Appendix B

Boring Logs, Well Logs, Well Records, Sealing Records, and Photos
LOG OF WELL MW-B1-001

Client: University of Minnesota
Drill Contractor: Traut
Project Name: UMA Groundwater Assessment
Drill Method: Rotasonic (4"x6")
Number: 23/19-0B05
Location: 194474.25'N, 553294.50'E
Logged By: EJC
Drilling Started: 1/8/09
Ended: 1/8/09
Elevation: 947.6
Total Depth: 75.0
Screened Interval: 61-71'

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Description</th>
<th>Well Or Piezometer Construction Detail and Drilling Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Organic-rich Soil (OL): very dark grayish brown (10YR 3/2), frozen, dense, low plasticity. [Topsoil]</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Silt (ML): dark yellowish brown (10YR 4/4), low plasticity, dry, blocky. [Loess]</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Organic-rich Soil (OL): very dark grayish brown (10YR 3/2), frozen, dense, low plasticity. [Topsoil]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lean Clay (CL): brown (10YR 5/3) with 5% well-rounded granite cobbles, moist, medium to soft consistency, oxidation mottling, low to medium plasticity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clayey Sand (SC): dark yellowish brown (10YR 4/4), well-graded, sub to well-rounded, fine to coarse-grained, (5/75/20), moist, medium density.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), sub to well-rounded, moist, medium-grained, (2/98/0), granite gravel. [Outwash]</td>
<td></td>
</tr>
</tbody>
</table>

Samp. Length & Recovery

Sample Number: 001
Sample Type: 001
Sample Description: 001
Sample Recovery: 001
Sample Headspace: 001

Barr Engineering Co.
4700 W. 77th St. Suite 200
Edina, MN 55435
Telephone: 952-832-2600
Fax: 952-832-2601

Remarks:
Unique ID # 769796.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.

UMP005163
Well MW-B1-001

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 194474.25'N, 553294.50'E  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  
**Drilling Started:** 1/8/09  
**Ended:** 1/8/09  
**Logged By:** EJC  
**Elevation:** 947.6  
**Total Depth:** 75.0  
**Screened Interval:** 61-71'

**DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPLE LENGTH &amp; RECOVERY</th>
<th>Headspace ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), sub to well-rounded, moist, medium-grained, (2/98/0), granite gravel. [Outwash] (continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>39': Six inches of silty sand.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

Unique ID # 769796.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-B1-001**

**Client:** University of Minnesota  
**Drill Contractor:** Traut

**Project Name:** UMA Groundwater Assessment  
**Drill Method:** Rotasonic (4"x6")

**Number:** 23/19-0B05  
**Drilling Started:** 1/8/09  
**Ended:** 1/8/09  
**Total Depth:** 75.0

**Location:** 194474.25'N, 553294.50'E  
**Logged By:** EJC

**Elevation:** 947.6  
**Screened Interval:** 61-71'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPL LENGTH &amp; RECOVERY</th>
<th>SAMPL NUMBER</th>
<th>HEADSPACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), sub to well-rounded, medium-grained, (2/98/0), granite gravel. [Outwash] Wet</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td>Six inches of very fine-grained silty sand at 68'.</td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>Silty Sand (SM): brown (10YR 5/3), very fine-grained, (0/70/30), wet, stiff consistency.</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td>End of Boring - 75 feet</td>
</tr>
</tbody>
</table>

**Remarks:**  
Unique ID # 769796.

Additional data may have been collected in the field which is not included on this log.

BGS = "below ground surface"
**LOG OF WELL MW-C2-002**

**SHEET 1 OF 3**

**Client**  University of Minnesota  
**Project Name**  UMA Groundwater Assessment  
**Number**  23/19-0B05  
**Location**  189952.63N, 555403.36'E  
**Drill Contractor**  Traut  
**Drill Method**  Rotasonic (4"x6")  
**Drilling Started**  1/28/09  
**Ended**  1/28/09  
**Elevation**  949.6  
**Total Depth**  75.0  
**Screened Interval**  65-75'  

---

### DEPTH VS. FEET

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organic-rich Soil (OL): very dark grayish brown (10YR 3/2), soft, frozen, low plasticity (0/0/100). [Topsoil]</td>
</tr>
<tr>
<td></td>
<td>Silt (ML): dark yellowish brown (10YR 4/4), dry, blocky, non-plastic. [Loess]</td>
</tr>
</tbody>
</table>

---

### WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS

- **PRO. CASING**
  - Diameter: 6"  
  - Type: Steel  
  - Interval: 0-6'  
- **RISER CASING**
  - Diameter: 2"  
  - Type: Black Steel  
  - Interval: 0-65'  
- **GROUT**
  - Type: High Solids Bentonite  
  - Interval: 0-65'  
- **SEAL**
  - Type: Bentonite  
  - Interval: 60-62'  
- **SANDPACK**
  - Type: Red Flint, 40-pack  
  - Interval: 62-75'  
- **SCREEN**
  - Diameter: 2"  
  - Type: 10 Slot, Stainless Steel  
  - Interval: 65-75'  
- **BOREHOLE**
  - Diameter: 6"  

---

**Remarks:**

- Unique ID # 769493.
- BGS = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.
## LOG OF WELL MW-C2-002

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 189952.63'N, 555403.36'E  
**Drill Contractor:** Traut  
**Drilling Started:** 1/28/09  
**Ended:** 1/28/09  
**Logged By:** EJC  
**Elevation:** 949.6  
**Total Depth:** 75.0  
**Screened Interval:** 65-75'

### DEPTH FEET

<table>
<thead>
<tr>
<th>SAMP. NUMBER</th>
<th>HEADSPACE (ppm)</th>
<th>DESCRIPTION</th>
<th>SAMPLE LENGTH &amp; RECOVERY</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td></td>
<td>Gravel lens at 50' bgs, about one inch thick.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)

**Remarks:**
- **Unique ID #** 769493.
- **BGS** = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.

---

**Barr Engineering Co.**
4700 W. 77th St. Suite 200
Edina, MN 55435
Telephone: 952-832-2600
Fax: 952-832-2601

**BARR**

**Simple Envirolog 6**
23190B05.GPJ  BARRLOG6_28.GDT  5/7/09

**UMP005167**
**Description:**


70-75': No recovery; same as above based on ease of drilling.

End of Boring - 75 feet
# LOG OF WELL MW-C2-202

## WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS

**Description:**

- **Silt (ML):** brown. [Loess]
- **Sand (SP):** brown, medium-grained with gravel. [Outwash]

### BOREHOLE

- Diameter: 6"

### SCREEN

- Diameter: 2"
  - Type: 10 Slot, Stainless Steel
  - Interval: 137-147'

### SANDPACK

- Type: Red Flint, 40-pack
  - Interval: 133-150'

### SEAL

- Type: Bentonite
  - Interval: 131-133'

### GROUT

- Type: High Solids Bentonite
  - Interval: 4-131'

### RISER CASING

- Diameter: 2"
  - Type: Black Steel
  - Interval: 0-137'

### PRO. CASING

- Diameter: 6"
  - Type: Steel
  - Interval: 0-4'

### DEPTH FEET

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample Length &amp; Recovery</th>
<th>HEADSPACE ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
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<td>30</td>
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<tr>
<td>65</td>
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<tr>
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<tr>
<td>80</td>
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<tr>
<td>85</td>
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<tr>
<td>90</td>
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<tr>
<td>115</td>
<td></td>
<td></td>
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<tr>
<td>120</td>
<td></td>
<td></td>
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<tr>
<td>125</td>
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<tr>
<td>130</td>
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<tr>
<td>145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

Pressure grouted with high solids bentonite grout. Unique ID # 769493.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
Client: University of Minnesota

Project Name: UMA Groundwater Assessment

Drill Contractor: Traut

Drill Method: Mud Rotary

Number: 23/19-0B05

Location: 189954.47'N, 555375.45'E

Drilling Started: 1/21/09

Ended: 1/21/09

Elevation: 949.9

Total Depth: 150.0

Screened Interval: 137-147'

---

<table>
<thead>
<tr>
<th>Depth</th>
<th>Headspace ppm</th>
<th>SAMP. LENGTH &amp; RECOVERY</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)</td>
<td></td>
</tr>
<tr>
<td>40-45</td>
<td></td>
<td></td>
<td>40-45': bit chattering - gravel.</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52-60</td>
<td></td>
<td></td>
<td>52-60': bit chattering - gravel.</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

Pressure grouted with high solids bentonite grout. Unique ID # 769493.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL MW-C2-202

**Client**  University of Minnesota  
**Project Name**  UMA Groundwater Assessment  
**Number**  23/19-0B05  
**Location**  189954.47'N, 555375.45'E  
**Drill Contractor**  Traut  
**Drill Method**  Mud Rotary  
**Date Started**  1/21/09  
**Date Ended**  1/21/09  
**Elevation**  949.9  
**Total Depth**  150.0  
**Screened Interval**  137-147'  

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>SAMP. LENGTH &amp; RECOVERY</th>
<th>Headspace (ppm)</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td></td>
<td></td>
<td>Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>885</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769493.  
BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.

**Logged By:**  EJC  
**Drill Method:**  Mud Rotary  
**Client:**  University of Minnesota  
**Location:**  189954.47'N, 555375.45'E  
**Client:**  University of Minnesota  
**Location:**  189954.47'N, 555375.45'E  
**Logged By:**  EJC  
**Drill Method:**  Mud Rotary  
**Client:**  University of Minnesota  
**Location:**  189954.47'N, 555375.45'E  
**Logged By:**  EJC  
**Drill Method:**  Mud Rotary  
**Client:**  University of Minnesota  
**Location:**  189954.47'N, 555375.45'E  
**Logged By:**  EJC  
**Drill Method:**  Mud Rotary  
**Client:**  University of Minnesota  
**Location:**  189954.47'N, 555375.45'E  
**Logged By:**  EJC  
**Drill Method:**  Mud Rotary
**LOG OF WELL MW-C2-202**

**Sheet 4 of 5**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td></td>
<td></td>
<td>Sand (SP): brown, medium-grained with gravel, [Outwash] (continued)</td>
<td>Pressure grouted with high solids bentonite grout. Unique ID #769493.</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Well or Piezometer Construction Detail and Drilling Remarks**

**Barr Engineering Co.**
4700 W. 77th St. Suite 200
Edina, MN 55435
Telephone: 952-832-2600
Fax: 952-832-2601

**Remarks:**
Pressure grouted with high solids bentonite grout. Unique ID # 769493.

**BGS = “below ground surface”**
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPLE COLUMN &amp; RECOVERY LENGTH &amp; % RECOVERY</th>
<th>HEADSPACE (ppm)</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td></td>
<td></td>
<td>Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)</td>
<td></td>
<td>805</td>
</tr>
<tr>
<td>130</td>
<td></td>
<td></td>
<td></td>
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<td>810</td>
</tr>
<tr>
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<td>815</td>
</tr>
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<td>140</td>
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<tr>
<td>145</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>825</td>
</tr>
<tr>
<td>148-150</td>
<td></td>
<td></td>
<td>148-150': Limestone [Prairie du Chien]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**
- Pressure grouted with high solids bentonite grout. Unique ID # 769493.
- BGS = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL PW-C2-202**

**Client**  University of Minnesota  
**Project Name**  UMA Groundwater Assessment  
**Drill Contractor**  Traut  
**Drill Method**  Mud Rotary  
**Number**  23/19-0B05  
**Drilling Started**  1/26/09  
**Ended**  1/27/09  
**Logged By**  EJC  
**Elevation**  949.6  
**Total Depth**  147.0  
**Screened Interval**  125-145'

### DESCRIPTION

**Headspace ppm** | **Silt (ML) [Loess]**
---|---
**30 Slot, Stainless Steel**

**Sand (SP): brown, medium-grained with gravel. [Outwash]**

**Headspace ppm** | **Screen**
---|---
**2"** | **Diameter:**
**Type:** 30 Slot, Stainless Steel  
**Interval:** 125-145'

**Headspace ppm** | **PRO. CASING**
---|---
**Type:**  
**Interval:** None

**Headspace ppm** | **RISER CASING**
---|---
**Type:** Black Steel  
**Interval:** 2-125'

**Headspace ppm** | **GROUT**
---|---
**Type:** High Solids Bentonite  
**Interval:** 6-113'

**Headspace ppm** | **SEAL**
---|---
**Type:** Bentonite  
**Interval:** 113-115'

**Headspace ppm** | **SANDPACK**
---|---
**Type:** Red Flint, 40-pack  
**Interval:** 115-145'

**Headspace ppm** | **SCREEN**
---|---
**Type:**  
**Interval:**

**Headspace ppm** | **BOREHOLE**
---|---
**Diameter:** 10''

---

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769482.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.

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**Barr Engineering Co.**  
**4700 W. 77th St. Suite 200**  
**Edina, MN 55435**  
**Telephone:** 952-832-2600  
**Fax:** 952-832-2601

**UMP005174**
Client: University of Minnesota  
Drill Contractor: Traut  
Project Name: UMA Groundwater Assessment  
Drill Method: Mud Rotary  
Number: 23/19-0B05  
Location: 189952.13'N, 555431.99'E  
Number: 23/19-0B05 Drilling Started: 1/26/09  
Logged By: EJC  
Drill Contractor: Traut  
Duration: 1/26/09 to 1/27/09  
Elevation: 949.6  
Total Depth: 147.0  
Screened Interval: 125-145'  

**Sand (SP):** brown, medium-grained with gravel. [Outwash] (continued)

Remarks: Pressure grouted with high solids bentonite grout. Unique ID # 769482.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL PW-C2-202

**Client**  
University of Minnesota

**Project Name**  
UMA Groundwater Assessment

**Number**  
23/19-0B05

**Location**  
189952.13'N, 555431.99'E

**Drill Contractor**  
Traut

**Drill Method**  
Mud Rotary

**Drilling Started**  
1/26/09

**Ended**  
1/27/09

**Elevation**  
949.6

**Total Depth**  
147.0

**Screened Interval**  
125-145'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>DESCRIPTION</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)</td>
<td>860</td>
</tr>
<tr>
<td>70</td>
<td></td>
<td>870</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>875</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>880</td>
</tr>
<tr>
<td>85</td>
<td></td>
<td>885</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769482.

