moist. Laminar, horizontal mottling. 1/2" subrounded clast of quartzite at 0.6'.

No recovery.

CL: Clay with trace sand and trace gravel, same as from 0.0 to 1.2'. Mottled clay, medium to high plasticity, very moist. Laminar horizontal mottling.

SC: Silty Sand with some gravel, brown (7.5YR5/3), ~80% sand (fine grained to coarse grained, subrounded to subangular), unconsolidated, well graded. 5 - 10% gravel (1/8" to 1/2" diameter, subangular) composed of granite and quartzite. 1" diameter subangular clast of quartzite at 2.5'. Wet at base of sand (3.0').

GC/CL: Clay/Gravel mixture, strong brown (7.5YR4/6) to brown (7.5YR4/3). ~10 - 15% gravel (1/4" to 3/4" diameter, subrounded), composed of granite and quartzite. Clay has medium plasticity and is soft. Spotty iron oxidation, decreased gravel at base of interval from 3.6' to 3.9' to trace. Clay becomes mottled from 3.6' to 3.9'. Decreasing moisture from wet to very moist.
5932
Filter Pack, 16/40 Silica Sand

5931
Screen, Sph 40-P/2, H. I.D., 0.015 in. hole

5930
No recovery.

CL: Clay with trace gravel and trace sand, same as from 5.0' to 6.5'. Soft and very moist. Extremely poor recovery.

5929
No recovery.

5928

5927
CL: Clay with trace gravel and trace sand, same as from 7.0' to 7.5'. 1/2" gravel (possible ironstone fragment) at 11.4'

5926

5925
CLAYSTONE: TOP OF BEDROCK. Clay[stone], olive brown (2.5Y4/3). Bedrock contact very, very subtle. Very uniform clay - possible claystone. Trace gravel (1.0" diameter, subangular) composed of broken granite cobble at 10.2'. 3/4" ironstone fragment at 11.6'. Trace white caliche stringers from 11.0' to 11.8'. Interval very massive, dense, and cohesive yet very pliable, very moist.

5924
No recovery.

CLAYSTONE: Clay[stone], same as from 11.5' to 11.8', decreased moisture to moist.

CLAYSTONE: Claystone, grayish brown (10YR5/2) with yellowish brown (10YR5/6) mottling. Very slightly silty, caliche-filled white
minor horizontal fracture at 13.0'. Interval is firm and dense, moist. Trace caliche stringers along internal bedding, massive textured, occasional carbonaceous flecks.

CLAYSTONE: Claystone, yellowish brown (10YR5/6) with lesser brown (10YR5/3) mottling. Increasing iron oxidation to moderate. Firm and dense interval, moist.

CLAYSTONE: Claystone, grayish brown (10YR5/2), predominantly un-weathered claystone bedrock. Weak pervasive iron oxidation from 18.0' to 19.3'. Interval dense but friable, decreasing moisture to very slightly moist.

No recovery.

Reamed borehole with augers, not sampled or cored from 20.0' to 21.0'.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 20205  PROJECT NAME: CH5S WELL REPLACEMENT PROGRAM; Water Pilesmons-W10RP
SCREENED FORMATION: Alluvial Drilling CONTRACTOR: Hiawatha Boring METHOD: Hiawatha DENA
DATE DRILLED: 4/6/05  DATE COMPLETED: 4/6/05  TOTAL DEPTH: 21.0'  COMPLETED DEPTH: 21.0'
ESTIMATED DEPTH TO BEDROCK: 11.5'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE):  DAY ON 4/6/05  COMPLETED WATER LEVEL (FT, DATE):
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" I.D. SCH 80 PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Steel Protective Cage - Stick-up

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP: (STICKUP OR Flush-MOUNT): 3.1'
*SECONDARY CASING TOP: N/A  BOTTOM: TYPE:
SURFACE CASING TOP: 2.5" PS ID (IN.): 2.0"
SURFACE SEAL TOP: 0.75" PS BOTTOM: 0.0"  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.75" PS 6" Deed
*WELL PAD DIMENSIONS, TYPE: 3' x 3' - Concrete Pad 48" wide x 0.5" thick
*ADD'L CASING FILL TOP: N/A  BOTTOM:
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM:
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE:
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM:
*OTHER CASING ID (IN): N/A  TYPE:
*CENTRALIZER(S) DD (IN.): N/A  NUMBER USED: TYPE:
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): TYPE:
*GRANULAR BENTONITE TOP: N/A  TYPE: N/A
*BENTONITE SEAL TOP: 0.0"  TYPE: Med. Bentonite Chips
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.75'
FILTER PACK TYPE: 4/40 Silica Sand  BRAND: CSSI
SURFACE CASING BOTTOM (= SCREEN TOP): 5.75"  TYPE: SCH 80 PVC
SCREEN ID (IN): 0.75" SLOT SIZE (IN): 0.01"  TYPE: SCH 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 20.75"  SUMP TYPE: Threepod End Cap - PVC
FILTER PACK BOTTOM (= "BACKFILL TOP): 21.0"  "BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 21.0"  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM): 21.0'

REMARKS: Normal Well Installation. Backfill leveled to 20.0'; Remain cut & fillers to 80.0' to assist well construction.
COMPLETED BY: Eillen S. Waap  DATE: 4/6/05
CHECKED BY:  DATE: 6/29/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
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<tr>
<th>Borehole Number: 207.05</th>
<th>Surface Elevation:</th>
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<tbody>
<tr>
<td>Location - North:</td>
<td>East:</td>
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<tr>
<td>Date: 4/19/05</td>
<td>Total Depth: 210'</td>
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<tr>
<td>Drilling Equip.:</td>
<td>Project No.: 7AD.51.300</td>
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<tr>
<td>Sample Type:</td>
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RMRS LOGGING SUPERVISOR

<table>
<thead>
<tr>
<th>APPROVAL</th>
<th>DATE 4/19/05</th>
</tr>
</thead>
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<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
</table>
| 0.0-1.2': Clay $^{1/4}$Fe sand and $^{1/4}$Fe gravel. 
  Bm. (75% Fe). $^{1/4}$In (25% Fe) and $^{1/4}$Fe. 
  Strong Bm. (75% Fe), medium $^{1/4}$Fe gravel. 
  Hard $^{1/4}$Fe sand, medium $^{1/4}$Fe gravel. 
  1.2-2.0': No Recovery. 
  1.0-2.0': Clay $^{1/4}$Fe sand and $^{1/4}$Fe gravel. 
  (same as above 0m. 0.0-1.2'), Well graded. 
  Clay, hard to high plasticity, kaolins. 
  Horizontal mud halos, 1.2', bedded, albite, quartz, 
  of granite and Qz. 
  2.0-3.0': Si and Fe sand, some gravel. 
  Bm. (75% Fe). Strong Bm. (80% Fe) and $^{1/4}$Fe. 
  Sub-rounded $^{1/4}$Fe gravel. 
  Well graded, 2.0-3.0': Si and Fe sand, some gravel. 
  Bm. (75% Fe). Strong Bm. (80% Fe) and $^{1/4}$Fe. 
  Sub-rounded $^{1/4}$Fe gravel. 
  Well graded, 3.0-3.5': Dry, clayey sand. 
  Matrix of granite and quartz. 
  3.5-5.0': No Recovery. 
  5.0-6.5': Clay $^{1/4}$Fe gravel and $^{1/4}$Fe sand. 
  Soft Bm. (25% Fe). $^{1/4}$In (10% Fe) 
  and $^{1/4}$Fe. 
  Well graded, 5.0-6.5': Dry, clayey sand. 
  Matrix of granite and quartz. 
  6.5-10.0': No Recovery. 
  7.0-7.5': Clay $^{1/4}$Fe gravel and $^{1/4}$Fe sand. 
  Some 0g. Bm. (60% Fe) Soft $^{1/4}$Fe gravel and $^{1/4}$Fe sand. 
  EXTREMELY POOR RECOVERY. |

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98

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**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BORŒHOLE LOG**

**Borehole Number:** 20260

**Location - North:** [Blank]

**Date:** 4/1/05

**Geologist:** [Blank]

**Drilling Equip.:** A-200-70

**Surface Elevation:** [Blank]

**Area:** [Blank]

**Total Depth:** 210'

**Company:** U.S. Army Project No. 0638-1300

**Sample Type:** [Blank]

---

**RMRS LOGGING SUPERVISOR APPROVAL**

**DATE:** 4/1/05

---

**SAMPLE DESCRIPTION**

- **12.0-12.6:** Claystone - Yellowish Brown (10YR 7/2) with occasional clay lens (10YR 5/3). Well-defined horizontal layering. Firm and dense. No cements or fossils.

- **12.6-13.8:** Claystone - Grayish Yellow (10YR 7/2) with occasional clay lens (10YR 5/3). Firm and dense. No cements or fossils.

---

**NOTES:**

- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
- Procedure No. RMRS/OPS-PRO.101
- Revision 0
- Date effective: 12/31/98

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**Anchorage borehole (not sampled or cored)**

**Anchorage:** 0-0.0 to 210' - T.D. @ 210'.

---
SC: Gravelly Sand with some clay, brown (7.5YR5/2). Fill material with trace roots, ~25% gravel (1/8" - 3/4" diameter, subangular), moist.

GC: Clayey Gravel, dark grayish brown (2.5Y4/2) clay, ~65% gravel (1/4" to 1-1/2" diameter, subangular to subrounded) composed of granite, quartzite and asphalt. Low plasticity, moist.

CL: Clay with abundant gravel, dark gray (5Y4/1) to dark olive gray (5Y3/2). Distinct color change. ~35% gravel (1/8" - 1/2" diameter, subangular), composed of amphibolite or basalt with lesser quartzite. Low plasticity, moist.

GC/CL: Gravel/Clay mixture with some sand, brown (7.5YR4/3). ~25% gravel (1/8" - 1/2" diameter, subangular), granitic composition, ~15% sand (coarse grained, subangular). Weak, patchy iron oxidation throughout, moist.

No recovery.

GW: Gravel, gray (7.5YR5/1). Shattered quartzite cobble (1" - 2" diameter, subangular). Moist.

GC/CL: Gravel/Sandy Clay mixture, dark yellowish brown (10YR4/6) to dark grayish brown (10YR4/2). ~35% gravel (1/4" - 1" diameter, subangular, granite and quartzite). Sandy clay from 2.3' to 2.5' with weak to moderate pervasive iron oxidation. Dark grayish brown from 2.5' to 3.3'; gravel/clay mixture, moist. Caliche grains common throughout.

CL: Silty Clay with trace sand and trace gravel, olive gray (5Y5/2) with yellowish brown (10YR5/6) mottling. Clast of silty claystone.
Moist.

No recovery.

CL: Silty Clay with sand and gravel. Silty clay as above with 20% gravel from 5.0' to 5.4'. Gravel is 1" - 2" diameter, subangular quartzite clasts. Decrease gravel and increase sand at base of interval from 6.0' to 6.5'. Sand is coarse grained, subangular, with caliche fragments common. Interval crumbly, moist.

No recovery.

GC/CL: Silty Clay/Gravel mixture. Silty clay is olive gray (5Y5/2) grading to dark brown (7.5YR3/3) at base of interval. ~60% silty clay and ~40% gravel (1/2" to 1-1/2" diameter, subangular, granite and quartzite), moist.

CL: Silty Clay, very pale brown (10YR7/3) with some dark yellowish brown (10YR4/6) mottling, very moist.

CL: Silty Clay, very dark brown (7.5YR2.5/2) to black (7.5YR2.5/1). Roots common, distinct color change, organic-rich (possible pond sediment). 5-8% gravel (1/4" - 1/2" diameter, subrounded), increased moisture to wet.

No recovery.

CL: Silty Clay with trace gravel, same as interval from 7.8' to 8.2'. Shattered quartzite cobble at base of interval between 10.7" to 10.8". Very poor recovery, probably pushing a cobble, which makes sample "ribbomed". Very plastic, roots common, wet.

No recovery.

GC/CL: Gravel/Clay mixture, very dark brown (7.5YR2.5/2) clay, 40 - 50% gravel (1/4" - 1/2" diameter, subangular) composed of granite and quartzite. Clay has medium plasticity. Decreased moisture to very moist. Caliche grains common.

SM: Silty Sand with some gravel, strong brown (7.5YR5/6). Sand is fine grained and subrounded, very uniform, poorly graded. Pervasive iron oxidation of silty sand. Very moist, but not saturated or flowing. Trace caliche. 1-1/2" diameter broken quartzite cobble at 12.5'.

GC/CL: Clay/Gravel mixture, brown (7.5YR4/3) clay. ~50 - 55%
gravel (1/2" to 1-1/2" diameter, subangular), composed of broken

CL: Clay, yellowish brown (10YR5/6) with grayish brown (10YR5/2) mottling. Re-worked claystone. Sandy-silty lens with pervasive iron oxidation from 13.6' to 13.7'. Iron oxidation decreases to trace at base of interval, moist.

No recovery.

CL: Clay with some gravel and some sand, grayish brown (10YR5/2). 5 - 8% gravel (1/4" - 1" diameter, subrounded). Caliche disseminated throughout. 1-1/2" diameter (subangular) broken quartzite cobbles at 15.4' and 16.1'. Trace iron oxidation of clay. Massive texture of clay. Interval cohesive except in zones of shattered cobbles, moist.

CLAYSTONE: TOP OF BEDROCK. Claystone with trace to some silt, grayish brown (10YR5/2). Subtle contact, massive textured. Trace iron oxidation at base, trace caliche blebs, moist.

No recovery.

CLAYSTONE: Claystone, gray (10YR5/1) with abundant pale brown (10YR8/2) caliche, moist.

CLAYSTONE: Silty Claystone, grayish brown (10YR5/2), massive textured claystone. Weak pervasive iron oxidation. Trace white blebs and stringers from 17.2' to 17.6'. Interval cohesive and firm, decreased moisture to slightly moist.

CLAYSTONE: Claystone to Silty Claystone, grayish brown (10YR5/2) with patchy yellowish brown mottling. Weak patchy iron oxidation throughout. Massive textured. Interval dense, firm, weakly friable. Decrease overall moisture to very slightly moist. Decreased silt below 22.0'.
Augers advanced to 26.0' to adjust well construction, but no sample collected.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 20505  PROJECT NAME: Fieldwell Replacement  PROGRAM: Water Programs-WARP
DATE DRILLED: 4/15/05  DATE COMPLETED: 4/15/05  TOTAL DEPTH: 26.0'  COMPLETED DEPTH: 26.0'
ESTIMATED DEPTH TO BEDROCK: 16.1'  LOGGING GEOLOGIST: F. Warp  BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0"
QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 4/15/05  COMPLETED WATER LEVEL (FT, DATE): N/A
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" I.D. PVC
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPHTIC, ETC.): Above ground Steel Protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- **PROTECTIVE CASING TOP** (STICKUP OR FLUSH-MOUNT): 2.875'
- **SECONDARY CASING TOP**: N/A
- **SURFACE CASING TOP**: 2.2' ID (IN): 2.0"
- **SURFACE SEAL TOP**: 1.882' BOTTOM: 0.25" TYPE: Concrete
- **PROTECTIVE CASING BOTTOM, ID (IN)**: 2.0' ID 6.0' OD
- **WELL PAD DIMENSIONS, TYPE**: 3'X3'-Concrete 6.02'X6.02' 0.3'-Top
- **ADD'L CASING FILL TOP**: N/A BOTTOM: N/A TYPE: N/A
- **SURFACE ISOLATION CASING TOP**: N/A BOTTOM: N/A
- **SURFACE ISOLATION CASING ID (IN)**: N/A TYPE: N/A
- **OTHER (E.G., ASEPTIC) CASING TOP**: N/A BOTTOM: N/A
- **OTHER CASING ID (IN)**: N/A TYPE, PURPOSE: N/A
- **CENTRALIZER(S) OD (IN)**: N/A NUMBER USED: N/A TYPE: N/A
- **CENTRALIZER(S) DEPTH(S)**: N/A
- **GROUT TOP**: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
- **GRANULAR BENTONITE TOP**: N/A
- **BENTONITE SEAL TOP**: 0.2' BGS. TYPE: Med Bentonite Chips. Pure Gold Brand. Hydrated 15 gals of Distilled H2O
- **BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP)**: 5.0'
- **FILTER PACK TYPE**: 1/4" Silica Sand BRAND: E.S. Brand
- **SURFACE CASING BOTTOM (= SCREEN TOP)**: 5.75' TYPE: Sch. 80 PVC
- **SCREEN ID (IN)**: 2.0" SLOT SIZE (IN): 0.01" TYPE: Sch. 80 PVC
- **SCREEN BOTTOM (= SUMP, TOP)**: 25.75' SUMP TYPE: Threaded 3/4" cap, Sch. 80 PVC
- **FILTER PACK BOTTOM (= BACKFILL TOP)**: 26.0' BACKFILL TYPE: N/A
- **SUMP BOTTOM (= WELL COMPLETED DEPTH)**: N/A PILOT HOLE TOP, DIAMETER: N/A
- **TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM)**: 26.0'

REMARKS: Routine well installation

COMPLETED BY: Leon S. Warp  DATE: 4/20/05
CHECKED BY: F. Warp  DATE: 4/27/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 20505
Location - North: 415105
Date: 4/27/05
Geologist: E. Wood
Drilling Equip. Yellow Steam Singer - OCE-75H
RMRS LOGGING SUPERVISOR
APPROVAL

| SAMPLE DESCRIPTION |
|--------------------|---|
| 0.0-0.3' Gravely sand w/ some clay, Brun. (7.5 V R 74) Sick matrix, w/sheets, ~35% gravel (60-30 dha, sub-ang.). Moist. |
| 0.3-1.2' Blond GRANITE. DK. Grey Brun. (6.5 V R 16) Clay, ~65% gravel (40-10 dha, sub-ang.), composed of quartz and feldspar, low plasticity. Moist. |
| 1.2-3.3' Clay/Granular gravel. DK. Grey (5.5 V R 28) to DK. Olive gray (5 V R 23), defined by change, ~35% gravel (60-20 dha, sub-ang.), composed of amphibolite or basalt welded siltstone, low plasticity. Moist. |
| 3.3-3.6' gravel/clay mixture, Brun. (7.5 V R 28) with ~35% gravel (60-20 dha, sub-ang.), granite compaction. |
| 3.6-5.0' No recovery. |
| 5.0-6.5' Silty clay as above w/20% gravel. |
| 6.5-7.0' Silty clay as above w/20% gravel. |
| 7.0-8.2' Black (75 V R 25), roots common, Destined soils. Organic-rich (possible peat soil) 5-8%, gravel (40-20 dha, sub-rounded). 0.25' recovery. |
| 8.2-10.0' No recovery. |

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 20505
Surface Elevation: 20598
Location - North: 495/05
East: 260
Date: 4/7/05
Geologist: E. W. W.
Drilling Equip.: Yellow Steer Auger - Cosco CA-1C-75-47

Company: US/HEMPLANS
Project No.: 6005-700
Sample Type:

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Interval</th>
<th>Sample Number</th>
<th>Sample Date</th>
<th>Sample Type</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-10.8</td>
<td>10.8-12.0</td>
<td>Sample 1</td>
<td>10-12</td>
<td>Silty Clay</td>
<td>V. Di. Brn. (7.5YR 2.5/2) Clay, 40-60% gravle (5-10 cm) Sub-rounded, V. uniform, poorly graded. Perk. Frcn. Various textures, V. wet, moist. Good to very good core.</td>
</tr>
<tr>
<td>12.0-12.5</td>
<td>12.5-12.8</td>
<td>Sample 2</td>
<td>12-15</td>
<td>Silty Clay</td>
<td>V. Di. Brn. (7.5YR 2.5/2) Clay, 40-60% gravle (5-10 cm) Sub-rounded, V. uniform, poorly graded. Perk. Frcn. Various textures, V. wet, moist. Good to very good core.</td>
</tr>
<tr>
<td>12.8-13.0</td>
<td>13.0-13.3</td>
<td>Sample 3</td>
<td>13-16</td>
<td>Clay/Gravel Mixture</td>
<td>Brn. (7.5YR 2.5/2) Clay, 40-60% gravle (5-10 cm) Sub-rounded, V. uniform, poorly graded. Perk. Frcn. Various textures, V. wet, moist. Good to very good core.</td>
</tr>
<tr>
<td>13.3-14.0</td>
<td>14.0-14.5</td>
<td>Sample 4</td>
<td>14-17</td>
<td>Clay/Siltstone</td>
<td>Brn. (7.5YR 2.5/2) Clay, 40-60% gravle (5-10 cm) Sub-rounded, V. uniform, poorly graded. Perk. Frcn. Various textures, V. wet, moist. Good to very good core.</td>
</tr>
<tr>
<td>14.7-17.0</td>
<td>17.0-17.2</td>
<td>Sample 5</td>
<td>17-20</td>
<td>Clay/Siltstone</td>
<td>Bedrock Contact</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98

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### Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 20505  
**Location - North:**  
**East:**  
**Date:** 4/15/05  
**Geologist:** E. Wang  
**Drilling Equipment:** Yellow Shoe Auger, CMU-75-HT

<table>
<thead>
<tr>
<th>RMRS Logging Supervisor</th>
<th>Date</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4/27/05</td>
<td>Clayey silt, grayish brown, with patchy yellowish brown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motting, wet, patchy Feathon.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variegated, massive textured.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Massive dense firm, weakly fracture.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decrease overall moisture to very slight moist. Decr. shr below 22'.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adjust well construct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26.0 to 26.0. Pageers advanced but no sample collected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T.D. = 26.0'</td>
</tr>
</tbody>
</table>

**NOTES:**  
- General: USCS is modified for this log as follows:  
- Materials amounts are estimated by % volume instead of % weight.  
- (1) Badly broken core, accurate footage measurements not possible.  
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Concrete Pad</td>
<td>0</td>
<td>CL: Silty Clay with trace sand and trace gravel, brown (10YR5/3). 3 - 5% gravel (1/8&quot; - 1/4&quot; diameter, subangular), 1 - 3% coarse grained sand. Moderate pervasive iron oxidation, trace disseminated caliche. 1/4&quot; diameter vug, filled with sparry calcite at 0.6'. Clay is soft and moist.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Concrete Seal</td>
<td>1</td>
<td>CL: Silty Clay, yellowish brown (10YR5/4). Moderate pervasive iron oxidation. Clay is soft and moist. Very poor recovery. Sample appears &quot;ribbed&quot; due to a cobble stuck in cutting shoe. Moist.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hydrated Bentonite Chips</td>
<td>2</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Protective Casing, 8 in. ID., Steel</td>
<td>3</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>Casing, Sch 40/ PVC, 2 in. ID.</td>
<td>3.5</td>
<td>CL: Silty Clay, same as interval from 0.7' to 0.9'. 2.0&quot; diameter cobble at 2.3'. Very poor recovery. Sample appears &quot;ribbed&quot; due to a cobble stuck in cutting shoe. Moist.</td>
<td></td>
</tr>
</tbody>
</table>
CL: Silty Clay, dark yellowish brown (10YR4/6) with occasional dark grayish brown (10YR4/2) mottling. Trace gravel. Moderate to strong pervasive iron oxidation. Interval cohesive from 5.0' to 5.3', crumbly from 5.3' to 6.0'. Caliche lense at 5.3'. Moist. Ironstone fragments common below ~5.5'.

No recovery.

CL: Silty Clay, same as interval from 5.3' to 6.0'. Crumbly and moist. Ironstone fragments to ~7.7'. Lense of silt from 8.0' to 8.1'.

No recovery.

CL: Silty Clay with trace gravel, yellowish brown (10YR4/6) with occasional dark grayish brown (10YR4/2) mottling. Moderate pervasive iron oxidation. Clay is soft and pliable, very moist. Occasional ironstones, more common from 10.0' to 10.4'.

No recovery.

CL: Clay with trace to some silt, yellowish brown (10YR5/4) to gray (10YR5/1), mottled. Decreased iron oxidation to weak/patchy oxidation. Clay is soft and pliable, moisture increases to very moist.

No recovery.

CL: Gravelly Clay with some sand, dark gray (2.5Y3/1) with lesser olive brown (2.5Y4/3) mottling. Distinct color change. 5 - 7% gravel (1/8" - 1/4" diameter, subangular). Shattered cobbles at 12.2' and 12.9'. Clay has medium plasticity, is soft and pliable. Moisture increases to wet. Disseminated caliche at 12.3' to 12.6'.

No recovery.
<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>CL: Gravelly Clay with some sand, very dark gray (2.5Y3/1) to very dark grayish brown (2.5Y3/2). Very similar to interval from 12.2' to 12.9'. Roots common, also possible pond sediments. Disseminated caliche throughout. Shattered cobbles (1/2&quot; to 1-1/2&quot; diameter, angular, schist) at 14.6'. Clay is soft and pliable, wet. Caliche most prevalent below 15'. No recovery.</td>
</tr>
<tr>
<td>16</td>
<td>CL: Clay with some sand and gravel, dark yellowish brown (10YR4/4). 5 - 15% sand (medium grained, subrounded), 5 - 8% gravel (1/2&quot; - 1&quot; diameter, subrounded to subangular). Clay is soft and pliable. Very poor recovery. Interval is completely saturated. No recovery.</td>
</tr>
<tr>
<td>19</td>
<td>CL: Clay with trace sand and trace gravel, light olive brown (2.5Y5/3) to yellowish brown (10YR5/4). Decreased sand and gravel to trace. Clay is soft and pliable, saturated. Roots at 20.1’. No recovery.</td>
</tr>
<tr>
<td>21</td>
<td>CL: Clay with trace sand and trace gravel, brown (10YR7/3). Interval completely saturated and unconsolidated, basically mud. No recovery.</td>
</tr>
</tbody>
</table>
CL: Clay with trace gravel, light olive brown (2.5Y5/3). Appears to be re-worked claystone, saturated. 3/4" angular cobble (granitic) at base of interval.

No recovery.

CL: Clay with trace gravel, same as interval from 24.0' - 24.5'. Unconsolidated, muddy, clay material; saturated. 1-1/2" diameter quartzite cobble at 26.4'.

CLAYSTONE: TOP OF BEDROCK. Claystone, grayish brown (10YR5/2). Very subtle contact. Weak iron oxidation - low angle, along bedding planes/fracture planes. Interval is firm and dense. Distinct decrease in moisture to moist. Becoming slightly moist at base of interval.

No recovery.

CLAYSTONE: Claystone, iron oxidized bedrock, yellowish brown (10YR5/4) with lesser grayish brown (10YR5/2) mottling. Moderate iron oxidation, patchy and along bedding planes/fractures (sub-horizontal).

CLAYSTONE: Claystone, un-weathered, gray (10YR5/1) to dark grayish brown (10YR4/2). Decreased iron oxidation to trace. Firm and dense, dry.

No recovery.

Interval reamed-out with augers, no core.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 20705
PROJECT NAME: Horseshoe Well Rehabilitation
PROGRAM: Water Programs-WAPR
SCREENED FORMATION: Washburne Dolomite
DRILLING CONTRACTOR: High Plains Boring
BORING METHOD: Hollow Stem Auger
DATE DRILLED: 4/10/05
DATE COMPLETED: 4/10/05
TOTAL DEPTH: 32.0'
COMPLETED DEPTH: 32.0'

ESTIMATED DEPTH TO BEDROCK: 26.9'
RIG GEOLOGIST: E. Wray
LOGGING GEOLOGIST: E. Wray

BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0'
QUANTITY OF FLUIDS LOST DURING DRILLING: N/A

INITIAL WATER LEVEL (FT, DATE): 17.2', 3/17/05
COMPLETED WATER LEVEL (FT, DATE): 15.7', 4/3/05

DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0” I.D. - PVC-WELL

TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground 6.0” I.D. Steel Prot. casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPlicable, DEpENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.95'

*SECONDARY CASING TOP: N/A
BOTTOM: N/A
TYPE: N/A

SURFACE CASING TOP: 2.4' ID (IN): 2.0'

SURFACE SEAL TOP: 1.55’ BOTTOM: 0.1’ TYPE: Concrete

PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.85” bs

WELL PAD DIMENSIONS, TYPE: 3’ x 3’ Concrete from 01/14/05

*ADD’L CASING FILL TOP: N/A
BOTTOM: N/A
TYPE: N/A

*SURFACE ISOLATION CASING TOP: N/A
BOTTOM: N/A

*SURFACE ISOLATION CASING ID (IN): N/A
TYPE: N/A

*OTHER (E.G., ASEPTIC) CASING TOP: N/A
BOTTOM: N/A

*OTHER CASING ID (IN): N/A
TYPE, PURPOSE: N/A

*CENTRALIZER(S) OD (IN): N/A
NUMBER USED: N/A
TYPE: N/A

CENTRALIZER(S) DEPTH(S): N/A

GROUT TOP: N/A
MEASURED DENSITY (LBS/GAL): N/A
TYPE: N/A

GRANULAR BENTONITE TOP: N/A

*GRANULAR BENTONITE BOTTOM: 0.1” TYPE: Medium Bentonite Chips

BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.0’

FILTER PACK TYPE: 1/40 Silica Sand
BRAND: C.S.S.I.

SURFACE CASING BOTTOM (=SCREEN TOP): 6.75’ TYPE: Sch. 80 PVC

SCREEN ID (IN): 2.0” SLOT SIZE (IN): 0.016’ TYPE: Sch. 80 PVC

SCREEN BOTTOM (= SUMP, TOP): 31.75’ SUMP TYPE: Threaded end cap, Sch. 80 PVC

FILTER PACK BOTTOM (=“BACKFILL TOP”: 32.0’ “BACKFILL TYPE: N/A

SUMP BOTTOM (=WELL COMPLETED DEPTH): 32.0’ “PILOT HOLE TOP, DIAMETER: N/A

TOTAL BOREHOLE DEPTH (=“PILOT HOLE AND “BACKFILL BOTTOM): 32.0’

REMARKS: Routine Well Installation. V. poor recovery due to cobbles clogging shoe (62). V. wet conditions. No PID hits but street observed on water surrounding augers at the surface

COMPLETED BY: Mark S. Wray
DATE: 4/10/05

CHECKED BY: J. Raymond
DATE: 5/12/05
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 20765  
**Surface Elevation:**  
**Location:** North:  
**Date:** 4/1/05  
**Geologist:** E. Knap  
**Drilling Equip.:** APH 150, FMI Auger, CME-75.6  
**Area:** Designated at 8711 - Replacement of Well #20765  
**Total Depth:** 32.0'  
**Company:** USERI/USRI/USPI  
**Project No.:** HADS 1300  
**Sample Type:**  

---

**SAMPLE DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.5'</td>
<td>Silty clay, yellowish brown.</td>
</tr>
<tr>
<td>0.5 - 1.0'</td>
<td>Medium to fine-grained sand and gravel.</td>
</tr>
<tr>
<td>1.0 - 1.5'</td>
<td>Medium to fine-grained sand and gravel.</td>
</tr>
<tr>
<td>1.5 - 2.0'</td>
<td>Medium to fine-grained sand and gravel.</td>
</tr>
<tr>
<td>2.0 - 2.5'</td>
<td>Very fine to fine-grained sand and gravel.</td>
</tr>
<tr>
<td>2.5 - 3.0'</td>
<td>Medium to fine-grained sand and gravel.</td>
</tr>
<tr>
<td>3.0 - 5.0'</td>
<td>Medium to fine-grained sand and gravel.</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.  

---

**Approval:**  
**Date:** 4/27/05  

---

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
**Page:** 27 of 28
<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.4 - 11.0° = No recovery</td>
</tr>
<tr>
<td>11.0 - 13.2° = Clay w/pe to silt, yellowish brown, (loose fine), muddy, Debris, Feathers, no air, pale yellow, clay is soft and pliable, grey, moist, wet, moisture to WET.</td>
</tr>
<tr>
<td>12.2 - 12.9° = gravelly clay w/some sand, dk. grey (2.5Y3/1) w/roe olive brown (2.5Y4/1) matrix, distinguished for change, 5 - 7.9% gravel (4% - 1/2&quot;, dia, sub-angular), shattered cobbles @ 12.2 - 12.9°, Med. plasticity, clay is soft and pliable, increments to WET, 12.9 - 14.0° = No recovery.</td>
</tr>
<tr>
<td>14.0 - 15.0° = Gravelly clay w/some sand, V. dk. grey (2.5Y3/1) to V. dk. greyish brown (2.5Y4/1), v. similar to 12.2 - 12.9° interval, Reeds, Sherman, possible, partial sediments, Des. calcilus, throughout, shattered cobbles (1/2 - 1&quot;, dia, avg. 1/2&quot;, size) @ 14.6, clay is soft and pliable, WET, clastic material produces 15°, 15.0 - 16.0° = No recovery</td>
</tr>
<tr>
<td>16.0 - 17.1° = Clay w/some sand and gravel, dk. yellowish brown (10YR 4/4), 5 - 15% sand (avg. sub-rounded), 5 - 7% gravel (1/2 - 1&quot; dia, sub-rounded to sub-angular), clay is soft and pliable. v. poor recovery, interval is completely saturated.</td>
</tr>
<tr>
<td>17.1 - 19.0° = No recovery</td>
</tr>
<tr>
<td>19.0 - 20.1° = Clay w/sand and gravel, dk. Olive brown (2.5Y9/3) to yellowish brown (10YR 4/4), Decreased sand and gravel, 100% clay is soft and pliable, Reeds @ 20.1° SATURATED</td>
</tr>
<tr>
<td>Depth in Feet</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>30.0</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>30.8</td>
</tr>
<tr>
<td>31.0</td>
</tr>
<tr>
<td>32.0</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
GC: Gravel with some sandy clay. Fill. Brown (7.5YR5/4) sandy clay matrix. 80 - 90% gravel and shattered cobbles (1/2" to 1-1/2" diameter, subangular, predominately quartzite and some fine grained sandstone). Unconsolidated. Dry.

GC/CL: Gravel/Sandy Clay mixture - fill material. Strong brown (7.5YR5/6) to brown (7.5YR5/4) matrix. 60 - 65% sandy clay matrix with some to abundant coarse grained angular white fragments. 35 - 40% gravel (1/8" - 3/4" diameter, subangular to subrounded, predominately quartzite with less schist). Low plasticity. Weakly consolidated. Slightly moist.

No recovery.

GC/CL: Gravel/Sandy Clay mixture, same as interval from 0.8' to 2.5'. Shattered quartzite cobbles at top of interval. Slightly moist.

CL: Silty Clay with trace sand and trace gravel, dark brown (7.5YR3/2). Distinct color change. Trace organic material (twigs and roots). Probably original ground surface. Medium to high plasticity. Moisture increases to moist. Interval is crumbly from 3.4' to 4.3'.
CL: Clay/Silty Clay with trace sand and trace gravel. Dark yellowish brown (10YR4/4). Distinct color change. Some portions appear to be re-worked claystone. Trace black organic stringers. Trace white caliche as stringers and blebs. Occasional sandy zones. Interval is firm, dense and cohesive. 1" to 1-1/2" diameter angular quartzite clasts at 8.0', 8.6', and 11.2'. Moist.

CL: Clay with some sand and some gravel. Strong brown (7.5YR5/6). Moderate to strong pervasive iron oxidation of clay. Appears to be re-worked claystone with sandy lenses common from 12.5' to 13.1'. Sandy lenses are poorly graded with coarse grained, subangular to subrounded sand. Disseminated white coarse grained fragments (caliche?) throughout sandy lenses with some caliche blebs. 2" diameter, angular clast of quartzite at 12.9' and 1"
diameter, subrounded clasts of quartzite at 13.0'. Re-worked claystone with sandy lenses appears fluvial in origin. Sharp contact with claystone bedrock at 13.1'. Moist.

CLAYSTONE: TOP OF BEDROCK. Claystone to claystone with silt. Mottled with diffuse carbonaceous content (13.3' - 13.4' and 15.0' - 15.1'). Iron oxides. Predominately grayish brown (2.5Y5/2) to -15.2', then dark gray (2.5Y4/1) to ~16.4', then mottled grays with light yellowish brown (2.5Y6/4), light olive brown (2.5Y5/4), and olive brown (2.5Y4/3). Pocket of sparry calcareous precipitate at 16.0'. Discrete iron-stained streaks and blebs below 17.8'. The claystone with silt is from ~16.0' to 17.8'. Slightly moist.
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 21305  
**Location - North:** 41605  
**Drilling Equip.:** 04016 DTH derric

**Geologist:** E. Nare  
**Surface Elevation:** 21308'  
**Area:** Replacement of well #21588, N. 6th St.

**Total Depth:** 20",  
**Company:** WES/Rez  
**Project No.:** WAP-1302  
**Sample Type:** Continuous Core

---

#### RMRS LOGGING SUPERVISOR APPROVAL

**DATE:** 9/20/05

---

#### SAMPLE DESCRIPTION

**Fill:** 8.0  
**2.5-8.0': No recovery.

---

**3.5'-3.9':**  
6.0-6.5', gravel/sandy clay mixtures - Fill - matrix, strat. strn. brn. (75% x 5%) to brn. (95% x 4%) matrix, 60-65% sandy clay matrix with some gravel.  
Slightly moist, likely consolidated.

---

**6.9'-8.0':** No recovery.  
Clay/silt/clay (2%).

---

**8.0'-10.0':**  
8.0-10.0', clayey/silt clay, silt/loam, some organic material, test sludge.  
Some portions appear to be re-worked claystone.  
1/2" to 3" angular clasts & 8.0', 8.6',  
used 1.2' MOIST

---

### NOTES:

- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101  
**Date effective:** 12/31/98  
**Page 27 of 28**
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 21305
Location: North: East:
Date: 9/1/95
Geologist: J. Wapn, J. Bajer
Drilling Equip.: 616 FT Progress

Surface Elevation: 200'
Area: Replacement of Well 921568, N. 6th St.
Total Depth: 200'
Company: URS/FTG
Sample Type: Continuous Core
Project No.: HDO51300

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 9/20/05

TOPTOP INT. SAMPLE GRANULIC LOG
OF CORE OF CORE DEPTH IN LOG
FRAC. ANGLE READING ANGLE
FEET TO CORE TO CORE INTERVAL FEET TO CORE TO CORE INTERVAL
SAMPLE NUMBER SYMBOL

DEPTH IN FEET

SAMPLE DESCRIPTION

Silty clay 1/20/05

Clayey Fe sand and Fe gravel (separation on page 1).

12.0-13.1 - Clay w some sand and some gravel. Strong brown (7.5y6/4). Moderately well sorted. Strong slaty cleavage. Top is claystone. Sandy lenses common throughout. Many large, angular, clasts of shale @ 12.9 and 11.5. Sub-rounded to rounded clasts of shale @ 12.0. Sandy lenses appear slightly in water. Sharp contact with claystone bedrock @ 13.1. Sharp contact with claystone bedrock @ 13.1.

13.1 - TD.

Claystone to claystone silt - mottled yellowish carbonaceous content (13.3 - 13.4, 15.0-15.1). Fe oxides. Preliminary observations:

13.4 - Yellowish brown tones (2.5y6/2) to 15.2

Then dark gray (2.5y 7/1) to 14.1.

Mottled gray with light yellowish brown, light brown, and olive brown (2.5y 6/4, 5/4, 4/2 respectively).

Pocket of sparry calciteous precipitate @ 14.0.

Discrete Fe-stained streaks in shale @ 13.8.

The claystone silt is @ 16.0 - 17.5.

St. moist

9/20/05

T.D. @ 200'

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.

(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
**MONITORING WELL INSTALLATION REPORT: Form PRO.118**

**LOCATION CODE:** 21305  
**PROJECT NAME:** Olmos Well Replacements  
**PROGRAM:** Water Programs  
**PROJECT NO:** WP  
**PROJECT NAME:** Olmos Well Replacements  
**PROGRAM:** Water Programs  
**WEL D NUMBER:** WP  
**DRILLER:** R.J.  
**DRILLER:** R.J.  
**DRILLING CONTRACTOR:** R.J.  
**DRILLING CONTRACTOR:** R.J.  
**DRILLING METHOD:** Geoprobe  
**DRILLING METHOD:** Geoprobe  
**DATE DRILLED:** 9/14/05  
**DATE DRILLED:** 9/14/05  
**DATE COMPLETED:** 9/14/05  
**DATE COMPLETED:** 9/14/05  
**TOTAL DEPTH:** 20.0'  
**TOTAL DEPTH:** 20.0'  
**COMPLETED DEPTH:** 19.5'  
**COMPLETED DEPTH:** 19.5'  
**ESTIMATED DEPTH TO BEDROCK:** 13.1'  
**ESTIMATED DEPTH TO BEDROCK:** 13.1'  
**RIG:** Geoprobe  
**RIG:** Geoprobe  
**LOGGING GEOLOGIST:** E. W.  
**LOGGING GEOLOGIST:** E. W.  
**Borehole Diameter in Screened Interval:** 3.5"  
**Borehole Diameter in Screened Interval:** 3.5"  
**QUANTITY OF FLUIDS LOST DURING DRILLING:** N/A  
**QUANTITY OF FLUIDS LOST DURING DRILLING:** N/A  
**INITIAL WATER LEVEL (FT, DATE):** Dry on 9/14/05  
**INITIAL WATER LEVEL (FT, DATE):** Dry on 9/14/05  
**COMPLETED WATER LEVEL (FT, DATE):** Dry on 9/14/05  
**COMPLETED WATER LEVEL (FT, DATE):** Dry on 9/14/05  
**DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.):** 1.0" PVC Well  
**DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.):** 1.0" PVC Well  
**TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPSTIC, etc.):** 6.0" Above ground steel protected casing  
**TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPSTIC, etc.):** 6.0" Above ground steel protected casing

---

**ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE**

*Denotes items that may not be applicable, depending on boring method, well protection & purpose*

---

**PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):** 3.64"  
**PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):** 3.64"  
**SECONDARY CASING TOP:** N/A  
**SECONDARY CASING TOP:** N/A  
**BOTTOM:** N/A  
**BOTTOM:** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**SURFACE CASING TOP:** 3.29"  
**SURFACE CASING TOP:** 3.29"  
**ID (IN):** 1.0"  
**ID (IN):** 1.0"  
**SURFACE SEAL TOP:** 0.12"  
**SURFACE SEAL TOP:** 0.12"  
**ID (IN):** 0.36"  
**ID (IN):** 0.36"  
**TYPE:** Concrete  
**TYPE:** Concrete  
**PROTECTIVE CASING BOTTOM, ID (IN), TYPE:** 0.36", Steel  
**PROTECTIVE CASING BOTTOM, ID (IN), TYPE:** 0.36", Steel  
**WELL PAD DIMENSIONS, TYPE:** 3' x 3' concrete  
**WELL PAD DIMENSIONS, TYPE:** 3' x 3' concrete  
**0.1" polyethylene**  
**0.1" polyethylene**  
**ADD'L CASING FILL TOP:** N/A  
**ADD'L CASING FILL TOP:** N/A  
**BOTTOM:** N/A  
**BOTTOM:** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**SURFACE ISOLATION CASING TOP:** N/A  
**SURFACE ISOLATION CASING TOP:** N/A  
**BOTTOM:** N/A  
**BOTTOM:** N/A  
**SURFACE ISOLATION CASING ID (IN):** N/A  
**SURFACE ISOLATION CASING ID (IN):** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**OTHER (E.G., ASEPSTIC) CASING TOP:** N/A  
**OTHER (E.G., ASEPSTIC) CASING TOP:** N/A  
**BOTTOM:** N/A  
**BOTTOM:** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**OTHER CASING ID (IN):** N/A  
**OTHER CASING ID (IN):** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**PURPOSE:** N/A  
**PURPOSE:** N/A  
**CENTRALIZER(S) OD (IN):** N/A  
**CENTRALIZER(S) OD (IN):** N/A  
**NUMBER USED:** N/A  
**NUMBER USED:** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**CENTRALIZER(S) DEPTH(S):** N/A  
**CENTRALIZER(S) DEPTH(S):** N/A  
**GROUT TOP:** N/A  
**GROUT TOP:** N/A  
**MEASURED DENSITY (LBS/GAL):** N/A  
**MEASURED DENSITY (LBS/GAL):** N/A  
**TYPE:** N/A  
**TYPE:** N/A  
**GRANULAR BENTONITE TOP:** 0.36"  
**GRANULAR BENTONITE TOP:** 0.36"  
**TYPE:** Gran. bentonite, slurry hydrated  
**TYPE:** Gran. bentonite, slurry hydrated  
**DISTILLED H2O**  
**DISTILLED H2O**  
**BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP):** 5.0'  
**BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP):** 5.0'  
**FILTER PACK TYPE:** 16/40 Silica Sand  
**FILTER PACK TYPE:** 16/40 Silica Sand  
**BRAND:** C.S.S.F.  
**BRAND:** C.S.S.F.  
**SURFACE CASING BOTTOM (= SCREEN TOP):** 5.62"  
**SURFACE CASING BOTTOM (= SCREEN TOP):** 5.62"  
**TYPE:** Sch. 40 PVC  
**TYPE:** Sch. 40 PVC  
**SCREEN ID (IN):** 1.0"  
**SCREEN ID (IN):** 1.0"  
**SLOT SIZE (IN):** 0.010"  
**SLOT SIZE (IN):** 0.010"  
**TYPE:** Sch. 40 PVC  
**TYPE:** Sch. 40 PVC  
**SCREEN BOTTOM (= SUMP, TOP):** 19.4"  
**SCREEN BOTTOM (= SUMP, TOP):** 19.4"  
**TYPE:** threaded end cap - Sch. 40 PVC  
**TYPE:** threaded end cap - Sch. 40 PVC  
**FILTER PACK BOTTOM (= "BACKFILL TOP": 19.5' "BACKFILL TYPE:" Granular bentonite  
**FILTER PACK BOTTOM (= "BACKFILL TOP": 19.5' "BACKFILL TYPE:" Granular bentonite  
**SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.5' PILOT HOLE TOP, DIAMETER:** 3.5"  
**SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.5' PILOT HOLE TOP, DIAMETER:** 3.5"  
**TOTAL BOREHOLE DEPTH (= PILOT HOLE AND "BACKFILL BOTTOM):** 20.0'  
**TOTAL BOREHOLE DEPTH (= PILOT HOLE AND "BACKFILL BOTTOM):** 20.0'  
**REMARKS:** Replacement of well #21398, Well installed 9/14/05, Protective casing and well pad installed on 9/16/05  
**REMARKS:** Replacement of well #21398, Well installed 9/14/05, Protective casing and well pad installed on 9/16/05  
**COMPLETED BY:** Ellen S. W.  
**COMPLETED BY:** Ellen S. W.  
**Date:** 9/14/05  
**Date:** 9/14/05  
**CHECKED BY:** John Boylan  
**CHECKED BY:** John Boylan  
**Date:** 10/19/05  
**Date:** 10/19/05
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Plezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5974</td>
<td></td>
<td>3</td>
<td>Protective Casing, Steel, 6 in. ID.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5973</td>
<td></td>
<td>2</td>
<td>Casing, Sch 60/ PVC, 1 in. ID.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5972</td>
<td></td>
<td>1</td>
<td>Concrete Seal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5971</td>
<td></td>
<td>0</td>
<td>Concrete Pad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5970</td>
<td></td>
<td>1</td>
<td>Hydrated Granular Bentonite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5969</td>
<td></td>
<td>2</td>
<td></td>
<td>GC/CL: Gravel/Sandy, Silty Clay mixture - fill material. Strong brown (7.5YR5/6 to 7.5YR4/6). 60 - 80% sandy, silty clay matrix (some coarse grained, subangular sand) with low to medium plasticity. 20 - 40% gravel and shattered cobbles (1/4&quot; to 1-1/4&quot; diameter, subrounded to subangular, predominately quartzite). Unconsolidated with 40% gravel from 0.0' to 0.8'. Loosely consolidated from 0.8' to 3.7'. Trace caliche. Trace roots. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5968</td>
<td></td>
<td>3</td>
<td></td>
<td>CL/SM: Clay with some silt, sand, and gravel to clayey silt with sand and gravel. Brown (7.5YR4/3) to dark brown (7.5YR3/2). Distinct color change. ~5% sand (medium grained to coarse grained,</td>
<td></td>
</tr>
</tbody>
</table>
subangular to subrounded), 5-7% gravel (1/8" - 1/4" diameter, subangular to subrounded). Probably original ground surface. Roots common. Cohesive. Slightly moist to moist. No recovery.

CL/SM: Clay with some sand and gravel to clayey silt with sand and gravel. Same as interval from 3.5' to 3.7'. Decrease roots/organics to trace. Weakly consolidated. Moist. 2" diameter cobble of quartzite at 5.4'.

CL: Clay with trace sand and gravel. Dark brown (7.5YR3/2) with brown (7.5YR4/4) motting. Interval is firm and dense. Moist.

CL: Clay with trace sand and gravel. Gray (10YR5/1) with some yellowish brown (10YR5/6) iron oxidation motting. Displaced claystone clast. Trace black organic stringers. Firm and dense. Moist. 1" thick iron oxidized lens (subhorizontal) of coarse grained sand at 6.5'.

No recovery.

CL: Clay with trace sand and gravel. Same as interval from 6.0' to 7.0'. Trace caliche blebs at 8.35'. Moist.

CL: Clay with some gravel and some sand (abrupt coarsening). Brown (10YR5/3) to yellowish brown (10YR5/6). 5 - 7% gravel (1/4" - 1" diameter, subangular to subrounded, quartzite and schist) from 8.35' to 8.8", then decreasing to trace in lower interval. Caliche blebs at 9.3'. Interval is cohesive, soft, and pliable. Moist. 1-1/2" coarse grained sandy lens at base of interval on top of bedrock contact.

CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock). Gray (10YR5/1) with yellowish brown (10YR5/6) motting. Very uniform claystone. Firm, dense, and cohesive. Trace black organic stringers throughout. Trace ironstone fragments (1/8" - 1/4" diameter) from 11.2' to 11.5'. Weak iron oxidation motting from 9.8' to 13.5'. Slight increase in iron oxidation to moderate (pervasive) from 13.5' to 15.0'. Moist. Increased silt below 11.5' to 14.5' in this interval (claystone with trace to some silt).
CLAYSTONE: Claystone, grayish brown (10YR5/2) to gray (10YR5/1) with yellowish brown (10YR5/6) mottling. Moderate pervasive iron oxidation and occasional rip-up clasts from 15.0' to 16.0'. Some to abundant black organic material along subhorizontal bedding planes from 15.9' to 16.0'. Decreased overall iron oxidation from 16.0' to 21.0' with iron oxidation predominately confined to subhorizontal bedding planes. Healed 45 deg fracture at 16.5' with iron oxidation coating. Trace black organic stringers. Overall, interval is moderately friable/crumble. Dense and firm from 20.8' to 21.0' with iron oxidation along undulating bedding planes. Slightly moist. Core is heavily damaged from ~16.0' to ~18.6', and 19.1' to 20.8'.
<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-3.5' gravel/sandy clay mixture (fill material) with 1.75% moisture.</td>
<td>Strata brn. (1.75% brn.) 60-80% sand. Clay matrix (some clay knobs) mud to medium plasticity. 20-40% gravel and small rounded cobbles (1.4-1.8 dia.), predominantly grit. Uncrusted 1/4' gravel ft. 0.0-0.8 loosely consolidated, ft. 0.8 to 3.0', to caliche, to roots, 30% moist.</td>
</tr>
<tr>
<td>3.5-3.8' clay, some sand and gravel, 30% moisture.</td>
<td>Bright, thick, clayey 30% sand and gravel.</td>
</tr>
<tr>
<td>3.8-5.4' clay, some sand and gravel, same as above.</td>
<td>3.5-3.7', Deer, roots to 30% moisture.</td>
</tr>
<tr>
<td>5.4-6.0' clay 75% sand and gravel, 20% moisture.</td>
<td>2&quot; dia. Hole at 6.0 ft. 5.4 ft.</td>
</tr>
<tr>
<td>6.0-7.0' clay 75% sand and gravel, 20% moisture.</td>
<td>50% yellow, brn. 50% clay.</td>
</tr>
<tr>
<td>7.0-8.0' clay 75% sand and gravel, 50% moisture.</td>
<td>Organic strings, firm and dense, moisture.</td>
</tr>
<tr>
<td>8.0-9.38' clay 75% sand and gravel, same as above.</td>
<td>8.0-9.8', to caliche below 8.38', moisture.</td>
</tr>
<tr>
<td>8.35-9.8' clay 10% sand and some gravel (unimportant).</td>
<td>60% yellow. 5-7% gravel (1.4-1.8 dia.), sub-rounded to sub-rounded, white and chalky.</td>
</tr>
<tr>
<td>9.8-9.9' sand and gravel, 40% moisture.</td>
<td>10% weathered lens of clay (shallow water) 10% to 18% moisture.</td>
</tr>
<tr>
<td>9.9-10.0' sand and gravel, 35% moisture.</td>
<td>10% weathered lens of clay at top of bedrock contact.</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 21505
Location - North: East:
Date: 9/15/05
Geologist: E. Warp
Drilling Equip: 4" DS DTH probe

Surface Elevation: Replacement of well 1994, 21.594, N 6° E
Area: Repl 21.0
Total Depth: 215'4" N 6° E St.
Company: URS/1976
Project No.: 10451360
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 9/20/05

SAMPLE DESCRIPTION

9.8-15.0 - Claystone - Bedrock, Gry (10%)/Yel/brown (10%)
Molting in uniform claystone, firm, dense and cohesive. 4" bl. organic
Stringers throughout 

Molting for 9.8-13.5'
Slight incr. Molten for moderate (permeative)
15.0-21.0 - Claystone, Gry/brown (10%) to Gry (10%)/Yel/brown (10%)
Molting. Most part. Molten and occasional
Molting of fossils. Min. 15.0-16.0. Some to
abundant bl. organic material along sub-horizontal
bedding planes. Min. 15.9-16.0. Dense overall
Molten in 16.0-21.0 with Molten predominately
confined to sub-horizontal bedding planes.
Healed 45° fracture to 16.5" well bl. organic
Molten. Te bl. organic Stringers. Overall
interval is moderately avai/perform.
Dense and firm for 10.8-21.0" well bl.
Molten along undulating bedding planes.
31' moist. Heavily damaged
from ~16.0 to 18.6 and 19.1 to
20.8'.

NOTES:
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- Procedure No. RMRS/OPS-PRO.101
- Revision 0
- Date effective: 12/31/98
- Page 27 of 28
## ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 21505  
**Location - North:**  
**East:**  
**Date:** 9/19/95  
**Geologist:** E. W.  
**Drilling Equip.:** WD DTH geoprobe  

**Surface Elevation:**  
**Area:** Replacement of well # 21598, N. 6° S.  
**Total Depth:** 210  
**Company:** HRM/ERG  
**Project No.:** HAM651360  
**Sample Type:** Continuous Core  

### RMRS LOGGING SUPERVISOR

**APPROVAL**  
**DATE:** 9/20/95

### SAMPLE DESCRIPTION

- Claystone (See description on pg. 2)

### NOTES:
- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
Page 27 of 28
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 21505  PROJECT NAME: 21505 Well Replacements  PROGRAM: Water Programs  WATER
SCREENED FORMATION: 01  BAK DRILLING CONTRACTOR: RTG  BORING METHOD: geoprobe
DATE DRILLED: 9/10/05  DATE COMPLETED: 9/10/05  TOTAL DEPTH: 23.5'  COMPLETED DEPTH: 20.5'
ESTIMATED DEPTH TO BEDROCK: 29.8'  RIG: WARP  LOGGING GEOLOGIST: E. WARP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.5'  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 9/15/05  COMPLETED WATER LEVEL (FT, DATE): Dry on 9/19/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1" PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND ASEPtic, ETC.): 6" Steel Protective Casing - above ground

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.10' AUS
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 3.5' AUS ID (IN): 1.0''
SURFACE SEAL TOP: 0.25' AUS  BOTTOM: 0.4''  TYPE: concrete
PROTECTIVE CASING BOTTOM, ID (IN): 0.4"  TYPE: N/A  6" steel
WELL PAD DIMENSIONS, TYPE: 2 x 2'  concrete
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPtic) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 0.4" AUS  TYPE: CEMCO granular bentonite, hydrated to 20% gal of distilled H2O
*BENTONITE SEAL TOP: N/A  TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 5.0'
FILTER PACK TYPE: 1-40 Silica Sand  BRAND: C-3-5-5
SURFACE CASING BOTTOM (= SCREEN TOP): 6.5'  TYPE: Sch. 40 PVC
SCREEN ID (IN): 10''  SLOT SIZE (IN): 0.01''  TYPE: Sch. 40 PVC
SCREEN BOTTOM (= SUMP TOP): 20.4'  SUMP TYPE: threaded end cap-Sch. 40 PVC
FILTER PACK BOTTOM (= BACKFILL TOP): 20.5'  BACKFILL TYPE: granular bentonite
SUMP BOTTOM (= WELL COMPLETED DEPTH): 21.0'  PILOT HOLE TOP, DIAMETER: N/A  5.5''
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 21.0'
REMARKS: Replacement of well 21598. Well installed on 9/15/05. Well pad and protective casing installed on 9/16/05

COMPLETED BY: Ellen S. WARP  DATE: 9/16/05
CHECKED BY:  DATE:
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5969</td>
<td>Casing, Sch Bo-PVC, 1 In. ID.</td>
<td>4</td>
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<tr>
<td>5970</td>
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<td>3</td>
<td></td>
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<tr>
<td>5971</td>
<td>Granular Basalt</td>
<td></td>
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</tr>
<tr>
<td>5972</td>
<td>Concrete Pad</td>
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<td>5973</td>
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<td>5975</td>
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<td>5976</td>
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</tr>
</tbody>
</table>

GC/CL: Gravel/Sandy, Silty Clay mixture - fill material. Brown (7.5YR5/4) to strong brown (7.5YR5/6) sandy clay matrix with 15 - 30% gravel (1/4" to 1" diameter, subrounded to subangular, predominately quartzite). Low plasticity. Loosely consolidated. Slightly moist.

