AMENDED APPLICATION FOR SURRENDER OF LICENSE
FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT R
100% Design Report
(Part 10 of 12)
Klamath River Renewal Corporation  Project Nos. 14803-001;
PacifiCorp  2082-063

AMENDED APPLICATION FOR SURRENDER OF LICENSE
FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT R-5
Fall Creek Hatchery
(continued)
Attachment A
Klamath River Renewal Project – Geotechnical Data Report
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# Acronyms and Abbreviations

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<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>GDR</td>
<td>Geotechnical Data Report</td>
</tr>
<tr>
<td>psi</td>
<td>pound(s) per square inch</td>
</tr>
<tr>
<td>SPT</td>
<td>Standard Penetration Test</td>
</tr>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>KRRP</td>
<td>Klamath River Renewal Project</td>
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<tr>
<td>ModCal</td>
<td>Modified California</td>
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<tr>
<td>HDD</td>
<td>horizontal directional drilling</td>
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Chapter 1: Introduction
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1. INTRODUCTION

1.1 Purpose and Scope

This Geotechnical Data Report (GDR) includes the results of the field investigation conducted from February 2018 through January 2019, and associated laboratory and geophysical testing.

1.2 Report Organization

After this introductory section, the GDR is organized as follows:

- Section 2: Describes the investigations at Copco and Iron Gate Reservoirs, at Jenny Creek, Camp Creek, Lakeview, Dry Creek, Fall Creek, and Scotch Creek Bridges, and along the proposed City of Yreka replacement water line. The investigations included soil and rock borings, piezometer construction, downhole geophysical testing, and field hydraulic conductivity testing.
- Section 3: Describes the laboratory testing.
- Section 4: Discusses the limitations of the work.

The data collected during the investigations is presented in Appendices A through E.
Chapter 2: Field Investigations
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2. FIELD INVESTIGATIONS

2.1 Subsurface Investigations

AECOM performed geotechnical investigations for the Klamath River Renewal Project between February 2018 and January 2019. The geotechnical investigations are described below. The field investigations were conducted in general conformance with the following ASTM standards:

1. Rock core drilling, ASTM D2113
2. Soil logging, ASTM D2488
3. Standard penetration test (SPT) sampling, ASTM D1586
4. Thin-walled (Shelby) tube sampling, ASTM D1587
5. Preserving and transporting of soil samples, ASTM D4220

2.1.1 Soil and Rock Borings

Forty-eight soil and/or rock core borings were drilled between February 1, 2018 and January 23, 2019. Boring locations are shown on Figure 1 Sheets 1 through 8 and summarized in Table 1 – Borings Summary Table.

The borings were drilled by Taber Drilling of West Sacramento, California, Gregg Drilling of Martinez, California, and/or Pitcher Drilling of East Palo Alto, CA. The locations of the borings were surveyed with a hand-held GPS unit with an approximate accuracy of ±15 feet. The coordinate locations for the borings are shown on the boring logs in State Plane Zone 1 coordinates.

Drilling footage totaled 2163.4 linear feet at the Copco Reservoir, Iron Gate Reservoir, City of Yreka Water line, and bridge abutment borings. The borings ranged in depth from 10.5 to 120 feet below ground surface (bgs). All but two borings were drilled vertically; two borings (B-202 and B-206) were drilled at an angle of 60° below horizontal.

The 2.5-inch HQ-3 core, 1.375-inch I.D. Standard Penetration Test (SPT), 2.5-inch I.D. Modified California (ModCal), and 2.0-inch I.D. California drive samples were photographed, labeled, bagged, or boxed (for rock cores), and stored onsite prior to transport of the samples to Tonon USA in Austin, TX, Cooper Testing Laboratory in Palo Alto, CA, or Inspection Services Inc. of Berkeley, CA. Pitcher barrel, Osterberg, and Shelby Tube samples were sealed with paraffin and carefully transported to the laboratory for testing.
City of Yreka Water Line Borings

Nine borings (B-201 to B-203, B-205 through B-208, BI-02 and BI-03) totaling 696.2 linear feet were drilled along a proposed tunnel alignment to determine subsurface geologic conditions for the replacement of the existing City of Yreka waterline by Horizontal Directional Drilling (HDD) or micro tunnel drilling. These boring locations are shown on Figure 1, Sheet 4, and the boring logs are presented in Appendix A.

The borings were drilled from February 21st to 23rd, August 14th to September 21st, 2018, and January 8th to January 11th, 2019. The boring logs and core box photographs are presented in Appendix A and Appendix E, respectively. Borings were advanced using hollow stem auger, rotary wash, and/or rock core drilling methods, and sampling methods included HQ-3 core, SPT, and a ModCal drive sampler. Blows per each 6-inches of driven sample were recorded.

Three of the borings (B-201, B-202, and B-206) were drilled by Pitcher Drilling Company of East Palo Alto, CA with a track-mounted Fraste XL drill rig. Three additional borings (B-205, B-207, and B-208) were drilled by Gregg Drilling of Martinez, CA with a truck-mounted B-53 drill rig. Three borings (BI-02, BI-03, and B-203) were drilled by Taber Drilling of West Sacramento, CA with BI-02 being drilled using a truck-mounted CME-55 and BI-03 and B-203 being drilled using a barge-mounted CME-45 drill rig.

Copco No. 1 Rim Stability

A subsurface investigation with laboratory testing was performed at Copco No. 1 reservoir to characterize and analyze the stability of the fluvio-lacustrine terrace deposits (diatomite) present around the reservoir rim and within the reservoir bed. Twenty-one hollow stem auger and rotary wash borings, described below, were completed as part of the rim stability investigation. The boring locations are shown on Figure 1, Sheets 6 through 8, and boring logs are presented in Appendix A.

Eleven rotary wash borings, BC-01 through BC-10 and BC-8a, were performed by Taber Drilling using a barge-mounted CME 45 between February 1st and 14th, 2018. The boring depths ranged from 11.5 to 96.5 feet below ground surface.

On land, along the Copco Reservoir Rim, five borings (BC-11 through BC-15) were drilled by Gregg Drilling, between October 2nd and 18th, 2018, using a truck-mounted Mobile B-53 (BC-13 through BC-15) and a track-mounted Geoprobe (BC-11 and BC-12). The borings were advanced to bedrock (10.5 to 42 feet bgs). BC-15 encountered bedrock within 1 foot of the surface; where the boring was terminated, and no boring log or laboratory test data is included as part of this GDR.

Soil samples were obtained in BC-01 to BC-15 using SPT, ModCal, and 3-inch diameter thin-walled Shelby tubes. The tubes were advanced by direct push or with a hydraulically activated piston sampler (Osterberg). Blows per each 6-inches of driven sample and hydraulic gage down pressure for undisturbed samples were recorded.

Five additional over-water borings (BC-16 through BC-20) were completed between January 13th and 14th, 2019. BC-16 through BC-20 were drilled without sampling to bedrock, with the goal of identifying the top of
bedrock. Bedrock was inferred when the driller noted significantly harder drilling conditions. Bedrock was sampled with an SPT sampler at the bottom of each exploration to confirm that bedrock was encountered.

**Iron Gate Rim Stability**

One boring, BI-01 shown on Figure 1, Sheet 3, was completed to characterize landslide history of a feature identified in aerial photograph at Iron Gate reservoir. Two other borings, BI-02 and BI-03 shown on Figure 1, Sheet 4, provided data for the rim stability analysis of Iron Gate, and are described in the City of Yreka Water Line section above.

The one rotary wash boring was drilled on February 20th, 2018 to 22.2 feet below ground surface with a barge-mounted CME-45 by Taber Drilling. The material was sampled with a ModCal or SPT; blows per 6-inches were recorded.

**Bridge Abutment Borings**

Seventeen borings were planned at the abutments of bridges requiring replacement or improvement during the Klamath River Renewal Project:

- Camp Creek Bridge (four borings, BC-01, BC-02, BC-03, and BC-20), See Figure 1, Sheet 2
- Jenny Creek Bridge (four borings, BC-04, BC-05, BC-06, and BC-07), See Figure 1, Sheet 3
- Lakeview Bridge (two borings, B-08 and B-10), See Figure 1, Sheet 1
- Fall Creek Bridge (two borings, B-13 and B-14), See Figure 1, Sheet 5
- Daggett Bridge (three borings, B-15, B-16, and B-17), See Figure 1, Sheet 4
- Scotch Creek Bridge (two borings, B-18 and B-19), See Figure 1, Sheet 2

The boring locations are shown on Figure 1, Sheets 1 through 5, and boring logs are presented in Appendix A.

Fourteen of the borings were drilled by Gregg Drilling between September 25 and October 18, 2018 with a truck-mounted Mobile B-53 drill rig to depths between 21.2 and 56.9 feet below ground surface. The borings were advanced with hollow stem auger, rotary wash, and/or HQ-3 rock coring. Soil was sampled with a ModCal or SPT; blows per 6 inches of driven sample were recorded.

Three additional borings, B-15 through B-17, were drilled by Taber Drilling with a barge-mounted CME-45 drill rig and a truck-mounted CME-75 between January 12th and 23rd, 2019. The depths of these borings ranged from 24.5 to 51.5 feet below grade. The borings were advanced using solid stem auger, rotary wash, and HQ-3 rock coring. Soil was sampled with a ModCal or SPT; blows per six inches of driven sample were recorded.
2.1.2 Piezometers

Two vibrating wire piezometers (VWP) were installed in each of the inclined borings B-202 and B-206, as shown in Table 1. In B-202, the VWPs were installed at 24.2 feet and at 62.4 bgs (28 and 72 lineal feet on boring trajectory). The VWPs were installed at 21.7 feet and another at 79.7 feet (at 25 and 92 lineal feet on boring trajectory) in B-206. All four VWPs were installed with recording dataloggers. Groundwater level data from the VWPs will be reported as an addendum to this report.

Borings were tremie-backfilled with neat cement grout to the ground surface without installation of a screen or sand sock.

2.1.3 Field Hydraulic Conductivity (Packer) Testing

Nine hydraulic conductivity (packer) tests were performed as part of the geotechnical investigation: seven by Taber Drilling with one in each of borings BI-02 and BI-03, and five in boring B-203 and two by Pitcher Drilling in boring B-206. The tests were performed to characterize hydraulic conductivities of the rock along the new HDD or micro-tunnel alignment for the City of Yreka water line. Results of the packer tests are presented in Appendix B.

Single Pneumatic Packer Tests

For borings BI-02, BI-03, and B-203, testing with a single pneumatic packer was used in a down-stage method, meaning that each successive packer test was performed as the hole was drilled deeper. An In-situ Level Troll 300 water pressure data logger installed in the packer assembly with a surface readout was used to monitor water pressures within the test intervals of the boreholes. Test interval lengths were 20.0 feet.

Prior to conducting the hydraulic conductivity testing, each borehole was conditioned by circulating clear water to remove cuttings and traces of polymer-based drilling fluid. Drill rods were then lifted off the bottom of the hole approximately 20 feet to expose the test section of the borehole.

For each interval a maximum test pressure (P_{max}) of 1 psi/foot of depth to the center of the test section was used to reduce the potential for hydrofracturing of the formation. When the packer assembly was in place and inflated, the testing commenced. Testing generally consisted of a five-step test at varying pressures approximately equal to \( \frac{1}{2} P_{max}, \frac{3}{4} P_{max}, P_{max}, \frac{3}{4} P_{max}, \text{ and } \frac{1}{2} P_{max} \). At each step, the pressure was held constant until a steady rate of flow could be maintained, which was then monitored for approximately five minutes. At the completion of the fifth step, the packer was deflated, removed from the borehole and drilling resumed.

Double Pneumatic Packer Tests

For boring B-206, an upstage technique was used after completion of drilling, with two pneumatic packers sealing off 10-foot intervals of the borehole for testing. A vibrating wire pressure transducer installed in the packer assembly with a surface readout was used to monitor water pressure during the test. Clean water was circulated in the boring after drilling to remove cuttings and traces of drilling fluid.
As for the single pneumatic packer tests discussed above, the maximum test pressure ($P_{\text{max}}$) of 1 psi/foot of depth to the center of the test section was used to prevent hydrofracturing of the formation. Due to poor performance of the flow metering equipment and hydraulic response of the formation at the test intervals, testing consisted of a one-step test at $P_{\text{max}}$. The pressure was held constant until a steady rate of flow could be maintained, which was then monitored for approximately five minutes. After the two consecutive tests (85 to 95 feet, and then 75 to 85 feet), the packer was deflated and removed from the borehole. Additional tests were not performed in this borehole due to failure of the pressure monitoring equipment. The boring was subsequently backfilled by tremie-grouting.

### 2.1.4 Borehole Geophysical Surveys

**Televiewer Logging**

To identify the orientation and width of planar geologic structural features encountered by the borings, borehole acoustic televiewer logging was performed in two borings drilled along the proposed water tunnel alignment (B-202 and B-206). Televiewer logging was performed by NORCAL Geophysical Consultants, Inc. and the results of which are presented in Appendix C.
Chapter 3: Laboratory Testing
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3. LABORATORY TESTING

Representative soil samples obtained from the exploratory borings were tested by Cooper Testing Labs in Palo Alto, California and Inspection Services Inc. in Berkeley, California. Representative rock samples were also obtained from the borings and tested by Tonon Laboratory in Austin, Texas and Cooper Testing Labs in Palo Alto, California. Laboratory test reports are presented in Appendix D.

The following geotechnical tests were performed on soils samples from borings:

1. Moisture Content, ASTM D2216
2. Atterberg Limits, ASTM D4318
3. Consolidated Undrained triaxial Compression Strength Tests, ASTM D4767
4. Unconsolidated Undrained triaxial Compression Strength Tests, ASTM D2850
5. Consolidation, ASTM D2435
6. Grain-Size Distribution Analysis, ASTM D422
7. Percent Passing No. 200, ASTM D1140
8. Moisture-Density tests, ASTM D7263b
9. X-rays of Samples
10. Corrosion Testing (pH and Minimum Resistivity (CT 643), Sulfate (CT 147), and Chloride (CT 422))

The following geotechnical tests were performed on rock core samples from borings:

1. Brazilian Tensile Strength Test, ASTM D3967
2. Moisture Content, ASTM D2216
3. Cerchar Abrasiveness tests, ASTM D7625
4. Point Load tests, ASTM D5731
5. Mohs Hardness
6. Unconfined Compressive Strength tests, ASTM D7012
7. Punch Penetration testing, Colorado Schools of Mines – 13
8. Bulk Density tests, ISRM 1977
9. Petrographic Analyses
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Chapter 4: Limitations
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4. LIMITATIONS

This GDR references geotechnical data obtained from various phases of geotechnical investigation programs and serves as a source of geotechnical information for the Klamath River Renewal Project.

Groundwater levels presented reflect conditions observed at the time of measurement and are expected to vary over time. The conditions indicated in boring logs and geophysical surveys represent only the subsurface conditions at the locations of the borings. The actual subsurface conditions are expected to vary between those locations.

This report does not interpret the available data. It is the Contractor’s responsibility to become familiar with the data in this GDR. The Contractor shall make its own interpretation of this data and shall assume full responsibility for its interpretation.

AECOM represents that the work described in this GDR were conducted in a manner consistent with the standard of care ordinarily applied as the state of practice in the profession within the limits prescribed by our client. No other warranties, either expressed or implied, are included or intended in this GDR.
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# TABLE 1

<table>
<thead>
<tr>
<th>BORING NUMBER</th>
<th>LOCATION</th>
<th>BORING TYPE</th>
<th>DEPTH (feet)</th>
<th>BEARING/PLUNGE</th>
<th>PIEZO INSTALLED</th>
<th>IN-SITU TESTING</th>
<th>GOAL</th>
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<td>BC-11</td>
<td>Copco Road</td>
<td>soil</td>
<td>10.5</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-12</td>
<td>Copco Road</td>
<td>soil</td>
<td>16.5</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-13</td>
<td>Copco Road</td>
<td>soil</td>
<td>42.0</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-14</td>
<td>Copco Road</td>
<td>soil</td>
<td>15.4</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-15</td>
<td>Copco Road</td>
<td>soil</td>
<td>1.0</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
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<tr>
<td>BC-16</td>
<td>Copco Rim</td>
<td>soil</td>
<td>64.8</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-17</td>
<td>Copco Rim</td>
<td>soil</td>
<td>37.4</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
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<tr>
<td>BC-18</td>
<td>Copco Rim</td>
<td>soil</td>
<td>34.5</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-19</td>
<td>Copco Rim</td>
<td>soil</td>
<td>37.5</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BC-20</td>
<td>Copco Rim</td>
<td>soil</td>
<td>19.0</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BI-01</td>
<td>Irongate Rim - Over Water</td>
<td>soil</td>
<td>22.2</td>
<td>Vertical</td>
<td>NA</td>
<td>NA</td>
<td>Rim Stability</td>
</tr>
<tr>
<td>BI-02</td>
<td>Irongate - Fall Creek</td>
<td>soil/core</td>
<td>67.0</td>
<td>Vertical</td>
<td>NA</td>
<td>HC</td>
<td>Water Line</td>
</tr>
<tr>
<td>BI-03</td>
<td>Irongate - Over Water</td>
<td>soil/core</td>
<td>35.1</td>
<td>Vertical</td>
<td>NA</td>
<td>HC</td>
<td>Water Line</td>
</tr>
</tbody>
</table>

**NOTES:**
1) HC = hydraulic conductivity, T = televiewer, VWP = vibrating wire piezometer, NA = not applicable
FIGURE 1
Planned and Completed Geotechnical Borings
Sheet 4 of 8
### Key to Log of Soil Boring

**Project:** Klamath River Dam Removal Project  
**Project Location:** Klamath River  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>SAMPLES</th>
<th>MATERIAL DESCRIPTION</th>
<th>REMARKS AND OTHER TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Elevation: Elevation in feet referenced to specified datum.</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Depth: Depth in feet below the ground surface.</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Sample Type: Type of soil sample collected at depth interval shown; sampler symbols are explained below.</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Sample Number: Sample identification number.</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Sampling Resistance: Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop, or down-pressure for pushed sampler.</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Recovery: Percentage of driven or pushed sample length recovered; “NA” indicates data not recorded.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Graphic Log: Graphic depiction of subsurface material encountered; typical symbols are explained below.</td>
<td></td>
</tr>
</tbody>
</table>

#### TYPICAL MATERIAL GRAPHIC SYMBOLS

- **FAT CLAY (CH)**
- **LEAN CLAY WITH ORGANICS (CL)**
- **LEAN CLAY with SAND (CL)**
- **POORLY GRADED GRAVEL (GP)**
- **SANDY FAT CLAY with SAND (CH)**
- **SANDY LEAN CLAY (CL)**
- **SANDY LEAN CLAY with GRAVEL (CL)**
- **POORLY GRADED GRAVEL with SAND (GP)**
- **SANDY FAT CLAY with GRAVEL (CH)**
- **LEAN CLAY with GRAVEL and SAND (CL)**
- **CLAYEY GRAVEL (GC)**
- **GRAVELLY LEAN CLAY (CL)**
- **GRANULAR LEAN CLAY (CL)**
- **POORLY GRADED GRAVEL (GP)**
- **WELL GRADED GRAVEL WITH SAND (GW)**
- **WELL GRADED GRAVEL WITH SAND (GW)**
- **WELL GRADED GRAVEL WITH SAND (GW)**
- **WELL GRADED GRAVEL WITH SAND (GW)**

#### TYPICAL SAMPLER GRAPHIC SYMBOLS

- **2.5-inch I.D. Modified California Shelby Tube**
- **2.0-inch I.D. California Shelby Tube**
- **Standard Penetration Test**

#### GENERAL NOTES

- **Check By:** Soil and core samples reviewed in-person by Project Geologist.  
- **Reviewed By:** Soil and core samples reviewed via run photos or core box photos in office by Project Engineer.
**COLUMN DESCRIPTIONS**

2. **Depth**: Distance (in feet) below the collar of the borehole.
3. **Run No.**: Number of the individual coring interval.
4. **Box No.**: Number of the core box which contains core from the corresponding runs.
5. **Recovery**: Amount in percent of core recovered from coring interval; calculated as length of core recovered divided by length of run.
6. **Fractures per Foot**: (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks (induced by drilling) or healed fractures. "NA" indicates not applicable due to lack of core recovery or soil-like nature of rock.
7. **R Q D**: (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in each coring interval; calculated as the sum of lengths of intact core divided by length of core run.
8. **Fracture Drawing**: Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. "NR" indicates no recovery.
9. **Fracture Number**: Location of each naturally occurring fracture (numbered) and mechanical break (labeled "M"). Naturally occurring fractures are described in Column 11 (keyed by number) using descriptive terms defined on Sheet 2 (Items a through g).

**TYPICAL MATERIAL GRAPHIC SYMBOLS**

- **SILT with SAND and GRAVEL (ML)**
- **CLAYEY SAND to SANDY LEAN CLAY (SC-CL)**
- **SILTY SAND with GRAVEL (SM)**
- **WELL GRADED SAND with GRAVEL (SW)**
- **SANDY SILT (ML)**
- **CLAYEY SAND with GRAVEL (SC)**
- **POORLY GRADED SAND (SP)**
- **ORGANIC SILT WITH SAND (OL)**
- **GRAVELLY FAT CLAY with SAND (CH)**
- **SILTY SAND (SM)**
- **SILTY to CLAYEY SAND with GRAVEL (SM-SC)**
- **POORLY GRADED SAND with GRAVEL (SP)**
- **POORLY GRADED SAND with SILT (SP-SM)**

**FIELD NOTES AND TEST RESULTS**

- **Lithology**: Graphic depiction of subsurface material encountered, typical symbols are explained below.
- **Description**: Lithologic description in this order: rock type, color, grain size, texture, weathering, strength, and other features; descriptive terms are defined on Sheet 2. Also, abbreviated description of fractures numbered in Column 9 using terms defined on Sheet 2.
- **Sample Type**: Type of soil sample collected at depth interval shown; sampler symbols are explained below.
- **Sample Number**: Sample identification number.
- **Blows / 6 in.**: Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop (unless otherwise noted).
- **Drill Time [Rate]**: Time (in 24-hour clock) marking start and finish of each run; drill rate (in feet per hour) is reported in brackets.
- **Field Notes and Tests Results**: Comments and observations regarding drilling or sampling made by driller or field personnel.

**OTHER GRAPHIC SYMBOLS**

- **FOSSIL**: Any naturally occurring fossil material found in the core.
- **LITHIC**: Any naturally occurring lithic material found in the core.
- **METAMORPHIC**: Any naturally occurring metamorphic material found in the core.
- **MINERAL**: Any naturally occurring mineral material found in the core.
- **ORGANIC**: Any naturally occurring organic material found in the core.
- **PETROLEUM**: Any naturally occurring petroleum material found in the core.
- **PLANT**: Any naturally occurring plant material found in the core.
### Key to Log of Core Boring

**Sheet 3 of 4**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

#### COLUMN DESCRIPTIONS

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elevation: Elevation (in feet) referenced to mean sea level (MSL).</td>
</tr>
<tr>
<td>2</td>
<td>Depth: Distance (in feet) below the collar of the borehole.</td>
</tr>
<tr>
<td>3</td>
<td>Run No.: Number of the individual coring interval.</td>
</tr>
<tr>
<td>4</td>
<td>Box No.: Number of the core box which contains core from the corresponding run.</td>
</tr>
<tr>
<td>5</td>
<td>Recovery: Amount (in percent) of core recovered from the coring interval; calculated as length of core recovered divided by run length.</td>
</tr>
<tr>
<td>6</td>
<td>Fractures per Foot: (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks (induced by drilling) or healed fractures. &quot;NA&quot; indicates not applicable due to lack of core recovery.</td>
</tr>
<tr>
<td>7</td>
<td>R Q D: (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in the coring interval; calculated as the sum of lengths of intact core divided by the run length. RQD value with &quot;*&quot; indicates moderately weathered / altered rock that does not meet soundness requirements, but provides an indication of rock quality with respect to degree of fracturing.</td>
</tr>
<tr>
<td>8</td>
<td>Fracture Drawing: Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. &quot;NR&quot; indicates no recovery.</td>
</tr>
<tr>
<td>9</td>
<td>Fracture Number: Location of each naturally occurring fracture (numbered) and mechanical break (labeled &quot;M&quot;). Naturally occurring fractures are described in Column 11 (keyed by number) using descriptive terms defined on Sheet 2 (Items a through g).</td>
</tr>
<tr>
<td>10</td>
<td>Lithology: A graphic log of material encountered using symbols to represent differing soil and rock types; symbols are explained below.</td>
</tr>
<tr>
<td>11</td>
<td>Description: Lithologic description in this order: rock type, color, texture, grain size, weathering, strength, and other features; descriptive terms are defined on Sheet 2. A detailed description of overburden material is not necessarily provided. Also, abbreviated description of fractures numbered in Column 9 using terms defined on Sheet 2.</td>
</tr>
<tr>
<td>12</td>
<td>Drill Time [Rate]: Time (in 24-hour clock) marking start and finish of each run; drill rate (in feet per hour) is reported in brackets.</td>
</tr>
<tr>
<td>13</td>
<td>Field Notes and Other Tests: Comments regarding drilling and sampling made by driller or field personnel. Tested rock specimen intervals and a record of tests performed using the abbreviations listed below.</td>
</tr>
</tbody>
</table>

#### TYPICAL MATERIAL GRAPHIC SYMBOLS

- ASPHALT
- ANDESITE
- BASALT
- BOULDERS and COBBLES
- BOULDER
- DIATOMITE
- DIATOMITE WITH ELASTIC SILT
- VOLCANIC BRECCIA
- VOLCANIC CINDER
- VOLCANIC CLAYSTONE
- VOLCANIC CONGLOMERATE
- VOLCANIC MUDSTONE
- VOLCANIC SANDSTONE
- VOLCANIC SILTSTONE/CLAYSTONE
- VOLCANIC SILTSTONE
- VOLCANIC SILTY SANDSTONE

#### OTHER GRAPHIC SYMBOLS

- Static Water Level
- First water encountered at time of drilling
- Inferred or transitional contact
- Change in material properties within a stratum

Material descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced, and are not warranted to be representative of subsurface conditions at other locations or times.
### KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

#### DISCONTINUITY DESCRIPTORS

<table>
<thead>
<tr>
<th>a</th>
<th>Dip of discontinuity, measured relative to a plane normal to the core axis.</th>
</tr>
</thead>
</table>

#### b Discontinuity Type:
- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

#### e Amount of Infilling:
- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- No - None

#### f Surface Shape of Joint:
- Pl - Planar
- Wa - Wavy
- St - Stepped
- Ir - Irregular

#### g Roughness of Surface:
- Silk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- SR - Slightly Rough [asperities on discontinuity surfaces are distinguishable and can be felt]
- R - Rough [ridges and side-angle steps are evident; asperities are clearly visible; surface feels very abrasive]
- VR - Very Rough [near-vertical steps and ridges occur on discontinuity surface]

#### c Aperture (inches):
- W - Wide (0.5-2.0)
- MW - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- VN - Very Narrow (<0.05)
- T - Tight (0)

#### d Type of Infilling:
- Bi - Biotite
- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Ep - Epidote
- Fe - Iron Oxide
- H - Healed
- My - Mylonite
- CR - Crushed Rock
- Mn - Manganese
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand
- Se - Serpentinite
- Si - Silty
- Uk - Unknown

#### ROCK FRACTURING

<table>
<thead>
<tr>
<th>Description</th>
<th>Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensely Fractured</td>
<td>Fractures spaced less than 2 inches apart</td>
</tr>
<tr>
<td>Highly Fractured</td>
<td>Fractures spaced 2 inches to 1 foot apart</td>
</tr>
<tr>
<td>Moderately Fractured</td>
<td>Fractures spaced 1 foot to 3 feet apart</td>
</tr>
<tr>
<td>Slightly Fractured</td>
<td>Fractures spaced 3 feet to 10 feet apart</td>
</tr>
<tr>
<td>Massive</td>
<td>Fracture spacing greater than 10 feet</td>
</tr>
</tbody>
</table>

#### ROCK WEATHERING / ALTERATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand</td>
<td>Residual Soil</td>
</tr>
<tr>
<td>Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand</td>
<td>Completely Weathered/Altered</td>
</tr>
<tr>
<td>More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric</td>
<td>Highly Weathered/Altered</td>
</tr>
<tr>
<td>Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric</td>
<td>Moderately Weathered/Altered</td>
</tr>
<tr>
<td>Rock is slightly discolored, but not noticeably lower in strength than fresh rock</td>
<td>Slightly Weathered/Altered</td>
</tr>
<tr>
<td>Rock shows no discoloration, loss of strength, or other effect of weathering/alteration</td>
<td>Fresh/Unweathered</td>
</tr>
</tbody>
</table>