**BGS = "below ground surface"**  
Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL PW-C2-202

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 189952.13'N, 555431.99'E  
**Drill Contractor:** Traut  
**Drill Method:** Mud Rotary  
**Drilling Started:** 1/26/09  
**Ended:** 1/27/09  
**Logger:** EJC  
**Elevation:** 949.6  
**Total Depth:** 147.0  
**Screened Interval:** 125-145'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPLING LENGTH &amp; RECOVERY</th>
<th>HEADSPACE ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td></td>
<td></td>
<td>Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>145</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769482.

**BGS = "below ground surface"**  
Additional data may have been collected in the field which is not included on this log.
LOG OF WELL PW-C2-202

DEEP LNTR. SHEET 5 OF 5

DEPTH FEET

DETAILED DESCRIPTION

Sand (SP): brown, medium-grained with gravel. [Outwash] (continued)

Lean Clay (CL): gray with gravel. [Till]

147: Limestone Bedrock [Prairie du Chien]
End of Boring - 147 feet

Remarks:
Pressure grouted with high solids bentonite grout. Unique ID # 769482.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMP. LENGTH &amp; RECOVERY</th>
<th>SAMPLE NUMBER</th>
<th>SAMP. NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td>Fill: Sandy Clay (CL), black, dry, hard.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1</td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), dry, 95% fine to medium sand, 5% fine gravel, trace fines.</td>
</tr>
<tr>
<td>10-11.5</td>
<td></td>
<td>2</td>
<td></td>
<td>10-11.5’: Abundant gravel, well-rounded, mineralogy includes mafics and granite.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>Light brownish gray (10YR 6/2), dry. 90% fine sand, 10% fine to medium gravel.</td>
</tr>
<tr>
<td>20-22</td>
<td></td>
<td></td>
<td></td>
<td>20-22’: medium to coarse sand with few large gravel and sandstone clasts.</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td>95% medium sand, 5% fine gravel.</td>
</tr>
<tr>
<td>27-29</td>
<td></td>
<td></td>
<td></td>
<td>27-29’: 95% fine sand, 5% gravel, trace fines.</td>
</tr>
</tbody>
</table>

(continued)
### LOG OF WELL MW-A3-003

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 196104.46'N, 559964.79'E  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  
**Logged By:** JME  
**Drilling Started:** 1/5/09  
**Ended:** 1/5/09  
**Elevation:** 941.0  
**Total Depth:** 85.0  
**Screened Interval:** 72-82'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMP. LENGTH &amp; RECOVERY</th>
<th>HEADSPACE ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>100% fine sand, yellowish brown (10YR 5/4).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>95% fine sand, 5% medium sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>100% fine to medium sand, trace fine gravel, trace fines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td>100% fine sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td>95% medium sand, 5% fine gravel, trace fines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>70</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
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<td></td>
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<tr>
<td>80</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

WL=58.3' bgs on 1/15/09. Unique ID # 769494.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
<th>Well or Piezometer Construction Detail and Drilling Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-67'</td>
<td>95% medium and coarse sand, 5% fine to medium gravel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63-64': 95% fine sand, 5% coarse sand, dry.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>65-67': Abundant medium and coarse gravel.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68-69': Well Graded Sand (SW).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95% medium sand, 5% fine gravel.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% medium to fine sand, trace fines, wet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt (ML): brown (10YR 4/3), wet, 100% non-plastic fines, massive, soft, weak reaction to HCl.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly Graded Sand (SP): brown, 100% fine to medium sand, wet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt (ML): as above.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly Graded Sand (SP): brown, fine to medium-grained.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt (ML): as above.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Boring - 85 feet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
WL=58.3' bgs on 1/15/09. Unique ID # 769494.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
LOG OF WELL MW-C7-004

Client: University of Minnesota
Project Name: UMA Groundwater Assessment
Drill Contractor: Traut
Drill Method: Rotasonic (4"x6")
Number: 23/19-0B05
Location: 191395.22'N, 568057.40'E
Elevation: 928.6
Total Depth: 90.0
Screened Interval: 80-90'

<table>
<thead>
<tr>
<th>Depth</th>
<th>SAMP LENGTH &amp; RECOVERY</th>
<th>Headspace</th>
<th>pp.m</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
</table>
| 0-4'  |                         |           |      | Well Graded Sand (SW): brown (10YR 4/4), with 10% angular gravel, (10/90/0), dry. [Fill] | PRO. CASING Diameter: 6"
Type: Steel
Interval: 0-4'
RISER CASING Diameter: 2"
Type: Black Steel
Interval: 0-65'
GROUT Type: High Solids Bentonite
Interval: 4-74'
SEAL Type: Bentonite
Interval: 74-77'
SANDPACK Type: Red Flint, 40-pack
Interval: 77-90'
SCREEN Diameter: 2"
Type: 10 Slot, Stainless Steel
Interval: 80-90'
BOREHOLE Diameter: 6"

Comments:
- Well Graded Sand (SW): dark yellowish brown (10YR 4/4) with 10% angular gravel, (10/90/0), dry. [Fill]
- Organic-rich Soil (OL): very dark grayish brown (10YR 3/2), moist, blocky, medium stiff consistency, low plasticity, (0/0/100). [Former Topsoil]
- Silt (ML): brownish yellow (10YR 6/6), dry, blocky, medium consistency, non-plastic, (0/0/100). [Loess]
- Well Graded Sand (SW): brownish yellow (10YR 6/6) with 2% subrounded gravel, dry, granular. Gravel mostly basalt and granite. [Outwash]

(-continued)
Well Graded Sand (SW): brownish yellow (10YR 6/6) with 2\% subrounded gravel, dry, granular. Gravel mostly basalt and granite. [Outwash] (continued)

39-41': Granite and basalt gravel and cobbles, well-rounded.

Poorly Graded Sand (SP): medium-grained.

59-61': Well-rounded granite and basalt gravel and cobbles, and angular dolomite cobbles.

Remarks:
Pressure grouted with high solids bentonite grout. Unique ID # 769484.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPLE LENGTH &amp; NUMBER</th>
<th>HEADSPACE ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>ELEV. FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>Well Graded Sand (SW).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td>Poorly Graded Sand with Silt (SP-SM): wet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td>Silt lenses at 82' and 83'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td>Sandy Silt (ML): fine-grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
<td>Poorly Graded Sand with Silt (SP-SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
<td></td>
<td>Sandy Silt (ML): fine-grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85+</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): coarse-grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Boring - 90 feet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
Pressure grouted with high solids bentonite grout. Unique ID # 769484.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-E2-305**

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 184388.28'N, 557403.68'E  
**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")

**DEPT** | **SAMP LENGTH & RECOVERY** | **SAMP. NUMBER** | **SAMP. LENGTH** | **RECOVERY** | **DESCRIPTION** | **HEADSPACE ppm** | **PRO. CASING** | **RISE CASING** | **GROUT** | **SEAL** | **SCREEN** | **BOREHOLE** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | Organic-rich Soil (OL): very dark grayish brown, frozen, low plasticity. (0/0/100). [Topsoil] | 0 | Diameter: 6"  
Type: Steel  
Interval: 0-4' |
| 1 | 0 | 0 | 0 | 0 | Silt (ML): brownish yellow (10YR 6/6), dry, blocky, non-plastic, (0/0/100). [Loess] | 0 | Diameter: 2"  
Type: Black Steel  
Interval: 0-65' |

**Remarks:**
- Pressure grouted with high solids bentonite grout. Unique ID # 769429.
- Additional data may have been collected in the field which is not included on this log.

**Additional Data:**
- **BGS = "below ground surface"**
- 40% gravel with black clay laminations up to 1" thick. [Lacustrine]
- Silty Gravel (GM): yellowish brown (10YR 6/6) with sand, (40/30/30), dry, some cementation of sand and gravel. [Alluvium]
- Gravelly Lean Clay (CL): light olive brown (2.5Y 5/4) with sand, (25/15/60), moist, low plasticity (25/15/60). Basalt, carbonate and granite gravel mineralogies; gray tolling and oxidation halos abundant. [Diamicton]
- Sandstone: white (2.5Y 5/1); fine to medium-grained sand, medium dense, moist, homogeneous. [St. Peter Sandstone]
### WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS

**Depth (Feet)** | **Headspace (ppm)** | **Description** | **Remarks**
---|---|---|---
41-42': | Very fine-grained powdery sand. | Pressure grouted with high solids bentonite grout. Unique ID # 769429. |
49-50': | Color changes to yellow (10YR 7/6). | |

**Log Details**
- **Client**: University of Minnesota
- **Project Name**: UMA Groundwater Assessment
- **Number**: 23/19-0B05
- **Location**: 184388.28'N, 557403.68'E
- **Drill Contractor**: Traut
- **Drill Method**: Rotasonic (4"x6")
- **Elevation**: 939.0
- **Total Depth**: 75.0
- **Screened Interval**: 64-74'
- **Logged By**: EJC
- **Drilling Started**: 1/30/09
- **Drilled To End**: 1/30/09

**Additional Data**
- **SAMP. LENGTH & RECOVERY**: 4
- **Headspace**: ppm
- **SAMP. NUMBER**: 5
- **ELEV. FEET**: 905

**Remarks**
- Pressure grouted with high solids bentonite grout. Unique ID # 769429.

**BGS**: *below ground surface*

*Additional data may have been collected in the field which is not included on this log.*
**LOG OF WELL MW-E2-305**

**Client**  University of Minnesota  
**Project Name** UMA Groundwater Assessment  
**Number** 23/19-0B05  
**Location** 184388.28’N, 557403.68’E  
**Drill Contractor** Traut  
**Drill Method** Rotasonic (4”x6”)  
**Drilling Started** 1/30/09  
**Ended** 1/30/09  
**Logged By** EJC  
**Elevation** 939.0  
**Total Depth** 75.0  
**Screened Interval** 64-74’  

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Description</th>
<th>Headspace (ppm)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Sandstone: white (2.5Y 5/1), fine to medium-grained sand, medium dense, wet, homogeneous. [St. Peter Sandstone]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>End of Boring - 75 feet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**
Pressure grouted with high solids bentonite grout. Unique ID # 769429.

BGS = “below ground surface”
Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-A6-006**

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Drill Contractor:** Traut  
**Drill Method:** Mud Rotary  
**Number:** 23/19-0B05  
**Drilling Started:** 1/20/09  
**Ended:** 1/20/09  
**Location:** 195438.37'N, 565915.79'E  
**Logged By:** EJC  
**Elevation:** 933.6  
**Total Depth:** 115.0  
**Screened Interval:** 102-112'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMP. LENGTH &amp; RECOVERY</th>
<th>SAMP. NUMBER</th>
<th>Headspace ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
</table>
| 0          |                          |              |               |             | PRO. CASING  
Diameter: 6"  
Type: Steel  
Interval: 0-4' |
| 4-95'      |                          |              |               | RISER CASING  
Diameter: 2"  
Type: Black Steel  
Interval: 0-102' |
| 95-97'     |                          |              |               | GROUT  
Type: High Solids Bentonite  
Interval: 4-95' |
| 95-97'     |                          |              |               | SEAL  
Type: Bentonite  
Interval: 95-97' |
| 95-97'     |                          |              |               | SANDPACK  
Type: Red Flint, 40-pack  
Interval: 97-115' |
| 95-97'     |                          |              |               | SCREEN  
Diameter: 2"  
Type: 10 Slot, Stainless Steel  
Interval: 102-112' |
| 102-112'   |                          |              |               | BOREHOLE  
Diameter: 6" |

**Remarks:**
Drilled with bentonite mud using 6" diameter tricone bit. Pressure grouted with high solids bentonite grout. Unique ID # 769491.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.

**SHEET 1 OF 4**
Remarks:
Drilled with bentonite mud using 6" diameter tricone bit. Pressure grouted with high solids bentonite grout. Unique ID # 769491.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.

---

**Sand (SP): brown, medium-grained. [Outwash] (continued)**

45-49': Bit chattering, moderate loss of drilling fluid probably due to cobbles.