CL: Clay with silt, trace gravel and trace sand. Dark brown (7.5YR3/2). Distinct color change. Probably old ground surface. Trace roots. Medium to high plasticity. Interval is soft, pliable and cohesive. Moist. No recovery.

CL: Clay with silt, trace gravel and trace sand. Same as interval from 2.6' to 3.4'. Moist.
CL: Silty Clay with trace sand and trace gravel. Brown (7.5YR5/4). Distinct color change. Low to medium plasticity. 1-1/2" diameter shattered quartzite cobbles at 5.2' and 5.7'. Interval is cohesive and moist.


CL: Clay with trace sand and trace gravel. Yellowish brown (10YR5/6) to brown (10YR5/4) grading into light olive gray (5Y6/2) from 11.0' to 12.0'. Re-worked claystone. Black organic stringers common throughout. Interval is firm and dense. Sandy, coarse grained lens from 11.6' to 12.0' on top of bedrock contact. Moist to very moist.

CLAYSTONE: TOP OF BEDROCK. Claystone (oxidized bedrock). Yellowish brown (10YR5/8) with some gray (10YR5/1) and some olive gray (5Y5/2) mottling. Strong pervasive iron oxidation. Rip-up clasts (?) or immature ironstone fragments with manganese oxide coating at 13.8' and 14.3'. Rip-ups also indicated by small lenses of silty clay, e.g. at 14.1'. Black organic stringers common. Firm, dense, and cohesive. Weakly friable from 14.7' to 16.0'. Moist from 12.0' to 14.5'. Slightly moist from 14.5' to 16.0'.
CLAYSTONE: Claystone, grayish brown (10YR5/2) to light brownish gray (10YR6/2) with yellowish brown (10YR5/6) mottling. Black organic stringers from 16.9' to 17.0'. Zone of strong pervasive iron oxidation from 18.2' to 18.3' with possible immature ironstone fragments. Silty rip-up clasts at 16.1', 16.6', 17.0', 17.1', etc. Interval is predominately dense and firm except for crumbly zone from 18.8' to 19.3'. Marked decrease in moisture from slightly moist at top to trace moisture at the base of the interval. Soft sediment deformation (ball and pillow) evident at 19.5' to 19.8' beneath subvertical iron oxide filled, rough-surfaced fracture-like feature at ~19.2' to 19.5'.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 21605  PROJECT NAME: CWS5 Well Replacement PROGRAM: Water Programs - WARP
SCREENED FORMATION: 21605  DRILLING CONTRACTOR: RT6  BORING METHOD: Geoprobe
DATE DRILLED: 9/15/05  DATE COMPLETED: 9/16/05  TOTAL DEPTH: 19.8'  COMPLETED DEPTH: 19.2'
ESTIMATED DEPTH TO BEDROCK: 12.0'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.5"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 9/15/05  COMPLETED WATER LEVEL (FT, DATE): Dry on 9/16/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEP, ETC.): 16" Above Ground Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

FLUSH-MOUNT EXAMPLE FOR PROBED WELL

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.36' ags
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 3.21' ags (IN): 1.0"
SURFACE SEAL TOP: 0.76'  BOTTOM: 0.64'  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 0.64 ags, 6" O.D. STEEL
WELL PAD DIMENSIONS, TYPE: 2.86' x 2.6', Concrete (0.15' - 0.25' ags)
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEP) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (lbs/gal): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 5.0'  0.6'  TYPE: CETCO - granular bentonite
*BENTONITE SEAL TOP: N/A  TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 5.0'
FILTER PACK TYPE: 16/40 Silica Sand  BRAND: CECOL  80 BAS
SURFACE CASING BOTTOM (= SCREEN TOP): 6.2'  TYPE: 5th 40 PVC
SCREEN ID (IN): 1.0'  SLOT SIZE (IN): 0.01'  TYPE: 5th 40 PVC
SCREEN BOTTOM (= SUMP, TOP): 19.1'  SUMP TYPE: Threaded end cap: 5th 40 PVC
FILTER PACK BOTTOM (= BACKFILL TOP): 19.2'  BACKFILL TYPE: Granular bentonite: CETCO
SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.8'  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND "BACKFILL BOTTOM"): 19.8' (3.5' T.D.)

REMARKS: Replacement of well #21605, Well installed on 9/15/05, Prot. casing and well pad installed on 9/16/05

COMPLETED BY: Ellen S. Warp  Ellen S. Warp  DATE: 9/15/05
CHECKED BY:  DATE:
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Silt</td>
<td>0.0-0.26' - gravel/sand, mostly sand (Fm. (75% &amp; 90%) to strong sand (95% &amp; 90%). Sandy clay matrix w/15-30% gravel, (9-12% dia, sub-rounded to sub-angular, predominately 1/8), low plasticity, loosely consolidated, SI, moist.</td>
</tr>
<tr>
<td>1.0</td>
<td>Sand</td>
<td>0.9-1.0' - clay w/1% gravel and 1% sand. Dk. brn. (75% &amp; 90%), distinct color change. Probably old ground surface to roots. Medium to high plasticity, Interval is soft, pliable and cohesive. MOIST.</td>
</tr>
<tr>
<td>2.0</td>
<td>Clay</td>
<td>1.1'-3.0' - Clay w/1% gravel and 1% sand. Same as above brn. 0.9-1.3', 3.4' MOIST.</td>
</tr>
<tr>
<td>3.1'</td>
<td>Silt</td>
<td>3.1'-4.5' - silty clay w/3% sand and gravel. Brn. (75% &amp; 90%), distinct color change. Low to medium plasticity, 12% dia, sheltered gravel cobbles 5.2' and 5.7', Interval cohesive and MOIST.</td>
</tr>
<tr>
<td>4.0</td>
<td>Clay</td>
<td>4.5'-5.7' - Silty clay w/1% sand and gravel. Brn. (75% &amp; 90%), distinct color change. Low to medium plasticity, 12% dia, sheltered gravel cobbles 5.2' and 5.7', Interval cohesive and MOIST.</td>
</tr>
<tr>
<td>5.7'</td>
<td>Sand</td>
<td>5.7'-9.0' - Gravel mixture, strong brn. (75% &amp; 90%). 0-15% gravel (4-12% dia, sub-angular 2 dia, sheltered gravel cobbles 0.6, 9%, sandy lenses throughout. Clasts of mudstone, brn. (5% &amp; 90%) claystone. Fm. 7.3-9.2', loosely consolidated. Clay has low plasticity, Te caliche blebs, MOIST.</td>
</tr>
<tr>
<td>9.0</td>
<td>Clay</td>
<td>9.0-12.0' - Clay w/1% sand and 1% gravel. Yellowish brn. (10% &amp; 90%) to brn. (10% &amp; 90%) grading into H. olive grey (5% &amp; 90%) Fm. 11.0-12.0', re-worked claystone. Blk. organic stringers common throughout. Interval is firm and dense. Sandy, SI.</td>
</tr>
</tbody>
</table>

**NOTES:** General. USGS is modified for this log as follows:

(1) Badly broken core; accurate footage measurements not possible.

(2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.** RMRS/OPS-PRO.101

**Revision 0.**

**Date effective:** 12/31/1998

**Page 27 of 28**
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 21605

**Location:** North 9/15/05

**Geologist:** E. Ware

**Drilling Equip:** 160 ft Geoprobe

**Surface Elevation:** Replacement of 21678; N.6"w.

**Area:** Total Depth: 19.8'

**Company:** USGS/ETG

**Project No.:** WA057300

**Sample Type:** Continuous

#### RMRS LOGGING SUPERVISOR

**APPROVAL**

**DATE:** 9/20/05

#### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0 - 12.0</td>
<td>Described on previous page</td>
</tr>
<tr>
<td>12.0 - 14.0</td>
<td>Bedrock contact @ 12.0'</td>
</tr>
<tr>
<td>14.0 - 16.0</td>
<td>Claystone - Oolitic Bedrock, yellowish brown (10YR 5/2) w/ some gray (10YR 6/1) and some olive gray (5Y 6/2) matrix. Strong pervasive FeOx. Rip-up clasts (?) of limestone frags w/ Mn ox coating @ 13.8 and 14.5'. Biologic stringers common. Firm, dense, and cohesive. Well friable fm. 14.7 - 16.0; MOST fm. 12.0 - 14.5; Si. moist fm. 14.5 - 16.0</td>
</tr>
<tr>
<td>16.0 - 19.8</td>
<td>Claystone, Grayish brown (10YR 7/2) to H. brown gray (10YR 4/2) w/yellowish brown (10YR 5/2) matrix. Biologic stringers, fm. 16.9 - 19.6. Bone of strong parc. Interal is dense and firm. w/ Fe in fm. 18.2 - 19.3 with possible irons. Ironstone fragments 16.2 - 17.1', 11.1 etc. Interal is predominately dense and firm except for pruning zone</td>
</tr>
</tbody>
</table>

**NOTES:** General: USGS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101

Revision 0

Date effective: 12/31/98

Page 27 of 28
### Lithologic Description

- **CL**: Clay with some gravel and sand, olive brown (2.5Y4/3), black (2.5Y2.5/1), and gray (2.5Y6/1). Clay is laminated and multi-colored. ~5% gravel (1/2'' to 1-1/2'' diameter, subangular), broken cobbles of quartzite and granite, moist.

- **No recovery.**

- **GC/CL**: Gravelly Clay with some sand, olive brown (2.5Y4/3) to brown (7.5YR4/2) clay. ~20% gravel (1/8'' to 3/4'' diameter, subrounded to subangular), ~10 - 15% sand (coarse grained, subangular). Some disseminated caliche, moist.

- **GC/CL**: Clayey Gravel with some sand, brown (7.5YR4/2), ~65% gravel (1/8'' to 1'' diameter, subrounded to subangular), predominately quartzite. ~25% clay and ~10% coarse grained sand, some asphalt chunks. Unconsolidated, well graded, moist. Spar/carbonate druse at 4.1''.

- **CL**: Silty Clay with trace gravel, olive brown (2.5Y4/3) to dark brown (7.5YR3/2) to brownish yellow (10YR6/6). Color changes throughout this interval - olive brown from 4.1' to 4.4', dark brown from 4.4' to...
4.7', brownish yellow from 4.7' to 5.3', dark brown (7.5YR3/2) from 5.3' to 5.7'. Appears to be re-worked claystone and siltstone. Interval fairly cohesive and firm, moist.

GW: Gravel with some sand, light brownish gray (10YR6/2), predominately shattered cobbles of quartzite and granite (up to 1-1/2" diameter), moist.

No recovery.

GC: Gravel with some sand and clay, brown (7.5YR5/4), ~70% gravel (1/8" to 3/4" diameter, subangular), predominately composed of quartzite, granitic, and trace schist, moist.

No recovery.

GC: Sandy, Clayey Gravel, brown (7.5YR5/4), very moist.

CL: Silty Clay, yellowish brown (10YR5/4), moderate pervasive iron oxidation. White caliche blebs of white stringers throughout. Appears to be re-worked claystone, very moist.

ML: Clayey, Sandy Silt, yellowish brown (10YR5/6). Moderate and pervasive iron oxidation. Appears to be interval of re-worked sandy siltstone, cohesive. Occasional white stringers throughout. Sand is very fine grained, very moist.

No recovery.

GC/ML: Sandy Silt and Sandy Clayey Gravel, yellowish brown (10YR5/6) Sandy Silt and strong brown (7.5YR4/6) Sandy Clayey Gravel. Silt and gravel are vertically divided. Sandy silt has strong, pervasive iron oxidation. Gravel zone is ~40% gravel (1/8" to 3/4" diameter, subangular), ~40% clay, ~20% sand (coarse grained, subangular), very moist to wet (no free water).

SLTSTONE: TOP OF BEDROCK - Sandy, Clayey Siltstone, yellowish brown (10YR5/6). Moderate to strong pervasive iron oxidation. ~50 - 60% silt, ~20 - 30% clay, balance is very fine grained sand (subrounded). Occasional thin clayey laminations and
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Holding</th>
<th>Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5918</td>
<td></td>
<td>Clays, trace black organic laminations. Interval is cohesive but very moist to wet.</td>
<td></td>
</tr>
<tr>
<td>5917</td>
<td>Filter Pack, 19/40 Silica Sand</td>
<td>CLAYSTONE: Claystone, gray (10YR5/1) to grayish brown (10YR5/2). Ironstone nodule/lense at 14.5'. Thiny laminated un-oxidized claystone with some black organic laminae. Trace iron oxide stringers. Decreasing moisture to slightly moist. No recovery.</td>
<td></td>
</tr>
<tr>
<td>5916</td>
<td></td>
<td>CLAYSTONE: Claystone, gray (10YR5/1) to grayish brown (10YR5/2). Thiny laminated un-oxidized claystone as above from 14.3' to 16.5'. Thin lense of yellowish brown (10YR5/6) sandy siltstone from 17.2' to 17.4'. Trace iron oxide along internal bedding planes. 45 deg fracture with caliche fill at 18.4'. Interval dense and firm, except at siltstone lense, very slightly moist. No recovery.</td>
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<td>5915</td>
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<tr>
<td>5914</td>
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<tr>
<td>5913</td>
<td>Threaded End Cap, Sump, Sch 80 PVC</td>
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</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 22005 PROJECT NAME: Flo's Well Replacement PROGRAM: Water Programs - WARP
SCREENED FORMATION: Allardt DRILLING CONTRACTOR: High Plains BORING METHOD: Hollow Stream Auger
DATE DRILLED: 9/16/05 DATE COMPLETED: 9/16/05 TOTAL DEPTH: 20.6' COMPLETED DEPTH: 20.6'
ESTIMATED DEPTH TO BEDROCK: 12.8 RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 20' on 9/16/05 COMPLETED WATER LEVEL (FT, DATE):
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT, ETC.): 2.0" I.D. PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above-ground 6.0" I.D. Steel

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, Depending on BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP FOR FLUSH-MOUNT): 3.0' ags
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: 
SURFACE CASING TOP: 2.5' I.D. IN (IN): 2.0
SURFACE SEAL TOP: 1.2' I.D. BOTTOM: 0.3' TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.8" 6.0" I.D. Steel
WELL PAD DIMENSIONS, TYPE: 3' x 3' Concrete 5m 0.3' ags
*ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: N/A TYPE: N/A
*BENTONITE SEAL TOP: 0.3' bgs. TYPE: Med. Bentonite Chips, Pure Sand Brand
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 9.2'
FILTER PACK TYPE: 1/40 Silica Sand BRAND: C.S.S.

SURFACE CASING BOTTOM (=SCREEN TOP): 4.75' TYPE: Sch 80 PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: Sch 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 19.75' SUMP TYPE: Threaded End Cap = Sch 80 PVC
FILTER PACK BOTTOM (= BACKFILL TOP): 20.0' BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 20.0' PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 20.0'

REMARKS: Roadside well installation

COMPLETED BY: Euan Warp Checked By: J. Boylan DATE: 9/16/05  DATE: 9/27/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 22298
Location - North: 
Date: 4/6/05
Geologist: J. W. E. Drilling Equip.: EME-RT-75
Drilling Equip.: Averill Rig

Surface Elevation: 
Area: 
Total Depth: 220.0'
Company: USES/High Plains Project No. HD51800
Sample Type: N/A

RMRS LOGGING SUPERVISOR
APPROVAL: 
DATE: 4/12/05

SAMPLE DESCRIPTION:

0.0 - 1.2' CLAY, some gravel and sand.
Olive Bn (2.5Y 4/3), Blck (2.5Y 2.5/1) and 6my (2.5 Y 6/7). Clay is laminated and
multi-colored. ~ 5% gravel (1/4' to 1/8' dia),
sub-angle, broken cobbles of granite and quartz,
and 5/

1.2 - 2.4' NO RECOVERY

2.4 - 3.2' gravelly clay, some sand.
Olive Bn (2.5 Y 4/3), Blck (7.5 Y 2/3) clay.
~20% gravel (1/4' to 1/8' dia.), sub-angle, to
sub-
angle ~ 10-15% sand. Silt (6 my, sub-angle).
Some disseminated calcite. MOIST.

3.2 - 4.1' Clayey gravel. Bn (7.5 Y 4/3)
~20% gravel (1/4' to 1/8' dia.) clay
~10% Bn. E. 4 Congo. Some scattered
asphaltic blocks. Lenses of silt and well-rounded,
granite. Carbonate. Dired. 6 my

4.1 - 5.7' Silty clay w/ gravel.
Olive Bn (2.5 Y 4/3), to Blck Bn (7.5 Y 2/3)
6 my Bn, yellow (6 Y 4/6). Color changed
throughout this interval. Olive Bn found
to 4.1' to Blck Bn. Bn 4.1 to 4.7', Brisk Yellow
Bn, 4.7 to 5.3'. Blck Bn (7.5 Y 4/3), 5.3 to 5.7'
Appears to be re-worked claystone and silt.
Evaporite, highly cohesive and firm. MOIST.

5.7 - 6.1' Gravelly silt sand. 6 my
Brick Bn (7.5 Y 4/3), predominantly spherical
pebbles of granite and quartz, firm. 6 my

6.1 - 7.8' NO RECOVERY

7.8 - 10.2' Clayey gravel. 6 my, Yellow Bn (6 Y 4/6), 20% gravel (1/4' to 1/8' dia.),
sub-angle, predominantly clays and fine gravel. E. 4 Congo. MOIST.

9.2 - 9.9' NO RECOVERY

9.9 - 10.2' Sandy clayey gravel. Blck Bn (7.5 Y 2/3)

NOTES:

General: USCS is modified for this log as follows:

Materials amounts are estimated by volume instead of weight.

1. Borehole log procedure No. RMRS/OPS-PRO-101 (1/31/98)

2. Core breaks may be matched, accurate footage measurements not possible.

3. Closely spaced, possibly <3/4" readings.
Sample Description:

10.2-11.2' Sandy Silt - Yellow Bn (10%)
10.2-11.2' Sandy Silt - Yellow Bn (10%)
Sand tight, lenticular, appears to be intergrading
with underlying sandy siltstone. Cohesive. Occasional
yellow stringers throughout. Sand is
very fine. V. MOIST

11.2-12.0' No Recovery

12.8-13.8' Sandy Silt and Sandy Clayey gravel
(Upper Sandy Bnl (10%))
12.8-13.8' Sandy Silt and
Sand Bnl (10%)
Sandy Clayey gravel, Midd. to Coarse
Vertically divided. Occasional sandy silt and
Sandy Bn. Was statistics. Poor. Freefall Gravel Zone = 0% gravel
(1/8" to 1/4" dia, subangular) ~ 40% clay, ~ 20% Sand
(C.e., subangular), V. MOIST to WET (no foot
print). 12.8-13.8' Sandy Silt and Yellow Bn (10%)

13.4-14.3' Sandy Silt and Yellow Bn (10%)

14.3-16.5' Claystone and Siltstone
14.3-16.5' Claystone and Siltstone
Grey (10%) to Grey Bnl (10%)
30% clay, 30% Siltstone
Re-Stone nodules/Lineae @ 14.5'
Travertine lenticular un-cemented Claystone
with organic laminae. S Fe02 Strings
Fine Debris moisture to Silt moisture

16.5-19.8' No Recovery

17.0-19.5' Claystone-Grey (10%)
17.0-19.5' Claystone-Grey (10%)
Grey Bn (10%)
Thin lenticular Siltstone (Grey) in 17.0-17.5'
Yellow Bn (10%) to Fe02 along
intra bedded planes, 95% Fine
5% Clayey

16.5-19.8' No Recovery

NOTES: General: USCS is modified for this log as follows:
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date Effective: 12/31/98
Page 27 of 28
GC/CL: Gravel/Sandy Clay mixture - fill material. Brown (7.5YR5/4) with trace reddish brown (5YR4/4) Rocky Flats Alluvium with occasional clast of grayish brown (10YR5/2) claystone. 50 - 55% gravel and cobbles (1/4" - 2" diameter, subangular to subrounded, predominately quartzite). 45 - 50% sandy clay. Clay matrix has low to medium plasticity with angular, very coarse grained white fragments common. Trace disseminated blebs of caliche. Chunks of asphalt from 1.8' to 2.0'. Loosely consolidated. Slightly moist.

No recovery.

CL: Sandy, Silty Clay with trace gravel (fill material). Brown
(7.5YR4/3). Similar to interval from 0.0' to 2.6' but gravel decreases to ~5%. Trace to some sand (coarse grained, subangular). White, angular, very coarse grained fragments common in clay. Loosely consolidated. Asphalt chunks from 5.5' to 5.8' and smaller clasts disseminated to base of interval. Moist. Occasional shattered

No recovery.

CL: Silty Clay with trace to some sand and trace gravel. Brown (7.5YR5/4). Sand is coarse grained, subangular. ~5% gravel (1/8" - 1/2" diameter, subangular). Occasional 1-1/2" diameter shattered cobbles (predominately quartzite). Trace disseminated blebs of caliche. Loosely consolidated. Increasing moisture throughout interval from very moist at top to wet (but not flowing) at base.

No recovery.

<table>
<thead>
<tr>
<th>Elevation (Ft)</th>
<th>Lithology</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>5991</td>
<td>No recovery</td>
<td></td>
</tr>
<tr>
<td>5990</td>
<td>CL: Silty Clay with gravel and sand.</td>
<td>Brown (7.5YR4/3) grading into very dark gray (7.5YR3/1). Distinct color</td>
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<tr>
<td></td>
<td></td>
<td>change. Very soft, pliable and plastic. Saturated, but not flowing.</td>
</tr>
<tr>
<td>5989</td>
<td>CL: Gravelly Clay with trace sand.</td>
<td>Reddish brown (2.5YR4/4) matrix. Distinct color change. 7 - 10% gravel</td>
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<tr>
<td></td>
<td></td>
<td>(1/4&quot; - 1&quot; diameter, subangular, quartzite, schist, granite). Very soft,</td>
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<td></td>
<td></td>
<td>pliable with high plasticity. Saturated, but not flowing.</td>
</tr>
<tr>
<td>5988</td>
<td>No recovery</td>
<td></td>
</tr>
<tr>
<td>5987</td>
<td>SC/CL: Gravelly, Sandy Clay, strong</td>
<td>brown (7.5YR5/6). Distinct color change. 40 - 45% sand (medium grained to</td>
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<td></td>
<td>coarse grained, subrounded to subangular). ~45% clay, ~10% gravel and</td>
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<td>cobbles (1/2&quot; to 1-1/2&quot; diameter, subrounded). Trace caliche blebs.</td>
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<td>Abundant coarse grain-sized, angular white fragments throughout. Iron</td>
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<td>oxidized matrix. Weakly cohesive. Low plasticity. Saturated, but not</td>
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<tr>
<td></td>
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<td>flowing.</td>
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<tr>
<td>5986</td>
<td>SC/CL: Gravelly, Sandy Clay to Gravelly,</td>
<td>Clayey Sand. Light yellowish brown (10YR6/4) to brown (10YR5/3) with some</td>
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<td>yellowish brown (10YR5/6) mottling. Very similar to interval from 18.2' to</td>
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<td></td>
<td>20.0' with decreased iron oxidation of clay matrix. 10 - 20% gravel from</td>
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<td>20.0' to 21.0' with some blebs of caliche, unconsolidated. Decreasing</td>
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<td>gravel to trace from 21.0' to 21.9'. Lower interval from 21.0' to 21.9' is</td>
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<td>consolidated and appears to be re-worked sandy claystone/siltstone with</td>
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<td></td>
<td></td>
<td>yellowish brown (10YR5/6) and brownish gray (2.5Y6/2) mottling. Decreasing</td>
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<td></td>
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<td>overall moisture to very moist.</td>
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<td>5985</td>
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<td>5984</td>
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<td>5983</td>
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</tbody>
</table>
CL: Clay to Silty Clay (displaced block of claystone, probably slump block). Light brownish gray (2.5Y6/2) and strong brown (7.5YR5/6), mottled. Black organic material (easily smeared when core was split). Cobbles (2" diameter, subangular) of schist at base of interval. Very moist to moist.


SM: Clayey, Silty Sand with some gravel. Strong brown (7.5YR4/6). Sand is fine grained to coarse grained, subangular to subrounded. 5 - 8% gravel and cobbles (1/2" to 1-1/2" diameter, subangular to subrounded, quartzite and schist). Strong pervasive iron oxidation of clay/silt matrix. Loosely consolidated to unconsolidated. Saturated, but not flowing.

CL: Clay with trace silt and gravel. Yellowish brown (10YR5/6) with trace to some gray (10YR6/1) mottling. Displaced claystone. Trace black organic stringers. Weak to moderate iron oxidation mottled throughout. Cohesive and firm. 2" diameter cobble (sandstone) at 28.9'. Slight decrease in moisture to very moist.

CLAYSTONE: TOP OF BEDROCK. Claystone with trace silt (iron-oxidized bedrock). Brownish yellow (10YR6/8) with gray (10YR5/1) mottling. Strong pervasive iron oxidation from 29.0' to 29.5', then mottled from 29.5' to 31.0'. Thin (1/4" thick) siltstone lense (possible ironstone?) with strong pervasive iron oxidation at 30.0'. Rip-up clasts and associated silty lenses common causing crumbly zones, otherwise claystone is firm and dense. Soft-sediment deformation ball and pillow structure common from ~29.7' to 30.8', with laminae sub-vertical, arcuate as a result. Distinct drop in moisture from very moist to slightly moist. Ironstone clasts to 1/2" at 29.1', 29.5', and possibly others.

CLAYSTONE: Claystone, dark gray (10YR4/1) with trace yellowish brown (10YR5/6). Decrease iron oxidation to trace. Friable/crumbly. Caliche stringers and weak pervasive iron oxidation from 31.3' to
<table>
<thead>
<tr>
<th>Elev (Fr)</th>
<th>Well or Plezometer Construction and Materials</th>
<th>Depth (Fr)</th>
<th>Lithology</th>
<th>Unified Soils Classification</th>
<th>or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5973</td>
<td>Threaded End Cap - Sump, 8x PVC</td>
<td>32</td>
<td>Granular Bentonite Backfill</td>
<td>31.4' Moisture decreases to trace.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 33905
Location - North: [Blank] East: [Blank]
Date: 9/27/05
Geologist: E. Wasp
Drilling Equip.: 16' DT Geoprobe

Surface Elevation: [Blank]
Area: [Blank]
Total Depth: 33' 0" (9.8 m)
Company: USF&G, LLC
Project No.: HADS5700
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 9/27/05

SAMPLE DESCRIPTION

6.0-2.6' - Generic/Sandy Clay Matrix - Fill Material. Brn.(75% 14% 9% reddish brn (5% 14% gray brn (10% 9%) claystone, 50-55% gravel and cobbles (4'/2"-dia., sub-angular, to sub-rounded, predominately granite. 15-20% Sandy Clay. Clay matrix has low to medium plasticity with angular, v.g. wlt. fragments present. To dis. cobbles of calcium chunks of asphalt. 1.8'-2.0' loosely consolidated. 5% moist.

2.6'-4.0' = No recovery

4.0-6.8' - Sandy Clay w/ gravel - Fill Material. Brn.(4.5% 1% reddish brn (95%). Similar to above from 0.0'-2.6' but decrease gravel to 5%, to some sand (e.g., subangular). Wlt. angular. v.g. fragments common in clay. Loosely consolidated. Asphalt chunks 5.5'-6.8' and occasional 1'-1 1/2" dia. Shattered cobbles. Smaller fragments to 6.8'

6.8'-8.0' = No recovery

80-161'-CLAY W/ mixed sand and gravel. Brn.(75% 25%) sand is e.g., subangular, 5% gravel (4'/2"-dia., sub-angular). Occasional 1'-1 1/2" dia. Shattered cobbles (predominately granite), To dis. cobbles of calcium. Loosely consolidated. Increasing moisture through overlain. 5% Moist a top to wet (not flowing) base.

NOTES:
General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 33905
Location - North: 
East: 
Date: 9/21/05
Geologist: E. Wierp
Drilling Equip.: HD DT Geoprobe

Surface Elevation: 
Area: Replacement of well # 33904
Total Depth: 23,0
Company: Wesco Inc.
Project No.: 6061200
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 9/27/05

SAMPLE DESCRIPTION

See page 1 for description.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0-12.0</td>
<td>No recovery</td>
</tr>
<tr>
<td>12.0-14.0</td>
<td>Clay w/ R sand and R gravel. Bm (75% fine). V. similar to above fm. 8.0 to 10.1. Loosely consolidated, WET (but not flowing).</td>
</tr>
<tr>
<td>14.0-15.0</td>
<td>No recovery</td>
</tr>
</tbody>
</table>


17.0-18.0 ft: Gravelly clay w/ R sand. Weaker sand (25% fine). Denser layer change. Very soft, pliable and plastic. Saturated (but not flowing).

18.0-20.0 ft: Gravelly sand. Strong Bm (15% fine), Distinct color change, 40-45% sand (avg. to 0% sub-rounded to sub-angular). 35% clay ~10% gravel and cobbles (2% 1/2 dia. sub-rounded).

Throughout red matrix. Very cohesive, low plasticity, Saturated (but not flowing).

NOTES: General: USCS is modified for this log as follows:
- Procedure No. RMRS/OPS-PRO.101
- Date effective: 12/31/98
- Revision 0

Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
## Sample Description

<table>
<thead>
<tr>
<th>Interval</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>Bedrock, brownstone (10%, yellow) with yellow tuff, strong, fine grained, firm, moisture 8% to 10%, then transitions to gray, firm, with occasional thin layers of clay, firm, moisture 2% to 3%</td>
</tr>
<tr>
<td>31</td>
<td>Silty claystone, possible ironstone, firm, strong, gray, moisture 6% to 8%, firm, with occasional thin layers of clay, firm, moisture 2% to 3%</td>
</tr>
<tr>
<td>32</td>
<td>Soft, silty claystone, possible ironstone, firm, strong, gray, moisture 6% to 8%, firm, with occasional thin layers of clay, firm, moisture 2% to 3%</td>
</tr>
<tr>
<td>33</td>
<td>Gray to white, fine grained, firm, moisture 6% to 8%, firm, with occasional thin layers of clay, firm, moisture 2% to 3%</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footing measurements not possible.
- (2) Core breaks cannot be matched, accurate footing measurements not possible.

Procedure No. RMRS/OPS-PRO.101

Revision 0

Date effective: 12/31/98

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MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 33905  PROJECT NAME: CSW Well Replacements  PROGRAM: Water Programs-Warp
SCREENED FORMATION: Q1/Bed  DRILLING CONTRACTOR: Golder  BORING METHOD: geoprobe
DATE DRILLED: 9/6/05  DATE COMPLETED: 9/16/05  TOTAL DEPTH: 33.0'  COMPLETED DEPTH: 32.0'
ESTIMATED DEPTH TO BEDROCK: 29.0'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.50  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry at 9/6/05  COMPLETED WATER LEVEL (FT, DATE): 29.5' at 9/16/05
DIAMETER & TYPE OF INSTALLATION (WELL/PEZOMETER/WELL POINT/ETC.): 1" PVC Well (32.02' OD)
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPHTIC, ETC.): Above ground, steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP/FLUSH-MOUNT): 3.35'
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.75' ID (IN): 1"
SURFACE SEAL TOP: 0.05' ID (IN): 1"
PROTECTIVE CASING BOTTOM, ID (IN): N/A  TYPE: Concrete
WELL PAD DIMENSIONS, TYPE: 28' x 28' concrete  foundation  3.5'
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPHTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 0.65' LS: CETCO-Granular Bentonite
*BENTONITE SEAL TOP: N/A  TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.5'
FILTER PACK TYPE: 1/4/10 Silica Sand  BRAND: C.S.I.  80°
SURFACE CASING BOTTOM (=SCREEN TOP): 5.15' TYPE: SCH 40 PVC  80
SCREEN ID (IN): 1.0" SLOT SIZE (IN): 0.01" TYPE: SCH 40 PVC
SCREEN BOTTOM (= SUMP, TOP): 31.9' SUMP TYPE: Threaded and cap
FILTER PACK BOTTOM (=BACKFILL TOP): 32.0'  BACKFILL TYPE: Granular Bentonite
SUMMIT BOTTOM (=WELL COMPLETED DEPTH): 32.0'  PILOT HOLE TOP, DIAMETER: 3.5"
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 33.0'

REMARKS: Routine well installation on 9/6/05. Protective casing.

COMPLETED BY: Ellen S. Warp  CHECKED BY: J. Bogdan  DATE: 9/22/05  DATE: 9/27/05
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Concrete Pad</td>
<td>0.0</td>
<td>GC/CL: Gravel/Silty, Sandy Clay mixture. Fill. Light yellowish brown (10YR6/4) silty, sandy clay matrix. 65 - 70% gravel and cobbles (1/2&quot; - 3&quot; diameter, subangular to subrounded, quartzite and pegmatitic quartz). 30 - 35% silty, sandy clay (to clayey, silty sand) matrix. Sand is fine grained to coarse grained, subrounded. Unconsolidated. Very slightly moist.</td>
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<tr>
<td>1</td>
<td>Concrete Seal</td>
<td>1.0</td>
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<td>2</td>
<td>Hydrated Bentonite Chips</td>
<td>2.0</td>
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<td>3</td>
<td>Hydrated Bentonite Pellets</td>
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<td>4</td>
<td></td>
<td>4.0</td>
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**Log of Boring Number:** 37105

**Remarks:** Replaces well 37101.
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<th>Elev (ft)</th>
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<th>Lithology or Rock Type</th>
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<tr>
<td>6006</td>
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<tr>
<td>6005</td>
<td>Filter Pack, 16/40 Silica Sand</td>
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<tr>
<td>6004</td>
<td>Screen, Sch 40-PVC, 2 3/4 in. ID, 0.010 in. Wall</td>
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</table>

**LOG OF BORING NUMBER:**

**37105**

**GC/CL: Gravel/Silty, Sandy Clay mixture. Fill (original B371 fill material).** Light olive gray (5Y6/2) to light brown (7.5YR6/3) with some brownish yellow (10YR6/6) silty, sandy clay matrix with occasional clay lenses. Some to abundant (15 - 35%) gravel and cobbles (1/2" - 3" diameter, subangular to subrounded, quartzite and schist). Abundant caliche (disseminated and as blebs) throughout matrix. Low to moderate plasticity. Loosely consolidated. Increased sand toward base of interval. Moist.

**GC/CL: Silty, Sandy Clay/Gravel mixture. Fill.** Light brown (7.5YR6/3) to reddish yellow (7.5YR6/6). 50 - 60% gravel and cobbles (1" - 3" diameter, subangular). Very loosely consolidated. Moist.
CLAYSTONE: TOP OF BEDROCK. Claystone (weathered bedrock). Yellowish brown (10YR5/8) with gray (10YR6/1) to light brownish gray (10YR6/2) mottling. Moderate iron oxidation mottled throughout. Trace to some black organic stringers. Massive texture. Weakly friable. Moist from 16.0' to 17.0'. Slightly moist from 17.0' to 19.0'. Moderate to strong iron oxidation from 17.0' to 19.0'. Occasional silty zones. Bedrock contact estimated within composite sample.

<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5987</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5986</td>
<td>CLAYSTONE: Claystone to claystone with silt (weathered bedrock). Light brownish gray (10YR6/2) with yellowish brown (10YR5/6). Decreased overall iron oxidation from above interval. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5985</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5984</td>
<td>CLAYSTONE: Claystone to claystone with silt (weathered bedrock). Yellowish brown (10YR5/4) to dark yellowish brown (10YR4/6). Moderate to strong pervasive iron oxidation. Moderately friable. Slightly moist to moist.</td>
<td></td>
</tr>
<tr>
<td>5983</td>
<td></td>
<td></td>
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<tr>
<td>5981</td>
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<tr>
<td>5980</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elev (Ft)</td>
<td>Well or Piezometer Construction and Materials</td>
<td>Depth (Ft)</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>5979</td>
<td>End Cap, Conical - Sump, Sch 4D-PVC</td>
<td></td>
</tr>
</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 37105  PROJECT NAME: 0405 WELL REPLACEMENT  PROGRAM: Water Programs-Wrap
SCREENED FORMATION: NA/NA  DRILLING CONTRACTOR: Layne  BORING METHOD: Perc Humer-Red Oil
DATE DRILLED: 12/16/05  DATE COMPLETED: 10/30/05  TOTAL DEPTH: 32.5'  COMPLETED DEPTH: 32.5'
ESTIMATED DEPTH TO BEDROCK: 16.0'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 9'  QUANTITY OF FLUIDS LOST DURING DRILLING: NA
INITIAL WATER LEVEL (FT, DATE): Dry on 12/16/05  COMPLETED WATER LEVEL (FT, DATE): 33.93' (M. TCC)
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/Etc.): 2" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT vs. ABOVE GROUND, ASEPTIC, Etc.): 6" steel protective casing - above ground

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

Casing Diagram:
- **Protective Casing Top (Stickup or Flush-Mount):** 2.99' agsl
- **Secondary Casing Top:** NA, Bottom: NA, Type: NA
- **Surface Casing Top:** 1.58' agsl, ID (in): 2.01
- **Surface Seal Top:** 1.58', Bottom: 0.12', Type: Concrete
- **Protective Casing Bottom, ID (in):** 2.60', Type: 6" steel
- **Well Pad Dimensions, Type:** 3' x 3' - concrete & 0.14' top
- **Addl Casing Fill Top:** NA, Bottom: NA, Type: NA
- **Surface Isolation Casing Top:** NA, Bottom: NA
- **Surface Isolation Casing ID (in):** NA, Type: NA
- **Other (E.g., Aseptic) Casing Top:** NA, Bottom: NA
- **Other Casing ID (in):** NA, Type, Purpose: NA
- **Centralizer(s) OD (in):** NA, Number Used: NA, Type: NA
- **Centralizer(s) Depth (s):** NA
- **GROUT TOP:** NA, Measured Density (lbs/gal): NA, Type: NA
- **Granular Bentonite Top:** 0.1' lbs, Type: Environ-Chip Medium Chips Hydrated 0.1' gal of 28.7 kg/lb
- **Bentonite Seal Top:** 2.0', Type: Bentonite Pellets (CT-70) - hydrated by 94.4% water
- **Bentonite Seal or Granular Bentonite Bottom (= Filter Pack Top):** 5.9'
- **Filter Pack Type:** 1/40 silica sand, Brand: F.S.S.
- **Surface Casing Bottom (= Screen Top):** 7.00', Type: Sch. 40 PVC
- **Screen ID (in):** 2.0' Slot Size (in): 0.01', Type: Sch. 40 PVC
- **Screen Bottom (= Sump Top):** 32.0', Sump Type: Conical Threaded End Cap
- **Filter Pack Bottom (= Backfill Top):** 32.5', Backfill Type: NA
- **Sump Bottom (= Well Completed Depth):** 32.5', Pilot Hole Top, Diameter: NA
- **Total Borehole Depth (= Pilot Hole and Backfill Bottom):** 32.5'

**Remarks:** Routine well installation on 12/16/05. Well pad poured on 12/16/05

**Completed By:** Ellen S. Warp  **Date:** 12/16/05
**Checked By:** John O'Boyle  **Date:** 12/18/05
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 27105  
**Location - North:**  
**Date:** 10/5/05  
**Geologist:** E. Warp  
**Drilling Equip.:** AP1000—Peru Hammar—Rev. C2b  
**Surface Elevation:**  
**Area:** Former B371 Replacement of well 37101  
**Total Depth:** 52.5'  
**Company:** URS/Levy  
**Project No.:** HPG/1260  
**Sample Type:** Composite Sampling & Lithologic Sampling only

**RMRS LOGGING SUPERVISOR APPROVAL**

<table>
<thead>
<tr>
<th>TIME</th>
<th>FEET OF CORE</th>
<th>IN CHAMBER</th>
<th>FEET OF CORE MEASURED</th>
<th>SAMPLE NUMBER</th>
<th>FRACTURE ANGLE</th>
<th>BEDDING ANGLE</th>
<th>GRANULAR DISTRIBUTION</th>
<th>USES SYMBOL</th>
<th>DEPTH IN FEET</th>
<th>SOIL DESCRIPTION</th>
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<tbody>
<tr>
<td>0.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 - 6.0 - gravel/sandy clay mixture. Ht. Yellowish brown (10YR 4/4) sandy clay matrix. 65-70% gravel and cobbles (1/2&quot; to 3&quot; dia., sub-angular to sub-rounded, gneiss and porphyritic gneiss. Silt). 30-35% sandy clay (to clay) sand matrix. Sand is 6 to 9 g, sub-rounded, unconsolidated, very slightly moist.</td>
</tr>
<tr>
<td>6.0</td>
<td>13.0 - gravel/sandy clay mixture. Ht. olive green (5Y 6/2) to H. brown (7.5YR 6/4) some brownish yellow (10YR 5/6) sandy clay matrix. Some to abundant (15-35%) gravel and cobbles (1/2&quot; to 3&quot; dia., sub-angular to sub-rounded, gneiss and schist). Abundant caliche (disseminated and as blebs) throughout matrix. Low to moderate plasticity. Loosely consolidated, increased sand toward base of interval. Moist.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
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<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>10.0-13.0' - Gravel/Sandy Clay Mixture - 15/hr. (see description on page 3)</td>
</tr>
<tr>
<td>12.0</td>
<td>12.0 - 14.0' - Silty Sandy Clay/Gravel mixture. Fill $L_{tr}$ (75% Gr) to reddish yellow (5YR 6/6). 50-60% gravel and cobbles (1-3&quot; dia., Subang.) V. loosely consolidated. MOIST. Bedrock contact estimated due to variation within composite sample. Definite lithologic change.</td>
</tr>
<tr>
<td>17.0</td>
<td>17.0 - 19.0' - Moderate to strong FeOxln.</td>
</tr>
<tr>
<td>19.0</td>
<td>19.0 - 25.5' - Claysone - Weathered Bedrock. (see description on page 3)</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 37105
Location - North: ___________________________ East: ___________________________
Date: 10/18/05
Geologist: E. Warp
Drilling Equip.: AP2400 - Port Hummer - Rev. Cle.

RMRS LOGGING SUPERVISOR
APPROVAL

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Lithologic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
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<tr>
<td>21.0</td>
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<tr>
<td>22.0</td>
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<td>23.0</td>
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<td>24.0</td>
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<td>25.0</td>
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<td>26.0</td>
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<td>28.0</td>
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<tr>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>30.0</td>
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</tbody>
</table>

SAMPLE DESCRIPTION


NOTES: General: USCS is modified for this log as follows:
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- (1) Badly broken core, accurate footage measurements not possible.
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Procedure No. RMRS/OPS-PRO.101
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0-31.0' Claystone, Weathered Bedrock. (See page 3 for description.)</td>
<td>10/18/05</td>
</tr>
<tr>
<td>31.0-32.5' Claystone, Un-weathered Bedrock. Gry (10% Av.) W./ Some Mt. British Gry (10% Av.). Massive Texture, Firm and dense, FE moisture.</td>
<td>10/18/05</td>
</tr>
<tr>
<td>T.D.O 32.5'</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
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<table>
<thead>
<tr>
<th>Elev. (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6010</td>
<td>Protective Casting: Steel, 6 in. Riser</td>
<td>3</td>
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<tr>
<td>6009</td>
<td>Casing: SCH 40 PVC, 2 in. ID.</td>
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<tr>
<td>6008</td>
<td>Concrete Seal</td>
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</tr>
<tr>
<td>6007</td>
<td>Concrete Pad</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6007</td>
<td>Hydrated Bentonite Chips</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6006</td>
<td>Hydrated Bentonite Pellets</td>
<td>2</td>
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<td>6005</td>
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<td>6004</td>
<td></td>
<td>4</td>
<td></td>
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</tr>
</tbody>
</table>

**GC/CL:** Clay/Gravel mixture, fill. Brown (7.5YR4/4) clay with 65-70% gravel and cobbles (1/2" - 3" diameter, subangular to subrounded, predominately quartzite with some schist and trace red sandstone). Loosely consolidated to unconsolidated. Trace moisture to very slightly moist.

**SC/GC:** Clayey Sand/Gravel, fill. Brown (7.5YR5/3) to light brown (7.5YR6/3) with some reddish-yellow (7.5YR6/6) clayey sand matrix.
~70% gravel and cobbles (1/4" - 3" diameter, subangular, quartzite, schist, and trace granite). Disseminated caliche throughout clayey sand. Unconsolidated. Slightly moist.

GC/CL: Gravelly, Silty Clay with some sand. Original B371 fill material. Light yellowish brown (2.5Y6/3) to pale olive (5Y6/3) silty clay matrix. 10 - 20% gravel (1/4" - 3/4" diameter, subrounded to subangular, quartzite and schist). Some to abundant disseminated white fragments (medium grained, angular) and disseminated caliche throughout matrix. Occasional 1" - 3" diameter quartzite cobbles. Increasing sand throughout interval from 7 - 20% (medium grained to coarse grained, subangular). Loosely consolidated. Slightly moist.

GC/CL: Gravelly, Silty Clay with some sand. Brown (7.5YR5/4) with some strong brown (7.5YR5/6) sandy, silty clay matrix. ~50% gravel (3/4" to 1-1/2" diameter, subrounded, quartzite and schist). ~50%
sandy, silty clay matrix. Occasional clast of pale olive (5Y6/3) gravelly clay with abundant caliche. Loosely consolidated to unconsolidated. Slightly moist.

CL: Silty Clay with some sand. Strong brown (7.5YR4/6) with trace light olive gray (5Y6/2) mottling. Distinct color change. Occasional clasts of re-worked/displaced iron oxidized claystone (with black organic stringers). Interval is predominately silty clay clasts with abundant medium grained to coarse grained, white angular fragments. Occasional quartzite cobbles. Single shattered mafic clast (artificial?) at ~18.7'. Moist.

SC/CL: Silty, Sandy Clay with trace gravel. Strong brown (7.5YR5/6) with some light olive gray (5Y6/2) mottling. 40 - 50% silty sand (medium grained to coarse grained, subangular to subrounded). 50 - 60% clay with abundant coarse grained, white fragments throughout. Some disseminated caliche. Cohesive. Iron oxidation mottled throughout matrix from 23.0' to 25.0'. Trace subrounded gravel (1/4" - 1" diameter) from 23.0' to 25.0'. Moist.

CLAYSTONE: TOP OF BEDROCK. Claystone, weathered bedrock, yellowish brown (10YR5/6) with gray (10YR6/1) and grayish brown (10YR5/2) mottling. Black organic stringers common. Firm and dense. Trace white caliche blebs from 29.0' to 31.0'. Silty. Iron oxidized lenses with ironstone fragments from 33.0' to 35.0'. Moist. Bedrock contact estimated within composite sample.
CLAYSTONE: Claystone, weathered bedrock. Same as interval from 27.5' to 35.0', but decreased moisture to slightly moist. Black organic coating fracture (orientation of clast?) at 35.5'. Trace silt (disseminated).

CLAYSTONE: Claystone, weathered bedrock, yellowish brown (10YR5/6 to 10YR5/4). Very similar to interval from 35.0' to 37.0', but more massive texture and decrease black organics to trace. Dense and firm. Decreasing moisture to very slightly moist. Trace disseminated silt.

CLAYSTONE: Claystone, weathered bedrock, yellowish brown (10YR5/6) with dark gray mottling. Undulatory bedding planes clearly visible. Dense and firm. Moisture decreases to trace.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5965</td>
<td>Threaded End Cap - Conical 5/8in PVC</td>
<td>43</td>
<td>CLAYSTONE: Claystone with trace to some silt. Un-weathered to weakly weathered bedrock. Grayish brown (10YR5/2) with trace to some yellowish brown (10YR5/8) mottling. Weakly fissile and friable. Some black organics on undulatory bedding planes. Trace moisture.</td>
<td></td>
</tr>
</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 3940
PROJECT NAME: CWS Well Replacement Program (Water Programs - WAP)
SCREENED FORMATION: Alluvial
CONTRACTOR: Layne
BORING METHOD: Perc. Hammer
REV. DATE: 05/14/00
DATE DRILLED: 05/14/05
DATE COMPLETED: 06/05
TOTAL DEPTH: 43.2'
ESTIMATED DEPTH TO BEDROCK: 21.5'
RIG GEOLOGIST: E. Warp
LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 2.0"
QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 05/14/05
COMPLETED WATER LEVEL (FT, DATE): Dry on 06/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEQIC, ETC.): Aboveground Steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.31'
SECONDARY CASING TOP: N/A
BOTTOM: N/A
TYPE: N/A
SURFACE CASING TOP: 2.68'
ID (IN): 2.0
SURFACE SEAL TOP: 1.44'
BOTTOM: 0.14'
TYPE: Conødex
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.69' 6" Steel
WELL PAD DIMENSIONS, TYPE: 3 x 3
CONC 8, 0.118, 0.1'
ADD'L CASING FILL TOP: N/A
BOTTOM: N/A
TYPE: N/A
SURFACE ISOLATION CASING TOP: N/A
BOTTOM: N/A
SURFACE ISOLATION CASING ID (IN): N/A
TYPE: N/A
OTHER (E.G., ASEPTIC) CASING TOP: N/A
BOTTOM: N/A
OTHER CASING ID (IN): N/A
TYPE, PURPOSE: N/A
CENTRALIZER(S) OD (IN): N/A
NUMBER USED: N/A
CENTRALIZER(S) DEPTH(S): N/A
GROUT TOP: N/A
MEASURED DENSITY (LBS/GAL): N/A
TYPE: N/A
GRANULAR BENTONITE TOP: 0.1'
TYPE: Med Chips CESCO Hydrated 1/2 gallon dist. 1/6
BENTONITE SEAL TOP: 3.9'
TYPE: Pellets CESCO Hydrated 1/2 gallon dist. 1/6
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.9'
FILTER PACK TYPE: 16/40 Silica Sand
BRAND: C.S.S.
SURFACE CASING BOTTOM (= SCREEN TOP): 7.56'
TYPE: SAD. 40 - PVC
SCREEN ID (IN): 2.0'
SLOT SIZE (IN): 0.01'
TYPE: SAD. 40 - PVC
SCREEN BOTTOM (= SUMP, TOP): 42.7'
TYPE: Threaded end cap - Conical
FILTER PACK BOTTOM (= BACKFILL TOP): 43.2'
BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 43.2'
PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 43.2'

REMARKS: Routine well installation on 05/14/05. Well pad installed on 06/05.

COMPLETED BY: John E. Warp
DATE: 06/05
CHECKED BY: John E. Warp
DATE: 06/05
<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0'</td>
<td>0.0-0.6' - Clay / Gravel Mixture - Fill. Brn (75% Grv) and Cbls (1/2-2&quot; dia), sub-rounded, slightly wet.</td>
</tr>
<tr>
<td>4.8'</td>
<td>4.0-9.0' - Clayey Sand / Gravel - Fill. Brn (75% Grv) to H, Hvr (75% Grv) with some reddish yellow (95% Grv) clayey matrix.</td>
</tr>
<tr>
<td>9.0'</td>
<td>9.0-13.0' - Gravelly Clay w/ some sand. Original B-Sand fill material. Lt. Yeller Hvr (25% Grv) to pale olive (50% Grv) clay matrix. 10-20% gravel (4&quot;-8&quot; dia), sub-rounded to sub-angular, gravel and sand. Some to abundant class, and fragments (m, r, e, f) and class pebbles throughout matrix. Occasional 1&quot;-3&quot; dia. Cbls of gray to brown. Increasing sand throughout interval. Brn (75% Grv) Sand. Loosely consolidated, slight moisture.</td>
</tr>
</tbody>
</table>

**NOTES:**
General: USCS is modified for this log as follows:
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 29405

Location: North: ___________ East: ___________

Date: 10/18/05

Geologist: E. Warp


Surface Elevation: ___________

Area Form: ___________

Total Depth: 43.2'

Company: UES/Lejayne  
Project No.: 14205-210

Sample Type: Composite Sampling for Lithology Logging Only

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0-13.0' Gravely Clay w/ Some Sand (described on page 1).</td>
</tr>
<tr>
<td>13.0-16.0' Gravelly Clay w/ Some Sand. Brn.: (35 Written) w/ Some Strong Brn.: (35 Written) Sandstone matrix. ~50% gravel (50% - 1½ dia., sub-rounded, gray, weathered, silty). ~50% sandstone matrix. Occasional elastics of pale olive (5Y6/3) gravelly clay w/ abundant calcite, loosely consolidated to unconsolidated, slightly moist.</td>
</tr>
<tr>
<td>15.0-19.0' Silty Clay w/ Some Sand. Strong Brn.: (35 Written). Distinct color change in H. Olive gray (5Y6/3) matrix. Occasional clasts of reworked/deposited reed claystone (4W4/2, organic strings). Interval is preponderantly silty clay clasts w/ abundant mica, to *W. Light angular fragments. Occasional stony calcite, single. MOIST: shaded area is artificial 1/8'-1/8'.</td>
</tr>
<tr>
<td>19.0-25.0' Silty, Sandy Clay w/ Gravel</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.  

Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
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**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 37405  
**Surface Elevation:**  
**Location - North:**  
**East:**  
**Date:** 10/13/05  
**Geologist:** E. Warf  
**Drilling Equip.:** PER1000: Perc. Hammer Rev. Cir.  
**Total Depth:** 43.2'  
**Company:** URS/Layne  
**Project No:** HR05/380  
**Sample Type:** Composite Sampling for Lithostratigraphy Only

<table>
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<tr>
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<th>USCS SYMBOL</th>
<th>DEPTH IN FEET</th>
<th>GRAIN SIZE DISTRIBUTION</th>
<th>BEDDING ANGLE</th>
<th>FRACTURE ANGLE</th>
<th>FRACTURE MEASUREMENT</th>
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<td></td>
<td>30</td>
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</tr>
</tbody>
</table>

**SAMPLE DESCRIPTION**

19.0-25.0' - Silty, Sandy Clay w/ Gravel.  
Strong brn. (7.5YR 7.5) w/ some H. Olive  
91% (5Y 4/8) mottling. 40-50% Sil. Sand  
(m. to cy, sub-rounded to sub-rounded),  
50-60% Clay w/ abundant e.g. mud fragments  
throughout. Some dis. Caliche.  
Cohesive, Feoxd mottled throughout.  
Matrix fm: 23.0-25.0'  
2 Sub-rounded gravel (1/4" to 1" dia.)  
23.0 to 25.0', MOIST.

25.0-27.5' - Sandy Clay (w/ To gran. gravel.  
Re-worked Claystone w/ e.g. Sandy lenses clay gravel.  
Yellowish brn. (10YR 4/8) w/ Eqy (10YR 4/8)  
Mottling. 7-15% sand (e.g. sub-rounded), Matted to  
Strong Feoxd Clay Matrix. Blks of  
Caliche common. Blk. organic material and  
possible Ilmenite disseminated. Win sandy lenses.  
MOIST.