#### ROCK STRENGTH

<table>
<thead>
<tr>
<th>Description</th>
<th>Recognition</th>
<th>Approximate Uniaxial Compressive Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Weak Rock</td>
<td>Can be indented by thumbnail</td>
<td>35 - 150</td>
</tr>
<tr>
<td>Very Weak Rock</td>
<td>Can be peeled by pocket knife</td>
<td>150 - 700</td>
</tr>
<tr>
<td>Weak Rock</td>
<td>Can be peeled with difficulty by pocket knife</td>
<td>700 - 3,600</td>
</tr>
<tr>
<td>Moderately Strong Rock</td>
<td>Can be indented 5 mm with sharp end of pick</td>
<td>3,600 - 7,200</td>
</tr>
<tr>
<td>Strong Rock</td>
<td>Requires one hammer blow to fracture</td>
<td>7,200 - 14,500</td>
</tr>
<tr>
<td>Very Strong Rock</td>
<td>Requires many hammer blows to fracture</td>
<td>14,500 - 36,000</td>
</tr>
<tr>
<td>Extremely Strong Rock</td>
<td>Can only be chipped with hammer blows</td>
<td>&gt;36,000</td>
</tr>
</tbody>
</table>

Report: GEO_CORE+SOIL_NO PACK_WITH LITH_KEY_PG2; File: ROCK CORES.GPJ; 6/26/2018 BI-03
**Log of Soil and Core Boring B-01**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Reviewed By</th>
<th>Drilling Method</th>
<th>Drill Bit Size/Type</th>
<th>Total Depth of Borehole</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/27/2018</td>
<td>S. Janowski</td>
<td>B. Aldridge</td>
<td>Hollow Stem Auger, HQ-3 Rock Core</td>
<td>6-inch flight auger, HQ-3 wireline diamond bit</td>
<td>25.5 feet</td>
</tr>
</tbody>
</table>

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling  
**Groundwater Level:** Not encountered before rotary wash drilling  
**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel  
**Groundwater Level:** NA  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Camp Creek Bridge  
**Coordinate Location:** N 2602866 E 6443027

**Start 9:00 9/27/2018; hang auger 0.0-5.0 ft.**  
**pp = 2.75 tsf**  
**Hollow stem auger 5.0 ft. to 9.0 ft.**  
**pp = 2.25 tsf**  
**Auger refusal at 9.0 ft.; advance 4.5-inch casing to 9.0 ft. and switch to rotary wash drilling with 3.7/8-inch tricone bit.**  
**75% fluid circulation**
GRAVEL and COBBLES in a SANDY LEAN CLAY matrix; GRAVEL and COBBLES are subrounded Basalt

VOLCANIC BRECCIA; dark reddish brown (10R 3/4); highly weathered; very weak; highly fractured; friable

Becomes yellowish grey (SY 7/2), moderately weathered

Becomes greyish brown (SYR 3/2)

Intensely fractured

75% fluid circulation

*Rock does not meet soundness criteria for RQD calculation.
Project: Klamath River Renewal Project  
Project Location: Copco and Iron Gate Reservoirs  
Project Number: 60537920

Log of Soil Boring B-02  
Sheet 1 of 2

Date(s) Drilled: 10/12/2018  
Logged By: P. Respess  
Reviewed By: B. Aldridge

Drilling Method: Hollow Stem Auger  
Drill Bit Size/Type: 6-inch flight auger  
Total Depth of Borehole: 31.4 feet

Drill Rig Type: Truck Mounted Mobile B-53  
Drilling Contractor: Gregg Drilling  
NAVD 88 Ground Surface Elevation: 2340 feet

Groundwater Level(s): 13.5 feet below ground surface  
Sampling Method(s): SPT  
Hammer Data: Automatic hammer; 140 lbs, 30-inch drop

Borehole Backfill: Cement grout to ground surface  
Borehole Location: Camp Creek Bridge  
Coordinate Location: N 2602747 E 6443180

---

MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Type</th>
<th>Sampling Resistance Recovery (feet)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2-inches GRAVEL roadway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>POORLY GRADED GRAVEL (GP); dense; fine to coarse GRAVEL and COBBLES; fine to coarse grained SAND; little no plasticity FINES; moist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; trace fine grained SAND; occasional GRAVEL and COBBLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>BOULDER, basalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>BOULDER, basalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>SILTY SAND with GRAVEL (SM); very dense; GRAVEL up to 1-inch; fine to coarse grained SAND; no plasticity FINES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>--ALLUVIUM--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>--ALLUVIUM--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>14</td>
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<td></td>
</tr>
<tr>
<td>27</td>
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<td></td>
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<tr>
<td>28</td>
<td>14</td>
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<tr>
<td>29</td>
<td>44</td>
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<td></td>
</tr>
<tr>
<td>30</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### REMARKS AND OTHER TESTS

- Start 9:00 9/27/2018; hollow stem auger 0-31ft.
- Logged from auger cuttings and rig chatter
- Rig chatter indicated rocky layer

---

Research: GEO_11B_OAK- File: KLAMATH_MASTER.GPJ; 6/20/2019 B-02
**Material Description**

[As Above] --ALLUVIUM--(continued)

**BASALT; dark grey; slightly weathered to fresh; moderately strong--TERTIARY to QUATERNARY INTRUSIVE BASALT--**

TOTAL DEPTH = 31.4 FEET

---

**Remarks and Other Tests**

S-02 attempted at 31.4; logged from flake in shoe

---

**Table**

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Sampling Resistance (feet)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-02</td>
<td>50/0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
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**Remainder of the table**


---

**Report Details**

- **Project**: Klamath River Renewal Project
- **Project Location**: Copco and Iron Gate Reservoirs
- **Project Number**: 60537920
- **Log of Soil Boring B-02**
- **Sheet 2 of 2**
**Log of Soil and Core Boring B-03**

**Date(s) Drilled:** 10/12/2018-10/16/2018

**Logged By:** P. Respress

**Reviewed By:** B. Aldridge

**Drilling Method:** Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core

**Drill Rig Type:** Truck Mounted Mobile B-53

**Drilling Contractor:** Gregg Drilling

**Groundwater Level:** Not encountered before rotary wash drilling

**Sampling Methods:** 2.5-inch ID ModCal, HQ Core Barrel

**Drill Rig Type:** Truck Mounted Mobile B-53

**Drill Rig Data:**
- **Hammer Type:** 140 lbs, 30-inch drop
- **Data:** Automatic hammer, NAVD 88
- **Surface Elevation:** 2341 feet

**Drill Rig Data:**
- **Elevation, feet:** 2340, 2338, 2336, 2334, 2332, 2330, 2328, 2326, 2324, 2322

**Borehole Backfill:** Cement grout to ground surface

**Borehole Location:** Camp Creek

**Coordinate Location:** N 2602664 E 6443265

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
<th>Field Notes and Test Results</th>
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<tbody>
<tr>
<td>-2340</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td>Start 12:00 10/12/2018; hang auger 0.0-5.0 ft.</td>
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<tr>
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<td></td>
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<td></td>
<td>End of day 10/12/2018 Begin day 10/15/2018</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Switch to rotary wash drilling with 3 7/8-inch tricone bit</td>
</tr>
<tr>
<td>-2334</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Advance 4.5-inch casing to 5 ft.</td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- POORLY GRADED GRAVEL with SAND (GP): medium dense to dense; fine to coarse GRAVEL to BOULDERS; fine to coarse grained SAND; some no plasticity FINES; dry to moist
- --FILL--
- BOULDER and COBBLES; 3.0-4.8 ft; BOULDER
- --ALLUVIUM--
- BOULDER
- BOULDERS and COBBLES
- BOUDERS and COBBLES
- BOULDERS and COBBLES
- BOULDERS and COBBLES

**SOIL SAMPLES**

- **Type:**
- **Number:**
- **Recovery, %:**
- **Blows / 6 in.:**
- **Drill Time [Rate, ft/hr]:**

**FIELD NOTES AND TEST RESULTS**

- Start 12:00 10/12/2018; hang auger 0.0-5.0 ft.
- End of day 10/12/2018 Begin day 10/15/2018
- Switch to rotary wash drilling with 3 7/8-inch tricone bit
- Advance 4.5-inch casing to 5 ft.
Log of Soil and Core Boring B-03

Sheet 2 of 2

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Total Depth = 27.3 FEET

BOULDER and COBBLES

--ALUVIUM-- (continued)

VOLCANIC Siltstone; reddish brown to olive grey; moderately to highly weathered; very weak to weak; very thinly laminated; locally clayey

--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --

SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Recovery, %</th>
<th>Blows / 6 in.</th>
<th>Drill Time (Rate, ft/hr)</th>
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<tbody>
<tr>
<td>S-01</td>
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<td>14</td>
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<tr>
<td>S-02</td>
<td>31</td>
<td>27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIELD NOTES AND TEST RESULTS

Reddish clay cuttings

Rig chatter at 20 ft. indicates rocky layer

End of day 10/15/2018
Begin day 10/16/2018
Advance 4.5-inch casing to 22 ft.
Switch to HQ-3 rock coring at 22.3 ft.

26.3-27.3 ft. driller reports harder drilling condition

BOULDER and COBBLES

VOLCANIC Siltstone; reddish brown to olive grey; moderately to highly weathered; very weak to weak; very thinly laminated; locally clayey

TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --

S-01 One liner retained (16-16.5 ft.)
S-02 One liner retained (21-21.5 ft.)
### Field Notes and Test Results

- **Start:** 9:30 9/25/2018
- **Method:** Hand Auger 0-5 ft.

- **Sample:**
  - *pp = 3.25 tsf*
  - Hollow Stem Auger 5-9.5 ft.
  - *pp = 4.25 tsf*
  - *pp = >4.5 tsf*

### Rock Core

**Lithology:**
- 2-inches ASPHALT roadway
- **ROAD BASE**
  - POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 40% subangular GRAVEL up to 1-inch; 60% medium grained SAND; moist
- **ROAD FILL**
  - SANDY LEAN CLAY with GRAVEL (CL); very stiff to hard; brown (10YR 4/3); 60% low plasticity FINES; 20% subangular gravel up to 2-inches; 20% fine grained SAND; moist
- **ALLUVIUM**
  - Becomes brown (10YR 5/3 with subangular to subrounded GRAVEL up to 1 1/2-inches, effervescent, with rootlets
- **CLAYEY GRAVEL with SAND (GC); very stiff; brown (10YR 4/3); 60% subrounded COBBLES and GRAVELS; 30% low plasticity FINES; 10% medium grained SAND
- **ALLUVIUM**
  - Becomes basalt COBBLES up to 5 inches in a clayey matrix

### Soil Samples

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2330</td>
<td>2-inches ASPHALT roadway</td>
</tr>
</tbody>
</table>
| 2330-2332 | **ROAD BASE**
  - POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 40% subangular GRAVEL up to 1-inch; 60% medium grained SAND; moist |
| 2332-2334 | **ROAD FILL**
  - SANDY LEAN CLAY with GRAVEL (CL); very stiff to hard; brown (10YR 4/3); 60% low plasticity FINES; 20% subangular gravel up to 2-inches; 20% fine grained SAND; moist |
| 2334-2336 | **ALLUVIUM**
  - Becomes brown (10YR 5/3 with subangular to subrounded GRAVEL up to 1 1/2-inches, effervescent, with rootlets |
| 2336-2340 | **CLAYEY GRAVEL with SAND (GC); very stiff; brown (10YR 4/3); 60% subrounded COBBLES and GRAVELS; 30% low plasticity FINES; 10% medium grained SAND |
| 2340-2342 | **ALLUVIUM**
  - Becomes basalt COBBLES up to 5 inches in a clayey matrix |
### Field Notes and Test Results

- Drill indicated good fluid return while pump running but rapid fluid level drop between runs.

### Material Description

CLAYEY GRAVEL with SAND (GS); very stiff; brown (10YR 4/3); 60% subrounded COBBLES and GRAVELS; 30% low plasticity FINES; 10% medium grained SAND

---

BECOMES greyish red (5YR 4/2) to brownish black (5YR 2/1), basalt BOULDERS with minor matrix and subrounded GRAVELS infilling void spaces with some vesicles up to 3/4-inches.

---

BASALT; olive grey (5Y 3/2); completely weathered; very weakly decomposed and easily friable by hand

---

BECOMES dusky yellow green (5Y 5/2) and pale reddish brown (10Y 5/4), highly to completely weathered, highly to intensely fractured.
**Log of Soil and Core Boring B-04**

**Sheet 3 of 3**

**Project**: Klamath River Renewal Project  
**Project Location**: Copco and Iron Gate Reservoirs  
**Project Number**: 60537920

---

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>30</td>
<td>7</td>
<td>1</td>
<td>30</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>BASALT; dusky yellow green (5Y 5/2) and pale reddish brown (10Y 5/4); highly to completely weathered; highly to intensely fractured; very weak; No Recovery likely in completely weathered zones. --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)</td>
</tr>
<tr>
<td>-2312</td>
<td>31</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>NR</td>
<td>0</td>
<td>NR</td>
<td>TOTAL DEPTH = 31.5 FEET</td>
</tr>
</tbody>
</table>

---

### SOIL SAMPLES

- **Type**: Soil Samples  
- **Number**:  
- **Blows / 6 in.**
- **Recovery, %**
- **Drill Time (Rate, ft/hr)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Samples</td>
<td>[13]</td>
<td>1445</td>
<td>1455</td>
<td></td>
</tr>
</tbody>
</table>

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**FIELD NOTES AND TEST RESULTS**

- **Report**: GEO_CORE+SOIL NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-04

---

**Report**

- **Project Number**: 60537920  
- **Project Location**: Copco and Iron Gate Reservoirs  
- **Project**: Klamath River Renewal Project
**Log of Soil and Core Boring B-05**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Reviewed By</th>
<th>Drilling Rig Type</th>
<th>Drilling Method</th>
<th>Total Depth of Borehole</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/26/2018</td>
<td>S. Janowski</td>
<td>B. Aldridge</td>
<td>Truck Mounted Mobile B-53</td>
<td>Hollow Stem Auger, HQ-3 Rock Core</td>
<td>50.0 feet</td>
</tr>
</tbody>
</table>

**Groundwater Level:** Not encountered before rotary wash drilling  
**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Jenny Creek Bridge  
**Coordinate Location:** N 2603527 E 6452997

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2342</td>
<td>2-inches ASPHALT roadway</td>
<td></td>
</tr>
<tr>
<td>-2340</td>
<td>POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 60% medium grained SAND; 40% subangular GRAVEL up to 1-inch; moist</td>
<td></td>
</tr>
<tr>
<td>-2338</td>
<td>SANDY LEAN CLAY (CL); very stiff; brown (10YR 1/3); low plasticity FINES; fine to medium grained SAND; subangular GRAVEL up to 2-inches; moist</td>
<td></td>
</tr>
<tr>
<td>-2336</td>
<td>BECOMES dark yellowish brown (10YR 4/4); dry to moist</td>
<td></td>
</tr>
<tr>
<td>-2334</td>
<td>LEAN CLAY with GRAVEL (CL); stiff; brown (10YR 4/3); 75% medium plasticity FINES; 15% subangular to subrounded GRAVEL up to 3/4-inch; 10% fine grained SAND; moist; with rootlets</td>
<td></td>
</tr>
<tr>
<td>-2332</td>
<td>ALLUVIUM</td>
<td></td>
</tr>
<tr>
<td>-2330</td>
<td>3-inches ASPHALT roadway</td>
<td></td>
</tr>
<tr>
<td>-2328</td>
<td>POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 60% medium grained SAND; 40% subangular GRAVEL up to 1-inch; moist</td>
<td></td>
</tr>
<tr>
<td>-2326</td>
<td>SANDY LEAN CLAY (CL); very stiff; brown (10YR 1/3); low plasticity FINES; fine to medium grained SAND; subangular GRAVEL up to 2-inches; moist</td>
<td></td>
</tr>
<tr>
<td>-2324</td>
<td>Becomes dark yellowish brown (10YR 4/4); dry to moist</td>
<td></td>
</tr>
<tr>
<td>-2322</td>
<td>LEAN CLAY with GRAVEL (CL); stiff; brown (10YR 4/3); 75% medium plasticity FINES; 15% subangular to subrounded GRAVEL up to 3/4-inch; 10% fine grained SAND; moist; with rootlets</td>
<td></td>
</tr>
<tr>
<td>-2320</td>
<td>ALLUVIUM</td>
<td></td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- Start 8:30 9/26/2018 hand auger 0-5ft.  
- Pocket Pen = 3.5 tsf  
- Hollow stem auger 5-7.5 ft.  
- 3.5 in; S=7%; S=25%; F=68%; pp = 1.5 tsf  
- Advance 4.5-inch casing to 7.5 ft.; switch to HQ coring at 7.5 ft. with wireline diamond bit  
- pp = 1.5 tsf
**LOG OF SOIL AND CORE BORING B-05**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R. Q. D. %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
<th>FIELD NOTES AND TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1</td>
<td>20</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td>COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3) --ALLUVIUM--(continued)</td>
<td>60-75% drill fluid return</td>
</tr>
<tr>
<td>-2328</td>
<td>2</td>
<td>20</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td>Basalt BOULDER; greyish red (5RP 4/2); slightly weathered; strong</td>
<td>1112</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>40</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td>COBBLES and GRAVELS in a washed-out CLAY matrix; very dark grey (10YR 3/1)</td>
<td>1115</td>
</tr>
<tr>
<td>-2326</td>
<td>3</td>
<td>40</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td>Basalt BOULDER and BOULDERS are non vesiculated to vesiculated with vesicles up to 1/2-inch</td>
<td>[24]</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>50</td>
<td>NA</td>
<td>NA</td>
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<td>UCS = 14975 psi</td>
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<td>[60]</td>
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<td>[20]</td>
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**PROJECT:** Klamath River Renewal Project  
**PROJECT LOCATION:** Copco and Iron Gate Reservoirs  
**PROJECT NUMBER:** 60537920  
**REPORT:** GEO_CORE+SOIL_NO PACK_WITH LITH; **FILE:** KLAMATH_MASTER.GPJ; **DATE:** 6/20/2019
<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Rock Core</th>
<th>Soil Samples</th>
<th>Field Notes and Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run No.</td>
<td>Box No.</td>
<td>Number</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3) --ALLUVIUM-- (continued)
**Log of Soil and Core Boring B-05**

**Sheet 4 of 4**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

**Elevation, feet, Depth, feet**

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td></td>
<td>57</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td>COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3) --ALLUVIUM--(continued)</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>65</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 50.0 FEET**

---

**Field Notes and Test Results**

- Fluid return: 0%
- Bit blocked off during run

---

**SOIL SAMPLES**

- **Type:**
- **Number:**
- **Recovery, %:**
- **Blows / 6 in.:**
- **Drill Time (Rate, 10/hr):**

---

**Report:** GEO_CORE+SOIL_No PACK_WITH LITH; **File:** KLAMATH_MASTER.GPJ; 6/20/2019 B-05
### Log of Soil and Core Boring B-06

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Drilling Method</th>
<th>Logged By</th>
<th>Reviewed By</th>
<th>Total Depth of Borehole</th>
<th>Drilling Rig Type</th>
<th>Drilling Contractor</th>
<th>NAVD 88 Ground Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/8/2018-10/9/2018</td>
<td>Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core</td>
<td>P. Respess</td>
<td>B. Aldridge</td>
<td>56.9 feet</td>
<td>Truck Mounted Mobile B-53</td>
<td>Gregg Drilling</td>
<td>2339 feet</td>
</tr>
</tbody>
</table>

**Groundwater Level:** 13.7 feet below ground surface  
**Borehole Backfill:** Cement grout to ground surface

### Registry

#### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>-2338</td>
<td>0</td>
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<td>-2336</td>
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<td>-2334</td>
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<td>-2332</td>
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<td>-2330</td>
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<tr>
<td>-2328</td>
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</tr>
<tr>
<td>-2326</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

#### MATERIAL DESCRIPTION

- **SANDY LEAN CLAY (CL):** stiff; yellowish brown; >50% medium plasticity FINES; fine to coarse grained SAND; GRAVEL up to 2-inches; dry to moist
- **--FILL--**
- **SILTY SAND (SM):** loose; brownish grey; fine to medium grained SAND; little coarse grained SAND and wood fragments; wet
- **--ALLUVIUM--**

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time, Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-01</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>S-02</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

#### FIELD NOTES AND TEST RESULTS

- **Start 9:10 10/8/2018; hollow stem auger 0-16.5 ft.**
- **S-01 One liner retained (5-5.5 ft.)**
- **S-02 One liner retained (10.5-11 ft.)**
- **SA: S=75%; F=25%**
- **Smother drilling at 9.0 ft.**
- **S-01 One liner retained (5-5.5 ft.)**
- **S-02 One liner retained (10.5-11 ft.)**
- **SA: S=75%; F=25%**
SILTY SAND (SM); loose; brownish grey; fine to medium grained SAND; little coarse grained SAND and wood fragments; wet

POORLY GRADED GRAVEL (GP); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet

BOULDER

CLAY, yellowish brown

BOULDER

CLAY, reddish brown

Logged from cuttings

30-60% Fluid return (higher in boulders)

Switch to rotary wash drilling with 3 7/8-inch tricone bit; advance 4.5-inch casing to 19 ft.

S-03 One liner retained (16-16.5 ft.)
## Log of Soil and Core Boring B-06

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  

### Sheet 3 of 4

#### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
</table>

- 2294
- 2296
- 2298
- 2300
- 2302
- 2304
- 2306
- 2308

**MATERIAL DESCRIPTION**

CLAYEY GRAVEL with SAND (GC); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet

---

#### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
</table>

- S-04 One liner retained (31-31.5 ft.)  
  - SA: G=63%; S=22%; F=25%  
  - Advance 4.5-inch casing to 30 ft.

- S-05 One liner retained (41-41.4 ft.)  
  - Advance 4.5-inch casing to 40 ft.

#### FIELD NOTES AND TEST RESULTS

- On boulder; no drive sample attempted
- Total fluid loss at 44 ft. (0% fluid return)
### MATERIAL DESCRIPTION

- **POORLY GRADED GRAVEL (GP):** medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet
  - *ALLUVIUM*—

- **VOLCANIC SILTSTONE/CLAYSTONE:** olive grey; moderately to highly weathered; weak; thinly laminated
  - *TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—*

- **VOLCANIC SILTY SANDSTONE:** light yellowish brown; highly to moderately weathered; fine to medium grained; becomes bluish grey at 51.5ft.

- **BASALT:** slightly weathered; moderately strong
  - *TERTIARY to QUATERNARY INTRUSIVE BASALT—*

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45–46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 46–51      | POORLY GRADED GRAVEL (GP) | medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet
| 51–56      | VOLCANIC SILTSTONE/CLAYSTONE | olive grey; moderately to highly weathered; weak; thinly laminated
| 56–61      | BASALT | slightly weathered; moderately strong

### FIELD NOTES AND TEST RESULTS

- **S-06 One liner retained (46-46.5ft.):**
  - **SA:** G=93%; S=7%
  - Advance 4.5-inch casing to 45ft.

- **S-07 Two liner retained (50.5-51.0 ft.):**
  - **51.0-51.5ft.:**
    - Formation pressurized; fluid continued to flow from hole after pump stopped; advanced 4.5-inch casing to 55ft; reddish brown clayey cuttings at 55.4-56.6 ft.
  - **52ft.:**
    - Switch to HQ-3 rock core at 52ft.

- **TOTAL DEPTH = 56.9 FEET**
### Log of Soil and Core Boring B-07

**Sheet 1 of 3**

**Project**: Klamath River Renewal Project  
**Project Location**: Copco and Iron Gate Reservoirs  
**Project Number**: 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>10/4/2018-10/5/2018</th>
<th>Logged By</th>
<th>B. Kozlowicz</th>
<th>Reviewed By</th>
<th>B. Aldridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling Method</td>
<td>Hollow Stem Auger, HQ-3 Rock Core</td>
<td>Drill Bit Size/Type</td>
<td>6-inch flight auger, 3 7/8-inch diamond core bit</td>
<td>Total Depth of Borehole</td>
<td>31.8 feet</td>
</tr>
<tr>
<td>Drill Rig Type</td>
<td>Truck Mounted Mobile B-53</td>
<td>Drilling Contractor</td>
<td>Gregg Drilling</td>
<td>NAVD 88 Ground Surface Elevation</td>
<td>2338 feet</td>
</tr>
<tr>
<td>Groundwater Level</td>
<td>Not encountered before rotary wash drilling</td>
<td>Sampling Methods</td>
<td>2.5-inch ID ModCal, HQ Core Barrel</td>
<td>Hammer Data</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
</tr>
<tr>
<td>Borehole Backfill</td>
<td>Cement grout to ground surface</td>
<td>Borehole Location</td>
<td>Jenny Creek</td>
<td>Coordinate Location</td>
<td>N 2603568 E 6453234</td>
</tr>
</tbody>
</table>

**SOIL SAMPLING**

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>POORLY GRADED SAND with GRAVEL (SP); loose to medium dense; light olive brown (2.5Y 5/3); 60% fine to medium grained SAND; 35% angular GRAVEL up to 2-inches; 5% no plasticity FINES; dry</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>VOLCANIC SANDSTONE; grey; fine grained; moderately weathered</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>VOLCANIC SANDSTONE BOULDER; dark grey; slightly weathered; very strong; fine to medium grained</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**Drill Rig Type**

- **6-inch flight auger, 3 7/8-inch diamond core bit**

**Groundwater Level**

- Not encountered before rotary wash drilling

**Drill Rig Type**

- Truck Mounted Mobile B-53

**Sampling Methods**

- 2.5-inch ID ModCal, HQ Core Barrel

**Drill Bit**

- 6-inch flight auger, 3 7/8-inch diamond core bit

**Borehole Location**

- Jenny Creek

**Coordinate Location**

- N 2603568 E 6453234

**FIELD NOTES AND TEST RESULTS**

- Start 15:00 10/4/2018
- Hand auger 0-4.5ft.
- Hollow stem auger 5-7ft.
- Hard rocky drilling 6-7ft; auger refusal at 7ft. Advance 4.5-inch casing to 6.5ft. Switch to HQ coring at 7ft. with wireline diamond bit; runs 1 and 2 not retained
- End of day 10/4/2018
- Begin day 10/5/2018
- Advance 4.5-inch casing to 9ft.
- 0% Fluid Return
### Material Description

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation, feet</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2324</td>
<td>13</td>
<td>CLAYEY GRAVEL with SAND (GC); dark yellowish to olive brown; subangular to subrounded GRAVEL up to 1.5-inches</td>
<td>ROCKY FILL/ALLUVIUM?--</td>
</tr>
<tr>
<td>2322</td>
<td>16</td>
<td>SILTY SAND (SM); medium dense; very dark grey (10YR 3/1); 80% fine grained SAND; 20% no to low plasticity FINES</td>
<td>ALLUVIUM--</td>
</tr>
<tr>
<td>2320</td>
<td>18</td>
<td>VOLCANIC CLAYSTONE; dusky red (10R 3/3); highly weathered; very weak</td>
<td>TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--</td>
</tr>
<tr>
<td>2318</td>
<td>20</td>
<td>VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained</td>
<td>Volcanic Sandstone</td>
</tr>
<tr>
<td>2316</td>
<td>22</td>
<td>VOLCANIC SANDSTONE with SAND (GC); dark reddish brown to olive brown; subangular to subrounded GRAVEL up to 1.5-inches</td>
<td>ROCKY FILL/ALLUVIUM?--</td>
</tr>
<tr>
<td>2314</td>
<td>24</td>
<td>VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained</td>
<td>Volcanic Sandstone</td>
</tr>
<tr>
<td>2312</td>
<td>26</td>
<td>VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained</td>
<td>Volcanic Sandstone</td>
</tr>
<tr>
<td>2310</td>
<td>28</td>
<td>VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained</td>
<td>Volcanic Sandstone</td>
</tr>
</tbody>
</table>

### Soil Samples

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation, feet</th>
<th>Number</th>
<th>Recovery, %</th>
<th>Field Notes and Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2324</td>
<td>13</td>
<td>0</td>
<td>NA</td>
<td>Continued 0% Fluid Return</td>
</tr>
<tr>
<td>2322</td>
<td>16</td>
<td>9</td>
<td>8037</td>
<td>SA: G=4%; S=55%; F=41%</td>
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<tr>
<td>2320</td>
<td>18</td>
<td>30/5</td>
<td>0859</td>
<td>[20]</td>
</tr>
<tr>
<td>2318</td>
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<td>1106</td>
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<tr>
<td>2310</td>
<td>28</td>
<td>1119</td>
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</tr>
</tbody>
</table>

*Rock does not meet soundness criteria for RQD calculation*
**Log of Soil and Core Boring B-07**

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2308</td>
<td>6</td>
<td>1</td>
<td>100</td>
<td>3</td>
<td>16*</td>
<td></td>
<td></td>
<td>VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained, TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --(continued)</td>
</tr>
<tr>
<td>-2306</td>
<td>3</td>
<td>4</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shoe disturbed</td>
</tr>
<tr>
<td>-2304</td>
<td>2308-31</td>
<td>313233</td>
<td>343536373839404142434445</td>
<td>16*</td>
<td></td>
<td></td>
<td></td>
<td>TOTAL DEPTH = 31.8 FEET</td>
</tr>
</tbody>
</table>

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, 10/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>[16]</td>
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</tr>
</tbody>
</table>

### FIELD NOTES AND TEST RESULTS

- Project Number: 60537920
- Project Location: Copco and Iron Gate Reservoirs
- Project: Klamath River Renewal Project
- Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019, B-07
Start 11:30
10/16/2018; hollow stem auger 0-3ft.