**Lean Clay (CL): gray with gravel. [Diamicton]**

**ELEV. FEET**

900
895
890
885
880
875
865
860
855
850
845
840
835
830
825
820
815
810
805
800
795
790
785
780
775
770
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760
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100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

---

**Barr Engineering Co.**
4700 W. 77th St. Suite 200
Edina, MN 55435
Telephone: 952-832-2600
Fax: 952-832-2601

---

**UMP005189**

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**Elevation** 933.6
**Total Depth** 115.0
**Screened Interval** 102-112'
**LOG OF WELL MW-A6-006**

**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Project Name:** UMA Groundwater Assessment  
**Drill Method:** Mud Rotary  
**Number:** 23/19-0B05  
**Location:** 195438.37'N, 565915.79'E  
**Logged By:** EJC  
**Drilling Started:** 1/20/09  
**Ended:** 1/20/09  
**Elevation:** 933.6  
**Total Depth:** 115.0  
**Screened Interval:** 102-112'

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPLE NUMBER &amp; RECOVERY</th>
<th>HEADSPACE ppm</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>845</td>
<td></td>
<td></td>
<td>Lean Clay (CL): gray with gravel. [Diamicton] (continued)</td>
<td></td>
</tr>
<tr>
<td>850</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>855</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>860</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>865</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>870</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**
Drilled with bentonite mud using 6" diameter tricone bit. Pressure grouted with high solids bentonite grout. Unique ID # 769491.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-A6-006**

- **Drill Contractor**: Traut
- **Drill Method**: Mud Rotary
- **Elevation**: 933.6
- **Total Depth**: 115.0
- **Screened Interval**: 102-112'

<table>
<thead>
<tr>
<th>ELEV. FEET</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>930</td>
<td>Lean Clay (CL): gray with gravel. [Diamict] (continued)</td>
</tr>
<tr>
<td>950</td>
<td>Sand (SP): brown, medium-grained. [Outwash]</td>
</tr>
<tr>
<td>115</td>
<td>End of Boring - 115 feet</td>
</tr>
</tbody>
</table>

**Remarks:**
Drilled with bentonite mud using 6" diameter tricone bit. Pressure grouted with high solids bentonite grout. Unique ID # 769491.

**BGS = "below ground surface"**
Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL MW-D3-007

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMP. LENGTH &amp; SAMP. NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Headspace ppm</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Organic-rich Soil (OL): dark brown (10YR 3/3), frozen, low plasticity, (0/0/100). [Topsoil]</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>Silt (ML): dark yellowish brown (10YR 4/6), blocky, dry, non-plastic, (0/0/100). [Loess]</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>Well Graded Sand (SW): dark yellowish brown (10YR 4/6), coarse-grained, (10/90/0), moist, granite and basalt gravel and cobbles, subangular to subrounded.</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>Medium-grained.</td>
</tr>
</tbody>
</table>

**Well or Piezometer Construction Detail and Drilling Remarks**

- **PRO. CASING**
  - Diameter: 6"
  - Type: Steel
  - Interval: 0-4'

- **RISER CASING**
  - Diameter: 2"
  - Type: Black Steel
  - Interval: 0-60'

- **GROUT**
  - Type: High Solids Bentonite
  - Interval: 54-57'

- **SEAL**
  - Type: Bentonite
  - Interval: 60-70'

- **SCREEN**
  - Diameter: 2"
  - Type: 10 Slot, Stainless Steel
  - Interval: 60-70'

- **BOREHOLE**
  - Diameter: 6"

**Remarks:**
- Pressure grouted with high solids bentonite grout. Unique ID # 769490.
- Additional data may have been collected in the field which is not included on this log.

**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 186970.60'N, 559064.56'E  
**Drilling Started:** 1/7/09  
**Ended:** 1/7/09  
**Elevation:** 943.6  
**Total Depth:** 70.0  
**Screened Interval:** 60-70'

**Client:** University of Minnesota  
**Drill Method:** Rotasonic (4"x6")  
**Log Depth:** 915
Well Graded Sand (SW): dark yellowish brown (10YR 4/6), coarse-grained, (10/90/0), moist, granite and basalt gravel and cobbles, subangular to subrounded. (continued)

Gravel (GP)

Well Graded Sand (SW): dark yellowish brown (10YR 4/6), coarse-grained, (10/90/0), moist, granite and basalt gravel and cobbles, subangular to subrounded.

Remarks:
Pressure grouted with high solids bentonite grout. Unique ID # 769490.
## LOG OF WELL MW-D3-007

**Client**  
University of Minnesota

**Project Name**  
UMA Groundwater Assessment

**Number**  
23/19-0B05

**Location**  
186970.60'N, 559064.56'E

**Drill Contractor**  
Traut

**Drill Method**  
Rotasonic (4"x6")

**Drilling Started**  
1/7/09

**Ended**  
1/7/09

**Elevation**  
943.6

**Total Depth**  
70.0

**Screened Interval**  
60-70'

### WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Well Graded Sand (SW): dark yellowish brown (10YR 4/6), coarse-grained, (10/90/0), moist, granite and basalt gravel and cobbles, subangular to subrounded. (continued)</td>
</tr>
<tr>
<td>70</td>
<td>End of Boring - 70 feet</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769490.

**BGS** = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-D5-308**

**Log Details:**
- **Client:** University of Minnesota
- **Drill Contractor:** Traut
- **Project Name:** UMA Groundwater Assessment
- **Drill Method:** Rotasonic (4"x6")
- **Number:** 23/19-0B05
- **Location:** 187762.84'N, 565044.66'E
- **Logged By:** JME
- **Drilling Started:** 1/6/09
- **Ended:** 1/6/09
- **Elevation:** 935.0
- **Total Depth:** 75.0
- **Screened Interval:** 65-75'

**Shale:**
- **Diameter:** 6"
- **Type:** Steel
- **Interval:** 0-4'

**Riser Casing:**
- **Diameter:** 2"
- **Type:** Black Steel
- **Interval:** 0-65'

**GROUT**
- **Type:** High Solids Bentonite
- **Interval:** 60-62'

**SEAL**
- **Type:** Bentonite
- **Interval:** 62-75'

**Sandpack**
- **Type:** Red Flint, 40-pack
- **Interval:** 65-75'

**Screen**
- **Diameter:** 2"
- **Type:** Stainless Steel
- **Interval:** 65-75'

**Boreshole**
- **Diameter:** 6"

**Description:**
- **Fill/Topsil:** black, clayey, roots.
- **Silt:** dark yellowish brown (10YR 4/4), moist, 100% non-plastic fines, trace sand, soft, weak reaction to HCl. [Loess]
- **Poorly Graded Sand with Gravel (SP):** brown (10YR 3/4), dry, 60% medium sand, 40% gravel. [Outwash]
- **Poorly Graded Sand (SP):** brown (10YR 4/3), dry, 95% medium sand, 5% fine gravel, trace fines. [Outwash]
- **Abundant Cobble above diamicton.**
- **Lean Clay with Sand (CL):** very dark greenish gray (10Y 2.5/1), moist, 70-80% fines, 20-30% sand and gravel, firm to hard, massive, moderate reaction to HCl. [Diamicton]

**Remarks:**

**BGS** = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
Sandy Lean Clay (CL): brown (10YR 4/3), moist, 70% fines, 30% sand and gravel, abundant zones of dark yellowish brown (10YR 4/6) matrix, firm to hard, massive, weak reaction to HCl. [Diamicton]

Lean Clay (CL)/Silt (ML): brownish yellow (10YR 6/6), moist, 90% fines, 10% fine to medium sand and fine gravel. [Diamicton]

Well Graded Sand (SW): dark yellowish brown (10YR 4/4), dry, 80% sand, 20% gravel.

Lean Clay with Sand (CL): yellowish brown (10YR 5/4), moist, 90% fines, 10% fine sand, trace fine gravel, soft, massive, no reaction to HCl. [Diamicton]

(continued)
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace ppm</th>
<th>Description</th>
<th>Well or Piezometer Construction Detail and Drilling Remarks</th>
<th>Elevation Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td></td>
<td></td>
<td>Sandstone: pale yellow (5Y 7/3) grading to white (5Y 8/1) with depth, weakly cemented, cohesive sample to 66.5'. (continued)</td>
<td></td>
<td>870</td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td>Wet, weak iron mottling/zonation - increasing with depth.</td>
<td></td>
<td>865</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td>Horizontal zones of iron discoloration.</td>
<td></td>
<td>860</td>
</tr>
<tr>
<td>74-74.25'</td>
<td></td>
<td></td>
<td>Pulverize sample, abundant clasts of sandstone. Iron discoloration increasing with depth.</td>
<td></td>
<td>855</td>
</tr>
<tr>
<td>74.25'</td>
<td></td>
<td></td>
<td>74-74.25': Cemented lens, hard, gray, iron staining along bedding plan, no reaction to HCl.</td>
<td></td>
<td>850</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td>Abundant iron discoloration and shaley texture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End of Boring - 75 feet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
<th>Well or Piezometer Construction Detail and Drilling Remarks</th>
</tr>
</thead>
</table>
Diameter: 6"  
Type: Steel  
Interval: 0-4"  
RISER CASING  
Diameter: 2"  
Type: Black Steel  
Interval: 0-57.7"  
GROUT  
Type: High Solids Bentonite  
Interval: 53.7-55.7"  
SEAL  
Type: Bentonite  
Interval: 53.7-55.7"  
SANDPACK  
Type: Red Flint, 40-pack  
Interval: 55.7-71"  
SCREEN  
Diameter: 2"  
Type: 10 Slot, Stainless Steel  
Interval: 57.7-67.7"  
BOREHOLE  
Diameter: 6"  |
| 0-2       |                           |                 | Well Graded Sand (SW): yellowish brown (10YR 5/4) with trace silt and gravel, sub to well-rounded, moist, massive, dry. | |
| 0-3       |                           |                 |             | |

Remarks: Pressure grouted with high solids bentonite grout. Unique ID # 769488.
**Client**  University of Minnesota  
**Project Name**  UMA Groundwater Assessment  
**Number**  23/19-0B05  
**Location**  186933.78'N, 555370.86'E  

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Sample Number &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
<th>Well or Piezometer Construction Detail and Drilling Remarks</th>
<th>Elev. (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>5</td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), fine to medium-grained, (0/100/0), moist.</td>
<td></td>
<td>915</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>Well Graded Sand (SW): yellowish brown (10YR 5/4) with trace silt and gravel, sub to well-rounded, moist, massive, dry.</td>
<td></td>
<td>910</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td>(continued)</td>
<td></td>
<td>905</td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td>895</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td>890</td>
<td></td>
</tr>
</tbody>
</table>

Remarks:  
Pressure grouted with high solids bentonite grout. Unique ID # 769488.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-E2-009**

**Client**: University of Minnesota  
**Project Name**: UMA Groundwater Assessment  
**Number**: 23/19-0B05  
**Location**: 186933.78’N, 555370.86’E

**Description**

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>SAMP. Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
<th>Elev. (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>6</td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), wet, fine to medium-grained, (0/100/0).</td>
<td></td>
<td>885</td>
</tr>
<tr>
<td>70</td>
<td>7</td>
<td></td>
<td>70-71': No recovery.</td>
<td></td>
<td>880</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End of Boring - 71 feet</td>
<td></td>
<td>875</td>
</tr>
</tbody>
</table>

**Remarks:**
- Pressure grouted with high solids bentonite grout. Unique ID # 769488.
- BGS = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.

**Client**: Barr Engineering Co.  
**4700 W. 77th St. Suite 200 Edina, MN 55435  
**Telephone**: 952-832-2600  
**Fax**: 952-832-2601
**LOG OF WELL MW-E2-209**

- **Client:** University of Minnesota
- **Drill Contractor:** Traut
- **Project Name:** UMA Groundwater Assessment
- **Drill Method:** Rotasonic (4"x6")
- **Number:** 23/19-0B05
- **Location:** 186932.91'N, 555352.64'E
- **Drilling Started:** 1/14/09  
  **Ended:** 1/27/09
- **Logged By:** EJC
- **Screened Interval:** 116-126'
- **Total Depth:** 126.0
- **Elevation:** 947.2

<table>
<thead>
<tr>
<th>Depth FEET</th>
<th>Sample Length &amp; Recovery</th>
<th>Sample Number</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>920</td>
<td></td>
<td></td>
<td></td>
<td><strong>PRO. CASING</strong></td>
</tr>
<tr>
<td>925</td>
<td></td>
<td></td>
<td></td>
<td>Diameter: 6&quot;</td>
</tr>
<tr>
<td>930</td>
<td></td>
<td></td>
<td></td>
<td>Type: Steel</td>
</tr>
<tr>
<td>935</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 0-4'</td>
</tr>
<tr>
<td>940</td>
<td></td>
<td></td>
<td></td>
<td><strong>RISER CASING</strong></td>
</tr>
<tr>
<td>945</td>
<td></td>
<td></td>
<td></td>
<td>Diameter: 2&quot;</td>
</tr>
<tr>
<td>950</td>
<td></td>
<td></td>
<td></td>
<td>Type: Black Steel</td>
</tr>
<tr>
<td>955</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 0-116'</td>
</tr>
<tr>
<td>960</td>
<td></td>
<td></td>
<td></td>
<td><strong>GROUT</strong></td>
</tr>
<tr>
<td>965</td>
<td></td>
<td></td>
<td></td>
<td>Type: High Solids Bentonite</td>
</tr>
<tr>
<td>970</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 4-110'</td>
</tr>
<tr>
<td>975</td>
<td></td>
<td></td>
<td></td>
<td><strong>SEAL</strong></td>
</tr>
<tr>
<td>980</td>
<td></td>
<td></td>
<td></td>
<td>Type: Bentonite</td>
</tr>
<tr>
<td>985</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 110-113'</td>
</tr>
<tr>
<td>990</td>
<td></td>
<td></td>
<td></td>
<td><strong>SANDPACK</strong></td>
</tr>
<tr>
<td>995</td>
<td></td>
<td></td>
<td></td>
<td>Type: Red Flint, 40-pack</td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 113-126'</td>
</tr>
<tr>
<td>1005</td>
<td></td>
<td></td>
<td></td>
<td><strong>SCREEN</strong></td>
</tr>
<tr>
<td>1010</td>
<td></td>
<td></td>
<td></td>
<td>Diameter: 2&quot;</td>
</tr>
<tr>
<td>1015</td>
<td></td>
<td></td>
<td></td>
<td>Type: 10 Slot, Stainless Steel</td>
</tr>
<tr>
<td>1020</td>
<td></td>
<td></td>
<td></td>
<td>Interval: 116-126'</td>
</tr>
<tr>
<td>1025</td>
<td></td>
<td></td>
<td></td>
<td><strong>BOREHOLE</strong></td>
</tr>
<tr>
<td>1030</td>
<td></td>
<td></td>
<td></td>
<td>Diameter: 6&quot;</td>
</tr>
</tbody>
</table>

**Remarks:**
Pressure grouted with high solids bentonite grout. Unique ID # 769483.

*BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.*
### LOG OF WELL MW-E2-209

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 186932.91'N, 555352.64'E  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  
**Drilling Started:** 1/14/09  
**Ended:** 1/27/09  
**Elevation:** 947.2  
**Total Depth:** 126.0  
**Screened Interval:** 116-126'  
**Logged By:** EJC

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>DESCRIPTION</th>
<th>WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
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<tr>
<td>55</td>
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<td>65</td>
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</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
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<tr>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769483.