Bedrock Contact (estimated) @ 27.5'  
DUE TO COMPOSITE SAMPLING

27.5 - 35.0' - Claystone - Weathered Bedrock.  
Yellowish brn. (10YR 4/8) w/ Eqy (10YR 4/8)  
and grayish brn. (10YR 4/8) mottling. Blke. organic  
Stringers common. Firm and dense.  
To wld. caliche blks fm: 23.0-25.0'.  
Silty, Feoxd, lenses w/ ironstone fragments  
fm: 33.0-35.0', MOIST.  

**NOTES:**  
General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
**Page 27 of 28**
### Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 37105  
**Surface Elevation:**  
**Location - North:**  
**East:**  
**Date:** 10/10/05  
**Geologist:** E. War  
**Company:** U.S. Leach  
**Sample Type:** Composite Samples for Lithologic Sampling Only

**RMRS Logging Supervisor**  
**Approval**  
**Date:** 10/10/05

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>SAMPLE NUMBER</th>
<th>OVERALL DRAINAGE DISTRIBUTION</th>
<th>USCS SYMBOL</th>
<th>NTHS SED.</th>
<th>SOIL LOGIC LOG</th>
<th>LIITHOLOGIC LOG</th>
</tr>
</thead>
</table>

**Sample Description**

- **30.0 - 350.0' Claystone-Weathered Bedrock**  
  (described on page 23).

- **35.0 - 37.0' Claystone-Weathered Bedrock**  
  Same as above from 27.5' to 35.0' lack decreased moisture to slightly moist. Blk. organic coating fracture orientation at 45°. (disseminated)

- **37.0 - 39.0' Claystone-Weathered Bedrock**  
  Yellowish brown (10YR 3/4) V. similar to above interval from 35.0 - 37.0' but more massive texture and decrease blk. organics to TF, Dense and Firm.  
  Deer. moisture to V. slightly moist.  
  (disseminated silt)

- **39.0 - 410' Claystone-Weathered Bedrock**  
  Yellowish brown (10YR 2/4) V. dark grey. (disseminated clayey).  
  Nodules. Undulating bedding planes clearly visible. Dense and Firm. Deer. moisture to TF.

### Notes

- **General:** USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.
  
*Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
Page 27 of 28*
# Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 37405
**Surface Elevation:**

**Location - North:**
**Area:** Former 1B311/134 Replacement of Well # 57402

**East:**
**Total Depth:** 43.2'

**Date:** 10/4/05
**Geologist:** E. Warp

**Company:** 2K5/Layne

**Drilling Equip.:** AP 1000, 9" Rod, Auger, Rev. Core

**Sample Type:** Composite Samples for Lithologic Logging Only

## RMRS Logging Supervisor

<table>
<thead>
<tr>
<th>Approval</th>
<th>Date</th>
</tr>
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</table>

## Sample Description

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Lithologic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td>400-410 Claystone - Weathered Bedrock (see description on page #4).</td>
</tr>
<tr>
<td>41.0</td>
<td>410-43.2 Claystone w/ Fissile, Un-weathered Bedrock. Grysh brek (10x30s) w/ 10 to 20% tuff to silt. Some yellowish brek (10x30s) w/10 to 20% tuff to silt. Likely fissile and friable. Some silt. Organics on undulatory bedding planes, T to moisture.</td>
</tr>
<tr>
<td>43.2</td>
<td>T to 43.2'</td>
</tr>
</tbody>
</table>

## Notes

- **General:** USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- Badly broken core, accurate footage measurements not possible.
- Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

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<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6012</td>
<td>Protochotic Casing, 6 in, square</td>
<td>3</td>
<td></td>
<td>CL: Sandy Clay with trace gravel, fill. Brown (7.5YR5/3 to 7.5YR5/4). Clay matrix with some sand (coarse grained, subangular). Trace gravel (1/4&quot; - 1/2&quot; diameter, subangular, predominately quartzite and schist). Some cobbles present in fill at surface, but not reflected in sample. Clay matrix has low to medium plasticity. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>6011</td>
<td>Casing, Sch 40 PVC, 2 in, ID.</td>
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<tr>
<td>6010</td>
<td>Concrete Seal</td>
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<tr>
<td>6009</td>
<td>Concrete Pad</td>
<td>0</td>
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<tr>
<td>6008</td>
<td>Hydrazed Bentonite Chips</td>
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<td>6007</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6006</td>
<td>Hydrazed Bentonite Pellets</td>
<td>4</td>
<td></td>
<td>GC/CL: Clayey Gravel, brown (10YR5/3) clay matrix with 35 - 40% gravel (1&quot; - 2&quot; diameter, subangular, quartzite, schist, and occasional red sandstone). Clay has low to medium plasticity.</td>
<td></td>
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<tr>
<td>6005</td>
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</tbody>
</table>
CL: Clay with trace sand and gravel. Brown (10YR5/3) to grayish brown. Interval is fill material predominately composed of displaced claystone.

GC: Gravel with some sand and clay. Asphalt and road base; asphalt at 8.0' to 9.0' interval. Brown (10YR5/3) clay matrix. 2" - 4" diameter chunks of black asphalt. Gravel is predominately quartzite (1" - 2" diameter, subangular).

GC/CL: Sandy, Clayey Gravel, strong brown (7.5YR5/6). Distinct color change. ~50% sandy clay (low plasticity) with pervasive iron oxidation. ~50% gravel (1" - 2" diameter, subangular, schist, quartzite and trace asphalt).
<table>
<thead>
<tr>
<th>Elevation (Ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5995</td>
<td>GC/CL: Sandy Clay/Gravel mixture, pinkish gray (7.5YR6/2) with strong brown (7.5YR5/6), yellowish brown (10YR5/6), and pale olive (5Y6/3) mottling within clay. Distinct color change. Blebs of caliche common. Appears to be original fill used during construction of B371.</td>
</tr>
<tr>
<td>5994</td>
<td>GC/CL: Sandy Clay/Gravel mixture. Strong brown (7.5YR5/6) sandy clay. ~65% sandy clay with white, coarse grained, subangular fragments common. Trace to some disseminated white caliche blebs. ~35% gravel (1/2&quot; to 1-1/2&quot; diameter, subrounded to subangular, quartzite, schist, and occasional red sandstone clasts).</td>
</tr>
<tr>
<td>5993</td>
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<td>5992</td>
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<td>5988</td>
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<td>5987</td>
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</tbody>
</table>

GC/CL: Sandy Clay/Gravel mixture. Strong brown (7.5YR5/6) sandy clay. Very similar to interval from 17.0' to 21.0'. ~60% gravel (1/4" - 1" diameter, subrounded to subangular, quartzite and schist) from 21.0' to 23.0'. Trace to some gravel from 23.0' to 24.0'. Sandy clay is very sticky and plastic. Very moist (moisture content of fill is questionable since water is periodically injected for dust control).
CL: Refer to description above.


Missed sample.

CLAYSTONE: Claystone, weathered bedrock. Same as interval from 24.0' to 27.0' with trace to some silt. Moisture decreases to slightly moist.

CLAYEY SILTSTONE: Clayey Siltstone, weathered bedrock. Light yellowish brown (10YR6/4) to brownish yellow (10YR6/6). Massive textured. Increasing pervasive iron oxidation throughout interval. Moderate pervasive iron oxidation from 33.0' to 35.0'. Firm and dense. Moisture decreases to trace.
<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5977</td>
<td>32</td>
<td>Silty Claystone, weathered bedrock. Brownish yellow (10YR6/6) with trace grayish brown (10YR5/2) mottling. Massive texture. Weak to moderate pervasive iron oxidation. Firm and dense. Trace moisture.</td>
<td></td>
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<tr>
<td>5976</td>
<td>33</td>
<td>CLAYSTONE: Claystone with trace silt. Light brownish gray (10YR6/2) with gray (10YR5/1) mottling. Black organic stringers throughout. Decreased overall iron oxidation to weak - pervasive. Trace small healed fractures with iron oxide coating. Firm and dense.</td>
<td></td>
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<tr>
<td>5975</td>
<td>34</td>
<td>CLAYSTONE: Claystone to claystone with silt, un-weathered bedrock. Gray (10YR5/1). Decreased iron oxidation to trace. Massive texture.</td>
<td></td>
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<tr>
<td>5974</td>
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<td>5969</td>
<td>40</td>
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MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 37505 PROJECT NAME: MONITORING WELL INSTALLATION
SCREENED FORMATION: A-1bck. DRILLING CONTRACTOR: F. Warp
BORING METHOD: Core Hammer-Rev. Core. DATE DRILLED: 9/15/05 DATE COMPLETED: 10/15/05 TOTAL DEPTH: 40.8 COMPLETED DEPTH: 40.8
ESTIMATED DEPTH TO BEDROCK: 24.0 RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 9.0" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 9/15/05 COMPLETED WATER LEVEL (FT, DATE): Dry on 9/15/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WEEL POINT/ETC.): 2.0" PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Flushing gravel steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.17
SECONDARY CASING TOP: N/A BOTTOM N/A TYPE N/A
SURFACE CASING TOP: 2.07 ID (IN): 2.0
SURFACE SEAL TOP: 0.5" BOTTOM 1.0" TYPE cement

PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.83 1/2 square
WELL PAD DIMENSIONS, TYPE: 3x3 concrete dm 0.1" 4x5
ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
OTHER CASING ID (IN): N/A TYPE: N/A
CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
CENTRALIZER(S) DEPTH(S): N/A
GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A 92.4 gallon of 60
GRANULAR BENTONITE TOP: 1.0' lbs TYPE: Medium chips hydrated-Emerg. Bag'
BENTONITE SEAL TOP: 4.0' lbs TYPE: Pellets (hydrated 1/2 gallon of 60 H20-Ceto
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (FILTER PACK TOP): 9.0' FILTER PACK TYPE: 10/40 Silica Sand BRAND: C.S. S.F.
SURFACE CASING BOTTOM (SCREEN TOP): 10.25 TYPE: Sch. 40 - PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: Sch. 40 - PVC
SCREEN BOTTOM (SUMP, TOP): 40.3 SUMP TYPE: Conical Threaded end cap
FILTER PACK BOTTOM (= BACKFILL TOP): 40.8" BACKFILL TYPE: N/A
SUMP BOTTOM (WELL COMPLETED DEPTH): 40.8 PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND *BACKFILL BOTTOM): 40.8'

REMARKS: Routine well installation

COMPLETED BY: Ellen S. Warp CHECKED BY: John Bowman DATE: 10/18/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 37505
Location - North:
Location - East:  
Date: 10/3/05  
Geologist: E. Wang
Drilling Equip: AP 1000 - Rev. Circulation

Surface Elevation: 
Area: Former B301 - Replacement of Well 37501  
Total Depth: 60.8
Company: USGS/Lane
Project: NPMS1300  
Sample Type: Composite samples for lithologic logging only

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 10/18/05

SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0 - 940 - Sandy clay w/ gravel. Fill. Bn. (10.5 YR 5/3-6/4). Clay matrix w/ gravel (4-5&quot; dia., subang., predominately gravel and sand). Clay matrix has low to medium plasticity, S1, moist. Some cobbles present in fill at surface but not reflected in sample.</td>
</tr>
<tr>
<td>8.0</td>
<td>8.0 - 20 - Some sand and gravel, Asphalt and red brecia, asphalt varies. Bn (10 YR 3/3) clay matrix, 2-4&quot; dia. Chunks of bit. asphalt. Gravel is predominately calcareous and subang.</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight:
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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<table>
<thead>
<tr>
<th>Depth Interval</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>110' - 130'</td>
<td>Sandy, clayey gravel. Strong Bm. (75% Silt), distinct color change, ~50% sandy clay (low plasticity) of sandy, FeO-rich, ~50% gravel (1-2&quot; dia., subangular, sub-rounded, goethite and Fe asphalt).</td>
</tr>
<tr>
<td>130' - 150'</td>
<td>Same as above Bm. 110' - 130'.</td>
</tr>
<tr>
<td>150' - 170'</td>
<td>Sandy clay/gravel mixture. Pinkishgray (7.5YR 4/6) strong Bm (75% Silt), yellowish Bm. (10YR 7/4) and pale olive (5Y 6/4) mottling within clay. Distinct color change. Blebs of calcite common. [Appears to be original fill used during construction of 5371].</td>
</tr>
<tr>
<td>170' - 210'</td>
<td>Sandy clay/gravel mixture. Strong Bm. (75% Silt) sandy clay, ~65% sandy clay +/− quartz, c.q., sub-angular, fragments common, Diss. with calcite blebs Fe-Om. ~35% gravel (1/2 - 1&quot; dia., sub-rounded, goethite, Fe oxide and occasional red sandstone clasts).</td>
</tr>
</tbody>
</table>
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 37503
Location - North: ___________________________ East: ___________________________
Date: 10/3/05
Geologist: E. Neele
Drilling Equip: AP 1000 - Rev. C

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 10/18/05

SAMPLE DESCRIPTION

210-240 - Sandy Clay / Gravel Mixture
- Strong Brn. (7.5 YR 2.5/1) Sandy clay
- V. similar to above Brn. 170-210, ~260% gravel (4-19" dia, sub-rounded V. subangular, cohesive and soft) Brn. 210-250
- Be same grade 1 Brn. 230-240, sandy clay is V. sticky and plastic. V. Moist
[Moisture content of fill is questionable since H20 is periodically added for dust control]

Bedrock contact estimated @ 210'

240-270 - Claystone - Weathered Bedrock
- Yellowish Brn. (10YR 5/6), Loess
- 65% gravel, 35% clays

Claystone is firm and dense, Moist.

270-290 - Missed Sample

290-310 - Claystone, Weathered Bedrock
- Same as above Brn. 240-270 except
- Some silt, Deen, moisture to slightly moist.

210-240 - Sandy Clay / Gravel Mixture
- Strong Brn. (7.5 YR 2.5/1) Sandy clay
- V. similar to above Brn. 170-210, ~260% gravel (4-19" dia, sub-rounded V. subangular, cohesive and soft) Brn. 210-250
- Be same grade 1 Brn. 230-240, sandy clay is V. sticky and plastic. V. Moist
[Moisture content of fill is questionable since H20 is periodically added for dust control]

Bedrock contact estimated @ 210'

240-270 - Claystone - Weathered Bedrock
- Yellowish Brn. (10YR 5/6), Loess
- 65% gravel, 35% clays

Claystone is firm and dense, Moist.

270-290 - Missed Sample

290-310 - Claystone, Weathered Bedrock
- Same as above Brn. 240-270 except
- Some silt, Deen, moisture to slightly moist.

NOTES: General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
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# Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 37501  
**Surface Elevation:**  
**Area:** Former B-371 Replacement of Well 37501  
**Total Depth:** 40.8  
**Company:** URS/Loew  
**Project No:** 14021/020  
**Sample Type:** Composite Samples for Lithologic Logging Only

## RMRS Logging Supervisor Approval
- **Date:** 10/12/05

## Sample Description

<table>
<thead>
<tr>
<th>Layer</th>
<th>Sample Description</th>
</tr>
</thead>
</table>
| 30.0 - 31.0 | Claystone - Weathered Bedrock (cont.)  
(described on previous page) |
| 37.0 - 39.0 | Claystone 1/2 to 3/4 silt.  
Lt. brnish gray (10YR 6/4) 1/2 silt. (10YR 6/4) 
Dee. overall Fedn. to wk. pervasive.  
Fe small healed fractures w/ freq. coatings.  
Firm and dense. |

## Notes:
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 37505
Location - North:  
East:  
Date: 10/9/05
Geologist: E. Wark
Drilling Equip.: AP1000 - Rev. Pipe

Surface Elevation:  
Area:  
Total Depth: 40.8
Company: UES/Layne  
Project No: HAD51300  
Sample Type: Composite samples for lithologic logging

RMRS LOGGING SUPERVISOR
APPROVAL  
DATE 10/9/05

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
<th>T. D. Q. 40.8'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claystone (cont.) - described on previous page.</td>
<td></td>
</tr>
</tbody>
</table>

---

NOTES:  
General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.
Location moved to SW to target former foundation drain corridors.

GC/CL: Gravel/Clay/Sand - fill. Dark yellowish brown (10YR4/4) to brown (10YR4/3). ~70% gravel and cobbles (1/2" - 4" diameter, subrounded to subangular, predominately quartzite and schist). Clay has low to medium plasticity. Unconsolidated. Trace moisture. Sand is very fine grained to coarse grained, subangular, quartz - feldspar.

GC/CL: Gravel/Clay/Sand - fill. Brown (10YR4/3) to dark grayish brown (10YR4/2). Very similar to interval from 0.0' to 4.0', but decrease cobbles and gravel size. ~70% gravel (1/4" - 1" diameter, subangular, quartzite, schist, and pink granite). ~30% clay/sand.
Very slightly moist.

CL: Clay with trace to some sand and gravel. Yellowish brown (10YR5/6 to 10YR5/4). Predominately displaced iron oxidized claystone used as fill material. Trace to some gravel (5 - 7%) 3/4" to 1-1/2" diameter, subrounded, predominately quartzite. Dark gray (10YR4/1) rip-up clasts (1/4" diameter, subangular) of unweathered claystone present within iron oxidized clay throughout interval. Trace black organics in clay. Slightly moist from 6.0' to 8.0', increasing moisture to moist from 8.0' to 13.0'.

GC/CL: Clay with some to abundant gravel. Yellowish brown (10YR5/6) with trace dark gray (10YR4/1). Displaced iron oxidized claystone. Very similar to interval from 6.0' to 13.0', but increased gravel and cobbles. 15 - 25% gravel and cobbles (3/4" - 2" diameter, subrounded, predominately quartzite). Occasional zones of dark
gray rip-up clasts (1/4" diameter, subangular, clay) in displaced claystone. Moist. Trace to some sand present in gravelly pockets/lenses.

CL: Clay with sand and trace gravel. Yellowish brown (10YR5/6) with gray (10YR5/1) mottling. Displaced claystone. Very similar to interval from 13.0' to 17.0', but decrease gravel to trace, otherwise unchanged. Moist from 17.0' to 21.0'; very moist from 21.0' to 23.5'.
CL: Clay with trace to some gravel and trace sand. Yellowish brown (10YR5/6) clay. Same as interval from 17.0' to 23.5' mixed with dark gray (10YR4/1) clay with trace to some gravel (1/4" - 1" diameter, subrounded). Dark gray clay has medium plasticity. Trace disseminated caliche. Moist.

GC/CL: Gravel/Clay mixture. Very dark gray (10YR3/1) clay matrix (plastic) with some very coarse grained, angular pink and white fragments. Occasional twigs and roots. (Color resembles asphalted soil.) 70 - 75% of interval is quartzite cobbles (2" - 4" diameter, subrounded). Possibly original ground surface, dirt road base, or fill for foundation drain corridors. Moist.

CL: Silty Clay with trace gravel. Re-worked/displaced iron oxidized claystone. Dark grayish brown (10YR4/2) with dark yellowish brown (10YR4/6) and some light olive brown (2.5Y5/3) mottling. Thinly laminated silty claystone (re-worked) with trace gravel and trace ironstone fragments (1/4" diameter) with black manganese oxide coating. Abundant black organic material on laminated bedding planes. Blebs and stringers of caliche common. Moist.

SILTSTONE: TOP OF BEDROCK. Siltstone (weathered bedrock). Dark yellowish brown (10YR4/6). Strong pervasive iron oxidation. Trace ironstone fragments up to 1" diameter with manganese oxide.
coating. Strongly friable. Moist. Includes unoxidized gray siltstone rip-up clasts. Bedrock contact estimated within composite sample.

SILTSTONE: Siltstone with some clay (weathered bedrock). Brownish yellow (10YR6/6) with trace gray (10YR6/1) mottling. Massive texture at top of interval, grading into laminated texture with increasing interbedded claystone at base of interval. Weakly friable. Moisture decreases to slightly moist. Includes unoxidized gray siltstone rip-up clasts. Increasing clay content below ~36.0'.


CLAYSTONE: Claystone to silty claystone, unweathered bedrock. Dark gray (10YR4/1) to dark grayish brown (10YR4/2). Trace black organic material. Weakly friable and fissile. Trace moisture.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 37705  PROJECT NAME: Cyco Well Replacements  PROGRAM: Water Programs - WARP
SCREENED FORMATION: Alluvial  DRILLING CONTRACTOR: LeVan  BORING METHOD: Core, Hammer, Rev. Cine
DATE DRILLED: 10/15/05  DATE COMPLETED: 10/15/05  TOTAL DEPTH: 41.1'  COMPLETED DEPTH: 41.1'
ESTIMATED DEPTH TO BEDROCK: 41.1'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0'  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 10/15/05  COMPLETED WATER LEVEL (FT, DATE): Dry on 10/15/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0' PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.07’ AGS
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.67’ ID (IN): 2.0’
SURFACE SEAL TOP: 0.4’ ID (IN): 0.25’ TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 1.93’ 6”  TYPE: Steel
*WELL PAD DIMENSIONS, TYPE: 3’x3’, Concrete Bm, 0.25’ 6” 4’ AGS
*ADJL CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE: N/A  PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 0.2’ TYPE: 1% Med. chips (Enviroplug) - Hydrated w/ 2 gal. of water.
*BENTONITE SEAL TOP: 5.5’ 6” TYPE: Pellets (Certo) - Hydrated w/ 2 gal. of water.
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 9.0’
FILTER PACK TYPE: 4/10 Silica Sand  BRAND: C.S.S.
SURFACE CASING BOTTOM (= SCREEN TOP): 10.58’ TYPE: Sch. 90 - PVC
SCREEN ID (IN): 2.0’  SLOT SIZE (IN): 0.01’ TYPE: Sch. 90 - PVC
SCREEN BOTTOM (= SUMP, TOP): 40.6’ SUMP TYPE: Threaded and cap-conical
FILTER PACK BOTTOM (= BACKFILL TOP): 41.1’  TYPE: NA
SUMP BOTTOM (= WELL COMPLETED DEPTH): 41.1’  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 41.1’

REMARKS: Routine well installation on 10/15/05. Well pad installed on 10/14/05. Offset from original (37710) to be adjacent to foundation drainaries.
COMPLETED BY: Eleana Warp  Eleana Warp  DATE: 10/15/05
CHECKED BY: John Boyan  DATE: 10/15/05
<table>
<thead>
<tr>
<th>DEPT.</th>
<th>FOOTAGE</th>
<th>SAMPLE NUMBER</th>
<th>FAULT</th>
<th>FRAC.</th>
<th>MOLD</th>
<th>ACREAGE</th>
<th>SHADE</th>
<th>USCS</th>
<th>SAMPLE DESCRIPTION</th>
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<td></td>
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<td>0.0-40' - 62N.W/CLM. FILL.</td>
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<tr>
<td>2.0</td>
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<td></td>
<td>4.0-60' - GRAVER/CLAY</td>
</tr>
<tr>
<td>3.0</td>
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<td>6.0-130' - CLAY</td>
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NOTES: General: USCS is modified for this log as follows:
(1) Badly broken core, accurate footage measurements not possible. (2) Core breaks cannot be matched, accurate footage measurements not possible.
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<tr>
<th>FEET</th>
<th>CONFINED DENSITY</th>
<th>PERIODIC PENETRATION</th>
<th>CAUSE OF STOP</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>12</td>
<td>13.0 - 17.0</td>
<td>Clay with abundant gravel.</td>
<td>Displaced, Feared claystone. Similar to above interval 6.0 - 13.0 but increased gravel and cobbles. 15 - 25% gravel and cobbles (1&quot; - 2&quot; dia., sub-rounded, predominately quartz). Occasional zones of dk. grey, rip-up clasts in displaced claystone. Also 2-5% sand present in gravelly pockets/lenses.</td>
<td>MOIST. Also f. some sand present in gravelly pockets/lenses.</td>
</tr>
<tr>
<td>13</td>
<td>17.0 - 25.5</td>
<td>Clay with gravel.</td>
<td>Displaced, Feared claystone. Similar to above 13.0 - 25.5 but decreased gravel to 5%, otherwise unchanged.</td>
<td>MOIST.</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No. RMRS/OPS-PRO.101**

Revision 0

Date effective: 12/31/98

Page 27 of 28
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 37705

**Location - North:** __________

**Date:** 10/5/05

**Geologist:** G. Warp

**Drilling Equip.:** A6100, Nac, Hummer, Rev Coin

---

**Surface Elevation:** __________

**Area:** Former B317/574 - Replacement of well #37701

**Total Depth:** 41.1'

**Company:** USFL/USFL

**Project No.:** HADS1920

**Sample Type:** Composite Sampling for Lithologic Logging Only

---

**Sample Description**

<table>
<thead>
<tr>
<th>Depth (in Feet)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0 - 20.5</td>
<td>Clay w/ gravel (described on page 2)</td>
</tr>
</tbody>
</table>
| 22.5 - 25.0 | Clay w/ E. St. gravel and Te. sand, yellowish brown (10YR 5/6) clay matrix
| 26.0 - 26.5 | Soil matrix (plastic) w/ some v.c.g., angular, pink and white fragments, occasional twigs and roots. Color resembles exposed soil |
| 29.0 - 31.5 | Silty clay w/ gravel. Reworked displaced claystone. DK grayish brown (10YR 6/2) pebbly yellowish brown (10YR 6/4) and some H. olive brown (2.5Y 5/2) mollusks, thinly laminated silty claystone (reworked) w/ E. gravel and T. limestone fragments (14% vol.) w/ bl. mud. Laminations, boulders, organic material, and sand are common. Moist |

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**NOTES:** General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/08

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**Page 27 of 28**
<table>
<thead>
<tr>
<th>Borehole Number: 37705</th>
<th>Surface Elevation:</th>
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<tbody>
<tr>
<td>Location: North:</td>
<td>Area: Former 5371/544, Replacement of well 57701</td>
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<tr>
<td>East:</td>
<td>Total Depth: 91.1</td>
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<tr>
<td>Date: 10/30/05</td>
<td>Geologist: B. W.arp</td>
</tr>
<tr>
<td>Drilling Equip.: Hh500 Rev, 300, Hammer, Rev, 300</td>
<td>Company: USLE/Layne</td>
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<tr>
<td>Sample Type: Composite Sampling for Lithoarcheologic Logging Only</td>
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**RMRS LOGGING SUPERVISOR**

**APPROVAL**

**DATE** 10/18/05

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<th>TOPSOIL OF CORE</th>
<th>DIRT</th>
<th>FAQ</th>
<th>BORE</th>
<th>GRANN</th>
<th>SIZE</th>
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<td></td>
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<td>CL</td>
<td></td>
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</tbody>
</table>

**SAMPLE DESCRIPTION**

- **340**: 28.0 - 31.5' Silty clay to gravel (littl)
  
  (See description on page 25)

  - Bedrock contact estimated within
  - Composite Sample interval
  - Bedrock Contact @31.5'

- **33.5 - 33.0**: Silty sand, weathered bedrock, dk. yellowish brown (10YR 4/8). Strongly persistent. Contains strong fragments of light brown, white, and grey, showing strongly to distinctly calcareous. Moist, includes unhardened, loose, gray, siltstone rip-up clasts.

- **32**: 30.0 - 37.0' Silty clay, some clay, weathered bedrock, brownish yellow (10YR 6/8). Grey (10YR 5/6) matting. Massive texture at top of interval grading into laminated texture with increasing interbedded claystone at base of interval. Very friable, brownish grey in color, slightly moist, includes unweathered grey, siltstone rip-up clasts, increasing clay content below ~ 36'.

- **31**: 37.0 - 45.0'


- **29**: 46.0 - 42.1'

**NOTES**: General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- Procedure No. RMRS/OPS-PRO.101
- Revision 0
- Date effective: 12/31/98

(10119103630394 from GTIA 2095/01/01)
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<th>Lithology</th>
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<tr>
<td>Sample 2</td>
<td>96.0</td>
<td>Claystone</td>
<td>Unmineralized Bedrock (described on page #4)</td>
</tr>
<tr>
<td>Sample 1</td>
<td>41.1</td>
<td>Clay</td>
<td></td>
</tr>
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</table>

Sample Description:

- Claystone: Unmineralized Bedrock (described on page #4)

NOTES: General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101

Revision 0

Date effective: 12/31/98

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CL/SM: Gravelly Clay with some sand to gravelly, sandy silt with clay. Brown (7.5YR5/3). 10 - 20% gravel (1/4" - 3/4" diameter, subrounded to subangular, predominately quartzite). ~5% sand (coarse grained, subangular), trace disseminated caliche. 1" - 2" diameter quartzite cobbles at 0.0' and 0.8'. Clay is stiff (crumbly due to removal from sample tube). Trace moisture.

GC/CL: Clay with trace sand/gravel mixture, brown (7.5YR3/2) clay. 15 - 25% gravel (1/4" - 3/4" diameter, subrounded to subangular, predominately granitic composition with lesser quartzite and trace sandstone). Trace roots, trace disseminated caliche, very slightly moist.

GC: Clayey Gravel with trace sand, dark brown (7.5YR3/3) clay. ~80% gravel (1/4" to 1-1/2" diameter, subangular, quartzite). ~20% clay with trace sand. Unconsolidated. Very slightly moist.

**CLAYEY SILTSTONE: TOP OF BEDROCK.** Clayey Siltstone, gray (10YR6/1) with abundant yellowish brown (10YR5/6) iron oxidation mottling. Abundant caliche with massive caliche from 4.7' to 4.8'. Trace manganese oxide associated with iron oxidation along internal fractures. Very moist, friable. Some zones more clayey, to silty.

**CLAYSTONE:** Claystone (oxidized bedrock), gray (2.5Y5/1) with dark yellowish brown (10YR4/6) iron oxidation mottling. Abundant caliche from 6.0' to 7.0' along near-vertical fractures and coating fractures (~30 deg) at 6.9'. Black organic stringers common. Claystone is dense and firm, except in areas of abundant caliche. Very moist at top of interval, decreasing to moist at base. Increasing silt below 8.0'.

**SILTY CLAYSTONE:** Claystone with silt, yellowish brown (10YR5/6) with some gray (10YR6/1) mottling. Iron oxidized claystone, decreasing overall caliche. Caliche occurs along fractures (~20 deg) at 9.0', 10.0', and 14.2'. Fracture at 10.7' to 11.2', vertical, caliche-filled. Trace to some black organic stringers throughout. Ironstone fragments at 12.0'. Dense and firm. Decreasing moisture to slightly moist.
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<th>Depth (Ft)</th>
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<th>Lithologic Description</th>
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<td>SILTY CLAYSTONE</td>
<td>Claystone with silt, brown (10YR5/3) to</td>
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<td></td>
<td></td>
<td>yellowish brown (10YR5/6). Oxidized claystone,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>trace black organic stringers. Ironstone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fragments with manganese oxide coating at</td>
</tr>
<tr>
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<td></td>
<td>15.8' and 16.0'. Interval slightly crumbly,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>very slightly moist.</td>
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<td>5990-16</td>
<td>CLAYSTONE</td>
<td>Claystone, gray (10YR6/1) with some yellowish</td>
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<td>brown (10YR5/4) motting. Trace black organic</td>
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<td></td>
<td></td>
<td>stringers. Massive textured. Weak to</td>
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<td></td>
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<td>moderately pervasive iron oxidation from 19.0'</td>
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<td></td>
<td>to 19.3' and 19.6' to 20.0'. Competent and</td>
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<td>firm. Very slightly moist. Occasional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>silty pockets, as at 17.8'.</td>
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</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 39065-005 PROJECT NAME: 0405 WELL Replacement/PROGRAM Water Programs Wrap
SCREENED FORMATION: RPT Geologic Drilling CONTRACTOR: RT6 Logs BORING METHOD: geoprobe
DATE DRILLED: 5/24/05 DATE COMPLETED: 7/25/05 TOTAL DEPTH: 212' COMPLETED DEPTH: 195'
ESTIMATED DEPTH TO BEDROCK: 4.5' RIG GEOLeOGIST: E. W. Amp LOGGING GEOLeOGIST: E. W. Amp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 4' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Day on 5/24/05 COMPLETED WATER LEVEL (FT, DATE): 10.09 (ftm.wtc) 4/19/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEzOMETER/WELL POINT/etc.): 1.0" PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground steel protective casing block

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 8.85' OGS
- SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
- SURFACE CASING TOP: 3.4' OGS ID (IN): 1.0''
- SURFACE SEAL TOP: 0.5' OGS BOTTOM: 0.5' OGS TYPE: Concrete
- PROTECTIVE CASING BOTTOM, ID (IN): 0.5' 6'' Steel
- *WELL PAD DIMENSIONS, TYPE: 2.5 x 2.5, Concrete
- *ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
- *SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
- *SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
- *OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
- *OTHER CASING ID (IN): N/A TYPE: PURPOSE: N/A
- *CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
- *CENTRALIZER(S) DEPTH(S): N/A
- *GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
- *GRANULAR BENTONITE TOP: N/A TYPE: N/A
- *BENTONITE SEAL TOP: 0.5' TYPE: Granular Bentonite - Ceto 20 crumbles #8

BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0''

FILTER PACK TYPE: 1/40 Silica Sand BRAND: ESSO
SURFACE CASING BOTTOM (=SCREEN TOP): 0.55'' TYPE: Sch 80 PVC
SCREEN ID (IN): 0.014'' SLOT SIZE (IN): 0.016'' TYPE: Sch 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 19.4' SUMP TYPE: Threaded end cap (PVC)
FILTER PACK BOTTOM (= BACKFILL TOP): 19.5' BACKFILL TYPE: Granular Bentonite
SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.5' PILOT HOLE TOP, DIAMETER: 4''

TOTAL BOREHOLE DEPTH (= PILOT HOLE AND "BACKFILL BOTTOM"): 21.2'

REMARKS: Installed Second Attempt. First Attempt Intercepted Abandoned Borehole Wells 39691, Offset ~1.5' NW of #39691 For Ultimate Location Completed By: Ellen S. Wamp DATE: 5/26/05
CHECKED BY: DATE: 6/29/05
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** E105241-039605  
**Surface Elevation:**  
**Location - North:**  
**East:**  
**Date:** 5/29/05  
**Geologist:** E. Waer  
**Drilling Equip.:** GE DT Geoprobe  
**Company:**  
**Project No.:**  
**Sample Type:**  

---

**RMRS LOGGING SUPERVISOR**  
**APPROVAL**  
**DATE:** 6/19/05

---

**SAMPLE DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
</table>
| 0.0        | 0.0-2.0 - Claystone, Gry (10YR4/4) w/some yellow bro. (10YR7/4) matting.  
            |             |
| 2.0        |             |
| 4.0        |             |
| 6.0        | 4.0-6.0 - Claystone, Gry (10YR4/4) w/some yellow bro. (10YR7/4) matting.  
            |             |
| 6.0        |             |
| 8.0        |             |
| 10.0       |             |
| 12.0       |             |
| 14.0       |             |
| 16.0       | 16.0-21.2 - Claystone, Gry (10YR4/4) w/some yellow bro. (10YR7/4) matting.  
            |             |
| 21.2       |             |

---

**NOTES:**  
- General: USCS is modified for this log as follows:  
- Materials amounts are estimated by % volume instead of % weight.  
- (1) Badly broken core, accurate footage measurements not possible.  
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Interval</th>
<th>Top Depth</th>
<th>Bottom Depth</th>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>20.0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21.2</td>
<td>21.2</td>
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<td></td>
</tr>
</tbody>
</table>

**NOTES:**
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101
**Revision:** 0
**Date effective:** 12/31/98

**Page:** 27 of 28
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6039</td>
<td>Protective Casing, 6&quot; Steel</td>
<td>3</td>
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<tr>
<td>6038</td>
<td>Casing, Sch 40-PVC, 2 in. I.D.</td>
<td>2</td>
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<tr>
<td>6037</td>
<td>Concrete Seal</td>
<td>1</td>
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</tr>
<tr>
<td>6036</td>
<td>Concrete Pad</td>
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<td></td>
</tr>
<tr>
<td>6035</td>
<td></td>
<td>1</td>
<td>GC/CL: Gravel with sandy, silty clay. Fill. Strong brown (7.5YR4/6)</td>
<td>45 - 55% gravel and cobbles (1/4&quot; to 1-1/2&quot; diameter, subangular to subrounded, predominately quartzite and granite). 10 - 20% sand (medium grained to coarse grained, subangular to subrounded). Trace disseminated caliche. Interval is weakly consolidated. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>6034</td>
<td></td>
<td>2</td>
<td>No recovery.</td>
<td></td>
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</tr>
<tr>
<td>6033</td>
<td>Bentonite Pellets</td>
<td>3</td>
<td>GC/CL: Gravel with sandy, silty clay, same as interval from 0' to 1.5'. Slightly moist.</td>
<td></td>
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</tr>
<tr>
<td>6032</td>
<td></td>
<td>4</td>
<td>No recovery.</td>
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<tr>
<td>6031</td>
<td></td>
<td></td>
<td>GC/CL: Gravel with sandy, silty clay, same as interval from 0' to 1.5'. Slightly moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elev. (Ft)</td>
<td>Well or Piezometer Construction and Materials</td>
<td>Depth (Ft)</td>
<td>Lithology</td>
<td>Unified Soils Classification or Rock Type</td>
<td>Lithologic Description</td>
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<tr>
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<td>6030</td>
<td></td>
<td>5</td>
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<td>No recovery.</td>
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<tr>
<td>6029</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6028</td>
<td>Filter Pack 16x60 Silica Sand</td>
<td>7</td>
<td>GC/CL: Gravel with sandy, silty clay, same as interval from 0' to 1.5'. Slightly moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6026</td>
<td>Screen, 5h 40-PVC, 2 in. id., 0.010 in. slots</td>
<td>9</td>
<td>GM/SM: Clayey, Silty Sand with some gravel. Possibly old road base. Brown (7.5YR4/3). 10 - 20% gravel (1/8&quot; - 1/2&quot; diameter, subangular) with trace asphalt chunks. Abundant caliche from 9.4' to 9.6'. 2&quot; diameter granitic fragments at 10.0'. Unconsolidated. Moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6025</td>
<td></td>
<td>10</td>
<td>GC/CL: Gravel with silty, sandy clay, strong brown (7.5YR5/6) with some reddish yellow (7.5YR6/6). Trace pink (5YR7/3) and trace light gray (5Y7/2) sandy clay matrix. 35 - 50% gravel and cobbles (1/4&quot; - 1&quot; diameter, subangular). 10 - 20% sand (coarse grained, subangular to subrounded) throughout matrix. Some disseminated caliche throughout interval. Loosely consolidated. Slightly moist.</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>6024</td>
<td></td>
<td>11</td>
<td></td>
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</tr>
<tr>
<td>6023</td>
<td></td>
<td>12</td>
<td>GC/CL: Gravel with silty, sandy clay, same as interval from 10.0' to 11.3'. 1-1/2&quot; diameter cobbles (quartzite and granite) at 12.2'. Slightly moist.</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>6022</td>
<td></td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6021</td>
<td></td>
<td>14</td>
<td>GC/CL: Gravel with silty, sandy clay, same as interval from 10.0' to 11.3'. 1-1/2&quot; diameter cobbles (quartzite and granite) at 12.2'. Slightly moist.</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>Depth (Ft)</td>
<td>Lithology</td>
<td>Description</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6021</td>
<td></td>
<td>11.3'. Abundant caliche from 14.2' to 14.9', and 15.4'. 1.5'' diameter</td>
<td></td>
<td></td>
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<tr>
<td>6020</td>
<td>No recovery.</td>
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<tr>
<td>6019</td>
<td>GC/CL: Gravel with silty, sandy clay, same as interval from 10.0' to 11.3'. Slightly moist.</td>
<td></td>
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<tr>
<td>6018</td>
<td>No recovery.</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6017</td>
<td>GC/CL: Gravel with silty, sandy clay, same as interval from 10.0' to 11.3'. 1'' diameter, subangular clasts of shattered reddish brown (2.5YR5/3) conglomerate from 20.7' to 20.8'. Slightly moist.</td>
<td></td>
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<td>6015</td>
<td>No recovery.</td>
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<tr>
<td>6014</td>
<td>CL: Clay with some silt, some sand, and trace gravel. Displaced re-worked claystone. Yellowish brown (10YR5/8) to strong brown (7.5YR5/6) with trace olive gray (5Y6/2) mottling. Some black organic stringers. Firm and dense. Silty sand from 23.2' to 23.6'. Moist.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CL: Silty Clay with trace sand and trace gravel. Re-worked displaced claystone. Yellowish brown (10YR5/8) with olive gray (5Y/2) mottling. Very similar to interval from 22.0' to 27.7' with less iron oxidation. Trace black organic stringers. Firm and dense. Very moist.

GC/CL: Gravel with sandy, silty clay, light gray (7.5YR7/1) and light reddish brown (7.5YR6/3) from 30.8' to 31.4', then brown (7.5YR5/4) from 31.4' to 31.8'. ~10% gravel (1/8" - 1/2" diameter), 10% sand (coarse grained) from 30.8' to 31.4'. Below 31.4', sand increases to ~25 - 30% (coarse grained, subangular). Pervasive iron oxidation from 30.8' to 31.4'. Weakly consolidated. Trace disseminated caliche throughout. Very moist.

CL: Silty Clay, same as interval from 28.0' to 30.5'. Very moist.

GC/CL: Sandy, Silty Clay with some gravel. Same as interval from 30.8' to 31.8'. Abundant caliche. Saturated, flowing water.

CL: Silty Clay, same as interval from 28.0' to 30.8'. Saturated, flowing water.

No recovery.
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>6001</td>
<td></td>
<td>34</td>
<td>SC/CL: Sandy, Silty Clay with some gravel, brown (5YR5/4). 5 - 10% sand (coarse grained), ~5% gravel. Saturated and flowing. Sandy gravelly base. Pervasive iron oxidation.</td>
<td></td>
<td></td>
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<tr>
<td>6000</td>
<td></td>
<td>35</td>
<td>CLAYSTONE: TOP OF BEDROCK. Silty Claystone (bedrock), yellowish brown (10YR5/4) with some light olive gray (5Y6/2) mottling. Strong pervasive iron oxidation. Trace black organic stringers. Abrupt decrease in moisture from 34.8' to 35.0' from flowing water to saturated to very moist at base. Firm and cohesive, but pliable. No recovery.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5999</td>
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<td>36</td>
<td>CLAYSTONE: Claystone (bedrock) light gray (10YR7/1) from 37.0' to 37.6', then pale yellow (2.5Y7/3) from 37.6' to 39.6'. Slight mottling. Trace black organic stringers. Weak pervasive iron oxidation from 37.6' to 39.6'. Interval is firm and dense. Moisture decreases from very moist at top of interval to moist at base. Trace to some silt.</td>
<td></td>
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<td>5996</td>
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</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 40005 PROJECT NAME: CVOS WELL REPLACEMENTS PROGRAM: Water Programs-WQEP
SCREENED FORMATION: Alluvial DRILLING CONTRACTOR: High Plains BORING METHOD: Hollow Stem Auger
DATE DRILLED: 08/06/05 DATE COMPLETED: 09/06/05 TOTAL DEPTH: 59.6 COMPLETED DEPTH: 39.6
ESTIMATED DEPTH TO BEDROCK: 34.5 RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 4" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 28.99 ft, 08/06/05 COMPLETED WATER LEVEL (FT, DATE): 28.91 ft, 07/06/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPCT, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 35.095
* SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
* SURFACE CASING TOP: 2.0" ID (IN): 2.0"
* SURFACE SEAL TOP: 0.75" BOTTOM: 0.35" TYPE: Concrete
* PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 1.35" ID, 6" Steel
* WELL PAD DIMENSIONS, TYPE: 3 x 3 concrete 0.25 x 0.35 x 0.35
* ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
* SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
* SURFACE ISOLATION CASING ID (IN), TYPE: N/A
* OTHER (E.G., ASEPCT) CASING TOP: N/A BOTTOM: N/A
* OTHER CASING ID (IN), TYPE, PURPOSE: N/A
* CENTRALIZER(S) OD (IN), NUMBER USED: N/A TYPE: N/A
* CENTRALIZER(S) DEPTH(S): N/A
* GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
* GRANULAR BENTONITE TOP: 0.35" TYPE: Enviroplug No. 8
* BENTONITE SEAL TOP: N/A TYPE: N/A
* BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 7.5'
* FILTER PACK TYPE: 16/40 Silica Sand BRAND: O.S.S.I.
* SURFACE CASING BOTTOM (=SCREEN TOP): 9.35" TYPE: Sch. 40 - PVC
* SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: Sch. 40 - PVC
* SCREEN BOTTOM (= SUMP TOP): 39.35" SUMP TYPE: Threaded end cap - conical
* FILTER PACK BOTTOM (= BACKFILL TOP): 39.6" BACKFILL TYPE: N/A
* SUMP BOTTOM (= WELL COMPLETED DEPTH): 39.6" PILOT HOLE TOP, DIAMETER: N/A
* TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 39.6'
* REMARKS: Routine well installation

COMPLETED BY: Ellen S. Warp DATE: 09/06/05
CHECKED BY:
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 40005
Location - North: 811615
Date: 8/16/05
Geologist: E. W. R. P
Drilling Equip.: "CME-0757 HT Yellowstone Auger"

Surface Elevation: 39.6'
Area: Former B4446 Replacement of Well A4009
Total Depth: 49.4'
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 8/22/05

SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-1.5'</td>
<td>Gravel, sandy, silty clay, Fill with sandy, silty clay matrix (mod. porosity), 45-55% gravel and cobbles (4-16&quot; dia.), subangular to sub-rounded. Predominantly silt and gravel.</td>
</tr>
<tr>
<td>1.5-2.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>2.0-3.3'</td>
<td>Gravel, sandy, silty clay (same as above from 0.0-1.5'), Silt, Moist.</td>
</tr>
<tr>
<td>3.3-4.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>4.0-4.95'</td>
<td>Gravel, sandy, silty clay (same as above from 0.0-1.5'), Silt, Moist.</td>
</tr>
<tr>
<td>4.95-7.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>7.0-7.9'</td>
<td>Gravel, sandy, silty clay (same as above from 0.0-1.5'), Silt, Moist.</td>
</tr>
<tr>
<td>7.9-8.5'</td>
<td>Clayey, silty sand, some gravel, possibly old road base. Brrn. (7.5YR8/4), ~80% clayey, silty sand (moist, sub-rounded), ~20% gravel. Visible: Chunks of asphalt (4-8&quot; dia., sub-angular), Unconsolidated. Mature moisture to MOIST.</td>
</tr>
<tr>
<td>8.5-9.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>9.0-10.0'</td>
<td>Clayey, silty sand, some gravel, possibly old road base. Brrn. (7.5YR6/4), 10-20% gravel. 1&quot; asphalt chunks (8-16&quot; dia., sub-angular), Abundant concrete from 9.5-10.0' Unconsolidated. Moist.</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated in % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 40005
Location - North: East:
Date: 9/16/95
Geologist: E. WANG
Drilling Equip: CME-75-TH-Hollow Stem Auger

Surface Elevation: 
Area: Former B444-Replacement of former 40099
Total Depth: 39.6'
Company: AUB/HPRA Project No. HADEI920
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 9/22/95

SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample Description</th>
</tr>
</thead>
</table>
| 10.0-11.3' | 10.0'-11.3' GRAVEL w/Silts, Sandy Clay, Strong brn (15.1%)
| | and some reddish yellow (7.5yR 5/6), R pink (5YR 4/4), and E Ylgray (5Y 7/4)
| | Sandy clay matrix 35-50% gravel and cobbles ('4" dia., sub-angular), 10-20% sand (49")
| | sub-angular to sub-rounded) Throughout matrix,
| | Some dissolution throughout interval, Loosely Consolidated, SL. MOIST. |
| 11.3-12.0' | No recovery |
| 12.0-12.9' | 12.0'-12.9' GRAVEL w/Silts, Sandy Clay (Same as above from 10.0-11.3') 1/4" dia. cobbles (y=bead HHGray)
| | @ 12.2', SL. MOIST. |
| 12.9-14.0' | No recovery |
| 14.0-15.6' | 14.0'-15.6' GRAVEL w/Silts, Sandy Clay, (Same as above from 10.0-11.3'). Abundant calcite fm. 14.2-14.5', 1/4" dia. cobbles @ 14.5', SL. MOIST. and 15.4' |
| 15.6-17.0' | No recovery |
| 17.0-18.0' | 17.0'-18.0' GRAVEL w/Silts, Sandy Clay (Same as above fm. 10.0-11.3'), SL. MOIST |
| 18.0-19.0' | No recovery |
| 19.0-21.3' | 19.0'-21.3' GRAVEL w/Silts, Sandy Clay (Same as above fm. 14.0-15.6'), 1/8" dia. sub-angular cobbles of lustrous reddish brown (2.5YR 4/4), Conglomerate fm. 20.7-20.8', SL. MOIST. |

NOTES: General USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 40005
Location - North: East:
Date: 08/16/05
Geologist: E. Waag
Drilling Equip.: 01/17-75-NT-Hollow Stem Auger

RMRS LOGGING SUPERVISOR:
 Approval
 DATE 8/22/05

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>CV</td>
<td>Gravel w/Silty Sand &amp; Clay (Some as ash in 12.0-13.3') - See description in Page 28.</td>
</tr>
<tr>
<td>213-218</td>
<td>CV, CL</td>
<td>Clay w/Some Silt and Some Gravel, Displaced Claystone, Yellowish Brn. (10yR/8) w/lt. oliv. grey (5Y7/4) mottling, FeOd clay w/ Some un-oxid. mottling, Te. Some blk. organic stringers. Firm and dense, 1/4-3/4&quot; dia. gravel and shattered cobbles &amp; base. Must, 218-222.5' No Recovery</td>
</tr>
<tr>
<td>22.0-55.5</td>
<td>CV</td>
<td>Clay w/Some Silt, Some Sand &amp; 27.7' Te. gravel, Displaced Claystone. Yellowish Brn. (10yR/8) to Strong Brn. (15yR8) w/lt. oliv. grey (5Y7/4) mottling. Some blk. organic stringers. Firm and dense, Silty sand Brn. 23.2-23.6', MOIST</td>
</tr>
<tr>
<td>27.7-28.0</td>
<td>SM</td>
<td>Silty Sand w/Some gravel, Yellowish red (5YR8), Wdry, Consolidated V. MOIST.</td>
</tr>
<tr>
<td>28.0-30.5</td>
<td>CL</td>
<td>Silty Clay w/Te. sand and Te. gravel. Displaced Claystone, Yellowish Brn. (10yR8) w/lt. oliv. grey (5Y4/4) mottling, V. Similar to above but. 22.0-22.2', Wdry FeOd. Te. blk. organic stringers Firm and dense V. MOIST</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Depth (FEET)</th>
<th>Sample Number</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td></td>
<td>30-38 - Silty Clay, Mound and R-gravel (see page 3 of 4 for description)</td>
</tr>
<tr>
<td>30.8</td>
<td></td>
<td>30.8-31.8 - Gravel, Sandy, Silty Clay, L.t. gey. (2.5% 5%, and H. redbr. (8.5%, 3%)</td>
</tr>
<tr>
<td>31.8</td>
<td></td>
<td>Am 30.8 to 31.4 clay brn (2.5%, 5%) Am 31.4-31.8, ~ 10% gravel (4% - 32%, 10% sand (0.5%)</td>
</tr>
<tr>
<td>31.9</td>
<td></td>
<td>Am 30.8 - 31.4 then more, Sand to ~ 35-50%</td>
</tr>
<tr>
<td>32.0</td>
<td></td>
<td>gritty, Pretty FeOx. Brn. 30.8 - 31.8...</td>
</tr>
<tr>
<td>32.5</td>
<td></td>
<td>Well consolidated, 115.  Cales, about 315. Y. 0.175.</td>
</tr>
<tr>
<td>32.8</td>
<td></td>
<td>32.8 - 32.8 - Silty Clay, Sandy, Silty Clay, M. gey. 70% sand, 30% Silty clay, Abandoned cattails, Stratified Flaking, H2O.</td>
</tr>
<tr>
<td>33.0</td>
<td></td>
<td>33-0 - 33.0 - 5% of Silty Clay, as shown Am 33.0-33.5, Sand + Clay (80%) 30% Sandy clay, Yellow clay (FeOx. 70%) 3% gravel, Very Hard, Stratified, H2O.</td>
</tr>
<tr>
<td>33.5</td>
<td></td>
<td>33.5 - 34.0 - No recovery</td>
</tr>
<tr>
<td>34.8</td>
<td></td>
<td>34.8 - 34.5 - Sandy, Silty Clay, 70% of grain, Bmn. (5% Silty, 1% gravel, Thinly stratified, Sandy gravelly sand. Perm. FeOx.</td>
</tr>
<tr>
<td>35.0</td>
<td></td>
<td>Bedrock Contact @ 35.0</td>
</tr>
<tr>
<td>35.5</td>
<td></td>
<td>35.5 - 36.0 - Silty claystone (Bedrock), Yellowish brn. (50%) 30% of sand, 2% gravel, 1% Organic Strings. We par FeOx.</td>
</tr>
<tr>
<td>36.0</td>
<td></td>
<td>36.0 - 37.0 - No recovery</td>
</tr>
<tr>
<td>37.0</td>
<td></td>
<td>37.0 - 37.0 - Clay Shale - Bedrock, L.t. gey. (10%), then Pale Yellow (2.5% 10%) Am 37.0 - 37.6, Silty mud, Organic Strings. We par. FeOx.</td>
</tr>
<tr>
<td>37.6</td>
<td></td>
<td>37.6 - 37.6 - Saturated is found and close. Poor moisture. Am. V. Moist a deep interval to moist a base. Tr. sand.</td>
</tr>
<tr>
<td>T.D. 38.6</td>
<td></td>
<td>38.6 - 39.0 - No recovery</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 8/27/05

SAMPLE DESCRIPTION

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No recovery.

GW: Gravel, shattered quartzite cobble, dark gray (10YR4/1) quartzite. 3/4" to 1-1/2" diameter, subangular fragments of quartzite with <5% fines. Trace moisture.

GC/CL: Gravel with sandy, silty clay, same as interval from 0' to 0.7'. Moist.

No recovery.
GC/CL: Gravel with sandy, silty clay. Light brown (7.5YR6/3), pink (7.5YR7/4) to reddish yellow (7.5YR6/8) silty clay matrix (medium plasticity). 55 - 60% gravel and cobbles (1/8" - 2" diameter, subrounded to subangular, predominately quartzite with minor schist). ~20% sand (medium grained to coarse grained, subangular to subrounded). Abundant disseminated caliche. Interval crumbly and unconsolidated due to amount of gravel and cobbles. Moisture decreases to slightly moist.

No recovery.

GC/CL: Gravel with sandy, silty clay. Brown (7.5YR5/4) to strong brown (7.5YR5/6) silty matrix. 30 - 35% gravel and cobbles (1/4" to 1-1/2" diameter, subangular to subrounded). ~15% sand (coarse grained, subangular). Silty clay matrix has medium plasticity. Some disseminated caliche. Interval is unconsolidated. Slightly moist.

GM/SM: Gravel/Silty Sand mixture (probable old road base). Brown (10YR4/3) silty sand matrix. 15 - 20% gravel and chunks of asphalt (1/4" - 3" diameter, subangular) within silty sand (medium grained to coarse grained, subrounded) matrix. Unconsolidated. Moist.

No recovery.

GC/CL: Gravel with sandy clay, very dark grayish brown (10YR3/2) to brown (10YR4/3). Probable old road base. Sandy clay matrix with 25 - 30% gravel and cobbles (1/4" to 1-1/2" diameter, subangular, quartzite and granite). 15 - 20% sand (coarse grained, subangular). Trace asphalt chunks (1/4" diameter) at top of interval. Some disseminated caliche. Slightly moist.

GC/CL: Gravel with sandy, silty clay. Light gray (5Y7/2) with some strong brown (7.5YR4/6) silty clay matrix. 30 - 35% shattered gravel (1/4" - 1" diameter, subangular, predominately quartzite). ~10% sand (coarse grained, subangular). Some to abundant disseminated caliche. Interval is crumbly. Slightly moist.

GC/CL: Gravel with silty, sandy clay. Strong brown (7.5YR4/6) silty clay matrix with pervasive iron oxidation. 20 - 30% shattered gravel (1/4" - 1" diameter, subangular, predominately quartzite). 10 - 15% sand (coarse grained, subangular to subrounded). Abundant caliche (disseminated and as blebs) throughout. Weakly consolidated. Slightly moist.
No recovery.