Switch to rotary wash drilling at 3ft.

Advance 4.5-inch casing to 10ft.
### Log of Soil and Core Boring B-08

**Project:** Klamath River Renewal Project  
**Location:** Copco and Iron Gate Reservoirs  
**Number:** 60537920

#### Sheet 2 of 4

**ROCK CORE**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
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<tbody>
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</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- **GRAVELY FAT CLAY with SAND (CH):** very stiff, olive brown; medium to high plasticity FINES; trace fine grained SAND; occasional fine to coarse GRAVEL; wet

- **Ricky layer:**
  - Becomes greyish green

- **SILT with SAND (ML):** very soft, olive brown; low plasticity FINES; trace fine to coarse grained SAND; occasional fine GRAVEL; wet

- **ROCKY layer:**
  - POORLY GRADED GRAVEL with SAND (GP) to POORLY GRADED SAND with GRAVEL (SP); dense; brown; fine to medium, locally coarse grained SAND; fine to coarse GRAVEL; wet

- **VOLCANIC CONGLOMERATE:** medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01</td>
<td>4</td>
<td>7</td>
<td>13</td>
<td>LL = 69; PL=22</td>
</tr>
<tr>
<td>S02</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>S-02 advanced with weight of hammer to 8-inches then pushed to 18-inches with 100 psi without liners SA: G=6%; S=12%; F=80%</td>
</tr>
<tr>
<td>S03</td>
<td>3</td>
<td>3</td>
<td></td>
<td>Advance 4.5-inch casing to 20ft, bluish grey cuttings; S-03 driven without liners</td>
</tr>
<tr>
<td>S04</td>
<td>50/5</td>
<td></td>
<td></td>
<td>Driller notes smooth drilling below 23.5ft.</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- Rig chatter with greyish green cuttings
- Advance 4.5-inch casing to 25ft.
- Basalt chip in cuttings; steady drilling

---

**Report** GEO_CORE+SOIL_NO PACK WITH LITH; **File:** KLAMATH_MASTER.GPJ; 6/20/2019 B-08
### Log of Soil and Core Boring B-08

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

#### VOLCANIC CONGLOMERATE:
- Medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures
- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)

#### VOLCANIC SANDSTONE:
- Light to medium grey; slightly weathered to fresh; moderately strong; highly fractured; fine grained with angular, white clasts up to 5 mm

---

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D, %</th>
<th>Fracture Drawing</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>34</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>89</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>36</td>
<td>35</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>89</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>37</td>
<td>36</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>89</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>38</td>
<td>37</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>89</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>39</td>
<td>38</td>
<td>2</td>
<td>100</td>
<td>1</td>
<td>95</td>
<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>40</td>
<td>39</td>
<td>2</td>
<td>100</td>
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<td>95</td>
<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
<tr>
<td>41</td>
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<td>95</td>
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<td>R.O.L.</td>
</tr>
<tr>
<td>42</td>
<td>41</td>
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<td>100</td>
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<td>95</td>
<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
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<tr>
<td>43</td>
<td>42</td>
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<td>100</td>
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<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
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<td>44</td>
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<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
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<tr>
<td>45</td>
<td>44</td>
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<td>1</td>
<td>95</td>
<td>95</td>
<td>NA</td>
<td>R.O.L.</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

1. **Switch to HQ-3 rock coring at 35ft.**

2. **B-08**

---

**Report:** GEO_CORE+SOIL_NO PACK_WITH LITH  
**FILE:** KLAMATH_MASTER.GPJ  
**6/20/2019**
**MATERIAL DESCRIPTION**

**ROCK CORE**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2148</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td>70</td>
<td>2</td>
<td>VOLCANIC SANDSTONE; light to medium grey; slightly weathered to fresh; moderately strong; highly fractured; fine grained with angular, white clasts up to 5 mm —TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)</td>
</tr>
<tr>
<td>-2146</td>
<td>2</td>
<td>2</td>
<td>50</td>
<td>1</td>
<td>60</td>
<td>1</td>
<td>1: 5-15, J, VN-N, C, Pa, Wa, SR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2: 60, J, Vn, Ch/Cl, Fi, Pl, Sr</td>
</tr>
<tr>
<td>-2144</td>
<td>4</td>
<td>3</td>
<td>100</td>
<td>4</td>
<td>42</td>
<td>6</td>
<td>VOLCANIC CONGLOMERATE</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>4: 30, J, Vn, Qz, Pa/Su, Pl-Wa, S-SR</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>6: 60, J, Vn, Qz, Sa, Pa, Pl, S</td>
</tr>
<tr>
<td>-2142</td>
<td>3</td>
<td>1</td>
<td>NA</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td>VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures</td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 52.8 FEET**

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, 1/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- UCS = 15268 psi
**LOG OF SOIL AND CORE BORING B-10**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

**Date(s) Drilled:** 10/17/2018-10/18/2018  
**Logged By:** P. Respess  
**Reviewed By:** B. Aldridge

**Drilling Method:** Rotary Wash, HQ-3 Rock Core  
**Drill Bit Size/Type:** 3 7/8-inch tricone; 3 7/8-inch diamond HQ bit

**Drill Rig Type:** Truck Mounted Mobile B-53  
**Drilling Contractor:** Gregg Drilling

**Groundwater Level:** Not encountered before rotary wash drilling

**Borehole Location:** Lakeview Bridge  
**Coordinate Location:** N 2587076 E 6441583

**Total Depth of Borehole:** 52.2 feet  
**Total Depth of Borehole Elevation:** 2194 feet

**Hammer Data:** Automatic hammer; 140 lbs, 30-inch drop

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2192</td>
<td>0</td>
<td>POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry</td>
</tr>
<tr>
<td>-2190</td>
<td>2</td>
<td>CLAYEY SAND (SC); medium dense; reddish brown; fine to coarse grained SAND; medium to high plasticity FINES; trace to some GRAVEL; moist</td>
</tr>
<tr>
<td>-2188</td>
<td>4</td>
<td>POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry</td>
</tr>
<tr>
<td>-2186</td>
<td>6</td>
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</tr>
<tr>
<td>-2184</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>-2182</td>
<td>10</td>
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<td>-2180</td>
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<td>-2178</td>
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<td>-2176</td>
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<tr>
<td>-2174</td>
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<td>-2172</td>
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<td>-2170</td>
<td>22</td>
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<td>-2168</td>
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<td>-2166</td>
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<td>-2164</td>
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<tr>
<td>-2162</td>
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<td>-2160</td>
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<td>-2156</td>
<td>36</td>
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<td>-2150</td>
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<td>-2148</td>
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</tr>
<tr>
<td>-2146</td>
<td>46</td>
<td></td>
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<td>-2144</td>
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<td>-2142</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>-2140</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

---

**FIELD NOTES AND TEST RESULTS**

Start 10:10  
10/17/2018; rotary wash drilling 0-29.5

Too cobbly for drive sample at 10ft.
POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry

--FILL-- (continued)

VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented

--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--

Advance 4.5-inch casing to 23.5 ft.

S-02 bagged
VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented—TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)

1: 60, J, VN, No, No, Pl, S
2: 10, J, VN, Qz, Sp, Pl, S
3: 40, J, VN, Fe, St, Pl, S

VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm

1: 35, J, VN, No, No, Pl-Wa, SR
2: 45, J, VN, Fe, St, Wa, S-SR

SOIL SAMPLES

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-30</td>
<td>VOLCANIC CONGLOMERATE</td>
</tr>
<tr>
<td>30-31</td>
<td>VOLCANIC SANDSTONE</td>
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<td>VOLCANIC SANDSTONE</td>
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<td>34-35</td>
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<td>39-40</td>
<td>VOLCANIC SANDSTONE</td>
</tr>
<tr>
<td>40-41</td>
<td>VOLCANIC SANDSTONE</td>
</tr>
<tr>
<td>41-42</td>
<td>VOLCANIC SANDSTONE</td>
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<td>42-43</td>
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<td>VOLCANIC SANDSTONE</td>
</tr>
<tr>
<td>44-45</td>
<td>VOLCANIC SANDSTONE</td>
</tr>
</tbody>
</table>

FIELD NOTES AND TEST RESULTS

1305 Switch to HQ-3 rock coring at 29.5 ft.
1315
1335
1341
1355 Driller reports hard drilling at 33.4 ft.

END OF DAY 10/17/2018
BEGIN DAY 10/18/2018
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2148</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>m</td>
<td>m</td>
<td>1</td>
<td>VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)</td>
</tr>
<tr>
<td>-2146</td>
<td>1</td>
<td></td>
<td>5</td>
<td>m</td>
<td>m</td>
<td>1</td>
<td>4: 20, J, T, No, No, Pl, S 5: 60, J, N, Fe, St, Wa-St, SR-R</td>
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<td>71</td>
<td>m</td>
<td>m</td>
<td>2</td>
<td>1: 85-90, J, T, H-Uk, Pl-Wa, SR 2: 50, J, N, Fe, St, Wa, SR 3: 60, J, N-MW, Fe, St, Pl-Wa, SR 4: 60, J, VN, Fe, St, Pl-Wa, SR 5: 50, J, VN, Fe, St, Wa, SR 6: 10, J, VN-N, Fe, St, Pl, SR</td>
</tr>
<tr>
<td>-2142</td>
<td>NA</td>
<td></td>
<td></td>
<td>m</td>
<td>m</td>
<td>3</td>
<td>VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm</td>
</tr>
<tr>
<td>-2140</td>
<td></td>
<td></td>
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<td>m</td>
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<td>3</td>
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<td>m</td>
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**TOTAL DEPTH = 52.2 FEET**
**Log of Core Boring B-13**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2494</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1-inch ASPHALT</td>
</tr>
<tr>
<td>-2492</td>
<td>1</td>
<td>NA</td>
<td>60</td>
<td>0</td>
<td>&gt;6</td>
<td></td>
<td>WELL GRADED SAND with GRAVEL (SW); medium dense to dense; dark yellowish brown (10YR 4/4); fine to coarse grained SAND; angular to rounded GRAVEL up to 2-inches</td>
</tr>
<tr>
<td>-2490</td>
<td>2</td>
<td>28</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>BASALT; very dark grey to black; slightly to moderately weathered; strong; highly fractured with iron staining along fracture surfaces; porphyritic; vesicular; with plagioclase phenocrysts up to 1/4-inch and irregular vesicles up to 1/2-inch</td>
</tr>
<tr>
<td>-2488</td>
<td></td>
<td>NA</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>--ROAD BASE--</td>
</tr>
<tr>
<td>-2486</td>
<td>3</td>
<td>66</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>Becomes dark yellowish brown, locally highly weathered with CLAYEY SAND, with rootlets</td>
</tr>
<tr>
<td>-2484</td>
<td></td>
<td>NA</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>Becomes highly to locally completely weathered to a CLAYEY SANDY/CLAYY CLAY with trace small gravel and strong, slightly weathered corestones of BASALT</td>
</tr>
<tr>
<td>-2482</td>
<td>4</td>
<td>68</td>
<td>19</td>
<td></td>
<td>&gt;6</td>
<td></td>
<td>CLAYEY SAND/SANDY CLAY</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND OTHER TESTS**

- Start 12:00 10/3/2018 hand auger 0-3.5ft.
- Auger refusal at 3.5ft.; switch to HQ rock coring with 3-3/4-inch diamond bit 0% fluid return
- Bentonite cement grout to ground surface 2494 feet
- Inclination from Horizontal/True North Bearing Vertical

---

**Report:** GEO_CORE_OAK_C  
**File:** KLAMATH_MASTER.GPJ  
**Date:** 6/20/2019  
**Sheet:** 1 of 2
BASALT; very dark grey to black; slightly to locally completely weathered; strong; highly to intensely fractured; porphyritic; vesicular; with plagioclase phenocrysts up to 2/5-inches and irregular vesicles up to 1/2-inch; fractures are wide and infilled with CLAYEY SAND/SANDY CLAY and small GRAVEL--TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)

TOTAL DEPTH = 21.1 FEET

FIELD NOTES AND OTHER TESTS

FILE: GEO_CORE_OAK_C;   File: KLAMATH_MASTER.GPJ;   6/20/2019   B-13
**Log of Soil and Core Boring B-14**

**Sheet 1 of 2**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Reviewed By</th>
<th>Drilling Method</th>
<th>Drill Rig Type</th>
<th>Groundwater Level</th>
<th>Sampling Methods</th>
<th>Total Depth of Borehole</th>
<th>NAVD 88 Ground Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/4/2018</td>
<td>B. Kozlowicz</td>
<td>B. Aldridge</td>
<td>HQ-3 Rock Core</td>
<td>Truck Mounted Mobile B-53</td>
<td>Not encountered before HQ rock coring</td>
<td>2.5-inch ID ModCal, HQ Core Barrel</td>
<td>28.6 feet</td>
<td>2494 feet</td>
</tr>
</tbody>
</table>

**Drill Rig**
- Type: Truck Mounted Mobile B-53
- Drilling Contractor: Gregg Drilling

**Groundwater Level**
- Not encountered before HQ rock coring
- Hammer: Automatic hammer; 140 lbs, 30-inch drop

**Backfill**
- Bentonite cement grout to ground surface
- Borehole Location: Fall Creek
- Coordinate Location: N 2606321 E 6463161

---

### ROCK CORE

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2494</td>
<td></td>
<td></td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td></td>
<td>-ROAD FILL-</td>
</tr>
<tr>
<td>-2492</td>
<td>1</td>
<td>12</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td>WELL GRADED GRAVEL with SAND (GW); loose to medium dense; dark yellowish brown (10YR 4/4); angular to subangular GRAVEL up to 3-inches; fine to coarse grained SAND; trace no plasticity FINES</td>
</tr>
<tr>
<td>-2490</td>
<td></td>
<td></td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td></td>
<td>SANDY LEAN CLAY (CL); stiff; very dark brown (7.5YR 2.5/3); 60% low plasticity FINES; 40% fine to medium grained SAND; trace angular, coarse grained SAND; trace fine GRAVEL</td>
</tr>
<tr>
<td>-2488</td>
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<td>40</td>
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<td>NA</td>
<td>NA</td>
<td></td>
<td>-ALLUVIUM/COALLUVIUM?-</td>
</tr>
<tr>
<td>-2486</td>
<td>3</td>
<td>60</td>
<td>25</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td>COBBLES and BOULDERS with CLAYEY SAND and GRAVEL; dark greenish grey and olive to reddish brown; slightly weathered, moderately strong volcanic sandstone COBBLES</td>
</tr>
<tr>
<td>-2484</td>
<td>4</td>
<td>7</td>
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<td>NA</td>
<td>NA</td>
<td></td>
<td>-CHANNEL ALLUVIUM-</td>
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<tr>
<td>-2482</td>
<td>5</td>
<td>0</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td></td>
<td>COBBLES and BOULDERS become dusky red, fine grained, slightly weathered, very intrusive volcanic</td>
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</tbody>
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### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
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<td>8</td>
<td>17</td>
<td>60</td>
<td>10</td>
<td>S-01</td>
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<td>FAT CLAY with SAND (CH); very stiff; dark brown (7.5YR 3/3); medium plasticity FINES; fine to medium SAND; rare angular GRAVEL</td>
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<td>-ROAD FILL-</td>
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<td>-ROAD FILL-</td>
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<td>NA</td>
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<td>-ROAD FILL-</td>
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<td>0</td>
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<td>-ROAD FILL-</td>
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<td>-2482</td>
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<td>NA</td>
<td>0</td>
<td>NA</td>
<td></td>
<td>-ROAD FILL-</td>
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</tbody>
</table>

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### FIELD NOTES AND TEST RESULTS

- Start 9:00 10/4/2018 hand auger 0-2ft.
- Auger refusal at 2.3ft.; switch to HQ rock coring with 3 3/4-inch diamond bit
- Run 1 bagged
- Two liners retained
- 80-100% fluid return
- Coarse grained SAND in cuttings

---

**Report: GEO_CORE+SOIL_NO PACK_WITH LITH;   File: KLAMATH_MASTER.GPJ;   6/20/2019   B-14**
## Log of Soil and Core Boring B-14

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>0</td>
<td><strong>PORPHYRITIC ANDESITE;</strong> very dark greyish brown (10YR 3/2); highly weathered; very weak; locally friable; with steeply dipping vein infilled with very pale yellow, fine grained SAND --TERTIARY VOLCANICS, undifferentiated--</td>
</tr>
<tr>
<td>-2480</td>
<td>14</td>
<td>Becomes dark reddish brown and very pale yellow, weak to extremely weak, highly to completely altered; with irregular chlorite alteration and vitreous quartz crystals up to 1/4-inch</td>
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<td>-2478</td>
<td>16</td>
<td>NA</td>
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<tr>
<td>-2476</td>
<td>18</td>
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<tr>
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<tr>
<td>-2472</td>
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<tr>
<td>-2470</td>
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<tr>
<td>-2464</td>
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**TOTAL DEPTH = 28.6 FEET**
### MATERIAL DESCRIPTION

<table>
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<tr>
<th>Depth, feet</th>
<th>Lithology</th>
<th>Description</th>
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<tbody>
<tr>
<td>-2344</td>
<td>SANDY LEAN CLAY with GRAVEL (CL); very stiff; moist; dark brown (10yr3/3); 20% subrounded to rounded GRAVEL to 3/4&quot;; 20% fine- to medium-grained SAND; 60% medium plasticity FINES</td>
<td></td>
</tr>
<tr>
<td>-2336</td>
<td>CLAYEY GRAVEL with SAND (SC); very dense; moist; yellowish brown to dark brown; interbedded layers of gravel with clay and sand</td>
<td></td>
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</table>

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
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</thead>
<tbody>
<tr>
<td>-2344</td>
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<td>-2336</td>
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</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- Fill estimate based on height of slope embankment
- Fill estimate based on height of slope embankment
- p = 3.0 t/sf
### Log of Soil and Core Boring B-15

**Project Number:** 60537920  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project:** Klamath River Renewal Project

#### Sheet 2 of 4

#### Rock Core

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
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</thead>
<tbody>
<tr>
<td>-2330</td>
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<td>1 1</td>
<td>NA</td>
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<td>0</td>
<td>16</td>
<td>3</td>
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<tr>
<td>-2328</td>
<td>16</td>
<td>2 2</td>
<td>NA</td>
<td>0</td>
<td>0</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>-2326</td>
<td>18</td>
<td>3</td>
<td>71</td>
<td>27*</td>
<td>0</td>
<td>61</td>
<td>5</td>
</tr>
<tr>
<td>-2324</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-2322</td>
<td>22</td>
<td>1</td>
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<td></td>
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<tr>
<td>-2320</td>
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<td>-2318</td>
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</table>

#### Soil Samples

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time [Rate, ft/hr]</th>
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</thead>
<tbody>
<tr>
<td>-2330</td>
<td>16</td>
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<td>78</td>
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<tr>
<td>-2328</td>
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</tr>
<tr>
<td>-2326</td>
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<td></td>
<td></td>
</tr>
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<td>-2324</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-2322</td>
<td>40</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-2320</td>
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<tr>
<td>-2318</td>
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</tr>
<tr>
<td>-2316</td>
<td>100</td>
<td></td>
<td></td>
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</tbody>
</table>

#### Field Notes and Test Results

- **SA:** G=42%; S=27%; F=31%
- **Rig chatter**
- **End of day 1/22/2019**
- **Begin day 1/23/2019:** AM water level=11.7’ bgs
- **Switch to HQ rock core**

---

**Material Description**

- **CLAYEY GRAVEL with SAND (SC);** very dense; moist; yellowish brown to dark brown; interbedded layers of gravel with clay and sand
- **BASALT BOULDERS and COBBLES in SAND & GRAVEL matrix;** medium dark gray (N4) to dark gray (N3), strong, some boulders are scoriaceous, matrix washed out

---

**SOIL SAMPLES**

- **Depth, feet**
- **Lithology**
- **MATERIAL  DESCRIPTION**
- **Run No.**
- **Box No.**
- **Recovery, %**
- **Fractures per Foot**
- **R Q D, %**
- **Fracture Drawing Number**

---

**LOG OF SOIL AND CORE BORING B-15**

---

**REPORT GEO_Core_SOIL_NO PACK WITH LITH; KLAMATH_MASTER.GPJ; 6/20/2019 B-15**
**Log of Soil and Core Boring B-15**

**Project**: Klamath River Renewal Project  
**Project Location**: Copco and Iron Gate Reservoirs  
**Project Number**: 60537920

---

### Field Notes and Test Results

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Soil Samples</th>
<th>Recovery, %</th>
<th>Blows / 6 in.</th>
<th>R Q D, %</th>
<th>Drill Time (Rate, ft/hr)</th>
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</thead>
<tbody>
<tr>
<td>29</td>
<td>-2314</td>
<td>3</td>
<td>1</td>
<td>VOLCANICLASTIC BRECCIA; light olive gray (5Y5/2); moderately weathered; weak; highly to intensely fractured; angular clasts to 1/2&quot;</td>
<td>71</td>
<td>5</td>
<td>-</td>
<td>10000</td>
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<tr>
<td></td>
<td>-2312</td>
<td>3</td>
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<td>Becomes grayish blue-green (5BG5/2); slightly weathered; moderately strong</td>
<td>6</td>
<td>0</td>
<td>-</td>
<td>1008</td>
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<tr>
<td></td>
<td>-2310</td>
<td>4</td>
<td>1</td>
<td>Becomes slightly fractured</td>
<td>100</td>
<td>82</td>
<td>-</td>
<td>1013</td>
</tr>
<tr>
<td></td>
<td>-2308</td>
<td>5</td>
<td>1</td>
<td>Becomes light olive gray (5Y5/2); moderately weathered; weak; highly fractured</td>
<td>5</td>
<td>96</td>
<td>-</td>
<td>1017</td>
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<tr>
<td></td>
<td>-2306</td>
<td>5</td>
<td>1</td>
<td>Becomes grayish blue-green (5BG5/2); slightly weathered</td>
<td>3</td>
<td>0</td>
<td>-</td>
<td>1013</td>
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<tr>
<td></td>
<td>-2304</td>
<td>2</td>
<td>1</td>
<td>Becomes moderately fractured</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2302</td>
<td>1</td>
<td>1</td>
<td>Becomes weak to very weak</td>
<td>6</td>
<td>100</td>
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<td></td>
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<td>ROCK CORE</td>
<td>6</td>
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<td>-</td>
<td>[43]</td>
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</table>

*Rock does not meet soundness criteria for RQD calculation*
### Log of Soil and Core Boring B-15

#### Project Information
- **Project:** Klamath River Renewal Project
- **Project Location:** Copco and Iron Gate Reservoirs
- **Project Number:** 60537920

#### Log Description

**Sheet 4 of 4**

#### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
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<td>VOLCANICLASTIC BRECCIA, grayish blue-green (5BG5/2); slightly weathered; weak to very weak; highly fractured; angular clasts to mostly 1/2&quot;, occasionally to 1.5&quot;) --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)</td>
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<td>4</td>
<td>72</td>
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<td>4</td>
<td>72</td>
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</tr>
</tbody>
</table>

**SOIL SAMPLES**

**FIELD NOTES AND TEST RESULTS**

TOTAL DEPTH = 51.5 FEET
Grout mix: 30 gallons of water, six 47# bags of cement, no bentonite
**Log of Soil and Core Boring B-16**

**Date(s) Drilled**: 1/12/2019  
**Logged By**: P. Respess  
**Checked By**: S. Janowski  
**Total Depth of Borehole**: 24.5 feet

**Drilling Method**: Rotary Wash, HQ-3 Rock Core  
**Drill Bit Size/Type**: 3-7/8-inch tricone, 3 3/4-inch diamond coring bit

**Drill Rig Type**: Barge Mounted CME-45  
**Drilling Contractor**: Taber Drilling  
**NAVD 88 Ground Surface Elevation**: 2319 feet

**Groundwater Level**: 12 feet above ground surface  
**Sampling Methods**: SPT, HQ Core Barrel  
**Automatic hammer; 140 lbs, 30-inch drop

**Borehole Backfill**: Bentonite cement grout to ground surface  
**Borehole Location**: 12' downstream of Daggett Road bridge  
**Coordinate Location**: N 2602237 E 6462573

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
<th>R Q D, %</th>
<th>Fractures per Foot</th>
<th>Recovery, %</th>
<th>Fracture Drawing</th>
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</thead>
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<tr>
<td>-2318</td>
<td>VOLCANICLASTIC BRECCIA; gray-green; completely weathered; extremely weak; fine-grained matrix; dark gray-black angular clasts up to 1/4&quot;-1/2&quot;; slightly fractured with widely-spaced natural fractures; numerous mechanical breaks --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --</td>
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**FIELD NOTES AND TEST RESULTS**

- **Drill Time [Rate, ft/hr]**: 1024, 1025, 1029
- **Recovery, %**: 3, 15, 1
- **Blows / 6 in.**: [90]
- **12' of water in river at time of drilling**
- **9" HWT casing driven to 14' (refusal) Tricone to 15' and continue with HQ core High Water Circulation Return (WCR)**
- **Borehole Location**: 12' downstream of Daggett Road bridge
- **Coordinate Location**: N 2602237 E 6462573
<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Lithology</th>
<th>Material Description</th>
<th>R Q D, %</th>
<th>Fractures per Foot</th>
<th>Recovery, %</th>
<th>Fracture Drawing Number</th>
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<tr>
<td>-2306</td>
<td>13</td>
<td>1</td>
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<td>VOLCANICLASTIC BRECCIA; gray-green; moderately to slightly weathered; moderately strong; slightly fractured; multi-colored clasts up to 2&quot;, numerous mechanical breaks.</td>
<td>▲ ▲ ▲</td>
<td>▲ ▲ ▲</td>
<td>▲ ▲ ▲</td>
<td>▲ ▲ ▲</td>
<td>became clasts up to 3-4&quot; at 13.8' — TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) — (continued)</td>
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<td>-2304</td>
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<td>▲ ▲ ▲</td>
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**TOTAL DEPTH = 24.5 FEET**

15 gallons of grout: 6 sack mix with 5% bentonite
**Log of Soil and Core Boring B-17**

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
<th>Total Depth of Borehole</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22/2019</td>
<td>S. Janowski</td>
<td>P. Respess</td>
<td>41.5 feet</td>
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</table>

**Drilling Method**
Solid Stem Auger, HQ-3 Rock Core
**Drill Rig Type**
Truck Mounted CME 75
**Groundwater Level**
Not encountered before HQ rock coring

**Groundwater Level**

**Borehole Backfill**
Cement grout to ground surface

**Borehole Location**
South end of Daggett Road Bridge

**Drill Rig Type**

**Drilling Method**

**Drill Rig Type**

**Tertiary Volcanics**

**Material Description**

**Rock Core**

**SOIL SAMPLES**

**FIELD NOTES AND TEST RESULTS**

**Gravelly Clay with Sand**
- stiff; moist; dark brown (7.5YR3/3); subangular to subrounded gravel to 1/2"; medium-grained sand; medium plasticity fines

**Sandy Gravel**
- very dense; moist; brown; subangular to subrounded gravel to 2.25"; medium- to coarse-grained sand

**Volcaniclastic Breccia**

**Driller adds water to facilitate advancement**
### MATERIAL DESCRIPTION

- **VOLCANICLASTIC BRECCIA**: greenish-gray (5G6/1); slightly weathered; moderately strong; slightly fractured; angular clasts to 1/2" in fine matrix
- **TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)** (continued)

---

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracture Drawing</th>
<th>Number</th>
<th>Lithology</th>
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### SOIL SAMPLES

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<tr>
<th>Depth, feet</th>
<th>Lithology</th>
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</thead>
<tbody>
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<td>Run No.</td>
<td>Box No.</td>
</tr>
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<tr>
<td>100</td>
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</table>

---

### FIELD NOTES AND TEST RESULTS

- UCS = 2130 psi
- Switch to HQ core
- Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-17
### Log of Soil and Core Boring B-17

**Project Number:** 60537920  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project:** Klamath River Renewal Project  

#### Sheet 3 of 3

**SOIL CORE**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Lithology</th>
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<tr>
<td>29</td>
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<td>0</td>
<td>0</td>
<td>100</td>
<td>VOLCANICLASTIC BRECCIA; greenish-gray (5G6/1); slightly weathered; moderately strong; slightly fractured; angular clasts to 1/2&quot; in fine matrix</td>
</tr>
<tr>
<td>30</td>
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<td>4</td>
<td></td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>-- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
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<tr>
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<td>0</td>
<td>Coarser clasts to 2&quot;</td>
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<td>Light brownish gray (5YR6/1); moderately weathered; weak; highly fractured</td>
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<tr>
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<td></td>
<td>5</td>
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<td>100</td>
<td>0</td>
<td>86</td>
<td>1: 60°, J/Sh, W, Ca+Mn+Fe, Pa+Su IR, VR-Slk (rough grooves)</td>
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<tr>
<td>-2304</td>
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<td>3</td>
<td>Abundant mechanical fractures</td>
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<td>6</td>
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**FIELD NOTES AND TEST RESULTS**

- **Drill Time (Rate, ft/hr):**
  - 1227
  - 1231
  - 1234
  - 1239
  - 1243

- **Total Depth:** 41.5 Feet

**SOIL SAMPLES**

- **Recovery, %**
  - [75]
  - [100]
  - [75]