**BGS = "below ground surface"**  
Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-E2-209**

**Client**: University of Minnesota  
**Project Name**: UMA Groundwater Assessment  
**Number**: 23/19-0B05  
**Location**: 186932.91’N, 555352.64’E  
**Drill Contractor**: Traut  
**Drill Method**: Rotasonic (4"x6")  
**Drilling Started**: 1/14/09  
**Ended**: 1/27/09  
**Logged By**: EJC  
**Elevation**: 947.2  
**Total Depth**: 126.0  
**Screened Interval**: 116-126’

### Depth Table

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>Poorly Graded Sand (SP): brown (10YR 4/3), loose, wet, medium to coarse-grained, (10/90/0), sub to well-rounded granite and basalt gravel and cobbles. [Outwash]</td>
</tr>
</tbody>
</table>

**Remarks:**

Pressure grouted with high solids bentonite grout. Unique ID # 769483.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL MW-E2-209

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 186932.91'N, 555352.64'E  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  
**Drilling Started:** 1/14/09  
**Ended:** 1/27/09  
**Total Depth:** 126.0'  
**Screened Interval:** 116-126'

**Logged By:** EJC

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>SAMP LENGTH &amp; RECOVERY</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): brown (10YR 4/3), loose, wet, medium to coarse-grained, (10/90/0), sub to well-rounded granite and basalt gravel and cobbles. [Outwash] (continued)</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td>Lean Clay (CL): dark gray (10YR 4/1) with gravel, (20/0/80), medium consistency, moist, low plasticity, well-rounded granite and basalt cobbles. [Diamicton]</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
<td>Low recovery due to a basalt cobble boulder. Driller reports that the entire length drilled the same.</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): grayish brown (2.5Y 5/2), medium-grained, medium dense, wet, subangular to well-rounded. [Outwash]</td>
</tr>
<tr>
<td>115</td>
<td></td>
<td></td>
<td>(continued)</td>
</tr>
</tbody>
</table>

**Elevation:** 947.2'

**Remarks:** Pressure grouted with high solids bentonite grout. Unique ID # 769483.

**BGS = "below ground surface"**

Additional data may have been collected in the field which is not included on this log.
## LOG OF WELL MW-E2-209

**Client**: University of Minnesota  
**Project Name**: UMA Groundwater Assessment  
**Drill Contractor**: Traut  
**Drill Method**: Rotasonic (4"x6")  
**Number**: 23/19-0B05  
**Location**: 186932.91'N, 555352.64'E

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Screened Interval</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>116-126'</td>
<td></td>
<td>Lean Clay (CL): very dark grayish brown (2.5Y 3/2) with sand, (5/30/65), hard, moist, low plasticity. Well-rounded to subrounded gravel, sand medium to coarse-grained. [Diamicton] (continued)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limestone recovered as angular gravel and cobbles. No to very weak reaction on fresh faces, strong reaction on exposed faces.</td>
</tr>
<tr>
<td>125-126'</td>
<td></td>
<td></td>
<td>125-126': No recovery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End of Boring - 126 feet</td>
</tr>
</tbody>
</table>

**Elevation**: 947.2  
**Total Depth**: 126.0  
**Screened Interval**: 116-126'

Remarks:  
Pressure grouted with high solids bentonite grout. Unique ID # 769483.

**Drill Method**: Rotasonic (4"x6")

**Drilling Started**: 1/14/09  
**Ended**: 1/27/09

**Remarks**:  
Pressure grouted with high solids bentonite grout. Unique ID # 769483.

**BGS = "below ground surface"**

Additional data may have been collected in the field which is not included on this log.

---

**Client**: University of Minnesota  
**Drill Contractor**: Traut  
**Drill Method**: Rotasonic (4"x6")  
**Number**: 23/19-0B05  
**Location**: 186932.91'N, 555352.64'E  
**Logged By**: EJC  
**Elevation**: 947.2  
**Total Depth**: 126.0  
**Screened Interval**: 116-126'

**Remarks**:  
Pressure grouted with high solids bentonite grout. Unique ID # 769483.

**BGS = "below ground surface"**

Additional data may have been collected in the field which is not included on this log.
**LOG OF WELL MW-E4-010**

**DEPT**

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>SAMPL LENGTH &amp; RECOVERY</th>
<th>HEADSPACE ppm</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>Organic-rich Soil (OL): very dark grayish brown (10YR 3/2), frozen, low plasticity, (0/0/100). [Topsoil]</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>Silt (ML): dark yellowish brown (10YR 4/6), moist, blocky, non-plastic, (0/0/100). [Loess]</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>Well Graded Sand (SW): light yellowish brown (10YR 6/4) with well-rounded granite cobbles, (5/95/0), medium to coarse-grained, dry. [Outwash]</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ELEV. FEET**

| 935 |
| 930 |
| 925 |
| 920 |
| 915 |
| 910 |

**DESCRIPTION**

**WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS**

- **PRO. CASING**
  - Diameter: 6"  
  - Type: Steel  
  - Interval: 0-4'

- **RISER CASING**
  - Diameter: 2"  
  - Type: Black Steel  
  - Interval: 0-62'

- **GROUT**
  - Type: High Solids Bentonite  
  - Interval: 4-66'

- **SEAL**
  - Type: Bentonite  
  - Interval: 56-59'

- **SANDPACK**
  - Type: Red Flint, 40-pack  
  - Interval: 59-72'

- **SCREEN**
  - Diameter: 2"  
  - Type: 10 Slot, Stainless Steel  
  - Interval: 62-72'

- **BOREHOLE**
  - Diameter: 6"

Remarks:

- Pressure grouted with high solids bentonite grout. Unique ID # 769487.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.

UMP005206
Well Graded Sand (SW): light yellowish brown (10YR 6/4) with well-rounded granite cobbles, (5/95/0), medium to coarse-grained, dry. [Outwash] (continued)

Poorly Graded Sand (SP): medium-grained, (0/100/0), moist. [Outwash]
**LOG OF WELL MW-E4-010**

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment

**Number:** 23/19-0B05  
**Location:** 184326.24'N, 560351.50'E

**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")

**Drilling Started:** 1/8/09  
**Ended:** 1/9/09  
**Elevation:** 938.6

**Total Depth:** 72.0  
**Screened Interval:** 62-72'

---

**DEPTH** | **FEET** | **SAMPL. LENGTH & RECOVERY** | **SAMPL. NUMBER** | **ELEV. FEET** | **DESCRIPTION** | **WELL OR PIEZOMETER CONSTRUCTION DETAIL AND DRILLING REMARKS**
---|---|---|---|---|---|---
65 | 6 | | | | Well Graded Sand (SW): medium to coarse-grained, (0/100/0), saturated. [Outwash] |  
70 | 7 | | | | End of Boring - 72 feet |  

**Remarks:** Pressure grouted with high solids bentonite grout. Unique ID # 769487.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
### LOG OF WELL MW-C4-311

**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Project Name:** UMA Groundwater Assessment  
**Drill Method:** Rotasonic (4"x6")  
**Number:** 23/19-0B05  
**Location:** 190788.86'N, 561893.27'E  
**Logged By:** EJC  
**Elevation:** 934.3  
**Total Depth:** 93.0  
**Screened Interval:** 82-92'

### Depth

<table>
<thead>
<tr>
<th>Depth FEET</th>
<th>Samp. Length &amp; Recovery</th>
<th>Samp. Number</th>
<th>Headpace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>Organic-rich Soil (OL): brown (10YR 3/3), frozen, soft, blocky, low plasticity, (0/15/85). [Topsoil]</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): brown(10YR 5/3), medium grained, (5/95/0), dry, granite and basalt gravel, sub to well-rounded. [Outwash]</td>
</tr>
</tbody>
</table>

### Description

- **PRO. CASING**  
  - Diameter: 6"  
  - Type: Steel  
  - Interval: 0-4"  
- **RISER CASING**  
  - Diameter: 2"  
  - Type: Black Steel  
  - Interval: 0-82"  
- **GROUT**  
  - Type: High Solids Bentonite  
  - Interval: 4-77"  
- **SEAL**  
  - Type: Cement  
  - Interval: 77-80"  
- **SANDPACK**  
  - Type: Red Flint, 40-pack  
  - Interval: 80-92"  
- **SCREEN**  
  - Diameter: 2"  
  - Type: 10 Slot, Stainless Steel  
  - Interval: 82-92"  
- **BOREHOLE**  
  - Diameter: 6"  

**Remarks:** Pressure grouted with high solids bentonite grout. Unique ID # 769485.

**BGS = "below ground surface"**

Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Description</th>
<th>Well or Piezometer Construction Detail and Drilling Remarks</th>
<th>Elevation (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Poorly Graded Sand (SP): brown (10YR 5/3), medium grained, (5/95/0), dry, granite and basalt gravel, sub to well-rounded. [Outwash] (continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Lean Clay (CL): yellowish brown (10YR 5/4) with silt and sand, (0/30/70), hard, dry, very tough, low plasticity, fine to coarse-grained sand (generally carbonate), trace oxidation staining, weak to moderate reaction with HCl. [Diamicton]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
Pressure grouted with high solids bentonite grout. Unique ID # 769485.
### LOG OF WELL MW-C4-311

**Client:** University of Minnesota  
**Drill Contractor:** Traut

**Project Name:** UMA Groundwater Assessment  
**Drill Method:** Rotasonic (4"x6")

**Number:** 23/19-0B05  
**Location:** 190788.86'N, 561893.27'E

**Drilling Started:** 1/29/09  
**Ended:** 1/29/09

**Logged By:** EJC

**Elevation:** 934.3

**Total Depth:** 93.0

**Screened Interval:** 82-92'

### DESCRIPTION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>FEET</th>
<th>HEADSPACE</th>
<th>SAMPL. NUMBER</th>
<th>SAMPL. LENGTH &amp; RECOVERY</th>
<th>HEADSPACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>60-79'</td>
<td>ppm</td>
<td></td>
<td></td>
<td></td>
<td>grades from yellowish brown to dark gray.</td>
</tr>
</tbody>
</table>
| 7     | 80-85' | ppm       |               |                          |           | Lean Clay (CL): dark yellowish brown (10YR 4/6) with silt and sand, (0/15/85), moist, very stiff, black mottling, coarse-grained carbonate sand, moderate reaction with HCl, silty laminations.  
Sandstone: light yellowish brown, well-cemented, no reaction with HCl. Recovered as angular shards. |

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769485.

**Additional data may have been collected in the field which is not included on this log.**
### LOG OF WELL MW-C4-311

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 190788.86'N, 561893.27'E  
**Drilling Started:** 1/29/09  
**Ended:** 1/29/09  
**Logged By:** EJC  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  

**Elevation:** 934.3  
**Total Depth:** 93.0  
**Screened Interval:** 82-92'  

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td></td>
<td>Sandstone: light yellowish brown, well-cemented, no reaction with HCl. Recovered as angular shards. (continued)</td>
</tr>
<tr>
<td>95</td>
<td></td>
<td>End of Boring - 93 feet</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout. Unique ID # 769485.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
### Description

**Silt (ML):** light yellowish brown (10YR 4/4), moist, soft, non-plastic, (0/0/100). [Loess]

**Silty Sand (SM):** light yellowish brown (10YR 4/4) well-graded sand with fines, (5/85/10), moist, subangular to angular, fine to coarse-grained. [Fill]

**Organic Soil (OL):** very dark grayish brown (10YR 3/2), frozen, soft, low plasticity, granular, (0/0/100). [Topsoil]

**Silt (ML):** dark yellowish brown (10YR 4/4), moist, soft, non-plastic, (0/0/100). [Loess]

**Poorly Graded Sand (SP):** yellowish brown (10YR 5/4), moist, medium-grained, (5/95/0), subrounded to subrounded, fine to coarse-grained granite and basalt gravel and cobbles. [Outwash]

### Notes

- **DTW=88' bgs on 1/13/09.** Pressure grouted with high solids bentonite grout.
- **BGS = "below ground surface"**
- Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring A6-Pilot**

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Poorly Graded Sand (SP): yellowish brown (10YR 5/4), moist, medium-grained, (5/95/0), subrounded with subangular to subrounded, fine to coarse-grained granite and basalt gravel and cobbles. <a href="continued">Outwash</a></td>
</tr>
<tr>
<td>40</td>
<td>Fine to medium-grained from 36 to 40'.</td>
</tr>
<tr>
<td>55</td>
<td>60% well-rounded cobbles and gravel from 52 to 53'.</td>
</tr>
<tr>
<td>60</td>
<td>Lean Clay (CL): very dark gray (10YR 3/1), moist, stiff, low plasticity with granite and carbonate, fine-grained gravel, (2/2/96), sub to well-rounded. [Diamicton]</td>
</tr>
</tbody>
</table>