GC/CL: Gravel with silty, sandy clay. Strong brown (7.5YR4/6) silty clay matrix (medium plasticity). 20 - 30% gravel (1/8" - 3/4"
diameter, predominately quartzite). 10 - 15% sand. Abundant disseminated caliche. Weakly consolidated. 1" angular quartzite
fragment at 13.7'. Moist.

No recovery.

GC/CL: Gravel with silty, sandy clay. Same as interval from 12.0' to 13.7'. Weakly consolidated. Moist.


No recovery.

GC/CL: Gravel with silty, sandy clay. Same as interval from 12.0' to 13.7'. Weakly consolidated. Moist.


GC/CL: Gravel with silty, sandy clay. Same as interval from 12.0' to 13.7'. Shattered pegmatitic quartz cobble (1" to 1-1/2" diameter
fragments) at base of interval. Moist.

No recovery.

GC/CL: Gravel with silty, sandy clay. Same as interval from 12.0' to 13.7'. Weakly consolidated to unconsolidated. Sandy lens from 20.5'
to 20.8'. Moist.

GC/CL: Gravel with sandy, silty clay. Strong brown (7.5YR5/8) to brown (7.5YR5/4) to pink (5YR7/3) silty clay matrix. Similar to
interval from 12.0' to 13.7' with decreased gravel and sand and
slight color change. 15 - 25% gravel (1/8" - 1/2" diameter, subangular to subrounded quartzite, schist, and occasional sandstone clasts). ~10% sand (medium grained). Moderate pervasive iron oxidation of silty clay matrix. Some caliche (disseminated and as blebs). Weakly consolidated. Moist.

No recovery.

GC/CL: Gravel with sandy, silty clay. Same as interval from 21.1' - 21.5', but with increased fines. Moist.

CL: Clay with trace gravel, light brown (7.5YR6/4) clay with black organic stringers. Interval dense and firm. Moist.

No recovery.

GC/CL: Gravel with sandy, silty clay. Same as interval from 21.1' - 21.5'. Shattered quartzite cobble at 25.2'. Moist.

GM/SM: Gravely, Silty Sand, reddish brown (5YR5/4) to yellowish red (5YR5/6) silty sand. 90 - 95% silty sand (coarse grained, subrounded to subangular), 5 - 10% gravel (1/8" - 1/4" diameter, subangular). Some to abundant disseminated caliche. Interval is cohesive. Moist.

No recovery.

GM/ML: Gravel with clayey, sandy silt. Reddish brown (5YR5/4) to reddish yellow (7.5YR6/6). 35 - 45% gravel (1/4" - 1" diameter, subrounded) and cobbles (1" diameter, subrounded) predominately quartzite and granite. 55 - 65% sandy silt matrix (sand is coarse grained, subrounded). Clayey zones from 28.7' to 29.0'. Silt lens from 29.9' - 30.3'. Abundant caliche from 30.3' - 30.9'. Interval is loosely consolidated to unconsolidated. Very moist and wet at 31.9' - 32.0'.
SM: Clayey, Sandy Silt with trace gravel. Light brown (7.5YR6/4) to strong brown (7.5YR5/6). ~60% clayey silt matrix and ~40% sand (medium grained, subrounded). Unconsolidated. Saturated, flowing water.

SM/ML: Clayey, Sandy Silt with trace to some gravel. Brown (7.5YR5/4) to strong brown (7.5YR5/6). 15 - 20% sand (medium grained, subrounded to subangular). 5 - 7% gravel. Loosely consolidated to unconsolidated. Saturated, but not flowing from 32.3' - 34.0'. Flowing water from 34.0' - 35.5'. Pervasive iron oxidation from 34.0' - 35.5'.

CLAYSTONE: TOP OF BEDROCK. Claystone with some silt - weathered bedrock. Gray (10YR7/1) to pale brown (10YR6/3) with yellowish brown (10YR5/6) iron oxidation mottling. Massive texture. Firm and dense. Iron oxidized rip-up clasts from 36.0' - 36.9'. Very moist to moist. Notable decrease in moisture at 35.5'.


CLAYSTONE: Claystone, unweathered bedrock, very dark grayish brown (10YR3/2) to dark grayish brown (10YR4/2). Black organic material (as stringers and blebs) common. Dense and firm. Slightly moist.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 10205  PROJECT NAME: 005 well Replacements  PROGRAM: Water Programs-Warp
SCREENED FORMATION: 01/Bakk  DRILLING CONTRACTOR: High Plains  BORING METHOD: Hollow Stem Auger
DATE DRILLED: 8/15/05  DATE COMPLETED: 9/15/05  TOTAL DEPTH: 39.0'  COMPLETED DEPTH: 39.0'
ESTIMATED DEPTH TO BEDROCK: 35.5'  RIG GEOLOGIST: F. Warp  LOGGING GEOLOGIST: F. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: - 8”  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 31.10 (6/26/05) 9/15/05 COMPLETED WATER LEVEL (FT, DATE): 31.01 (6/26/05) 9/15/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2” PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEP, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (FLUSH-MOUNT OR FLUSH-MOUNT): 4.25' G S
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 5.75' G S ID (IN): 2.0
SURFACE SEAL TOP: 1.875' G S BOTTOM: 0.35' TYPE: Convede
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 0.60' G S 6” steel
WELL PAD DIMENSIONS, TYPE: 3 x 3', Concrete
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEP, ETC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTERLIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTERLIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 0.35' G S TYPE: Grav. Bent. - Envoalgay - No. 8
*BENTONITE SEAL TOP: N/A  TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 7.5'
FILTER PACK TYPE: 1/40 Silica Sand  BRAND: C.S.S.E.
SURFACE CASING BOTTOM (= SCREEN TOP): 8.75' TYPE: Selv. 40 - PVC
SCREEN ID (IN): 2.0' SLOT SIZE (IN): 0.01' TYPE: Selv. 40 - PVC
SCREEN BOTTOM (= SUMP, TOP): 38.75' SUMP TYPE: Threaded ended - conical
FILTER PACK BOTTOM (= BACKFILL TOP): 39.0' TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 39.0' PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 39.0'
REMARKS: Routine well installation

COMPLETED BY: Ellen S. Warp  DATE: 9/15/05
CHECKED BY:  DATE:  

FLUSH-MOUNT EXAMPLE FOR PROBED WELL
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.7</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>0.7 - 1.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>1.0 - 1.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>1.5 - 2.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>2.0 - 2.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>2.5 - 3.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>3.0 - 3.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>3.5 - 4.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>4.0 - 4.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>4.5 - 5.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>5.0 - 5.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>5.5 - 6.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>6.0 - 6.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>6.5 - 7.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>7.0 - 7.5</td>
<td>Gravel, Silty Clay, Strong (\phi = 0.4), sub-rounded, (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>7.5 - 8.0</td>
<td>Silty Clay matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>8.0 - 8.5</td>
<td>Gravel, Silty Sand matrix, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
<tr>
<td>8.5 - 9.0</td>
<td>Silty Sand, (n = 0.1), (e = 0.4), (k = 0.3), (q = 0.1)</td>
</tr>
</tbody>
</table>

**NOTES:**
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

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**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 40205

**Location - North:**

**East:**

**Date:** 6/15/05

**Geologist:** P. WARE

**Drilling Equip:** LM-18x7, HOLLOW Stem Auger

**Surface Elevation:**

**Area:** Former 4443 - Replacement of # 40209

**Total Depth:** 53.0'

**Company:** USES / High Plains

**Project No:** HE057280

**Sample Type:** Continuous Core

---

**RMRS LOGGING SUPERVISOR**

**APPROVAL**

**DATE 8/29/05**

**SAMPLE DESCRIPTION**

10.0 - 10.5' See page 14 for description.

10.5 - 11.0' Gravel (29%) Sandy, Silty Clay, 12.9' (57%) Silty clay matrix, 30-35% gravel (14 to 1 div, subangular, predominantly gritty), 10% sand (5%, subangular) same to 11.0' Abundant calcite (dissolved) as flakes in clay and sand. SL MOIST.

11.0 - 11.5' Silty, Sandy Clay, Strong brown (15% gritty), Silty clay matrix (subangular, 20-30% gravel (14 to 1 div, subangular, predominantly gritty), 10-15% sand (5%, subangular, sub-rounded). Abundant calcite (dissolved) as flakes in clay and sand. SL MOIST.

11.5 - 12.0' No recovery.

12.0 - 12.7' Gravel (29%) sandy, Silty Clay, Strong brown (17.5% gritty), Silty clay matrix, (subangular, 20-30% gravel (14 to 1 div, predominant gritty), 10-15% sand. Abundant calcite, 13.7' Wkly consolidated, 15% gritty matrix. B ENTER

13.7 - 14.0' No recovery.

14.0 - 14.5' Gravel (30%) Silty, Sandy Clay, Same as above from 12.0 - 13.7' Wkly consolidated, MOIST.

15.5 - 16.2' Silt, Yellow (10% gritty), Perv. Feathers, MOIST.

16.2 - 17.0' No recovery. Gravel, sand, silt matrix.

17.0 - 17.5' Gravel (30%) Silty, Sandy Clay, Same as above from 12.0 - 13.7' Wkly consolidated, MOIST.

17.5 - 18.0' Silt, Yellow (10% gritty), Perv. Feathers, MOIST.

18.0 - 18.5' Gravel (30%) Silty, Sandy Clay, Same as above from 12.0 - 13.7' Wkly consolidated, MOIST.

18.5 - 19.0' No recovery.

19.0 - 21.1' Gravel (30%) Silty, Sandy Clay, Same as above from 12.0 - 13.7' Wkly consolidated, MOIST.

---

**NOTES:**

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Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.

(2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedures No. RMRS/OPS-PRO.101**

**Revision 0**

**Date effective:** 12/31/98

**Page 27 of 28**
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 40205  
**Location - North:**  
**Location - East:**  
**Date:** 8/25/05  
**Geologist:** E. Weak  
**Drilling Equip.:** Cat 794T Hollow Stem Auger

#### RMRS LOGGING SUPERVISOR

**APPROVAL**

**DATE:** 8/25/05

#### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0 - 21.1</td>
<td>See page 2074 for description</td>
</tr>
<tr>
<td>21.1 - 21.5</td>
<td>Gravel 4 Sandy, Silty Clay, Silt and Bv, (95-10%) to Bv (5-98%) to pink (5yR 7/4), Silty clay matrix, similar texture f.m. 18.0 - 21.4, with dispersed gravel and sand and S1. Color change.</td>
</tr>
<tr>
<td>15 - 25% gravel (1/4&quot;, sub-angular to sub-rounded) and occasional S1. Color change.</td>
<td></td>
</tr>
<tr>
<td>-30% sand (S2). Moderate part FeOx, Silty Clay matrix. Some caliche (diss. and as beds).</td>
<td></td>
</tr>
<tr>
<td>Wkly. Consolidated, MOIST.</td>
<td></td>
</tr>
<tr>
<td>215 - 220 = No recovery</td>
<td></td>
</tr>
<tr>
<td>220 - 234 (Gravel 4 Sandy, Silty Clay, Silt and Bv, above f.m. 21.1 - 21.5. MOIST. deposited.</td>
<td></td>
</tr>
<tr>
<td>234 - 23.7 (Clay 4 Claystone, fine gr. f.m. 21.7 - 21.5, clayey, organic Strings, Interval dense and firm. MOIST.</td>
<td></td>
</tr>
<tr>
<td>23.7 - 240 = No recovery</td>
<td></td>
</tr>
<tr>
<td>24.0 - 25.3</td>
<td>Gravel 4 Sandy, Silty Clay, Same as above f.m. 21.1 - 21.5. Shattered gpr, calcite.</td>
</tr>
<tr>
<td>25.3 - 26.8</td>
<td>Gravel, Silty Sand, Reddish brown (5yR 7/2). Sand, 90 - 95% silt and sand (sandy). Sub-rounded to angular.</td>
</tr>
<tr>
<td>5 - 10% gravel (1/4&quot; dia. sub-angular). Sandy to abundant diil, calcite. Interval is very abrasive, MOIST.</td>
<td></td>
</tr>
<tr>
<td>26.8 - 270 = No recovery</td>
<td></td>
</tr>
<tr>
<td>270 - 31.9 (Gravel Volcanic, sandy to Silty Reddish brown (5yR 7/2). Reddish yellow (7.5YR 7/3).</td>
<td></td>
</tr>
<tr>
<td>-35-45% gravel (1/4&quot; dia. sub-rounded) and cobble (1/2&quot; dia. sub-rounded) predominantly from granite, quartz.</td>
<td></td>
</tr>
<tr>
<td>55 - 60% Sandy Silt matrix (1/2&quot; dia. Sub-rounded).</td>
<td></td>
</tr>
<tr>
<td>Clayey silt f.m. 28.1 - 30.9. Silty dense f.m.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

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- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 40205
Surface Elevation:
Location - North: 
East:
Date: 8/15/05
Geologist: E. Upp
Total Depth: 390'
Drilling Equip.: CME-75-HT - Hollow Stem Auger
Company: US/High Plains
Sample Type: Continuous Core
Project No. HADS1300

RMRS LOGGING SUPERVISOR:

APPROVAL

DATE 8/15/05

SAMPLE DESCRIPTION

30.0 - 31.9' GRAVEL w/Clasts, Sandy Silt, described on p. 8b/d4.

31.9 - 32.3' clayey, Sandy Silt w/gravel, fl. brn. (7.5% vs%)
~ 60% clayey silt matrix and ~ 40% sand (m.g.,
sub-rounded), Unconsolidated, SATURATED, Freeing H2O.

32.3 - 35.5' Clayey, Sandy Silt w/gravel,
Fl. Brn. (7.5% vs%) to Strong Brn. (15% vs%)
15-20% sand (m.g. sub-rounded to sub-angular)
5-7% gravel, loosely consolidated to unconsolidated,
Saturation, 34° Flowing, H2O, 34° - 35°, Peru, FeCl3
in fm 34° - 35°.

Bedrock Contact @ 35.5'

35.5 - 36.9' CLAYSTONE w/ some silt. Weathered Bedrock
Grayish Brn. (10% vs%) to pale brn. (10% vs%) to yellowish brn. (10% vs%)
FeCl3, Motting, Massive texture, Firm and dense,
FeCl3, IP at a loss fm 36.0 - 36.5°, M. 35.5°,
Notable decrease in moisture @ 35.5°.

36.9 - 38.4' CLAYSTONE - Gray (10% vs%)
FeCl3 oriented to sub-horizontal bedding planes, Blk organic
strings, Common, Dense and Firm, Decrease moisture to 5%.

38.4 - 39.0' CLAYSTONE - Un-weathered Bedrock
v. dark gray brn. (10% vs%) to dk grayish brn. (10% vs%)
Black Organic material (as strings and blocks)
Common, Dense and Firm, 5% Moist.

NOTE: FeCl3 Fm 0.3 ppm to 1.0 ppm

T.D. @ 39.0'

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Unifed Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
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<tbody>
<tr>
<td>6026</td>
<td>Protective Casing 8&quot; Steel</td>
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<tr>
<td>6025</td>
<td>Casing, Sch 43 PVC, 2 In. ID.</td>
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<tr>
<td>6024</td>
<td>Concrete Seal</td>
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<tr>
<td>6023</td>
<td>Concrete Pad</td>
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<tr>
<td>6022</td>
<td>Hydrated Bentonite Chipp</td>
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</tr>
<tr>
<td>6021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6020</td>
<td>SC: Sand with some gravel (fill), road base. Brown (7.5YR4/2). ~90% sand (medium grained to coarse grained, subrounded),~10% gravel (1/8&quot; - 1/4&quot; diameter, subangular). Moist. No recovery.</td>
<td></td>
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</tr>
<tr>
<td>6019</td>
<td>GC/CL: Gravel/Sand mixture (fill). Asphalt/road base. Black (7.5YR2.5/1). 1/2&quot; - 1&quot; diameter chunks of asphalt containing 1/4&quot; - 1/2&quot; diameter clasts of quartzite and granite. ~40% gravel and 60% sand content. Very moist.</td>
<td>SC: Sand with some gravel (fill), road base. Brown (7.5YR4/2). ~90% sand (medium grained to coarse grained, subrounded),~10% gravel (1/8&quot; - 1/4&quot; diameter, subangular). Moist. No recovery.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GC/CL: Sandy, Gravelly Clay (fill), brown (7.5YR5/4). 15 - 20% gravel (1/4&quot; - 3/4&quot; diameter, subangular, predominately quartzite). 15 - 25% sand (coarse grained, subrounded to subangular). Clay has medium plasticity. 2&quot; quartzite cobble at 0.4'. Very moist. Fill extends to probably 15' to 20'.</td>
<td>GC/CL: Gravel with sandy clay (fill). Dark brown (7.5YR3/2). 50 - 55% gravel and cobbles (1/4&quot; to 1-1/2&quot; diameter, subangular to subrounded) quartzite and granitic composition with some asphalt chunks. ~25% sand (coarse grained), ~25% clay. Shattered quartzite cobbles (up to 2&quot; diameter) from 2.8' to 3.2'. Moist.</td>
<td></td>
</tr>
</tbody>
</table>
No recovery.

GC/CL: Gravel with sandy clay. Same as interval from 2.0' to 3.2'. Moist. 1-1/2' clasts of quartzite at base.


GC/CL: Gravel with sandy clay. Same as interval from 2.0' to 3.2'. Moist.

GC/CL: Gravelly, Sandy Clay with silt. Strong brown (7.5YR4/6). 25 - 30% sand (medium grained to coarse grained, subrounded to subrounded). 10 - 15% gravel (1/8' - 1/4' diameter, subangular). Clay has medium plasticity. Cohesive. Moist. 50 - 60% coarse grained, subangular, white/light tan sand at base, with some caliche blebs.

No recovery.

GM/SM: Gravelly, Silty Sand with clay. Strong brown (7.5YR5/6) silty/clay matrix. ~65% sand (medium grained to coarse grained, subrounded to subangular). ~15% gravel (1/8' - 1/4', subrounded). Clay/silt is cohesive. Abundant white/light tan caliche disseminated throughout. Caliche blebs and stringers (and sand-sized rock fragments) common. Zones of shattered quartzite cobbles and gravel at 7.6', 8.1' to 8.3', and 8.8'. Moist.

GC/CL: Gravelly, Sandy, Silty Clay. Pinkish gray (7.5YR6/2) silty clay matrix. ~10% gravel, ~10 - 20% sand (coarse grained, subangular) with abundant quartzite cobbles (1' - 2' diameter, subangular). Abundant caliche throughout. Unconsolidated. Moist.

GM/SM: Gravelly, Silty Sand with clay. Same as interval from 7.0' to 9.0'. Moist.

GC/CL: Gravel with silty, sandy clay. Light brown (7.5YR6/3) to pinkish gray (7.5YR7/2) to light olive gray (5Y6/2) matrix. 50 - 55% gravel (1/4' - 3/4' diameter, subrounded to subangular) composed of predominately quartzite with less granite. 50 - 55% sandy, silty/clay matrix (multi-colored). Abundant caliche (disseminated and stringers). Crumbly and unconsolidated. Slightly moist.

GC/CL: Gravel with silty, sandy clay. Very similar to interval from 10.1' to 13.5', except slight color change of silty, sandy clay matrix. Reddish yellow (5YR7/6) to pink (5YR7/3) matrix. 50 - 55% gravel and 50 - 55% silty, sandy clay matrix. Abundant caliche. Unconsolidated and crumbly. Moist. Note: PID = 17 ppm in borehole.

No recovery.

GC/CL: Gravel with silty, sandy clay. Same as interval from 14.0' to 16.4'. Moist.

CL: Silty Clay, strong brown (5YR5/8) with some brown (5YR4/4) and trace light olive gray (5Y6/2) mottling. Strong pervasive iron oxidation. Trace black organic stringers. Firm, dense, and cohesive. Moist. Increasing silt, fine grained sand below 18.5'.

SM: Silty, Clayey Sand with trace gravel. Strong brown (5YR5/6). Strong pervasive iron oxidation of silty matrix. ~80% sand (medium grained, subrounded). ~20% silty matrix. Abundant disseminated white, coarse grained, sand-sized rock fragments - caliche (?). White, subangular blebs of caliche at 20.0' to 21.0'. Very moist. Note: PID hits up to 115 ppm on soil associated with the augers (outside of borehole). 75 ppm hits within the borehole.
GM/SM: Gravelly, Silty, Clayey Sand, strong brown (7.5YR5/6 to 7.5YR5/8) with some reddish brown (7.5YR6/8). 85 - 90% silty sand (medium grained to coarse grained, subangular to subrounded). 10 - 15% gravel (1/2" - 3/4" diameter, subrounded to subangular, composed of quartzite, granite, and minor schist). Similar to interval from 18.8' to 21.5', but less cohesive due to gravel. Disseminated caliche common. Strong pervasive iron oxidation of silty matrix. Increasing moisture from very moist to saturated/flowing water from 22.0' to 24.3'. Caliche lens (1/4" thick) at 22.6'.

No recovery.

GM/SM: Gravelly, Silty Sand. Same as interval from 21.5' to 23.5'. Pink (5YR7/3) sandstone clasts (3/4" - 1" diameter, angular) above bedrock contact. Saturated/flowing water.

SILTY CLAYSTONE: TOP OF BEDROCK. Silty Claystone (weathered bedrock). Brownish yellow (10YR6/6) with minor light gray (10YR7/1). Interval is firm and dense with faint bedding planes. Some black organic material throughout. Trace manganese oxide along internal bedding planes. Abrupt decrease in moisture at bedrock contact. Silty claystone is moist.

CLAYEY Siltstone: Clayey Siltstone, weathered. Light yellowish brown (2.5Y6/3). Massive textured. Very silty from 27.0' to 27.8'. Weak to moderate pervasive iron oxidation. Cohesive yet moderately friable. Moist.

MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 40305 PROJECT NAME: CVSS Well Replacement PROGRAM: Water Programs - WP
SCREENED FORMATION: All Red Drilling Contractor: High Plains Boring Method: Hollow Stem Auger
DATE DRILLED: 9/11/05 DATE COMPLETED: 11/11/05 TOTAL DEPTH: 30.0' COMPLETED DEPTH: 30.0'
ESTIMATED DEPTH TO BEDROCK: 24.3' RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 16.85 (10/24) 9/6/05 COMPLETED WATER LEVEL (FT, DATE): 19.82 (10/24) 9/6/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2" T.D. - PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above Ground Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP FOR FLUSH-MOUNT): 4.25' a.g.s.
"SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: N/A ID (IN.): 2.0"
SURFACE SEAL TOP: 1.0" BOTTOM: 0.375" TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN.): 0.55" TYPE: 6" Steel
WELL PAD DIMENSIONS, TYPE: 3'x3' concrete 3"m, 0.33x3x0.33x3"
"ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
"SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
"SURFACE ISOLATION CASING ID (IN.): N/A TYPE: N/A
"OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
"OTHER CASING ID (IN.): N/A TYPE, PURPOSE: N/A
"CENTRALIZER(S) OD (IN.): N/A NUMBER USED: N/A TYPE: N/A
"CENTRALIZER(S) DEPTH(S): N/A
"GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
"GRANULAR BENTONITE TOP: N/A TYPE: N/A
"BENTONITE SEAL TOP: 4.3' lbs. TYPE: Med. Bentonite chips "Pure gold" hydrated 1/5 gallon of Distilled H2O.
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 8.0'
FILTER PACK TYPE: 1/4" Silica Sand BRAND: C.S.I.
SURFACE CASING BOTTOM (= SCREEN TOP): 9.75' TYPE: EMT SCH. 40 - PVC
SCREEN ID (IN.): 2.0" SLOT SIZE (IN.): 0.01" TYPE: SCH. 40 - PVC
SCREEN BOTTOM (= SUMP, TOP): 23.75' SUMP TYPE: Threaded end cap - Conical
FILTER PACK BOTTOM (= BACKFILL TOP): 30.0' BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 30.0' PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 30.0'
REMARKS: P.I.D, HITS Am. 17.115 ppm Am. 17.0 - 22.0, Routine Well Installation
COMPLETED BY: Ellen S. Warp DATE: 11/11/05
CHECKED BY: DATE:
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 40305
Location: North: East:
Date: 8/1/05
Geologist: E. Wrase
Drilling Equip.: CMF-75-HT-Hollow Stem

RMRS LOGGING SUPERVISOR
APPROVAL

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-0.85</td>
<td>Sandy, silt, clay, Brn (1.5% clay), 15-25% gravel, 15-25% sand, clay, sub-rounded to sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill (probably 0.15-20)</td>
</tr>
<tr>
<td>0.85-1.94</td>
<td>Sand/gravel, matrix, Brn (15% clay), VS (25%), 15-25% gravel, 15-25% sand, clay, sub-rounded to sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
<tr>
<td>1.94-3.32</td>
<td>Sand/gravel, matrix, Brn (15% clay), VS (25%), 15-25% gravel, 15-25% sand, clay, sub-rounded to sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
<tr>
<td>3.32-6.0</td>
<td>Sand/gravel, matrix, Brn (15% clay), VS (25%), 15-25% gravel, 15-25% sand, clay, sub-rounded to sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
<tr>
<td>6.0-6.32</td>
<td>Sandy, silt, clay, Brn (1.5% clay), 15-25% gravel, 15-25% sand, clay, sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
<tr>
<td>6.32-10.0</td>
<td>Sandy, silt, clay, Brn (1.5% clay), 15-25% gravel, 15-25% sand, clay, sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
<tr>
<td>10.0-15.5</td>
<td>Sandy, silt, clay, Brn (1.5% clay), 15-25% gravel, 15-25% sand, clay, sub-rounded, silty clay, 75% clay, 25% sand, medium plasticity, 2% loss, Mobile 0.4, % Moist, Fill</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

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### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 40305  
**Surface Elevation:**  
**Location:**  
**Geologist:** E. Whap  
**Drilling Equip.:** CM6-75-HT *Holland from Angle*  
**Company:** NER/Haf Plant  
**Sample Type:** Continuous Core

#### RMRS LOGGING SUPERVISOR

**APPROVAL**  
**DATE:** 8/15/05

#### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-9.4</td>
<td>Gravelly, sandy, silt, clay. Pinkish gray (7.5YR 4/4) silt, clay matrix, ~10% gravel, ~10% sand (s.s., subang). Abundant calcite (1-2&quot;, dia., subang.). Unconsolidated, MOIST.</td>
</tr>
<tr>
<td>9.4-10.1</td>
<td>Gravelly, silty, SAND 75% Rhyolite (same as above fm. 7.0-2.0), MOIST.</td>
</tr>
<tr>
<td>10.1-13.5</td>
<td>Gravelly, sandy, clay, 1:1 brm (7.5YR 4/4) to pinkish gray (7.5YR 3/4) to H. olivine gray (5Y 4/8) matrix, 50-55% gravel (4-6&quot;, dia., subang., to subang.)*composed of predominately quartz and granite, 50-55% Sandy, silty, clay matrix (multi-colored). Abundant calcite (diss and stringers). Crumbly and unconsolidated, SL MOIST.</td>
</tr>
<tr>
<td>13.5-14.0</td>
<td>Gravelly, sand, calcite, Pinkish gray (5YR 6/8), Unconsolidated, sandy lane, clay, 75% calcite (95% calcite).</td>
</tr>
<tr>
<td>14.0-16.4</td>
<td>Gravelly, sandy, clay. (V, similar to above fm. 10.1-13.5 except slight color change of silty, sandy, clay matrix). Reddish yellow (5YR 6/8) to Pink (5YR 3/4) matrix, 50-55% gravel and 50-55% silty sandy, clay matrix, Abundant calcite. Unconsolidated and crumbly, MOIST.</td>
</tr>
<tr>
<td>16.4-19.0</td>
<td>No recovery</td>
</tr>
<tr>
<td>19.0-18.0</td>
<td>Gravelly, clay, sand, clay. Same as above fm. 14.0-16.4, MOIST.</td>
</tr>
<tr>
<td>18.0-90.0</td>
<td>Sandy clay, 75% sand, 25% clay. 75% sand, 25% clay. Some brn. (7.5Y 4/4) to H. olivine gray (5Y 4/8) matrix, Strong perv. FeOx. E blk. organic stringers. Firm, dense, and adhesive, MOIST. Inc. silty, sand, and gravel.</td>
</tr>
<tr>
<td>90.0-310.0</td>
<td>Silty, sand, 75% gravel, 25% sand. Strong brn. (7.5YR 4/4), some brn. (7.5YR 4/4) and FeOx. E blk. organic stringers. Firm, dense, and adhesive, MOIST. Inc. silty, sand, and gravel.</td>
</tr>
</tbody>
</table>

#### NOTES:

1. **General:** USCS is modified for this log as follows:  
2. **Materials amounts are estimated by % volume instead of % weight.**
3. **Procedure No. RMRS/OPS-PRO.101**
4. **Revision 0**
5. **Date effective:** 12/3/98
6. **Page 27 of 28**
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 40305  
**Location - North:**  
**Date:** 6/1/05  
**Geologist:** E. WeaP  
**Drilling Eqp.:** MTE-7ST-HT - Hollow Stem Auger  
**Surface Elevation:**  
**Area:**  
**Total Depth:** 30.0’  
**Company:**  
**Project No.:** 9457300  
**Sample Type:** Continuous Core  
**Page 3 of 3**

** RMRS LOGGING SUPERVISOR APPROVAL **  
**DATE:** 6/15/05

<table>
<thead>
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<tbody>
<tr>
<td>Silty SAND w/ Te gravel (described on page 2). [NOTE: PI0 hits up to 115 ppm on soil associated w/ the auger (outside of borehole). 75 ppm: HITS WITHIN THE BOREHOLE].</td>
</tr>
</tbody>
</table>

- **2.5-23.5’:** Gravelly, Silty SAND. Strongly deformed limestone (7.5YR 7/8 – 7.5YR 8/2). Bedrock contact 24.3’. Caliche lens (.54’ thick) @ 22.6’.  
- **23.5-24.0’:** No recovery.  
- **24.0-24.5’:** Gravelly, Silty SAND (same as above).  
- **24.5-25.0’:** Pink (5YR 6/3) limestone (6” thick) above bedrock contact.  
- **25.0-25.5’:** Bedrock contact @ 25.5’.

- **24.3-25.2’:** Silty Claysilts (Bedrock) - Weathered.  
- **25.2-27.8’:** Silty Claysilts - Weathered.  
- **27.8-30.0’:** Clayey silts and clay (10YR 5/4).  

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
1. Badly broken core, accurate footage measurements not possible.  
2. Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No:** RMRS/OPS-PRO-101  
**Revision:** 0  
**Date effective:** 12/31/98  
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<td>Concrete Pad</td>
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<td>5936</td>
<td>Granular Bentonite</td>
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<td>Granular Bentonite</td>
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<tr>
<td>5934</td>
<td>Filter Pack, 1/4&quot; Silk</td>
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</table>

CL: Clay with traces sand, silt, and gravel, very dark gray (10YR3/1) to yellowish brown (10YR5/4) mottled. Scattered gravel clasts to 1", predominately quartzite, also ironstone, Lyons Sandstone, schist, fill, and re-worked claystone. Moist and pliable. Slight increase in gravel (still trace) below 6.0', but not uniformly scattered. Increased moisture below 7.1' to soft, very moist. Clot of organic debris at 8.2' (re-worked). Distinctly different color, light brownish gray (2.5Y6/2), from 10.5' - 10.7' (re-worked claystone).
CL: Re-worked claystone from 12.0' to 12.2', light brownish gray (2.5Y6/2). Below 12.2' is same as interval from 0' to 10.5', though occasional small fragments/interval of re-worked claystone is present from 13.3' to 13.4' and at 13.8'. Very moist.
No recovery.


No recovery.

CLAYSTONE: TOP OF BEDROCK. Claystone, grayish brown (2.5Y5/2) to light brownish gray (2.5Y6/2). No iron-oxide staining. Moist, pliable. Quartzite clasts at top “pushed”. Color change below 18.0’ as mottling (iron oxides), with overall color change to light olive brown (2.5Y5/3) to olive brown (2.5Y4/3) below ~18.6’. Core above 18.0’ is intact, pliable; below 18.0’ is fluffed by Geoprobe, less moist (slightly moist to moist). Iron oxides below 18.0’ are disseminated with isolated, scattered, localized concentrations of iron oxides that may be associated with fracture healing, but core is too damaged to confirm. Below 20.0’, occasional trace silt, but very minor, possibly as very small rip-up clasts. Core fluffed (damaged) as above.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 42505  PROJECT NAME: WARP-05  PROGRAM: WARP
SCREENED FORMATION: WARP  DRILLING CONTRACTOR: RTA  BORING METHOD: Geograde
DATE DRILLED: 8/16/05  DATE COMPLETED: 8/16/05  TOTAL DEPTH: 21.9  COMPLETED DEPTH: 21.9
ESTIMATED DEPTH TO BEDROCK: 16.0  RIG GEOLOGIST: J. Bogdan
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.25  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): DRY 8/16/05  COMPLETED WATER LEVEL (FT, DATE): DRY 8/17/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1" well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Steel above ground

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.0
SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 3.0  ID (IN): 1.0
SURFACE SEAL TOP: 4.0  BOTTOM: 1.0  TYPE: Granular bentonite
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 0.65, 6", steel
WELL PAD DIMENSIONS, TYPE: 2' x 1.9' x 0.35' concrete 0.5"
ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
CENTRALIZER(S) DEPTH(S): N/A
GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
GRANULAR BENTONITE TOP: 0.0  TYPE: Granular bentonite (CETCO)
BENTONITE SEAL TOP: N/A  TYPE: N/A
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0
FILTER PACK TYPE: 16/40 silica sand  BRAND: Ogilby Norton
SURFACE CASING BOTTOM (= SCREEN TOP): 4.91  TYPE: Sch. 80 PVC
SCREEN ID (IN): 1.0  SLOT SIZE (IN): 0.010  TYPE: Sch. 80 PVC USFilter
SCREEN BOTTOM (= SUMP, TOP): 21.80  SUMP TYPE: Threaded end cap
FILTER PACK BOTTOM (= BACKFILL TOP): 21.90  BACKFILL TYPE: Bentonite pellets
SUMP BOTTOM (= WELL COMPLETED DEPTH): 21.90  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 22.0
REMARKS: Located at approximate west edge of former PACS3 parking lot; borehole materials predominantly soft, wet fill
COMPLETED BY: J. Bogdan  DATE: 8/16/05
CHECKED BY:  DATE: 

FLUSH-MOUNT EXAMPLE FOR PROBED WELL
<table>
<thead>
<tr>
<th>DEPTH INTERVAL</th>
<th>SAMPLE NUMBER</th>
<th>ROCK TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td>CL</td>
<td>Clay <em>Annes</em> sand, silt, s. gravel; very dark gray to yellowish brown (10YR3/1 - 10YR 3/4), mottled. Scattered gravel clasts to 1&quot;, predom. qtz, also Festuca Lymanii, silt. Fill, reworked clays. Moist, pliable. Slight increase in gravel (still trace) below 0.0&quot; but not uniformly scattered. Inc. moisture below 7.1&quot; to soft, v. moist. Lot of organic debris @ 8.2&quot; (reworked).</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
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<tr>
<td>9.0</td>
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</tbody>
</table>

NOTES:
- General: USCS is modified for this log as follows:
- Procedure No. RMRS/OPS-PRO.101

Materials amounts are estimated by % volume instead of % weight.

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.
NOTE: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101

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<thead>
<tr>
<th>Depth Interval</th>
<th>Sample Number</th>
<th>Investigation</th>
<th>Medium</th>
<th>Sedimentology</th>
<th>Analysis</th>
<th>Comments</th>
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<tr>
<td>20.0 - 22.0</td>
<td></td>
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<td></td>
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<td></td>
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<td>22.0 - 22.0</td>
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<tr>
<td>22.0 - 22.0</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Sample Description**

Claystone, same as above (below 18.0').
Occ. Fine silt, but v. minor, poss. as v.s.u., rip-up clasts. Core flushed, damaged. Residual.

**TD = 22.0'**

**Notes:** General: USCS is modified for this log as follows:

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101

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<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5967</td>
<td>Protective Casing, 6&quot; Steel</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5966</td>
<td>Casing, Sch 80-PVC, 1 in. ID.</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5965</td>
<td>Concrete Seal</td>
<td>1</td>
<td></td>
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<tr>
<td>5964</td>
<td>Concrete Pad</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5963</td>
<td>Hydrated Granular Bentonite</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5962</td>
<td></td>
<td>1</td>
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<td>5961</td>
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<td></td>
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<tr>
<td>5960</td>
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<td>4</td>
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<td></td>
</tr>
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</table>

CL: Gravelly Clay with trace sand - fill. Brown (10YR5/3) with some yellowish brown (10YR5/6). Iron oxidation mottled throughout. ~5% - 10% gravel (1/4" - 3/4" diameter, subrounded). Clay has medium plasticity. Abundant 1" - 2" diameter, subrounded cobbles from 0.0' to 0.8'. Cobbles of asphalt at 1.7'. Cohesive. Moist.

No recovery.

CL: Silty Clay with trace to some gravel and trace sand - fill. Yellowish brown (10YR5/6) with trace grayish brown (10YR5/2) mottling. Clay matrix (low plasticity) with 3 - 7% gravel (1/4" - 1/2")
diameter, subangular). Strong pervasive iron oxidation from 4.0' to 4.3'. Pink (7.5YR7/3) to light brown (7.5YR6/3) caliche-rich zone from 5.0' to 6.0', loosely consolidated to unconsolidated. Interval is overall loosely consolidated. 2" diameter, subrounded quartzite cobbles at 4.5' and 4.9'. Thin (1/2" thick) cobble of ironstone in iron oxidized siltstone at 7.0'. Caliche in clay matrix at 7.9'. Caliche blebs common from 9.0' to 9.8'. Moist.

---

CL: Silty, Sandy Clay with trace to some gravel - fill. Light yellowish brown (10YR6/4) to brownish yellow (10YR6/6). 7 - 15% sand (medium grained, subangular) with blebs of caliche throughout. ~5% gravel (1/4" - 3/4" diameter, subangular). Low plasticity. Moderately consolidated. Lens of dark reddish brown (7.5YR3/4) clay from 10.0' to 10.2'. Silty lens, brownish yellow (10YR6/6) at base of interval. Moist.

No recovery.

---

CL: Silty Clay with trace gravel and trace sand - fill. Pale brown (10YR6/3) to very pale brown (10YR7/3). Abundant caliche throughout interval. Loosely consolidated. Includes lenses of some dark reddish brown clay at 12.4' to 12.7' (as at 9.8' to 10.4') and asphaltic material from 14.6' to 14.9'. Slightly moist.
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GC/CL: Gravelly Clay with trace to some sand - fill. Same as interval from 15.6' to 19.2'.

GC: Gravel, asphalt and road base - fill. Very dark brown (10YR2/2) to black (10YR2/1). Unconsolidated.

GC/CL: Gravelly Clay with trace to some sand. Brown (10YR5/6) with grayish brown (2.5Y5/2) mottling. 5 - 20% gravel and cobbles (1/2" to 1-1/2" diameter, subrounded to subangular). Interval is a mixture of Rocky Flats Alluvium and displaced claystone. Moderately consolidated, except in cobbly zones. Some disseminated caliche throughout. Moist.

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GC/CL: Clay with some gravel and some sand. Dark brown (10YR3/3) to brown (10YR4/3) with some dark yellowish brown (10YR4/6). Distinct color change. Some gravel and cobbles (1/2" to 1-1/2" diameter, subangular to subrounded, predominately quartzite and schist). Medium plasticity. Moist.

No recovery.

GC/CL: Clay with some gravel and some sand. Same as interval from 19.2' to 19.7'. Disseminated caliche common from 20.0' to 23.9'. Moist. Asphalt cobble at 23.8'.

Page 3 of 5
CL: Clay with trace to some sand and trace gravel. Brown (10YR5/3) with yellowish brown (10YR5/6) and reddish brown (5YR4/4) mottling. Caliche-rich, crumbly zone from 24.8' to 25.2'. Overall, interval is moderately consolidated. Low plasticity. Very moist.

CL: Clay with trace gravel and trace sand. Predominately displaced (re-worked) claystone with gravel and sandy lenses. Gray (10YR5/1) to grayish brown (10YR5/2) with yellowish brown (10YR5/4 to 10YR5/6) mottling. Distinct color change. Overall, interval is firm, dense, and cohesive. Strong pervasive iron oxidation and crumbly from 26.3' to 26.5'. Sandy lens with disseminated caliche from 26.9' to 27.1'. 2" quartzite cobble at 29.0'. Reddish brown (5YR4/3) clay lens with disseminated caliche and gravel at 31.5'. Crumbly lenses of caliche with trace sand and gravel common from 31.5' to 33.2'. Very moist. Weak to moderate plasticity.
CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock), predominately unweathered. Grayish brown (10YR5/2) to dark grayish brown (10YR4/2). Firm and dense. Black organic stringers common throughout. Trace iron oxide at 33.5' and 33.7'. Moist from 33.2' to 34.0', then slightly moist from 34.0' to 34.5'. Bedrock contact is subtle, distinguished by lack of sand and gravel lenses.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 45605  PROJECT NAME: CVPs Well Replacements  PROGRAM: Water Programs  WMP
SCREENED FORMATION: 01/40  DRILLING CONTRACTOR: RTE  BORING METHOD: Geoprobe
DATE DRILLED: 9/26/05  DATE COMPLETED: 10/3/05  TOTAL DEPTH: 39.5  COMPLETED DEPTH: 34.0
ESTIMATED DEPTH TO BEDROCK: 33.2  RIG GEOLOGIST: E. Wmep  LOGGING GEOLOGIST: E. Wmep
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.5"  QUANTITY OF FLUIDS LOST DURING DRILLING:
INITIAL WATER LEVEL (FT, DATE): Dry on 10/3/05  COMPLETED WATER LEVEL (FT, DATE): Dry on 10/7/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):
  - SECONDARY CASING TOP:
    - BOTTOM: NA  TYPE: NA
  - SURFACE CASING TOP:
    - ID (IN): 1.0"
  - SURFACE SEAL TOP:
    - BOTTOM: 1.95"  TYPE: Concrete
  - PROTECTIVE CASING BOTTOM, ID (IN.):
    - TYPE: 6" Steel
  - WELL PAD DIMENSIONS, TYPE: 2.5 x 25 Concrete in 9.5 x 9.5 x 9.5
  - ADD'L CASING FILL TOP:
    - BOTTOM: NA  TYPE: NA
  - SURFACE ISOLATION CASING TOP:
    - BOTTOM: NA
  - SURFACE ISOLATION CASING ID (IN.):
    - TYPE: NA
  - OTHER (E.G., ASEPTIC) CASING TOP:
    - BOTTOM: NA
  - OTHER CASING ID (IN.):
    - TYPE, PURPOSE: NA
  - CENTRALIZER(S) OD (IN.):
    - NUMBER USED: NA  TYPE: NA
  - CENTRALIZER(S) DEPTH (S):
    - NA
  - GROUT TOP:
    - NA  MEASURED DENSITY (lbs/gal): NA  TYPE: NA
  - GRANULAR BENTONITE TOP:
    - TYPE: NA
  - BENTONITE SEAL TOP:
    - 1.95"  TYPE: Granular Bentonite - "Cerro"
  - BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP):
    - 9.0'
  - FILTER PACK TYPE:
    - 1/40 Silica Sand  BRAND: CSI, S.I. 80
  - SURFACE CASING BOTTOM (= SCREEN TOP):
    - TYPE: Sch.40 PVC
  - SCREEN ID (IN.):
    - 1.0"  SLOT SIZE (IN.): 0.01"  TYPE: Sch.40 PVC
  - SCREEN BOTTOM (= SUMP, TOP):
    - TYPE: Threaded end cap. Sch.40 PVC
  - FILTER PACK BOTTOM (= "BACKFILL TOP."
    - "BACKFILL TYPE:
      - TYPE: Granular Bentonite - "Cerro"
  - SUMP BOTTOM (= WELL COMPLETED DEPTH):
    - TYPE: "PILOT HOLE TOP, DIAMETER:
    - TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM):
    - 39.5
  - REMARKS: Routine well installation on 9/26/05. Well pad and protective casing installed on 10/3/05

COMPLETED BY: Ellen S. Wmep  DATE: 10/5/05
CHECKED BY:  DATE: 

FLUSH-MOUNT EXAMPLE FOR PROBED WELL

*Flush-Mount Example for Probed Well*
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 4S05
Location - North: E
Date: 9/30/05
Geologist: E. Warr
Drilling Equip.: 66 FT Geoprime

Surface Elevation: 34.5
Area: S of 5th Ave.
Total Depth: 100.5
Company: RHS/ETC
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL: 
DATE 10/3/05

SAMPLE DESCRIPTION

0.0 - 2.6' gravelly clay w/Fe sand - Fill. Gravel 90% sand (90% Fe), 10% gravel (10% Fe) sandy matrix. Gravel matrix 90% sand, 10% gravel. Clay has medium plasticity. Abundant 1-2" dia. sub-rounded cobbles from 0.0 to 0.8". Cobbles of asphaltic origin.

2.6 - 4.0' = No recovery

4.0 - 9.8' - Silty clay w/ Fe to some gravel and Fe sand. Yellowish brown (10YR 5/8) with grayish brown (10YR 5/2) matrix. Clay matrix (low plasticity) 3/7 gravel (3/4 - 1/4" dia., sub-angular). Strong por. Fe sand from 4.0 - 4.3'. Pink (5YR 8/6) to 4.3' brown (7.5YR 4/2). Caliche-pitch zone from 5.0 - 6.0' loosely consolidated to unconsolidated. Interval is overall loosely consolidated. 2" dia. sub-rounded cobbles of 9/27c cemented in 4.5 and 4.9'.

6.8 - 8.0' thick soft caliche on top, cemented in 7.9'. Caliche blebs commonly found. 9.0 - 9.8' = MOIST.
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 45605  
**Location - North:**  
**Date:** 9/18/05  
**Geologist:** C. Warp  
**Drilling Equip.:** 240 DT hammer

**RMRS LOGGING SUPERVISOR**  
**APPROVAL**  
**DATE:** 10/18/05

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.8 - 10.4'</td>
</tr>
<tr>
<td>10.4 - 12.6'</td>
</tr>
</tbody>
</table>

| 12.0 - 14.9' | Silty clay, 2% gravel and fine sand. Pale brn. (10/04/04) to v. pale brn. (10/04/04) 1% plasticity. Moderately consolidated, SH moist. |  
| 14.9 - 15.2' | Gravelly clay, 2% to fine sand (as described below to 15.6 - 19.2')). |

| 15.2 - 15.6' | Gravelly clay, 2% to fine sand. V. dark brn. (10/04/04) to dk. brn. (10/04/04) unconsolidated. |

| 15.6 - 19.2' | Gravelly clay, 2% to fine sand. Brn. (10/12/04) to gray brn. (2yR-3/4) with 5-20% gravel and cobbles (1/4-3/4) d.a. Sub-rounded to subangular. Moderately consolidated except in cobbles and clasts. Is a mixture of Rocky Flats alluvium and displaced claystone. Moderately consolidated except in cobbles and clasts. Some clay, caliche throughout. MOIST. |

| 19.2 - 19.9' | Clay, 2% gravel and some sand. Pale brn. (10/04/04) to brn. (10/04/04) at some dk. yellowish brn. (10/04/04) 1% plasticity. Distinct of 2r change. Clay has medium to high plasticity. Some gravel and cobbles. MOIST. |

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.  

Procedure No: RMRS/OPS-PRO.101  
Revision 0  
Date effective: 12/31/98  
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 15605
Location - North: 
East: 
Date: 9/30/05
Geologist: C. Narw
Drilling Equip: 04 DF Degraded

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 10/3/05

SAMPLE DESCRIPTION

200-240. Clay w/some gravel and some sand. Same as as 19.2-19.7. Discol Caliche common. An. 20.0-23.0. MOIST.
Asphalt cobble @ 23.8'.

240-260. Calcy x'to sand and gravel. Brn. (10% Brn. (10% Brn. (10%) and redish brn. (5%) mixing). Caliche rich, crumbly zone from 24.5 to 25.2. Overall, interval is moderately consolidated, low moisture.

260-35.2. Clay x'to sand and gravel. Predominantly (expanded)石膏(water) grey (49%) to greyish brown (40%) and sandy brown (10%) mixing. Overall interval is firm and cohesive.
- S. per Bahan, very wet @ 26.0 to 26.6.
- Sandy brown, caliche. Caliche from 26.6 to 27.5.
- 2'b debr (pale) to 2.6
- Reddish brn. (5%) and white Ye. caliche and grade from 29.5.
- Clayey Caliche 7% sand and grade from 31.5 to 33.5. V. Moist, not to mod. plasticity.
<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>Clay with gravel and sand. (see pg. 25 for description)</td>
</tr>
<tr>
<td>31</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
</tr>
<tr>
<td>32.2</td>
<td>Bedrock contact is subtle, distinguished by lack of sand and gravel layers.</td>
</tr>
<tr>
<td>33.2</td>
<td>Bedrock contact</td>
</tr>
<tr>
<td>33.5</td>
<td></td>
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<tr>
<td>34</td>
<td>33.2-34.5 - Claystone, Bedrock (predominantly argillaceous)</td>
</tr>
<tr>
<td>34.5</td>
<td>33.2-34.0 - Sandstone, 34.0-34.5 - T.D. C 34.5</td>
</tr>
</tbody>
</table>

**NOTES:**

- General: USCS is modified for this log as follows:
  - Procedure No. RMRS/OPS-PRO.101
  - Revision 0
  - Date effective: 12/31/98

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
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<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
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<tbody>
<tr>
<td>5843</td>
<td>Protective Casing, 5&quot; square Steel</td>
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<td>5842</td>
<td>Casing, Sch 40-PVC, 2 in. ID.</td>
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<tr>
<td>5841</td>
<td>Concrete Seal</td>
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<td></td>
</tr>
<tr>
<td>5840</td>
<td>Concrete Pad</td>
<td>0</td>
<td>CL: Clay with some gravel, dark brown (7.5YR3/2). Organic-rich topsoil. 5 - 8% gravel (3/4&quot; - 1&quot; diameter, subrounded, predominately quartzite and granite). Medium to high plasticity. Dry.</td>
<td></td>
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<tr>
<td>5839</td>
<td></td>
<td>1</td>
<td>GC: Gravel with some clay, dark brown (7.5YR3/2) clay. 80% gravel (cobbles 1&quot; - 2&quot; diameter, quartzite and granite). Dry.</td>
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<tr>
<td>5838</td>
<td>Hemplspan Bentonite Pastea</td>
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<td>No recovery.</td>
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<tr>
<td>5836</td>
<td></td>
<td>4</td>
<td>No recovery.</td>
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<td>GC: Gravel with some clay and silt. Dark grayish brown (2.5Y4/2). Cobbles (1/2&quot; to 1-1/2&quot; diameter, subangular) of quartzite with some clay. Very poor recovery, probably due to clogged split spoon.</td>
<td></td>
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### LOG OF BORING NUMBER: 51605

<table>
<thead>
<tr>
<th>Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slightly moist.</td>
<td>No recovery.</td>
</tr>
<tr>
<td>CL: Clay with some silt and sand and trace gravel. Dark grayish brown (2.5Y4/2) with dark gray (2.5Y4/1) and gray (2.5Y5/1) mottling. Medium to high plasticity. Sandy lense (weak iron oxidation) from 6.6' to 6.8', dark grayish brown (2.5Y4/2). Trace disseminated iron oxidation throughout. 45 deg fracture at base of interval with caliche coating, or rock flour at edge of cobbles causing lost recovery. Slightly moist to moist.</td>
<td>No recovery.</td>
</tr>
<tr>
<td>GC/CL: Gravel/Sandy Clay mixture, gray (2.5YR5/1) and grayish brown (2.5Y5/2). 40 - 45% gravel (1/4&quot; - 1&quot; diameter, subangular, predominate quartzite). ~40% clay, moderate plasticity. ~15% sand (coarse grained). Moderate iron oxidation from 8.5' to 8.8'. Ironstone fragments at 8.5'. Clay is slightly &quot;ribboned&quot; at base, probably pushing a cobble. Moisture increases to moist.</td>
<td>No recovery.</td>
</tr>
<tr>
<td>GC/CL: Gravel/Sandy Clay mixture, same as interval from 8.0' to 9.3'. 1-1/2&quot; diameter, subangular quartzite cobble at 10.1'. Moist.</td>
<td></td>
</tr>
<tr>
<td>SILTSTONE: TOP OF BEDROCK. Clayey Siltstone (bedrock) gray (10YR5/1). Very silty from 10.1' to 11.0', then increasing clay from 11.0' to 13.0'. Trace iron oxidation at 10.1'. Massive texture, faint laminations (bedding planes) visible. Weakly friable. Some black organic material from 11.5' to 12.2'. Abundant black organic material from 12.2' to 12.3', decreasing to some from 12.3' to 13.0'. Slightly moist.</td>
<td></td>
</tr>
</tbody>
</table>
CLAYSTONE: Silty Claystone, brown (10YR5/3) with some yellowish brown (10YR5/6) mottling. Massive texture. Dense and firm. Weak iron oxidation mottling from 14.4' to 14.6' with trace manganese oxide associated with iron oxidation. Some black organic material (blebs) from 14.4' to 14.6'. Moisture decreases to very slightly moist.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 51605  PROJECT NAME: CY05 Well Replacement  PROGRAM: Water Programs
SCREENED FORMATION: 216.4  DRILLING CONTRACTOR: Layne  BORING METHOD: Hollow Stem Auger
ESTIMATED DEPTH TO BEDROCK: 10'-1"  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 6"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): DRY 4/27/05  COMPLETED WATER LEVEL (FT, DATE): DEPT 16.63"  ROC 4/28/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" I.D. Pvc. Well on 4/28/05
TYPE OF PROTECTION (FLUSH-MOUNT VS ABOVE GROUND ASEQIC, ETC.): 5" Square Steel

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.0" Casing
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.5" Casing  ID (IN): 2.0"
SURFACE SEAL TOP: 0.25" Casing  ID (IN): 0.25"  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 6.5"  TYPE: 5" Square Steel
WELL PAD DIMENSIONS, TYPE: 3' X 3'  Concrete  5" Dikes
ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEQIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
GRANULAR BENTONITE TOP: N/A  TYPE: N/A
BENTONITE SEAL TOP: 0.2"  TYPE: 1/4" Bentonite Pellets - Baroid Bond
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0'
FILTER PACK TYPE: 1/4" Silica Sand  BRAND: O.S.S.T.
SURFACE CASING BOTTOM (= SCREEN TOP): 4.3"  TYPE: Sch. 40 - Pvc
SCREEN ID (IN): 2.0"  SLOT SIZE (IN): 0.01"  TYPE: Sch. 40 - Pvc
SCREEN BOTTOM (= SUMP, TOP): 14.35"  TYPE: Threaded End Cap - Sch. 40 - Pvc
FILTER PACK BOTTOM (= *BACKFILL TOP): 14.7"  *BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 14.7"  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 14.7'

REMARKS: Routine well installation on 4/27/05. Well pad installed on 4/28/05

COMPLETED BY: Ellen S. Warp  Ellen S. Warp  DATE: 4/28/05
CHECKED BY: J. Baylson  DATE: 8/3/05
## Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 51605
**Location:** North: 01, East: 05
**Date:** 6/12/05
**Geologist:** E. warp
**Drilling Equip.:** CME-950 Auger Rig (Molyten)

### Sample Description

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.5'</td>
<td>CLAY w/ gravel, De. Brn (75%) and organic-rich topsoil. Vel. B of De. Brn (94%) clay. Sub-rounded, well-rounded, and granular. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>0.5 - 1.0'</td>
<td>GRAY w/ some clay and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>1.0 - 2.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>2.0 - 3.4'</td>
<td>CLAY w/ gravel and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>3.4 - 4.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>4.0 - 4.1'</td>
<td>ROCKET w/ some gravel, De. Brn (25%) and gravel (75%). Vel. B of gravel (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>4.1 - 4.2'</td>
<td>CLAY w/ gravel and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>4.2 - 5.0'</td>
<td>No recovery</td>
</tr>
<tr>
<td>5.0 - 5.6'</td>
<td>SAND w/ some gravel and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>5.6 - 6.0'</td>
<td>CLAY w/ gravel and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>6.0 - 6.6'</td>
<td>No recovery</td>
</tr>
<tr>
<td>6.6 - 7.2'</td>
<td>GRAY w/ gravel and De. Brn (25%). Vel. B of De. Brn (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
<tr>
<td>7.2 - 8.1'</td>
<td>No recovery</td>
</tr>
<tr>
<td>8.1 - 9.2'</td>
<td>SANDY CLAY MIXTURE. Vel. B of gravel (94%) and gravel (75%). Vel. B of gravel (94%) clay. Medium to high plasticity. DRY.</td>
</tr>
</tbody>
</table>

### Notes:
- General: U.S.G.S is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core: accurate footage measurements not possible.
  - (2) Core breaks cannot be matched: accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101
**Revision:** 0
Date effective: 12/31/98

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Borehole Number: 5/605</th>
<th>Surface Elevation: Replacement of well #1286</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location - North: 4/27/05</td>
<td>Total Depth: 19.7'</td>
</tr>
<tr>
<td>Geologist: E. WREP</td>
<td>Company: YRS/Handling</td>
</tr>
<tr>
<td>Drilling Equip.: DAE-750 Hollow Stem Auger</td>
<td>Project No: WADST300</td>
</tr>
<tr>
<td>Sample Type: Continuous Core-Split Spoon</td>
<td></td>
</tr>
</tbody>
</table>

RMRS LOGGING SUPERVISOR

APPROVAL

DATE 7/19/05

SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>TOPATION CODE</th>
<th>MATERIAL</th>
<th>FRACTURED</th>
<th>ANGLE</th>
<th>MAJORITY</th>
<th>ANOMALIES</th>
<th>DEPTH M</th>
<th>CMF</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>10'</td>
<td>Bedrock Contact</td>
<td>40'</td>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>10.1</td>
<td>Moist</td>
</tr>
<tr>
<td>10.1</td>
<td>10.1-12.0 - Gravel, Sandy Clay Mixtures, Same as Am. 8O-9.5, 1% oliv., Sub-angular gravel 0.10' Moist. Bedrock Contact 8.10'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-13.0 - Clayey Siltstone (Bedrock), 6% (10% silty) Am 10.1 to 11.0, Then incr. Clay Am. 11.0 to 12.0, FeOon 10.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-13.5 - Clayey siltstone (Weathered/FeOon), Yellish brown (10% silty). Med. friable FeOon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.5-14.0 - No recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-19.7 - Silty claystone, Brn. (10% silty)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES: General: USGS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5946</td>
<td>Protective Coating Steel, 8 in. ID</td>
<td>0</td>
<td>CL</td>
<td>Silty Clay with some gravel and trace sand, dark brown (10YR3/3) with some brownish yellow (10YR6/6) mottling. 5 - 10% gravel (1/4&quot; - 3/4&quot; diameter, subrounded). 3 - 5% sand (coarse grained, subangular). Weak iron oxidation as mottling in clay and as a coating on some coarse grained sand and gravel. Roots common. Trace disseminated caliche. Pliable, medium plasticity. 1-1/2&quot; diameter quartzite cobble (subangular) at 1.0'. Moist.</td>
<td></td>
</tr>
<tr>
<td>5945</td>
<td>Concrete Seal</td>
<td>1</td>
<td>CL</td>
<td>Silty Clay with trace to some gravel and trace sand, brown (10YR4/3) with some dark yellowish brown (10YR4/6) mottling. Very similar to interval from 0.0' to 1.5', decreased gravel and sand. Roots common to 3.6'. Trace to some disseminated caliche. Grades into black clay at base. Very moist and pliable.</td>
<td></td>
</tr>
<tr>
<td>5944</td>
<td>Bentonite Chips</td>
<td>2</td>
<td>CL</td>
<td>Silty Clay with trace to some sand and trace to some gravel,</td>
<td></td>
</tr>
<tr>
<td>5943</td>
<td></td>
<td>3</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5942</td>
<td></td>
<td>4</td>
<td>CL</td>
<td></td>
<td></td>
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<tr>
<td>5941</td>
<td></td>
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<td>CL</td>
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<td></td>
</tr>
<tr>
<td>5940</td>
<td></td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5939</td>
<td></td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
very dark gray (10YR3/1) with some dark yellowish brown (10YR3/4). Distinct color change. Trace to some sand (coarse grained, angular). Trace caliche, trace roots. Very soft and pliable. Very moist to saturated at 5.0'.