- **Type, Number, Blows / 6 in., Recovery, %, Drill Time (Rate, ft/hr):**
  - 60°, J/Sh, W, Ca+Mn+Fe, Pa+Su IR, VR-Slk (rough grooves)
  - Abundant mechanical fractures

**Total Depth = 41.5 Feet**

Grout mix: 20 gallons of water, five 47# bags of cement, no bentonite

- **UCS:** 2985 psi
**MATERIAL DESCRIPTION**

- **2.5-inches ASPHALT roadway**
  - **GRAVEL**
  - SANDY LEAN CLAY (CL); medium stiff to stiff; reddish brown; 80-90% medium plasticity FINES; 10-20% fine to coarse grained SAND; occasional GRAVEL and COBBLE
  - **FILL**

- **POORLY GRADED GRAVEL with SAND (GP); medium dense; varied dark grey with purple, red, and yellowish brown; fine to coarse grained SAND, COBBLES, and BOULDERS; fine to coarse grained SAND**
  - **FILL** (continued)

- **BOULDERS, basalt**

- **ALLUVIUM**

- **VOLCANIC SILTSTONE; reddish purple; slightly weathered to fresh; weak to moderately strong; very thinly laminated**
  - **TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS)**

**TOTAL DEPTH = 28.3 FEET**

**REMARKS AND OTHER TESTS**

- Start 10/11/2018; hollow stem auger 0-28ft.
- Smooth drilling
- Rig chatter
- Return to smooth drilling to 13ft.
- Rig chatter
- Driller indicates hard rock at 18ft.
- Driller indicates smooth, consistent drilling 22-25ft.
**Log of Soil and Core Boring B-19**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
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<tbody>
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<td>-2346</td>
<td>Sandwich asphalt road.</td>
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<td>-2344</td>
<td>Sandy lean clay (CL); medium stiff to stiff; reddish brown; 80-90% medium plasticity FINES; 10-20% fine to coarse grained SAND, occasional GRAVEL and COBBLE.</td>
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<tr>
<td>-2342</td>
<td>Sandy silt (ML); stiff; light reddish brown; non to medium plasticity FINES; fine to medium grained SAND.</td>
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<tr>
<td>-2340</td>
<td>Fat clay with SAND (CH); medium stiff; light reddish brown; high plasticity FINES; fine to medium grained SAND.</td>
</tr>
<tr>
<td>-2338</td>
<td>Gravel.</td>
</tr>
<tr>
<td>-2336</td>
<td>Gravel.</td>
</tr>
<tr>
<td>-2334</td>
<td>Gravel.</td>
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**FIELD NOTES AND TEST RESULTS**

- **Start Date**: 10/11/2018
- **Hollow stem auger 0-23ft.**

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>RQD, %</th>
<th>Drill Time (Rate, ft/hr)</th>
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</table>
POORLY GRADED GRAVEL with SAND (GP); medium dense; dark grey with some yellow brown; fine to coarse angular GRAVEL, COBBLES, and BOUDLERS; fine to coarse grained SAND; trace to little low plasticity FINES; moist to wet

SANDY SILT (ML); soft to medium stiff; dark grey; fine grained SAND; low plasticity FINES; trace GRAVEL; wet

CLAYEY GRAVEL with SAND (GC); medium dense; dark grey with some yellow brown; fine to coarse angular GRAVEL, COBBLES, and BOUDLERS; fine to coarse grained SAND; low plasticity FINES; moist to wet

ALLUVIUM

BOUDLER, basalt

VOLCANIC SILTY CLAYSTONE/SILTSTONE; reddish purple; slightly weathered; weak; very thinly laminated

--TERTIARY VOLCANICS (BOOGUS MOUNTAIN BEDS, undifferentiated)--
**Material Description**

- **Volcanic Silty Claystone/Siltstone**: reddish purple; slightly weathered; weak; very thinly laminated.
- Tertiary Volcanics (Bogus Mountain Beds, undifferentiated) -- (continued)
- Becomes weak to moderately strong

**Soil Samples**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Recovery, %</th>
<th>Blows / 6 in.</th>
<th>Drill Time (Rate, hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S05</td>
<td>50/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[8]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Field Notes and Test Results**

- Switch to HQ rock coring with 3 7/8-inch diamond bit; all breaks mechanical
- 0.7 ft. of core slipped out of core barrel; left in hole prior to grouting

---

**TOTAL DEPTH = 37.5 FEET**
Start 9:00
10/10/2018; hollow stem auger 0-28ft.

-2340
2.5-inches Aggregate base
POORLY GRADED GRAVEL (GP); dense; fine to coarse GRAVEL and COBBLES, little no plasticity FINES; moist

-2338
FAT CLAY (CH); medium stiff; brown; medium plasticity FINES; trace fine grained SAND; occasional GRAVEL and COBBLES; moist

-2332
SANDY LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; fine to coarse grained SAND; rare GRAVEL; moist

-2330
S-01 One liner retained (5.5-6ft.) LL=87; PL=24

-2328
S-02 One liner retained (10.5-11ft.) SA: G=3%; S=33%; F=64%
### Log of Soil and Core Boring B-20

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

#### Sheet 2 of 4

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Lithology</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>SANDY LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; fine to coarse grained SAND; rare GRAVEL; moist</td>
<td>--FILL--(continued)</td>
</tr>
<tr>
<td>14</td>
<td>SANDY CLAY to CLAYY SAND (CL-SC); medium stiff; olive brown; ~50% medium plasticity FINES; ~50% fine to coarse grained SAND and fine GRAVEL</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse grained SAND; fine to coarse GRAVEL with COBBLES and BOULDERS, wet</td>
<td>--ALLUVIUM--</td>
</tr>
<tr>
<td>16</td>
<td>CLAYEY SAND (SC); medium dense; fine to coarse grained SAND; fine GRAVEL with COBBLES and BOULDERS, wet</td>
<td>--ALLUVIUM--</td>
</tr>
<tr>
<td>20</td>
<td>BOULDER: 28-29.5 ft.</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>RUN No.</th>
<th>BOX No.</th>
<th>RECOVERY, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-03</td>
<td>8</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-04</td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-05</td>
<td>24</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- S-03 One liner retained (16-16.5 ft.)
- S-04 One liner retained (21-21.5 ft.) SA: G=14%; S=42%; F=44%
- S-05 One liner retained (26-26.5 ft.)

Switch to rotary wash drilling with 3 3/8-inch tricone bit at 28 ft.
BOULDER: 28-29.5 ft. --ALLUVIUM-- (continued)

POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse grained SAND; fine to coarse GRAVEL with COBBLES and BOULDERS

BASALT; dark grey; slightly weathered; moderately strong; with Fe staining around joints; chlorite and quartz infilling; numerous healed fractures

--TERTIARY to QUATERNARY INTRUSIVE BASALT--

FIELD NOTES AND TEST RESULTS

<table>
<thead>
<tr>
<th>SOIL SAMPLES</th>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery,%</th>
<th>Drill Time (Rate, ft/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Skip sample; rig behavior indicates gravel and cobbles

Switch to HQ rock coring with 3 7/8-inch diamond bit

UCS = 343 psi
**Log of Soil and Core Boring B-20**

**Elevation, feet**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>BASALT: dark grey; slightly weathered; moderately strong; with Fe staining around joints; chlorite and quartz infilling; numerous healed fractures --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)</td>
</tr>
<tr>
<td>46</td>
<td>2: 60, J, V, W (20mm), Ch, Fl, Wa, ?</td>
</tr>
<tr>
<td>47</td>
<td>3: 60, J, N, Ch, Sp, SR, ?</td>
</tr>
<tr>
<td>48</td>
<td>4: 70, J, VN, Ch, Sp, SR</td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 47.0 FEET**

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, 1hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1400</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

**UCS = 7517 psi**
**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  

---

**Log of Soil and Core Boring B-201**  
**Sheet 1 of 4**

**Date(s) Drilled:** 8/23/2018 - 8/24/2018  
**Logged By:** T. Vande Voorde  
**Checked By:** B. Kozlowicz/K. Zeiger

<table>
<thead>
<tr>
<th>Drilling Method</th>
<th>Drill Bit</th>
<th>Total Depth of Borehole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary Wash; HQ-3 Rock Core</td>
<td>5-inch tricone; 5-inch rock bit; 4-inch #2 diamond coring bit</td>
<td>50.5 feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drill Rig Type</th>
<th>Drilling Contractor</th>
<th>NAVD 88 Ground Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track Mounted Fraste XL</td>
<td>Pitcher Drilling Company</td>
<td>2334 feet</td>
</tr>
</tbody>
</table>

**Groundwater Level:** Not encountered before rotary wash drilling

**Sampling Methods:** 2.5-inch ID ModCal; SPT; HQ Core Barrel

**Hammer Data:**
- **NAVD 88 Ground Surface Elevation:** 2334 feet
- **Data:** Automatic hammer; 140 lbs, 30-inch drop

**Total Depth of Borehole:** 50.5 feet

**Borehole Backfill:** Cement grout to ground surface

---

**MATERIAL DESCRIPTION**

- SANDY FAT CLAY (CH); very stiff; very dark greyish brown (10YR 3/4) with mottled yellow; 52% high plasticity FINES; 42% medium to coarse grained SAND; 6% angular GRAVEL up to 1 1/4-inch; trace organics (roots); dry

- Becomes brown (10YR 4/3); GRAVEL is volcanic tuff and basalt

- With streaks of very pale brown (10YR 8/4); GRAVEL up to 1/2-inch

- FAT CLAY (CH); medium stiff; brown (10YR 4/5); 85% high plasticity FINES; 15% fine grained SAND; trace angular GRAVEL up to 1/4-inch; moist; cohesive

---

**FIELD NOTES AND TEST RESULTS**

- **Start 10:00 8/23/2018**  
  - Trash barrel drilling to 3.5 ft.
  - Trash barrel sample at 1.5 ft bagged.
  - Trash barrel sample at 3-3.5 ft bagged.
  - Begin rotary wash drilling at 3.5 ft with 5-inch tricone bit
  - Switch to 5-inch rock bit at 5 ft.
  - 2 liners retained LL=62; PL=23 SA: G=61%; S=42.4%; F=51.5%
  - Rig chatter

---

**SOIL SAMPLES**

- **Type:** Number | Blows / 6 in. | Recovery, % | Drill Time [Rale, hr] |
  - S01 13 | 50 |
  - S02 3 | 33 |

---

**Elevation, feet**

- -2332
- -2330
- -2328
- -2326
- -2324
- -2322

**Depth, feet**

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13

---

**Log of Soil and Core Boring B-201**

**Report: GEO_CORE+SOIL_NO PACK_WITH LITH; FILE: KLAMATH_MASTER.GPJ; 6/20/2019 B-201**
BASALT (see next page) 1: 25, J, W, Fe, Su, Pl, SR     2: 25, J, W, Fe+Sd, Fi, Pl, R

### Material Description

**FAT CLAY (CH); medium stiff; brown (10YR 4/3); 85% high plasticity FINES; 15% fine grained SAND; trace angular GRAVEL up to 1/4-inch; moist; cohesive**

---

**CLAYEY GRAVEL with SAND (GC); medium dense; brown (10YR 4/3); 55% angular basaltic GRAVEL up to 1 1/4-inch; 30% angular coarse grained SAND; 15% low plasticity FINES; wet**

---

**BOULDERS and COBBLES; dark bluish grey with white filled vesicles; round to angular COBBLES; some fine to coarse grained SAND; trace FINES; GRAVEL is slightly weathered, strong to very strong basalt**

---

**BASALT (see next page)**
## Log of Soil and Core Boring B-201

### Sheet 3 of 4

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

<table>
<thead>
<tr>
<th>Elevation, ft</th>
<th>Rock Core</th>
<th>Soil Samples</th>
<th>Field Notes and Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2304</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Material Description**

- **Basalt:** moderate bluish grey; slightly weathered; moderately strong to very strong; highly fractured; fine grained; with CaCO$_3$ filled vesicles and occasional green phenocrysts.
- **Tertiary to Quaternary Intrusive Basalt:**
  - Less but continued watertake
  - Caving borehole at 26 ft.
  - End of day 8/23/2018
  - Begin day 8/24/2018

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Depth, ft</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>BASALT; moderate bluish grey; slightly weathered; moderately strong to very strong; highly fractured; fine grained; with CaCO$_3$ filled vesicles and occasional green phenocrysts --Tertiary to Quaternary Intrusive Basalt--</td>
</tr>
<tr>
<td>30</td>
<td>Becomes slightly to moderately weathered with brown staining along joints; intensely fractured</td>
</tr>
<tr>
<td>31</td>
<td>Becomes light bluish grey, moderately to highly weathered/alteration; moderately strong; with 1/2-inch wide Calcite vein</td>
</tr>
<tr>
<td>32</td>
<td>Becomes highly to completely weathered, highly oxidized, yellowish brown</td>
</tr>
<tr>
<td>33</td>
<td>Brown, moderately weathered, moderately strong</td>
</tr>
<tr>
<td>34</td>
<td>Becomes dark yellowish brown to pale tan, completely weathered, very weak, highly fractured, granular, partially decomposed to clay</td>
</tr>
<tr>
<td>35</td>
<td>Becomes moderately to highly weathered, moderately strong to strong, fine grained matrix</td>
</tr>
<tr>
<td>36</td>
<td>Intensely fractured/broken, abundant oxidation</td>
</tr>
<tr>
<td>37</td>
<td>Becomes light bluish grey, slightly to locally moderately weathered, strong to very strong, irregular calcite filled vesicles</td>
</tr>
<tr>
<td>38</td>
<td>Becomes moderately strong</td>
</tr>
<tr>
<td>39</td>
<td>Intensely fractured</td>
</tr>
<tr>
<td>40</td>
<td>Becomes bluish grey with brownish orange staining along fractures, strong, fine grained, with irregular Calcite filled vesicles and veins</td>
</tr>
</tbody>
</table>

---

**Field Notes and Test Results**

- Less but continued watertake
- Caving borehole at 26 ft.
- End of day 8/23/2018
- Begin day 8/24/2018

---

**Report GEO_CORE+SOIL_NO PACK WITH LITH:** FEM KLNAMTH_MASTER.GPJ; 6/20/2019 B-201
### Log of Soil and Core Boring B-201

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

#### Sheet 4 of 4

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Lithology</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
</table>
| -2288          | -2288       | 2         | BASALT; bluish grey; slightly to locally moderately weathered; strong; highly fractured; fine grained with calcite filled vesicles; brownish orange oxidation along fractures  
(TERTIARY to QUATERNARY INTRUSIVE BASALT—continued) |
| -2286          | -2286       | 11        | 5: 10-15, J, N, Fe, Su, Pi  
6: 10, J, N-W, Fe, Su, Ir, VR  
7: 80, J, N-MW, Fe+Ca, Su+Pa, Pi, SR  
8: 55, J, N, Fe, Su, Pi, SR with 1-inch weathered rind  
9: 20, V, N, Ca, Pi, Pi  
10: 40, J, ?, Fe, Su, Pi-Ir, VR  
11: 60, J, N-MW, Fe+Ca, Su+Fi, Pl, R  
12: 60-90, J, VN, Fe+Ca, Su+Pa, Pi-Ir, R  
3: 60, J, N-MW, Fe+Ca, Su+Fi, Pl, R  
TOTAL DEPTH = 50.5 FEET |

#### Soil Samples

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Field Notes and Test Results

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-201
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracture Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2320</td>
<td>13</td>
<td>1</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td></td>
<td>13</td>
<td>2</td>
<td>53</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>-2318</td>
<td>14</td>
<td>3</td>
<td>100</td>
<td>NA</td>
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<td>4</td>
<td>56</td>
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<td>NA</td>
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<td>-2314</td>
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<td>-2308</td>
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<td>68</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

### MATERIAL DESCRIPTION

- With increasing GRAVEL and decreasing SAND; abundant grey to black basaltic COBBLES fragments
- BOULDERS and COBBLES; bluish grey; 60% angular GRAVEL up to 2-inches; 30% medium to coarse grained SAND; 10% medium plasticity FINES; BOULDERS (fragments) and COBBLES are fresh to slightly weathered, rounded, very strong porphyritic BASALT up to 10-inches; MATRIX is fine grained with quartz and trace pyrite phenocrysts weathered to a POORLY GRADED SAND with GRAVEL and CLAY;

--RIVER ALLUVIUM--

- With basaltic BOULDERS (fragments) up to 1-foot; rounded to angular GRAVEL, coarse grained SAND, and medium plasticity FINES

- with basaltic BOULDERS (fragments) and COBBLES up to 5-inches; abundant rounded GRAVEL

### FIELD NOTES AND OTHER TESTS

- Rig chatter; possible boulder at 13-14ft.
- Switch to HQ coring at 14ft with 4-inch #6 diamond coring bit
- Coarse material from Run 1 – 14 retained in core box
- Driller notes softer material at 21.5ft. Minor fluid loss.
- Driller notes material is alternating soft and hard.
- Minor fluid loss.
- End of day 8/18/2018
- Begin day 8/19/2018
**MATERIAL DESCRIPTION**

BOULDERS and COBBLES; bluish grey; 60% angular GRAVEL up to 2-inches; 30% medium to coarse grained SAND; 10% medium plasticity FINES; BOULDERS (fragments) and COBBLES are fresh to slightly weathered, rounded, very strong BASALT up to 10-inches; MATRIX is fine grained with quartz and trace pyrite phenocrysts weathered to a POORLY GRADED SAND with GRAVEL and CLAY; with boulders and cobbles up to 8-inches at 28.2'--RIVER ALLUVIUM--(continued)

Becomes round to angular COBBLES up to 4-inches, abundant fine GRAVEL, coarse grained SAND, with some brown, no plasticity FINES

With basalt and very strong brecciated tuff COBBLES

---

**FIELD NOTES AND OTHER TESTS**

- **Increase fluid loss.**
  - Advance 4-inch casing to 29.5 ft.
  - Swivel breaks at 32.5 ft; End of day 8/19/2018
  - Begin day 8/20/2018
  - Drill fluid becomes brownish grey.
  - Some fluid loss.
  - Switch to 4" carbonado bit at 40.5 ft; pale brown, tuff-like material in bit
  - Drill fluid becomes light grey
**Material Description**

- **VOLCANIC BRECCIA; light grey; highly to completely weathered; very weak with strong clasts; slightly fractured; locally friable; fine grained matrix with angular to subrounded strong, black clasts up to 3/4-inch and extremely weak, green clasts up to 1 1/4-inch**

  "--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--"

- **1: 15, J, N, No, No, Pl, R-VR (likely mechanical)**

- **Becomes pale greenish grey, weak to locally extremely weak, highly weathered, increased percentage of clasts in a fine grained matrix**

  "Minor fluid loss."

- **1: 10, J, N-VN, Ch?, Pa, Pl, R (mechanical)**

- **2: 0, J, N-MW, No, No, Ir, VR (mechanical)**

- **3: 15, J, VN-N, No, No, Pl, R (mechanical)**

- **With green, clayey clasts elongated vertically**

- **Light bluish grey, completely weathered, extremely weak, with coarse grained SAND and fine GRAVEL**

- **Increasingly cohesive, extremely weak, highly to completely weathered, with smaller clasts**

- **1: 55, J, VN-N, No, No, Pl**

- **60.5-61.4ft: completely weathered to a residual soil, extremely weak, friable, with soil-like texture, clasts up to 1/2-inch**

---

**Field Notes and Other Tests**


- **Log of Core Boring B-202**

- **Sheet 4 of 7**

- **Project: Klamath River Renewal Project**

- **Project Location: Copco and Iron Gate Reservoirs**

- **Project Number: 60537920**

- **End of day 8/20/2018**

- **Begin day 8/21/2018**

---

**Packer Test Intervals**

<table>
<thead>
<tr>
<th>Fractures per Foot</th>
<th>Fracture Drawing</th>
<th>Lithology</th>
<th>Elevation, feet</th>
<th>Fracture Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>1: 55, J, VN-N, No, No, Pl</td>
<td>62.2</td>
<td>Increasingly cohesive, extremely weak, highly to completely weathered, with smaller clasts</td>
</tr>
</tbody>
</table>

---

**Drill Time, 24-hr Drill Rate, ft/hr**

- **1240**
- **1252**
- **1307**
- **1321**
- **1347**
- **1403**
- **1434**
- **1303**

---

**Fractures per Foot**

- **Run No. 14**
- **Run No. 2**
- **Run No. 15**
- **Run No. 16**
- **Run No. 17**
- **Run No. 18**

---

**Fracture Drawing**

- **Fracture Drawing**
## Log of Core Boring B-202

### Project: Klamath River Renewal Project
### Project Location: Copco and Iron Gate Reservoirs
### Project Number: 60537920

#### Sheet 5 of 7

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>R.Q.D. %</th>
<th>Fractures per Foot</th>
<th>Fracture Number</th>
<th>Lithology</th>
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### MATERIAL DESCRIPTION

- **VOLCANIC BRECCIA; light bluish grey; completely weathered; extremely weak with strong clasts; slightly fractured; locally friable; fine grained matrix with angular to subrounded strong, black clasts up to 3/4-inch and extremely weak, green clasts up to 1 1/4-inch**
  - **TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)** *(continued)*

- Highly weathered, with strong, black clasts up to 3/4-inch and very soft, green clasts up to 1 1/4-inch, extremely weak/friable

- 63.6-64.2'

- 1: 0, J, MW, No, No, Pl/fr, R (mechanical)

#### FIELD NOTES AND OTHER TESTS

- 0.1' of Run 20 recovered with Run 21

---

**Report: GEO_CORE_OAK_C; File: KLAMATH_MASTER.GPJ; 6/20/2019**

---

**Start of day 8/21/2018**

**End of day 8/22/2018**
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>ROCK CORE</th>
<th>Fractures per Foot</th>
<th>RQD, %</th>
<th>Fracture Number</th>
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<tbody>
<tr>
<td></td>
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<td>Run No.</td>
<td>Box No.</td>
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<tr>
<td>78</td>
<td></td>
<td>23</td>
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<td>100</td>
<td>TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)</td>
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<tr>
<td>-2264</td>
<td>79</td>
<td>23</td>
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<td>0</td>
<td>With increased clast size and percentage; matrix is extremely weak matrix with strong basaltic clasts and decomposed green clasts</td>
</tr>
<tr>
<td>-2262</td>
<td>80</td>
<td>24</td>
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<td>100</td>
<td>With stronger matrix</td>
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<tr>
<td>-2260</td>
<td>81</td>
<td>5</td>
<td></td>
<td>0</td>
<td>With weaker matrix</td>
</tr>
<tr>
<td>-2258</td>
<td>82</td>
<td>25</td>
<td></td>
<td>100</td>
<td>VOLCANIC MUDSTONE; dusky to very dusky red (2.5 YR 3/2 TO 2.5/2); slightly weathered; weak to very weak; slightly fractured; fine grained with occasional gravel up to 1/2-inch</td>
</tr>
<tr>
<td>-2256</td>
<td>83</td>
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<td></td>
<td>Becomes dark reddish brown</td>
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<tr>
<td>-2254</td>
<td>84</td>
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<td>-2236</td>
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</tbody>
</table>

### FIELD NOTES AND OTHER TESTS

- UCS 82.0-82.8 = 614 psi
- Top of Run 24 mechanically broke when transferring to core box

---

**MATERIAL DESCRIPTION**

- VOLCANIC BRECCIA; light greenish grey; highly to completely weathered; extremely weak with strong clasts; slightly fractured; locally friable; fine grained matrix with angular to subrounded strong, black clasts and extremely weak, green clasts up
- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) (continued)
- With increased clast size and percentage; matrix is extremely weak matrix with strong basaltic clasts and decomposed green clasts
- With stronger matrix
- With weaker matrix
- VOLCANIC MUDSTONE; dusky to very dusky red (2.5 YR 3/2 TO 2.5/2); slightly weathered; weak to very weak; slightly fractured; fine grained with occasional gravel up to 1/2-inch
- Becomes dark reddish brown
**MATERIAL DESCRIPTION**

**ROCK CORE**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Number</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>93</td>
<td>2250</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td>VOLCANIC MUDSTONE: dusky to very dusky red (2.5 YR 3/2 TO 2.5/2); slightly weathered; weak to very weak; slightly fractured; fine grained with occasional gravel up to 1/2-inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --(continued)</td>
</tr>
<tr>
<td>94</td>
<td>2248</td>
<td>26</td>
<td>86</td>
<td>86</td>
<td>1</td>
<td></td>
<td></td>
<td>With trace gravel</td>
</tr>
<tr>
<td>95</td>
<td>2244</td>
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<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>Without gravel; increasing strength</td>
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<td>100</td>
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<td>1: 10, J/V, N-MW, H+Cl, Fi, Pl, ? 2: 70, J, ?, No, No, Pl, ? (mechanical)</td>
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<tr>
<td>96</td>
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<td>0</td>
<td>86</td>
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<td></td>
<td>1: 40, J, W, Cl+Sd, Pa, Pl, R</td>
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<td>[13]</td>
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</table>

**TOTAL DEPTH = 100.5 FEET**

Televiwer and caliper survey by NorCal Geophysics 8/22/2018. Install two VWP's at 28ft and 72ft with neat cement grout to ground surface with 3ft above-ground monument.
**Log of Soil and Core Boring B-203**

**Date(s) Drilled:** 1/8/2019-1/11/2019  
**Logged By:** P. Respess  
**Checked By:** S. Janowski

- **Drilling Method:** Rotary Wash, HQ-3 Rock Core
- **Drill Bit Size/Type:** 3-7/8-inch tricone, 3 3/4-inch diamond coring bit #10
- **Drill Rig Type:** Barge Mounted CME-45
- **Drilling Contractor:** Taber Drilling
- **NAVD 88 Ground Surface Elevation:** 2305 feet
- **Groundwater Level:** 25 feet above ground surface
- **Borehole Completion:** Bentonite cement grout to ground surface

**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing</th>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (hr)</th>
<th>FIELD NOTES AND TEST RESULTS</th>
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<td>-2304</td>
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<td>NA</td>
<td>NA</td>
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<td>54</td>
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<td>NA</td>
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<td>1</td>
<td>38</td>
<td>71</td>
<td>50/5%</td>
<td>Begin day 1/9/2019 Mudline is 25' below reservoir level</td>
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<td>Advance 5', HWT casing to 8', good WCR</td>
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<td>0% WCR to 13' Change HQ drill bit; no advancement; change to tricone advancement</td>
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</table>

**SOIL SAMPLES**

- Mudline is 24' below reservoir level
- End of day 1/8/2019
- Begin day 1/9/2019 Mudline is 25' below reservoir level
- Tricone to 2' switch to HQ-3
- Yellow-brown cuttings
- 0% Water Circulation Return (WCR)
- Blue-gray cuttings
### Field Notes and Test Results

**Volcaniclastic Breccia**: Grayish blue-green (5BG5/2); highly weathered; very weak; angular clasts up to 1/4"-1".

**Tertiary Volcanics (Bogus Mountain Beds, Undifferentiated)**
- Breaks become slightly weathered; moderately strong; slightly fractured.
- Moderately weathered; weak.