**Remarks:**
- DTW=88' bgs on 1/13/09. Pressure grouted with high solids bentonite grout.
- Client: University of Minnesota
- Drill Contractor: Traut
- Drill Method: Rotasonic (4"x6")
- Number: 23/19-0B05
- Location: 195437.33'N, 565908.13'E
- Drilling Started: 1/12/09
- Ended: 1/13/09
- Elevation: 934.0
- Total Depth: 162.0
- Logged By: EJC
- Screened Interval: NA

**BGS = "below ground surface"**

Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring A6-Pilot**

**Client:** University of Minnesota  
**Project Name:** UMA Groundwater Assessment  
**Number:** 23/19-0B05  
**Location:** 195437.33'N, 565908.13'E  

**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")  
**Drilling Started:** 1/12/09  
**Ended:** 1/13/09  
**Elevation:** 934.0  
**Total Depth:** 162.0  
**Logged By:** EJC  
**Screened Interval:** NA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEET</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lean Clay (CL): very dark gray (10YR 3/1), moist, stiff, low plasticity with granite and carbonate, fine-grained gravel, (2/2/96), sub to well-rounded. [Diamicton] (continued)</td>
</tr>
<tr>
<td></td>
<td>Well Graded Sand with Silt (SW-SM): yellowish brown (10YR 5/8), moist, subangular to subrounded with granite gravel, (5/85/10).</td>
</tr>
</tbody>
</table>

**Remarks:**  
DTW=88' bgs on 1/13/09. Pressure grouted with high solids bentonite grout.  
BGS = “below ground surface”  
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>Six inch lens of very fine-grained silty sand at 96' bgs.</td>
</tr>
<tr>
<td>99</td>
<td>Thin clay lens at 99' bgs.</td>
</tr>
<tr>
<td>100</td>
<td>Well Graded Sand (SW): wet, (5/90/5).</td>
</tr>
</tbody>
</table>

Well Graded Sand with Silt (SW-SM): yellowish brown (10YR 5/6), moist, subangular to subrounded with granite gravel, (5/85/10). (continued)

Remarks:
DTW=88' bgs on 1/13/09. Pressure grouted with high solids bentonite grout.

Additional data may have been collected in the field which is not included on this log.

BGS = "below ground surface"
### LOG OF Boring A6-Pilot

**Client**  
University of Minnesota

**Project Name**  
UMA Groundwater Assessment

**Number**  
23/19-0B05

**Location**  
195437.33'N, 565908.13'E

**Drill Contractor**  
Traut

**Drill Method**  
Rotasonic (4"x6")

**Drilling Started**  
1/12/09  
**Ended**  
1/13/09

**Elevation**  
934.0

**Total Depth**  
162.0

**Logged By**  
EJC

**Screened Interval**  
NA

<table>
<thead>
<tr>
<th>ELEV. FEET</th>
<th>DEPTH FEET</th>
<th>SAMPL. NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>810</td>
<td>125</td>
<td>125</td>
<td>Silty Sand (SM): fine to very fine-grained, (0/80/20).</td>
</tr>
<tr>
<td>805</td>
<td>130</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>135</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>795</td>
<td>140</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>790</td>
<td>145</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td>785</td>
<td>150</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**  
DTW=88' bgs on 1/13/09. Pressure grouted with high solids bentonite grout.

**BGS** = "below ground surface"

*Additional data may have been collected in the field which is not included on this log.*
<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>Well Graded Sand with Silt (SW-SM): yellowish brown (10YR 5/6), moist, subangular to subrounded with granite gravel, (5/85/10).</td>
</tr>
<tr>
<td>160</td>
<td>Lean Clay (CL): yellowish brown (10YR 5/4) with fine-grained carbonate gravel, (5/90/5), very hard, moist, low plasticity. [Diamict]</td>
</tr>
<tr>
<td>165</td>
<td>Poorly Graded Gravel with Sand (GP): yellowish brown (10YR 5/4), generally granitic, (60/35/5).</td>
</tr>
<tr>
<td>170</td>
<td>Limestone: light grayish brown, recovered as angular gravel, cobble and clayey matrix. [Prairie du Chien]</td>
</tr>
<tr>
<td>175</td>
<td>End of Boring - 162 feet</td>
</tr>
</tbody>
</table>

Remarks:
DTW=88’ bgs on 1/13/09. Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>0</td>
<td>Organic Soil (OL): very dark grayish brown (10YR 3/2) with trace sand, coarse-grained, frozen, medium plasticity, soft to medium consistency, granular texture. [Topsoil]</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0</td>
<td>Lean Clay (CL): yellowish brown (10YR 3/4), dry, low plasticity, blocky and massive, very stiff, trace gray mottling and red oxidation clasts, small roots.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0</td>
<td>Sandy Silt (ML): yellowish brown (10YR 3/4), dry, no plasticity, very soft, noncohesive, granular. [Loess]</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0</td>
<td>Well Graded Sand (SW): light yellowish brown (10YR 6/4), dry, angular, medium to coarse-grained with trace gravel, (10/85/5). [Outwash]</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>0</td>
<td>Poorly Graded Sand (SP): yellowish brown (10YR 5/4), rounded, dry, fine to medium-grained. [Outwash]</td>
</tr>
</tbody>
</table>

Remarks:
Pressure grouted with high solids bentonite grout. DTW=45’ bgs on 1/17/09 (casing set in clay).
BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Description</th>
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<tr>
<td>40-50'</td>
<td>Medium to coarse-grained.</td>
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<tr>
<td>48-50'</td>
<td>Abundant well-rounded coarse gravel.</td>
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<td>Lean Clay (CL): dark gray (5Y 4/1) with trace sub to well-rounded gravel and cobbles (limestone and chert), (5/0/95), stiff, massive, moderate to strong reaction with HCl, moist, (5/0/95). [Diamicton]</td>
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</tbody>
</table>

Remarks:
Pressure grouted with high solids bentonite grout. DTW=45' bgs on 1/17/09 (casing set in clay).

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**Client**  University of Minnesota  
**Project Name**  UMA Groundwater Assessment  
**Number**  23/19-0B05  
**Location**  193288.82'N, 556259.30'E  
**Elevation**  951.3  
**Total Depth**  140.0  
**Logged By**  EJC  

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Headspace (ppm)</th>
<th>Description</th>
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<tbody>
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<td>7</td>
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<td>Lean Clay (CL): dark gray (5Y 4/1) with trace sub to well-rounded gravel and cobbles (limestone and chert), (5/0/95), stiff, massive, moderate to strong reaction with HCl, moist, (5/0/95). [Diamicton] (continued)</td>
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<td></td>
<td></td>
<td>Weak to moderate reaction with HCl.</td>
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</tbody>
</table>

**Remarks:**  
- Pressure grouted with high solids bentonite grout. DTW=45' bgs on 1/17/09 (casing set in clay).  
- BGS = "below ground surface"  
- Additional data may have been collected in the field which is not included on this log.
Lean Clay (CL): dark gray (5Y 4/1) with trace sub to well-rounded gravel and cobbles (limestone and chert), (5/0/95), stiff, massive, moderate to strong reaction with HCl, moist, (5/0/95). [Diamicton] (continued)

No reaction with HCl.

Silty Sand (SM): yellowish brown (10YR 5/6), medium to coarse-grained, (0/80/20), subangular, wet.

(continued)

Remarks:
Pressure grouted with high solids bentonite grout. DTW=45' bgs on 1/17/09
(casing set in clay).

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
## LOG OF Boring B2-Pilot

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<td>10</td>
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<td></td>
<td>Silty Sand (SM): yellowish brown (10YR 5/6), medium to coarse-grained, (0/80/20), subangular, wet. (continued)</td>
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<td>11</td>
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<td>Poorly Graded Sand (SP): yellowish brown (10YR 5/6), wet, medium-grained, (0/95/5), few iron stains.</td>
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<td>130</td>
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<td>Sandy Silt (ML): yellowish brown (10YR 5/6), thinly bedded, alternating gray, orange, yellow and white, (0/95/5).</td>
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<tr>
<td>140</td>
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<td>140': Very hard, yellowish brown (10YR 5/6) sandstone. [St. Peter]</td>
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<td>End of Boring - 140 feet</td>
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</table>

Remarks:
Pressure grouted with high solids bentonite grout. DTW=45' bgs on 1/17/09 (casing set in clay).

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
### Organic Soil (OL): very dark grayish brown (10YR 3/2), soft, low plasticity, massive, granular, frozen, (0/0/100). [Topsoil]

### Lean Clay with Silt (CL): yellowish brown (10YR 5/6), medium consistency, low plasticity, blocky, dry, (0/0/100). [Loess]

### Well Graded Sand with Silt (SW-SM): dark yellowish brown (10YR 4/6), fine to coarse-grained, (0/90/10), angular, dry. [Outwash]

### Poorly Graded Sand (SP): light yellowish brown (10YR 6/4), fine to coarse-grained, subrounded, moist.

### Clayey Sand (SC): yellowish brown (10YR 5/6), very fine-grained, (0/80/20), very soft, massive, moist. [Outwash]

### Lean Clay (CL): yellowish brown (10YR 5/6), fine-grained, (2/0/98), trace gravel, low plasticity, soft, laminated with black mottling. [Diamicton]

### Silty Sand (SM): yellowish brown (10YR 5/6), fine-grained, (0/80/20), massive, moist. [Outwash]

### Lean Clay (CL): dark yellowish brown (10YR 4/6) with trace sand, (0/5/95), massive, medium consistency, weak reaction to HCl, some iron staining, moist. [Diamicton]

### Silty Sand (SM): dark yellowish brown (10YR 4/6), fine-grained, (0/80/20), moist.

### Lean Clay (CL): dark yellowish brown (10YR 4/6) to dark gray (5Y 4/1) with coarse-grained sand, (0/5/95), low plasticity, massive, very stiff, moist, weak reaction with HCl. [Diamicton]
Grayish brown (2.5Y 5/2) with medium to coarse-grained sand, (0/10/90), abundant iron staining, massive, medium consistency, moist, weak reaction with HCl. [Diamicton]

Olive gray (5Y 4/2) lean clay with very fine-grained sand, (0/25/75), trace iron staining, strong reaction with HCl, massive, very stiff, moist. [Diamicton]

**Remarks:**
Pressure grouted with high solids bentonite grout.

**BGS =** "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring C2-Pilot**

**Client**: University of Minnesota  
**Project Name**: UMA Groundwater Assessment  
**Number**: 23/19-0B05  
**Location**: 190174.05'N, 556863.16'E  
**Drill Contractor**: Traut  
**Drill Method**: Rotasonic (4"x6")  
**Drilling Started**: 12/18/08  
**Ended**: 12/19/08  
**Logged By**: EJC  
**Elevation**: 950.4  
**Total Depth**: 165.0  
**Screened Interval**: NA

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<th>DEPTH FEET</th>
<th>HEADSPACE ppm</th>
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<td>Dark gray (5Y 4/1) with fine-grained gravel and medium to coarse-grained sand, (5/5/90), hard, broken along horizontal planes, very strong reaction with HCl, moist. [Diamicton]</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout.

**BGS = "below ground surface"**  
Additional data may have been collected in the field which is not included on this log.
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Remarks:
Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring C2-Pilot**  
**SHEET 5 OF 6**

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>samp. length &amp; recovery</th>
<th>samp. number</th>
<th>Headspace ppm</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>Lean Clay (CL): very dark grayish brown (10YR 3/2) with fine gravel and coarse sand, (10/5/85), hard, weak lamination, weak reaction with HCl. [Diamicton] (continued)</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td>Well Graded Sand (SW): dark yellowish brown (10YR 4/6), medium to coarse-grained, (0/95/5), sub to well-rounded, wet. [Outwash]</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
- Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring C2-Pilot**

**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>SAMP. Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>Well Graded Sand (SW): dark yellowish brown (10YR 4/6), medium to coarse-grained, (0/95/5), sub to well-rounded, wet. [Outwash] (continued)</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td>Limestone: light olive gray (10YR 6/2), angular limestone gravel and cobbles in a soft clayey matrix with low plasticity. Reacts strongly with HCl. [Prairie du Chien - weathered]</td>
</tr>
<tr>
<td>165</td>
<td>NA</td>
<td></td>
<td>End of Boring - 165 feet</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout.