No recovery.

GM/ML: Clayey Sand/Silt/Gravel mixture, very dark gray (10YR3/1). ~70% clayey, sandy silt, ~30% gravel (1/4" - 1" diameter, subangular to subrounded). 1-1/2" diameter quartzite cobble at 8.2'. Predominately unconsolidated. Saturated.

CL: Silty Clay with trace to some sand and gravel, very dark brown (10YR2/2). 3 - 7% gravel (1/4" - 1/2" diameter, subrounded). Trace iron oxidation motting. Interval cohesive but soft and saturated.

CL: Clay with trace gravel, light olive brown (2.5Y5/4) and some dark greyish brown (2.5Y4/2), slightly mottled. Weak pervasive iron oxidation. Appears to be re-worked claystone. Cohesive, saturated.

No recovery.

CLAYSTONE: TOP OF BEDROCK. Claystone, yellowish brown (10YR5/6) with trace gray (10YR6/1) motting. Strong pervasive iron oxidation. Trace white stringers from 10.0' to 10.2'. Trace black organic stringers at base of interval. Cohesive interval. Decreasing moisture to very moist. Bedrock contact estimated due to poor recovery.

No recovery.

<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Unified Soil Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5929</td>
<td>Threaded End Cap - Sump Sch 40 PVC</td>
<td>14</td>
<td>CLAYSTONE: Claystone, yellowish brown (10YR5/6) with trace grayish brown (10YR5/2) mottling. Strong pervasive iron oxidation. Trace black organic stringers along bedding planes. Interval is firm and dense. Increasing silt (to claystone with silt) below 13.9'. Moist.</td>
<td>No recovery.</td>
<td></td>
</tr>
</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 6205 PROJECT NAME: Osos Well Replacement PROGRAM: Water Program
SCREENED FORMATION: O/PHL DRILLING CONTRACTOR: High Planet BORING METHOD: Hollow Stem Auger
DATE DRILLED: 5/14/05 DATE COMPLETED: 5/17/05 TOTAL DEPTH: 15.0' COMPLETED DEPTH: 15.0'
ESTIMATED DEPTH TO BEDROCK: 10.0' RIG GEOLOGIST: E.H. Warp LOGGING GEOLOGIST: E.H. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 5/14/05 COMPLETED WATER LEVEL (FT, DATE): 5/17/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground steel

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- **PROTECTIVE CASING TOP (STICKUP FOR FLUSH-MOUNT):** 3.5' above
  - **SECONDARY CASING TOP:** N/A BOTTOM: N/A TYPE: N/A
  - **SURFACE CASING TOP:** 3.0' above ID (IN): 2.0"
  - **SURFACE SEAL TOP:** 1.5' above BOTTOM: 0.5' TYPE: Concrete
  - **PROTECTIVE CASING BOTTOM, ID (IN), TYPE:** 1.5' steel
  - **WELL PAD DIMENSIONS, TYPE:** 3'x3' concrete 0.5' above
  - **ADD'L CASING FILL TOP:** N/A BOTTOM: N/A TYPE: N/A
  - **SURFACE ISOLATION CASING TOP:** N/A BOTTOM: N/A
  - **SURFACE ISOLATION CASING ID (IN):** N/A TYPE: N/A
  - **OTHER (E.G., ASEPITIC) CASING TOP:** N/A BOTTOM: N/A
  - **OTHER CASING ID (IN):** N/A TYPE: PURPOSE: N/A
  - **CENTRALIZER(S) OD (IN):** N/A NUMBER USED: N/A TYPE: N/A
  - **CENTRALIZER(S) DEPTH(S):** N/A
  - **GROUT TOP:** N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
  - **GRANULAR BENTONITE TOP:** N/A TYPE: N/A
  - **BENTONITE SEAL TOP:** 0.5' TYPE: Bentonite chips medium "Pure Gel" 4.0'

- **FILTER PACK TYPE:** 1/40 silica sand BRAND: O.S.S.I.
  - **SURFACE CASING BOTTOM (SCREENED):** 4.75' TYPE: Sch. 40 - PVC
  - **SCREEN ID (IN):** 2.0' SLOT SIZE (IN): 0.01' TYPE: Sch. 40 - PVC
  - **SCREEN BOTTOM (SUMP, TOP):** 14.75' SUMP TYPE: threaded end cap
  - **FILTER PACK BOTTOM (BACKFILL TOP):** 15.0' BACKFILL TYPE: N/A
  - **SUMP BOTTOM (WELL COMPLETED DEPTH):** 15.0' PILOT HOLE TOP, DIAMETER: N/A
  - **TOTAL BOREHOLE DEPTH:** 15.0'

- **REMARKS:** Rounding well installation on 5/14/05, well pad graced on 5/17/05
  - **COMPLETED BY:** Ewan. S. Warp DATE: 5/17/05
  - **CHECKED BY:** Ewan. S. Warp DATE: 5/17/05
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 52506  
**Location - North:**  
**Date:** 8/10/85  
**Geologist:** E. WARP  
**Drilling Equip.:** DAME-25-HT Auger Rig

---

**Surface Elevation:**  
**Area:** PG-2, Replacement of well #1986  
**Total Depth:** 15.0  
**Company:** VENUS/Hydro Phys.  
**Project No.:** HAD51900  
**Sample Type:** Auger "2spit" spoon

---

**RMRS LOGGING SUPERVISOR**

**APPROVAL**

---

**SAMPLE DESCRIPTION**

0.0 - 1.5 feet: silty clay w/some gravel and  
73% sand, 10% brown, 10% yellow (10YR6/6) matsling.  
5% gravel (4-8" dia, sub-rounded).  
3.0 feet: sand, 10% gravel and sand.

---

3.0 - 3.3 feet: silty clay w/some gravel and  
75% sand, 10% brown, 10% yellow (10YR6/6) matsling.  
5% gravel (4-8" dia, sub-rounded).  
3.0-3.6 feet: sand, 10% gravel and sand.  
3.6 - 4.0 feet: sand, 10% gravel and sand.  
4.0 - 4.5 feet: sand, 10% gravel and sand.  
4.5 - 5.0 feet: sand, 10% gravel and sand.  
5.0 - 5.5 feet: sand, 10% gravel and sand.  
5.5 - 6.0 feet: sand, 10% gravel and sand.  
6.0 - 6.5 feet: sand, 10% gravel and sand.  
6.5 - 7.0 feet: sand, 10% gravel and sand.  
7.0 - 7.5 feet: sand, 10% gravel and sand.  
7.5 - 8.0 feet: sand, 10% gravel and sand.  
8.0 - 8.5 feet: sand, 10% gravel and sand.  
8.5 - 9.0 feet: sand, 10% gravel and sand.  
9.0 - 9.5 feet: sand, 10% gravel and sand.  
9.5 - 10.0 feet: sand, 10% gravel and sand.  
10.0 - 10.5 feet: sand, 10% gravel and sand.  
10.5 - 11.0 feet: sand, 10% gravel and sand.  
11.0 - 11.5 feet: sand, 10% gravel and sand.  
11.5 - 12.0 feet: sand, 10% gravel and sand.  
12.0 - 12.5 feet: sand, 10% gravel and sand.  
12.5 - 13.0 feet: sand, 10% gravel and sand.  
13.0 - 13.5 feet: sand, 10% gravel and sand.  
13.5 - 14.0 feet: sand, 10% gravel and sand.  
14.0 - 14.5 feet: sand, 10% gravel and sand.  
14.5 - 15.0 feet: sand, 10% gravel and sand.

---

**NOTES:**

- USGS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core; accurate footage measurements not possible.
  - (2) Core breaks cannot be matched; accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO-101  
**Revision:** 0  
**Date effective:** 12/31/98

---

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**Some diagenic horizons (2.5YR6/6) slightly altered, but not filled.**  
**Appears to be re-worked claystone, cohesive, stabilized.**
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Borehole Number</th>
<th>Location - North:</th>
<th>East:</th>
<th>Surface Elevation</th>
<th>Area:</th>
<th>Total Depth:</th>
<th>Company: WECHL, Project No: NAP71300</th>
</tr>
</thead>
<tbody>
<tr>
<td>52505</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15.0</td>
<td></td>
</tr>
</tbody>
</table>

Geologist: E. Waep
Drilling Equip.: OME-06-117

RMRS LOGGING SUPERVISOR

<table>
<thead>
<tr>
<th>APPROVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
</tr>
<tr>
<td>6/8/05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedrock, Unit 10.0 ft estimated due to poor recovery.</td>
</tr>
<tr>
<td>10.0-11.1 ft: Claystone (Bedrock), Notches, w/ Gypsum (50%), w/ Gypsum (40%), No Notches.</td>
</tr>
<tr>
<td>11.0-12.0 ft: Black, organic stringers, base of interval. Cohesive interval. Dear moisture. T. D. is V. MOIST.</td>
</tr>
<tr>
<td>11.1-12.6 ft: No recovery.</td>
</tr>
<tr>
<td>12.0-13.7 ft: Claystone, T. D. w/ stringers. Gypsum (50%), w/ Gypsum (40%), No Notches.</td>
</tr>
<tr>
<td>Fleshy. T. D. w/ stringers.</td>
</tr>
<tr>
<td>13.0-14.1 ft: Black, organic stringers along bedding planes. Interval is firm and dense. T. D. is MOIST.</td>
</tr>
<tr>
<td>14.2-15.0 ft: No recovery.</td>
</tr>
</tbody>
</table>

Increasing salt (w/ claystone w/ lilt) below 13.9 ft. 6/8/05

NOTES: General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Construction and Materials</th>
<th>Depth (ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5998</td>
<td>Protective Casing: Steel, 6 in. I.D.</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5997</td>
<td>Casing, Sch 40-PVC, 2 in. I.D.</td>
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<td>5994</td>
<td>Hydrated Granular Bentonite and Bentonite Chips</td>
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<td>4</td>
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<td>Protective casing destroyed after installation; it, PVC stickup, and pad replaced.</td>
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</tbody>
</table>


No recovery.

SC/CL: Silty, Sandy Clay. Same as interval from 0.0' to 0.6'. Slight color change to strong brown (7.5YR5/8). Increased gravel to ~10%. Moist.

GC/CL: Gravel with silty, sandy clay. Brown (7.5YR5/4) to reddish yellow (7.5YR6/6) with some strong brown (7.5YR5/8) silty clay matrix. 15 - 25% shattered gravel (1/8" - 3/4" diameter, subangular, predominately quartzite with trace schist). ~10% sand (medium grained, subangular to subrounded). Cobbles up to 1-1/2" diameter common throughout. Loosely consolidated. Slightly moist.

No recovery.
### LOG OF BORING NUMBER: 55905

<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
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</table>

**GC/CL:** Gravel with silty, sandy clay. Same as interval from 2.2' to 3.0'. Moisture increases to moist.

**SMML:** Sandy, Clayey Silt with trace gravel. Brown (7.5YR5/4) grading into light yellowish brown (2.5Y6/3) at 5.8'. 35 - 40% sand (very fine grained). Cohesive. Moist. 1-1/2" cobbles of pegmatitic quartzite at base.

**No recovery.**

**GC/CL:** Gravel with silty, sandy clay. Same as interval from 2.2' to 3.0'. Loosely consolidated. Moist. 1-1/2" diameter quartzite cobble at 7.6'. Increasing silt at base.

**SC/CL:** Silty, Clayey Sand to Silty, Sandy Clay, strong brown (7.5YR5/8 to 7.5YR4/6) silty clay matrix. >40% sand (medium grained to coarse grained, subrounded to subangular). Some disseminated caliche throughout. Interval is cohesive, but pliable. Moist.

**CL:** Clay, brown (7.5YR4/4) with trace light olive gray (5Y6/2) mottling. Distinct change in color and soil type. Predominate light olive gray from 12.0' to 12.4'. Black organic stringers common from 10.0' to 11.5'. Dense and firm. Moist.

**GC/CL:** Gravel with silty, sandy clay. Matrix is pinkish gray (7.5YR6/2) with some light olive gray (5Y6/2) from 12.4' to 13.0', then predominately yellowish brown (10YR5/8). 15 - 25% gravel


GC/CL: Gravel with silty, sandy clay to silty, sandy clay with gravel. Same as interval from 12.4' to 14.0'. Loosely consolidated. Moist.

CL: Clay with trace silt. Same as interval from 14.0' to 14.6'. Moist.

GC/CL: Gravel with silty, sandy clay. Same as interval from 12.4' to 14.0'. Abundant sand at base of interval. Increasing moisture throughout interval. Moist from 16.1' to 17.0'. Very moist to wet (not flowing) from 17.0' to 18.8'.

No recovery.


CLAYEY SILTSTONE: TOP OF BEDROCK. Clayey Siltstone with trace sand to clayey, sandy siltstone. Weathered bedrock. Pale brown (10YR6/3) with some light gray (10YR7/1) mottling. Yellowish brown (10YR5/8) iron oxidation mottling throughout and along subhorizontal bedding planes. Trace faint black organic stringers. Dense and cohesive. Notable decrease in moisture at 19.5', from saturated at 19.5' to very moist from 19.5' to 22.0', moist from 22.0' to 24.0'. Slightly moist from 24.0' to 27.0'. Silty/very fine grained sandy lens with pervasive iron oxidation from 23.9' to 24.0'. Caliche-filled fracture from 22.1' to 22.4', near-vertical. Rip-up clasts of coarser material common, especially from 24.7' to 27.0'.
### LOG OF BORING NUMBER: 55905

<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
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<tr>
<td>5968</td>
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<td>27</td>
<td></td>
<td>CLAYSTONE: Claystone with some silt. Weathered bedrock. Yellowish brown (10YR5/6) to light yellowish brown (10YR6/4). Strong pervasive iron oxidation from 27.0' to 27.3'. Black organic stringers common. Dense and firm. Moisture decreases to trace. Silt rip-ups, laminae common.</td>
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<tr>
<td>5966</td>
<td>Threaded End Cap - Conical Sub-40 PVC</td>
<td>29</td>
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<td>Augers advanced to 29.6'. Interval not sampled.</td>
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<td>5965</td>
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<tr>
<td>0.0 - 0.6</td>
<td>Silty, sandy clay, fine to coarse gravel. Strong to very strong, silty clay matrix, medium plasticity (v. p. example). ~10% sand (e.g., sub-rounded), ~5% gravel (~1/4&quot; dia., sub-rounded to angular). Weakly consolidated, soft and pisolitic. Dry, with occasional fine sand-sized fragments throughout. Occasional 1/2&quot; cobbles. MOIST.</td>
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<tr>
<td>0.6 - 2.0</td>
<td>No recovery</td>
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<tr>
<td>2.0 - 2.2</td>
<td>Silty, sandy clay, fine to coarse gravel. Strong to very strong, silty clay matrix, medium plasticity (v. p. example). ~10% sand (e.g., sub-rounded), ~5% gravel (~1/4&quot; dia., sub-rounded to angular). Weakly consolidated, soft and pisolitic. Dry, with occasional fine sand-sized fragments throughout. Occasional 1/2&quot; cobbles. MOIST.</td>
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<tr>
<td>2.2 - 3.0</td>
<td>Gravel, fine to coarse gravel, silty, sandy clay, B.</td>
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<tr>
<td>(7 SYR 84)</td>
<td>Reddish yellow (7 SYR 84), % fine to coarse gravel, silty clay matrix, medium plasticity (v. p. example). Predominantly angular, with a few sub-rounded, sub-elliptical, and sub-elliptical cobbles. Loose, unconsolidated. MOIST.</td>
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<tr>
<td>3.0 - 4.0</td>
<td>No recovery</td>
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<tr>
<td>4.0 - 5.5</td>
<td>Gravel, fine to coarse gravel, silty, sandy clay, B.</td>
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<tr>
<td>(7 SYR 84)</td>
<td>Reddish yellow (7 SYR 84), % fine to coarse gravel, silty clay matrix, medium plasticity (v. p. example). Predominantly angular, with a few sub-rounded, sub-elliptical, and sub-elliptical cobbles. Loose, unconsolidated. MOIST.</td>
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<td>5.5 - 6.2</td>
<td>Silty, clayey silt, fine to coarse gravel, B.</td>
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<tr>
<td>(7 SYR 84)</td>
<td>Reddish yellow (7 SYR 84), % fine to coarse gravel, silty clay matrix, medium plasticity (v. p. example). Predominantly angular, with a few sub-rounded, sub-elliptical, and sub-elliptical cobbles. Loose, unconsolidated. MOIST.</td>
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<tr>
<td>6.2 - 7.0</td>
<td>No recovery</td>
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<tr>
<td>7.0 - 8.0</td>
<td>Gravel, fine to coarse gravel, silty, sandy clay, B.</td>
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<tr>
<td>(7 SYR 84)</td>
<td>Reddish yellow (7 SYR 84), % fine to coarse gravel, silty clay matrix, medium plasticity (v. p. example). Predominantly angular, with a few sub-rounded, sub-elliptical, and sub-elliptical cobbles. Loose, unconsolidated. MOIST.</td>
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<tr>
<td>8.0 - 9.5</td>
<td>Silty, clayey sand to silty sandy clay, B.</td>
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<tr>
<td>(7 SYR 84)</td>
<td>Reddish yellow (7 SYR 84), % fine to coarse gravel, silty clay matrix, medium plasticity (v. p. example). Predominantly angular, with a few sub-rounded, sub-elliptical, and sub-elliptical cobbles. Loose, unconsolidated. MOIST.</td>
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<tr>
<td>9.5 - 12.4</td>
<td>Clay. See page 206 for description.</td>
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</table>
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

PAGE 2 OF 3

Borehole Number: 55705
Location - North: 8/23/05
Geologist: E. Wood
Drilling Equip: CME-75-HT - Hollow Stem Auger

Surface Elevation:
Area: Former B559 - Replacement of well 55701
Total Depth: 29.6'
Company: USR High Plains Project No. HAOS/200
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR:
APPROVAL
DATE 8/29/05

SAMPLE DESCRIPTION

9.5'-12.4' - CLAY - Discolored Claystone.
Bnl. (75%+60%) of E Lm. olive gray (5Y6/2) mottling.
Distinct change in color and Subtype.
Predominately H. olive gray grn. 12.0'-12.4'.
Bilk. organic strings of element 10.0'-11.5'.
Dense and firm. MOIST.

12.4'-14.0' - GRAVEL +Silt, Sandy CLAY,
Matrix is pinkish gray (7.5Y6/4) & Some Lm. olive gray (5Y6/2) grn. 12.4'-13.0'. Then
predominately yellowish bnl. (10/6Y6).
15-25% gravel (14-34 ch. Subang. predominantly
gray & granite. 10-25% sand (29). Sub-
rounded to subangular. Mottled throughout.
Loosely consolidated. MOIST.

Yellowish bnl. (10/6Y6) w/ H. olive gray (5Y6/2) mottling.
Bilk. organic strings. Dense and firm. MOIST. @shale

14.6'-15.7' - GRAVEL +Silt, Sandy CLAY-
Matrix as above 14.0'-14.0'. Loosely consolidated. MOIST.

15.9'-16.1' - CLAY +T E Silt. Same as above. 14.0'-14.6'.
MOIST.

16.1'-18.8' - GRAVEL +Silt, Sandy CLAY-
Same as above 12.4'-14.0'. Abundant
Sand at base of interval. Increasing moisture
throughout interval. MOIST fm. 16.1' to 17.0'.
V. MOIST to wet (not flowing) fm. 17.0
to 18.8'.

18.8'-19.0' - No recovery

19.0'-19.5' - Silt, Sandy CLAY w/ some gravel.
Strong bnl. (75%+60%) w/ yellowish bln. (10/6Y6).
20-25% sand (29), sub-rounded. 15% gravel (14-34
Unconsolidated. SATURATED w/ flowing H. O.

Bedrock contact 19.5'.

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28

See page 31 for 19.5' description.
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 55705  
**Location - North:**  
**Date:** 8/23/05

**Geologist:** E. WARP  
**Drilling Equip.:** ONE-T/FNT-Hollow Stem Auger

**Surface Elevation:**  
**Area:** Former BS55 - Replacement of Well #55701  
**Total Depth:** 29.6`

**Company:** YES/High Plains  
**Project No.:** HAD51300  
**Sample Type:** Continuous Core

---

**RMRS LOGGING SUPERVISOR:**  
**APPROVAL:**

**DATE:** 9/28/05

**SAMPLE DESCRIPTION**

<table>
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<th>SAMPLE</th>
<th>DESCRIPTION</th>
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<tr>
<td>200'</td>
<td>19.5-220' Clayey Siltstone w/ sandstone. Weathered bedrock. Pale brown (10YR 4/6) w/ some t. gry. (10YR 7/4) notting. Yellowish brown (10YR 7/6) FedEx notable throughout and along sub-horizontal bedding planes. No faint blue organic strings. Dense and cohesive. Noticeable decrease in moisture @ 19.5', fm saturated @ 19.5' to moist @ 220', fm 19.5 to 220'. Moist fm. 220 to 24.0', Sl. moist fm. 24.0 to 27.0'.</td>
</tr>
</tbody>
</table>
| 21     | Silty v.f. g. sandy silt with v. per.  
| 22     | FedEx fm. 23.9 to 24.0', Caliche filled fracture @ 27.5' (22.4') near vertical. Rip-up clasts of caliche common, especially fm. 24.7 to 27.0'. |
| 23     | 27.0-270' Claystone w/ some silt. Weathered bedrock. Yellowish brown (10YR 7/6) to H. yellowish brown (10YR 7/6). Strong per. FedEx fm. 27.0 to 29.3. Blue organic strings common. Dense and firm. Decrease moisture to 2.4' fm. rip up. Laminar common.  
| 24     | 29.8-220' Claystone w/ some silt. Unweathered bedrock. Gray (10YR 6/4) w/ yellowish brown (10YR 7/6). faded along healed 45' fracture @ 28.0'. V. firm and dense. DRY.  
| 25     | Augers advanced to 29.6' - Not sampled. |
| 26     | T.D. @ 29.6' - 220' |

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**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/3/98  
**Page 27 of 28**
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Plezo[...]</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
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<td>5998</td>
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<tr>
<td>5997</td>
<td>Concrete Seal</td>
<td>GC/CL: Gravel with sandy, silty clay, brown (7.5YR5/4). ~75% silty clay matrix. 10 - 15% gravel (1/8&quot; - 1/2&quot; diameter, subangular). ~10% sand (coarse grained, subangular to subrounded). Some disseminated caliche. Weakly consolidated to unconsolidated. Moist. Quartzite cobbles (1-1/2&quot; diameter, subangular) at 0.0' and 0.5'. 1-1/2&quot; diameter cobbles (subrounded) of vesicular, lithic-rich material (man-made) at 0.5' (super-porous concrete?). 1-1/2&quot; diameter cobbles of schist at 1.0'.</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5996</td>
<td>Concrete Pad</td>
<td>GC/CL: Gravel with sandy, silty clay. Same as interval from 0.0' to 1.0'. Weakly consolidated. Increasing moisture from very moist at 2.0' to saturated (not flowing) at 3.0'.</td>
<td>No recovery.</td>
<td></td>
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<tr>
<td>5995</td>
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<tr>
<td>5994</td>
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</tbody>
</table>
GC/CL: Gravel with sandy, silty clay. Brown (7.5YR5/4) to light brown (7.5YR6/4). Similar to interval from 0.0' to 1.0', except increased gravel. 65 - 70% gravel and cobbles (1/4" - 1" diameter, subangular). ~10% sand. 20 - 25% silty clay matrix. Abundant caliche (disseminated and as blebs) in matrix from 4.5' to 5.0'. Saturated.

No recovery.

CL: Silty Clay with some sand and trace gravel. Appears to be re-worked claystone. Light gray (5Y7/2) to light olive gray (5Y6/2) with some yellowish brown (10YR5/6) iron oxidation mottling. Trace black organic stringers. Interval is firm and dense. Decreasing moisture to slightly moist. Sandy gravelly lenses at 10.6' and from 11.0' to 11.3' and from 11.8' to 12.0'. Strong pervasive iron oxidation at 11.3'. Some caliche at base of interval.

SM: Silty, Clayey Sand with some gravel. Strong brown (7.5YR5/8) silty matrix with ~80% sand (fine grained to medium grained, subrounded). Some gravel and some disseminated caliche from 12.0' to 12.6'. Interval is cohesive, but not firm. Increasing moisture to very moist.
SM/ML: Sandy, Clayey Silt with some gravel and cobbles. Strong brown (7.5YR4/6). 20 - 25% sand (coarse grained, subangular). 10 - 15% gravel (1/8" - 1/4" diameter, subangular). 60% clayey silt matrix. Some to abundant disseminated caliche throughout. Weakly consolidated. Very moist at top of interval, decreasing to slightly moist at base. Shattered 1" quartzite cobble fragments at 14.2' and 14.9'. Sandy silt lens from 15.0' to 16.0'.


No recovery.

CL: Silty Clay with trace sand. Same as interval from 16.0' to 16.6'. Slightly moist.

GC/CL: Gravel with sandy, silty clay. Strong brown (7.5YR4/6) with light brown (7.5YR6/3) and some light reddish brown (2.5YR6/3). 20 -25% gravel (1/4" - 3/4" diameter, subangular). ~10% sand (coarse grained) in silty clay matrix. Loosely consolidated. Some caliche throughout. Increasing moisture to moist. 1-1/2" cobbles at 17.4' and 19.0'.

SM/ML: Clayey, Silty Sand with some gravel. 25 - 30% sand (coarse grained, subangular to subrounded) in clayey silt matrix. 5 - 10% gravel (1/8" - 1/4" diameter, subangular to subrounded). Weakly consolidated. Saturated, flowing water.

GC/CL: Gravel with sandy, silty clay. Same as interval from 17.4' to 19.0'. Very moist, not saturated.

No recovery.

CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock), dark
grayish brown (10YR4/2) with some yellowish brown (10YR5/8) iron oxidation. Iron oxidation associated with rip-up clasts from 22.4' to 22.6' and on subhorizontal to subvertical bedding and fracture planes. Very dense and firm. Trace black organic stringers. Decreasing moisture to slightly moist. Iron oxide associated with fractures are most common from 22.3' to 23.6'.

CLAYSTONE: Claystone, gray (10YR5/1) to grayish brown (10YR5/2) with some yellowish brown (10YR5/8) iron oxidation. Firm and dense. Iron oxidation along subhorizontal and subvertical bedding and fracture planes. Some black organic stringers. Slightly moist. Trace to some silt. Decreased fracturing. Most iron oxides are on curvilinear bedding planes.

Reamed with augers, not sampled.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 56.305 PROJECT NAME: CYSW Well Replacement PROGRAM: Water Prog
SCREENED FORMATION: Clay Drilling CONTRACTOR: High Plains BORING METHOD: Hollow Stem Auger
DATE DRILLED: 9/1/05 DATE COMPLETED: 9/4/05 TOTAL DEPTH: 29.3' COMPLETED DEPTH: 29.3'
ESTIMATED DEPTH TO BEDROCK: 22.0' RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 11.6' on 7/26 COMPLETED WATER LEVEL (FT, DATE): 11.6' on 7/26 9/4/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/Well POINT/Etc.): 2" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.75' N/A
- SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
- SURFACE CASING TOP: 3.2' ID (IN): 2.0'
- SURFACE SEAL TOP: 1/4' ID (IN): 0.35' TYPE: Concrete
- PROTECTIVE CASING BOTTOM, ID (IN): 1.14' TYPE: 6" steel
- WELL PAD DIMENSIONS, TYPE: 3'x3' CONCRETE 6"x6" 0.35' x 0.35' x 6'
- ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
- SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
- SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
- OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
- OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
- CENTRALIZER(S) ID (IN): N/A NUMBER USED: N/A TYPE: N/A
- CENTRALIZER(S) DEPTH(S): N/A
- GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
- GRANULAR BENTONITE TOP: 0.35' TYPE: Enyouning No. 8 (gran bentonite)
- BENTONITE SEAL TOP: N/A TYPE: N/A
- BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 8.0'
- FILTER PACK TYPE: 1/4" SilicaSand BRAND: C.S.S.I
- SURFACE CASING BOTTOM (=SCREEN TOP): 9.05' TYPE: 3/4" 90 PVC
- SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: 3/4" 90 PVC
- SCREEN BOTTOM (= SUMP, TOP): 12.05' SUMP TYPE: Conical Threaded end cup
- FILTER PACK BOTTOM (= BACKFILL TOP): 29.3' BACKFILL TYPE: N/A
- SUMP BOTTOM (= WELL COMPLETED DEPTH): 29.3' PILOT HOLE TOP, DIAMETER: N/A
- TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 29.3'

REMARKS: N/A

COMPLETED BY: Ellen S. Warp DATE: 9/4/05
CHECKED BY: Elliot S. Warp DATE: 9/4/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 56305
Location - North: 
East: 
Date: 8/29/05
Geologist: 
Drilling Equip.: 

Surface Elevation: Area: 
Total Depth: 20.5
Company: 
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR

APPROVAL

DATE 8/29/05

SAMPLE DESCRIPTION

0-10' Wet sand and gravel, 25% gravel, 25% sand, 50% silt-rich material. Some clastic, likely consolidated to unconsolidated, moister.

20-30' Wet sand, massive fine sand, some gravel, slightly consolidated, slow moisture.

40-50' Wet sand, 10% gravel, similar to above, no recovery.

70-90' No recovery (cutting off at 90').

90-120' Silty clay, some silt and gravel. Appears to be a different claystone. Grain size: 50% silt, 50% sand. Few organic slugs, 6% moisture, softer soil. 25% gravelly layer, 1.5% silt, 60% sand. Some organic matter.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 46305
Location: North East
Date: 9/18/95
Geologist: E. Warr
Drilling Equip.: CME-7S-HT Hollow Stem Auger

Surface Elevation: 835.3' Above MSL
Area: Former B559 - Replacement of well 456301
Total Depth: 252.3'
Company: UC/High Plains Project No.: 1/4051300
Sample Type: Continously Core

RMRS LOGGING SUPERVISOR APPROVAL

DATE 5/29/97

SAMPLE DESCRIPTION

10.0 - 12.0 = Silty clay (55% montmorillonite) 12.0 - 13.1 = Silty sand w/ some gravel. Strong Brn (2.5% Fm) Silty matrix. 20 - 30% sand (Fm, to mg, sub-rounded). 13.1 - 16.0 = Sandy, Silty with some gravel (and cobbles). Strong Brn (2.5% Fm), 30 - 40% Sand (Fm-sub). 16.0 - 19.6 = Si with clayey silty matrix. Some to abundant clay, calcite through out. Very hard, consolidated. Most a loose, aerial deposit, to Sil clay (Fm) g by 16.2 and 18.9. Sandy, Silty dense from 15.0 - 16.0.

16.0 - 19.6 = No recovery.

19.0 - 20.2 = Silty Sand = some gravel. Clayey, 20 - 30% sand, (Fm, sub-rounded) to clayey silty matrix. 5 - 15% gravel (Fm, sub-rounded).

NOTES: General. USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Buggy broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 52305
Location - North: E, Wamp
Geologist: E. Wamp
Drilling Equip.: CAM-5K-HHT-Hollow Stem Auger

Surface Elevation: 01/26/05
Area: Former B359 - Replacement of well #156301
Total Depth: 29.3
Company: HBSY/High Plains, Project No. HAD57300
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR APPROVAL

SECTION

Layer

Description

Bedrock: Bedded of 0.220'
22.0 - 23.9: Claystone-Bedrock. Dk. gray, bn.
(on 10% w) & yellowish brn (on 10% w)
Firm and dense. Feldspar along sub-horizontal bedding planes. Some bkl. organic stringers
Sl. moist. Freness associated with fractures we must commence 22.3 - 23.6

23.9 - 24.0: Claystone - Dry (10% w) to dry
(on 10% w). Some yellowish brn (10% w) Fren
Firm and dense. Feldspar along sub-horizontal bedding planes. Some bkl. organic stringers
Sl. moist. Frequent associated with

24.0 - 24.2: Poorly consolidated Silt. Not sampled

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
CL: Clay with some gravel, very dark brown (7.5YR2.5/2), 5 - 7% gravel (1/2" - 1.5" diameter, subrounded). Roots common, topsoil. Moist.

GC: Sandy, Clayey Gravel, brown (7.5YR4/3). ~50% gravel (1/4" to 1" diameter, subangular, predominately quartzite), ~40% clay, ~10% sand (coarse grained). Clay has medium plasticity. Some patchy iron oxidation and patchy caliche, moist.

SC: Clayey, Gravelly Sand, strong brown (7.5YR4/6). 70 - 75% sand (medium grained, subangular to subrounded), 25 - 30% gravel (1/4" to 3/4" diameter, subangular, predominately quartzite). Pervasive iron oxidation of clay matrix (yellowish brown). Interval is crumbly. 2" subrounded quartzite cobble at 2.2'. Moist.

No recovery.

GM/SM: Sandy Gravel with some clay, strong brown (7.5YR5/6). ~50% gravel (1/4" - 3/4" diameter, subangular, quartzite and granite composition). ~50% silty/clayey sand (medium grained, subangular to subrounded). Pervasive iron oxidation of silty/clayey sand matrix, moist.

CL: Silty Clay with trace to some sand and gravel, yellowish brown (10YR5/6) to light yellowish brown (2.5Y6/3). Pervasive iron oxidation from 5.0' to 5.2', decreasing iron oxidation (weak and patchy) from 5.2' to 5.7'. Tiny white fragments disseminated throughout with white caliche stringers. Probably re-worked claystone, interval fairly dense and firm. 1" diameter angular clast of quartzite at 5.7'. Moist.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Pleizometer Construction and Materials</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology or Rock Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>5994</td>
<td>Filter Pack, 10x40 Silica Sand</td>
<td>CL: Sandy, gravelly clay, light yellowish brown (2.5Y6/3) with some patchy pink (7.5YR7/3) zones. 10 - 15% gravel (1/4&quot; - 1&quot; diameter, subangular to subrounded), 8 - 20% sand (coarse grained, subangular). Patchy bleaching and disseminated caliche throughout. Patchy iron oxidation at 7.0'. Interval crumbly, especially at base, moist.</td>
<td></td>
</tr>
<tr>
<td>5993</td>
<td>Screen, Sch 80-PVC, 1 in. ID, 0.010 in. slots</td>
<td>SC/GC: Clayey, Gravelly Sand, light brown (7.5YR6/3). 30 - 40% gravel (1/4&quot; - 1-1/2&quot; diameter, subangular), 40% sand (medium grained to coarse grained, subangular). Weak pervasive iron oxidation of clay/sand matrix, crumbly, broken quartzite cobble at top of interval from 7.1' to 7.3'. Wet from 8.5' to 9.0'.</td>
<td></td>
</tr>
<tr>
<td>5992</td>
<td></td>
<td>CL: Sandy, Gravelly Clay, light yellowish brown (2.5Y6/3) to light olive brown (2.5Y5/3) with patchy, red hematitic staining. 5 - 7% gravel (1/4&quot; - 1&quot; diameter, subangular). 2&quot; subrounded cobbles of quartzite common. Clay matrix is cohesive with medium plasticity. Decreasing water content to very damp, but not wet.</td>
<td></td>
</tr>
<tr>
<td>5991</td>
<td></td>
<td>CL: Sandy, Gravelly Clay, same as above from 9.0' to 10.1', but increased gravel to 10 - 15%. Very crumbly. Pinkish white caliche lens at 10.6'. Moist.</td>
<td></td>
</tr>
<tr>
<td>5990</td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5989</td>
<td></td>
<td>SC/GC: Clayey, Sandy Gravel, yellowish brown (10YR5/4) matrix (clayey sand). 40 - 50% gravel (1/4&quot; - 1.5&quot; diameter, subangular, predominately quartzite with lesser granite and schist). 40% sand (medium grained to coarse grained, subangular to subrounded). Shattered cobbles of quartzite common. Patchy pink/white caliche throughout. Unoxidized zone from 13.0' to 13.6', light yellowish brown (2.5Y6/3) with abundant clay and sand. Shattered quartzite cobble at 13.9'. Increased iron oxidation of clayey sand matrix from 14.0' to 15.3'. Interval very crumbly, very moist to wet, but not completely saturated.</td>
<td></td>
</tr>
</tbody>
</table>
SM: Silty Sand with some gravel, strong brown (7.5YR5/6). 90% silty sand (medium grained to very coarse grained, subrounded to subangular). Pervasive iron oxidation of silty sand matrix. -10% gravel (1/8" - 3/4" diameter, subangular to subrounded) predominately quartzite with lesser granite and trace schist. Interval very moist from 15.3' to 15.9', wet from 15.9' to 17.3'.

No recovery.

SM: Silty Sand with some gravel, same as above from 15.3' to 17.3', wet.

No recovery.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 63805  PROJECT NAME: FLYS WARP  PROGRAM: WATER PROGRAMS
SCREENED FORMATION: A1  DRILLING CONTRACTOR: RT6  BORING METHOD: Geoprobe
DATE DRILLED: 3/10/05  DATE COMPLETED: 3/10/05  TOTAL DEPTH: 20.0'  COMPLETED DEPTH: 19.5'
ESTIMATED DEPTH TO BEDROCK: N/A  RIG GEOLOGIST: E. WARP  LOGGING GEOLOGIST: E. WARP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.25"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 18.76 (1/20/05)  COMPLETED WATER LEVEL (FT, DATE): 6.69 (1/20/05)
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/ptype point/etc.): 1" PVC WELL
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTEC, ETC.): ABOVEGROUND PVC STICK-UP

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 1.7' A.G.
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 1.5' A.G. ID (IN.): 1.0
SURFACE SEAL TOP: N/A  BOTTOM: N/A  TYPE: N/A
PROTECTIVE CASING BOTTOM, ID (IN.): 0.4'  TYPE: 2" GLASS
WELL PAD DIMENSIONS, TYPE: N/A
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN.): N/A  TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN.): N/A  TYPE, PURPOSE: N/A
*CENTERLIZER(S) OD (IN.): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTERLIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: N/A  TYPE: N/A
*BENTONITE SEAL TOP: 0.0  TYPE: Granular Bentonite - Volclay crumbles
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.0'
FILTER PACK TYPE: 1/40 Silica Sand  BRAND: CSR
SURFACE CASING BOTTOM (= SCREEN TOP): 6.5'  TYPE: PVC - SCH. 80
SCREEN ID (IN.): 1.0'  SLOT SIZE (IN.): 0.010  TYPE: PVC - SCH. 80
SCREEN BOTTOM (= SUMP TOP): 19.4  SUMP TYPE: PVC - SCH. 80 THREADED END CAP
FILTER PACK BOTTOM (= BACKFILL TOP): 19.5'  BACKFILL TYPE: Granular Bentonite
SUMP BOTTOM (= WELL COMPLETED DEPTH): 19.5'  PILOT HOLE TOP, DIAMETER: 3.25'
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 20.0'

REMARKS: No Bedrock Encountered. 5 ppm PID HT @ 18.0' in Borehole which dissolved immediately. Smooth well installation.

COMPLETED BY: ELLEN S. WARP  DATE: 3/10/05
CHECKED BY:  DATE: 3/23/05
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 63805  
**Surface Elevation:**  
**Location - North:**  
**Date:** 3/11/15  
**Geologist:** G. W. Murphy  
**Drilling Equip.:** Lota DT \(660\)  
**Company:** URS/RTK  
**Sample Type:**  
**Project No.:** HAD51309  
**Motor:**  

### RMRS LOGGING SUPERVISOR APPROVAL

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>CL</td>
<td>6.0 - 6.6 - Clayey alluvial gravel. V. dark brown (7.5YR 2.5/2).</td>
</tr>
<tr>
<td>6.6</td>
<td>CL</td>
<td>5.7% gravel (4.5 to 1.5 mm) sub-rounded, R0.5 - 1.0.</td>
</tr>
<tr>
<td>10.0</td>
<td>CL</td>
<td>Brown, TERR. MOIST.</td>
</tr>
<tr>
<td>1.0</td>
<td>CL</td>
<td>0.6 - 1.0 - Sandy, clayey GRAVEL, brown (7.5YR 6/8).</td>
</tr>
<tr>
<td>5.5</td>
<td>CL</td>
<td>5% gravel (4.5 to 1.5 mm) sub-rounded, predominate small particles.</td>
</tr>
<tr>
<td>10.0</td>
<td>CL</td>
<td>40% clay, 10% sand (silt). Clay has medium plasticity. Some patchy FeOin and patchy talc in FeO inclusions. MOIST.</td>
</tr>
<tr>
<td>1.9</td>
<td>CL</td>
<td>1.9 - 2.2 - Clayey, gravelly SAND. Strong brown (7.5YR 4/4).</td>
</tr>
<tr>
<td>5.6</td>
<td>CL</td>
<td>70% sand (m.g., main to sub-rounded), 20% gravel (4.5 to 1.5 mm) sub-rounded to sub-angular.</td>
</tr>
<tr>
<td>4.0</td>
<td>CL</td>
<td>0.5% gravel, 5% silt clays, sand. Mois.</td>
</tr>
<tr>
<td>2.2</td>
<td>CL</td>
<td>Interval is crumbly, 2&quot; sub-rounded gravel cobble @ 2.2'.</td>
</tr>
<tr>
<td>2.2</td>
<td>CL</td>
<td>2.2 - 4.0 - No recovery.</td>
</tr>
<tr>
<td>9.6</td>
<td>CL</td>
<td>4.0 - 5.0 - Sandy GRAVEL. Some clay, brown (7.5YR 6/8), 5% gravel, 5% silt clays, sand. (m.g., sub-rounded to sub-angular). FeOin of silt clays.</td>
</tr>
<tr>
<td>5.0</td>
<td>CL</td>
<td>Interval of sand, gravel, and silt clays.</td>
</tr>
<tr>
<td>3.6</td>
<td>CL</td>
<td>Pivot, FeOin on 3.6 to 3.8, poor FeOin (non-patchy) in 3.8 to 4.5. Tiny white, fragmented throughout with calcite, clay coatings. Probably re-worked claystone. Interval fairly dense and firm, 1&quot; dia.</td>
</tr>
<tr>
<td>2.0</td>
<td>CL</td>
<td>Any clay of 6.0 to 8.4.</td>
</tr>
<tr>
<td>1.9</td>
<td>CL</td>
<td>1.9 - 7.1 - Sandy, gravelly CLAY, light yellowish brown (2.5Y 4/3) to brown (7.5YR 7.5).</td>
</tr>
<tr>
<td>8.0</td>
<td>CL</td>
<td>8 - 10% gravel (4.5 to 1.5 mm), sub-rounded to sub-angular.</td>
</tr>
<tr>
<td>7.1</td>
<td>CL</td>
<td>8 - 10% gravel (4.5 to 1.5 mm), sub-rounded to sub-angular.</td>
</tr>
<tr>
<td>2.1</td>
<td>CL</td>
<td>7.1 - 9.0 - Clayey, gravelly SAND. Light brown (7.5YR 4/3), to light yellowish brown (2.5Y 4/3).</td>
</tr>
<tr>
<td>5.7</td>
<td>CL</td>
<td>90% sand (m.g., sub-angular). No FeOin of clayey sand matrix, crumbly, broken system, possible hydrothermal alteration.</td>
</tr>
<tr>
<td>5.7</td>
<td>CL</td>
<td>Top of interval 7.1 - 9.3, WET in 5.7 to 6.0.</td>
</tr>
<tr>
<td>2.1</td>
<td>CL</td>
<td>9.0 - 10.1 - Sandy, gravelly CLAY, light yellowish brown (2.5Y 4/3).</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
1. Badly broken core, accurate footage measurements not possible.  
2. Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date Effective:** 12/31/98  
**Page:** 27 of 28
## ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

### Borehole Number: 43805
### Location - North: East:
### Date: 3/1/05
### Geologist: E. W. Rep
### Drilling Equip.: 1/44 DR GEOPLUG
### Surface Elevation: 2200
### Area: ROCK CREEK - REPLACEDTRY #63895
### Total Depth: 20.6
### Company: LUST & REN
### Sample Type: NIA
### Project No.: MAD57800

### RMRS LOGGING SUPERVISOR

<table>
<thead>
<tr>
<th>APPROVAL</th>
<th>DATE 2/21/05</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1 - 10.6' Sand, gravelly CLAY. Some as above fr. 10.6' to 10.1' but in gr. Gravel tcl 15% v, erumbly. Pinkish wht. calcite lenses. 10.6' moist.</td>
</tr>
<tr>
<td>10.6' - 11.6' No Recovery</td>
</tr>
<tr>
<td>11.6' - 12.6' Clayey, sandy GRAVEL. Yell low brown (10YR 7/4) matrix (clayey sand). 90% gravel (12 to 1/4 dia.) sub-rounded, predominately Qtz. W/lesses granite and silt.</td>
</tr>
<tr>
<td>12.6' - 13' Sand, gravelly CLAY. Some as above fr. 13.0' to 13.6'. Horizontal clay and sand. Shattered, pale green, calcite foliation. Increase Feldspar of clayey sand matrix. An 13.0' to 13.6'. Interval v. erumbly. V. moist to wet but not completely saturated.</td>
</tr>
<tr>
<td>13.6' - 14.6' Silty SAND of some gravel. Strong brown (15YR 7/4) 90% silty sand. (mrg. 10YR 7/6) sub-rounded Vs sub-angular. Peri. Feldspar of silty sand matrix. 107% gravel (1/4 to 1/4 dia. sub-rounded). Qtz. W/less Granite and silt. Interval v. moist fr. 13.6' to 14.6'.</td>
</tr>
<tr>
<td>14.6' - 15.3' No Recovery</td>
</tr>
<tr>
<td>15.3' - 16.3' WET fr. 15.3' to 16.3' (max 5' depth in borehole).</td>
</tr>
<tr>
<td>16.3' - 17.3' No Recovery</td>
</tr>
<tr>
<td>17.3' - 19.8' Silty SAND of some gravel. (Same as above fr. 19.8' to 18.0').</td>
</tr>
<tr>
<td>19.8' - 20.0' No Recovery</td>
</tr>
</tbody>
</table>

### NOTES:
General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98

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<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5994</td>
<td>Protective Casing, 6&quot; Steel</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5993</td>
<td>Casing, Sch 40/PVC, 2 in. ID</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5992</td>
<td>Concrete Seal</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5991</td>
<td>Concrete Pad</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5990</td>
<td></td>
<td>1</td>
<td></td>
<td>GC/CL: Gravel with sandy, silty clay. Fill. Strong brown (7.5YR5/6). ~50% shattered gravel (1/2&quot; to 1&quot; diameter, subrounded, quartzite and schist). ~50% sandy, silty clay matrix. Trace disseminated caliche. Unconsolidated. Very poor recovery due to cobbles of the unconsolidated fill clogging split-spoon shoe. Trace moisture.</td>
</tr>
<tr>
<td>5989</td>
<td></td>
<td>2</td>
<td></td>
<td>No recovery.</td>
</tr>
<tr>
<td>5988</td>
<td>Hydrated Granular Bentonite and Bentonite Pellets</td>
<td>3</td>
<td></td>
<td>GC/CL: Gravel with sandy, silty clay, same as interval from 0.0' to 0.3' with increased gravel and cobbles to ~70% (1/4&quot; - 1&quot; diameter, angular). Weakly consolidated to unconsolidated. Shattered quartzite cobbles from 2.0' to 2.1' (up to 1-1/2&quot; diameter fragments). Shattered quartzite and granitic cobbles from 1.5' to 1.6'. Moist.</td>
</tr>
<tr>
<td>5987</td>
<td></td>
<td>4</td>
<td></td>
<td>No recovery.</td>
</tr>
</tbody>
</table>
GC/CL: Gravel with silty, sandy clay, brown (7.5YR4/3). Distinct color change. ~25 - 30% gravel (1/8" - 3/4" diameter, subangular). ~20% sand (coarse grained, subangular). Clay has medium plasticity. Trace roots (?). Slightly moist.

SC/CL: Sandy, Silty Clay with trace to some gravel, brown (7.5YR4/3). Similar to interval from 4.0' - 5.2' with decreased sand and gravel. 15 - 20% sand (medium grained to coarse grained, subangular to subrounded). 5 - 7% gravel (1/8" - 1/4", subangular). Interval is cohesive but soft. Shattered granitic cobble (1" angular clasts) at base of interval. Moisture increases to moist.

SC/CL: Sandy, Silty Clay with trace gravel, red (2.5YR5/8). Distinct color change, otherwise similar to interval from 7.0' - 7.7'. ~20% sand (fine grained to medium grained, subangular to subrounded). Interval cohesive and soft. Moisture increases to very moist.

SC/CL: Sandy, Silty Clay with trace to some gravel, brown (7.5YR4/3). Same as interval from 7.0' - 7.7'. Very moist.

SC/CL: Sandy, Silty Clay with trace to some gravel, brown (7.5YR4/3). Same as interval from 7.0' - 7.7'. Increased moisture to saturated with flowing water.

SC/CL: Sandy, Silty Clay with trace gravel, red (2.5YR5/8). Distinct color change. Same as interval from 7.7' - 8.2'. Trace disseminated caliche. Decreased moisture, saturated but no flowing water.

SC/CL: Sandy, Silty Clay with trace to some gravel, red (2.5YR5/8). Same as interval from 7.7' - 8.2'. Moist and cohesive from 12.0' to 12.6'. Very moist to saturated and crumbly from 12.2' to 13.2'.

No recovery.
SM: Clayey, Silty Sand with some gravel and cobbles, brown (7.5YR4/2). 50 - 55% sand (coarse grained, subangular to subrounded). ~40% clayey silt, 5 - 7% gravel (predominately granite). Unconsolidated. Very moist to saturated, but not flowing. No recovery.

SM: Clayey, Silty Sand with trace gravel, brown (7.5YR4/2). Same as interval from 13.2' - 13.8', except decreased gravel to trace. Saturated, but not flowing.

SM/ML: Clayey, Silty Sand with trace gravel and silt mixture. Same as interval from 14.0' - 14.3' mixed with brownish yellow silt (reworked siltstone). Saturated, but not flowing.


CLAYEY SILTSTONE: Clayey Siltstone, same as interval from 14.8' to 16.8'. Firm and dense. Moist.