**Packer Test Intervals and Fracture Drawing**

**Soil Samples**
- Drill Time
- Recovery, %
- Recover, %
- Borehole Cuttings
  - Good WCR; blue-green clayey cuttings
  - Change HQ drill bit to increase recovery

**Material Description**

<table>
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<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D. %</th>
<th>Fracture Drawing Number</th>
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**MATERIAL DESCRIPTION**

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<th>R.Q.D. %</th>
<th>Fracture Drawing</th>
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<tr>
<td>-2260</td>
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</tbody>
</table>

**VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); slightly weathered; moderately strong; angular clasts up to 1/4"-1"; slightly fractured.**

---

**BASALT; grayish red purple (5RP4/2); highly weathered; very to extremely weak.**

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracture Drawing</th>
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<tbody>
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<td>1</td>
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<td></td>
<td>100</td>
<td>M</td>
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<td>5</td>
<td>11</td>
<td>92</td>
<td>0</td>
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<td>M</td>
</tr>
</tbody>
</table>

**Drill Time [Rate, ft/hr]**

- 1518
- 1526
- 1534
- 1539
- 1546
- 1550

**Good WCR**

**Red-brown cuttings**

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**FIELD NOTES AND TEST RESULTS**
# Log of Soil and Core Boring B-203

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 6057920  
**Sheet 4 of 8**

## ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing</th>
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</table>

### MATERIAL DESCRIPTION

- **BASELT:** grayish red purple (5RP4/2); highly weathered; very to extremely weak; slightly fractured; mechanically broken to 47.8"  
  - TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)  
  - VOLCANICLASTIC BRECCIA: dark greenish gray to greenish gray (5G4/1-6/1); slightly weathered; weak; slightly fractured; angular clasts up to 1/4"-1"; abundant calcite inclusions and veinlets  
  - Becomes dark gray (N3); highly to moderately fractured  
    - 1: 70°, J, VN, No, No, Pl-Wa, SR  
  - Mechanically broken  
  - BASALT: medium bluish gray (5B5/1) to dark gray (N3); slightly weathered; moderately strong; abundant calcite inclusions  
  - Becomes dark gray (N3); highly to moderately fractured  
    - 1: 70°, J, VN, No, No, Pl-Wa, SR  
    - 2: 35°, J, VN, No, No, Pl-Wa, SR  
    - 3: 60°, J, N, Ca, Pa, Pl-Wa, SR  
    - 4: 50°, J, VN, No, No, Pl-Wa, SR  
    - 5: 20°, J, VN, No, No, Pl-Wa, SR  
  - Overdrilled  

### SOIL SAMPLES

- **Type:** Blows / 6 in.  
- **Recovery, %:**  
  - 1: 50% WCR  
  - 2: 50% WCR  
  - 3: 50% WCR  
  - 4: 50% WCR  
  - 5: 50% WCR  
  - 6: 50% WCR  

### FIELD NOTES AND TEST RESULTS

- **End of day 1/9/2019**  
  - 1058 Packer Test Intervals  
  - 1020 Drill Time Rate [ft/hr]  
  - 105% WCR  
- **Begin day 1/10/2019**  
  - 1020 Packer Test Intervals  
  - 1020 Drill Time Rate [ft/hr]  
  - 50% WCR  

**Report:** GEO_CORE+SOIL_17B_PACK  
**File:** KLAMATH_MASTER.GPJ  
**Date:** 6/20/2019  
**B-203**
## ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>Fracture Drawing Number</th>
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</table>

## MATERIAL DESCRIPTION

**VOLCANICLASTIC BRECCIA:**
- Description: dark greenish gray to greenish gray (5G4/1-6/1); slightly weathered; moderately strong, angular clasts up to 1/4"-2"; highly to moderately fractured; abundant calcite inclusions and veinlets
- Location: TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)

**BASALT:**
- Description: dark gray (N3); slightly weathered; moderately strong; highly to locally intensely fractured; abundant calcite inclusions

**SOIL CORE:**
- Description: Drill Time, Rate, ft/hr: Continued 0% WCR

---

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Box No.</th>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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</tr>
<tr>
<td>3</td>
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---

**FIELD NOTES AND TEST RESULTS**

- Continued 0% WCR
- [25]
- [38]
- [48]
- [50]
- [60]
- [70]
- [80]
- [90]
- [100]
### Log of Soil and Core Boring B-203

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

#### Sheet 6 of 8

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Fractures per Foot</th>
<th>R.Q.D., %</th>
<th>Fracture Drawing</th>
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</thead>
<tbody>
<tr>
<td>77</td>
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<tr>
<td>78</td>
<td>19</td>
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**MATERIAL DESCRIPTION**

BASALT; dark gray (N3); slightly weathered; moderately strong; highly to locally intensely fractured; abundant calcite inclusions; with numerous healed fractures (not logged)  

---TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--- (continued)

<table>
<thead>
<tr>
<th>Fracture Drawing</th>
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<tbody>
<tr>
<td>1: 55°, J, VN, Ca, Sp, Wa, S-SR</td>
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<tr>
<td>2: 60°, J, VN-N, Ca, Sp, Wa, S-SR</td>
</tr>
<tr>
<td>3: 40°, J, VN, Ca, Sp, Pl-Wa, SR</td>
</tr>
<tr>
<td>4: 30°, J, VN, Ca, Sp, Pl-Wa, SR</td>
</tr>
<tr>
<td>5: 40°, J, VN-N, Ca, Sp, Pl-Wa, SR</td>
</tr>
<tr>
<td>6: 40°, J, VN-N, Ca, Sp, Pl-Wa, SR</td>
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<tr>
<td>7: 50°, J, VN-N, Ca, Sp, Pl-Wa, SR</td>
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<tr>
<td>8: 75°, J, VN-N, Ca, Sp, Pl-Wa, SR</td>
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</table>

**Weak; mechanically broken**

Mechanically broken

**Mechanically broken**

Weak; intensely fractured with slickensides (shear zone)

---Continued 0% WCR---

**SOIL SAMPLES**

- **R Q D, %**
- **Type**
- **Blows / 6 in.**
- **Recovery, %**
- **Drill Time (Rate, ft/hr)**

**FIELD NOTES AND TEST RESULTS**

**ROCK CORE**

- **Run No.**
- **Box No.**
- **Fractures per Foot**
- **R.Q.D., %**
- **Fracture Drawing**

**ELEVATION, feet**

- **SOIL SAMPLES**

- **DRILL TIME (Rate, ft/hr)**

---

**Report:** GEO_CORE+SOIL_17B_PACK; **File:** KLAMATH_MASTER.GPJ; **6/20/2019** B-203
VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); slightly weathered; moderately strong; highly to moderately fractured; abundant calcite inclusions and veinlets; with numerous healed fractures (not logged) --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)

1: 70°, J, VN-N No, No, Wa-Ir, SR

Becomes mottled very dusky purple (5RP2/2) and grayish blue-green (5BG5/2)

Mechanically broken

1: 40°, J, VN-N, No, No, Pi-Wa, S-SR

6: 90°, J/V, N, Ca?+Ch?, Fi, Pl, S-SR

Becomes slightly fractured

4: 70°, J, VN-N, Ca, Sp/Pa, Pl, S-SR

5: 70°, V, N, Ca, Fl, Pi, S??
**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>ROCK CORE</th>
<th>SOIL SAMPLES</th>
<th>FIELD NOTES AND TEST RESULTS</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>Faster drilling 109-110'</td>
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<tr>
<td></td>
<td></td>
<td>Continued 0% WCR</td>
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<tr>
<td></td>
<td></td>
<td>Faster drilling 113-117'</td>
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<tr>
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<td>Slower drilling to TD</td>
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**TOTAL DEPTH = 120.0 FEET**

---

**ROCK CORE**

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<tr>
<th>Elevation, feet</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D. %</th>
<th>Fracture Drawing Number</th>
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<td>NA</td>
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<td>27</td>
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<td>76</td>
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</table>

**MATERIAL DESCRIPTION**

- PORPHORYTIC BASALT: dark gray to grayish black (N3-N2); slightly weathered to fresh; moderately strong to strong; abundant white phenocrysts (feldspar?) and healed calcite fractures and veins, slightly fractured - TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)

- Becomes very dark red (5R2/6)
- Highly weathered; very to extremely weak; crushed
- VOLCANICLASTIC BRECCIA; very dusky purple (5RP2/2) to grayish blue-green (5BG5/2); highly weathered; weak to very weak; moderately fractured; angular to subangular medium- to coarse-grained sand-sized clasts with occasional to 1/2"; with numerous mechanical fractures - TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)

- Becomes moderately strong
- Becomes very dusky purple (5RP2/2)

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
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</thead>
<tbody>
<tr>
<td>109</td>
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<td>78</td>
<td>NA</td>
</tr>
<tr>
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<td>NA</td>
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</tr>
<tr>
<td>-2188</td>
<td>27</td>
<td>92</td>
<td>1</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- Faster drilling 109-110'
- Continued 0% WCR
- Faster drilling 113-117'
- Slower drilling to TD

**TOTAL DEPTH = 120.0 FEET**
### Log of Soil and Core Boring B-205

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

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<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
<th>Total Depth of Borehole</th>
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<tbody>
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<td>9/12/2018</td>
<td>K. Zeiger</td>
<td>P. Respess</td>
<td>62.0 feet</td>
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<table>
<thead>
<tr>
<th>Drilling Method</th>
<th>Drill Bit Size/Type</th>
<th>Drilling Contractor</th>
<th>Total Depth of Borehole</th>
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<td>Rotary Wash, HQ-3 Rock Core</td>
<td>3 7/8-inch PDC drag bit, 3 3/4-inch carbide tooth bit</td>
<td>Gregg Drilling</td>
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<table>
<thead>
<tr>
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<th>Sampling Methods</th>
<th>Hammer Data</th>
<th>Surface Elevation</th>
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<tr>
<td>Truck Mounted Mobile B-53</td>
<td>2.5-inch ID ModCal; HQ Core Barrel</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
<td>2359 feet</td>
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<table>
<thead>
<tr>
<th>Groundwater Level</th>
<th>Sampling Methods</th>
<th>Hammer Data</th>
<th>Surface Elevation</th>
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<tbody>
<tr>
<td>21.7 feet bgs 9/13/2018</td>
<td>2.5-inch ID ModCal; HQ Core Barrel</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
<td>2359 feet</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Borehole Backfill</th>
<th>Borehole Location</th>
<th>Coordinate Location</th>
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<tbody>
<tr>
<td>Cement grout to ground surface</td>
<td>Iron Gate Reservoir along Copco Road</td>
<td>N 2602659 E 6461881</td>
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</table>

<table>
<thead>
<tr>
<th>Rock Core</th>
<th>Soil Samples</th>
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<tr>
<td>Elevation, feet</td>
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<td>---------</td>
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**MATERIAL DESCRIPTION**

- **CLAYEY GRAVEL (GC):** dense; dark brown (10YR 3/2); 70% angular GRAVEL up to 1-inch; 25% low plasticity FINES; 5% organics; dry; GRAVEL is volcanic
  --COLLUVIUM--

- Boulder (fragments)

<table>
<thead>
<tr>
<th>Soil Samples</th>
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<td>Run No.</td>
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<table>
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<tr>
<th>Soil Samples</th>
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<td>Run No.</td>
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<tr>
<td>----------</td>
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<tr>
<td>19</td>
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</tbody>
</table>

- **CLAYEY GRAVEL with SAND (GC):** medium dense; dark brown (7.5YR 3/2); 35% high plasticity FINES; 40% subangular GRAVEL up to 1-inch; 25% fine grained SAND; dry; cohesive; gravel is chert and rhyolite
  --COLLUVIUM/RESIDUAL SOIL--

- At 9ft.: becomes moist

- With gravel up to 2.5-inches

- **GRAVELLY FAT CLAY (CH):** hard; dark brown (7.5 YR 3/2); 65% high plasticity FINES; 35% subangular GRAVEL to 1-inch; moist; cohesive

**FIELD NOTES AND TEST RESULTS**

- Hollow stem auger to 0 to 19ft.
- One liner retained (5.8-6.3ft.)
- Lithology transition logged from cuttings
- One liner retained (11-11.5ft.)
- LL=61; PL=22; SA: G=38.4%; S=25.7%; F=34.9%
**MATERIAL DESCRIPTION**

**GRAVELLY FAT CLAY (CH);** hard; dark brown (7.5 YR 3/2); 65% high plasticity FINES; 35% subangular GRAVEL to 1-inch; moist; cohesive

---COLLUVIIUM/RESIDUAL SOIL---

**POORLY GRADED GRAVEL with CLAY and SAND (GP-GC);** very dense; light olive grey (5Y 5/2); 60% rounded GRAVEL up to 1/2-inches; 30% low plasticity FINES; 10% medium grained SAND; dry; cohesive; gravel is weathered in place

---TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)---

**VOLCANIC CONGLOMERATE;** light olive grey (5Y 5/2); highly weathered; very weak; fine grained with rounded to angular clasts up to 1/2-inch

Becomes medium bluish grey (5B 5/1); moderately weathered; weak to very weak; massive

Becomes highly weathered; very weak

Light olive grey (5Y 5/2)

---FIELD NOTES AND TEST RESULTS---

Driller reports hard consistent drilling 15.5-19.0 ft; cuttings are dry gravelly

Advance 4-inch casing to 19.5 ft; switch to HQ-3 rock coring.

*Rock does not meet soundness criteria for RQD calculation*
### Log of Soil and Core Boring B-205

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  
**Sheet 3 of 5**

#### Rock Core

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Type</th>
<th>Recovery, % Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Type</th>
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<tbody>
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<td>-2330</td>
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</tbody>
</table>

**MATERIAL DESCRIPTION**

VOLCANIC CONGLOMERATE; medium bluish grey (5B 5/1); highly weathered; very weak; massive; fine grained with rounded to angular clasts up to 1/2-inch; chlorite rich matrix (?)

TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)

1: 5, J, MW, No, No, Wa, SR (likely mechanical)  
2: 35, J, MW, No, No, Wa, SR (likely mechanical)  
3: 20, J, MW, No, No, Wa, SR (likely mechanical)

Broken while placing in box

With clasts up to 3/4-inch

Completely weathered to clay; extremely weak

**Soil Samples**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, 1/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1455</td>
<td>1505</td>
<td></td>
</tr>
</tbody>
</table>

**Field Notes and Test Results**

Run 4 broken during removal from core barrel (all fractures mechanical?)

**Report:** Geo_Core+Soil NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-205
Project: Klamath River Renewal Project  
Project Location: Copco and Iron Gate Reservoirs  
Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 4 of 5

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No</th>
<th>Box No</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2314</td>
<td>45</td>
<td>6</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>m</td>
<td>VOLCANIC CONGLOMĄRATE; medium bluish grey (5B 5/1); highly weathered; very weak; massive; fine grained with rounded to angular clasts up to 3/4-inch. --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>-2312</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fractured zone with iron and manganese staining</td>
</tr>
</tbody>
</table>
| -2310          | 49         | 7      | 100    | 3           | 0                   |         |                        | 1: 85, J, T, Fe+Mn, Su, Wa, SR  
2: 10, J, N, No, No, Wa-Ir, R  
3: 25, J, MW, Fe+Mn, Su, Wa, SR |
|                |            | 4      |        |             |                     |         |                        | [50] |
| -2308          | 51         |        |        |             |                     |         |                        | 1: 10, J, T, No, No, Wa-Ir, SR (contact between weathering zones)  
Becomes completely weathered; extremely weak; clayey |
|                |            |        |        |             |                     |         |                        | [42] |
| -2306          | 53         | 8      | 86     | 1           | 0                   |         |                        | 1: 10, J, T, No, No, Wa, SR  
Becomes highly weathered; very weak  
Becomes moderately weathered; weak; intensely fractured with calcite precipitation |
|                |            |        |        |             |                     |         |                        | [12] |
| -2304          | 55         | 9      | 100    | 0           | 0                   |         |                        | 1: 35, J, N, No, No, Pl, S |
|                |            |        |        |             |                     |         |                        | 1637 |
| -2302          | 57         |        |        |             |                     |         |                        | VOLCANIC BRECCIA; dusky brown (SYR 2/2); highly weathered; weak; highly fractured; with angular clasts up to 1-inch; 58.4-58.7' crushed |
|                |            |        |        |             |                     |         |                        | [33] |
| -2300          | 59         | 5      | 96     | 5           | 20°                  |         |                        | 1: 85, J, N, No, No, Wa, SR  
2: 70, J, N, Ca, Pa, Pl, Sr  
3: 35, J, N, No, No, Pl, S  
4: 10, J, T, No, No, Wa-Ir, Sr-R  
5: 10-15, J, N, No, No, Wa-Pi, Sr  
6: 25, J, Bedding, N-T, No, No, Wa, Sr |
|                |            |        |        |             |                     |         |                        | 1650 |
| -2298          | 61         | 2      |        |             |                     |         |                        | 1533  
1540  
1546  
1555  
1559  
1625  
1637  
1650

SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time [Rate, ft/hr]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIELD NOTES AND TEST RESULTS

- Fractured zone with iron and manganese staining
- Soft zone plugged bit during Run 8
- 47-49.5 ft. wrapped for review

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-205
### Log of Soil and Core Boring B-205

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

#### Elevation, Depth, Lithology

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2298</td>
<td>VOLCANIC BRECCIA; dusky brown (5YR 2/2); highly weathered; weak; highly fractured; with angular clasts up to 1-inch</td>
</tr>
<tr>
<td>-2296</td>
<td>TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) (continued)</td>
</tr>
</tbody>
</table>

#### Sheet 5 of 5

**Elevation, feet**

| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 |

**Depth, feet**

| 10 | 5  | 96 | 1  | 20′ |

**Fractures per Foot**

| 7  | 45 | J, N, Ca, Sp, Pl, SR |

**R.O.D. %**

| 1653 |

**Soil Sample**

- **Type:** Number  
- **Blows / 6 in.:**  
- **Recovery, %:**  
- **Drill Time (Rate, hr):**

**TOTAL DEPTH = 62.0 FEET**
**MATERIAL DESCRIPTION**

- **SANDY FAT CLAY with GRAVEL (CH);** dry; dark brown (10YR 3/3) with trace mottled yellow (10YR 7/6); 75% high plasticity FINES; 15% subangular to rounded GRAVEL up to 1 1/4-inch; 10% fine to coarse grained SAND; little organic material (roots)

---

**ALLUVIUM---**

- With angular basaltic and some volcanic tuff GRAVEL up to 1 1/2-inch

**FIELD NOTES AND OTHER TESTS**

- Trash barrel to 10ft.

- Begin rotary wash drilling at 10 ft. with 3 7/8-inch tricone bit; Drill fluid is light grey.

- Rig chatter.
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Fractures per Foot</th>
<th>R.O.D. %</th>
<th>Fracture Drawing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>-234</td>
<td>1</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
<td>Basalt and volcanic tuff fragments in cuttings</td>
</tr>
<tr>
<td>14</td>
<td>-232</td>
<td>40</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
<td>Weathered light yellow and greenish brown tuff fragments in cuttings</td>
</tr>
<tr>
<td>15</td>
<td>-2318</td>
<td>70</td>
<td>0</td>
<td>1</td>
<td>75</td>
<td>Basalt and volcanic tuff fragments in cuttings</td>
</tr>
<tr>
<td>16</td>
<td>-2316</td>
<td>70</td>
<td>0</td>
<td>1</td>
<td>75</td>
<td>Weathered light yellow and greenish brown tuff fragments in cuttings</td>
</tr>
<tr>
<td>17</td>
<td>-2314</td>
<td>100</td>
<td>100</td>
<td>1</td>
<td>75</td>
<td>Basalt and volcanic tuff fragments in cuttings</td>
</tr>
<tr>
<td>18</td>
<td>-2312</td>
<td>5</td>
<td>10</td>
<td>1</td>
<td>75</td>
<td>Basalt and volcanic tuff fragments in cuttings</td>
</tr>
</tbody>
</table>

### MATERIAL DESCRIPTION

- SANDY FAT CLAY with GRAVEL (CH); dry; dark brown (10YR 3/3) with trace mottled yellow (10YR 7/8); 75% high plasticity FINES; 15% subangular to rounded GRAVEL up to 1 1/2-inch; 10% fine to coarse grained SAND; trace organic material (roots)
- ALLUVIUM-- (continued)

- Weathered light yellow and greenish brown tuff fragments in cuttings

### FIELD NOTES AND OTHER TESTS

1. Begin HQ rock core at 20 ft. with 4-inch carbonado bit.
2. Run 1 not retained.
3. Switch to 4-inch #13 diamond coring bit at 23 ft.
4. Reviewer note: All healed veins and fractures were mechanically broken by core handling.
**Project**: Klamath River Renewal Project  
**Project Location**: Copco and Iron Gate Reservoirs  
**Project Number**: 60537920

---

### ROCK CORE

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D, %</th>
<th>Fracture Number</th>
<th>Elevation, feet</th>
<th>R.O.D, %</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td></td>
<td>Basalt; grey to bluish grey (5B 6/1); slightly weathered; strong; highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch; --TERTIARY to QUATERNARY INTRUSIVE BASALT-- (continued) --</td>
</tr>
</tbody>
</table>
| 2       | 4       | 4           |                    |          |                 | -2310           |          | 1: 40, J, VN, Ca, Sp, Pi, SR  
|          |         |             |                    |          |                 | 2: 60, J, VN, Ca, Fl, Pi, SR  
|          |         |             |                    |          |                 | 3: 65, J, VN, H+Ca, Sp, ?, ? (possible mechanical)  
|          |         |             |                    |          |                 | 4: 40-50, J, VN-T, Ca+Mn, Sp, Pi, SR  |
| 4       | 5       | 90          | 5                  | 4        |                 | -2308           |          | 5: 65, J, VN, H+No, No, Ir, ?  
|          |         |             |                    |          |                 | 6: 60, J, N, Uk, Pa, Pi, SR  
|          |         |             |                    |          |                 | 7: 30, J, VN, Fe, Su, Pi, SR |
| 5       | 6       | 90          | 5                  | 4        |                 | -2306           |          | 1: 50, J, N, Ca, Sp, Pi, SR  
|          |         |             |                    |          |                 | 2: 45-50, J, VN-MW, Ca+Mn, Fl, Si, S + with 90° slk  
|          |         |             |                    |          |                 | 3: 15, J, N, Ca+Mn, Pa, Ir, ?  |
| 4       | 7       | 90          | 5                  | 4        |                 | -2304           |          | 4: 55, J, VN, Ca, Sp, Pi, SR (with MN staining)  
|          |         |             |                    |          |                 | 5: 60, J, N, H+Ca, Fl, Pi, SR (with MN staining)  
|          |         |             |                    |          |                 | 6: 40, J, VN, Ca, Fl+Sp, Pi, SR (with MN staining) |
| 2       | 3       | 80          | 5                  | 4        |                 | -2302           |          | 1: 25, J, N, Ca, Pa, Pi, SR  
|          |         |             |                    |          |                 | 2: 70-80, J, Mn, Sp, St/Ir, R  |
|          |         |             |                    |          |                 | <6               |          | Crushed; likely mechanical |
| 6       | 83      | 3           | 5                  | 4        |                 | -2300           |          | 3: 40, J, T-VN, Ca?, Sp, Pi, SR  
|          |         |             |                    |          |                 | 4: 60, J, No, No, Pi, S-SR  
|          |         |             |                    |          |                 | 5: 60, J/Sp, MW, Cr+Sp+Ca, Fl, Pi, SR |
|          |         |             |                    |          |                 | <6               |          | Becomes intensely fractured |
| 8       | 100     | >6          | 0                  | 4        |                 | -2298           |          | 1: 50, J, Ca?, Sp, Ir, R  
|          |         |             |                    |          |                 | 2: 80, J, VN, H+Uk, Fl, Wa, ?  
|          |         |             |                    |          |                 | <6               |          | 1: 45, J, Mn?, Su, Pi, R  
|          |         |             |                    |          |                 | 2: 50-60, J, VN-MW, H+Ca, Fl, Pi, SR  
|          |         |             |                    |          |                 | 3: 65, J, Ca, Fl+Pa, Pi, SR  
|          |         |             |                    |          |                 | 4: 60, V, ?, Ca?, Fl, Pi, ?  
|          |         |             |                    |          |                 | 5: 70, J, ?, Ca, Pa, Pi, SR |

---

### MATERIAL DESCRIPTION

- Basalt; grey to bluish grey (5B 6/1); slightly weathered; strong; highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch; --TERTIARY to QUATERNARY INTRUSIVE BASALT-- (continued) --

---

### FIELD NOTES AND OTHER TESTS

- End of day 8/14/2018
- Begin day 8/15/2018
- Drill fluid becomes light grey greenish grey at 35ft.
Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-206
Sheet 4 of 7

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D, %</th>
<th>Fracture Drawing</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>-2296</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td>2</td>
<td>&gt;6</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
| 48             |             | 9       | 100     | 6           | 50                  |         |                 | BASALT; grey to bluish grey (5B 6/1); slightly weathered; strong; intensely fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch}
| -2294          |             |         |         |             |                     |         |                 | TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)-- |
| 50             |             |         |         |             |                     |         |                 | 1: 45, J, VN, Ca, Fl, Pi, S-SR |
| -2292          |             | 10      | 100     | 0           | 100                 |         |                 | 2: 60-90, J, VN, H+Uk, Fl, Pi, ? |
| 51             |             |         |         |             |                     |         |                 | 3: 30-40, J, VN, H+Ca, Fl, Pi, ? |
| -2290          |             | 11      | 83      | 3           | 50                  |         |                 | 4: 30, J, VN, H+Fe?, Fl, Ir, ? |
| 52             |             |         |         |             |                     |         |                 | 5: 80, J, VN-N, Ca+Fe, Fl, Pi, ? |
| -2288          |             |         |         |             |                     |         |                 | 6: 60, J, N, Fe+Ca, Pa, Pi, ? |
| 53             |             |         |         |             |                     |         |                 | 7: 40, J, N, H+Uk, Fl, Pi, ? |
| -2286          |             |         |         |             |                     |         |                 | Becomes moderately fractured; with healed fractures |
| 54             |             |         |         |             |                     |         |                 | 1: 40, J, N, H+Ca+Mn+Fe, Fl+Su, Pi, SR |
| -2284          |             |         |         |             |                     |         |                 | 2: 75, J, N, Fe+Mn+Ca, Su+Pa, Pi, SR |
|               |             |         |         |             |                     |         |                 | 3: 50, J, T, H+No, No, Pi |
|               |             |         |         |             |                     |         |                 | 4: 85, J, VN-N, Ca+Fe, Fl-Pa, Pl-Wa, SR |
|               |             |         |         |             |                     |         |                 | Becomes highly fractured |
| 55             |             |         |         |             |                     |         |                 | 1: 90, J, T, H+Fe?, Fi, Wa, ? |
| -2282          |             |         |         |             |                     |         |                 | 2: 35, J, VN, Ca?, Pa-Sp, Pi, SR |
| 56             |             |         |         |             |                     |         |                 | 3: 70, J, VN-N, Ca+Fe, Fl, Pi, ? |
| -2280          |             |         |         |             |                     |         |                 | Becomes highly fractured |
| 57             |             |         |         |             |                     |         |                 | 4: 20, J, VN, Ca?, Pa, Pi, SR |
| -2278          |             |         |         |             |                     |         |                 | 5: 85, J, VN, Ca+Ch?, Pa, Pi, SR |
| 58             |             | 12      | 100     | 2           | 100                 |         |                 | 1: 80, J, N, Ca?, Pi, Pa, SR |
| -2276          |             |         |         |             |                     |         |                 | 2: 75, J, N, H+Ca+Mn, Fl+Sp, Pi, SR |
| 59             |             |         |         |             |                     |         |                 | 3: 65, J, VN, Ca?, Sp, Pi, SR |
| -2274          |             |         |         |             |                     |         |                 | 1: 80, J, N, Ca?, Pi, Pa, SR |
| 60             |             |         |         |             |                     |         |                 | 2: 75, J, N, H+Ca+Mn, Fl+Sp, Pi, SR |
| -2272          |             |         |         |             |                     |         |                 | 3: 65, J, VN, Ca?, Sp, Pi, SR |

MATERIAL DESCRIPTION

FIELD NOTES AND OTHER TESTS

Packer Test Intervals
Drill Time, 24-hr
(1) 1107
(2) 1159
(3) 1239
(4) 1306
(5) 1332

Report: GEO_ CORE_OAK_C; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-206

[7] 47.4-48.7ft.: Mohs Hardness = 3-4; UCS = 20,886 psi
# Log of Core Boring B-206

## Project: Klamath River Renewal Project
## Project Location: Copco and Iron Gate Reservoirs
## Project Number: 60537920

### Rock Core

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Lithology</th>
</tr>
</thead>
</table>

### Material Description

**BASALT:** grey to bluish black (5B 2.5/1); slightly weathered; strong; moderate to highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch.

---

**TERTIARY to QUATERNARY INTRUSIVE BASALT**

---

<table>
<thead>
<tr>
<th>Packer Test Intervals</th>
<th>Drill Time, 24-hr [Drill Rate, ft/hr]</th>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
</table>

### Field Notes and Other Tests

*Rock does not meet soundness criteria for RQD calculation.*

---

**End of day 8/15/2018**
**Begin day 8/16/2018**

---

**Mohs Hardness = 3-4; UCS = 15,739 psi**
### Packer Test Intervals

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracturing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
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<td>20</td>
<td>6</td>
<td>100</td>
<td>75*</td>
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<td>21</td>
<td>100</td>
<td>100</td>
<td>75*</td>
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</tbody>
</table>

### FIELD NOTES AND OTHER TESTS

- **Packer Test Intervals: 0825 Packer test #2 from 75.0 to 85.0**
- **0810 Switch to 4-inch carbonado bit**
- **1050**
- **1110 Packer test #1 from 85.0 to 95.0**

### Material Description

**VOLCANIC BRECCIA:** greenish grey with grey and black clasts; moderately weathered; moderately strong to strong; highly fractured; medium grained matrix with angular clasts up to 1-inch; some calcite veins

---TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--- (continued)

4: 50-60, J, VN-T, Ca?, Fl, Pl, ?

5: 70, V, MW, Uk, Fl, Pl, ?

With planar, 70° fabric

6: 70, J, VN, Ca, Pa, Pl, SR

Becomes highly weathered/altered; weak to very weak; locally crushed

1: 30, J, VN, No, No, Pl, ? (possibly mechanical)

Becomes slightly weathered; moderately strong to strong; with light bluish grey and dark grey clasts 1/8-inch to 1-inch

2: 60, J, N, No, No, Pl, R

Weak rock in shoe

Becomes moderately weathered; moderately strong; medium to coarse grained matrix with strong black and grey clasts and soft clayey green clasts

1: 40, J, VN-T, No, No, Ir, ?