**Elevation:** 950.4  
**Total Depth:** 165.0  
**Logged By:** EJC  
**Screened Interval:** NA

**Client Location:** 190174.05'N, 556863.16'E

**Drilling Started:** 12/18/08  
**Ended:** 12/19/08  
**Elevation:** 950.4  
**Total Depth:** 165.0  
**Logged By:** EJC  
**Screened Interval:** NA

**Drill Contractor:** Traut

**Client:** University of Minnesota

**Location:** 190174.05'N, 556863.16'E

**Remarks:** Pressure grouted with high solids bentonite grout.

**Additional data may have been collected in the field which is not included on this log.**
## Description of Soils

**Organic Soil (OL):** Very dark grayish brown (10YR 3/2), very soft, massive, frozen, (0/0/100). [Topsoil]

**Silt (ML):** Yellow (10YR 7/6), massive, blocky, medium consistency, dry, (0/0/100). [Loess]

**Silty Sand (SM):** Yellow (10YR 7/6), well-graded, (2/80/18), sub to well-rounded, dry.

---

### Notes

- Remarks: Pressure grouted with high solids bentonite grout.
- BGS = "below ground surface"
- Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>SAMP. Length &amp; Recovery</th>
<th>Headspace (ppm)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Silty Sand (SM): yellow (10YR 7/6), well-graded, (2/80/18), sub to well-rounded, dry. (continued)</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): yellowish brown, (10YR 5/4), moist, fine to medium-grained, (0/100/0).</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>Well-graded sand, medium to coarse-grained, (30/70/0), well-rounded gravel, basalt and granite.</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>Lean Clay (CL): dark gray (5Y 4/1) with trace angular, coarse-grained sand, (0/2/98), massive, medium consistency, black mottling in sub-horizontal orientation, weak reaction to HCl, moist. [Diamicton]</td>
</tr>
</tbody>
</table>

Remarks: Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring E1-Pilot**

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Headspace (ppm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td>Lean Clay (CL): dark gray (5Y 4/1) with trace angular, coarse-grained sand, (0/2/98), massive, medium consistency, black mottling in sub-horizontal orientation, weak reaction to HCl, moist. <a href="continued">Diamicton</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>71-73': Lenses of fine-grained sand, less than one inch thick.</td>
</tr>
</tbody>
</table>

**Client:** University of Minnesota  
**Drill Contractor:** Traut  
**Drill Method:** Rotasonic (4"x6")

- **Number:** 23/19-OB05  
- **Drilling Started:** 12/19/08  
- **Ended:** 12/20/08  
- **Elevation:** 950.4  
- **Total Depth:** 162.0  
- **Logged By:** EJC  
- **Screened Interval:** NA

**Remarks:**  
Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Description</th>
<th>Elevated (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>860</td>
<td></td>
<td></td>
</tr>
<tr>
<td>855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>850</td>
<td></td>
<td></td>
</tr>
<tr>
<td>845</td>
<td></td>
<td></td>
</tr>
<tr>
<td>840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>835</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105-115</td>
<td>Lenses silty sand (SM) spaced six inches apart, less than one inch thick.</td>
<td></td>
</tr>
</tbody>
</table>

Remarks: Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"

Additional data may have been collected in the field which is not included on this log.
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Sample Length &amp; Recovery</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-140'</td>
<td></td>
<td></td>
<td>Lenses of medium-grained sand spaced two to three inches apart throughout. Sand content increasing: 15% fine to medium-grained and 2% coarse-grained.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Poorly Graded Sand (SP): light gray (5Y 7/2), fine-grained, (0/100/0), trace oxidation stains throughout. Stained dark yellowish to reddish brown over lower four inches, wet. [Reworked St. Peter Sandstone]</td>
</tr>
<tr>
<td>140</td>
<td></td>
<td></td>
<td>Silty Sand (SM): dark gray (5Y 4/1), fine-grained, (0/40/60), laminated, soft, wet. [Lacustrine]</td>
</tr>
</tbody>
</table>

Remarks:
Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.
**LOG OF Boring E1-Pilot**  

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Samp. Length &amp; Recovery</th>
<th>Headspace ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Silty Sand (SM): dark gray (5Y 4/1), fine-grained, (0/40/60), laminated, soft, wet. [Lacustrine] (continued)</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>Well Graded Sand (SW): yellowish brown (10YR 5/6) with gravel, medium to coarse-grained, (20/75/5), sub to well-rounded, some oxidation staining, wet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limestone: weathered, composed of angular cobbles and gravel, possibly brecciated, weak reaction to HCl. Reddish staining on exposed faces, fresh faces are light gray. [Prairie du Chien]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End of Boring - 162 feet</td>
</tr>
</tbody>
</table>

**Remarks:**  
Pressure grouted with high solids bentonite grout.

BGS = "below ground surface"  
Additional data may have been collected in the field which is not included on this log.
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
(Republic of Minnesota, Chapter 103)

769482

WELL OR BORING LOCATION

County Name:

Dakota

WELL / BORING DEPTH (completed) n.:

145

WELL / BORING DEPTH (completed):

1-27-09

DRILLING METHOD:

[ ] Cable Tool
[ ] Auger
[ ] Rotary
[ ] Dug
[ ] Jetted

DRILLING FLUID:

Bentonite

WELL HYDROFRACTURED? [ ] Yes [X] No

USE:

[ ] Domestic
[ ] Monitoring
[ ] Heating / Cooling
[ ] Noncommunity PWS
[ ] Environ. Impact
[ ] Irrigation
[ ] Community PWS
[ ] Commercial
[ ] Desalination
[ ] Elevator
[ ] Dewatering
[ ] Elevator
[ ] Dewatering
[ ] Test well

CASING MATERIAL:

[X] Steel
[ ] Plastic

Dowel Shoe? [ ] Yes [X] No

CASING DIAM.

HOLE DIAM.

SCREEN:

Johnson

NUMBER:

OPEN HOLE

Type:

Stainless Steel

Diam.: 6" PS

Skt / Gage: 30

Length: 20' Fittings:

125' ft. and 145' ft.

STATIC WATER LEVEL:

Date measured: 1-27-09

PUMPING LEVEL (below land surface):

Flow:

Date measured: 1-27-09

PUMPING LEVEL (below land surface):

Flow:

Date measured: 1-27-09

PUMP:

[ ] Installed
[ ] Not Installed

Manufacturer:

Model:

Capacity:

G.P.M.

Length of drop pipe:

ft.

Type:

[ ] Submersible
[ ] Jet

Does property have any in use and not sealed well(s)? [ ] Yes [X] No

VARIANCE:

Was a variance granted from the MDH for this well? [ ] Yes [X] No

WELL CONTRACTOR CERTIFICATION:

This well was drilled under supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc.

1404

Licensee Business Name:

Lic. or Reg. No.:

589

Certified Representative Signature:

Certified Reg. No.:

Date:

Perry Storkamp

1-27-09

Name of Driller:

Remarks, Elevation, Source of Data, etc.: Drilled near MN 02-004

MINN. DEPT. OF HEALTH COPY

769482

IC 140-0029

UMP005236

HE-0120-11 (Rev. 2007)
**WELL OR BORING LOCATION**

**County Name:** Dakota

** Township Name:** Empire

** Township No.:** 114N

** Range No.:** 19W

** Section No.:** 4

** Fraction:** NW NW SE

** GPS LOCATION:**

- **Latitude:** 44° 42' 09"
- **Longitude:** 093° 06' 23"

** House Number, Street Name, City, and Zip Code of Well Location:** SW of Station Trail & 160th St. W

** DISCLAIMER:** Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

**PROPERTY OWNER’S NAME/COMPANY NAME:**

** University of MN**

** Address:**

- Boyton Health Center
- Room W-140
- 410 Church St.
- Minneapolis, MN 55455

** WELL OWNER’S NAME/COMPANY NAME:**

** Name:** Same

** ADDRESS:**

- Permitted as industrial well, but monitor well installed.

---

**MINNESOTA DEPARTMENT OF HEALTH**

**WELL AND BORING RECORD**

**Minnesota Statutes, Chapter 163**

**WELL BORING DEPTH (completed):** 126 ft.

**DATE WORK COMPLETED:** 1-27-09

**DRILLING METHOD:**

- □ Cable Tool
- □ Driven
- □ Rotary
- □ Auger
- □ Sonic
- □ Dug
- □ Jetted

**DRILLING FLUID:**

- H2O

**USE:**

- □ Domestic
- □ Monitoring
- □ Heating/Cooling
- □ Noncommunity PWS
- □ Environment Bore Hole
- □ Industry/Commercial
- □ Community PWS
- □ Irrigation
- □ Remedial
- □ Elevator
- □ Dewatering

**CASING MATERIAL:**

- □ Steel
- □ Plastic

**Casing Diameter:** 2 in. to 116 ft.

**Weight:** 3.65 lbs./ft.

**Specifications:** 7 in. to 126 ft.

**SCREEN MATERIAL:**

- Johnson

** Screen OPEN HOLES:**

- Diameter: 2"
- Length: 10'

**Set below:**

- 116 ft. and 126 ft.

**FITTINGS:**

- T&C

**STATIC WATER LEVEL:**

- 60 ft.

**PUMPING LEVEL (below land surface):**

- Measured from:
  - ft. after pumping
  - g.p.m.

**WELLHEAD COMPLETION:**

- Pressure/separator manufacturer: 
- Casing Protection: 
- 12 in. above grade

**GROUTING INFORMATION:**

- Well grouted: Yes
- Grout materials:
  - Heat cement
  - Bentonite
  - Concrete
  - Other

**ABANDONED WELLS:**

- Does property have any not in use and not sealed well(s)?
  - Yes
  - No

**WELL CONTRACTOR CERTIFICATION:**

- This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725.
- The information contained in this report is true to the best of my knowledge.

**Mark J. Traut Wells, Inc.**

**1404**

**Certified Representative Signature:**

- Mike Anderson

**Certified Rep. No.:** 589

**Date:**

**MINN. DEPT. OF HEALTH COPY**

**769483**
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 163

MINNESOTA UNIQUE WELL AND BORING NO.
769484

WELL OR BORING LOCATION

County Name: Dakota

 Township No. 115N Range No. 19W
 Section No. 36 Fraction SE NE, SW

GPS LOCATION:
N Latitude 44 degrees 43 minutes 341 seconds
W Longitude 093 degrees 03 minutes 291 seconds

House Number, Street Name, City, and Zip Code of Well Location
SW of 156th St. E. & Blaine Ave.

Show exact location of well/boring in section grid with "X."

Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

DRILLING METHOD
No Cable Tool
No Auger
X Sonic

DRILLING FLUID
H2O

USE
No Domestic
Yes Monitoring
No Heating/Cooling
No Noncommunity PWS
Environ. Bore Hole
No Industry/Commercial
No Community PWS
Irrigation
Rehabil
No Elevator
Dewatering

CASING MATERIAL
X Steel

CASING DIAMETER

Weight

3.65 lbs./ft.

2 in. to 80 ft.

in. to 80 ft.

in. to 80 ft.

in. to 80 ft.

2 in.

in.

in.

in.

in.

OPEN HOLE

SCREEN

Johnson

Make

Stainless Steel Diam. 2"

Type

10 Slot Gauge Length

Set between

80 ft. and 90 ft.

FITTINGS

40 ft.

Measured from

5 ft. Below

Below land surface

Date measured 1-22-09

PUMPING LEVEL (below land surface)

ft. after

his. pumping

g.p.m.

WELLHEAD COMPLETION

X Pressure/adapter manufacturer

Model

X Casing Protection

Protrox

At-grade (Environmental Well and Boring ONLY)

GROUTING INFORMATION

Well grouted

X Yes

No

GROUT MATERIALS

X Neat cement

Bentonite

Concrete

Other

From

To

74 ft.

6

Yds.

X

Bags

From

To

ft.

Yds.

Bags

From

To

ft.

Yds.

Bags

NEAREST KNOWN SOURCE OF CONTAMINATION

feet

direction

type

Well disinfected upon completion? Yes No

PUMP

X Not installed Date installed

Manufacturer's name:

Model Number

HP

Volts

Length of drop pipe

ft.

Capacity

g.p.m.

Type

Submersible

LS Turbine

Reciprocating

Jet

ABANDONED WELLS

Does property have any in use and not sealed well(s)? Yes No

VARIANCE

Was a variance granted from the MDH for this well? Yes No

WELL CONTRACTING CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc. 1404

License Business Name Lic. or Reg. No.

589

Certified Representative Signature Certified Rep. No. Date

Mike Anderson

Name of Dealer
WELL OR BORING LOCATION

County Name: Dakota

 Township No. 115N  19W

 Range No. 34

 Section No. NW  SE

 G.P.S. LOCATION: Latitude 44  degrees 43. minutes 242 seconds

 Longitude 093  degrees 04. minutes 714 seconds

 House Number, Street Name, City, and Zip Code of Well Location: Angus Ave & 160th St. Rosemount

Show exact location of well/boring in section grid with "X." Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO

WELL/BORING DEPTH (completed)  92 ft.  1-29-09

DRILLING METHOD

Drilling Fluid

H2O

USE

MONITORING

WELL HYDROFRACURED?

No

DRILLING WATER:

Use at grade (Environmental Well and Boring ONLY)

No

CASING MATERIAL

Steel

NOT Installed

Screen

Johnson

OPEN HOLE

Make

Stainless Steel

Type

Diam

2"

Set between

82

ft. and 92 ft.

Fittings

T&C

STATIC WATER LEVEL

Measured from

ft. above

ft. below

ft. at

PUMPING LEVEL (below land surface)

ft. after

hrs. pumping

WELL HEAD COMPLETION

No Pitless/adapter manufacturer:

Model:

X Protop 8"

Grouting Information

Well grouted

Yes

No

Neat cement

X Bentonite

Concrete

Other

From

To

Yds.

Bags

NEAREST KNOWN SOURCE OF CONTAMINATION

Feet
direction

type

Well disinfected upon completion?

Yes

No

PUMP

X Not installed

Date installed

Manufacturer's name

Model Number

HP

Volts

Length of drop pipe

ft.

Capacity

g.p.m.

Type

Submersible

L.S. Turbine

Reciprocating

Jet

ABANDONED WELLS

Does property have any not in use and not sealed well(s)?

Yes

No

WARRANTY

Was a variance granted from the MDH for this well?

Yes

No

TND

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc.  1404

License Business Name

Lic. or Reg. No.

589

Certified Representative Signature

Certified Reg. No.