SILTY CLAYSTONE: Silty Claystone to Clayey Siltstone, weathered. Brownish yellow (10YR6/8) with pale brown (10YR6/3) and some gray (10YR2/1) mottling. Rip-up clasts from 18.2' to 18.7'. Trace black organic stringers. Silty lenses throughout, particularly between 21.0' and 22.0'. Pervasive iron oxidation from 21.5' to 22.0'. Overall massive texture. Firm and dense. Slightly moist.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5968</td>
<td></td>
<td>23</td>
<td></td>
<td>CLAYEY SILTSTONE: Clayey Siltstone (weathered bedrock), yellow (10YR7/6) to very pale brown (10YR7/4) with trace light gray (10YR7/1) mottling. Overall massive texture with very faint bedding planes. Dense and firm. Strong pervasive iron oxidation at 25.7'. Weakly friable. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5967</td>
<td></td>
<td>24</td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5966</td>
<td></td>
<td>25</td>
<td></td>
<td>SILTY CLAYSTONE: Silty Claystone to Clayey Siltstone (weathered bedrock). Pale brown (10YR6/3) with yellowish brown (10YR5/6) iron oxidation mottling. Massive texture. Firm and dense. Ironstone nodules (1/2&quot; diameter) at 26.2' and from 27.7' to 27.8' (1&quot; diameter, round). 3/4&quot; diameter ironstone nodule at 28.0'. Silty lenses from 27.0' to 27.3', and from 27.7' to 27.8'. Slightly moist to moist. Fines gradually and irregularly with depth.</td>
<td></td>
</tr>
<tr>
<td>5965</td>
<td></td>
<td>26</td>
<td></td>
<td>CLAYSTONE: Claystone (weathered bedrock), yellowish brown (10YR5/6) to yellow (10YR7/6) with trace light brownish gray (10YR6/2) mottling. Pervasive iron oxidation. Decreasing silt to trace. Occasional rip-up clasts. Dense and firm. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5964</td>
<td></td>
<td>27</td>
<td></td>
<td>CLAYSTONE: Claystone (unweathered), gray (10YR5/1) to grayish brown (10YR5/2) with trace light yellowish brown (10YR6/4) mottling. Decreasing iron oxidation to trace. Trace black organic stringers. Dense and firm.</td>
<td></td>
</tr>
<tr>
<td>Elev (ft)</td>
<td>Well or Piezometer Construction and Materials</td>
<td>Depth (ft)</td>
<td>Unified Soils Classification</td>
<td>Lithology or Rock Type</td>
<td>Lithologic Description</td>
</tr>
<tr>
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<td>------------------------</td>
</tr>
<tr>
<td>5959</td>
<td>Threaded End Cap, Conical Sump, Sch 40 PVC</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 72705  PROJECT NAME: City of Des Moines  PROGRAM: Water Programs
SCREENED FORMATION: 1/8-1/4 in.  DRILLING CONTRACTOR: High Plains  BORING METHOD: Hollow Stem Auger
DATE DRILLED: 8/1/05  DATE COMPLETED: 8/17/05  TOTAL DEPTH: 32.0'  COMPLETED DEPTH: 32.0'
ESTIMATED DEPTH TO BEDROCK: 14.8'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 11.02 ft.  9/6/05  COMPLETED WATER LEVEL (FT, DATE): 11.02 ft.  9/6/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEQIC, ETC.): Above ground steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.75
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 3.25 in.  ID (IN): 2.0"
SURFACE SEAL TOP: 1.75 in.  BOTTOM: 0.5"  TYPE: concrete
PROTECTIVE CASING BOTTOM, ID (IN), TYPE: 6" steel
*WELL PAD DIMENSIONS, TYPE: 3'x3' concrete
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: 0.5"  TYPE: Enviroleq No. 9 and Pure Gold
*BENTONITE SEAL TOP: N/A  TYPE: N/A

BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 6.00"
FILTER PACK TYPE: Silica Sands  BRAND: C.S.S.I.
SURFACE CASING BOTTOM (= SCREEN TOP): 6.75"  TYPE: Sch. 40 PVC
SCREEN ID (IN): 2.0"  SLOT SIZE (IN): 0.01"  TYPE: Sch. 40 PVC
SCREEN BOTTOM (= SUMP, TOP): 31.75"  SUMP TYPE: Threaded end cap - conical
FILTER PACK BOTTOM (= *BACKFILL TOP): 32.0"  *BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 32.0"  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM): 32.0'

REMARKS: Routine well installation

COMPLETED BY: Ellen S. Warp  DATE: 8/17/05
CHECKED BY:  DATE:
### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Interval</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.3'</td>
<td>Gravel w/ Sandy, Silty Clay. Fill. Strong brn. (7.5 YR 5/6), 52% sand, 16% gravel. Sub-rounded, grit-like fragments. 50% sandy, silty clay matrix. T.e. class siltie. Unconsolidated. No recovery due to cobbles of the unconsolidated fill clogging split spoon shoe. To moisture. 3.0 to 2.0' = No recovery.</td>
</tr>
<tr>
<td>2.0 - 3.0'</td>
<td>Gravel w/ Sandy, Silty Clay. Some as above from 0.0 - 0.3', increased gravel and cobbles to ~ 70% (9/16&quot;, 1/2&quot; dia., avg.). NVL column, consolidated to unconsolidated. Shattered, grit-like gravel 2.0 - 2.1&quot; (up to 1 3/4&quot;, dia. frags). Shattered, grit-like and granitic cobbles 1.5 - 1.6&quot;, MOIST. 3.0 - 4.0' = No recovery.</td>
</tr>
<tr>
<td>4.0 - 5.2'</td>
<td>Gravel w/ Silty, Sandy Gravel. Brn. (7.5 YR 3/4). Diameter range 418&quot; to 2.5%. Gravel 1/4&quot; - 3/4&quot;, Sub-rounded. 20% sand (e.g., sub-rounded). Clay has med. plasticity, becomes very dry, moisture to 5.2&quot;, MOIST.</td>
</tr>
<tr>
<td>5.2 - 7.0'</td>
<td>No recovery. Gravel may have flat, thin layers.</td>
</tr>
<tr>
<td>7.0 - 7.7'</td>
<td>Sandy, Silty Clay w/ Eocene gravel. Brn. (7.5 YR 4/5). Similar to 4.0 - 5.2&quot;, decreased sand and gravel. 16 - 20% sand (gray, to e.g., Sub-rounded). 5 - 7% gravel (8 - 9/16&quot;, sub-rounded). Interval is cohesive but soft. Shattered, granitic cobbles (1&quot; - 2&quot; dia.) at base of interval. Water moisture to MOIST.</td>
</tr>
<tr>
<td>7.7 - 8.2'</td>
<td>Sandy, Silty Clay w/ Eocene gravel. Rcl. (2.5 YR 5/6). Distinct color change, otherwise similar to above from 7.0 - 7.7&quot;, ~ 20% sand. Water moisture to V. MOIST. (8, 9/16&quot;, sub-rounded) Interval cohesive and soft.</td>
</tr>
<tr>
<td>8.2 - 8.6'</td>
<td>Sandy, Silty Clay w/ Eocene gravel. Brn. (7.5 YR 4/5). Same as above from 7.0 - 7.7&quot;, V. MOIST.</td>
</tr>
<tr>
<td>8.6 - 9.</td>
<td>No recovery.</td>
</tr>
<tr>
<td>9.0 - 9.7'</td>
<td>Sandy, Silty Clay w/ Eocene gravel. Brn. (7.5 YR 4/5). Same as from 7.0 - 7.7&quot;, Inc. moist. to Saturation/Flowing.</td>
</tr>
</tbody>
</table>

### NOTES:
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by volume instead of by weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
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Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
Page 27 of 28
## Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 70705  
**Location - North:**  
**Date:** 8/17/05  
**Geologist:** E. Wamp  
**Drilling Equip.:** CME 75 HT - Hollow Stem Auger  
**Surface Elevation:**  
**Area:** Former B-57 - Replacement of well 00200  
**Total Depth:** 320.0  
**Company:** USE/H.P.  
**Project No:** HAD51300  
**Sample Type:** Continuous Core

### RMRS Logging Supervisor

**Approval:**  
**Date:** 8/17/05

### Sample Description

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
</tr>
</thead>
</table>
| 200-240 | Silty Claystone (weathered bedrock)  
(described marker 2 1/2 ft) |
| 240-290 | Silty Claystone (weathered bedrock)  
Pale brn. (loose) & yellowish brn. (loose)  
Firm and dense,  
Massive texture,  
Ironstone nodules (1/2" dia) @ 262"  
and 277-278 (1" dia, round)  
3/4" dia, Ironstone nodules @ 280"  
Silty siltstone 270-273, and 277 to 279. Sl. moist to moist  
Fines gradually change to clay  
(When wet)  
(Wet Edges) |
| 290-305 | Claystone (loose)  
Yellowish brn. (loose)  
Pen. Feathery, Debris to E.  
Clayey, rip-up clasts |

### Notes:

- USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

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**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date Effective:** 12/31/98  
**Page:** 27 of 28
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0 - 30.5</td>
<td>Claystone (weathered bedrock) - described on page 3.49.</td>
</tr>
</tbody>
</table>

**NOTES:** General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Concrete Seal</td>
<td>1</td>
<td>Siltstone</td>
<td>Clayey Siltstone with trace to some sand in pockets (rip-up?), brownish yellow (10YR6/6) with some light gray (10YR7/1) mottling. Weak to moderate pervasive iron oxidation with some unoxidized mottling. Massive texture. Weak to moderately friable, trace roots. Slightly moist. Trace to some, very fine grained, sand.</td>
</tr>
<tr>
<td>2</td>
<td>Hydrated Bentonite Pastes</td>
<td>1</td>
<td>Claystone</td>
<td>Silty Claystone, light brownish gray (10YR6/2). Decreased iron oxidation to trace. Strongly friable, crumbly, trace roots, slightly moist.</td>
</tr>
<tr>
<td>2</td>
<td>Filter Pack, 16/30 silica sand</td>
<td>4</td>
<td>Siltstone</td>
<td>Claystone with some silt, light brownish gray (10YR6/2). Trace weak iron oxidation, predominately along bedding planes (subhorizontal) and fracture surfaces. Trace white caliche stringers and blebs. Massive texture, moderately friable, slightly moist.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0</td>
<td>Claystone</td>
<td>Claystone with some silt, pale brown (10YR6/3) with some gray (10YR5/1) mottling. Weak pervasive iron oxidation from 2.0’ to 2.1’. Increasing clay at base of interval. Moderately friable.</td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>Lithology</td>
<td>Lithologic Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
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<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>4.0' to 4.4'. Gray mottling from 4.4' to 4.8', with iron oxidation on internal fracture surfaces. Massive texture. Slightly moist from 4.0' to 4.4', increase to moist from 4.4' to 4.8'. Friable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>CLAYSTONE: Claystone with some silt, gray (10YR5/1) to grayish brown (10YR5/2). Weak iron oxidation along bedding planes. Massive texture, weak to moderately friable, slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>No recovery.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>CLAYSTONE: Claystone with trace silt, same as interval from 4.8' to 5.9'. Slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>CLAYSTONE: Claystone, gray (10YR6/1), predominately unoxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable. Slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>No recovery.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0</td>
<td>CLAYSTONE: Claystone, gray (10YR6/1), predominately unoxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable, slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>No recovery.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.0</td>
<td>CLAYSTONE: Claystone, gray (10YR6/1), predominately unoxidized. Faint undulating bedding planes visible. Trace black organic stringers throughout. Weak to moderately friable, slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLAYSTONE: Claystone, brown (10YR5/3), slight color change. Faint laminations (bedding planes) visible with trace to some black organic stringers on planes. Trace to some iron oxidation stringers along bedding planes and fracture surfaces. Weak to moderately friable, slightly moist.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CLAYSTONE: Claystone, gray (10YR5/1 to 10YR6/1). Weak iron oxidation along bedding planes at 11.6' and from 12.2' to 13.0'. Fissile and moderately friable, slightly moist. Iron oxidation along fracture surfaces, especially from 11.6' to 11.8' and 12.2' to 13.0'.</td>
<td></td>
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</tr>
</tbody>
</table>
SILTSTONE: Clayey Siltstone to silty claystone, pale brown (10YR6/3) to light brownish gray (10YR6/2). Weak iron oxidation on sub-horizontal bedding planes (approximately 4 to 6 iron-oxidized bedding planes per foot) and fracture surfaces. Trace black organic stringers. Notable iron oxidation coating 80 deg fracture from 18.9' to 19.2'. Color of iron oxidation is strong brown (7.5YR5/6). Iron oxidation on 20 deg fracture from 19.5' to 19.6'. Moisture decreasing to trace. Occasional iron oxidation-replaced organic debris fragments. Some intervals to silty claystone, but predominately clayey siltstone.

SILTSTONE: Clayey Siltstone to silty claystone, gray (10YR5/1). Notable color change. Decrease iron oxidation to trace as minor fracture coating. Massive texture, moderately friable. Increase moisture to slightly moist.
CLAYSTONE: Claystone with some silt, yellowish brown (10YR5/6) and gray (10YR5/1). Weak iron oxidation mottled throughout. Iron oxide coating ~80 deg fracture at 22.9'. Moderate pervasive iron oxidation from 23.7' to 23.8'. Moderately friable from 23.1' to 24.0', corresponding with increased moisture zone. Slightly moist from 22.7' to 23.1', moist from 23.1' to 24.0'.

CLAYSTONE: Claystone with trace silt, gray (10YR5/1) to light brownish gray (10YR6/2). Decreased iron oxidation to trace along bedding planes and fracture surfaces. Massive textured, moderately friable. Clay-rich (no silt) from 24.0' to 24.2' and slightly darker color (dark gray: 10YR4/1). Moist, decreasing to very slightly moist from 24.2' to 26.0'. Fissile between 24.5' and 25.7'. Trace black organic material.

CLAYSTONE: Claystone, grayish brown (10YR5/2). Massive texture, weakly friable. Iron oxidation along internal fractures at 26.3' and 27.0'. Very slightly moist.

CLAYSTONE: Claystone, dark gray (10YR4/1). Notable color change. Fissile and friable, trace moisture.

No recovery.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 73005  PROJECT NAME: CYSO Well Instrument Program: Present Landfill
SCREENED FORMATION: Park  DRILLING CONTRACTOR: Layne  BORING METHOD: Hollow Stem Auger
DATE DRILLED: 9/21/05  DATE COMPLETED: 9/27/05  TOTAL DEPTH: 280' COMPLETED DEPTH: 250'
ESTIMATED DEPTH TO BEDROCK: 0'  RIG GEOLOGIST: E. Waep  LOGGING GEOLOGIST: E. Waep
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Day, 9/21/05  COMPLETED WATER LEVEL (FT, DATE): Day, 9/27/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPATIC, ETC.): Arnie Brown Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.1' a.g.s.
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.7' a.g.s  ID (IN): 2.0
SURFACE SEAL TOP: 1.35' a.g.s  BOTTOM: 0.6' a.g.s  TYPE: CONCRETE
PROTECTIVE CASING BOTTOM, ID (IN): 1.5' 5" x 5" SQUARE STEEL
WELL PAD DIMENSIONS, TYPE: 3' x 3' SQUARE CONCRETE
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPATIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: N/A  TYPE: N/A
*BENTONITE SEAL TOP: 0.2'  TYPE: 1/4" Bentonite pellets - Brown and Hydrona Perm Plug 1 gal. of Distilled H2O
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0'
FILTER PACK TYPE: 1/4" Silica Sand  BRAND: 0, 5, 3, 2
SURFACE CASING BOTTOM (= SCREEN TOP): 4.6'  TYPE: Sch. 40 - PVC
SCREEN ID (IN): 2.0"  SLOT SIZE (IN): 0.01  TYPE: Sch. 40 - PVC
SCREEN BOTTOM (= SUMP TOP): 24.65'  SUMP TYPE: Threaded End Cap - Sch. 40 PVC
FILTER PACK BOTTOM (= "BACKFILL TOP" = 35.0')  "BACKFILL TYPE: 1/4" Bentonite pellets - Perm Plug
SUMP BOTTOM (= WELL COMPLETED DEPTH): 25.0'  "PILOT HOLE TOP, DIAMETER: 26.0' 2.5"
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM" = 28.0'

REMARKS: Routine well installation on 9/21/05. Top 2' of bentonite seal and protective casing installed on 9/23/05. Concrete well pad installed on 9/27/05
COMPLETED BY: Ewen S. Warp  Ellen S. Warp  DATE: 9/27/05
CHECKED BY: J. Boylan  DATE: 10/30/05
### Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 75006  
**Location - North:**  
**Date:** 6/27/05  
**Geologist:** E. Wasp  
**Drilling Equip.:** CME-750-Hollow Stem Auger

**Surface Elevation:** Present Landslides  
**Area:**  
**Total Depth:** 28.6'  
**Company:** USGS/Layne  
**Project No.:**  
**Sample Type:** Continuous Core-Split Spoon

#### RMRS Logging Supervisor
**APPROVAL**  
**DATE:** 6/29/05

#### Sample Description

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>100-10.5 - Claystone - Same as fm. 8.0 - 9.9'</td>
</tr>
<tr>
<td>11.0</td>
<td>10.5 - 11.6 - Claystone - Brn. (10/13/93) Slight color change, faint laminations (bedding planes) visible W/E to some bulk organic stringers on planes. To some Fe Ox stringers along bedding planes. WE moderately friable. Sl MOIST.</td>
</tr>
<tr>
<td>11.6</td>
<td>11.6- 13.6 - Claystone - Gry (10/94) to 41' Wk. Fcln on bedding planes at 11.6' and fm. 12.2 to 13.6' Fissile and moderately friable. Sl MOIST. Fractures, especially 12.6'-13.6'-13.8'</td>
</tr>
<tr>
<td>13.6</td>
<td>13.6 - 22.0 - Clayey Siltstone to silty clay - Pale Brn. (10/94) to lt. brtshgray. (10/94), Wk. Fcln on sub-horiz. bedding planes (approximately 14.6'). Fcln bedding planes perp. To bulk organic stringers. Notable Fcln coating 80° fracture thk. 18.9' to 19.2'. Color of Fcln is strong brn (75 YR 7/2). Fcln in 20° fracture thk. 19.5' to 46'. Moisture decreasing to FE. (Fcln replaced organic debris/friant). Some intervals to silty claystone, but predominately clayey siltstone. Sl MOIST.</td>
</tr>
</tbody>
</table>

#### Notes:
- General: USGS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - Badly broken core, accurate footage measurements not possible.
  - Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date Effective:** 12/31/98  
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<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>240-220 - Clayey Siltstone, silt, clay (described on pg. 2).</td>
</tr>
<tr>
<td>22.0</td>
<td>22.0-22.7 - Clayey Siltstone, dry (10% water). Notable color change. Decrease Fe2O3 to Fe3O4 as minor fracture coating. Massive texture. Moderately friable. Slightly moist to SL MOIST.</td>
</tr>
<tr>
<td>23.0</td>
<td>22.9-23.2 - Claystone with some silt, yellowish brown (10% water) and gray (10% water). Clayey Fe3O4 potted throughout. Fracture coating - 80% fracture. SL MOIST. Moderate primary Fe2O3 from 23.2 to 23.4. Corresponding with increased moisture zone. SL MOIST. Fe2O3 22.7 to 22.1; MOIST Fe2O3 22.1-23.2.</td>
</tr>
<tr>
<td>24.0</td>
<td>24.0-28.0 - Claystone of 5% Silt, gray (10% water) to light brownish gray (10% water). Cedar fan to Fe2O3 along bedding planes and from surfaces. Massive texture, moderately friable. Color (dark gray - 10% water). SL MOIST. Deeper moisture and slightly moist Fe2O3 24.2 to 26.0. Fissile between 24.2 to 26.0.</td>
</tr>
<tr>
<td>27.8-28.0</td>
<td>27.8-28.0 - No recovery.</td>
</tr>
</tbody>
</table>

**NOTES:**
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Plezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5929</td>
<td>Protective Casing, 5 in. square, Steel</td>
<td>3</td>
<td>GP: Gravel (fill), pea gravel (1/4&quot; diameter, subrounded to subangular), composed of granite and quartzite. Poorly graded, dry.</td>
<td></td>
</tr>
<tr>
<td>5928</td>
<td>Casing, Sch 40 PVC, 2 in. ID.</td>
<td>2</td>
<td>CL: Clay with trace sand and gravel, grayish brown (10YR5/2) to gray (10YR5/1). Re-worked claystone. Thin black organic stringers common, moist.</td>
<td></td>
</tr>
<tr>
<td>5927</td>
<td>Concrete Seal</td>
<td>1</td>
<td>SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR5/6). Imported fill (Qalr). 60% clay, medium plasticity, 30% sand (medium grained to coarse grained, subrounded to subangular), 10% gravel (1/4&quot; diameter, subrounded to subangular), very moist.</td>
<td></td>
</tr>
<tr>
<td>5926</td>
<td>Concrete Pad</td>
<td>0</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5925</td>
<td>Hydrated Bentonite Pellets</td>
<td>1</td>
<td>SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR4/6). Imported fill (Qalr). Very similar to interval from 0.4' to 0.8'. 65% clay, medium plasticity, 20 - 25% sand (medium grained to coarse grained, subangular to subrounded), 10 - 15% gravel (1/8&quot; - 1/4&quot; diameter, subrounded, predominately granite and quartzite), saturated, but not flowing.</td>
<td></td>
</tr>
<tr>
<td>5924</td>
<td></td>
<td>2</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5923</td>
<td></td>
<td>3</td>
<td>SC/CL: Gravelly, Sandy Clay to clayey, gravelly sand, strong brown (7.5YR4/6). Imported fill (Qalr). Very similar to interval from 2.0' to</td>
<td></td>
</tr>
<tr>
<td>5922</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elev (ft)</td>
<td>Well or Plezometer Construction and Materials</td>
<td>Depth (ft)</td>
<td>Unified Soils Classification or Rock Type</td>
<td>Lithology</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------</td>
<td>------------</td>
<td>------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>5921</td>
<td>Filter Pack, 16/40 Silica Sand</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5920</td>
<td>Screen, Sph 40-PVC 2 in. ID, 0.003 in. slots</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5919</td>
<td>GP: Gravel with trace sandy clay, strong brown (7.5YR4/6) clay. Appears to be pea-gravel (possible slough). Gravel (1/4&quot; - 3/4&quot; diameter, subrounded to subangular), poorly graded. Moisture decreases from saturated to moist.</td>
<td>7</td>
<td>GC/CL: Gravelly, Sandy Clay and shattered quartzite cobble mixture. 45% gravelly sandy clay, light brown (7.5YR6/4) with 55% shattered cobbles (1/2&quot; to 1-1/2&quot; diameter, angular), moist.</td>
<td>No recovery.</td>
</tr>
<tr>
<td>5918</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5917</td>
<td>GC/CL: Sandy Clay/Gravel mixture, strong brown (7.5YR5/6), 60 - 70% gravel and cobbles, 20 - 30% clay (medium plasticity), 5 - 10% sand (coarse grained, subangular). Shattered quartzite cobbles from 8.4' to 8.6' (2&quot; diameter) and from 9.2' to 9.5' (2&quot; - 3&quot; diameter). Moist.</td>
<td>9</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5916</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5915</td>
<td>GC/CL: Sandy Clay/Gravel mixture, strong brown (7.5YR5/6), 50% clay (medium plasticity), 30% gravel (1/8&quot; - 3/4&quot; diameter, subangular), ~20% sand (coarse grained), moist. Quartzite cobbles (1&quot; - 2&quot; diameter) at 11.2' and 11.7'.</td>
<td>11</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5914</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elev. (ft)</td>
<td>Depth (ft)</td>
<td>Lithology</td>
<td>Unified Soils Classification or Rock Type</td>
<td>Lithologic Description</td>
</tr>
<tr>
<td>-----------</td>
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<td>------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>5912</td>
<td>14</td>
<td>CLAYSTONE: TOP OF BEDROCK. Silty Claystone (weathered bedrock), grayish brown (10YR5/2) with some yellowish brown (10YR5/6) mottling. Massive texture, firm and cohesive. Weak to moderately friable. Weak iron oxidation mottled throughout. Trace black organic material. Moist. Bedrock contact estimated at 12.5'. Estimated by drilling conditions and changes in penetration. No recovery.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5910</td>
<td>16</td>
<td>CLAYSTONE: Silty Claystone, iron oxidized, yellowish brown (10YR5/4), grading to gray (10YR5/1) at base of interval. Moderate pervasive iron oxidation from 16.0' to 16.3', then decreasing at base. Massive texture, weak to moderately friable. Saturated from 16.0' to 16.2', decreasing to moist from 16.2' to 16.3'. CLAYSTONE: Claystone with silt, iron oxidized, yellowish brown (10YR5/8). Strong pervasive iron oxidation. Firm and dense, moist. Black organic material common as stringers and along undulating bedding planes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5909</td>
<td>17</td>
<td>CLAYSTONE: Claystone with silt, grayish brown (10YR5/2) with some yellowish brown (10YR5/6) mottling. Decreasing overall iron oxidation to weak, mottled. Firm, weakly friable, moist. Black organic stringers common. Faint bedding visible. No recovery.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5905</td>
<td>20</td>
<td>CLAYSTONE: Claystone, light brownish gray (10YR6/2) to gray (10YR6/1). Massive texture, firm/dense. Trace overall iron oxidation. Weak iron oxidation from 21.7' to 22.0'. Trace black organic stringers. Moisture decreases to slightly moist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5904</td>
<td>22</td>
<td>CLAYSTONE: Claystone, gray (10YR5/1) to dark gray (10YR4/1).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elev (Ft)</td>
<td>Well or Piezometer Construction and Materials</td>
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<tr>
<td>----------</td>
<td>---------------------------------------------</td>
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<td>----------------------------------------</td>
</tr>
<tr>
<td>5902</td>
<td></td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5900</td>
<td>Threaded End Cap - Sump. Sch 40 PVC</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5899</td>
<td>Bentzite Pebble Backfill in Pilot Hole</td>
<td>27</td>
<td></td>
<td>No recovery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Un-oxidized, un-weathered bedrock. Fissile/friable. Black carbonaceous material common. Abundant black carbonaceous material from 27.0' to 27.7'. Moisture decreases to trace. Refusal at 27.7'.</td>
</tr>
</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 73105
PROJECT NAME: CV05 Well Installation
PROGRAM: Present Landfill
SCREENED FORMATION: 01/89
DRILLING CONTRACTOR: Layne
BORING METHOD: Hollow Stem Auger
DATE DRILLED: 4/23/05
DATE COMPLETED: 4/27/05
TOTAL DEPTH: 27.7
COMPLETED DEPTH: 26.0
ESTIMATED DEPTH TO BEDROCK: 12.5
RIG GEOLOGIST: G. Warp
LOGGING GEOLOGIST: G. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"
QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry, 4/23/05
COMPLETED WATER LEVEL (FT, DATE): 25.33, 4/27/05
Possibly H2O used to hydrate seal.
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above Ground Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.35'

*SECONDARY CASING TOP: N/A
BOTTOM: N/A
TYPE: N/A

SURFACE CASING TOP: 2.7' ID (IN): 2.0

SURFACE SEAL TOP: 0.4' ID (IN): 0.1'
BOTTOM: 0.1'
TYPE: Concrete

PROTECTIVE CASING BOTTOM, ID (IN): 1.65
TYPE: Steel

WELL PAD DIMENSIONS, TYPE: 3' x 3' Concrete pad

ADD'L CASING FILL TOP: N/A
BOTTOM: N/A
TYPE: N/A

*SURFACE ISOLATION CASING TOP: N/A
BOTTOM: N/A

*SURFACE ISOLATION CASING ID (IN): N/A
TYPE: N/A

*OTHER (E.G., ASEPTIC) CASING TOP: N/A
BOTTOM: N/A

*OTHER CASING ID (IN): N/A
TYPE, PURPOSE: N/A

*CENTRALIZER(S) OD (IN): N/A
NUMBER USED: N/A
TYPE: N/A

CENTRALIZER(S) DEPTH(S): N/A

GROUT TOP: N/A
MEASURED DENSITY (LBS/GAL): N/A
TYPE: N/A

GRANULAR BENTONITE TOP: N/A
TYPE: N/A

BENTONITE SEAL TOP: 0.1'
TYPE: 1/4" bentonite pellets Baroid®
Hydrated with 5 gal. of distilled H2O.

BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (EQUAL FILTER PACK TOP): 4.5'

FILTER PACK TYPE: 1/8/40 Silica Sand
BRAND: C.S.S.E.

SURFACE CASING BOTTOM (EQUAL SCREEN TOP): 5.65'
TYPE: Sch. 40 PVC

SCREEN ID (IN): 2.0
SLOT SIZE (IN): 0.01
TYPE: Sch. 40 PVC

SCREEN BOTTOM (EQUAL SUMP TOP): 25.65'
TYPE: Threaded End Cap Sch. 40 PVC

FILTER PACK BOTTOM (EQUAL BACKFILL TOP): 26.0'
BACKFILL TYPE: 1/4" bentonite pellets Baroid®

SUMP BOTTOM (EQUAL WELL COMPLETED DEPTH): 26.0'
PILOT HOLE TOP, DIAMETER: 26.0, 2.5"

TOTAL BOREHOLE DEPTH (EQUAL PILOT HOLE AND BACKFILL BOTTOM): 226'

REMARKS: Routine well installation on 4/23/05. Concrete well pad installed on 4/27/05.

COMPLETED BY: Ellen S. Warp
DATE: 4/27/05

CHECKED BY: J. Beylon
DATE: 6/30/05
### Rocky Flats Environmental Technology Site Borehole Log

**Borehole Number:** 75105  
**Location - North:** East  
**Date:** 4/16/05  
**Geologist:** E. Warp  
**Drilling Equip.:** (NE-750-Hollow Stem Auger)  
**Surface Elevation:** Present Land 811  
**Area:**  
**Total Depth:** 6820'  
**Company:** UC/Layne  
**Project No.:** HADS-5100  
**Sample Type:** Continuous Core - Split Spoon

**RMRS Logging Supervisor Approval:**  
**Date:** 0/29/05

#### Sample Description
- **0.0-0.5'** - Admixed (misc.) - Pea gravel (2-6 in), sub-rounded to sub-angular, composed of granite and graywacke gravel. Dry.  
- **0.2-0.4'** - Clay 1/8" sand and gravel. From 20 to 25% granite (10%), 15% clay (10%). Re-worked claystone. Thin, biq.  
- **0.4-0.6'** - Gravelly, sandy clay. Strong brn. (75%), 65% clay (med. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular.  
- **0.9-1.2'** - Gravelly, sub-rounded, predominantly granite and gravel.  
- **2.0-2.9'** - Gravelly, sandy clay. Strong brn. (75%), 65% clay (med. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular.  
- **2.9-4.0'** - No recovery.  
- **4.0-5.2'** - Gravelly, sandy clay. Strong brn. (75%), 65% clay (med. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular. Poorly graded. Decrease moisture in saturated soil.  
- **5.2-6.0'** - No recovery.  
- **6.1-6.3'** - Gravel 1/8" sand. Strong brn. (75%), 65% clay (mrg. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular.  
- **6.3-6.6'** - Gravelly, sand and gravel.  
- **6.9-7.6'** - Sandy clay/Gravel mixture. Strong brn. (75%), 65% clay (mrg. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular.  
- **7.6-8.0'** - Sandy clay/Gravel mixture. Strong brn. (75%), 65% clay (mrg. plasticity), 20-25% sand (mrg.). Sub-rounded to sub-angular.  
- **9.2-9.6'** - Sandy clay/Gravel mixture.  

#### Notes:
- General: USES is modified for this log as follows:  
- Materials amounts are estimated by % volume instead of % weight.  
- Badly broken core, accurate footage measurements not possible.  
- Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
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### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 13055

**Location - North:** 42°31'10"N

**Date:** 1/23/05

**Geologist:** E. Waep

**Drilling Equip.:** CME-750 - Hallow Stem Auger

**Surface Elevation:** Present Sandhill

**Area:** ER201400

**Geological:** PE38S-YLNKE

**Sample Type:** Continuous Core - Split Spoon

---

**RMRS LOGGING SUPERVISOR APPROVAL**

**DATE:** 1/29/05

---

### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Top Depth</th>
<th>USCS Symbol</th>
<th>Depth in Feet</th>
<th>Nature of Material</th>
</tr>
</thead>
</table>
| 10.0 | clay, gravel | 10.0 | Sandy clay/Gravel mixture, Strong, 75% gravel, 25% clay. Moderate to great.
| 11.2 | clay, gravel | 11.2 | Gravel (40-70 mm), Subangular, 20%, Sand (silt), cobble of granite (1-2 mm), 20%, Moist.
| 11.9 | clay, gravel | 11.9 | No recovery
| 12.0 | clay, gravel | 12.0 | Sandy clay/Gravel mixture, Same as above, thinner, 10-15 mm
| 12.1 | clay, gravel | 12.1 | Sandy claystone, Poor recovery due to clogging
| 12.2 | clay, gravel | 12.2 | Split spoon sample produced, ribbon of claystone, Moist. A possible cobble lodged in sample.
| 12.3 | clay, gravel | 12.3 | No recovery
| 12.4 | clay, gravel | 12.4 | Bedrock contact (estimated) at 12.5 feet
| 12.5 | clay, gravel | 12.5 | Bedrock contact estimated by drilling conditions and changes in penetration
| 14.0 | clay, gravel | 14.0 | Silty claystone (brittle), 40% silt, 60% clay, 15% yellowish, thin (10% water), mottling, Massive texture, Firm to dense, Wet, moderately friable, Wet, Fed on mottled throughout, TE, 1%. Organic material, Moist.
| 15.3 | clay, gravel | 15.3 | No recovery
| 16.0 | clay, gravel | 16.0 | Silty claystone, Fe Oxid - Yellow clay, 40% silt, 60% clay, 10% water, @ base of interval, Medium sand. Firm, dense, Wet, moderately friable, Saturated. An 16.0-16.2 decreasing to Moist. 16.2-16.3, with 30% water.
| 16.6 | clay, gravel | 16.6 | Silty claystone, Fe Oxid - Yellow clay, 40% silt, 60% clay, Strong Permeability, Firm and dense, Bk organic material common as stringers and along undulating bedding planes, Moist.
| 16.7 | clay, gravel | 16.7 | Silty claystone, Fe Oxid - Yellow clay, 40% silt, 60% clay, Medium sand, 15% yellowish, thin (10% water), mottling, Dense, overall Fed on in situ, 12%. Organic material common, Wet, friable, Bk organic material common. Raint bedding visible. Moist.
| 17.8 | clay, gravel | 17.8 | Silty claystone, Fe Oxid - Yellow clay, 40% silt, 60% clay, Strong Permeability, Firm and dense, Bk organic material common as stringers and along undulating bedding planes, Moist.

---

**NOTES:** General: USCS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No. RMRS/OPS-PRO.101**

**Date effective:** 12/31/98

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<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>White sand, silt, gravel</td>
</tr>
</tbody>
</table>
|              | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 21.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.2. 
              | No recovery |
| 22.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 23.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 24.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 25.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 26.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |
| 27.0         | Claystone, grey (10% grey) to grey (10% grey) 
              | Massive texture, firm/dense. Acidity value 2.4. 
              | No recovery |

NOTES: General: USCS is modified for this log as follows:
1. Materials amounts are estimated by % volume instead of % weight.
2. Badly broken core, accurate footage measurements not possible.
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<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5940</td>
<td>Protective Coating, 5 in. square, Steel</td>
<td>3</td>
<td>CL: Clay with silt, trace gravel, and trace sand, brown (7.5YR4/3). Medium plasticity and firm. Trace to 3% disseminated caliche. Trace roots. Schist cobble (3/4&quot; diameter, subangular) at 0.3'. Slightly moist to moist.</td>
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<tr>
<td>5939</td>
<td>Casing, Sch 40-PVC, 2 in. 60.</td>
<td>2</td>
<td>No recovery.</td>
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<tr>
<td>5938</td>
<td>Concrete Seal</td>
<td>1</td>
<td>CL: Clay with silt, trace gravel, and trace sand, brown (7.5YR4/4 to 7.5YR4/2). Medium plasticity and firm. Same as interval from 0.0' to 1.5'. Slightly moist.</td>
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</tr>
<tr>
<td>5937</td>
<td>Concrete Pad</td>
<td>0</td>
<td>GC/CL: Sandy Gravel/Clay mixture, brown (7.5YR4/4). ~75% sandy gravel and ~25% clay. Gravel (1/4&quot; - 1&quot; diameter, subangular to subrounded, predominately quartzite). Sand (coarse grained, subangular). Weak iron oxidation disseminated throughout clay and as coating on 1/4&quot; gravel clasts. Trace disseminated caliche. 2&quot; diameter quartzite cobble at 2.4'. Shattered quartzite cobble from 3.0' to 3.2'. Poor recovery due to cobbles. Slightly moist.</td>
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<tr>
<td>5936</td>
<td>Filter Pack, 15/40 Silica Sand</td>
<td>3</td>
<td>No recovery.</td>
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<tr>
<td>5935</td>
<td>Screen, Sch 40-PVC, 2 in. OD, 0.010 in.</td>
<td>2</td>
<td>CL: Sandy, Gravelly Clay, brown (7.5YR4/4). 5 - 10% gravel (1/4&quot; - 1/2&quot; diameter, subrounded to subangular, predominately quartzite). 5 - 7% sand (coarse grained, subangular). Clay has medium</td>
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**Remarks:**
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Lithology</th>
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<tr>
<td>5932</td>
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<tr>
<td>5924</td>
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<td>13</td>
</tr>
</tbody>
</table>

**LOG OF BORING NUMBER:**

**73205**

**Unified Soils Classification or Rock Type**

**Lithologic Description**

- **Elev (Ft) 5932:** Plasticity. Moisture increases from slightly moist to moist.
- **CLAYSTONE: TOP OF BEDROCK.** Claystone, grayish brown (10YR5/2) to gray (10YR5/1). Firm/dense. Black organic stringers common on undulating bedding planes. 1/4" caliche lense at base of interval. Sharp basal contact, color change. Moist.

- **Elev (Ft) 5931:** CLAYSTONE: Claystone, iron-oxidized/weathered, yellowish brown (10YR4/6). Moderate to strong pervasive iron oxidation. Moderately friable. 1/4" caliche lense at top of interval and as blebs throughout. Moist.

- **Elev (Ft) 5930:** CLAYSTONE: Silty Claystone, gray (10YR6/1). Distinct color change. Massive texture. Caliche mottled throughout. Friable. Moisture decreases to very slightly moist.

- **Elev (Ft) 5929:** No recovery.

- **Elev (Ft) 5928:** CLAYSTONE: Claystone, iron oxidized/weathered, yellowish brown (10YR5/6 to 10YR5/4). Weak pervasive iron oxidation. Weak to moderately friable. Trace white caliche stringers. Thin caliche lense at 6.8'. Slightly moist.

- **Elev (Ft) 5927:** CLAYSTONE: Claystone, grayish brown (10YR5/2). Decreased iron oxidation to trace as stringers. Moderately friable. Massive texture. Slightly moist.

- **Elev (Ft) 5926:** No recovery.

- **Elev (Ft) 5925:** CLAYSTONE: Silty Claystone, iron oxidized, yellowish brown (10YR5/4). Weak to moderate pervasive iron oxidation. Massive texture. Weak to moderately friable. Black manganese oxide (possible organics) bleb at 8.2'. Slightly moist.

- **Elev (Ft) 5924:** CLAYSTONE: Claystone, gray (10YR5/1). Decreased iron oxidation to trace. Massive texture, firm yet weakly friable. Trace black organic stringers throughout. Black organic lense (1/8" thick) at 11.2'. Trace iron oxidation stringers from 11.2' to 12.0'. Moisture decreases to very slightly moist. Hard, cryptocrystalline calcareous clast (~3/8") at 9.9'.

- **Elev (Ft) 5923:** CLAYSTONE: Claystone, gray (10YR6/1). Massive texture, dense/firm, weakly friable. Trace to some iron oxidation. Abundant black organic material from 12.8' to 13.0'. Very slightly moist.

- **Elev (Ft) 5922:** CLAYSTONE: Claystone with silt, gray (10YR6/1). Massive texture as above interval from 12.0' to 13.3'. Un-oxidized bedrock. Trace black organic stringers. Firm/dense. Thin caliche lense along
internal bedding plane at 13.7'. Very slightly moist.

CLAYSTONE: Silty Claystone, gray (10YR6/1). Weak iron oxidation along horizontal bedding planes. Predominantly massive texture, firm/dense. Trace black organic stringers and blebs. Weak to moderate pervasive iron oxidation from 17.3' to 17.7'. Near-vertical fracture (~80 deg) from 18.9' to 19.5' with iron oxide coating. 1/4" horizontal lense of carbonate (druse) at 19.7'. Interval slightly moist. Occasional sandy intervals at 17.1', and from 17.6' to 17.7'. Claystone interval from 18.8' to 19.1'. Rip-up clasts, iron oxide-replaced organic debris present. Sand is very fine grained to fine grained.

CLAYSTONE: Claystone, grayish brown (10YR5/2). Weak iron oxidation as stringers and along bedding planes. Black organic material along bedding planes. Possible manganese oxide associated with iron oxidation along bedding and fracture surfaces. Dense/firm. Slightly moist.

CLAYSTONE: Claystone, gray (10YR6/1 to 10YR5/1). Trace weak iron oxidation as stringers and along bedding/fracture surfaces. Iron oxidation as fracture (~50 deg) coating at 22.6’. Interval weak to moderately friable. Massive texture. Slightly moist.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
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</thead>
<tbody>
<tr>
<td>5914</td>
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<td>20</td>
<td>CLAYSTONE: Claystone, dark gray (10YR4/1). Firm/dense. Trace iron oxidation along bedding planes/fracture surfaces. Bedding planes are faintly visible. Trace black organic material along bedding and as clasts (to 1/2&quot; diameter). Slightly moist from 23.1' to 24.2', decreases to trace moisture from 24.2' to 30.4'. Weak pervasive iron oxidation from 29.1' to 29.3'.</td>
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<td>5904</td>
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<td>30</td>
<td>CLAYSTONE: Claystone, un-iron oxidized/un-weathered, very dark gray (10YR3/1). Distinct color change. Firm and dense. Trace iron oxidation stringers from 31.8' to 31.9'. Sub-horizontal, undulating bedding faintly visible. Black organic material common along bedding planes and as clasts (to 1/2&quot; diameter). Trace moisture.</td>
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</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 73205 PROJECT NAME: Cypress Well Installation PROGRAM: Present Landfill
SCREINED FORMATION: 1/4/81 DRILLING CONTRACTOR: Layne BORING METHOD: Hollow Stem Auger
DATE DRILLED: 6/30/05 DATE COMPLETED: 6/30/05 TOTAL DEPTH: 32.0 COMPLETED DEPTH: 32.0
ESTIMATED DEPTH TO BEDROCK: 4.2' RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry, 6/30/05 COMPLETED WATER LEVEL (FT, DATE): Dry, 6/30/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0" PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above Ground Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

- **PROTECTIVE CASING TOP** (STICK UP OR FLUSH-MOUNT): 3.1' ags.
- **SECONDARY CASING TOP** (N/A BOTTOM): N/A
- **SURFACE CASING TOP**: 2.3' ags, ID (IN): 2.0
- **SURFACE SEAL TOP**: 0.3' ags BOTTOM: 0.2', TYPE: Concrete
- **PROTECTIVE CASING BOTTOM, ID (IN)**, TYPE: 1.95" x 1.5" square
- **WELL PAD DIMENSIONS, TYPE**: 3' x 3' square, concrete top 0.5' ags.
- **ADD L CASING FILL TOP**: N/A BOTTOM: N/A
- **SURFACE ISOLATION CASING TOP**: N/A BOTTOM: N/A
- **SURFACE ISOLATION CASING ID (IN)**, TYPE: N/A
- **OTHER (E.G., ASEPtic) CASING TOP**: N/A BOTTOM: N/A
- **OTHER CASING ID (IN)**, TYPE, PURPOSE: N/A
- **CENTRALIZER(S) OD (IN)**, NUMBER USED: N/A, TYPE: N/A
- **CENTRALIZER(S) DEPTH(S)**: N/A
- **GROUT TOP**: N/A MEASURED DENSITY (LBS/GAL): N/A
- **GRANULAR BENTONITE TOP**: N/A
- **BENTONITE SEAL TOP**: N/A, TYPE: Med. bentonite chips with plugs
- **BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP)**: 9.0'
- **FILTER PACK TYPE**: 1/40 Silica Sand," BRAND: C.S.T.
- **SURFACE CASING BOTTOM (= SCREEN TOP)**: 4.55 TYPE: Sch 40 - PVC
- **SCREEN ID (IN)**: 2.0 SLOT SIZE (IN): 0.01 TYPE: Sch 40 - PVC
- **SCREEN BOTTOM (= SUMP TOP)**: 29.65 TYPE: Tapered End Cap - Sch 40 - PVC
- **FILTER PACK BOTTOM (= BACKFILL TOP)**: 30.0 *BACKFILL TYPE: Med. bentonite pellets
- **SUMP BOTTOM (= WELL COMPLETED DEPTH)**: 30.0 *PILOT HOLE TOP, DIAMETER: 30.0, 2.5"
- **TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM)**: 32.0'

**REMARKS**: Routine well installation (6/30/05), Concrete pad installed on 6/30/05.

**COMPLETED BY**: Ellen S. Warp DATE: 6/30/05

**CHECKED BY**: J._BYRON DATE: 6/30/05
## ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

### General Information
- **Borehole Number:** 73205
- **Location:** North: East:
- **Date:** 4/2/05
- **Geologist:** E. Waep
- **Drilling Equip.:** CMK-750-500 Hollow Stem Auger
- **Surface Elevation:** Present Landfill
- **Total Depth:** 32.0
- **Company:** URS Layne
- **Project No.:** H235-100
- **Sample Type:** Und, ov, sp, split spoon

### Approval Log
- **Approval Date:** 6/30/05

### Sample Description

<table>
<thead>
<tr>
<th>Sample</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-1.5'</td>
<td>0.0</td>
</tr>
<tr>
<td>1.5-2.0'</td>
<td>1.5</td>
</tr>
</tbody>
</table>
| 2.0-2.4' | 2.0 | Clay, gravel and sand. BM (75%/25%). Medium plasticity and firm. (Same as 0.0-1.5'). Fe-3%...
| 2.4-3.2' | 2.4 | Sandy gravel/clay mixture. BM (75%/25%). Sandy gravel and sand. BM (75%/25%). Clay, gravel (45%/55%), sub-rounded predominantly to spherical. Sand (45%, sub-angular). Wk. Fecl. in it through clay and as coating on 1/8" gravel clasts. Fe-3%... |
| 3.2-4.0' | 3.2 | No recovery. |
| 4.0-4.2' | 4.0 | Sandy gravelly clay, BM (75%/25%). 5-10% gravel (45%, sub-rounded to sub-angular). Clay has medium plasticity. Skl. moist to moist. Bedrock contact @ 4.2. |
| 4.7-5.0' | 4.7 | Claystone-weathered. Yellowish, BM (10%/90%). Wk. Fecl. Sp. perp. to bedding. Fe-3%... |
| 5.0-5.7' | 5.0 | Caliche, Sickly Claystone. BM (98%/2%). Distinct caliche, massive texture. Caliche molded throughout. Friable. Decease moisture to V. Slightly moist. |
| 5.7-6.0' | 5.7 | No recovery. |
| 6.0-6.2' | 6.0 | Claystone-weathered, gritty BM (10%/90%). Wk. perp. Fecl. to moderately friable. Fe-3%... |

### Notes
- General: USGS is modified for this log as follows:
  - Procedure No. RMRS/OPS-PRO.101
  - Revision 0
  - Date effective: 12/31/98

(See page 2 for 0.0-100' description)
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 73205
Location - North: 40°12'05"
Date: 4/21/05
Geologist: E. Wahe
Drilling Equip.: DTH 950 - Hollow Stem Auger

Surface Elevation: Present Landfill
Area: 32.8
Total Depth: 69.201 (400.8 ft)
Company: USES/Layne
Project No.: 020000
Sample Type: Cont. Core - Split spoon

RMRS LOGGING SUPERVISOR

APPROVAL:

DATE: 10/29/05

SAMPLE DESCRIPTION

7.0 - 7.7 - Claystone, Grayish brown (10YR 5/4), Deformed, Fossils to 1/2 as stringers, Massively bedded, Massive texture, SI, moist.
7.7 - 8.0 - No recovery

8.0 - 8.3 - Silt-claystone, Fedde, yellow sand (10YR 5/4), Wk. to mat. perv. Fossils, Massive texture, Wk. to moderately friable, Blk. Mino (possible organics) Bld & @ 8.2, SI, moist.


Deformed perv. Fedde Am. 17.3 to 17.7. Near vertical fracture (20°) Am. 18.9 to 19.5 with Fedde coating, 1/4 horizontal lense of carbonate (dune) at 19.7. Interval SI, Moist. Occ. sandy intervals at 17.1, 17.6 - 17.7, and claystone intervals as at 18.0 - 19.1. Rip-up clasts, Fe Ox. replaced organic debris present. Sand is wft - 5g.

NOTES: General. USGS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO101
Revision 0
Date effective: 12/31/98
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**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

- **Borehole Number:** 73205
- **Location - North:**
- **East:**
- **Date:** 4/21/05
- **Geologist:** E. Wang
- **Drilling Equip.:** AVE KD - Hollow Stem Auger
- **Surface Elevation:**
- **Area:** Present Landfill
- **Total Depth:** 32.0'
- **Company:** UC/SCS
- **Project No.:** 1805704
- **Sample Type:** Continuous Core, Split Spent

**RMRS LOGGING SUPERVISOR APPROVAL**

**DATE:** 10/21/05

**SAMPLE DESCRIPTION**

<table>
<thead>
<tr>
<th>Interval</th>
<th>Sample Description</th>
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<tbody>
<tr>
<td>20.0-20.8</td>
<td>See previous page for description. Silty Claystone</td>
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<tr>
<td>21.6-21.8</td>
<td>Claystone - Gray (loamy) Ten. Feokn as stringers and along bedding planes. Fine sand. Feokn as loose. (-30) acting @ 22.6&quot;. Interval w/moderately tripped, massive texture. Slightly moist.</td>
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</tbody>
</table>

**NOTES:**
- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

**Page 27 of 28**
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 13205  
**Surface Elevation:**  
**Location - North:**  
**East:**  
**Date:** 6/21/05  
**Geologist:** E. WARP  
**Area:** Present Landfill  
**Total Depth:** 32.0'  
**Company:** Westlake  
**Project No.:** 8220140  
**Sample Type:** Continuous Core - Split Spoon  

<table>
<thead>
<tr>
<th>RMRS LOGGING SUPERVISOR</th>
<th>APPROVAL</th>
<th>DATE</th>
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<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPOSURE OF CORE INDEX</th>
<th>TOPOF CORE INTERVAL</th>
<th>NUMBER OF SAMPLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>30.0-30.4</td>
<td>-30A</td>
<td>30.4-32.0' CLAYSTONE - Un-weathered. V. Dry (80% RH)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Firm and dense. F Fox's string #931.8-31.5'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Distinct color change.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub-horizontal, undulating bedding faintly visible. Blk. organic material; common along bedding planes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30.0-32.0' as clay to 1/2&quot; drum. 30-32.0'</td>
</tr>
</tbody>
</table>

**T.D.032.0'**

---

**NOTES:** General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101  
**Revision:** 0  
**Date effective:** 12/31/98  
**Page 27 of 28**
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Pleziometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5965</td>
<td>Casing, Sch 40 PVC, 2 in. OD.</td>
<td>0</td>
<td>GC/CL: Clay/Gravel mixture with some sand, dark brown (7.5YR3/2). Clay with 30% - 40% gravel (1/8&quot; to 1&quot; diameter, subangular), predominately composed of quartzite and granite. Clay has medium plasticity. Roots common, especially from 0.0' to 0.2'. Some disseminated caliche. Trace iron oxide coating on gravel. Very slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5964</td>
<td>Casing, 6 In. ID., Steel</td>
<td>1</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5963</td>
<td>Concrete Seal/Concrete Pad</td>
<td>2</td>
<td>GC/CL: Clay/Gravel mixture, same as 0.0' to 1.2': 1.5' broken granite cobble at base. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>5962</td>
<td>Barite/site Chips</td>
<td>3</td>
<td>CL: Silty, Sandy Clay, light brownish gray (10YR6/2). Sand is coarse grained, subangular. Cobble probably clogged in split spoon, core appears like &quot;ribbons&quot;. Patchy zones of white caliche, moist.</td>
<td></td>
</tr>
<tr>
<td>5961</td>
<td></td>
<td>4</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5960</td>
<td></td>
<td>5</td>
<td>CLAYSTONE: TOP OF BEDROCK. Claystone, oxidized (weathered), light yellowish brown (10YR6/4) with some light brownish gray (10YR6/2) mottling. Abundant patchy white caliche zones throughout interval. Weak iron oxidation mottled throughout. Trace black stringers. Interval competent except for caliche zones at 4.2', 4.6', and 5.5'. Increased moisture to moist. Bedrock contact estimated due to poor recovery at 4.0'.</td>
<td></td>
</tr>
</tbody>
</table>
CLAYSTONE: Claystone, oxidized (weathered), yellowish brown (10YR5/6) and gray (10YR6/1), mottled. Iron oxidation mottled throughout. Competent bedrock. Trace black organic stringers, trace to some white caliche (disseminated), moist.

No recovery.

CLAYSTONE: Claystone, gray (10YR5/1), trace iron oxidation. White caliche common as stringers and blebs. Abundant caliche from 8.0' to 8.55'. Caliche zone also friable and broken.

No recovery.

CLAYSTONE: Claystone, light brownish gray (10YR6/2) with yellowish brown mottling. Weak to moderate iron oxidation throughout (mottled). Thin lens of white carbonate (very fine sparry calcite) at 9.1'. Interval is dense and firm, moist to slightly moist. Caliche lens at 10.3' is friable/crumbly.

CLAYSTONE: Claystone, light gray (10YR7/1), unoxidized. Massive textured, weakly friable. Decreasing moisture to slightly moist.

No recovery.


No recovery.

CLAYSTONE: Claystone, same as from 12.0' to 13.6'.

CLAYSTONE: Claystone, gray (10YR6/1), decreasing iron oxidation to trace. Trace white stringers. Interval is dense and firm. Weak iron oxidation at 18.0' along fractures. Decreased moisture to slightly moist.


CLAYSTONE: Claystone, grayish brown (10YR5/2), with lesser yellowish brown (10YR5/6) mottling. Predominately un-oxidized claystone with trace weak iron oxidation mottling. Black organic blebs and as coating along internal bedding planes as at 21.5'. Interval firm and dense, moist.

CLAYSTONE: Claystone, gray (10YR6/1), predominately un-oxidized, un-weathered claystone bedrock. Black organic stringers along internal bedding planes, dense and firm. Vertical fracture from 25.2' to 25.5' with yellowish brown (10YR5/6), iron oxidation coating, slightly moist.
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Unified Soil Classification</th>
<th>Lithology or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5939</td>
<td></td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5938</td>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5937</td>
<td></td>
<td>26</td>
<td>Threaded Ext Cap - Sump, Sch 40-PVC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**MONITORING WELL INSTALLATION REPORT:** Form PRO.118

<table>
<thead>
<tr>
<th>INFORMATION</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location Code</td>
<td>T9605</td>
</tr>
<tr>
<td>Project Name</td>
<td>POSWELL REPLACEMENTS PROGRAM: VWRP</td>
</tr>
<tr>
<td>Drilling Contractor</td>
<td>Austin</td>
</tr>
<tr>
<td>Screened Formation</td>
<td>Helle Plains</td>
</tr>
<tr>
<td>Boring Method</td>
<td>Missouri</td>
</tr>
<tr>
<td>Date Drilled</td>
<td>4/5/05</td>
</tr>
<tr>
<td>Date Completed</td>
<td>4/5/05</td>
</tr>
<tr>
<td>Total Depth</td>
<td>26.0'</td>
</tr>
<tr>
<td>Completed Depth</td>
<td>26.0'</td>
</tr>
<tr>
<td>Estimated Depth to Bedrock</td>
<td>4.0'</td>
</tr>
<tr>
<td>Rig Geologist</td>
<td>E. W. Wrap</td>
</tr>
<tr>
<td>Logging Geologist</td>
<td>E. W. Wrap</td>
</tr>
<tr>
<td>Borehole Diameter in Screened Interval</td>
<td>8.0&quot;</td>
</tr>
<tr>
<td>Quantity of Fluids Lost During Drilling</td>
<td>N/A</td>
</tr>
<tr>
<td>Initial Water Level (ft, date)</td>
<td>Day on 4/5/05</td>
</tr>
<tr>
<td>Completed Water Level (ft, date)</td>
<td>4/5/05</td>
</tr>
<tr>
<td>Diameter &amp; Type of Installation (Well/Piezometer/Well Point/etc.)</td>
<td>2.0&quot; PVC Well</td>
</tr>
<tr>
<td>Type of Protection (Flush-Mount vs. Above Ground, Aseptic, etc.)</td>
<td>6.0&quot; I.D. Steel Protection Casings - Stick-up</td>
</tr>
</tbody>
</table>

**ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE**

*Denotes items that may not be applicable, depending on boring method, well protection & purpose*

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective Casing Top (Stickup or Flush-Mount)</td>
<td>2.5' D.G.</td>
</tr>
<tr>
<td>Secondary Casing Top, Bottom, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Casing Top, ID (In), Type</td>
<td>2.0' D.G.</td>
</tr>
<tr>
<td>Surface Seal Top, Bottom, Type</td>
<td>0.5' D.G.</td>
</tr>
<tr>
<td>Protective Casing Bottom, ID (In), Type</td>
<td>2.6' D.G.</td>
</tr>
<tr>
<td>Well Pad Dimensions, Type</td>
<td>Concrete Pad (6 x 8)</td>
</tr>
<tr>
<td>Add'l Casing Fill Top, Bottom, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Isolation Casing Top, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Isolation ID (In), Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Other (E.G., Aseptic) Casing Top, Bottom, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Other Casing ID (In), Type, Purpose</td>
<td>N/A</td>
</tr>
<tr>
<td>Centralizer (s) OD (In), NumberUsed, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Centralizer (s) Depth (s)</td>
<td>N/A</td>
</tr>
<tr>
<td>Grout Top, Measured Density (lbs/gal)</td>
<td>N/A</td>
</tr>
<tr>
<td>Granular Bentonite Top, Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Bentonite Seal Top, Type</td>
<td>0.5' Medium Bentonite Chips (<em>Puriflax</em>)</td>
</tr>
<tr>
<td>Bentonite Seal or Granular Bentonite Bottom (= Filter Pack Top)</td>
<td>5.0'</td>
</tr>
<tr>
<td>Filter Pack Type</td>
<td>1440 Silica Sand</td>
</tr>
<tr>
<td>Screen Bottom (= Screen Top), Type</td>
<td>SCH. 50 PVC</td>
</tr>
<tr>
<td>Screen ID (In), Slot Size (In), Type</td>
<td>SCH. 50 PVC</td>
</tr>
<tr>
<td>Screen Bottom (= Sump, Top), Type</td>
<td>26.0' PVC</td>
</tr>
<tr>
<td>Filter Pack Bottom, Backfill Top, Type</td>
<td>26.0' Backfill Type</td>
</tr>
<tr>
<td>Sump Bottom (= Well Completed Depth), Diameter</td>
<td>N/A</td>
</tr>
<tr>
<td>Total Borehole Depth (= Pilot Hole and &quot;Backfill Bottom&quot;)</td>
<td>26.0'</td>
</tr>
</tbody>
</table>

**Remarks:** Routine well installation on 4/5/05. Concrete well pad poured/installed on 4/5/05. Concrete well pad poured/installed on 4/5/05.