2: 60, J, N-VN, H+Ca, Fl-Pa, Pl, SR

With more abundant soft, green clasts

With decreasing clast size

Becomes locally moderately strong to strong; moderately to locally highly weathered/altered; intensely fractured

With fewer breccia clasts

1: 0-10, J, VN, No, No, Pl-Ir, ? (possibly mechanical)

2: 25, J, Vn, Mn?, Fl, Pl, ? (surface staining around joint)

3: 0, J, VN, Mn?, Su, St-Pl, ? (surface staining around joint)
**Log of Core Boring B-206**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Run No</th>
<th>Box No</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R. Q. D. %</th>
<th>Fracture Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td>100</td>
<td>75°</td>
<td></td>
<td>3</td>
<td>VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately to highly weathered; moderately strong; moderately fractured; medium to coarse grained matrix with angular clasts up to 1/2-inch</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>100</td>
<td>0</td>
<td></td>
<td>0</td>
<td>--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>94.3ft.: becomes browish grey; weak to moderately strong With 45° fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>3</td>
<td>100</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Becomes slightly weathered; strong to moderately strong; with elongated inclusions along fabric</td>
</tr>
<tr>
<td>97</td>
<td>22</td>
<td>100</td>
<td>0</td>
<td>100°</td>
<td>1</td>
<td>Becomes very light bluish grey; moderately strong; matrix supported</td>
</tr>
<tr>
<td>98</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td>Becomes brownish grey; fewer clasts</td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 100.0 FEET**

Televiewer and caliper survey by NorCal Geophysics 8/16/2018. Install two VWPs at 25ft and 92ft with neat cement grout to ground surface with 12° flush mount monument.

---

**FIELD NOTES AND OTHER TESTS**

1. 0, J, VN-MW, Ca?, Sp, Pl, SR
2. 0, J, MW, Cl+Sp, Fl, Pl, ?
3. 0, J, MW, H+Uk, Fl, Pl, ?

---

**TABLE**

<table>
<thead>
<tr>
<th>Number</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Fractures per Foot</th>
<th>R. Q. D. %</th>
<th>Fracture Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>3</td>
<td>VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately to highly weathered; moderately strong; moderately fractured; medium to coarse grained matrix with angular clasts up to 1/2-inch</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>94.3ft.: becomes browish grey; weak to moderately strong With 45° fabric</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>3</td>
<td>100</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Becomes slightly weathered; strong to moderately strong; with elongated inclusions along fabric</td>
</tr>
<tr>
<td>97</td>
<td>22</td>
<td>100</td>
<td>0</td>
<td>100°</td>
<td>1</td>
<td>Becomes very light bluish grey; moderately strong; matrix supported</td>
</tr>
<tr>
<td>98</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td>Becomes brownish grey; fewer clasts</td>
</tr>
</tbody>
</table>

---

**Report:** GEO_CORE_OAK_C; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-206
**Log of Soil and Core Boring B-207**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>K. Zeiger/B. Kozlowicz</th>
<th>Checked By</th>
<th>P. Respess</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/13/2018-9/18/2018</td>
<td>Drill Rig Type</td>
<td>Truck Mounted Mobile B-53</td>
<td>Total Depth of Borehole</td>
<td>81.1 feet</td>
</tr>
</tbody>
</table>

**Drilling Method:** Rotary Wash, HQ-3 Rock Core  
**Drill Rig Type:** Truck Mounted Mobile B-53  
**Groundwater Level:** 23.1 feet bgs 9/14/2018  
**Borehole Backfill:** Cement grout to ground surface

### ROCK CORE

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2358</td>
<td>CLAYEY GRAVEL (GC); loose; brown (7.5YR 4/3); 70% angular to rounded GRAVEL up to 2 inches; 30% low plasticity FINES; dry; gravel is chert, rhyolite, and other volcanics; abundant roots</td>
<td></td>
</tr>
<tr>
<td>-2356</td>
<td>GRAVELLY LEAN CLAY (CL); medium stiff; brown (10YR 4/3); 60% low plasticity FINES; 40% angular GRAVEL up to 1 inch; dry; with roots and rootlets</td>
<td></td>
</tr>
<tr>
<td>-2354</td>
<td>SANDY LEAN CLAY with GRAVEL (CL); stiff; brown (10YR 4/3); 55% low plasticity FINES; 25% angular GRAVEL; 25% fine grained SAND; dry; gravel is highly weathered; with rootlets</td>
<td></td>
</tr>
</tbody>
</table>
| -2352      | Complete Weathered Volcanic Breccia--

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-01</td>
<td>7</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-02</td>
<td>10</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Groundwater Level:** 23.1 feet bgs 9/14/2018  
**Borehole Location:** Iron Gate Reservoir along Copco Road  
**Drill Rig Type:** 2 7/8-inch ID HQ Bit  
**Drilling Contractor:** Gregg Drilling  
**Drill Bit Size/Type:** 2 7/8-inch ID HQ Bit  
**Hammer Type:** Automatic hammer; 140 lbs, 30-inch drop  
**Elevation, feet:** 2359 feet  
**Coordinate Location:** N 2602272 E 6461618

**FIELD NOTES AND TEST RESULTS:**

- Start 12:00 9/13/2018 with Hollow Stem Auger to 15.2 ft.; K. Zeiger logging
- One liner retained (11.0-11.5 ft.)
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>13</td>
<td>1</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Volcanic Breccia: grey (7.5YR 5/1); slightly weathered; strong; cemented fine grained matrix with angular volcanic clasts up 4 inches; highly fractured. --Tertiary Volcanics (Bogus Mountain Beds, undifferentiated)--</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>1</td>
<td>94</td>
<td>61</td>
<td>1</td>
<td></td>
<td></td>
<td>1: 10, J, N, No, No, Wa, SR</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>2</td>
<td>100</td>
<td>&gt;6</td>
<td>26</td>
<td></td>
<td></td>
<td>2: 50, J, N, Fe, Sp, Wa, R</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>1</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3: 20, J, N7, Ca, Sp, Wa, SR (run break)</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>1</td>
<td>&gt;6</td>
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<tr>
<td>18</td>
<td>18</td>
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<td>100</td>
<td>&gt;6</td>
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<td>96</td>
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<td>100</td>
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<td>27</td>
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<td>&gt;6</td>
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<tr>
<td>29</td>
<td>29</td>
<td>&gt;6</td>
<td>100</td>
<td>&gt;6</td>
<td></td>
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</tr>
</tbody>
</table>

### MATERIAL DESCRIPTION

- Volcanic Breccia: grey (7.5YR 5/1); slightly weathered; strong; cemented fine grained matrix with angular volcanic clasts up 4 inches; highly fractured.
- Tertiary Volcanics (Bogus Mountain Beds, undifferentiated).

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time [Rate, ft/hr]</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-03</td>
<td>50</td>
<td>3.5</td>
<td>100</td>
<td>1400</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>1405</td>
</tr>
<tr>
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<td></td>
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<td>1411</td>
</tr>
</tbody>
</table>

### FIELD NOTES AND TEST RESULTS

- Switch to HQ coring with 2.78 inch HQ bit at 15.2 ft.
- 0.3 ft. of Run 2 recovered with Run 3; HQ inner barrel stuck in rods after Run 2 pull rods to retrieve.
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>&gt;6</td>
<td>46°</td>
<td>3</td>
<td></td>
<td>VOLCANIC BRECCIA; light yellowish brown (10YR 6/4); moderately weathered; moderately strong; locally crushed; highly fractured. --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>-2328</td>
<td>31</td>
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</tr>
<tr>
<td>-2326</td>
<td>33</td>
<td>3</td>
<td>100</td>
<td>&gt;6</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2324</td>
<td>35</td>
<td>5</td>
<td>100</td>
<td>&gt;6</td>
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<td>1</td>
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<td></td>
</tr>
<tr>
<td>-2322</td>
<td>37</td>
<td>6</td>
<td>NA</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2320</td>
<td>39</td>
<td>7</td>
<td>56</td>
<td>NA</td>
<td>10</td>
<td>4</td>
<td></td>
<td>Becomes completely weathered to a CLAYEY SAND, extremely weak.</td>
</tr>
</tbody>
</table>

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Elevation, feet</th>
<th>Number</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>[18]</td>
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<td></td>
<td></td>
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<td>[23]</td>
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<tr>
<td>[19]</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### FIELD NOTES AND TEST RESULTS

- **Lost all circulation at 35.0 ft.**
- **Becomes highly weathered, weak, intensely fractured.**
- **Becomes highly weathered, weak, crushed.**
- **Becomes moderately weathered, moderately strong.**
- **Becomes completely weathered, crushed.**
- **Becomes completely weathered to a CLAYEY SAND, extremely weak.**
- **Drtiller noted 'harder' drilling conditions.**
- **End of day 9/13/2018**
- **Begin day 9/16/2018**
- **1500 gallons of water used in Run 7**
- **Advance 4-inch casing to 29 ft.**
VOLCANIC BRECCIA; light yellowish brown (10YR 6/4); completely weathered to a CLAYEY SAND; extremely weak; locally crushed.

- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)
  
  At 46ft.: becomes very dark greenish grey (5BG 3/1) and greenish grey (5G 6/1); moderately weathered; moderately strong; intensely fractured.
  
  1: 20, J, N, Sa, Pa, Pi, S
  2: 50, J, T, No, No, Pi, S

At 47ft.: becomes very dark greenish grey (5BG 3/1), highly weathered, very weak, with angular clasts weathering out of soft matrix.

Slightly weathered, strong clast

1: 10, J, N, No, No, Wa, SR
2: 45, J, N, No, No, Wa, SR
3: 55, J, T, No, No, Wa, SR
4: 30, J, N7, No, No, Pi, S (clast boundary)
5: 20, J, T, No, No, Wa, SR

Crushed

With calcite veins

1: 65, J, N, No, No, Wa, SR
2: 30, J, N, No, No, Wa-St, SR
3: 10, J, T, No, No, Wa-St, SR

Becomes slightly to moderately weathered, moderately strong

Crushed

Becomes slightly fractured

Clast weathering out of matrix

1: 85, J, MW, No, No, Wa-St, R
2: 10, J, MW, No, No, Wa-St, R
3: 15, J, N, No, No, Wa, SR
4: 50, V, N, H+Ca, Pi, Fr, ?
5: 30, V, MW, H+Ca, Fi, Wa, ?
Log of Soil and Core Boring B-207

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Sheet 5 of 6

MATERIAL DESCRIPTION

- VOLCANIC BRECCIA; very dark greenish grey (5BG 3/1) and greenish grey (5G 6/1); slightly to locally moderately weathered; moderately strong; slightly fractured; fine grained matrix with angular to subangular clasts of porphyritic basalt up to 1.5 inches
- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) (continued)

FIELD NOTES AND TEST RESULTS

- End of day 9/14/2018
- Begin day 9/18/2018
- B. Kozlowicz logging
- Water level at 28.8 ft, 9/19/2018
- 50% fluid circulation

SOIL SAMPLES

- Recovery, %
- Drill Time [Rate, ft/hr]
- Type
- Number
- Blows / 6 in.
- Elevation, feet
- Lithology
- Number
- Run No.
- Box No.
- Fractures per Foot
- Fracture Drawing Number
- Fractures/

SOIL CORE

- Run No.
- Box No.
- Depth, feet
- R Q D, %
- Recovery, %
- Elevation, feet
- Fractures per Foot
- Fracture Drawing Number
- Lithology

SOIL SAMPLES

- Type
- Number
- Blows / 6 in.
- Recovery, %
- Drill Time [Rate, ft/hr]
<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>78</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td>100</td>
<td></td>
<td>VOLCANIC BRECCIA; very dark greenish grey (5BG 3/1) to greenish grey (5G 6/1) and dark grey; slightly weathered; strong; slightly fractured; fine grained matrix with angular to subangular clasts of porphyritic basalt up to 1 inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)</td>
</tr>
<tr>
<td>-2280</td>
<td>79</td>
<td>16</td>
<td></td>
<td>100</td>
<td></td>
<td>85</td>
<td></td>
<td>1: 75-90, V, MW, H+Ca, Fi, Ir-St, ?</td>
</tr>
<tr>
<td>-2278</td>
<td>81</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>2: 40, J, VN, No, No, Pl, SR-R (possibly mechanical)</td>
</tr>
<tr>
<td>-2276</td>
<td>83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very strong, dark grey porphyritic basalt</td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 81.1 FEET**

**SOIL SAMPLES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time (Rate, ft/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1128</td>
<td>[14]</td>
<td></td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**
## Log of Soil and Core Boring B-208

### Project Details
- **Project:** Klamath River Renewal Project
- **Project Location:** Copco and Iron Gate Reservoirs
- **Project Number:** 60537920

### Logging Details
- **Logged By:** B. Kozlowicz/T. Vande Voorde
- **Checked By:** B. Kozlowicz

### Drilling Details
- **Date(s) Drilled:** 9/18/2018-9/21/2018
- **Drilling Method:** Hollow Stem Auger, HQ-3 Rock Core
- **Drill Rig Type:** Truck Mounted Mobile B-53
- **Groundwater Level:** 14.1 feet bgs 9/19/2018
- **Backfill:** Cement grout to ground surface

### Soil Samples

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lithology:**
- CLAYEY SAND with GRAVEL (SC); loose to medium dense; dark brown (10YR 3/3); 40% low plasticity FINES; 40% fine to coarse grained SAND; 20% angular to subrounded GRAVEL and COBBLES up to 3 inches; dry
- SANDY LEAN CLAY (CL); very stiff; 70% medium plasticity FINES; 30% fine to medium grained SAND; trace small GRAVEL; moist

**MATERIAL DESCRIPTION:**

### Field Notes and Test Results
- **Start:** 15:50 9/18/2018 with Hollow Stem Auger; B. Kozlowicz logging
SANDY LEAN CLAY (CL); very stiff; 70% medium plasticity FINES; 30% fine to medium grained SAND; trace small GRAVEL; moist

SANDY LEAN CLAY with GRAVEL (CL); medium stiff; with rounded to subangular GRAVEL; wet

GRAVEL and COBBLES with SANDY LEAN CLAY/CLAYEY SAND; washed, rounded COBBLES and BOULDERS (fragments) up to 6 inches

With washed, subrounded to rounded GRAVEL; some angular to coarse grained SAND; COBBLES are vesicular up to 6-inches

Rig chatter

Switch to HQ coring with 4-inch #2 diamond bit at 2.0 ft. Advance 4.5-inch casing to 24 ft.

Advance 4.5-inch casing to 24 ft.

Begin Day 9/18/2018; T. VandeVoorde logging; 0% fluid return

Advance 4.5-inch casing to 24 ft.

With washed, subrounded to rounded GRAVEL; some angular to coarse grained SAND; COBBLES are vesicular up to 6-inches

--- ALLUVIUM ---(continued)
**Log of Soil and Core Boring B-208**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  
**Sheet 3 of 6**

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>R.Q.D. %</th>
<th>Fractures per Foot</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>4</td>
<td>15</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
<td></td>
<td>GRAVEL and COBBLES with SANDY LEAN CLAY/CLAYEY SAND; washed, rounded vesicular COBBLES and BOULDERS (fragments) up to 6 inches; washed, subrounded to rounded GRAVEL; some angular to coarse grained SAND --RIVER ALLUVIUM--(continued)</td>
</tr>
<tr>
<td>-2308</td>
<td>5</td>
<td>14</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
<td></td>
<td>COBBLES become angular to rounded</td>
</tr>
<tr>
<td>-2306</td>
<td>6</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
<td></td>
<td>Coarse black and light brown SAND in cuttings</td>
</tr>
<tr>
<td>-2304</td>
<td>7</td>
<td>34</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
<td></td>
<td>With rounded, basaltic COBBLES; angular, vesicular basaltic GRAVEL; some medium to coarse grained SAND</td>
</tr>
</tbody>
</table>

**FIELD NOTES AND TEST RESULTS**

- Advance 4.5-inch casing to 29ft.
- Angular coarse grained SAND recovered from cuttings possibly from no recovery zones
- Cuttings bagged for review
- Driller notes sandy loose drilling conditions
- Initially no recovery for Run 5; run recored and bagged for review
- Cuttings bagged for review
- Driller notes change in cuttings with increased brown fine grained SAND or FINES; change in color of drilling fluid from grey to brown
<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R . Q . D . %</th>
<th>Fracture Drawing</th>
<th>Number</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>45</td>
<td>45</td>
<td>7</td>
<td>1</td>
<td>34</td>
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<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>48</td>
<td>48</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
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<td>50</td>
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<td>10</td>
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<td>84</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>52</td>
<td>52</td>
<td>11</td>
<td>17</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>54</td>
<td>54</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>56</td>
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<td>58</td>
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<td>14</td>
<td>73</td>
<td>73</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- GRAVEL and COBBLES with SAND, rounded, basaltic COBBLES; angular, vesicular basaltic GRAVEL; some medium to coarse grained SAND; 45-46 ft. fine-grained, basaltic BOUDLER with 1-2 mm feldspar phenocrysts
  - (RIVER ALLUVIUM—(continued))

- With more rounded COBBLES and BOULDERS; variable volcanic lithologies of basaltic, andesite, and tuff

- VOLCANIC BRECCIA; dark, dusky purple and bluish grey; moderately weathered, extremely weak, fine grained matrix with strong clasts
  - (TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated))

- Strong, volcanic breccia clast in shoe

- Becomes very dusky red (2.5YR 2.5/2) to dark reddish brown (2.5YR 2.5/4); moderately to highly weathered, very weak breccia clasts in a friable, completely weathered, extremely weak matrix; locally recovered as CLAYEY SAND with GRAVEL

**FIELD NOTES AND TEST RESULTS**

- Continued 20-30% fluid return
- Drilling fluid becomes dark brown
- Advance 4.5-inch casing to 54 ft.
- End of day 9/19/2018
- Begin day 9/20/2018
- Switch to new #2 diamond bit at 59 ft.
MATERIAL DESCRIPTION

- VOLCANIC BRECCIA; dark brown to dusky purple; moderately to highly weathered; extremely weak; fine grained, sandy matrix with basaltic breccia clasts
- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)

FIELD NOTES AND TEST RESULTS

- Continued 20-30% fluid return; hard drilling (1500 psi down pressure)
- Switch to 4-inch drag bit at 695 ft.
- Drilling fluid becomes light grey
- Drilling fluid becomes brown/purple
### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>77</td>
<td>3</td>
<td>19</td>
<td>86</td>
<td>3</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2260</td>
<td>78</td>
<td>3</td>
<td>20</td>
<td>NA</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

VOLCANIC BRECCIA; dark reddish grey (10YR 3/1); moderately weathered; extremely weak; highly fractured  
--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)

3: 65, J, VN, No, No, SR, Pl  
4: 10, J, W, No, No, Ir, SR

Becomes <10% clasts; 90% clayey matrix

TOTAL DEPTH = 80.0 FEET

### FIELD NOTES AND TEST RESULTS

- **SOIL SAMPLES**
  - Recovery, %
  - Drill Time (Rate, ft/hr)

- **Elevation, feet**
  - 77
  - -2260
  - 79
  - -2258
  - 80
  - -2256
  - 82
  - -2254
  - 84
  - -2252
  - 86
  - -2250
  - 88
  - -2248
  - 90
  - -2246
  - 92
  - 93

**Report**: GEO_CORE_SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-208
### MATERIAL DESCRIPTION

- **S01**: SILT with SAND and GRAVEL (ML); very soft; very dark gray to black (2.5Y 3/1 to 2.5/1); fine to coarse grained SAND; subangular to rounded GRAVEL; sand and gravel consist of diatomite clasts—RECENT LAKE SEDIMENT—

- **S02**: Becomes soft; dark olive brown (2.5Y 3/3) to very dark grayish brown (2.5Y 3/2) with trace gravel

- **S03**: DIATOMITE; light olive brown (2.5Y 5/4); highly weathered; extremely weak; highly fractured; friable—LACUSTRINE DIATOMACEOUS TERRACE (Ql)—

- **S04**: Becomes soft with iron staining on irregular subvertical fractures

- **S05**: BASALT; black (10Y 2.5/1); highly to completely weathered; friable—TERTIARY to QUATERNARY INTRUSIVE BASALT—

### REMARKS AND OTHER TESTS

- **Sampler fell 18 inches on last blow**
- **Advance 6-inch casing to 6 feet with hammer (hard/stiff at about 3.5 feet)**
- **Advance 6-inch casing to 8 feet with hammer; LL=33; PL=25**
- **End of day 16:45; Begin day 08:30**
- **Advance 6-inch casing to 11 feet with hammer**
- **Cuttings become dark greenish gray sandy clay; slower drilling**
### Log of Soil Boring BC-01

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

---

**SAMPLES**

<table>
<thead>
<tr>
<th>Elevation feet</th>
<th>Depth, feet</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery, feet</th>
<th>Material Description</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 30.4 FEET**

---

**Graphic Log:**

- Sheet 2 of 2
### Log of Soil Boring BC-02

#### Project Details
- **Project:** Klamath River Renewal Project
- **Project Location:** Copco and Iron Gate Reservoirs
- **Project Number:** 60537920

#### Drilling Information
- **Date Drilled:** 2/5/2018
- **Logged By:** B. Kozlowicz
- **Checked By:** D. Simpson
- **Drilling Method:** Rotary Wash
- **Drill Rig Type:** Barge Mounted CME-45
- **Groundwater Level:** 9.4 feet above ground surface (2/5 at 9:00)
- **Backfill:** Bentonite cement grout to 10 feet bgs

#### Sampling Method
- **Sample Method:** Automatic hammer; 140 lbs, 30-inch drop

#### Drilling Parameters
- **Drill Rig:** Taber Drilling
- **Hammer:** Automatic hammer; 140 lbs, 30-inch drop

#### Borehole Details
- **Total Depth of Borehole:** 64.6 feet
- **NAVD 88 Ground Surface Elevation:** 2600 feet

#### Sampling and Testing

#### SAMPLES

<table>
<thead>
<tr>
<th>Elevation feet</th>
<th>Depth, feet</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery Feet</th>
<th>Graphic Log</th>
<th>MATERI AL DESCRIPTION</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>REMARKS AND OTHER TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2595</td>
<td>5</td>
<td>S01</td>
<td>2</td>
<td></td>
<td>10</td>
<td>12</td>
<td>SANDY LEAN CLAY (CL): very soft; very dark gray (2.5Y 3/1) to black (2.5Y 2.5'/1); trace fine rounded gravel</td>
<td>85</td>
<td></td>
<td></td>
<td>Drove sampler for extra 6 inches (last three blowcounts reported) SA: G=52%; S=20%; F=28% Advance 6-inch casing to 3.8 feet with hammer</td>
</tr>
<tr>
<td>2590</td>
<td>10</td>
<td>S02</td>
<td>5</td>
<td></td>
<td>5</td>
<td>10</td>
<td>CLAYEY GRAVEL with SAND (GC): stiff/medium dense; very dark grayish brown (10YR 3/2); subangular to rounded fine to coarse gravel up to 2 inches in diameter; fine to coarse sand</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2585</td>
<td>15</td>
<td>S03</td>
<td>10</td>
<td></td>
<td>10</td>
<td>10</td>
<td>DIATOMITE: olive to olive yellow (5Y 4/3 to 2.5Y 6/6); moderately to highly weathered; extremely weak; highly fractured; with sub-horizontal bedding and irregular sub-vertical fractures; friable</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2580</td>
<td>20</td>
<td>S04</td>
<td>11</td>
<td></td>
<td>9</td>
<td>9</td>
<td>Becomes light yellowish brown (2.5Y 6/4); extremely weak/clayey; moderately fractured</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2575</td>
<td>25</td>
<td>S05</td>
<td>4</td>
<td></td>
<td>4</td>
<td>6</td>
<td>DIATOMITE with ELASTIC SILT: greenish gray (10Y 5/1); soft to extremely weak; highly fractured; friable</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2570</td>
<td>30</td>
<td>S06</td>
<td>200 psi</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2595</td>
<td>5</td>
<td>S07</td>
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<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td>93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Graphical Log
- **Elevation:** 0 to 30 feet
- **Depth:** 0 to 64.6 feet

**Log of Soil Boring BC-02**

Sheet 1 of 2

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-02
<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation, feet</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance (psi)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>2535</td>
<td>65</td>
<td>S11</td>
<td>50/3&quot;</td>
<td>100</td>
<td>2565-2553.5</td>
<td></td>
</tr>
<tr>
<td>2540</td>
<td>60</td>
<td>S10</td>
<td>2</td>
<td>100</td>
<td>2555-2543</td>
<td></td>
</tr>
<tr>
<td>2550</td>
<td>50</td>
<td>S09</td>
<td>3</td>
<td>100</td>
<td>2565-2553.5</td>
<td></td>
</tr>
<tr>
<td>2560</td>
<td>40</td>
<td>S08</td>
<td>200 to 500 psi</td>
<td>84</td>
<td>2565-2553.5</td>
<td></td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- **DIATOMITE; olive to olive yellow (5Y 4/3 to 2.5Y 6/6); moderately to highly weathered; extremely weak; highly fractured; with sub-horizontal bedding and irregular sub-vertical fractures; friable** — LACUSTRINE DIATOMACEOUS TERRACE (Ql) — (continued)

- Increase in plasticity; soft; olive (5Y 5/3) and very dark gray to black (2.5Y 2.5/1 to 2.5Y 3/1) in ~2.5-inch beds; sub-horizontal bedding

- **BASALT; black (10Y 2.5/1); slightly weathered; strong; recovered as angular gravel up to 1-inch in diameter** — TERTIARY to QUATERNARY INTRUSIVE BASALT

**REMARKS AND OTHER TESTS**

- S-10: Two liners retained (55-55.5 ft., 55.5-56 ft.)