Date

Mike Anderson

Name of Driller

MINN. DEPT. OF HEALTH COPY

769485

IC 140-0120

HE-01205-T1 (Rev. 3/07)
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD

MINNESOTA UNIQUE WELL AND BORING NO. 769487

WELL OR BORING LOCATION

County Name
Dakota

Township Name
Empire

Range No. 114N 19W

Section No. 3

Fraction SE SE SW 

GPS LOCATION

Latitude 44 degrees 42. minutes 180 seconds

Longitude 093 degrees 05. minutes 075 seconds

House Number, Street Name, City, and Zip Code of Well Location
NW Corner of Akron & 170th St. W Rosemount

Show exact location of well/boring in section grid with "X." Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

PROPERTY OWNER'S NAME/COMPANY NAME

University of MN

Boyton Health Center
Room w-140
410 Church St.
Minneapolis, MN 55455

WELL OWNER'S NAME/COMPANY NAME

Same

Screen

Make
Johnson

Type
Stainless Steel

Slot/Gauge
10

Set between 62 ft and 72 ft

FITTINGS

HOLE DIAM. open hole

20'

2 in.

Specs. 0.75 in. and 72 in.

2 in.

7 in. to 72 in.

SCREEN

Type
Stainless Steel

Slot/Gauge
10

Set between 62 ft and 72 ft

FITTINGS

HOLE DIAM. open hole

20'

2 in.

Specs. 0.75 in. and 72 in.

2 in.

7 in. to 72 in.

WELL OPERATIONS

Drilling Method

Cable Tool

Drilling Fluid

H2O

Drilling SPEED

Sonic

Well Hydrofracture

No

GROUTING INFORMATION

Well grouted

Y

Yes

No

Neat cement

Yes

No

X

Concrete

6 Yds

X

Bags

6 Yds

X

Bags

Sand & Gravel

Brown

M 4 73

USING A SECOND SHEET, IF NEEDED

USE A SECOND SHEET, IF NEEDED

MINN. DEPT. OF HEALTH COPY 769487

IC 140-0020

HE-9129-1T (Rev. 3/07)
WELL OR BORING LOCATION

County Name: Dakota

GPS LOCATION:
North Latitude 44° 42' 113"
South Latitude 093° 06' 224"

House Number, Street Name, City, and Zip Code of Well Location:
Station Trail & 160th Rosemount

Show exact location of well/boring in section grid with "X."
Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.
769488

WELL/BORING DEPTH (completed) 67.7
DATE WORK COMPLETED 12-21-08

DRILLING METHOD
X Sonic

DRILLING FLUID
H20

USE
X Monitoring

Casing Material
X Basal

Casing Diameter
2 in. to 7 ft.

SCREEN
Johnson Stainless Steel

Set between 57.7 ft. and 67.7 ft.

Static water level
57 ft. below ground level

Fittings
8" protop

WELLHEAD COMPLETION
X Not installed

GROUTING INFORMATION
Well grouted

Manufacturer's name

Model Number

Length of drop pipe

Type

ABANDONED WELL

Was property any in use and not sealed well(s)?

X Yes

VARIANCE

Was a variance granted from the MDH for this well?

X Yes

WELL CONTRACTOR CERTIFICATION
This well was drilled under my supervision in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut, Wells, Inc. 1404
Licensor Business Name Lic. or Reg. No. 589

Certified Representative Signature Certified Rep. No. Date
Mike Anderson

PROPERTY OWNER'S NAME/COMPANY NAME
University of MN

Well owner's mailing address if different than property owner's address indicated above.

Boytown Health Center
Room W-140
410 Church St.
Minneapolis, MN 55455

WELL OWNER'S NAME/COMPANY NAME
Same

GEOLOGICAL MATERIALS
COLOR
HARDNESS OF
MATERIAL
FROM TO

Top Soil Black M 0 1
Silty Sand Brown M 1 5
Sand & Gravel Brown M 5 40
Sand Brown M 40 70

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

MW - E2-009

MINN. DEPT. OF HEALTH COPY 769488
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103E

MINNESOTA UNIQUE WELL AND BORING NO. 769489

WELL OR BORING LOCATION

County Name: Dakota

Township Name: Rosemount

Range No.: 19W

Section No.: 33

Fraction: SE, SE

GPS LOCATION:
Latitudes: _____ degrees _____ minutes _____ seconds
Longitudes: _____ degrees _____ minutes _____ seconds

House Number, Street Name, City, and Zip Code of Well Location or Fire Number:

160th St. & Station Trail Rosemount

Show exact location of well/boring in section grid with "X." Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

PROPERTY OWNER'S NAME/COMPANY NAME:

University of MN

Boyton Health Center
Room W-140
410 Church St.
Minneapolis, Mn 55455

WELL OWNER'S NAME/COMPANY NAME:

Boring owner's mailing address if different than property owner's address indicated above.

WELL BORING DEPTH (completed): 147 ft.

DATE WORK COMPLETED: 1-22-09

DRILLING METHOD:
- Cable Tool
- Driven
- Auger
- Rotary
- Dug
- Jetted

DRILLING FLUID:
- Bentonite

WELL HYDROFRAC?: No

USE:
- Domestic
- Heating/Cooling
- Noncommunity Water System
- Irrigation
- Elevator
- Non-Residential Commercial
- Dewatering
- Residential Commercial

CASING MATERIAL:
- Steel
- Plastic
- Threaded
- Welded

CASING Depth:

Steel:

Weight:

Screws:

Open Hole:

Make: Johnson

Type: Stainless Steel

Size:

Slit/Inch:

Slot:

Set between:

137 ft and 147 ft.

FITTINGS:

STATIC WATER LEVEL:

67 ft. below land surface.

PUMPING LEVEL (below land surface):

Date measured: 1-22-09

PUMPING LEVEL (above land surface):

Date measured: 1-22-09

WELLHEAD COMPLETION:

- Pressure/adapter manufacturer
- Model
- Casing Protection: X 12 in. above grade
- At-grades (Environmental Well and Boring ONLY)

GROUTING INFORMATION:

- Well grouted: X Yes
- Great materials: X Yes
- Cement:
- Bentonite:
- Concrete:
- Other:

From:

To:

134 ft.

Yds:

Bags:

NEAREST KNOWN SOURCE OF CONTAMINATION:

- Well disinfected upon completion: X Yes

PUMP:

- Not installed: Date installed

Manufacturer's name:

Model Number:

HP:

Watts:

Length of drop pipe:

ft.

Capacity:

gpm:

Type:

- Submersible
- L.S. Turbine
- Reciprocating
- Jet

ABANDONED WELLS:

- Does property have any not in use and not sealed well(s)?
- X Yes

VARIANCE:

- Was a variance granted from the MDH for this well?
- X Yes

WELL CONTRACTOR CERTIFICATION:

- This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725.
- The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc.
1404

Licensor Business Name:

M.B. Wells

589

Certified Representative Signature:

Certified Reg. No.:

Date:

Perry Storkamp

1-22-09

Name of Driller:

UMP005243

IC 1-40-0020

HE-91225-11 (Rev. 5-07)

MINN. DEPT. OF HEALTH COPY 769489

MM - ca - 20a

MM - 02 - 004
**WELL OR BORING LOCATION**
- **County Name**: Dakota
- **Well Name**: Empire
- **Location**: Akron Ave & 164th St, W Rosemount

**WELL AND BORING RECORD**
- **Minnesota Department of Health**
- **Section No.**: 3 NW NE, NW%
- **Fraction**: 70 ft
- **WELLBORING DEPTH (completed)**: 70 ft
- **DATE WORK COMPLETED**: 1-7-09

**DRILLING METHOD**
- Cable Tool
- Auger
- Sonic

**DRILLING FLUID**
- H20

**USE**
- Domestic
- Noncommunity PWS
- Community PWS
- Commercial
- Irrigation
- Drinking Water
- Other

**CASING MATERIAL**
- Steel
- Threaded
- Welded

**CASING DIAMETER**
- 2 in to 60 ft
- 3.65 lbs/ft.

**SCREEN**
- Johnson
- Stainless Steel
- Diam. 2"

**SCREW**
- Slot/Insert
- 10 ft
- Length 10'
- Get between 60 ft and 70 ft
- FITTINGS
- T&C

**STATIC WATER LEVEL**
- Measured from
- Below
- Above ground surface
- Date measured

**PUMPING LEVEL**
- Below land surface
- Date measured

**GEOLOGICAL MATERIALS**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>COLOR</th>
<th>HARDNESS OF MATERIAL</th>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil</td>
<td>Black</td>
<td>M</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Silty Sand</td>
<td>Brown</td>
<td>M</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Sand &amp; Gravel</td>
<td>Brown</td>
<td>M</td>
<td>3</td>
<td>70</td>
</tr>
</tbody>
</table>

**REMARKS, ELEVATION, SOURCE OF DATA**

Use a second sheet, if needed.

**MINN. DEPT. OF HEALTH COPY**

**MINNESOTA UNIQUE WELL AND BORING NO.**

**MARK J. TRAUT WELLS, INC.**
- **Location**: 1404
- **Licensed Business Name**: Mark J. Traut Wells, Inc.
- **License or Reg. No.**: 589
- **Certified Representative Signature**: Mike Anderson
- **Certified Rep. No.**: Date

**WELL CONTRACTION CERTIFICATION**

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

**MARK J. TRAUT WELLS, INC.**
- **Location**: 1404
- **Licensed Business Name**: Mark J. Traut Wells, Inc.
- **License or Reg. No.**: 589
- **Certified Representative Signature**: Mike Anderson
- **Certified Rep. No.**: Date
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO
769491

WELL OR BORING LOCATION

County Name: Dakota

GPS LOCATION:
Latitude ______ degrees ______ minutes ______ seconds ______
Longitude ______ degrees ______ minutes ______ seconds ______

House Number, Street Name, City, and Zip Code of Well Location
152nd St E & Blaine Ct

Sketch map of well/boring location, showing property lines, roads, buildings, and direction.

SHOW EXACT LOCATION OF WELL/BORING IN SECTION GRID WITH "X."

PROPERTY OWNER'S NAME/COMPANY NAME
University of MN Boynton Health Center
410 Church St.
Minneapolis, MN 55455

WELL OWNER'S NAME/COMPANY NAME
Same

GEOLOGICAL MATERIALS

<table>
<thead>
<tr>
<th>Material</th>
<th>Color</th>
<th>Hardness</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>Brown</td>
<td>M</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Sand</td>
<td>Brown</td>
<td>S</td>
<td>5</td>
<td>49</td>
</tr>
<tr>
<td>Clay</td>
<td>Brown</td>
<td>M</td>
<td>49</td>
<td>52</td>
</tr>
<tr>
<td>Clay</td>
<td>Gray</td>
<td>H</td>
<td>52</td>
<td>92</td>
</tr>
<tr>
<td>Sand</td>
<td>Brown</td>
<td>S</td>
<td>92</td>
<td>112</td>
</tr>
</tbody>
</table>

WELL OR BORING DEPTH (completed)

Drilling Method
- Cable Tool
- Auger
- Rotary

WELL HYDROFRACTURED?
- Yes X No

Drilling Fluid
Bentonite

USE
- Domestic
- Monitoring
- Noncommunity PWS
- Environment
- Community PWS
- Indirect
- Elevator
- Remedial

Casing Material
- Steel
- Plastic

Hole Diameter

2 in. to 102 ft. 3.65 lbs/ft.

SCREEN

Make: Johnson
Type: Stainless Steel
Slot/Sieve: 2
Set between: 102 ft. and 112 ft.

STATIC WATER LEVEL
87 ft. below

PUMPING LEVEL (below land surface)

SCREEN MATERIAL

OPEN HOLE

Well head Completion
- Piping/adapter manufacturer
- Model
- Casing Protection
- Al-grades (Environmental Wall and Boring ONLY)

GROUTING INFORMATION

Well Grouted X Yes No

GROUT MATERIALS
- Heat Curing
- Bentonite
- Concrete
- Other

ABANDONED WELLS

Does properly have any not in use and not sealed well(s)?
- Yes X No

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc. 1404
Lic. or Reg. No. 589
Name of Diller

Certified Representative Signature
Certified Rep. No. Date

IC 140-0020
HE-9106-11 (Rev. 3/07)
WELL OR BORING LOCATION

County Name: Dakota

Township Name: Rosemount

Range No.: 115

Section No.: 33

Fraction: SE SE SE

WELL AND BORING RECORD

MINNESOTA DEPARTMENT OF HEALTH

Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.

769493

WELLBORING DEPTH (completed):

75 ft.

DATE WORK COMPLETED:

1-28-09

DRILLING METHOD:

X Sonic

DRILLING FLUID:

H2O

WELL HYDROFRACURED?: Yes

USE:

X Monitoring

X Heating/Cooling

X Domestic

□ Noncommunity PWS

□ Community PWS

□ Elevator

□ Irrigation

□ Bore Hole

□ Industry/Commercial

□ Dewatering

□ Piezometric

□ Other

CASING MATERIAL:

Steel

HOLE DIAM.

7 in. to 75 ft.

DIAMETER:

2 in.

Weight:

65 lbs.

SPECIFICATIONS:

3.65 lbs/ft.

SCREEN:

Johnson

Type:

Stainless Steel

SLOT/SIZE:

10

SLOT/SAUCE:

10'

Set between:

65 ft. and 75 ft.

FITTINGS:

T&C

STATIC WATER LEVEL:

Measured from:

ft.:

n.s.

pumping:

g.p.m.

WELLHEAD COMPLETION:

□ PELLS/ADAPTER MANUFACTURER:

□ CASING PROTECTION:

Steel

□ GRADE (ENVIRONMENTAL WELL AND BORING ONLY):

X 24 above grade

□ OTHER:

□ GROUTING INFORMATION:

□ Well grouted:

□ Not grouted:

□ Grout materials:

□ Sand:

□ Grout mix:

□ Mortar:

□ Limestone:

□ Cement:

□ Concrete:

□ Other:

□ FROM:

0 ft.