Completed By: **Eunu W. Wep** Date: 4/5/05

Checked By: **Eunu W. Wep** Date: 4/5/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: DATE  1/6/05
Location - North: East:
Date: 4/5/05
Geologist: RMRS
Drilling Group: CME - HT-75 - Allen R. 816

Sample Type: R

Surface Elevation: Area: FORMER FLOOR PRICE REPLACEMENT PRDPPDO
Total Depth: 260'
Company: RMRS/HAMMOND

Sample Description:

0.0 - 1.2' - Clay/Gravel mixture w/ some sand
Dr. Bed, (75% clay) Clay (30-40%) Gravel
(10-10' dia, sub-ang) preliminarily composed of shale and grout. Plastics of clay. Roots common especially on 0.0 - 2.0'
Some disseminated calcite. R Coke
Coating gravel, V.S. moist

1.2 - 2.0' No Recovery

2.0 - 2.5' - Clay/Gravel mixture
Same as above, fm 0.0 - 1.2',
3.5' Broken grout contain a base sl. moist

2.5 - 5.0' Silty, Sandy Clay
H. Br/sh Gr (10% clay), Sand is 9%, subang, coble probably capped in split spoon cyst ap that like rollers. Patchy zones of vet.
Vet, Moist.

2.9 - 4.0' No Recovery

Bedrock contact estimated 4.0
Poor recovery @ 4.0

9.0 - 5.5' - Claystone - oxidized (weathered)
H. Yeild/br (0% clay) w/ some H. Br/sh
Gr/ silt/mulch (0% clay), Abundant patchy
And calcite zones throughout interval
Lk Fr Ck notched throughout, E blk
Stringers. Interval competent except for calcite zones @ 4.2, 4.6 and 5.5
Lmk moisture to moist.

5.5 - 4.3' - Claystone - oxidized (weathered)
Yield/br (20% clay) and clay (10% clay)
Well rounded, 2-4' bkls, E blk
Stringers. Erosion and calcite (skeletal)

6.0 - 7.0' No Recovery

Note: C1aystone - Ck w/ (10% clay) to Fe/cr
With Gritto vation as softs and dry
Abundant calcite fm 8.0 to 8.5 years ago. Also
Large and broken, (particle)

NOTES:
General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO-010
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 29605
Location - North: 72605
Date: 4/5/05
Geologist: E. W. M. P.
Drilling Eqip.: B&K - HT-75 B-386-42

Surface Elevation: 260'
Area: Ferien-Sacramento, Department of P207989
Total Depth: 260'
Company: RMRS/ENR Reusers Project No. J-08-57300
Sample Type: N/A

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 4/6/05

SAMPLE DESCRIPTION

9.0 - 10.5 - Claystone, Br. (1042) 4
10.5 - 11.9 - Yellow-Brown, wet to mid, FeOvisi.
11.7 - 12.3 - Claystone, Br. (1042) 6
12.3 - 12.7 - Claystone (1042) 6
12.7 - 13.4 - Claystone, Br. (1042) 6
13.4 - 14.0 - Claystone, Br. (1042) 6
14.0 - 14.7 - Claystone, Br. (1042) 6
15.6 - 16.6 - Claystone, Br. (1042) 6
16.6 - 17.1 - Claystone, Br. (1042) 6
17.1 - 19.0 - Claystone, Br. (1042) 6
19.0 - 20.5 - Claystone, Br. (1042) 6

NOTES: General: USCS is modified for this log as follows:
1) Badly broken core, accurate footage measurements not possible.
2) Core breaks cannot be matched, accurate footage measurements not possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 79605
Location: North: 45.155
Drilling Equip: ONE-AT-15

Surface Elevation:
Area: Kettle Pond Ponds - Expansion of P207900
Total Depth: 26.0'
Company: USACE/AMS

Drilling Supervisor: [Signature]
Date: 4/6/05
Sample Type: KIP

<table>
<thead>
<tr>
<th>T.D.</th>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
</table>
| 20.0 | 22.4 - CLAYSTONE, Gryph. Bm. (40%)
|      | with lesser yellow Bm (60%) |
|      | Predominately un-oxidized claystone, nontextured. |
|      | Wiz. Fec. coating. |
|      | Blk. organics, blebs along internal bedding planes. |
|      | Natural to dense. Moist. |<sup>(1)</sup> |
| 22.4 | 24.0 - CLAYSTONE, Gryph. Bm. |
|      | Predominately un-oxidized, unweathered claystone bedding. |
|      | Blk. org. stringers along internal bedding planes. |
|      | Dense and firm. Vertically faulted. |
|      | Fec. coating. Sl. moist. |

NOTES: General: USCS is modified for this log as follows:

(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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GC/CL: Gravely, Sandy Clay with silt, brown (7.5YR4/4). 8 - 10% gravel (1/8" - 1/4" diameter, subangular to subrounded, composed of granite, schist, and quartzite). ~8% sand (coarse grained, subrounded to subangular). Clay has medium plasticity. Moist. 1" to 1-1/2" diameter cobbles of quartzite and granite at 0.4'.

CL: Clay with trace gravel and sand, dark brown (7.5YR3/2). ~3 - 5% gravel (1/8" - 1/2" diameter, subangular), ~3 - 5% sand. Clay has medium plasticity. Shattered quartzite cobble at 0.6'. Roots at base of interval. Moist.

CL: Clay with trace gravel and trace sand, brown (10YR4/3) with dark yellowish brown (10YR4/8) mottling. Possibly re-worked claystone with gravel and sand. Weak iron oxidation mottled throughout and disseminated at base. Trace roots. Moist.

No recovery.

CL: Clay with trace gravel and trace sand, same as interval from 0.8' to 1.3'. Moist.

GP: Gravel/Cobbles, schist and quartzite cobbles (3/4" - 2" diameter, subangular) with gravel (1/4" - 1/2" diameter, subangular, composed of amphibolite (?)). Gravel is greenish gray (GLEY5/1).

No recovery

GC/CL: Sandy, Gravely Clay with silt, dark brown (7.5YR3/2) clay matrix with ~30% gravel (1/4" - 3/4" diameter, subangular, composed of quartzite and schist). 5 - 10% sand (coarse grained,
5952
Subangular to subrounded. Clay has medium plasticity. Moist. Shattered cobbles (1" - 2" diameter) at base of interval from 4.6' to 4.8'.

SC/CL: Silty, Sandy Clay with some gravel, brown (7.5YR4/3 to 7.5YR4/4). Sand and gravel increase at base of interval. ~35% sand from 5.1' to 5.4', sand is coarse grained, subangular. ~25% gravel (1/4" - 1/2" diameter, subangular) from 5.1' to 5.4'. Moist. Possibly fluvioglacial in origin (?)

No recovery.

5950
SC/CL: Silty, Sandy Clay with some gravel, same as interval from 4.8' to 5.4'. Moist.

SILTSTONE: TOP OF BEDROCK. Clayey Siltstone with some fine grained sand. Bedrock is gray (10YR6/1) with abundant yellowish brown (10YR5/6) mottling. Siltstone interbedded with claystone and fine grained sandy lenses. Some caliche as stringers and blebs throughout interval. Strong pervasive iron oxidation from 8.5' to 8.7' with ironstone fragments. Moist.

5948
SILTSTONE: Sandy Siltstone, grayish brown (10YR5/2) with light yellowish brown (10YR6/4) iron oxidation mottled throughout. Abundant very fine grained sand in siltstone. Friable. Caliche along internal bedding at 10.7'. Decreasing moisture to slightly moist.

5946
SILTSTONE: Clayey, Sandy Siltstone, yellowish brown (10YR5/6) with gray (10YR6/1) and light brownish gray (10YR6/2) mottling. Clayey lenses at 10.9' and from 11.65' to 11.8'. Black organic stringers associated with clayey lenses. Interval is friable and slightly fissile. Rip-up clasts common. Small healed fracture (45 deg) with iron oxidation at 11.95'. Abundant very fine grained sand from 11.2' to 11.4'. Slightly moist.

5945
SILTSTONE: Clayey Siltstone, yellowish brown (10YR5/6) with gray (10YR5/1) mottling from 12.4' to 13.0'. Color changes to brown (10YR5/3) from 13.0' to 14.0'. Decreasing very fine grained sand to trace. Black organic stringers common from 13.0' to 14.0'. Interval is competent, yet weak to moderately friable. Rip-up clasts common. Weak to moderate iron oxidation throughout. Slightly moist.
CLAYSTONE: Claystone with trace silt, gray (10YR5/1) with grayish brown (10YR5/2) and yellowish brown (10YR5/4) mottling. Weak to moderate pervasive iron oxidation. Some black organic stringers. Interval is firm and dense. Decreased moisture to very slightly moist.

CLAYSTONE: Claystone, un-weathered, dark gray (2.5Y4/1) to gray (2.5Y5/1). Trace iron oxidation along internal fractures from 16.8' to 17.0', and at 17.0'. Interval is highly fissile and friable. Dry.

No recovery.

CLAYSTONE: Claystone, un-weathered, dark gray (2.5Y4/1). Dense and firm, weakly fissile, dry.
**MONITORING WELL INSTALLATION REPORT: Form PRO.118**

**LOCATION CODE:** 80005  **PROJECT NAME:** 1995 Well Replacements  **PROGRAM:** Water Programs-NEPD

**SCREENED FORMATION:** 0/16,  **DRILLING CONTRACTOR:** High Plains  **BORING METHOD:** Hollow Stem Auger

**DATE DRILLED:** 8/15/05  **DATE COMPLETED:** 9/4/05  **TOTAL DEPTH:** 210'  **COMPLETED DEPTH:** 210'

**ESTIMATED DEPTH TO BEDROCK:** 71'  **RIG GEOLOGIST:** E. Warp  **LOGGING GEOLOGIST:** E. Warp

**BOREHOLE DIAMETER IN SCREWED INTERVAL:** 8'  **QUANTITY OF FLUIDS LOST DURING DRILLING:** N/A

**INITIAL WATER LEVEL (FT, DATE):** Dry on 8/15/05  **COMPLETED WATER LEVEL (FT, DATE):** 10.18  **10-5-05**

**DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.):** 2'' T.D. PVC Well

**TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.):** Above-ground Steel protective casing

---

**ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE**

* Denotes items that may not be applicable, depending on boring method, well protection & purpose

---

**PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):** 3.2' AGS

**SECONDARY CASING TOP:** N/A  **BOTTOM:** N/A  **TYPE:** N/A

**SURFACE CASING TOP:** 2.75'.  **ID (IN):** 2.0'.  **Diameter:** 6''

**SURFACE SEAL TOP:** 0.125'  **Diameter:** 8''

**PROTECTIVE CASING BOTTOM, ID (IN):** 1.625'  **Diameter:** 6''

**WELL PAD DIMENSIONS, TYPE:** 3' x 3'  **Concrete:** 705 lbs.

**ADD'L CASING FILL TOP:** N/A  **BOTTOM:** N/A  **TYPE:** N/A

**SURFACE ISOLATION CASING TOP:** N/A  **BOTTOM:** N/A

**SURFACE ISOLATION CASING ID (IN):** N/A  **TYPE:** N/A

**OTHER (E.G., ASEPTIC) CASING TOP:** N/A  **BOTTOM:** N/A

**OTHER CASING ID (IN):** N/A  **TYPE:** N/A  **PURPOSE:** N/A

**CENTRALIZER(S) OD (IN):** N/A  **NUMBER USED:** N/A  **TYPE:** N/A

**CENTRALIZER(S) DEPTH(S):** N/A

**GROUT TOP:** N/A  **MEASURED DENSITY (LBS/GAL):** N/A  **TYPE:** N/A

**GRANULAR BENTONITE TOP:** N/A  **TYPE:** N/A

**BENTONITE SEAL TOP:** 0.5'  **lbs:** N/A  **TYPE:** Medium Bentonite Chips - Pale Grey - 1/16''

**FILTER PACK TYPE:** 1/4'' Silica Sand  **BRAND:** C.S. S.

**SURFACE CASING BOTTOM (= SCREEN TOP):** 5.8'  **TYPE:** Sch. 40 PVC

**SCREEN ID (IN):** 2.0'  **SLOT SIZE (IN):** 0.01'  **TYPE:** Sch. 40 PVC

**SCREEN BOTTOM (= SUMP, TOP):** 20.8'  **SUMP TYPE:** Threaded end cup

**FILTER PACK BOTTOM (= BACKFILL TOP):** 21.0'  **BACKFILL TYPE:** N/A

**SUMP BOTTOM (= WELL COMPLETED DEPTH):** 210'  **PILOT HOLE TOP, DIAMETER:** N/A

**TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM):** 210'

**REMARKS:** Routine well installation

---

**COMPLETED BY:** Ellen S. Warp  **DATE:** 8/15/05

**CHECKED BY:** Gary S. Holsen  **DATE:** 8/18/05
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 00005  
**Location - North:**  
**Date:** 8/9/05  
**Geologist:** E. WARP  
**Drilling Equip.:** CME-TS-HT - Auger Rig

### RMRS LOGGING SUPERVISOR:

**APPROVAL**

**DATE:** 8/4/05

### SAMPLE DESCRIPTION

- **0.0-0.4 ft.** Gravelly Sandy Clay 90%, Bed. (0.5% 7YR 4/4), 8-12% gravel (0.5-8" dia.), sub-angular to sub-rounded, composed of granite, sandstone, and gravel. 90% Sand (e.g., sub-rounded to sub-angular), clay has no plasticity. MOIST.
  - 1.1% silica, 1% stone and granite 8.9%.
  - 45.5% clay. Wet gravel and sand. Dk. brn. (0.5% YR 4/4).
  - 3-5% gravel (0.5-8" dia., 8-12" dia.), 7-10% sand. Clay has no plasticity. Shattered granite, gravel, and sand. 0% liquids at base of interval. MOIST.

- **0.5-1.5 ft.** Clay 90%, Bed. 80%, Bed. (0.5% 7YR 4/4) matting. Possibly re-worked claystone, gravel and sand. Brn. Fed. n't. Ital. and thoroughly disseminated at base. R. roots, MOIST.

- **1.8-2.0 ft.** No recovery.

- **2.0-2.1 ft.** Clay 90%, gravel and sand (sand as above). Brn. 80%, MOIST.

- **2.1-5.7 ft.** Gravel, cobbles, granite, cobbles (24" dia.), sub-rounded. 70% gravel (4-8" dia., 8-16" dia.), composed of amphibolite (3) gravel is grayish (4.5Y 4/7).

- **5.7-10.4 ft.** No recovery.

- **4.0-4.8 ft.** Sandy gravelly Clay 90%, Bed. (0.5% YR 4/4).
  - 55% gravel (4-8" dia., sub-angular, composed of granite and schist). 5-10% sand (e.g., sub-angular, sub-rounded, clay has no plasticity. MOIST.
  - Shattered cobbles (1-2" dia.) at base of interval. Brn. 4.6-4.8 ft.

- **4.8-5.4 ft.** Silty Sandy Clay "some gravel" Brn. (0.5% YR 4/4). Sand and gravel increase at base of interval. 35% sand, 51% 4.5-4.8 ft., sand and 4% gravel (4-8" dia., 8-16" dia., sub-rounded). Brn. 5.1-5.4 ft., MOIST. Possibly formed in origin (2).

- **10.4-19.0 ft.** No recovery.

- **19.0-21.6 ft.** Silty Sandy Clay "some gravel" Brn. (0.5% YR 4/4). 54% MOIST.

- **21.6-22.0 ft.** Bedrock contact @ 21.6 ft.

- **9.1-9.3 ft.** Clayey Siltstone "some p. g. sand" Bedrock 60% (0.5% 8Y 4/4), abundant yellowish Brn. (0.5% YR 4/4) matting. 5% limestone interbedded Weylimestone and Aq. Sandy lenses. Some calcite as stringers and bleeds throughout interval. S. perv. Fedn. Brn. 8.5-8.7 ft. with Fe-stone fragments. MOIST.

### NOTES:

- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No:** RMRS/OPS-FRO.101

**Revision:** 0  
**Date effective:** 12/31/98

**Page 27 of 28**
### ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

**Borehole Number:** 80005  
**Location - North:**  
**Date:** 8/9/05  
**Geologist:** T. Withr  
**Drilling Equip.:** CME-75-4T Hollow Stem Auger  
**Sample Type:** Continuous Core  

### APPROVAL

**DATE:** 8/10/05

### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Description</th>
</tr>
</thead>
</table>
| 9.3-11.9 | Sandy Siltstone - Gray shale (10YR7.5)  
Wht. Yellish Brn (10YR4.5) FeOx mats throughout  
Abundant v.f. sand in Siltstone  
Friable  
Caliche along internal bedding @ 10.7'  
Deer moisture to slightly moist |
| 12.0 |  
10.9 - 11.9 | Clayey, Sandy Siltstone, Yellish Brn (10YR7.5)  
Gr. 10YR4.5) and H. Brnsh.  
Gr (10YR4.5) mats  
Clayey lenses @ 10.9' and Am. 11.05 to 11.18  
Bk. Organic stringers associated w/ clayey lenses  
Interval is friable and slightly fissile.  
Small healed fractures (45°) @ FeOx at 11.05  
Abundant v.f. sand Am. 11.2 to 11.4  
SL. MOIST |
| 12.1-14.0 | Clayey Siltstone, Yellish Brn (10YR4.5)  
(10YR5.5) @ Gry (10YR5.5) mats Am. 12.1 to 13.0  
13.0 | Color changes to Brn (10YR7.5) Am. 13.0  
14.0 | Deer v.f. sand to Bk. Organic stringers common Am. 13.0 to 14.0  
Interval is competent yet weak to moderately friable.  
Wk. to mod. FeOx throughout. SL. MOIST |
| 14.0-16.8 | Claystone w/ Bk. Gry (10YR7.5) @ Gryish Brn (10YR5.5) and  
Yellish Brn (10YR7.5) mats  
Wk. to mod.  
Perv. FeOx. Some bk. Org. stringers  
Interval is firm and dense.  
Deer moisture to v. slightly moist |
| 16.8-19.0 | Claystone - Un-weathered  
Dk. Gry (2.5Y4/1) to Gry (2.5Y5/1)  
Te FeOx along internal fractures Am. 16.8 to 17.0  
and at 17.0  
Interval is highly fissile and Arible. DRY |
| 19.0-20.0 | No recovery |

### NOTES

- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.  
- (1) Badly broken core, accurate footage measurements not possible.  
- (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No.** RMRS/OPS-PRO.101  
**Revision 0**  
**Date effective:** 12/31/98  
**Page 27 of 28**
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 80005
Surface Elevation: 
Location - North: 
East: 
Date: 8/9/05
Geologist: E. WAPE
Drilling Equip.: EME-75-H Hollow Stem Auger
Sample Type: Continuous Core - split spoon
Company: USEL/HIGH Plains
Project No: HFD5/300

RMRS LOGGING SUPERVISOR
APPROVAL [Signature] DATE 8/10/05

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21'</td>
<td></td>
<td>8.0-21.0' - CLAYSTONE, weathered, DK. Gry. (2.5 YR), Dense and Firm, Wfy. fissile, DRY</td>
</tr>
<tr>
<td>21'</td>
<td></td>
<td>T.D. @ 21.0'</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.
- (1) Badly broken core, accurate footage measurements not possible.
- (2) Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Protective Casing, Steel, 6 in. ID.</td>
<td>0</td>
<td>GC/CL: Gravel/Sandy Clay with silt mixture. Imported Qalrf fill. Strong brown (7.5YR4/6). 20 - 25% gravel (1/8&quot; - 1&quot; diameter, subrounded to subangular), predominately quartzite with less schist and granite. 20% sand (coarse grained, subangular to subrounded). Clay has medium plasticity. Dark brown (7.5YR3/2) clay lense from 0.4' to 0.5'. Disseminated caliche, tiny white specks common throughout interval. Moist. No recovery.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Casing, Sch 43/PVC, 2 in. ID.</td>
<td>1</td>
<td>GC/CL: Gravel/Sandy Clay with silt mixture, same as interval from 0.0' to 1.2'. Moist. No recovery</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hydrated Bentonite Chips</td>
<td>2</td>
<td>CL: Gravelly, Sandy Clay, dark brown (7.5YR3/2). Distinct color change. ~10% sand (coarse grained, subangular), 5 - 8% gravel (1/8&quot; - 1/2&quot; diameter, subrounded to subangular). Trace to some</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Filter Pack, 16/40 Silica Sand</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
organic material (woodchips). Medium to high plasticity, very moist. Color change may indicate prior ground surface (before fill added).

GC/CL: Gravelly, Sandy Clay, dark gray (7.5YR4/1) to brown (7.5YR4/4). ~30% sand (coarse grained, subangular), 20 - 25% gravel (1/8" to 1-1/2" diameter, subrounded to subangular). Possible fluvial deposit. Well graded, poorly sorted, very moist.

CL: Silty Clay. Re-worked bedrock. Light gray (10YR6/2) with brownish yellow (10YR6/6) mottling. Weak iron oxidation mottling. Trace caliche. [Very poor recovery, clay has been extruded like a "ribbon" due to a clogged cutting shoe.] Very moist.

No recovery.

CL: Silty Clay. Re-worked bedrock. Light gray (10YR7/1) with some light yellowish brown (10YR6/4) iron oxidation mottling. Trace alluvial clastics indicate not yet bedrock.

CL: Clay with trace to some sand, gravel, and silt. Dark grayish brown (10YR4/2) with some light brownish gray (10YR6/2), 3 - 5% gravel (1/8" - 1/4" diameter), 3 - 5% sand (coarse grained, subangular). Weak to moderate iron oxidation mottled throughout. Very moist.

SILTSTONE: TOP OF BEDROCK. Clayey Siltstone, gray (10YR6/1) with yellowish brown (10YR6/4) iron oxidation mottled throughout. Very subtle bedrock contact. [Very poor recovery, cutting shoe is clogged causing siltstone to appear "ribboned" in sample tube.] Very moist.

No recovery.


CLAYSTONE: Claystone, grayish brown (10YR5/2). Weak pervasive iron oxidation. Trace caliche blebs. Trace black organic material. Weakly friable. Organics or trace iron oxidation along internal fractures at 12.3', 12.6', and 13.4'. Decreased moisture to very slightly moist.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>5920</td>
<td>Threaded Snd Cap</td>
</tr>
<tr>
<td>5921</td>
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<td>5922</td>
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<tr>
<td>5923</td>
<td></td>
</tr>
<tr>
<td>5924</td>
<td></td>
</tr>
<tr>
<td>5925</td>
<td></td>
</tr>
</tbody>
</table>

**SILTSTONE:** Clayey Siltstone, light brownish gray (10YR6/2) with some light yellowish brown (10YR6/4) iron oxidation mottling throughout. Massive texture. Weakly friable. Trace black organic stringers. Trace iron oxidation on minor internal fractures at 15.1', 15.5', 15.8', and 16.3'. Trace moisture. Occasional rip-up clasts.

**CLAYSTONE:** Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Very fissile, friable, and dry. Abundant black carbonaceous material from 18.0' to 18.5'.

No recovery. Reamed with augers from 19.0' to 20.15'. Did not sample this interval.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 80105  PROJECT NAME: Eyes Well Replacement  PROGRAM: Water Programs - WARP
SCREENED FORMATION: Argentine Sandstone  DRILLING CONTRACTOR: High Plains  BORING METHOD: Hollow Stem Auger
DATE DRILLED: 8/10/05  DATE COMPLETED: 8/10/05  TOTAL DEPTH: 20.15'  COMPLETED DEPTH: 20.15'
ESTIMATED DEPTH TO BEDROCK: 17.5'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): 3.25  COMPLETED WATER LEVEL (FT, DATE): 3.25  FULL TO TOP 8/10/05
DIAMETER & TYPE OF INSTALLATION (WELL/ZIPEROMETER/WELL POINT/ETC.): 2" PVC - Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPITIC, ETC.): Above Ground, Steel Protective Casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.45' NG
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 3.05' ID (IN): 2.0'
SURFACE SEAL TOP: 1.04' ID (IN): 0.5' BOTTOM: N/A  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 1.4' ID (IN): 6'  TYPE: Steel
WELL PAD DIMENSIONS, TYPE: 3' X 3' - Concrete  6033 lbs
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: N/A  TYPE: N/A
*BENTONITE SEAL TOP: 0.5' HGS  TYPE: Med. bentonite chips "Pure Gold" hydrated w/1/2 gall of distilled water
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 1.95'
FILTER PACK TYPE: 1/4" Silica Sand  BRAND: C.S.S.T.
SURFACE CASING BOTTOM (= SCREEN TOP): 1.95'  TYPE: 2" I.D. - Sch. 40 - PVC
SCREEN ID (IN): 2.0  SLOT SIZE (IN): 0.01  TYPE: 2" I.D. - Sch. 40 - PVC
SCREEN BOTTOM (= SUMP TOP): 19.95'  SUMP TYPE: Threaded end cap
FILTER PACK BOTTOM (= "BACKFILL TOP": 20.15'  "BACKFILL TYPE": N/A
SUMM BOTTOM (= WELL COMPLETED DEPTH): 20.15'  "PILOT HOLE TOP DIAMETER": N/A
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND BACKFILL BOTTOM": 20.15'
REMARKS: Routine well installation. Concrete well pad installed on 8/10/05

COMPLETED BY: Elven S. Warp  DATE: 8/10/05
CHECKED BY: Gary Strietesky  DATE: 8-18-05
<table>
<thead>
<tr>
<th>Borehole Number: 80105</th>
<th>Surface Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location - North: West</td>
<td>Area: Original half</td>
</tr>
<tr>
<td>Date: 9/10/05</td>
<td>Total Depth: 20.15</td>
</tr>
<tr>
<td>Geologist: E. Waar</td>
<td>Company: DES/High Plains</td>
</tr>
<tr>
<td>Drilling Equip: CASE-75-H7-Hollow Stem Auger</td>
<td>Project No.: HAO51300</td>
</tr>
<tr>
<td>Sample Type: Continuous Core push</td>
<td></td>
</tr>
</tbody>
</table>

**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

### APPROVAL

<table>
<thead>
<tr>
<th>DATE</th>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/10/05</td>
<td>0.0-1.2' - Gravel/Sandy Clay 85%/15% mixture. Imported granular fill, Strong brn. (7.5% g), 20%-25% gravel (1'-1'/2' dia, sub-rounded to angular), predominantly quartzite, less schist and granite, 20% sand (e.g., sub-rounded to angular), clay has medium plasticity. Dk. brn. (7.5% e), clay lens, from 0.4' to 0.5', disseminated calcite. Tiny, whitish specks common throughout interval. MOIST.</td>
</tr>
<tr>
<td>2.2-2.5' - No recovery</td>
<td></td>
</tr>
<tr>
<td>2.6-4.0' - No recovery</td>
<td></td>
</tr>
<tr>
<td>4.0-4.5' - Gravelly, Sandy Clay, Dk. Brn. (7.5% g), 5% gravel (1'-1'/1' dia, sub-rounded to angular), R. Some organic material (wood chips), Medium to high plasticity. V. MOIST. Color change may indicate prior ground surface before fill added.</td>
<td></td>
</tr>
<tr>
<td>4.6-5.0' - Gravelly, Sandy Clay - Dk. Brn. (7.5% e), 50% gravel (1'-1'/2' dia, sub-rounded to angular), 25% sand (e.g., sub-rounded to angular). Possible fluvial deposit. Well graded, poorly sorted. V. MOIST.</td>
<td></td>
</tr>
<tr>
<td>5.1-5.5' - Silty Clay - Remapped bedrock, Lt. gray, (10YR 4.5), Brn. (10YR 5/6) moister, Nd. Fe oxin notting. E calcite, V. No recovery. Clay has been extruded like a &quot;ribbon&quot; due to a clogged cutting shoe. V. MOIST.</td>
<td></td>
</tr>
<tr>
<td>5.6-9.0' - No recovery</td>
<td></td>
</tr>
<tr>
<td>7.0-7.35' - Silty Clay, Remapped bedrock, Lt. gray, (10YR 2/6), W. same as H. brn. (10Y6), moister. F. Fe oxin notting. Nd. calcite, V. No recovery. Clay has been extruded like a &quot;ribbon&quot; due to a clogged cutting shoe. V. MOIST.</td>
<td></td>
</tr>
<tr>
<td>7.5-7.75' - Clay 50% to some very fine gravel, 50% Silt. Dk. Brn. (7.5% g), 50% gravel (1'/2' dia), 5% sand (e.g., sub-rounded to angular). Nd. Fe oxin notting throughout. V. MOIST.</td>
<td></td>
</tr>
<tr>
<td>7.8-8.0' - Clayey Silt, brn. (10Y6), with 10YR 4/6, brn. V. Subtle bedrock, V. No recovery. Noting. V. Poor recovery, cutting shoe is clogged causing or &quot;ribbon&quot; in sample tube. V. MOIST.</td>
<td></td>
</tr>
</tbody>
</table>

### NOTES

General: USGS is modified for this log as follows:

- Materials amounts are estimated by % volume instead of % weight.
- 1) Badly broken core, accurate footage measurements not possible.
- 2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No: RMRS/OPS-PRO.101

Revision 0

Date effective: 12/31/98

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 80105
Location - North: 8/16/15
Date: 8/16/15
Geologist: E. WARP
Drilling Equip.: CME-65T-Hollow Stem Auger

Surface Elevation: O:\\Original Landfill
Area: O:\\Original Landfill
Total Depth: 20.15'
Company: RPS/High Plains
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL
DATE 8/10/05

SAMPLE DESCRIPTION

10.0 - 10.4' CLAYSTONE, Gry (10YR 2.5/1) w/yellowish brn (10YR 3/1) mottling. Caliche blebs and stringers common throughout. W. FeOx, mottling. Massive texture. Moderately friable. Notable decrease in moisture to SL MOIST.

10.0 - 10.4' CLAYSTONE, V. Dk Gry (10YR 3/1) to Gry (10YR 5/4). Massive texture. Abundant blk, organic stringers Am. 10.4 to 10.6. V. Caliche stringers. Mod. friable. No FeOxln.

12.0 - 14.0' CLAYSTONE, Gry'sh brn (10YR 5.5/2). We. perv. FeOxln. V. Caliche blebs. R. blk, organic material. Wkly friable. A. stringers. R. FeOxln along internal fractures @ 12, 3, 13, 9. Dec. moisture to V. SL MOIST.


16.5 - 17.0' No recovery

17.0 - 19.0' CLAYSTONE, Dk Gry (10YR 4/1) to V. Dk Gry (10YR 3/1). V. fine, friable and clv. Abundant black carbonaceous material @ 18.0 - 18.5'.

REMOVED WITH AUGERS FIN. 19.0 -> 20.15 (TA)
DID NOT SAMPLE THIS INTERVAL

20.15' = T.D.

NOTES:

General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight. 19.0 - 20.15'

(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

NO RECOVERY Procedure No. RMRS/OPS-PRO.101
Revision 0

8/14/05 Date effective: 12/31/98
Page 27 of 28

(2011-10-01 16:49:08 GMT Form CT.1.a.0195.97)
GC/CL: Gravel/Sandy Clay with silt, strong brown (7.5YR4/6). 15 - 25% gravel (1/8" - 3/4" diameter, subrounded to subangular, predominately quartzite and granite). 20 - 25% sand (coarse grained, subangular). Clay has medium plasticity. Moist from 0.0' to 1.0'. Saturated, but not flowing, from 1.0' to 1.5'.

CL: Silty Clay with trace sand and trace gravel, dark brown (7.5YR3/2) with some yellowish brown (10YR5/4) mottling. Clay has medium plasticity. Granite clast (3/4" diameter, angular) at 1.7". Saturated, but not flowing.

CL: Clay with trace silt, trace gravel, and trace sand, brown (7.5YR4/3) from 2.0' to 2.2', yellowish brown (10YR5/4) to dark yellowish brown (10YR4/4) from 2.2' to 4.0'. Appears to be re-worked claystone bedrock (?). Interval is firm and dense but pliable due to moisture. Trace black organic stringers. Trace caliche blebs at base of interval. Roots and twigs common throughout. Gravel (1/4" - 1/2", subrounded) from 3.4' to 3.6', and at base of interval. Decreased moisture to very moist.
CL: Clay (re-worked claystone), gray (10YR5/1) with trace yellowish brown (10YR5/6) mottling. Roots common throughout interval. Trace caliche blebs. Caliche stringer with iron oxidation halo at 5.1'. Slight color change from 5.9' to 6.7' to light brownish gray (10YR6/2) with faint mottling. Decreased moisture to moist.

No recovery.

CL: Clay with trace gravel (probably re-worked claystone), grayish brown (10YR5/2). Roots common. Soft and pliable. Saturated, free water from 7.6' to 8.0'. Gravel (1/2" diameter, subrounded) at 7.6' with trace iron oxidation in clay surrounding gravel clast.

GC/CL: Gravelly Clay, dark brown (7.5YR3/3) with some strong brown (7.5YR5/6) iron oxidation at 8.15'. Strongly fractured and crumbly. 20 - 25% gravel (1/4" - 3/4" diameter, subrounded to subangular). Composition of gravel (?) - possible conglomerate, coated with iron oxide and manganese oxide. Interval is saturated with free water.

CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock) - possibly re-worked. Grayish brown (10YR5/2) to gray (10YR5/1) with minor yellowish brown (10YR5/6) mottling. Roots common. Trace caliche stringers. Interval competent from 8.35' to 9.0'; friable from 9.0' to 9.45'. Distinct decrease in moisture to very moist, further decreasing to moist at base.

CLAYSTONE: Claystone, grayish brown (10YR5/2) to gray (10YR5/1) with trace brownish yellow (10YR6/8) iron oxidation mottling throughout. Massive texture. Interval is moderately friable. Slightly moist.

No recovery.

CLAYSTONE: Claystone, pale brown (10YR6/3). Massive texture. Trace iron oxidation along bedding planes. Silty lense (~1/8" thick) with iron oxidation at 13.8'. Firm and dense. Decreased moisture to very slightly moist. Trace silt at 12.5' and below.
CLAYSTONE: Claystone, gray (10YR5/1) to dark gray (10YR4/1). Massive textured. Trace iron oxidation along bedding planes (sub-horizontal). Disseminated caliche coating from 15.2' to 15.8' along vertical fracture with iron oxidation. Interval weakly friable. Trace black organic stringers. Decreased moisture to trace.

CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Massive texture. Moderately fissile and friable. No iron oxidation. Trace moisture to dry.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 80205 PROJECT NAME: CWRS Well Replacements PROGRAM: Water Programs - WBRP
SCREENED FORMATION: 04/70 WELL CONTRACTOR: High Plains BORING METHOD: Hollow Stem Auger
DATE DRILLED: 06/10/05 DATE COMPLETED: 06/10/05 TOTAL DEPTH: 20.0' COMPLETED DEPTH: 20.0'
ESTIMATED DEPTH TO BEDROCK: 8.35' RIG GEOLOGIST: E. Waep LOGGING GEOLOGIST: E. Waep
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Day on 01/01/05 COMPLETED WATER LEVEL (FT, DATE): 12.03 Tc 8/18-05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0" I.D. PVC well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPCT, ETC.): Above ground - steel protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.93'g85
* SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 3.48' ID (IN): 2.0"
SURFACE SEAL TOP: 1.13' BOTTOM: 0.47 TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 8.87 lbs, 6" steel
WELL PAD DIMENSIONS, TYPE: 3' x 3' - Concrete
* ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
* SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
* SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
* OTHER (E.G., ASEC'TIC) CASING TOP: N/A BOTTOM: N/A
* OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
* CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
* CENTRALIZER(S) DEPTH(S): N/A
* GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
* GRANULAR BENTONITE TOP: N/A TYPE: N/A
* BENTONITE SEAL 0.4' TOP: 4.2'g85 TYPE: Molded bentonite chips - "Pure Gold" (used 2 bags)
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.2'g85
FILTER PACK TYPE: 4/40 Silica Sand BRAND: C.S.S.T (used 2 bags)
SURFACE CASING BOTTOM (= SCREEN TOP): 4.75 TYPE: 2.0" I.D. - Sch. 40 PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: 2.0" I.D. - Sch. 40 PVC
SCREEN BOTTOM (= SUMP, TOP): 19.75' SUMP TYPE: Sch. 40 PVC - Conical threaded end cap
FILTER PACK BOTTOM (= BACKFILL TOP): N/A *BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 20.0' *PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND BACKFILL BOTTOM): 20.0'

REMARKS: Routine well installation

COMPLETED BY: Ellen J. Waep DATE: 06/10/05
CHECKED BY: Gary Stitesky DATE: 8/18-05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 80205
Location - North: East:
Date: 8/19/05
Geologist: E. WARP
Drilling Equip: CME TS-HT Hollow Stem Auger

Surface Elevation: Area: Original Landfill
Total Depth: 22.0'
Company: USGS High Plains Project No. 00010300
Sample Type: Continuous Core

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 8/19/05

SAMPLE DESCRIPTION

0-0.15' - Gray/Beige clayey sand, div. fine, silt, silt, clay, firm, gravel. (93X49%)
0.15-2.25' - Silt, clayey sand, div. fine, silt, silt, clay, firm, heterogeneous. 70-75% sand. (38X49%)
2.25-1.5' - Clay has medium plasticity, moist. 60-70% sand. (38X49%)
1.5-1.0' - Silty clayey sand, div. fine, silt, silt, clay, firm, heterogeneous. (93X49%)
1.0-0.6' - No recovery.
0.6-0.2' - Clayey silty sand, div. fine, silt, silt, clay, firm, heterogeneous. (93X49%)
0.2-0.0' - Clayey silty sand, div. fine, silt, silt, clay, firm, heterogeneous. (93X49%)

NOTES:

General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.109
Revision 0
Date effective: 12/31/98

Bedrock contact @ 8.35' (v. vague.)

8.35-9.45' - Claystone (Bedrock) possibly re-worked.
9.45-10.50' - Gray clayey sand, div. fine, silt, silt, clay, firm, heterogeneous. (93X49%)
10.50-10.65' - No recovery.

Distinct dear in moisture to V. MOIST, further cleaning to MOIST @ BASE.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.0'</td>
<td>Yellow clay, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>14.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>16.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>17.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>18.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>19.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
<tr>
<td>20.0'</td>
<td>Light gray, massive texture, Fe oxides along bedding planes, silty silt, 15% Fe oxides.</td>
</tr>
</tbody>
</table>

**NOTES:**
- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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GC/CL: Sandy, Gravelly Clay, brown (7.5YR4/3 to 7.5YR5/3). 60 - 65% clay, medium plasticity, 20 - 25% gravel (1/8" - 1" diameter, subangular), ~15% sand (coarse grained, subangular). Trace to some disseminated caliche throughout interval. 1-1/2" diameter quartzite cobble (subangular) at 0.9'. Moist.

No recovery

GC/CL: Sandy, Gravelly Clay, strong brown (7.5YR4/6 to 7.5YR5/6). Slight color change, otherwise unchanged from 0.0' to 1.5' interval. Shattered 1" to 1-1/2" diameter cobbles of quartzite at 2.0', 2.5', and 2.7'. Approximately 45% of interval is shattered cobbles. Moist.

CL: Clay with trace to some gravel and sand. Yellowish brown (10YR5/4) with trace to some brownish yellow (10YR6/8) motting. 5 - 8% gravel (1/8" - 1/2" diameter, subrounded to subangular). Clay appears to be derived from claystone (bedrock) material. Weak disseminated iron oxidation. Trace disseminated caliche. Moist.
SC/GC: Silty, Gravelly Sand, grayish brown (10YR5/2). 70 - 75% silty sand (medium grained to coarse grained, subrounded to subangular), 25 - 30% gravel (1/8" to 3/4" diameter, subangular to subrounded). Gravel composed of quartzite, granite, and concrete. Moist. Abundant concrete fragments (grayish-white concrete with angular rock clasts) from 5.6' to 6.0' (1" to 2" diameter).

GC: Silty, Sandy Gravel fill, grayish brown (10YR5/2) to light brownish gray (10YR6/2). Gravel fill composed of manmade and natural material. 65 - 70% of interval composed of gravel and concrete fragments (1/4" to 2" diameter). 1" to 2" diameter cobble-size chunks of vesicular, lithic-rich man-made material at 6.5' and 7.7' to 7.9'. Reddish-brown (5YR4/4) to dark reddish gray (5YR4/2) vesicular matrix with 1/8" to 1/4" diameter, subrounded clasts of medium gray (GLEY) vesicular material. Clasts in material (chunk) at 7.9' are yellowish red (5YR5/6 to 5YR4/6). Some to abundant 1" to 1-1/2" diameter, subangular fragments of concrete from 8.0' to 8.5'. Very moist increasing to saturated (free water) at 9.3'. Very moist clay with sandy lense from 6.4' to 6.7'. Wet in sandy lense from 7.6' to 8.0'. 2" wood fragment at 9.3'.

No recovery.

SC/GC: Asphalt Gravel/Sand mixture, black (10YR2/1). ~80% silty sand composed of asphalt and road base with ~20% gravel (1/8" to 3/4" diameter, subrounded) composed of asphalt and road base. Previous ground surface prior to fill being placed on 881 Hillside. Saturated and flowing water.

GC/CL: Gravel/Sandy Clay mixture with some silt. Brown (7.5YR5/4). ~40% gravel (1/8" - 1" diameter, subrounded to subangular, composed of quartzite and granite). ~35% silty clay (medium plasticity), ~30% sand (coarse grained, subangular to subrounded). 2" quartzite clast at 10.7'. 1" concrete clast at 10.8'. Some caliche disseminated throughout. Wet and flowing from 10.5' to 10.6', remainder of interval is saturated but has no flowing water.

No recovery.

GC/CL: Gravel/Sandy Clay with some silt. Very similar to above interval from 10.5' to 11.5' with slight color change from brown (7.5YR5/4) to strong brown (7.5YR4/6). Disseminated caliche common. 3" diameter quartzite cobble at 13.1'. Saturated, but not flowing.

No recovery.
GC/CL: Gravelly, Silty Clay with trace to some sand, light brown (7.5YR6/4) to brown (7.5YR5/3) with trace to some strong brown (7.5YR5/8). ~70% silty clay (medium plasticity), 15 - 20% gravel (1/8" - 1/2" diameter, subrounded), 10 - 15% sand (medium grained to coarse grained, subrounded). Weak to moderate iron oxidation mottled throughout. Trace disseminated caliche. Saturated, but not flowing.

No recovery.

GC/CL: Gravelly, Silty Clay with some sand. Same as interval from 14.0' to 15.7'. Saturated, but not flowing.

No recovery.

CL: Gravelly, Silty Clay with some sand, brown (10YR5/3) with trace to some yellowish brown (10YR5/6) mottling and trace to some light olive gray (5Y6/2) mottling. ~80% silty clay (medium plasticity), ~10 - 15% gravel (1/8" - 1/2" diameter, subrounded), 5 - 8% sand (medium grained to coarse grained, subrounded to subangular). Slight decrease in gravel from above interval. Trace disseminated caliche. Saturated, but not flowing.

No recovery.

CL: Gravelly, Silty Clay with trace sand, brown (7.5YR5/4). 75 - 80% silty clay (medium plasticity), ~20% gravel (1/4" - 1" diameter, subrounded, composed of quartzite and granite). Some caliche-coated gravel clasts (1" diameter) at base of interval. Saturated, but not flowing.

CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock) with trace to some silt, grayish brown (10YR5/2) to dark grayish brown (10YR4/2). Massive texture. Friable, broken/crumbly. Trace black organic stringers. Definite decrease in moisture from saturated to moist.

No recovery.

CLAYSTONE: Claystone to claystone with silt, dark grayish brown (10YR4/2) to very dark grayish brown (10YR3/2). Firm and dense. Weak to moderate iron oxidation along internal fractures (70 - 90%) at 23.3' to 23.5' and 24.6' to 25.0'. Black organic stringers common from 25.7' to 27.0'. Massive texture. Abundant black organic
material along sub-horizontal bedding planes from 26.2' to 27.0'.

Not sampled between 27.0' and 27.5'. Reamed out with augers only.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 88205  PROJECT NAME: C405 Well Replacement  PROGRAM: Water Programs
SCREENED FORMATION:  Borehole  DRILLING CONTRACTOR: Layne  BORING METHOD: Hollow Stem Auger
DATE DRILLED: 4/28/05  DATE COMPLETED: 4/29/05  TOTAL DEPTH: 27.5'  COMPLETED DEPTH: 27.5'
ESTIMATED DEPTH TO BEDROCK: 203'  RIG GEOLOGIST: E. Warp  LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8"  QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): N/A  ADDITIONAL WATER LEVEL (FT, DATE): 9.97 (2m 70cm) 4/29/05
DIAMETER & TYPE OF INSTALLATION (WELL/Piezometer/WELL POINT/etc.): 2" I.D.- PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground Steel

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.85' aqs
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.3' aqs  ID (IN.): 2.0"
SURFACE SEAL TOP: 1.2' TOP: BOTTOM: 0.2"  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN.): 2.15" I.D.  TYPE: 5" x 5" Square steel
*WELL PAD DIMENSIONS, TYPE: 3' x 3', Concrete
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN.): N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN.): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN.): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (lbs/gal): N/A
*GRANULAR BENTONITE TOP: N/A
*BENTONITE SEAL TOP: 0.2"  TYPE: Bentonite pellets (4") - Baccard and Bentonite chips (Enviroplug)
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 5.0'
FILTER PACK TYPE: 1/40 Silicon Sand  BRAND: C.S.S.
SURFACE CASING BOTTOM (= SCREEN TOP): 7.05' TYPE: Sel. 40 - PVC
SCREEN ID (IN.): 8.0"  SLOT SIZE (IN.): 0.01" TYPE: Sel. 40 - PVC
SCREEN BOTTOM (= SUMP TOP): 27.15"  SUMP TYPE: Threaded End Cap
FILTER PACK BOTTOM (= BACKFILL TOP): 27.5'  BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 27.5'  PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 27.5'

REMARKS: Routine well installation on 4/28/05, lagged/sampled at 0-270 ft
Room 1 auger (not sampled) at 270-295'. Well pad installed on 4/29/05
COMPLETED BY: Ellen S. Warp  EEllen S. Warp  DATE: 7/7/05
CHECKED BY: J. Bogdan  J. Bogdan  DATE: 8/3/05
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 88205
Location - North: 100
East: 100
Date: 4/28/80
Geologist: WAP
Drilling Equip.: CME 75D - Hollow Stem Auger

Surface Elevation: Replacement of well 7 5187
Area: Total Depth: 215'
Company: HADDY
Project No.: WAD57300
Sample Type: Continuous Core Split Downhole Sampler

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 7/19/85

SAMPLE DESCRIPTION

0.0-1.5' Sandy, gravelly clay. Bnn (95.4% 8% 1.5), 10.0% clay-mud, plasticity 26-25, gravel (1/2"-1"), subst. 10-15% sand. Some clay, calcite, throughout interval. 1/2 dia. cobbles of granite. (0.9') MOIST.

1.5'-2.2' No recovery

2.0-3.0' Sandy, gravelly CLAY, Strong Bnn (100% 0% 0%), Slight color change otherwise, undisturbed. 1.5' interval. Shatter 1/2" clay. Cobbles of granite 1/2", 2/3", and 2". Approximately 45% of interval is shattered. MOIST.

3.0-5.3' CLAY w/20% gravel and Sand. Yellowish bnn (100%) 1/4" to 1/2" bnn. (10%) yellow (10%) No recovery. 5-8% gravel (1/2" dia. sub-rounded to subangular). Clay appears to be derived from claystone (bedrock). Material W. 60% FeO 38% CaO. MOIST.

5.3-10.0' Silty, gravelly SAND, Greyish bnn. (100%) 70-75% Silty Sand (1/2" to 1" sub-rounded to subangular). 25-30% gravel (1""). 1/4" to 1/2" sub-rounded. Coarse gravel and quartzite. MOIST. Abundant concretion forms. (1.2')

10.0-24.2' Silty, Sandy gravel fill, 100% bnn. (100%) 20% yellow (10%) gravel fill composed of manmade and natural material. 65-70% of interval. Composed of gravel and concretion forms. Sand 2" dia. Cobble size chunks of vesicular basalt with basalt. 20% of interval. C 66, 77 to 79% Basalt. (5%)

4.0-9.3' Silty, Sandy gravel fill, 100% bnn. (100%) 20% yellow (10%) gravel fill composed of manmade and natural material. 65-70% of interval. Composed of gravel and concretion forms. Sand 2" dia. Cobble size chunks of vesicular basalt with basalt. 20% of interval. C 66, 77 to 79% Basalt. (5%)

3.0-10.0' Sandy gravel fill, 100% bnn. (100%) 20% yellow (10%) gravel fill composed of manmade and natural material. 65-70% of interval. Composed of gravel and concretion forms. Sand 2" dia. Cobble size chunks of vesicular basalt with basalt. 20% of interval. C 66, 77 to 79% Basalt. (5%)

NOTES: General: USGS is modified for this log as follows:

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 3
Date effective: 12/31/98

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<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Lithology Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 - 105.5'</td>
<td>Asbestos-Ground Surface</td>
</tr>
<tr>
<td>105.5' - 115'</td>
<td>Ground Surface</td>
</tr>
<tr>
<td>115' - 125'</td>
<td>Medium plasticity, 30% sand, 70% silt and clay</td>
</tr>
<tr>
<td>125' - 135'</td>
<td>No recovery</td>
</tr>
<tr>
<td>135' - 145'</td>
<td>Ground surface, 70% silt, 30% sand and 1% clay</td>
</tr>
<tr>
<td>145' - 155'</td>
<td>No recovery</td>
</tr>
<tr>
<td>155' - 165'</td>
<td>Ground surface, 70% silt, 30% sand and 1% clay</td>
</tr>
<tr>
<td>165' - 175'</td>
<td>Medium plasticity, 30% sand, 70% silt and clay</td>
</tr>
<tr>
<td>175' - 185'</td>
<td>No recovery</td>
</tr>
<tr>
<td>185' - 195'</td>
<td>Ground surface, 70% silt, 30% sand and 1% clay</td>
</tr>
</tbody>
</table>

**NOTES:**
- General: USGS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

**Procedure No.:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/11/98

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<table>
<thead>
<tr>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0-26.3' - Gravelly, Silty Clay (5% to 20% gravel)</td>
</tr>
<tr>
<td>Bedrock Contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.3'-21.2' - Claystone w/ Shale (Bedrock)</td>
</tr>
<tr>
<td>Gravelly, Silty Clay (10% gravel), Firm, broken, lenticular, W. organic stringers, Massive texture</td>
</tr>
<tr>
<td>21.2'-22.6' - No recovery to claystone/shale</td>
</tr>
</tbody>
</table>

Notes: Not sampled between 27.0'-27.5'.
Well replaces 91103 and 91104, but is outside (downgradient of) source removal excavation. Pre-existing wells were within the source area.


GC/CL: Clay/Gravel mixture with some sand. Dark brown (7.5YR3/2) with some strong brown (7.5YR5/6) mottling. 15 - 25% gravel (1/8" - 1/2" diameter, subangular to subrounded). 7 - 15% sand (coarse grained, subangular). Some to abundant coarse grained, angular, white fragments (?). Disseminated caliche common. Clay is very plastic. Consolidated except in zone of shattered quartzite cobbles from 1.7' to 1.9'. Moist.

CL/ML: Silty Clay with trace to some sand and trace gravel. Yellowish brown (10YR5/6) silty clay matrix with gray (10YR6/1) and pale brown (10YR6/3) clasts of clay (1/4" - 1/2" diameter, subangular). Consolidated, but soft. Very moist. Saturated at 5.5'.
CL/ML: Silty Clay with trace to some sand and trace gravel. Yellowish brown (10YR5/6) silty clay matrix with gray (10YR6/1) and pale brown (10YR6/3) clasts of clay (1/4" - 1" diameter, subangular). Very similar to interval from 2.0' to 5.5', but very soft and pliable. Saturated.

No recovery.

CL/ML: Silty Clay with trace sand and trace gravel. Same as interval from 5.5' to 6.5'. Shattered quartzite cobble (2" diameter) at 8.5'. Very soft and pliable. Saturated.

CL/ML: Sandy, Silty Clay with trace gravel and trace cobbles. Strong brown (7.5YR4/6) silty clay matrix. Notable color change. Trace gray (7.5YR5/1) clasts of clay. 5 - 10% sand (very coarse grained, subangular). ~5% gravel (1/8" - 1/4" diameter, subangular). Disseminated white caliche? (tiny angular specks) throughout. 2" quartzite cobble at 9.7'. Very plastic matrix, soft. Saturated. Note: PID 1.2 ppm for this interval.

No recovery.

CL/ML: Sandy, Silty Clay with trace gravel and cobbles. Same as interval from 8.8' to 9.9'. 1-1/2" angular quartzite cobble at 12.2'. Saturated.


Silty Claystone: Silty Claystone, gray (10YR6/1), unweathered. Strongly friable, weakly fissile. Trace black organic stringers and
blebs. Significant decrease in moisture, very moist from 12.7' to 12.9', slightly moist from 12.9' to 16.5'. Weak iron oxidation from 16.2' to 16.3'. Note: PID (178 ppm) from 12.0' to 14.4' on previous borehole attempt (located 1' east).

CLAYEY SILTSTONE: Clayey Siltstone, gray (10YR6/1) with patchy brownish yellow (10YR6/6) iron oxidation mottling throughout. Overall weak iron oxidation. Slightly more cohesive than silty claystone from 12.7' to 16.5', still friable. Very slightly moist.

CLAYEY SILTSTONE: Clayey Siltstone, gray (10YR6/1). Same as interval from 16.5' to 17.2'. Decreasing iron oxidation to trace. Some black organic stringers and blebs (manganese oxide) from 17.9' to 18.5'. Very slightly moist.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 9/105 PROJECT NAME: CWOS Well Replacements PROGRAM: Water Programs - WARP
SCREENED FORMATION: 41144 Drilling CONTRACTOR: RT6 BORING METHOD: geoprobe
DATE DRILLED: 9/10/05 DATE COMPLETED: 5/19/05 TOTAL DEPTH: 18.5 COMPLETED DEPTH: 18.0
ESTIMATED DEPTH TO BEDROCK: 12.5 RIG GEOLOGIST: E. Warp LOGGING GEOLOGIST: E. Warp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 3.25 QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): N/A COMPLETED WATER LEVEL (FT, DATE): 8.87' (below TCA) 5/19/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 1" PVC Wall
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPSTIC, ETC.): Steel Protective casing (Stick-up)

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE
* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 3.2' a.g.s.
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.8' a.g.s ID (IN): 1.0
SURFACE SEAL TOP: 1.8' a.g.s ID (IN): N/A TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 0.8' I.D. 5' OD STC
*WELL PAD DIMENSIONS, TYPE: 3'X3' Concrete pad
*ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEPSTIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: 0.5' N/A TYPE: N/A
*BENTONITE SEAL TOP: 0.5' N/A TYPE: Cerro-Granular Bentonite - Boron-free
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.0'
FILTER PACK TYPE: 1/40 Silica Sand BRAND: C.S.T.
SURFACE CASING BOTTOM (=SCREEN TOP): 5.0' TYPE: Sch. 80 PVC
SCREEN ID (IN): 1.0' SLOT SIZE (IN): 0.01' TYPE: Sch. 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 17.9' SUMP TYPE: Threaded end cap
FILTER PACK BOTTOM (= BACKFILL TOP): 18.0' BACKFILL TYPE: Granular Bentonite
SUMP BOTTOM (= WELL COMPLETED DEPTH): 18.0' PILOT HOLE TOP, DIAMETER: ~ 4.0'
TOTAL BOREHOLE DEPTH (= PILOT HOLE AND BACKFILL BOTTOM): 18.5'
REMARKS: Well installed on 5/12/05. Pilot hole and backfill were completed on 5/19/05.