- Harder drilling, small black basalt chips in cuttings

- Cuttings become very dark gray

- TX-ICU

**Fines Content (%<#200Sieve) Plasticity Index**

<table>
<thead>
<tr>
<th>Number</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td>S09</td>
<td>178</td>
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<td>100</td>
</tr>
<tr>
<td>S10</td>
<td>171</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>171</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 64.6 FEET**
<table>
<thead>
<tr>
<th>DATE</th>
<th>DRILLED</th>
<th>LOGGED BY</th>
<th>CHECKED BY</th>
<th>PROJECT NUMBER</th>
<th>DRILLING METHOD</th>
<th>ROTARY WASH</th>
<th>DRILL BIT SIZE/TYPE</th>
<th>TOTAL DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/6/2018 - 2/7/2018</td>
<td>60537920</td>
<td>B. Kozlowicz</td>
<td>D. Simpson</td>
<td>96.5 feet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| BOREHOLE | BACKFILL | LOCATION | | | | | | |
|-----------|----------|---------|------|--------------|-------------|
| Copco Reservoir | Bentonite cement grout to 10 feet bgs | Copco Reservoir | |

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>RECOVERY FEET</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01</td>
<td>2</td>
<td></td>
<td>ORGANIC SILT WITH SAND (OL); very soft; very dark grayish brown (2.5Y 3/2) --RECENT LAKE SEDIMENT--</td>
</tr>
<tr>
<td>S02</td>
<td>0.6</td>
<td></td>
<td>SANDY LEAN CLAY (CL); soft; black (5Y 2.5/2); fine grained sand; trace rounded gravel; small angular rock fragments; and fine rootlets --COLLUVIUM/RESIDUAL SOIL--</td>
</tr>
<tr>
<td>S03</td>
<td>0.1</td>
<td></td>
<td>POORLY GRADED GRAVEL with CLAY (GP-GC); subrounded gravel up to 2.5-inch in diameter of varied volcanic lithology and clayey infill --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--</td>
</tr>
<tr>
<td>S04</td>
<td>1.0</td>
<td></td>
<td>DIATOMITE; light olive brown (2.5Y 5/3); very soft; locally clayey with vesicular basalt GRAVEL; bedding/fractures not present --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--</td>
</tr>
<tr>
<td>S05</td>
<td>1.3</td>
<td></td>
<td>DIATOMITE with ELASTIC SILT; dark grayish brown (2.5Y 4/2); massive/soft to very soft --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--</td>
</tr>
</tbody>
</table>

**REMARKS AND OTHER TESTS**

- **Type**: Organic Silt with Sand (OL)
- **Type**: Sandy Lean Clay (CL)
- **Type**: Poorly Graded Gravel with Clay (GP-GC)
- **Type**: Diatomite
- **Type**: Diatomite with Elastic Silt

**Properties**

- **Water Content, %**: 35
- **Plasticity Index**: NP 67
- **Fines Content (%<#200Sieve)**: 25

**Remarks**

- Sampler settled to 1-foot; drove sampler for extra 6 inches (last three blowcounts reported) LL=48; PL=25; SA: G=3%; S=30%; F=67%
- Advanced 6-inch casing to 4 feet (stiff from 3 feet)
- Hard chattering drilling
- Switch to rock core bit with SPT sampler
- Faster drilling from 10.5 to 11.5 feet
- Return fluid becomes olive
- Advanced 6-inch casing to 14 feet with hammer
- Switch back to tricone bit
**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
</tr>
</thead>
</table>

- Type: DIATOMITE with ELASTIC SILT
- Number: dark grayish brown (2.5Y 4/2); massive/soft to very soft
- Project: Klamath River Renewal Project
- Project Location: Copco and Iron Gate Reservoirs
- Log of Soil Boring BC-03

**REMARKS AND OTHER TESTS**

- Cutting very dark greenish gray
- TX-CU

**Elevation feet**

<table>
<thead>
<tr>
<th>Depth, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2550</td>
</tr>
<tr>
<td>2545</td>
</tr>
<tr>
<td>2540</td>
</tr>
<tr>
<td>2535</td>
</tr>
<tr>
<td>2530</td>
</tr>
<tr>
<td>2525</td>
</tr>
<tr>
<td>2520</td>
</tr>
</tbody>
</table>

**Sampling Resistance**

- 200 lb

**Recovery (feet)**

- 2.5

**Graphic Log**
<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>2515</td>
</tr>
<tr>
<td>85</td>
<td>2510</td>
</tr>
<tr>
<td>90</td>
<td>2505</td>
</tr>
<tr>
<td>95</td>
<td>2500</td>
</tr>
<tr>
<td>100</td>
<td>2495</td>
</tr>
<tr>
<td>105</td>
<td>2490</td>
</tr>
<tr>
<td>110</td>
<td>2485</td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

DIATOMITE with ELASTIC SILT; dark greenish gray (10Y 4/1); massive/soft to very soft; 1 to 2-inch beds/lenses of very dark gray to black clay—LACUSTRINE DIATOMACEOUS TERRACE (Q)—(continued)

- With trace rounded GRAVEL (possibly slough)
- End of day 2/6/2018
- Begin day 2/7/2018
- Cuttings greenish black

**PROJECT DATA**

- Project: Klamath River Renewal Project
- Project Location: Copco and Iron Gate Reservoirs
- Project Number: 60537920

**LOG OF SOIL BORING BC-03**

**SAMPLES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance (psi)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>S07</td>
<td>5</td>
<td>7</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>S08</td>
<td>100 psi</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>S09</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S10</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>4</td>
<td>5</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

**REMARKS AND OTHER TESTS**

- TX-ICU
- Driller out of rods

**TOTAL DEPTH = 96.5 FEET**

**FABRIC TESTS**

- Wettability
- Force of Attraction

**PLASTICITY TESTS**

- Plasticity Index
- Plastic Limit
- Liquid Limit

**FINES CONTENT (%)<200 SIEVE**

- Water Content, %
- Fines Content (%<200 Sieve)
**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Material Description</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5</td>
<td>SILTY SAND (SM); very loose; very dark brown (10YR 2/2); trace subangular diatomite GRAVEL up to 0.75 inches in diameter ---RECENT LAKE SEDIMENT---&lt;br&gt;---Becomes organic rich and softer/looser with increased nonplastic fines---</td>
<td>61</td>
<td>44</td>
<td>44</td>
<td>6-inch casing settles to 1.5 feet&lt;br&gt;Advance 6-inch casing to 5.5 feet with hammer&lt;br&gt;Drove sampler for extra 6 inches (last three blowcounts reported)&lt;br&gt;Advance 6-inch casing to 12.5 feet with hammer&lt;br&gt;SA: G=9%; S=50%; F=41%; TX-ICU&lt;br&gt;TX-ICU</td>
</tr>
<tr>
<td>5 to 10</td>
<td>CLAYEY SAND (SC); very loose; very dark brown (10YR 2/2); trace fine GRAVEL and coarse organics ---RECENT LAKE SEDIMENT---</td>
<td>61</td>
<td>58</td>
<td>58</td>
<td>100 percent WCR&lt;br&gt;TX-ICU&lt;br&gt;TX-ICU&lt;br&gt;Lost circulation to 27.5 feet&lt;br&gt;Drove sampler for extra 6 inches (last three blowcounts reported)&lt;br&gt;About 50% WCR</td>
</tr>
<tr>
<td>10 to 15</td>
<td>WEAKLY CEMENTED DIATOMITE GRAVEL; medium dense; light olive brown (2.5Y 5/4); angular diatomite GRAVEL; weakly cemented and friable with sub-horizontal bedding and sub-vertical fractures ---LACUSTINE DIATOMACEOUS TERRACE (Ql)---</td>
<td>61</td>
<td>41</td>
<td>41</td>
<td>100 percent WCR&lt;br&gt;TX-ICU&lt;br&gt;TX-ICU&lt;br&gt;Lost circulation to 27.5 feet&lt;br&gt;Drove sampler for extra 6 inches (last three blowcounts reported)&lt;br&gt;About 50% WCR</td>
</tr>
<tr>
<td>15 to 20</td>
<td>DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish gray (5GY 7/1) ---LACUSTINE DIATOMACEOUS TERRACE (Ql)---</td>
<td>61</td>
<td>105</td>
<td>105</td>
<td>TX-ICU&lt;br&gt;TX-ICU&lt;br&gt;100 percent WCR</td>
</tr>
<tr>
<td>20 to 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 to 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REMARKS AND OTHER TESTS**

- 6-inch casing settles to 1.5 feet
- Advance 6-inch casing to 5.5 feet with hammer
- Drove sampler for extra 6 inches (last three blowcounts reported)
- Advance 6-inch casing to 12.5 feet with hammer
- TX-ICU
- TX-ICU
- 100 percent WCR
- TX-ICU
- Lost circulation to 27.5 feet
- Drove sampler for extra 6 inches (last three blowcounts reported)
- About 50% WCR
**Material Description**

DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish grey (10YR 8/3) mottled with very pale brown (10YR 8/3) and light greenish grey (5GY 7/1) with 10 degree bedding—LACUSTRINE DIATOMACEOUS TERRACE (Ql)—(continued)

Becomes completely weathered to a FAT CLAY; with 0.25-inch very dark gray (5Y 3/1) 10-degree beds (varves?)

With vertical dark grey stained (Mn?) fractures

---

**Remarks and Other Tests**

- LL = 120; PL = 65
- SA; S = 1%; F = 99%
- Consol TX-ICU

About 75% WCR

- LL = 60
- PL = 24
- PI = 36
- 1% Sand
- 99% Fines
- About 50% to 75% WCR

---

**Samples**

<table>
<thead>
<tr>
<th>Elevation feet</th>
<th>Depth, feet</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>2565</td>
<td>30</td>
<td>S08</td>
<td>200 to 500 psi</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>2560</td>
<td>35</td>
<td>S09</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2555</td>
<td>40</td>
<td>S10</td>
<td>200 to 400 psi</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2550</td>
<td>45</td>
<td>S11</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

---

**Final hammer blow advanced sampler 2-inches**
### Project: Klamath River Renewal Project
#### Project Location: Copco and Iron Gate Reservoirs
#### Project Number: 60537920

**Log of Soil Boring BC-04**

**Sheet 3 of 3**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation feet</th>
<th>Sample</th>
<th>Description</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>2530</td>
<td>S12</td>
<td>DIATOMITE; highly to completely weathered; pale yellow to olive yellow (2.5Y 6/6 to 2.5Y 8/4) with orange oxidation stain/mottling; fine grained vitreous gypsum crystals along very dark gray (5Y 3/1) sub-vertical fractures --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--</td>
<td>Hard drilling, very dark gray to black volcanic fragments in cuttings</td>
</tr>
<tr>
<td>70</td>
<td>2525</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>2520</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>2515</td>
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<tr>
<td>85</td>
<td>2510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>2505</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL DEPTH = 73.5 FEET**
**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

**Log of Soil Boring BC-05**

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>2/2/2018, 2/8/2018</th>
<th>Logged By</th>
<th>B. Kozlowicz</th>
<th>Checked By</th>
<th>D. Simpson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling Method</td>
<td>Rotary Wash</td>
<td>Drill Bit Size/Type</td>
<td>4-inch Tricone</td>
<td>Total Depth of Borehole</td>
<td>20.5 feet</td>
</tr>
<tr>
<td>Drilling Rig Type</td>
<td>Barge Mounted CME-45</td>
<td>Drilling Contractor</td>
<td>Taber Drilling</td>
<td>NAVO 88 Ground Surface Elevation</td>
<td>2601 feet</td>
</tr>
<tr>
<td>Groundwater Level(s)</td>
<td>8.2 feet (2/2 at 11:00) and 6.6 (2/8 at 12:15) feet above ground surface</td>
<td>Sampling Method(s)</td>
<td>2.5-inch ID ModCal, SPT, 3-inch Shelby Tube</td>
<td>Hammer Data</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
</tr>
<tr>
<td>Borehole Backfill</td>
<td>Bentonite cement grout to 10 feet bgs</td>
<td>Borehole Location</td>
<td>Copco Reservoir</td>
<td>Coordinate Location</td>
<td>N 2604139 E 6474515</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation feet</th>
<th>Samples</th>
<th>Recovery feet</th>
<th>Material Description</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2600</td>
<td>S01</td>
<td>35</td>
<td>SILTY SAND with GRAVEL (SM); very loose; very dark grayish brown (2.5Y 3/2); greenish gray clayey diatomite GRAVEL up to 1-inch in diameter; nonplastic FINES --RECENT LAKE SEDIMENT--</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>Sampler advanced 2 feet under hammer weight</td>
</tr>
<tr>
<td>5</td>
<td>2595</td>
<td>S02</td>
<td>10, 20</td>
<td>Clayey gravel made up of mostly DIATOMITE clasts up to 0.75 inches in diameter</td>
<td>4</td>
<td>10</td>
<td>20</td>
<td>Advance 6-inch casing to 5 feet with hammer</td>
</tr>
<tr>
<td>10</td>
<td>2590</td>
<td>S03</td>
<td>100</td>
<td>LEAN CLAY (CL); very stiff; very dark gray to very dark greenish gray (10Y 3/1 to 2.5Y 3/1); low to medium plasticity FINES; trace highly to completely weathered GRAVEL of diatomite and organics --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Oligo) -- DIATOMITE with ELASTIC SILT; extremely weak/very soft; greenish gray (5GY 6/1); 20-degree bedding and 90-degree fractures; with fine roots at 118 ft. --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td>Drove sampler for extra 6 inches (last three blowcounts reported)</td>
</tr>
<tr>
<td>15</td>
<td>2585</td>
<td>S04</td>
<td>200 to 400 psi</td>
<td>Becomes medium stiff to stiff with olive yellow (2.5Y 6/6) with angular clasts; friable</td>
<td>4</td>
<td>10</td>
<td>20</td>
<td>Advance 6-inch casing to 8.5 feet (refusal) End of day 2/2/18 at 9.0 ft. Begin day 2/8/18</td>
</tr>
<tr>
<td>20</td>
<td>2580</td>
<td>S05</td>
<td>32, 50/5*</td>
<td>VOLCANIC SANDSTONE; yellowish brown (10YR 5/6); highly to completely weathered; very weak; locally clayey --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>TX-ICU</td>
</tr>
<tr>
<td>25</td>
<td>2575</td>
<td></td>
<td></td>
<td>TOTAL DEPTH = 20.5 FEET</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>TX-ICU</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>Harder drilling with yellowish to reddish brown rock chips in cuttings</td>
</tr>
</tbody>
</table>

**Graphical Log:**

- **Material Description:**
  - SILTY SAND with GRAVEL (SM)
  - LEAN CLAY (CL)
  - DIATOMITE
  - VOLCANIC SANDSTONE

**Log:**

- **Date:** 2/2/2018, 2/8/2018
- **Type:** Rotary Wash
- **Rig:** Barge Mounted CME-45
- **Contractor:** Taber Drilling
- **Method(s):** 2.5-inch ID ModCal, SPT, 3-inch Shelby Tube
- **Elevation:** NAVO 88 Ground Surface Elevation 2601 feet
- **Water Content:**
  - S01: 0%
  - S02: 4%
  - S03: 2%
  - S04: 4%
  - S05: 32%
- **Plasticity Index:**
  - S01: 5%
  - S02: 10%
  - S03: 100%
  - S04: 20%
  - S05: 50/5*
- **Fines Content (%<#200Sieve):**
  - S01: 0%
  - S02: 10%
  - S03: 100%
  - S04: 20%
  - S05: 32%

**Remarks and Other Tests:**

- Sampler advanced 2 feet under hammer weight
- Advance 6-inch casing to 5 feet with hammer
- Drove sampler for extra 6 inches (last three blowcounts reported)
- Advance 6-inch casing to 8.5 feet (refusal)
- End of day 2/2/18 at 9.0 ft. Begin day 2/8/18
- TX-ICU
- TX-ICU
- Harder drilling with yellowish to reddish brown rock chips in cuttings
---RECENT LAKE SEDIMENT---
LEAN CLAY with SAND (CL); stiff; olive gray to dark olive gray (5Y 4/2 to 5Y 3/2); 20% fine grained SAND; 80% low to medium plasticity FINES; trace fine angular volcanic GRAVEL and wood debris/roots up to 1-inch

---COLLUVIUM---

VOLCANIC SANDSTONE: dark greenish gray to black (5GY 4/1 to GLEY 1 2.5/N); moderately to slightly weathered

---TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)---

TOTAL DEPTH = 15.4 FEET

Advance 6-inch casing to 5ft. with hammer from 2 to 5ft.

Harder drilling with gravelly cuttings

Hard, slow drilling at 15ft.
Project: Klamath River Renewal Project  
Project Location: Copco and Iron Gate Reservoirs  
Project Number: 60537920

---RECENT LAKE SEDIMENTS--
FAT CLAY with SAND (CH); medium stiff; very dark gray (10YR 3/1); fine to medium grained SAND; medium to high plasticity
FINES; trace rootlets

---COLLUVIUM/RESIDUAL SOIL--
Wood/roots up to 1-inch in size

---COLLUVIUM/RESIDUAL SOIL--
CLAYEY SAND (SC); loose; very dark grayish brown (10YR 3/2); medium to coarse grained SAND; medium plasticity FINES; ... completely weathered; with irregular 5 to 10-degree bedding

TOTAL DEPTH = 15.9 FEET
## MATERIAL DESCRIPTION

### Depth, feet

<table>
<thead>
<tr>
<th>Elevation feet</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ORGANIC SILT to ORGANIC CLAY (OL/OH); very soft; dark olive gray (5Y 3/2) with coarse organic debris</td>
</tr>
<tr>
<td>-2585</td>
<td>FAT CLAY with SAND (CH); stiff; black (5Y 2.5/2); fine grained SAND; medium plasticity FINES; trace angular to subrounded GRAVEL up to 1.5 inches in diameter</td>
</tr>
<tr>
<td>-2580</td>
<td>WELL GRADED GRAVEL with SAND (GW); very dense; very dark grayish brown to black (10YR 3/2 to 10YR 2/1); broken rounded GRAVEL up to 1.5 inches in diameter; medium to coarse grained SAND; trace low plasticity FINES</td>
</tr>
<tr>
<td>-2575</td>
<td>--FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg) --</td>
</tr>
</tbody>
</table>

### TOTAL DEPTH = 11.5 FEET

### REMARKS AND OTHER TESTS

- **Advance 6-inch casing to 3 feet with hammer**
- **Very hard drilling with volcanic rock chips in cuttings; switched to 2 7/8-inch drag but Blow counts affected by large particles**

---

**Date(s) Drilled**: 2/3/2018  
**Logged By**: B. Kozlowicz  
**Checked By**: D. Simpson

**Drilling Method**: Rotary Wash  
**Drill Rig Type**: Barge Mounted CME-45  
**Groundwater Level(s)**: 22.2 feet above ground surface (2/3 at 14:00)

**Sampling Method(s)**: 2.5-inch ID ModCal, SPT

**Groundwater Level(s)**: 22.2 feet above ground surface (2/3 at 14:00)

**Borehole Backfill**: Bentonite cement grout to 10 feet bgs

**Borehole Location**: Copco Reservoir

**Drill Rig Type**: Barge Mounted CME-45  
**Drill Bit Size/Type**: 4-inch Tricone, 2 7/8-inch drag bit

**Total Depth of Borehole**: 11.5 feet

**NAVD 88 Ground Surface Elevation**: 2586 feet

**Drilling Contractor**: Taber Drilling

**Drill Rig Type**: 2.5-inch ID ModCal, SPT

**Drill Rig Type**: 2.5-inch ID ModCal, SPT

**Groundwater Level(s)**: 22.2 feet above ground surface (2/3 at 14:00)

**Borehole Backfill**: Bentonite cement grout to 10 feet bgs

**Borehole Location**: Copco Reservoir

**Check by**: D. Simpson

**Drill Rig Type**: Barge Mounted CME-45

**Sampling Method(s)**: 2.5-inch ID ModCal, SPT

**Groundwater Level(s)**: 22.2 feet above ground surface (2/3 at 14:00)

**Borehole Backfill**: Bentonite cement grout to 10 feet bgs

**Borehole Location**: Copco Reservoir

**Check by**: D. Simpson

**Drill Rig Type**: Barge Mounted CME-45

**Sampling Method(s)**: 2.5-inch ID ModCal, SPT

**Groundwater Level(s)**: 22.2 feet above ground surface (2/3 at 14:00)

**Borehole Backfill**: Bentonite cement grout to 10 feet bgs

**Borehole Location**: Copco Reservoir

**Check by**: D. Simpson
Material Description:

- **ORGANIC SILT (OL)**: very soft; very dark brown (10YR 2/2) --RECENT LAKE SEDIMENT--
- **CLAYEY SAND to SANDY LEAN CLAY (SC-CL)**: loose/medium dense; black (10YR 2/1); fine to medium grained SAND; 45 to 90-degree fractures with some iron staining and 0 to 15-degree fractures--LACUSTRINE DIATOMACEOUS TERRACE (Ql)--
- **DIATOMITE**: light yellowish brown (2.5Y 6/4); extremely weak; with irregular 45 to 90-degree fractures with some iron staining and 0 to 15-degree fractures--LACUSTRINE DIATOMACEOUS TERRACE (Ql)---

Remarks and Other Tests:

- Sampler sank to 4ft.; drove sampler for extra 18 inches (last three blow counts reported, previous blows were 2-2-7)
- Hard chattering drilling from 7 to 11ft. Advance 6-inch casing to 8ft. with hammer
- Fast smooth drilling with olive brown diatomite cuttings
- Advance 6-inch casing to 14ft. with hammer
**MATERIAL DESCRIPTION**

**DIATOMITE WITH ELASTIC SILT**, olive gray (5Y 4/2) and greenish black (10Y 2.5/1); very soft/extremely weak; 0.25 to 0.5-inch alternating beds

---LACUSTRINE DIATOMACEOUS TERRACE (Ql)---

**REMARKS AND OTHER TESTS**

Cuttings become greenish gray

---

**Sample S04**

- **Type**: E
- **Number**: 2
- **Sampling Resistance (feet)**: 4
- **Water Content, %**: 179
- **Plasticity Index**: 112
- **Fines Content (%<#200Sieve)**: 99
- **Remarks**: LL=200; PL=98

**Sample S05**

- **Type**: E
- **Number**: 2
- **Sampling Resistance (feet)**: 3
- **Water Content, %**: 119
- **Plasticity Index**: 102
- **Fines Content (%<#200Sieve)**: 99
- **Remarks**: LL=200; PL=98

SA: S=1%; F=99%
DIATOMITE WITH ELASTIC SILT; olive gray (5Y 4/2) and greenish black (10Y 2.5/1); very soft/extremely weak; 0.25 to 0.5-inch alternating beds--LACUSTRINE DIATOMACEOUS TERRACE (Q)--(continued)

With 0.1-0.2-inch irregular subhorizontal bedding
With 0.5-inch dark reddish brown (5YR 2.5/2) CLAY bed at 20°

BASALT; black (10Y 2.5/1); slightly weathered; strong; recovered as angular gravel up to 1-inch in diameter

--TERTIARY to QUATERNARY INTRUSIVE BASALT--

TOTAL DEPTH = 85.2 FEET
## Log of Soil Boring BC-09

### Sheet 1 of 3

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
<th>Drilling Method</th>
<th>Rotary Wash, HQ-3 Rock Core</th>
<th>Drilling Rig Type</th>
<th>Drilling Contractor</th>
<th>Total Depth of Borehole</th>
<th>Groundwater Level(s)</th>
<th>Sampling Method(s)</th>
<th>Hammer Data</th>
<th>Drilling Method Date(s) Drilled</th>
<th>Sampling Method(s)</th>
<th>Drilling Rig Type</th>
<th>Drilling Contractor</th>
<th>Total Depth of Borehole</th>
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</thead>
<tbody>
<tr>
<td>2/13/2018</td>
<td>B. Kozlowicz</td>
<td>D. Simpson</td>
<td>Rotary Wash, HQ-3 Rock Core</td>
<td>4-inch Tricone, 4-inch diamond #2 bit</td>
<td>Barge Mounted CME-45</td>
<td>Taber Drilling</td>
<td>70.5 feet</td>
<td>5.8 feet above ground surface (2/13 at 9:00)</td>
<td>2.5-inch ID ModCal, SPT, 3-inch Shelby Tube, HQ Core Barrel</td>
<td>Automatic hammer; data</td>
<td>140 lbs, 30-inch drop</td>
<td>Rotary Wash, HQ-3 Rock Core</td>
<td>Automatic hammer; data</td>
<td>Barge Mounted CME-45</td>
<td>Taber Drilling</td>
</tr>
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</table>

### MATERIAL DESCRIPTION

- **FAT CLAY with SAND (CH); medium stiff; brown (10YR 4/3)**
- **ALLUVIUM/RESIDUAL SOIL**
- **CLAYEY GRAVEL (GC); dark gray (10YR 4/1) and yellowish brown (10YR 5/6); cored and wash subrounded to rounded basalt GRAVEL and COBBLES; some CLAYEY SAND matrix observed**
- **FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtl)**
- **DIATOMITE with ELASTIC SILT; medium stiff/weak; dark yellowish brown (10YR 4/4); trace fine grained SAND**
- **LACUSTRINE DIATOMACEOUS DEPOSIT (Ql)**
- **Becomes greenish gray (10Y 5/1); extremely weak/soft**

### REMARKS AND OTHER TESTS

- Sampler advanced 2 feet under weight of hammer
- Set casing to 2 feet; hard driving at 2 feet (casing bouncing); switched to core bit
- Advance 6-inch casing to 4.5 feet

---

**Relevant Table Data**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance (feet)</th>
<th>Recovery (feet)</th>
<th>Graphical Log</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
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**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  
**Log of Soil Boring BC-09**  
**Sheet 1 of 3**  
**Report:** GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-09
DIATOMITE with ELASTIC SILT; extremely weak/soft; greenish gray (10Y 5/1); trace fine grained SAND—LACUSTRINE DIATOMACEOUS DEPOSIT (Q1)—(continued)

Sampler advanced an additional 6 inches by pushing
DIATOMITE with ELASTIC SILT; extremely weak/soft; greenish gray (10Y 5/1); trace fine grained SAND—LACUSTRINE DIATOMACEOUS DEPOSIT (Q1)—(continued)

TOTAL DEPTH = 70.5 FEET

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<th>Depth, feet</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
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<td>2535</td>
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## Log of Soil Boring BC-10

### General Information
- **Project:** Klamath River Renewal Project
- **Project Location:** Copco and Iron Gate Reservoirs
- **Project Number:** 60537920

### Soil Description

<table>
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<th>Sample</th>
<th>Type</th>
<th>Depth (feet)</th>
<th>Water Content (%)</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
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<td>0.1%</td>
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<td>S03</td>
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<td>0.1%</td>
<td>1%</td>
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### Graphical Log

- Recent Lake Sediment
- Colluvium/Residual Soil/Slope Wash
- Well-graded gravel with sand (GW): dense; dark brown (10YR 3/3); subangular to rounded gravel up to 3 inches in diameter consisting of various volcanic lithologies
- Fluvial-lacustrine terrace deposit with gravel (Qtg)
- Diatomite with elastic silt; olive (5Y 5/3); medium stiff/very weak; with trace oxidation
- Lacustrine diatomaceous terrace (Ql)

### Additional Notes
- Set 6-inch casing to 4 feet (very soft to 2.5 feet)
- Hard, chattering drilling
- Clayey diatomite curving; switched back to tricone bit
- Advance 6-inch casing to 14 feet with hammer
**DIATOMITE with ELASTIC SILT; medium stiff/extremely weak; light olive brown (2.5Y 5/4) and olive brown (5Y 5/3); with 0.1 to 0.5 inch 10-degree bedding and some oxidation stains** --LACUSTRINE DIATOMACEOUS TERRACE (Q)---(continued)

**VOLCANIC CINDER; very dark brown (10YR 2/2); very weak/dense to very dense; medium to coarse grained weakly welded sand; friable with corestones and weakly expressed 10 to 15-degree bedding** --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)---

**ANDESITE; reddish brown (5YR 5/3); strong brown (7.5YR 5/6); and dusky purple; highly to completely weathered; very weak; coarse grained** --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)---

**TOTAL DEPTH = 43.0 FEET**

---

<table>
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<tr>
<th>Material Description</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
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<tr>
<td>Diatomite</td>
<td></td>
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<td>Harder drilling</td>
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**REMARKS AND OTHER TESTS**

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**SOIL BORING LOG**

---

**PROJECT:** Klamath River Renewal Project

**PROJECT LOCATION:** Copco and Iron Gate Reservoirs

**PROJECT NUMBER:** 60537920

**REPORT:** GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-10

---

**GRAPHIC LOG**

---

**SAMPLES**

---

<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth (feet)</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance (feet)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
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<td>2545</td>
<td>20 to 40 psi</td>
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<td>37</td>
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**TOTAL DEPTH = 43.0 FEET**
### Log of Soil Boring BC-11

**Date(s) Drilled:** 10/18/2018  
**Logged By:** B. Kozlowicz  
**Checked By:** B. Aldridge

**Drilling Method:** Hollow Stem Auger/Direct Push  
**Drill Bit Size/Type:** 6-inch flight auger  
**Total Depth of Borehole:** 10.5 feet

**Drill Rig Type:** Truck Mounted Marl M2.5 DP  
**Drilling Contractor:** Gregg Drilling  
**NAVD 88 Ground Surface Elevation:** 2617 feet

**Groundwater Level(s):** Not encountered  
**Sampling Method(s):** 2.5-inch ID ModCal, SPT  
**Hammer Data:** Geoprobe Hydraulic Hammer

**Borehole Backfill:** Cement grout to ground surface  
**Borehole Location:** Copco Road/Reservoir Rim  
**Coordinate Location:** N 2606419  E 6479490

---

**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Type</th>
<th>Sampling Resistance</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
<th>Remarks and Other Tests</th>
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</tr>
<tr>
<td>5</td>
<td>S01</td>
<td>57</td>
<td></td>
<td></td>
<td>Start 10/18/2018 with hollow stem auger</td>
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<tr>
<td>10</td>
<td>S02</td>
<td>100</td>
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<td></td>
<td>Auger refusal at 3.5ft; move 30ft. west of initial boring location and redrill</td>
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<tr>
<td>TOTAL DEPTH = 10.5 FEET</td>
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**REMARKS AND OTHER TESTS**

- ROAD BASE
- DIATOMITE: pale yellow (2.5Y 7/3); moderately weathered; with occasional subvertical fractures and trace small rootlets
- QUATERNARY DIATOMITE (Od)
- POORLY GRADED GRAVEL? (GP); very dark grey; with slightly weathered basalt fragments
- RESIDUAL SOIL/COLLUVIUM
- VOLCANIC BEDROCK?: olive grey and reddish to yellowish brown; completely weathered; extremely weak; friable
- COMPLETELY WEATHERED VOLCANIC BEDROCK

**TOTAL DEPTH = 10.5 FEET**
### Log of Soil Boring BC-12

#### Project Information
- **Project:** Klamath River Renewal Project
- **Project Location:** Copco and Iron Gate Reservoirs
- **Project Number:** 60537920

#### Drilling Details
- **Date Drilled:** 10/17/2018
- **Drilling Method:** Hollow Stem Auger/Direct Push
- **Drill Rig Type:** Truck Mounted Marl M2.5 DP
- **Drill Rig Contractor:** Gregg Drilling
- **Total Depth of Borehole:** 16.5 feet
- **Groundwater Level:** Not encountered
- **NAVD 88 Ground Surface Elevation:** 2642 feet
- **Drilling Contractor:** Gregg Drilling
- **Data Hammer:** Geoprobe Hydraulic Hammer

#### Sampling Details
- **Sampling Method(s):** 2.5-inch ID ModCal, SPT
- **Drill Bit Size/Type:** 6-inch flight auger
- **Drill Rig:** 2.5-inch ID ModCal, SPT
- **Borehole Location:** Copco Road/Reservoir Rim
- **Groundwater Level(s):** Not encountered
- **Borehole Backfill:** Bentonite cement grout to ground surface
- **Checked By:** B. Aldridge

#### Material Description

<table>
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<tr>
<th>Depth, feet</th>
<th>Type</th>
<th>Sampling Resistance (feet)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
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<td>15</td>
<td>S-03</td>
<td>100</td>
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</table>

#### REMARKS AND OTHER TESTS

- **Start:** 14:00 10/18/2018 with hollow stem auger
- **S-01 Bagged:** Smooth drilling 0-4.7 ft. Rig chatter 4.7-5.5 ft. Smooth drilling 5.5-9 ft.
- **S-03 Three Liners Retained:** (8.5-9, 9-9.5, 9.5-10 ft.)