□ TO:

62 ft.

□ Yards:

5

□ Bags:

□

□ NEAREST KNOWN SOURCE OF CONTAMINATION:

□ Well disinfected upon completion?: Yes

□ No

□ PUMP:

□ Not installed:

Date installed:

□ MANUFACTURER:

□ Model:

□ Number:

□ HP:

□ Volts:

□ Length of drop pipe:

□ Feet:

□ Capacity:

□ g.p.m.

□ Type:

□ Submersible:

□ L.S. Turbine:

□ Reciprocating:

□ Jet:

□ REASON:

□ ABANDONED WELLS:

□ Do property have any not in use and not sealed well(s)?

□ Yes:

□ No

□ VARIAIANCE:

□ Was a variance granted from the MDH for this well?: Yes

□ No

□ WELL CONTRACTOR CERTIFICATION:

Mark J. Traut Wells, Inc.

1404

Licensor Business Name:

Mark J. Traut

Lic. or Reg. No.:

589

Certified Representative Name:

Mike Anderson

Certified Rep. No.:

Date:

UMP005246
**WELL OR BORING LOCATION**

- **County Name**: Dakota
- **Ship Name**: Empire
- **GPS Location**: N Latitude 44 degrees 42. minutes, W Longitude 093 degrees 05. minutes
- **House Number, Street Name, City, and Zip Code of Well Location**: 170th & Station Trail, Minneapolis, MN 55455

**PROPERTY OWNER'S NAME/COMPANY NAME**

- **Name**: University of MN

**WELL OWNER'S NAME/COMPANY NAME**

- **Name**: Same

**MINNESOTA DEPARTMENT OF HEALTH**

**WELL AND BORING RECORD**

- **MINNESOTA UNIQUE WELL AND BORING NO.**: 769492
- **WELL/BORING DEPTH (completed)**: 75 ft
- **DATE WORK COMPLETED**: 1-30-09

**DRILLING METHOD**

- Sonic

**DRILLING FLUID**

- H2O

**USE**

- Monitoring
- Domestic
- Noncommunity PWS

**CASING MATERIAL**

- Stainless Steel
- Plastic

**SCREEN**

- Johnson Stainless Steel
- Open Hole

**GROUTING INFORMATION**

- Well grouted: Yes
- Grout materials: Neat cement
- From 0 to 62 ft
- From 62 to 75 ft

**NEAREST KNOWN SOURCE OF CONTAMINATION**

- Well disinfected upon completion?: Yes

**PUMP**

- Not installed

**ABANDONED WELLS**

- Does property have any not in use and not sealed wells?: Yes

**VARIANCE**

- Was a variance granted from the MDH for this well?: Yes

**WELL CONTRACTOR CERTIFICATION**

- This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

**Mark J. Traut Wells, Inc.**

<table>
<thead>
<tr>
<th>GEOLOGICAL MATERIALS</th>
<th>COLOR</th>
<th>HARDNESS OF MATERIAL</th>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil</td>
<td>Black</td>
<td>M</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Silty Sand</td>
<td>Brown</td>
<td>M</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Sand &amp; Gravel</td>
<td>Brown</td>
<td>M</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Silt &amp; Clay</td>
<td>Gray</td>
<td>M</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>Silt &amp; Clay</td>
<td>Brown</td>
<td>M</td>
<td>28</td>
<td>75</td>
</tr>
<tr>
<td>Sandstone</td>
<td>Tan</td>
<td>M</td>
<td>28</td>
<td>75</td>
</tr>
</tbody>
</table>

**Remarks, Elevation, Source of Data, etc.**

- mw - 62 - 305
Geological Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Color</th>
<th>Hardness</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil</td>
<td>Black</td>
<td>M</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Sand &amp; Rocks</td>
<td>Brown</td>
<td>M</td>
<td>5</td>
<td>77</td>
</tr>
<tr>
<td>Silty Sand</td>
<td>Brown</td>
<td>M</td>
<td>77</td>
<td>82</td>
</tr>
</tbody>
</table>

Screen Material: Stainless Steel
Diam. 2" M N

Static Water Level: 69 ft. below ground level

Wellhead Completion:
- Pikes/adapter manufacturer: Model:
- Casing Protection: Protex
- Al-grade (Environmental Wells and Drains only) Y N

Groundwater Information:
- Well grouted Y N
- Grout materials: Heat Cement Y N
- Bentonite Y N
- Concrete Y N
- Other N

Nearest Known Source of Contamination:
- Well disinfected upon completion? Y N
- Pump Y N
- Well abandoned? Y N
- Abandoned wells Y N
- Does property have any not in use and not sealed well(s)? Y N
- Variance Y N
- Was a variance granted from the MWD for this well? Y N

WELL CONTRACTOR CERTIFICATION
This well was drilled by me and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc. 1404

Licenses Business Name Lic. or Reg. No.
589

Certified Representative Signature Certified Rep. No. Date

Mike Anderson

Name of Driller
### WELL OR BORING LOCATION

**County Name:** Dakota  
**Township No.:** 115N  
**Range No.:** 19W  
**Section No.:** 33  
**Fraction:** NW NW  
**GPS LOCATION:**  
- **Latitude:** 44 degrees 43. minutes  
- **Longitude:** 093 degrees 06. minutes

### HOUSE NUMBER, STREET NAME, CITY, AND ZIP CODE OF WELL LOCATION
- **Biscayne & Co Rd 42, Rosemount**

### PROPERTY OWNER'S NAME/COMPANY NAME
- **University of MN**
- **Boytton Health Center**  
- **410 Church St.**  
- **Minneapolis, MN 55455**

### WELL OWNERS' NAME/COMPANY NAME
- **Same**

### GEOLOGICAL MATERIALS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>COLOR</th>
<th>HARDNESS OF MATERIAL</th>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Soil</td>
<td>Black</td>
<td>M</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Silty Sand &amp; Clay</td>
<td>Brown</td>
<td>M</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Sand &amp; Gravel</td>
<td>Brown</td>
<td>M</td>
<td>8</td>
<td>62</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>Brown</td>
<td>M</td>
<td>62</td>
<td>72</td>
</tr>
<tr>
<td>Silty Sand</td>
<td>Brown</td>
<td>M</td>
<td>72</td>
<td>75</td>
</tr>
</tbody>
</table>

### SCREEN
- **Make:** Johnson  
- **Type:** Stainless Steel  
- **Diam.:** 2"  
- **Slot/Size:** 10  
- **Set between:** 61 ft. and 71 ft.  
- **Fittings:**
- **Static Water Level:** Measured from 62 ft. below
- **Pumping Level:**
  - After: hrs., pumping: g.p.m.

### GROUTING INFORMATION

<table>
<thead>
<tr>
<th>Material</th>
<th>Yes</th>
<th>Grass</th>
<th>Bottom Cement</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>0 to 55 ft.</td>
<td>6</td>
<td>Bags</td>
</tr>
<tr>
<td>From</td>
<td>To</td>
<td>62 to 72 ft.</td>
<td>Bags</td>
<td>Bags</td>
</tr>
</tbody>
</table>

### NEAREST KNOWN SOURCE OF CONTAMINATION
- **Type:**
- **Well disinfected upon completion:** Yes/No
- **Pump:** Not installed

### ABANDONED WELLS
- **Does property have any not in use and not sealed well(s):** Yes/No

### WELL CONTRACTOR CERTIFICATION
- **Mark J. Traut Wells, Inc.**  
- **Lic. No.:** 589

### REMARKS, ELEVATION, SOURCE OF DATA, ETC.
- **MW-B1-001**
WELL OR BORING LOCATION

County Name: Dakota

GPS Data:
- Latitude: N 44 degrees, 42 minutes, 29 seconds
- Longitude: W 93 degrees, 725 seconds

Numerical Street Address or Fire Number and City of Well or Boring Location:
NE Corner of Bicayne & 170th St. W

Show exact location of well or boring in section grid with "X".

PROPERTY OWNER'S NAME/COMPANY NAME

University of MN

Well owner's mailing address different than well location address indicated above.

B o y t o n  H e a l t h  C e n t e r
410 Church St.
 Minneapolis, MN 55455

WELL OWNER'S NAME/COMPANY NAME

Same

Well owner's mailing address different than property owner's address indicated above.

GEOLOGICAL MATERIAL COLOR HARDNESS OR FORMATION FROM TO

Top Soil Black M 0 2
Fine Silty Sand Brown M 2 5
Sand & Gravel Brown M 5 58
Silty Clay Gray M 58 140
Reworked Sandstone Tan M 140 147
Silty Clay Gray M 147 152
Sand & Gravel Brown M 152 159
Limestone Brown H 159 162

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

H 277821

EMPIRE

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

MINNESOTA STATUTES, CHAPTER 103B

Date Sealed: 12-20-08
Date Well or Boring Constructed: 12-19820-08

WELL SIZE

Depth Before Sealing: 162 ft
Original Depth: 162 ft

AQUIFER(S)

- Single Aquifer
- Multiwell

WELLBORING

- Water-Supply Well
- Monit. Well

- Env. Bore Hole

CASING TYPE(S)

- Steel
- Plastic
- Tile
- Other

WELLHEAD COMPLETION

- Outside: Well House
- At Grade

- Inside: Basement Offset

- Well Pit

- Other

CASING(S)

Diameter

IN. FROM TO Depth

Set in oversize hole?

- Yes
- No

Annular space initially grouted?

- Yes
- No

SCREEN/OPEN HOLE

Screen from N/A to ft
Open Hole from N/A to ft

OBSTRUCTIONS

- Rods/Drop Pipe
- Check Valve(s)
- Debris
- Fill
- No Obstruction

Type of Obstructions (Describe)

PUMP

Type

- Removed
- Not Present
- Other

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE:

- No Annular Space Exists
- Annular Space Grouted with Tremie Pipe
- Casing Perforation/Removal

- From in. to in. ft

Type of Perforator

GROUTING MATERIAL(S)

- Bentonite

Grouting Material: Bentonite

From 0 to 162 ft

14 bags

OTHER WELLS AND BORINGS

Other unscaled and unused well or boring on property?
- Yes
- No
- How many?

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc.

Certified Representative Signature:

Mike Anderson

Name of Person Sealing Well or Boring
WELL OR BORING LOCATION

County Name: Dakota

Township Name: Section No. 33
Range No. 145

GPS LOCATION:

Latitude: 47° 12' 47.9"
Longitude: 95° 42' 37.6"

Municipal Street Address or Fire Number and City of Well or Boring Location:

Station No. 160

Sketch map of well or boring location, showing property lines, roads, and buildings.

PROPERTY OWNER'S NAME/COMPANY NAME

University of MN

WELL OWNER'S COMPANY NAME


GEOLOGICAL MATERIAL | COLOR | HARDNESS OR FORMATION | FROM TO
--- | --- | --- | ---
Topsoil | BK | 1 | 2
Sand & Gravel | Brn | 3 | 12
Silt Clay | Brn | 12 | 14
Fine Sand | Brn | 24 | 26
Silty Clay | Brn | 36 | 38
Fine Sand | Brn | 40 | 32
Silty Clay | Brgy | 50 | 53
Silty Clay/Clays | Brgy | 53 | 54
Granite | Brn | 160 | 166

GROUTING MATERIAL(S): (One bag of cement = 84 lbs., one bag of bentonite = 50 lbs.)

Grafting Material: Bentonite from 0 ft. to 165 ft. yards bags

OTHER WELLS AND BORINGS

C2 - Pilot Boring

Certified Representative Signature: Mike Anderson

MINN. DEPT. OF HEALTH COPY

HE-005251 UMA1105251
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD
Minnesota Statutes, Chapter 103I

M. Wall and Boring Sealing No. 277823

WELL OR BORING LOCATION
County Name: Dakota

TO Township No.: 103° 05' W
Range No.: 155 S
Section No.: 36
Fraction (sw, ne, se, nw): 44° 54' 43" NW

GEOGRAPHICAL LOCATION
Latitude: 44° 54' 43"
Longitude: 93° 28' 23"

Numerical Street Address or File Number and City of Well or Boring Location
2120 W. 47th St.

Show exact location of well or boring in section grid with "X."

PROPERTY OWNER'S NAME
University of Min.

PROPERTY OWNER'S ADDRESS
Bryant Health Center
Room T460
410 Church St.
Minneapolis, MN 55455

WELL OWNER'S NAME
Same

WELL OWNER'S ADDRESS
Same

WELL OR BORING

Date Sealed: 1-13-89
Date Well or Boring Constructed: 1-13-19-2000

GEOLOGICAL MATERIAL
Sandy Clay
Silt Clay
Fine Sand
Silt Sand
Loam
Silt Sand Rocks
Limestone

EARTHWORK OR FORMATION
Bentonite

COLOR
Brown
Gray
Brown
Brown
Brown
Brown
Brown

FROM TO 0 51 84 120 132 150 155 180 182

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE
X No Annular Space Exists
X Annular Space Grouted with Tremie Pipe

CONSTRUCTION MATERIAL
Bentonite

CONSTRUCTION MATER from 0 to 120 ft. yards bags

OTHER WELLS AND BORINGS
Other unsual and unusual well or boring on property? X Yes No

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION
Certified Representative Signature: Mike Anderson
Certified Rep. No: Date: 6-1-00

MINN. DEPT. OF HEALTH COPY
Figures B-1, B-2, and B-3

Example Photos of Outwash, Till, and St. Peter Sandstone
UMore Park

Figure 1 Outwash deposits at MW-C2-002

Figure 2 St. Peter Sandstone at MW-E2-305

Figure 3 Till deposits at C2-Pilot