COMPleted by: Ellen S. Warp DATE: 5/19/05
CHECKED BY: DATE:

Well installed on 5/19/05. Protective casing wall pad installed on 5/19/05.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 91105
Location - North: 57136
Date: 5/18/05
Geologist: G. Wup
Drilling Equip.: 60 DT Geoprobe

Surface Elevation:
Area: 07 Burn Pk. #1 (dammed)
Total Depth: 18.0'
Company: WRS/RTR
Project No: HADS/30
Sample Type: N/A

RMRS LOGGING SUPERVISOR
APPROVAL: DATE: 6/18/05

SAMPLE DESCRIPTION

0.0-0.7: Silty clay, 1/2" sand and 1/2 gravel.
(yellow brn. (10%/8%) w/some H. brasl grey.
(10%/4%) mottling. 5/8" crv. Fe_Ox. 5m. joseph
7.29.20: Clay (sand mix) w/some yellow
sand. Brn. (7.5yR 7/2) w/some sienna
brn. (7.5R 7/2) mottling. 15-25% gravel
(1/2-1" dia.)
Sub-ang. to sub-rounded, 7-15% sand (Cl),
sub-angular, some to abundant c.a.g., avg. 1/2"-
frags (2). Disc. calichey common. Clay is
v. plastic. Consolidated except in zone of
shattered gilente cobbles brn. 1.7-1.9'. Moist.
2.0-5.5: Silty clay 1/2" some sand and 1/2
gavel. Yellow brn. (10%/6%) silty clay matrix
(10%/4%) and pale brn. (10%/4%) clays
60 clay (sub-angular, 1/4-1/4" dia.). Consolidated
but soft. V. moist. Saturated @ 5.5'.

5.5-6.5': Silty Clay 1/2" sand and
1/2 gravel. Yellow brn. (10%/6%) Silty
clay matrix, w/sand (10%/4%) and pale brn.
(10%/4%) clays of clay (sub-angular, 1/4-1/4" dia.)
V. similar to intervals
2.0-5.5'. But v. soft and pliable.
Saturated.

6.5-8.0: No recovery

8.0-8.8: Silty clay 1/2" sand and 1/2 gravel.
Same as 5.5-6.5'. Shattered gilente
lobble (2" dia.) @ 8.5'. V. soft and pliable.
Saturated.

8.8-9.9: Sandy, Silty clay 1/2" to gravel
and clays. Strong brn. (7.5yR 4/) Silty
clay matrix. Notable color orange. Te
clay matrix, w/sand (10%/4), sub-angular, 1/4-
dia.), and gravel (1/4 dia.), sub-angular. Disc. soft, calichey (ting, any, streaks)
throughout. V. plastic matrix, soft. Saturated.

NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO-101
Revision 0
Date effective: 12/31/98
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**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG**

**Borehole Number:** 91105

**Location - North:** 51065

**Date:**

**Geologist:** E. Nunn

**Drilling Equip.:** Geoprobe

---

**RMRS LOGGING SUPERVISOR**

**APPROVAL**

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>10.0 - 12.0 = No recovery</td>
</tr>
<tr>
<td><strong>16.5 - 17.2 = Clayey Siltstone, gray (10YR 6/1). W/ patchy Barn. Yeallow (10YR 7/4).</strong></td>
</tr>
<tr>
<td>17.2 - 18.5 = Clayey Siltstone - Gray (10YR). As above from 16.5 - 17.2. Drier. F.H. to D. Some B.H. organic stringers and bleeds (White) from 17.9 to 18.5. V. Slightly moist.</td>
</tr>
</tbody>
</table>

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**NOTES:**

General: USCS is modified for this log as follows:

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.

**Materials amounts are estimated by % volume instead of % weight.**

**Procedure No:** RMRS/OPS-PRO.101

**Revision:** 0

**Date effective:** 12/31/98

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Log of Boring Number: 91305

State Plane Coordinates Area: 749915.187
North: 749915.187
East: 2085822.672
Project: FC-4/5
Remarks: replaces 2187

<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Protective Casing 6 in. OD, Steel</td>
<td></td>
<td></td>
<td>CL: Clay with trace sand and trace gravel, brown (7.5YR4/2), ~5% gravel (1/4&quot; to 1/2&quot; diameter, subangular), granitic. ~3% sand (coarse grained, subrounded), trace roots, trace disseminated caliche, slightly moist.</td>
</tr>
<tr>
<td>2</td>
<td>Casing, Sch 40 PVC, 2 in. OD</td>
<td></td>
<td>CL: Gravelly, Sandy Clay, strong brown (7.5YR4/6), 15 - 20% sand (coarse grained, subangular), 5 - 7% gravel (1/8&quot; to 1/2&quot; diameter, subrounded to subangular). Shattered quartzite cobble (1-1/2&quot; diameter, subangular) at 0.3'. Some to trace disseminated caliche. Crumbly interval, slightly moist.</td>
<td></td>
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<tr>
<td>1</td>
<td>Concrete Seal</td>
<td></td>
<td>GC/CL: Gravel/Sandy Clay mixture, very dark brown (7.5YR2.5/2), ~60% gravel (1/2&quot; to 1-1/2&quot; diameter, subangular, predominately quartzite), ~40% sandy clay, 1-1/2&quot; diameter shattered quartzite cobble at 1.3'. Disseminated caliche throughout, slightly moist.</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Concrete Pad</td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hydrated Bentonite Chips</td>
<td></td>
<td>GC/CL: Gravel/Sandy Clay mixture, same as from 1.0' to 1.3'. Shattered granite cobble at 2.8'. Slightly moist.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>CL: Clay, dark grayish brown (10YR4/2), trace gravel. Sample appears &quot;ribboned&quot; at base due to a cobble stuck in the bit. Caliche lense, yellow, at 3.4'. Increased moisture to moist.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>Elev (Ft)</td>
<td>Well or Piezometer Construction and Materials</td>
<td>Depth (Ft)</td>
<td>Lithology or Rock Type</td>
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</tr>
<tr>
<td>5924</td>
<td>Filter Pack, 10% Silica Sand</td>
<td>5</td>
<td>CL: Clay, same as from 2.8' to 4.0'. 2.0&quot; diameter quartzite cobble at 5.7&quot;. Poor recovery due to cobble stuck in bit. Moist.</td>
<td>CL: Clay, same as from 2.8' to 4.0'. 2.0&quot; diameter quartzite cobble at 5.7&quot;. Poor recovery due to cobble stuck in bit. Moist.</td>
</tr>
<tr>
<td>5923</td>
<td>Screen, Sch 40-PVC, 2 in. x 1/10, 0.010 in. slot</td>
<td>6</td>
<td>CL: Clay with trace gravel, brown (10YR5/3) to yellowish brown (10YR5/4), mottled. Weak to moderate pervasive iron oxidation. Caliche stringers at 8.6' and 9.8'. Interval is cohesive, soft, and pliable. Medium plasticity, moist.</td>
<td>CL: Clay with trace gravel, brown (10YR5/3) to yellowish brown (10YR5/4), mottled. Weak to moderate pervasive iron oxidation. Caliche stringers at 8.6' and 9.8'. Interval is cohesive, soft, and pliable. Medium plasticity, moist.</td>
</tr>
<tr>
<td>5922</td>
<td></td>
<td>7</td>
<td>CL: Clay with trace gravel, grayish brown (10YR5/2) to gray (10YR5/1). Massive texture. Decreasing iron oxidation to trace, trace caliche stringers, medium plasticity. Interval is cohesive and soft, very moist. Very silty at 11.0'.</td>
<td>CL: Clay with trace gravel, grayish brown (10YR5/2) to gray (10YR5/1). Massive texture. Decreasing iron oxidation to trace, trace caliche stringers, medium plasticity. Interval is cohesive and soft, very moist. Very silty at 11.0'.</td>
</tr>
<tr>
<td>5921</td>
<td></td>
<td>8</td>
<td>CL: Clay, same as from 10.8' to 11.3'. Medium plasticity, clay is soft and pliable. Increasing moisture, totally saturated at 13.2'.</td>
<td>CL: Clay, same as from 10.8' to 11.3'. Medium plasticity, clay is soft and pliable. Increasing moisture, totally saturated at 13.2'.</td>
</tr>
<tr>
<td>5920</td>
<td></td>
<td>9</td>
<td>CL: Silty Clay, yellowish brown (10YR5/6), very silty, trace gravel (scattered, up to 1/4&quot; diameter). Strong pervasive iron oxidation, trace disseminated white caliche. Interval is cohesive, yet soft and pliable, saturated.</td>
<td>CL: Silty Clay, yellowish brown (10YR5/6), very silty, trace gravel (scattered, up to 1/4&quot; diameter). Strong pervasive iron oxidation, trace disseminated white caliche. Interval is cohesive, yet soft and pliable, saturated.</td>
</tr>
</tbody>
</table>
CL: Silty Clay, dark gray (10YR4/1), distinct color change. Decreasing iron oxidation to trace. Twigs, roots at 14.2' and 14.5' (possibly original ground surface?). Crumbly lense of caliche at base. Interval is cohesive, yet soft and pliable, saturated.

CL: Silty Clay with sand, yellowish brown (10YR5/6), distinct color change. Increased pervasive iron oxidation. Roots at 15.8'. Silty, clayey, very fine grained sand at base of interval. Very crumbly, saturated.

SILTY CLAYSTONE: TOP OF BEDROCK. Silty Claystone to Clayey Siltstone, yellowish brown (10YR5/6), strong, pervasive iron oxidation, massive texture. Bedrock contact very subtle. Interval cohesive, soft, and pliable; saturated. Some lenses of very fine grained sand.

No recovery.

SILTSTONE: Sandy, Clayey Siltstone, yellowish brown (10YR5/6), strong, pervasive iron oxidation, massive texture. Bedrock contact very subtle. Interval cohesive, soft, and pliable; saturated. Some lenses of very fine grained sand.

CLAYSTONE: Claystone, dark gray (10YR4/1), un-weathered claystone, distinct color change. Decreasing iron oxidation to trace, massive textured. Very dense and firm. Bleached fracture with caliche fill at 19.7'. Decreasing moisture to slightly moist. Silty at 19.9' to 20.1'.

SILTSTONE: Clayey Siltstone, yellowish brown (10YR5/6), distinct color change. Moderate to strong pervasive iron oxidation, totally saturated (flowing), very soft and pliable.

CLAYSTONE: Claystone with silt, gray (10YR5/1), distinct color and lithology change. Very massive texture, decreasing iron oxidation to trace, trace black organic stringers. Very firm and dense/hard, decreasing moisture to very slightly moist.
No recovery.

CLAYSTONE: Claystone with silt, gray (10YR5/1), same as from 21.1' to 24.5', except increased iron oxidation along bedding planes from 27.3' to 29.1'. Dry. 1/8" thick sandy lenses, and possible rip-up clasts, at 26.4', 27.3', and 29.0'. Iron oxide-healed fractures at 27.8', 28.0', 28.2', 28.5', 28.6', 28.9' to 29.1'; all subhorizontal to −45 deg.

No recovery.

Reamed borehole with augers 30.0' to 30.65'.
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 91305 PROJECT NAME: FY05 Well Replacement PROGRAM: Water Programs
SCREENED FORMATION: 01/40 Drilling Contractor: High Plains BORING METHOD: Hollow Stem Auger 02/17
DATE DRILLED: 4/18/05 DATE COMPLETED: 4/18/05 TOTAL DEPTH: 30.05 COMPLETED DEPTH: 30.05
ESTIMATED DEPTH TO BEDROCK: 160' RIG GEOLOGIST: E. Wamp LOGGING GEOLOGIST: E. Wamp
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0" QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 4/18/05 COMPLETED WATER LEVEL (FT, DATE): 5.98 ft, 7/30/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/etc.): 2.0" PVC well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Steel above ground protective casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.8"n/a
*SECONDARY CASING TOP: N/A BOTTOM: N/A TYPE: N/A
SURFACE CASING TOP: 2.1" ID (IN): 2.0"
SURFACE SEAL TOP: 1.8" BOTTOM: 0.1" TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 2.0" TYPE: Steel
*WELL PAD DIMENSIONS, TYPE: 8x8 Concrete from 0.1' bgs to
*ADD'L CASING FILL TOP: N/A BOTTOM: N/A TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A BOTTOM: N/A
*OTHER CASING ID (IN): N/A TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A NUMBER USED: N/A TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A MEASURED DENSITY (LBS/GAL): N/A TYPE: N/A
*GRANULAR BENTONITE TOP: N/A TYPE: N/A
*BENTONITE SEAL TOP: 0.1' bgs TYPE: Med Bentonite Chips, Pure Gold Brand, hydrated
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 4.5' wave till of Dist. H2O
FILTER PACK TYPE: 1/40 Silica Sand BRAND: C. S. S. I. New
SURFACE CASING BOTTOM (=SCREEN TOP): 5.4" TYPE: Sch. 80 PVC
SCREEN ID (IN): 2.0" SLOT SIZE (IN): 0.01" TYPE: Sch. 80 PVC
SCREEN BOTTOM (= SUMP, TOP): 30.4" SUMP TYPE: Threaded end cap-Sch. 80 PVC
FILTER PACK BOTTOM (= "BACKFILL TOP): 30.65" BACKFILL TYPE: N/A
SUMP BOTTOM (= WELL COMPLETED DEPTH): 30.65 PILOT HOLE TOP, DIAMETER: N/A
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM): 30.65

REMARKS: Routine well installation on 4/18/05 Concrete well pad
poured on 4/19/05. Pad poured "high" to anticipate an additional 0.2' as fill

COMPLETED BY: Ewen S. Wamp DATE: 4/25/05
CHECKED BY: DATE:
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 91305
Location: North: East:
Date: 9/10/05
Geologist: E. Wump
Drilling Equip: Hollow Stem Auger-CME-75-4T

RMRS LOGGING SUPERVISOR
APPROVAL

DATE 4/19/05

SAMPLE DESCRIPTION

0.0-0.3': Clay 30% & sand 70%& gravel. Brn. (7.5:2.5:12), 5% gravel (4-5 dia, sub-angular), granite, 5% sand (e.g., sub-rounded). Kerms. To diss. caliche. Si. moist.

0.3-1.0': Gravelly Sandy Clay, Strong Brn. (70% gravel), 15-20% sand (e.g., sub-angular), 5-7% gravel (4-5 dia, sub-rounded to sub-angular) Shards, cobble of granite (3-5 dia, sub-angular) &. 5% S, M, T diss. Caliche. Crumbly interval. Si. moist.

1.0-1.3': Gravel/Sandy Clay Mixture, V. Drk. Brn. (7.5:2.5:12), 60% gravel (4-5 dia, sub-angular), predominately granite. 40% sandy clay. 1½ dia. Sharded cobble of granite. 0.5'. Diss caliche through out. Si. moist.

1.3-2.0': No Recovery

2.0-2.8': Gravel/Sandy Clay Mixture. Same as 1.9. 1½ Sharded cobble of granite @ 2.0'. Si. moist.

2.8-4.0': Clay, Drk. Gravish Brn. (10:2:4) &. Gravel. Sample appears "sickened" at base due to a cobble stuck in the bit. Caliche lense, pale t. 3.4'. Equir. moisture to moist.

4.0-5.0': No recovery

5.0-5.7': Clay-Sand mix. 2.8-4.0'. 2½ dia. Sharded cobble @ 5.7'. Poor recovery due to cobble stuck in bit. Moist.

5.7-7.0': No Recovery


NOTES: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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Rocky Flats Environmental Technology Site Borehole Log

Borehole Number: 91305
Location - North: 400 East
Geologist: E. W. Kemp
Drilling Equipment: Kelley Stem Auger - CME-75-17

Surface Elevation: 60.4 ft.
Total Depth: 218.7 ft.
Area: 60.4 ft.
Company: U.S. Army Corps of Engineers
Project No.: 0261217
Sample Type:

Sample Description:
10.8 - 10.8 - Clay (see description on page 1)
10.8 - 11.3 - Clay, 1/2 asphalt, grey shale, (110 x 100)
to 60 y (100 x 100), Massive texture, Deeper, Feldspar, 10 ft, To calcite stringers, Medium to Plastic.
Interval is cohesive and soft, V. Moist. 90 ft.

11.3 - 12.0 - No recovery
12.0 - 13.3 - Clay, Same as 10.8 - 11.3.
Medium plasticity, Clay is soft and pliable.
Increasing moisture. V. Vertically Saturated.

13.3 - 14.0 - Silty Clay, Yellow shale (100 x 100), V. Silty, To gravel, few stringers, Medium.
Interval is cohesive and soft.

14.0 - 14.6 - Silty Clay, Dark grey (100 x 100), Distinct color change. Deeper, Feldspar to F.
Twist, Shale @ 14.2 and 14.5 (possibly original ground surface). Crumbly lens of
calcite at base. Interval is cohesive yet soft and pliable.

14.6 - 15.2 - Silty Clay, Yellow shale (100 x 100), Distinct color change.

15.2 - 15.6 - Bedrock Contact (21), V. Subtle.

Bedrock Contact @ 15.2 - 15.6, Sandy, Clayey Sandstone (100 x 100), No recovery.
Described above @ 15.2 - 15.6. Saturated

15.6 - 16.0 - Sandy, Clayey Siltstone (100 x 100), Distinct color change.

16.0 - 16.5 - Sandy, Clayey Siltstone (100 x 100), Distinct color change.

16.5 - 17.0 - No Recovery
17.0 - 18.1 - Sandy, Clayey Siltstone (100 x 100), Distinct color change.

Notes: General: USCS is modified for this log as follows:
Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
**Rocky Flats Environmental Technology Site Borehole Log**

<table>
<thead>
<tr>
<th>Surface Elevation</th>
<th>Area: FC-415 - Replacement of Well 2187</th>
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</thead>
<tbody>
<tr>
<td>Total Depth: 30.0'</td>
<td>Company: USGS/US Army Corps of Engineers</td>
</tr>
<tr>
<td>Sample Type:</td>
<td>Project No: HAOS1300</td>
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**BMRS Logging Supervisor Approval**

<table>
<thead>
<tr>
<th>Top Bottom</th>
<th>Interval</th>
<th>Sample</th>
<th>Fracture</th>
<th>Bedding</th>
<th>Grain Size</th>
<th>USCS Symbol</th>
<th>Depth in FEET</th>
<th>Soil Lithics</th>
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<tbody>
<tr>
<td>200'</td>
<td>206'</td>
<td></td>
<td></td>
<td></td>
<td>20.0</td>
<td></td>
<td>20.1</td>
<td></td>
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<tr>
<td>220'</td>
<td>226'</td>
<td></td>
<td></td>
<td></td>
<td>21.1</td>
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<td>21.1</td>
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<td>250'</td>
<td>256'</td>
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<td></td>
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<td>22.2</td>
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<td>280'</td>
<td>286'</td>
<td></td>
<td></td>
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<td>23.3</td>
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<td>23.3</td>
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<td>300'</td>
<td>306'</td>
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<td>24.4</td>
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<td>310'</td>
<td>316'</td>
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<td>25.5</td>
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<td>25.5</td>
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<td>320'</td>
<td>326'</td>
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<td>26.6</td>
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<tr>
<td>330'</td>
<td>336'</td>
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<td>27.7</td>
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<td>340'</td>
<td>346'</td>
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<td>28.8</td>
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<td>28.8</td>
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<tr>
<td>350'</td>
<td>356'</td>
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<td></td>
<td>29.9</td>
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<td>360'</td>
<td>366'</td>
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<td></td>
<td></td>
<td>30.0</td>
<td></td>
<td>30.0</td>
<td></td>
</tr>
</tbody>
</table>

**Sample Description**

- **20.0 - 20.1**: Claystone (see description on page 2). Muddy to silty.

25.0 - 29.1: Claystone, Gry (10YR 7/8)

Same as fm. 21.1 - 24.5 except incr. FeOx along bedding planes, fm. 27.3 - 29.1.

Dry. 1/4 thick sandy cream, and possible clayey layer at 26.4', 27.3', 28.1'. Fe ox-hued frieze at 27.8', 28.0', 28.2', 28.5', 28.6', 28.3' - 29.1'. All subsurface to 29.5'.

29.1 - 30.0: No recovery

Reamed borehole. Flat angle to 30.0'. T.D. = 30.65'.

**Notes:**
- General: USCS is modified for this log as follows:
- Materials amounts are estimated by % volume instead of % weight.

1. Badly broken core, accurate footage measurements not possible.
2. Core breaks cannot be matched, accurate footage measurements not possible.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5940</td>
<td>Protective Casing, 5 in. ID, Steel</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5939</td>
<td>Casing, Sch 43-PVC, 2 in. ID</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>5938</td>
<td>Concrete Seal</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5937</td>
<td>Concrete Pad</td>
<td>0</td>
<td>CL: Clay with some gravel and some sand, brown (10YR4/3), ~5% gravel (1/8&quot; to 1/2&quot; diameter, subrounded to subangular), ~5% sand (coarse grained, subrounded to subangular). Clay has medium plasticity. Broken quartzite cobble from 1.0' to 1.2'. Moist.</td>
<td></td>
</tr>
<tr>
<td>5936</td>
<td>Hydrated Bentonite Chips</td>
<td>1</td>
<td>No recovery. Original hole's core (located ~2' to west) is CL to GC. (Offset due to refusal at 5'.)</td>
<td></td>
</tr>
<tr>
<td>5935</td>
<td></td>
<td>2</td>
<td>CL: Clay with some gravel and sand, grayish brown (10YR5/2) to yellowish brown (10YR5/4), ~5% gravel (1/8&quot; to 1/4&quot; diameter, subrounded), ~5% sand (coarse grained). Clay is laminated with alternating colors. Broken quartzite cobble at top (3.0'), moist. Traces roots at ~3.6' and deeper.</td>
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<tr>
<td>5934</td>
<td></td>
<td>4</td>
<td>No recovery.</td>
<td></td>
</tr>
<tr>
<td>5933</td>
<td>Filter Pack</td>
<td>5</td>
<td>CL: Clay with some gravel and sand, dark grayish brown (10YR4/2)</td>
<td></td>
</tr>
</tbody>
</table>
and yellowish brown (10YR5/4), laminated clay with iron oxidation (yellowish brown) mottled throughout. ~5% gravel (1/8" to 3/4" diameter, subrounded), quartzite and granite composition with trace Fountain Formation. Clay has low plasticity. ~5% sand (medium grained, subangular), occasional black organic stringers noticeable, probably re-worked claystone, moist. Trace roots in approximately

<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5930</td>
<td>16105 Silica Sand</td>
<td>6</td>
<td>CL: Clay with some gravel and sand, same as interval from 5.0' to 7.0', increasing moisture to very moist. No recovery.</td>
<td></td>
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<tr>
<td>5929</td>
<td>Screen, Sch 40xPVC, 2 in. ID, 0.035 in. slots</td>
<td>7</td>
<td>SC: Clayey, Gravelly Sand, brown (10YR5/3), ~50% sand is medium grained to coarse grained (subrounded to subangular), ~10% gravel (1/8&quot; to &gt;1&quot; diameter, subrounded), ~40% clay. Wet. CL: Clay as above (from 5.0' to 7.0'), wet. No recovery.</td>
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<tr>
<td>5928</td>
<td></td>
<td>8</td>
<td>CL: Clay with some silt, gray (10YR6/1) and light brownish gray (10YR6/2), and yellowish brown (10YR5/6), mottled texture. Yellowish brown is weak to moderate iron oxidation mottled throughout interval. Appears to be re-worked claystone. Interval is firm and dense, decreasing moisture to moist. Sharp color change at base. CL: Silty Clay, black (10YR2/1) to very dark grayish brown (2.5Y3/2), very plastic clay, trace gravel, trace coarse grained sand, trace roots, cohesive. Graded color from black at top of interval to very dark grayish brown at base, very moist. No recovery.</td>
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<tr>
<td>5927</td>
<td></td>
<td>9</td>
<td>CL: Clay, black (10YR2/1), like above. Very plastic clay, trace to some silt, trace sand, very moist. CL: Clay with some sand, olive gray (5Y5/3), 5-10% sand (medium grained to coarse grained, subrounded to subangular). Appears to be re-worked claystone, very moist. CL: Clay with trace to some sand, gray (10YR6/1), trace to 5% sand (coarse grained, subangular) in patchy zones. Re-worked claystone bedrock. ~5% white stringers and caliche blebs throughout, patchy zones of yellowish brown (10YR5/6) iron oxidation. Moderate iron oxidation (pervasive at 13.6'). Very moist. CLAYSTONE: TOP OF BEDROCK. Claystone (oxidized bedrock), yellowish brown (10YR5/6) to brown (10YR5/3), weathered, iron oxidized claystone bedrock. Moderate to strong pervasive iron oxidation. Slightly mottled, weakly friable, trace black organic stringers, very moist. Bedrock contact very subtle, could be as</td>
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<td>5926</td>
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<td>13</td>
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<tr>
<td>Elev (Ft)</td>
<td>Lithology</td>
<td>Unified Soils Classification or Rock Type</td>
<td>Lithologic Description</td>
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<tr>
<td>0-15</td>
<td>Filter Pack, 1004 Silica Sand</td>
<td>CLAYSTONE: Claystone, dark gray (10YR4/1), dense and firm, slightly fissile, moderately friable, un-oxidized, non-weathered, decreasing moisture to slightly moist.</td>
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<tr>
<td>16-17</td>
<td>No recovery.</td>
<td>CLAYSTONE: Claystone, gray (10YR5/1), dense and firm, trace iron oxidation from 17.6' to 18.0'. Trace bleaching along internal fractures at 19.5' and 19.7': Slightly moist.</td>
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<tr>
<td>18-20</td>
<td>No recovery.</td>
<td>CLAYSTONE: Claystone, un-weathered, gray (10YR5/1), weakly fissile, weakly to moderately friable, trace iron oxidation, trace patchy bleaching at 20.1', dense and firm, very slightly moist to dry.</td>
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<tr>
<td>21-24</td>
<td>No recovery.</td>
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<tr>
<td>24</td>
<td>No recovery.</td>
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<td>5913</td>
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<td>5922</td>
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Shallow as ~12.9'.
<table>
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<th>Elev (Ft)</th>
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</tr>
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<tbody>
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<td>5912</td>
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<td>5911</td>
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<tr>
<td>5910</td>
<td></td>
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<tr>
<td>5910</td>
<td>25</td>
<td>CLAYSTONE: Claystone, gray (10YR5/1) to light grayish brown (10YR6/2), predominately un-weathered claystone bedrock. Trace iron oxidation and bleaching along horizonal fracture at 25.7'. Weak iron oxidized stringers at 26.3' to 26.5'. Trace black organic stringers throughout interval, weakly fissile, weakly friable, dry.</td>
</tr>
<tr>
<td>26</td>
<td>25</td>
<td>No recovery. Borehole augered to 26.5'. Drove split-spoon from 26.5' to 28.0'. Backfilled pilot hole with native material.</td>
</tr>
<tr>
<td>25</td>
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<td>26</td>
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<td>27</td>
<td>26</td>
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<tr>
<td>28</td>
<td>26</td>
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</tbody>
</table>
MONITORING WELL INSTALLATION REPORT: Form PRO.118

LOCATION CODE: 99305  PROJECT NAME: FY05 Well Replacements  PROGRAM: Water Programs - WAEP
SCREENED FORMATION: 2/1 Bulk  DRILLING CONTRACTOR: H. Plains  BORING METHOD: Hollow Stem Auger "Sept"
DATE DRILLED: 9/16/05  DATE COMPLETED: 9/16/05  TOTAL DEPTH: 28.0' COMPLETED DEPTH: 26.5'
ESTIMATED DEPTH TO BEDROCK: 13.6' RIG: Geologist: E. WAEP  LOGGING GEOLIGIST: E. WAEP
BOREHOLE DIAMETER IN SCREENED INTERVAL: 8.0' QUANTITY OF FLUIDS LOST DURING DRILLING: N/A
INITIAL WATER LEVEL (FT, DATE): Dry on 9/16/05  COMPLETED WATER LEVEL (FT, DATE): 11.20' on 7/27, 5/10/05
DIAMETER & TYPE OF INSTALLATION (WELL/PIEZOMETER/WELL POINT/ETC.): 2.0" I.D. - PVC Well
TYPE OF PROTECTION (FLUSH-MOUNT VS. ABOVE GROUND, ASEPTIC, ETC.): Above ground-Steel Prot. @ casing

ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT): 2.9' (N/A)
*SECONDARY CASING TOP: N/A  BOTTOM: N/A  TYPE: N/A
SURFACE CASING TOP: 2.4' (N/A)  ID (IN): 2.0'
SURFACE SEAL TOP: 1.9'  ID (IN): 0.25  TYPE: Concrete
PROTECTIVE CASING BOTTOM, ID (IN): 1.9'  ID (IN): 0.25  TYPE: Steel
*WELL PAD DIMENSIONS, TYPE: 5x3' Concrete pad @ n/a 2.5' 0.5'set
*ADD'L CASING FILL TOP: N/A  BOTTOM: N/A  TYPE: N/A
*SURFACE ISOLATION CASING TOP: N/A  BOTTOM: N/A
*SURFACE ISOLATION CASING ID (IN): N/A  TYPE: N/A
*OTHER (E.G., ASEPTIC) CASING TOP: N/A  BOTTOM: N/A
*OTHER CASING ID (IN): N/A  TYPE, PURPOSE: N/A
*CENTRALIZER(S) OD (IN): N/A  NUMBER USED: N/A  TYPE: N/A
*CENTRALIZER(S) DEPTH(S): N/A
*GROUT TOP: N/A  MEASURED DENSITY (LBS/GAL): N/A  TYPE: N/A
*GRANULAR BENTONITE TOP: N/A  TYPE: N/A
*BENTONITE SEAL TYPE: 0.2'  TYPE: Med. Bentonite chips - Pure gel - Hydrated Distilled H20.
BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP): 5.0'
FILTER PACK TYPE: 1/40 Silica Sand  BRAND: C.S.S.I.
SURFACE CASING BOTTOM (= SCREEN TOP): 6.25'  TYPE: Sch. 30 PVC
SCREEN ID (IN): 2.0  SLOT SIZE (IN): 0.01  TYPE: Sch. 30 PVC
SCREEN BOTTOM (= SUMP, TOP): 26.25'  SUMP TYPE: Threaded end-cap - Sch. 80 PVC
FILTER PACK BOTTOM (= *BACKFILL TOP): 26.5'  *BACKFILL TYPE: Native material
SUMP BOTTOM (= WELL COMPLETED DEPTH): 26.5'  "PILOT HOLE TOP, DIAMETER: 26.5' 2.0" dia. pilot hole
TOTAL BOREHOLE DEPTH (= "PILOT HOLE AND "BACKFILL BOTTOM": 28.0'
REMARKS: Augered to 26.5'. Drive split spoon only fn. 26.5 to 28.0'.
Backfilled pilot hole w/ native material. Graded Borehole stepped shallower than
Park Plan due to completed well installation objectives (Sufficient penetration within un-augered
completed by: E. 9/16/05  TYPE: E. 9/16/05
CHECKED BY:  DATE: 4/5/05
Note: this was the second borehole attempt. Hit refusal at 5.0'-on first borehole attempt.
Completed well location is approx. 2 ft. No. 4 of original well #89301 location.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: R9301  REPLACEMENT OF #9301
Surface Elevation: 280.0 / 24.5
Area: 2891 - Replacement of #9301
Total Depth: 280.0 / 24.5
Location - North: East:
Geologist: E. Wrapp
Company: US WEST FLATS
Drilling Equip.: CORE NT-75 AUGER RIG
Sample Type: N/A
Project No.: HAD57300

RMRS LOGGING SUPERVISOR:

APPROVAL:

DATE 4/1/05

SAMPLE DESCRIPTION

0.0 - 1.2 - Clay w/ Some Gravel. Brn (10% 9/3), 5% gravel (6/8-12/20), sub-rounded to sub-angular. 5% sand (e.g., sub-rounded to sub-angular). Clay has moderate plasticity. Broken black cobble. fn 1.0 - 1.2. Moist.


3.0 - 4.6 - Clay w/ Some Gravel and Sand. Brn (10% 9/3) to Yellow Brn (10% 9/3). 5% gravel (6/8-12/20), sub-rounded to sub-angular. 5% sand (e.g., sub-rounded to sub-angular). Clay has moderate plasticity. Broken black cobble. fn 1.0 - 1.2. Moist. Trace roots. fn 3.5. Sand dikes.

4.6 - 5.0 - No Recovery.

5.0 - 7.0 - Clay w/ Some Gravel and Sand. Brn (10% 9/3) and Yellow Brn (10% 9/3). Laminated clay w/ Feldspar. Various sand contents. Clay has moderate plasticity. 5% sand (e.g., sub-rounded to sub-angular). Occasional blk, organic stringers noticeable. Probably remolded clay. fn 1.0 - 1.2. Moist. Trace roots.

7.0 - 8.0 - No Recovery.

8.0 - 9.1 - Clay w/ Some Gravel and Sand. Same as above. fn 5.0 - 7.0. Moist.

9.1 - 10.0 - No Recovery.

NOTES: General: USCS is modified for this log as follows:

(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No. RMRS/OPS-PRO.101
Revision 0
Date effective: 12/31/98
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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 99305
Location - North: 
East: 
Date: 4/1/05
Geologist: E. Waeg
Drilling Equip.: CME-U1-75 Auger Rv

Surface Elevation: 
Area: B391 - Replacemnent of d 99301
Total Depth: 
Company: 
Project No.: H005/300
Sample Type: N/A

RMRS LOGGING SUPERVISOR 
APPROVAL 

DATE 4/12/05

SAMPLE DESCRIPTION

10.0 - 10.8 - CLAY, Loam, Silt, Gravel (10YR 4/1), and with stringy (10YR 4/1) and with stringy (10YR 4/1). Typical texture, yellowish, comminuted, feet, and white, 100% nontypical, and to be re-worked a claystone, interval. No firm moisture. Very firm, moisture. Very frangible, still firm. Slight break near 

10.8 - 11.7 - CLAY, Blk (10YR 4/1), to V. OK, Dysth. Blk (2.5 YR 3/4). V. Plastic, clay, e.g., and E. e.g., sand, E. rock, graded Borden clay, Blk, at top of interval to V. OK Dysth. Blk, at least moist. Very firm, moisture.

11.7 - 12.8 - No Recovery


12.3 - 13.6 - CLAY, V. some Sand, Olive Grav (5YR 3/4). V. 100% Sand (e.g., e.g., sand, e.g., e.g., sand), 85% banded. Appears to be re-worked claystone, interval. V. Moist.

12.6 - 13.6 - CLAY, V. some Sand, Silt Clay (10YR 3/1). V. 5% Sand (e.g., e.g., sand, e.g., e.g., sand), in patches of 100% claystone, bedrock, 5% broken strands and calcite bleeds throughout, slaty layer of yellowish, Blk (10YR 4/1). Feet, V. Moist. V. Moist.

13.6 - 15.9 - Top of Bedrock @ 13.6

CLAYSTONE - Ox, Bedrock. Yellowish Blk (10YR 5/1) to Blk (10YR 4/1). Weathered, FeOed Claystone Bedrock. Moderately to Strong firm. Fused, slightly modified, weakly friable. V. Blk organic


16.4 - 17.0 - No Recovery

17.0 - 19.8 - CLAYSTONE - Grey (10YR 5/1). Dense and firm, slightly friable. E. Bedrock to moderately friable, un-oxid. No moisture.
**Rocky Flats Environmental Technology Site Borehole Log**

**Borehole Number:** 99305  
**Location - North:**  
**Date:** 4/7/05  
**Geologist:** E. WAF  
**Drilling Equip.:** CME HT-75 Auger Rig

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Fracture Angle</th>
<th>Record Angle</th>
<th>Grain Size Distribution</th>
<th>USCS Symbol</th>
<th>Depth in Feet</th>
<th>Lithologic Log</th>
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</thead>
<tbody>
<tr>
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<td>Dense and firm. V. slightly moist to dry.</td>
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<td>241-250' = No Recovery.</td>
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<td>25.0-27.3 - Claystone - Gry (104%) to L. Gry</td>
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<td>Predominantly Un-weathered Claystone Ban.</td>
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<td></td>
<td>Breaks, E FeOOH and bleaching along</td>
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<td></td>
<td>Horizontal fracture @ 25.7, W. FeOOH</td>
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<td></td>
<td>Stringers @ 26.3 to 26.5, E block</td>
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<td>Organode Stringers throughout interval.</td>
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<td>28.0 - E. Fissile, slightly moist.</td>
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<td>26.5'</td>
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</tbody>
</table>

**Notes:**  
General: USCS is modified for this log as follows:  
Materials amounts are estimated by % volume instead of % weight.  
(1) Badly broken core, accurate footage measurements not possible.  
(2) Core breaks cannot be matched, accurate footage measurements not possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

Borehole Number: 99305 - 1st attempt

Location - North: 99305 - 1st attempt

Date: 4/1/01

Geologist: E. W. M. P. 

Drilling Equip: CME-2T-75 Puleo

Surface Elevation: 

Area: 99301 - Replacement

Total Depth: 5.0

Company: USEC/High Plains

Project No.: N/A0530

Sample Type: N/A

RMRS LOGGING SUPERVISOR

APPROVAL

DATE

SAMPLE DESCRIPTION

0.0 - 0.8 - Clay w/some gravel, Hell's Bvn.
(10X25%), Dk Blx' sh Bvn (40X15%),
5-10% gravel (2X1" dia., sub-rounded to sub-angular),
clay has some plasticity, gravel predominately
gravel and granite, moist.

0.8 - 2.9' - Gravelly Clay - Strong Bvn. (75X25%),
sandy, 50% gravel (2X1" dia., sub-rounded to sub-angular),
lean Bx' sh Bvn. 50% sand (4X1" sub-angular),
& Dk Bx' sh, Broken clot (25X75%),
& 2.0" (1/2" ang. class).

2.9 - 3.8' - Clay w/some gravel (Sue A 3.00-3.80)

3.8 - 5.0' - No Recovery

UNABLE TO ALLOW Past 5.0', Will
OFFSET 2.0' EAST (SMME, CSM)

T.D. @ 5.0'

Backfill | Basaltite Chips

NOTES: General: USCS is modified for this log as follows:

Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Procedure No: RMRS/OPS-PRO.101

Revision 0

Date effective: 12/31/98.

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<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
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<th>Lithology</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5936</td>
<td>Protective Casing, 6 in. ID, Steel</td>
<td>0</td>
<td></td>
<td></td>
<td>CL: Gravelly, Sandy Clay, strong brown (7.5YR5/6), ~10% sand (coarse grained, subangular), 5 - 10% gravel (1/8&quot; to 1/4&quot; diameter, subangular to subrounded). Clay has medium plasticity. Wet, ground saturated due to recent precipitation (snow).</td>
</tr>
<tr>
<td>5935</td>
<td>Casing, 6 in. ID, 43 PVC, 2 in. ID</td>
<td>1</td>
<td>Concrete Soil</td>
<td></td>
<td>GC/CL: Calcareous Gravel/Sandy Clay mixture, brown (7.5YR4/2), ~20% gravel (1/4&quot; to 1&quot; diameter, subrounded to subangular, predominately quartzite), ~25% sand (medium grained to coarse grained, subrounded to subangular). Wet, saturated due to recent snow.</td>
</tr>
<tr>
<td>5934</td>
<td>Concrete Pad</td>
<td>2</td>
<td></td>
<td></td>
<td>No recovery.</td>
</tr>
<tr>
<td>5933</td>
<td>Bentonite Clays</td>
<td>3</td>
<td></td>
<td></td>
<td>GC/CL: Gravel/Sandy Clay mixture (same as 0.5' to 1.3'), wet.</td>
</tr>
<tr>
<td>5932</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td>GC: Gravel with some clay, dark grayish brown (10YR4/2) clay matrix. Gravel (1/2&quot; to 1-1/2&quot; diameter, subangular) is a shattered quartzite cobble. Wet CL: Clay with some gravel, grayish brown (10YR5/2) to gray (10YR5/1), mottled. &quot;Ribbons&quot; of sample from 2.7' to 3.2' due to clogged bit. Dense from 3.2' to 3.9'. Re-worked claystone, wet.</td>
</tr>
<tr>
<td>5931</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recovery.</td>
</tr>
</tbody>
</table>
CL: Clay with trace sand and gravel, grayish brown (2.5Y5/2) with lesser gray (2.5Y5/1), mottling, trace sand (coarse grained, subangular), trace gravel (1/4" diameter, subangular), 1-1/2" diameter broken quartzite cobble at 5.4'. Re-worked claystone, wet. Note: this interval could be slough.

CL: Clay, gray (2.5Y5/1) to grayish brown (2.5Y5/2), mottled. Re-worked claystone, wet. Trace to some fine grained sand.

CL: Silty Clay, brown (10YR4/3), distinct color change. ~5% sand (coarse grained, subangular to subrounded), wet.

CLAYSTONE: TOP OF BEDROCK. Claystone, gray (10YR5/1) with yellowish brown (10YR5/4), mottling. Weak, patchy iron oxidation. Bedrock contact very subtle. Interval competent but soft and wet. Trace white stringers.

No recovery.

CLAYSTONE: Claystone, gray (10YR5/1) to grayish brown (10YR5/2), trace iron oxidation increasing to weak iron oxidation as stringers along internal fractures from 11.4' to 11.7'. Trace to some black stringers and blebs along bedding planes. Competent, dense, and firm. Decreasing moisture to slightly moist. Bleached, caliche-filled seam at 11.2' to 11.3'.

No recovery.

CLAYSTONE: Claystone to Claystone with silt below 16.2'. Very dark gray (10YR3/1) changing to gray (10YR5/1) at base of interval. Predominately un-weathered, un-oxidized claystone bedrock. Trace iron oxidation, massive textured. Some black organic stringers throughout. Lenses of black carbonaceous material along bedding.
planes at 15.9', 17.0', and 17.4'. Abundant black carbonaceous material from 18.2' to 18.4', with patchy, associated iron oxidation. Very competent and dense interval, decreasing moisture; very slightly moist to dry.

CLAYSTONE: Claystone to Claystone with silt, gray (10YR5/1) with yellowish brown (10YR5/6) iron oxidation along bedding planes. Pervasive iron oxidation from 19.9' to 20.0', very silty, trace to some black organic stringers throughout. Weakly friable, very slightly moist to dry.

CLAYSTONE: Claystone with silt, very dark grayish brown (10YR3/2), dense and firm, very slightly moist to dry.

CLAYSTONE: Claystone with silt, gray (10YR5/1) with weak to moderate yellowish brown (10YR5/6) iron oxidation along fractures and bedding planes. Trace manganese oxide coating associated with iron oxidation, very firm and dense, many fractures, all iron oxide-healed, generally ~30 deg - 60 deg, below 20.8' to 23.0', then rare. Decreased moisture to dry.
<table>
<thead>
<tr>
<th>Elev (Ft)</th>
<th>Well or Piezometer Construction and Materials</th>
<th>Depth (Ft)</th>
<th>Unified Soils Classification or Rock Type</th>
<th>Lithology</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5909</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5908</td>
<td>Augers advanced to 25.5', no core collected.</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5907</td>
<td>Threaded End Cap: Surry Silt 40-PVC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**MONITORING WELL INSTALLATION REPORT: Form PRO.118**

**LOCATION CODE:** 92405  
**PROJECT NAME:** FY05 Well Replacement Program  
**PROGRAM:** Water Programs - WAG  
**SCREENED FORMATION:** N/A  
**DRILLING CONTRACTOR:** High Plains  
**BORING METHOD:** Hollow Stem Auger  
**DATE DRILLED:** 9/13/05  
**DATE COMPLETED:** 4/19/05  
**TOTAL DEPTH:** 25.5'  
**COMPLETED DEPTH:** 25.5'  
**ESTIMATED DEPTH TO BEDROCK:** 5.0'  
**RIG GEOLOGIST:** E. Wamp  
**LOGGING GEOLOGIST:** E. Wamp  
**BOREHOLE DIAMETER IN SCREENED INTERVAL:** 8.0"  
**QUANTITY OF FLUIDS LOST DURING DRILLING:** N/A  
**INITIAL WATER LEVEL (FT, DATE):** Dry on 9/13/05  
**COMPLETED WATER LEVEL (FT, DATE):** E6655 2/22  
**DIAMETER & TYPE OF INSTALLATION:** N/A  
**WELL PIEZOMETER/WELL POINT/Etc.:** 2.0" PVC WELL  
**TYPE OF PROTECTION:** Flush-Mount vs. Above Ground, Aseptic, etc.: 6.0" E.D. Steel Protective Casing Above Ground

**ALL MEASUREMENTS WILL BE MADE IN FEET FROM GROUND SURFACE**

* DENOTES ITEMS THAT MAY NOT BE APPLICABLE, DEPENDING ON BORING METHOD, WELL PROTECTION & PURPOSE

---

**PROTECTIVE CASING TOP (STICKUP OR FLUSH-MOUNT):** 3.5'

**SECONDARY CASING TOP:** N/A  
**BOTTOM:** N/A  
**TYPE:** N/A

**SURFACE CASING TOP:** 2.9' ID (IN): 2.0"  
**SURFACE SEAL TOP:** 1.9' ID (IN): 0.125"  
**PROTECTIVE CASING BOTTOM, ID (IN):** 1.4"  
**DENSITY:** 6.5 D, Steel

**WELL PAD DIMENSIONS:** 3x3'  
**Concrete Base, .045"  
**ADD'L CASING FILL TOP:** N/A  
**BOTTOM:** N/A  
**TYPE:** N/A  
**SURFACE ISOLATION CASING TOP:** N/A  
**BOTTOM:** N/A  
**SURFACE ISOLATION CASING ID (IN):** N/A  
**TYPE:** N/A  
**OTHER (E.G., ASEPTIC) CASING TOP:** N/A  
**BOTTOM:** N/A  
**OTHER CASING ID (IN):** N/A  
**TYPE, PURPOSE:** N/A  
**CENTRALIZER(S) OD (IN):** N/A  
**NUMBER USED:** N/A  
**TYPE:** N/A  
**CENTRALIZER(S) DEPTH:** N/A

**GROUT TOP:** N/A  
**MEASURED DENSITY (LBS/GAL):** N/A  
**TYPE:** N/A  
**GRANULAR BENTONITE TOP:** N/A  
**TYPE:** N/A  
**BENTONITE SEAL OR GRANULAR BENTONITE BOTTOM (= FILTER PACK TOP):** 4.5'

**FILTER PACK TYPE:** 1/40 Silica Sand  
**BRAND:** C.S.S.I.

**SURFACE CASING BOTTOM (=SCREEN TOP):** 5.25'  
**TYPE:** Sch. 80 PVC  
**SCREEN ID (IN):** 2.0"  
**TYPE:** Sch. 80 PVC  
**SCREEN BOTTOM (= SUMP, TOP):** 25.25'  
**TYPE:** Threaded End Cap - Sch. 80, PVC

**FILTER PACK BOTTOM (= BACKFILL TOP):** 25.5'  
**BACKFILL TYPE:** N/A  
**SUMP BOTTOM (= WELL COMPLETED DEPTH):** 25.5'  
**PILOT HOLE TOP, DIAMETER:** N/A  
**TOTAL BOREHOLE DEPTH (= *PILOT HOLE AND *BACKFILL BOTTOM):** 25.5'

**REMARKS:** Normal Well Installation on 4/13/05. Concrete Well Pad installed on 4/19/05.

**COMPLETED BY:** E. Wamp  
**DATE:** 4/19/05

**CHECKED BY:** E. Wamp  
**DATE:** 6/19/05
## ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Borehole Number:</th>
<th>99405</th>
<th>Surface Elevation:</th>
<th>700.0 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: North</td>
<td></td>
<td>Area: BSC-01</td>
<td>265.5</td>
</tr>
<tr>
<td>East</td>
<td></td>
<td>Total Depth:</td>
<td>265.5</td>
</tr>
<tr>
<td>Date:</td>
<td>4/19/05</td>
<td>Company:</td>
<td>NWELCO</td>
</tr>
<tr>
<td>Geologist:</td>
<td>E. Nunez</td>
<td>Project No:</td>
<td>NAD 51300</td>
</tr>
<tr>
<td>Drilling Equip.</td>
<td>Hollow Stem Auger: 4:1:5:75:HT</td>
<td>Sample Type:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### RMRS LOGGING SUPERVISOR

**APPROVAL**

**DATE** 4/19/05

### SAMPLE DESCRIPTION

<table>
<thead>
<tr>
<th>Top Depth</th>
<th>Interval</th>
<th>Sample Number</th>
<th>Fracture Angle</th>
<th>Bedding Angle</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td>0.0-0.5 gravel, Sandy Clay, Strong (15%), Sand (95%), 5-10% gravel. Clay has med. plasticity. Saturated due to recent precipitation. Ground water saturated.</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td>0.5-1.3 gravel, Sandy Clay Mixture. Grain (1.5y 24), ~20% gravel (1-2&quot; dia.), ~20% sand, ~25% gravel, predominately clastic, ~20% sand, ~25% gravel, predominately clastic. WET saturated due to recent precipitation.</td>
</tr>
<tr>
<td>5.0</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td>1.3-2.0 no recovery.</td>
</tr>
<tr>
<td>8.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
<td>2.0-2.3 gravel, Sandy Clay Mixture (similar to 0.5-1.3), WET saturated.</td>
</tr>
<tr>
<td>11.0</td>
<td>11.0</td>
<td></td>
<td></td>
<td></td>
<td>2.3-2.7 gravel, Sandy Clay, Dr. Grysh, Brn (0.05y 24), clay mat, gravel (1-2&quot; dia.), sand, ~25% gravel, predominately clastic. WET saturated due to recent precipitation.</td>
</tr>
<tr>
<td>14.0</td>
<td>14.0</td>
<td></td>
<td></td>
<td></td>
<td>2.7-3.9 Clay, 1/2&quot; gravel, 6&quot; Grysh, Brn, 0.05y 24, dr. Grysh, Brn, 0.05y 24, mat, 1/2&quot; gravel, 6&quot; Grysh, Brn, 0.05y 24, mat. WET saturated due to recent precipitation.</td>
</tr>
<tr>
<td>17.0</td>
<td>17.0</td>
<td></td>
<td></td>
<td></td>
<td>3.9-5.0 no recovery.</td>
</tr>
<tr>
<td>20.0</td>
<td>20.0</td>
<td></td>
<td></td>
<td></td>
<td>5.0-5.1 clay, 1/2&quot; sand and gravel, Grysh, Brn, (2.5y 24), Lesser Grysh, (2.5y 24), mat, ~5% sand, ~25% gravel, ~25% gravel, predominately clastic. WET saturated.</td>
</tr>
<tr>
<td>23.0</td>
<td>23.0</td>
<td></td>
<td></td>
<td></td>
<td>5.1-5.5 clay, Grysh, Brn, (2.5y 24), Grysh, Brn, (2.5y 24), mat. WET saturated.</td>
</tr>
<tr>
<td>26.0</td>
<td>26.0</td>
<td></td>
<td></td>
<td></td>
<td>5.5-5.6 Silty clay, Brn (0.05y 24), distinct color change. ~5% sand, ~25% gravel, predominately clastic. WET saturated.</td>
</tr>
<tr>
<td>29.0</td>
<td>29.0</td>
<td></td>
<td></td>
<td></td>
<td>5.6-6.9 Clay, 1/2&quot; gravel, 6&quot; Grysh, Brn, (0.05y 24), dr. Grysh, Brn, (0.05y 24), mat. WET saturated.</td>
</tr>
<tr>
<td>32.0</td>
<td>32.0</td>
<td></td>
<td></td>
<td></td>
<td>6.9-8.0 no recovery.</td>
</tr>
<tr>
<td>35.0</td>
<td>35.0</td>
<td></td>
<td></td>
<td></td>
<td>8.0-12.7 Clay, 1/2&quot; gravel, 6&quot; Grysh, Brn, (0.05y 24), dr. Grysh, Brn, (0.05y 24), mat. WET saturated.</td>
</tr>
</tbody>
</table>

### NOTES

- General: USCS is modified for this log as follows:
  - Materials amounts are estimated by % volume instead of % weight.
  - (1) Badly broken core, accurate footage measurements not possible.
  - (2) Core breaks cannot be matched, accurate footage measurements not possible.

---

**Procedure No:** RMRS/OPS-PRO-101

**Revision:** 0

**Date effective:** 12/31/98

**Page 27 of 28**
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>Claystone (cont) see page 2-3 8.0-12' for description. Bleached, calcite-filled seams.</td>
</tr>
<tr>
<td>12.7-15.0</td>
<td>No Recovery</td>
</tr>
<tr>
<td>13.0-19.4</td>
<td>Claystone - V. DK Gry (10% chert) changing to Gry (10% chert) at base of interval. Predominately un-streaked, un-broken, claystone bedrock. Fe Oxid, Massive textured. Some blk organic strings throughout. Lenses of blk carbonaceous material along bedding planes. E15.9', 17.0' and 17.4'. Abundant blk carbonaceous material between 18.2' and 18.4' patchy, assoc'd. Fe Oxid. V. competent and dense interval. Poor moisture. V. sl. moist to dry.</td>
</tr>
<tr>
<td>19.1-20'</td>
<td>Claystone Gry (10% chert) with yellow bow (10% chert) Fe Oxid along bedding planes. Perm. Fe Oxid from 19.9' to 20.' V. some black organic strings throughout.</td>
</tr>
</tbody>
</table>

NOTES: General: USCS is modified for this log as follows:

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- (2) Core breaks cannot be matched, accurate footage measurements not possible.
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE BOREHOLE LOG

<table>
<thead>
<tr>
<th>Borehole Number: 99405</th>
<th>Surface Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location - North:</td>
<td>Area: 8991 - Replacement of well # 99401</td>
</tr>
<tr>
<td>Date: 1/13/05</td>
<td>Total Depth: 25' 5&quot;</td>
</tr>
<tr>
<td>Geologist: E. Young</td>
<td>Company: USG High Plains</td>
</tr>
<tr>
<td>Drilling Equip.:</td>
<td>Project No: HAD51300</td>
</tr>
<tr>
<td></td>
<td>Sample Type: N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPROVAL</th>
<th>DATE: 1/13/05</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TAPPOSITION IN BOX</th>
<th>TOPOT SITATION OF CORK IN INTERNAL MEASUREMENT</th>
<th>SAMPLE NUMBER</th>
<th>FrACTURE ANGLE</th>
<th>REDDING ANGLE</th>
<th>GRANN SIZE DISTRIBUTION</th>
<th>USCS SYMBOL</th>
<th>DEPTH IN FEET</th>
<th>SOURCE LOG</th>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.0-20.4 - Claystone, V, DK Gryan Brn (1046%2), Dense and firm. V, SI, moist to dry.</td>
</tr>
<tr>
<td>Run #2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.4-250 - claystone, dry (1048%) with wk. to Med. yellow Brn (1046%) Fire in along bed planes. Fire on coating (1046%).</td>
</tr>
<tr>
<td>030' 250'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Debe, moisture to dry.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>V, firm and dense, many fractures all Fire-headed, generally 30'-60' below 23.0', then none.</td>
</tr>
<tr>
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<td></td>
<td>Note: augers advanced to 25' 5' No core collected.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T.D. @ 25' 5'</td>
</tr>
</tbody>
</table>

**Note:** 99405 is located 2' West of original well # 99401.

**NOTES:** General: USCS is modified for this log as follows:

Materials: amounts are estimated by % volume instead of % weight.

(1) Badly broken core, accurate footage measurements not possible.

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