#### Material Description
- **Silty to Clayey Sand with Gravel (SM-SC); medium dense; brown (10YR 5/5); with angular Gravel up to 3-inches** --Road Base--
- **Silty Sand (SM); loose to medium dense; dark brown (10YR 5/3); with occasional small Gravel; dry** --Colluvium--
- **Clayey Sand to Sandy Lean Clay (SC-CL); loose to medium dense; dark brown (10YR 5/3); with angular Gravel up to 2-cm; low plasticity FINES; moist**
- **Poorly Graded Sand (SP); loose to medium dense; yellowish brown (10YR 5/4); with small, subangular diatomite gravel; fine to medium grained Sand; dry** --Fluvio-Lacustrine Terrace Deposit (Qt)--
- **Volcanic Bedrock; very dense; greyish brown (10YR 5/2) to olive brown (2.5Y 4/4); highly to completely weathered; very weak; friable; medium to coarse grained; possibly Porphyritic Andesite** --Tertiary Volcanics (Bogus Mountain Beds, undifferentiated)--

**TOTAL DEPTH = 16.5 FEET**
### Log of Soil Boring BC-13

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

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<th>Checked By</th>
<th>Drilling Method</th>
<th>Drill Bit Size/Type</th>
<th>Total Depth of Borehole</th>
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<td>10/2/2018</td>
<td>B. Kozlowicz</td>
<td>B. Aldridge</td>
<td>Hollow Stem Auger</td>
<td>6-inch flight auger</td>
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<td>Truck Mounted Mobile B-53</td>
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<td>Not encountered</td>
<td>3.0-inch Shelby Tube, SPT</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
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<tr>
<th>Borehole Backfill</th>
<th>Borehole Location</th>
<th>Coordinate Location</th>
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<tbody>
<tr>
<td>Bentonite cement grout to ground surface</td>
<td>Copco Road/Reservoir Rim</td>
<td>N 2604508 E 6475654</td>
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#### MATERIAL DESCRIPTION

- **Elevation:** feet  
- **Depth:** feet  
- **Type:**  
- **Number:**  
- **Sampling Resistance:** psi  
- **Recovery:** feet  
- **Graphic Log:**  
- **Material Description:**
  - 2-inches ASPHALT POORLY GRADED GRAVEL with SAND (GP); dense; brown (10YR 4/4); angular GRAVEL up to 3-inches; dry
  - 1500 psi  
  - DIATOMITE; moderately weathered; with occasional subvertical fractures and trace small rootlets
    - With Fe + Mn stained vertical fracture surfaces
    - Becomes pale yellow (2.5Y 7/3); slightly weathered, extremely weak, without fractures or roots
    - Becomes medium dense to dense with some small, angular gravel

**Remarks and Other Tests:**
- Start 13:50 10/2/2018 with hand auger
- Hollow stem auger 5 to 42 ft.
- TX-UU
- TX-ICU
- TX-UU
- Cuttings become moist
**PROJECT:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

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### MATERIAL DESCRIPTION

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<tr>
<th>MATERIAL DESCRIPTION</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>REMARKS AND OTHER TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIATOMITE; pale yellow (2.5Y 7/3); dry; slightly weathered; extremely weak; massive; with trace orange mottling—QUATERNARY DIATOMITE—(continued)</td>
<td>72</td>
<td></td>
<td></td>
<td>TX-UU</td>
</tr>
<tr>
<td>LEAN CLAY with SAND (CL); stiff; dark yellowish brown (10YR 3/4); with trace rootlets—COLLUVIUM/RESIDUAL SOIL—</td>
<td></td>
<td></td>
<td></td>
<td>Logged from cuttings</td>
</tr>
<tr>
<td>CLAYEY SAND (SC); very dense/extremely weak; olive and dark yellowish brown to reddish brown; with weakly expressed 20° foliation/bedding—COMPLETELY WEATHERED VOLCANICLASTIC BEDROCK—</td>
<td></td>
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**TOTAL DEPTH = 42.0 FEET**
## MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Type</th>
<th>Sampling Method(s)</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>3-inches ASPHALT</td>
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</tr>
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<td></td>
<td>3-inches ASPHALT</td>
</tr>
<tr>
<td></td>
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<td>POORLY GRADED GRAVEL with SAND (GP); medium dense; dark yellowish brown; with angular GRAVEL up to 3-inches; dry</td>
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<td>2665</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>VOLCANIC BEDROCK; yellowish to reddish brown; highly to completely weathered; very dense/very weak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REMARKS AND OTHER TESTS**

- **Start 10:00 10/2/2018 with hand auger 0-5ft.**
- **Hollow stem auger 5 to 15.4ft.**
- **TX-ICU**
- **TX-UU**
- **TX-ICU**

---

**TOTAL DEPTH = 15.4 FEET**
### Log of Soil Boring BC-16

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  
**Date Drilled:** 1/14/2019  
**Logged By:** P. Respess  
**Checked By:** S. Janowski  
**Drilling Method:** Rotary Wash  
**Drill Rig Type:** Barge Mounted CME-45  
**Groundwater Level:** 14 feet above ground surface (1/14/2019)  
**Drill Bit Size/Type:** 4-inch Tricone  
**Drilling Contractor:** Taber Drilling  
**Sampling Method(s):** 2.5-inch ID ModCal  
**Drill Rig Type:** 2.5-inch ID ModCal  
**Groundwater Level(s):** NAVD 88 Ground Surface Elevation 2592 feet  
**Groundwater Level:** 14 feet above ground surface (1/14/2019)  
**Sampling Resistance:** Rotory Wash  
**Borehole Backfill:** Bentonite cement grout to ground surface  
**Borehole Location:** Copco Lake  
**Coordinate Location:** N 2604576 E 6472913  
**Total Depth of Borehole:** 64.8 feet  
**Hammer Data:** Automatic hammer; 140 lbs, 30-inch drop  

### MATERIAL DESCRIPTION

- **SILTY CLAY (CL-ML):** soft; wet; grayish brown; apparent mix of diatomite and topsoil/colluvium  
- **DIATOMITE:** greenish gray; soft

**REMARKS AND OTHER TESTS:**

Boring logged from cuttings
### Log of Soil Boring BC-16

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

**TOTAL DEPTH = 64.8 FEET**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Sampling Resistance (feet)</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>DIATOMITE; greenish gray; soft</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>VOLCANICLASTIC SANDSTONE; medium gray; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts</td>
</tr>
</tbody>
</table>

**REMARKS AND OTHER TESTS**

- Harder drilling
- Rig repair 1315-1335
- Bottom liner retained
**Log of Soil Boring BC-17**

**Date(s) Drilled:** 1/14/2019  
**Logged By:** P. Respess  
**Checked By:** S. Janowski  

**Drilling Method:** Rotary Wash  
**Drill Bit Size/Type:** 4-inch Tricone  
**Total Depth of Borehole:** 37.4 feet

**Drill Rig Type:** Barge Mounted CME-45  
**Drilling Contractor:** Taber Drilling  
**NAVD 88 Ground Surface Elevation:** 2593 feet

**Groundwater Level(s):** 12.5 feet above ground surface (1/14/2019)  
**Sampling Method(s):** 2.5-inch ID ModCal  
**Hammer Data:** Automatic hammer; 140 lbs, 30-inch drop

**Borehole Backfill:** Bentonite cement grout to ground surface  
**Borehole Location:** Copco Lake  
**Coordinate Location:** N 2603825 E 6474508

---

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth, feet</th>
<th>SAMPLES</th>
<th>GRAPHIC LOG</th>
<th>REMARKS AND OTHER TESTS</th>
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<tr>
<td>2565</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Silty Clay (CL-ML):** soft; wet; brown to grayish brown; apparent mix of diatomite and topsoil/colluvium  
**--SLUMPED BANK MATERIAL--**

**Diatomite:** greenish gray; soft  

---

**Remarks and Other Tests:** Boring logged from cuttings
<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth, feet</th>
<th>SAMPLES</th>
<th>MATERIAL DESCRIPTION</th>
<th>GRAPHIC LOG</th>
</tr>
</thead>
<tbody>
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<td>2530</td>
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<tr>
<td>2535</td>
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</tr>
</tbody>
</table>

**TOTAL DEPTH = 37.4 FEET**

**Bottom liner retained**

---

**REMARKS AND OTHER TESTS**

**PROJECT NUMBER:** 60537920

**PROJECT:** Klamath River Renewal Project

**PROJECT LOCATION:** Copco and Iron Gate Reservoirs

---

**LOG OF SOIL BORING BC-17**

**Sheet 2 of 2**

---

**REPORT:** GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-17
### Project Information

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

### Log of Soil Boring BC-18

**Date(s) Drilled:** 1/14/2019  
**Logged By:** P. Respess  
**Checked By:** S. Janowski

<table>
<thead>
<tr>
<th>Drilling Method</th>
<th>Rotary Wash</th>
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</thead>
<tbody>
<tr>
<td>Drill Bit Size/Type</td>
<td>4-inch Tricone</td>
</tr>
<tr>
<td>Drill Rig Type</td>
<td>Barge Mounted CME-45</td>
</tr>
<tr>
<td>Drilling Contractor</td>
<td>Taber Drilling</td>
</tr>
<tr>
<td>Drilling Method(s)</td>
<td>2.5-inch ID ModCal</td>
</tr>
<tr>
<td>Hammer Data</td>
<td>Automatic hammer; 140 lbs, 30-inch drop</td>
</tr>
<tr>
<td>Groundwater Level(s)</td>
<td>8 feet above ground surface (1/14/2019)</td>
</tr>
</tbody>
</table>

**Groundwater Level(s):** 8 feet above ground surface (1/14/2019)

**Borehole Backfill:** Bentonite cement grout to ground surface

**Groundwater Level:** 8 feet above ground surface (1/14/2019)

**Backfill:** Bentonite cement grout to ground surface

**Total Depth of Borehole:** 34.5 feet

**BAcre Location:** Copco Lake

**Coordinate Location:** N 2604477 E 6475056

### Sampling Methods

**Drill Rig Type:** 2.5-inch ID ModCal

### Borehole Backfill

**Backfill:** Bentonite cement grout to ground surface

### Remarks and Other Tests

- **MATERIAL DESCRIPTION**
  - **SILTY CLAY (CL-ML):** soft; wet; brown to grayish-brown; apparent mix of diatomite and topsoil/colluvium; tree root fragments
  - **SLUMPED BANK MATERIAL**
  - **DIATOMITE:** greenish gray to yellowish brown; soft

- **Remarks and Other Tests:** Boring logged from cuttings
**MATERIAL DESCRIPTION**

DIATOMITE; greenish gray to yellowish brown; soft

---continued---

VOLCANICLASTIC SANDSTONE; grayish brown; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts

---continued---

**TOTAL DEPTH = 34.5 FEET**

**REMARKS AND OTHER TESTS**

Bottom liner retained
**Log of Soil Boring BC-19**

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
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</thead>
<tbody>
<tr>
<td>1/13/2019</td>
<td>P. Respess</td>
<td>S. Janowski</td>
</tr>
</tbody>
</table>

**Drilling Method**: Rotary Wash
**Drill Rig Type**: Barge Mounted CME-45
**Drill Bit Size/Type**: 4-inch Tricone
**Hammer Data**: Automatic hammer; 140 lbs, 30-inch drop
**Drilling Contractor**: Taber Drilling
**NAVD 88 Ground Surface Elevation**: 2599 feet

**Groundwater Level(s)**: 7 feet above ground surface (1/13/2019)
**Sampling Method(s)**: 2.5-inch ID ModCal

**Drill Rig Type**: Barge Mounted CME-45

**Backfill**: Bentonite cement grout to ground surface

**Borehole Location**: Copco Lake
**Coordinate Location**: N 2604654 E 6475303

**Borehole Backfill**: Bentonite cement grout to ground surface

**Total Depth of Borehole**: 37.5 feet

---

### MATERIAL DESCRIPTION

- **SILTY CLAY (CL-ML)**: soft; wet; brown to grayish brown; apparent mix of diatomite and topsoil/colluvium; --SLUMPED BANK MATERIAL--
- **DIATOMITE**: light gray; soft; occasional fine- to coarse-grained SAND

---

**Remarks and Other Tests**: Boring logged from cuttings
<table>
<thead>
<tr>
<th>Elevation feet</th>
<th>Depth, feet</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
<th>MATERIAL DESCRIPTION</th>
<th>Water Content, %</th>
<th>Plasticity Index</th>
<th>Fines Content (%&lt;#200Sieve)</th>
<th>REMARKS AND OTHER TESTS</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

**DIATOMITE:** light gray; soft; occasional fine- to coarse-grained SAND

**VOLCANICLASTIC SANDSTONE:** light to medium gray; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts

TOTAL DEPTH = 37.5 FEET

Two bottom liners retained
### Log of Soil Boring BC-20

**Date(s) Drilled:** 1/14/2019  
**Logged By:** P. Respess  
**Checked By:** S. Janowski

**Drilling Method:** Rotary Wash  
**Drill Rig Type:** Barge Mounted CME-45  
**Groundwater Level(s):** 9 feet above ground surface (1/14/2019)

**Borehole Backfill:** Bentonite cement grout to ground surface  
**Borehole Location:** Copco Lake

**Drill Bit:** 4-inch Tricone  
**Drilling Contractor:** Taber Drilling  
**Sampling Method(s):** 2.5-inch ID ModCal

**Total Depth:** 19.0 feet  
**NAVD 88 Ground Surface Elevation:** 2597 feet

**Drill Rig:** Automatic hammer; 140 lbs, 30-inch drop  
**Drill Bit Size/Type:** 4-inch Tricone  
**Groundwater Level(s):** 9 feet above ground surface (1/14/2019)

**Backfill:** Bentonite cement grout to ground surface  
**Borehole Location:** Copco Lake

**Hammer Data:** Automatic hammer; 140 lbs, 30-inch drop

**Drill Rig Type:** 2.5-inch ID ModCal

**Groundwater Levels:** 9 feet above ground surface (1/14/2019)

**Drilling Contractor:** Taber Drilling  
**Sampling Method(s):** 2.5-inch ID ModCal

**Total Depth:** 19.0 feet  
**Borehole Backfill:** Bentonite cement grout to ground surface

**Borehole Location:** Copco Lake

**Checked By:** S. Janowski

### MATERIAL DESCRIPTION

**DIATOMITE:**
- Greenish gray to light yellowish brown; soft

**BASALT?**
- Dark gray to black; hard; aphanitic

**TOTAL DEPTH = 19.0 FEET**

**REMARKS AND OTHER TESTS:**
- Boring logged from cuttings
- Hard drilling

---

**Log of Soil Boring BC-20**  
**Sheet 1 of 1**
### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Type</th>
<th>Number</th>
<th>Sampling Resistance</th>
<th>Recovery (feet)</th>
<th>Graphic Log</th>
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<td>15</td>
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<tr>
<td>20</td>
<td>S-5</td>
<td>50/3</td>
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</tr>
<tr>
<td>25</td>
<td>S-6</td>
<td>50/3</td>
<td>100</td>
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</tr>
</tbody>
</table>

**LEAN CLAY with ORGANICS (CL); very soft; wet; dark red brown (5YR 3/4); twigs and roots**

**LEAN CLAY (CL); stiff; dry; dark red brown (5YR 3/4); trace rootlets; CaCO3 ribbons; developed soil texture**

**BASEALT; dark red brown (5YR 2.5/2); fresh; strong**

**VOLCANIC BRECCIA; mottled dark gray (2.5Y 4/1) and light yellow brown (2.5Y 6/4); slightly weathered; moderately strong; coarse grained with quartz phenocrysts**

**TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)**

**REMARKS AND OTHER TESTS**

- **S-1 Sampler sank under weight of rods 12.5-14.5 ft. and pushed 14.1-17.5 ft.**
- **Advance 5-inch casing 7.5 ft.**
- **Begin rotary wash drilling**
- **Driller notes change at 11.5 ft., Volcanics in cuttings**
- **Driller notes bedrock drilling conditions from 12 ft.-17 ft.**

**TOTAL DEPTH = 22.2 FEET**
### Log of Soil and Core Boring BI-02

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>K. Zeiger</th>
<th>Checked By</th>
<th>B. Kozlowicz</th>
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<tbody>
<tr>
<td>2/22/2018 - 2/23/2018</td>
<td>Drill Rig Type</td>
<td>Truck Mounted CME 75</td>
<td>Drilling Contractor</td>
<td>Taber Drilling</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Rotary Wash, HQ-3 Rock Core</td>
<td>Drill Bit</td>
<td>4-inch solid stem auger, 3-7/8 inch tricone, 4-inch #2 diamond coring bit</td>
<td>Total Depth of Borehole</td>
</tr>
<tr>
<td>Groundwater Level</td>
<td>4.8 feet below ground surface (2/22/2018)</td>
<td>Sampling Methods</td>
<td>2.5-inch ID ModCal, HQ Core Barrel</td>
<td>NAVD 88 Ground Surface Elevation</td>
</tr>
<tr>
<td>Borehole Backfill</td>
<td>Cement grout to ground surface</td>
<td>Borehole Location</td>
<td>Iron Gate Reservoir; near Fall Creek Boat Ramp</td>
<td>Coordinate Location</td>
</tr>
</tbody>
</table>

#### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
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<td>-2334</td>
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<td></td>
<td></td>
<td></td>
<td>SANDY FAT CLAY (CH); stiff; very dark brown (7.5YR 2.5/3); moist; high plasticity fines; 10 percent rounded gravel up to 1-inch in diameter--OLD ALLUVIUM-FLOOD PLAIN DEPOSIT--</td>
</tr>
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<td>2-inch rounded clasts with trace decomposed rootlets</td>
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<td>-2330</td>
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<td></td>
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<td></td>
<td>SANDY FAT CLAY (CH); stiff; dry; brown (7.5YR 4/3); high plasticity fines; fine grained sand; trace rounded gravel up to 0.25 inches in diameter; CaCO3 ribbons--OLDER ALLUVIUM/RESIDUAL SOIL--</td>
</tr>
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<td></td>
<td></td>
<td>4-inch solid stem auger</td>
</tr>
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<td>-2326</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2-inch rounded clasts with trace decomposed rootlets</td>
</tr>
<tr>
<td>-2324</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4-inch solid stem auger</td>
</tr>
<tr>
<td>-2322</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-inch rounded clasts with trace decomposed rootlets</td>
</tr>
</tbody>
</table>

#### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>6</td>
<td>14:30</td>
<td>L=78; P=28</td>
<td>140 lbs, 30-inch drop</td>
</tr>
<tr>
<td>S-2</td>
<td>5</td>
<td>14:40</td>
<td>L=68; P=28</td>
<td>140 lbs, 30-inch drop</td>
</tr>
</tbody>
</table>

#### FIELD NOTES AND TEST RESULTS

- R Q D, %
- Drill Time Rate, ft/hr
### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Lithology</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Number</th>
<th>Rock Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>17-20</td>
<td>SANDY FAT CLAY (CH); stiff; dry; brown (7.5YR 4/3); low plasticity fines; fine grained sand; trace rounded gravel up to 0.25 inches in diameter; CaCO₃ ribbons</td>
<td>1</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>SANDY FAT CLAY (CH); medium stiff to stiff; brown (7.5YR 5/4); fine grain sand; high plasticity fines; trace rounded gravel up to 1-inch</td>
<td>2</td>
<td>17</td>
<td>0</td>
<td>NR</td>
<td>NA</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>VOLCANIC BRECCIA; green gray (10Y 6/1); highly to completely weathered; extremely weak; intensely fractured with angular breccia clasts up to 1-inch; fine to medium grained matrix</td>
<td>3</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>1: 60, J, N, No, No, Pl, SR</td>
<td>4</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>2: 10, J, MW, No, No, Wa, SR</td>
<td>5</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NR</td>
</tr>
</tbody>
</table>

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROCK CORE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevation, feet</td>
<td>Number</td>
<td>R Q D, %</td>
<td>Drill Time Rate, ft/hr</td>
<td></td>
</tr>
<tr>
<td>2320</td>
<td>6</td>
<td>6</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2318</td>
<td>7</td>
<td>S-3</td>
<td>6</td>
<td>100</td>
</tr>
</tbody>
</table>

### FIELD NOTES AND TEST RESULTS

- First water at 14.0 feet; after 20 minutes at 4.8 feet
- L=61; PL=27 S=40%; S=40%; F=52%
- Advance 4-inch casing to 14 feet
- Switch to rotary wash
- Refusal with tricone bit; switch to HQ rock core
- 100% fluid return

---

**SANDY FAT CLAY (CH); stiff; dry; brown (7.5YR 4/3); low plasticity fines; fine grained sand; trace rounded gravel up to 0.25 inches in diameter; CaCO₃ ribbons**

---

**SANDY FAT CLAY (CH); medium stiff to stiff; brown (7.5YR 5/4); fine grain sand; high plasticity fines; trace rounded gravel up to 1-inch**

---

**VOLCANIC BRECCIA; green gray (10Y 6/1); highly to completely weathered; extremely weak; intensely fractured with angular breccia clasts up to 1-inch; fine to medium grained matrix**

---

**TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)**

---

**Clayey volcanics cuttings**

---

**Becomes moderately to slightly weathered; weak to moderately strong; moderately fractured; rough; irregular fractures likely mechanical along weathered contacts of breccia clasts**

---

**Run break**

---

**Run break**

---

**Rock does not meet soundness criteria for RQD calculation**

---

**Mohs Hardness = 3 UCS = 841 psi Bulk Density = 141.42pcf**
### Log of Soil and Core Boring BI-02

**Project Number:** 60537920  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project:** Klamath River Renewal Project  
**Report:** GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 BI-02

#### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, ft.</th>
<th>Depth, ft.</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>-2304</td>
<td>4</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td></td>
<td>VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to slightly weathered; weak to moderately strong; moderately fractured with angular breccia clasts up to 1-inch; medium grained matrix. --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)</td>
</tr>
<tr>
<td></td>
<td>-2302</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>1: 10, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2300</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td>96</td>
<td></td>
<td>2: 10-15, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2298</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>3: 10, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2296</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>4: 10, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2294</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>5: 10, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2292</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>6: 10, J, N, No, No, Wa-St, R</td>
</tr>
<tr>
<td></td>
<td>-2290</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td></td>
<td></td>
<td>7: 10, J, N, No, No, Wa-St, R</td>
</tr>
</tbody>
</table>

#### MATERIAL DESCRIPTION

- **100% fluid return**
- **Mechanically broken from placement in box**

#### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Elevation, ft.</th>
<th>Depth, ft.</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Type</th>
<th>Blows / 6 in.</th>
<th>Drill Time (Rate, ft/hr)</th>
<th>Recovery, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>-2304</td>
<td>4</td>
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<td>100</td>
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<td></td>
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<tr>
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<td>-2302</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2300</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
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<td></td>
<td>-2294</td>
<td>1</td>
<td>1</td>
<td>100</td>
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</tr>
<tr>
<td></td>
<td>-2292</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td></td>
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</tr>
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<td>-2290</td>
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<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### FIELD NOTES AND TEST RESULTS

- End of day 2/22/2018
- Begin day 2/23/2018
# Log of Soil and Core Boring BI-02

## Rock Core

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R.Q.D. %</th>
<th>Fracture Drawing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>100</td>
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</tr>
<tr>
<td>7</td>
<td>1</td>
<td>100</td>
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</tr>
<tr>
<td>8</td>
<td>1</td>
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<tr>
<td>9</td>
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<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Material Description

- **Volcanic Breccia**: green gray (10Y 6/1); moderately to slightly weathered; weak to moderately strong; moderately fractured; angular breccia clasts up to 1-inch; fine to medium grained matrix
- **Tertiary Volcanics** (Bogus Mountain Beds, undifferentiated)

---

### Soil Samples

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-46</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>47-48</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>49-50</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>51-52</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>53-54</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>55-56</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>57-58</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>59-60</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>61</td>
<td>Volcanic Breccia</td>
</tr>
</tbody>
</table>

### Field Notes and Test Results

- **Brazilian Tensile Strength Test**
  - Mohs Hardness = 3
  - UCS = $2288\text{ psi}$
  - Bulk Density = $148.67\text{pcf}$
  - Punch Penetration Index Test
  - Cerchar Abrasiveness Test
  - Brazilian Tensile Strength Test
  - Mechanically broken from placementinbox
  - Packer test #1 from 47.0 to 67.0

- **100% fluid return**

---

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920  
**Report:** GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 BI-02
### MATERIAL DESCRIPTION

VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to slightly weathered; weak to strong; slightly fractured; angular breccia clasts up to 1-inch; fine to medium grained matrix—TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—(continued)

3: 5, J, N, No, No, Wa, SR

---

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation, feet</td>
<td>Number</td>
</tr>
<tr>
<td>Run No.</td>
<td>Box No.</td>
</tr>
<tr>
<td>61</td>
<td>4</td>
</tr>
<tr>
<td>62</td>
<td>62</td>
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<tr>
<td>63</td>
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<td>64</td>
<td>64</td>
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<td>65</td>
<td>65</td>
</tr>
<tr>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>67</td>
<td>67</td>
</tr>
</tbody>
</table>

### TOTAL DEPTH = 67.0 FEET
## Log of Soil and Core Boring BI-03 Sheet 1 of 3

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>2/21/2018</th>
</tr>
</thead>
</table>

**Logged By** K. Zeiger  
**Checked By** B. Kozlowicz

**Drilling Method** Rotary Wash, HQ-3 Rock Core  
**Drill Rig Type** Barge Mounted CME 45

**Groundwater Level** 25.3 feet above ground surface (2/21)

**Borehole Backfill** Cement grout to ground surface

### Field Notes and Test Results

#### Rock Core

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2304</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>POORLY GRADED GRAVEL with SILT and SAND (GP-GM); dark green gray (N 4/1); wet; loose; subangular to subrounded gravel up to 0.25-inch</td>
</tr>
<tr>
<td>2</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-RIVER ALLUVIUM-</td>
</tr>
<tr>
<td>3</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&gt;6</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>&gt;6</td>
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</tr>
<tr>
<td>8</td>
<td>&gt;6</td>
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<td>89</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); highly weathered; weak to very weak; fine to medium grained matrix with angular to subrounded clasts up to 0.75 inches; -TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10</td>
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</tr>
<tr>
<td>12</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Soil Samples

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Blows / 6 in.</th>
<th>Recovery, %</th>
<th>Drill Time Rate, ft/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>12</td>
<td>47</td>
<td>10-10</td>
<td></td>
</tr>
</tbody>
</table>

**Advance 5-inch casing to 3ft.**

#### Notes

- Refusal with tricone bit; switched to HQ rock core
- Rock does not meet soundness criteria for RQD calculation

---

**LOG OF SOIL AND CORE BORING BI-03**

**Project:** Klamath River Renewal Project  
**Project Location:** Copco and Iron Gate Reservoirs  
**Project Number:** 60537920

**Date(s) Drilled:** 2/21/2018  
**Logged By:** K. Zeiger  
**Checked By:** B. Kozlowicz

**Drilling Method:** Rotary Wash, HQ-3 Rock Core  
**Drill Rig Type:** Barge Mounted CME 45

**Groundwater Level:** 25.3 feet above ground surface (2/21)

**Borehole Backfill:** Cement grout to ground surface

---

**Table 1: Soil Samples**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Elevation, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing Number</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>1</td>
<td>&gt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>POORLY GRADED GRAVEL with SILT and SAND (GP-GM); dark green gray (N 4/1); wet; loose; subangular to subrounded gravel up to 0.25-inch</td>
</tr>
<tr>
<td>2</td>
<td>&gt;6</td>
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<td>-RIVER ALLUVIUM-</td>
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<tr>
<td>3</td>
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<tr>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td>&gt;6</td>
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<tr>
<td>7</td>
<td>&gt;6</td>
<td></td>
<td>89</td>
<td>0</td>
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<td></td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); highly weathered; weak to very weak; fine to medium grained matrix with angular to subrounded clasts up to 0.75 inches; -TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-</td>
</tr>
<tr>
<td>8</td>
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<tr>
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<tr>
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</tr>
</tbody>
</table>

**Notes**

- Refusal with tricone bit; switched to HQ rock core
- Rock does not meet soundness criteria for RQD calculation

---

**Figures**

- **Figure 1:** Rock core description
- **Figure 2:** Soil samples analysis

---

**References**

- Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 BI-03
### ROCK CORE

**Elevation, feet**  **Run No.**  **Box No.**  **Recovery, %**  **Fractures per Foot**  **R Q D, %**  **Fracture Drawing Number**  **Lithology**

<p>| | | | | | | |</p>
<table>
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<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 13  | 1   | 5   | 5   | 5   | 5   | VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)
| 14  | 2   | 100 | 14  | 1   | 1   | 5: 30, J, N, No, No, Wa-Pt, SR
| 15  | 3   | 1   | 1   | 1   | 1   | Becomes slightly fractured; moderately strong
| 16  | 4   | 1   | 1   | 1   | 1   | 1: 35, J, N, No, No, St, R
| 17  | 5   | 1   | 1   | 1   | 1   | 2: 30, J, N, No, No, Wa, SR
| 18  | 6   | 1   | 1   | 1   | 1   | 3: 20, J, T, No, No, Wa, SR
| 19  | 7   | 1   | 1   | 1   | 1   | Becomes highly fractured
| 20  | 8   | 1   | 1   | 1   | 1   | 1: 10, J, MW, No, No, Wa, SR
| 21  | 9   | 1   | 1   | 1   | 1   | 2: 25, J, T, No, No, Wa-St, SR-R
| 22  | 10  | 2   | 2   | 1   | 1   | 3: 10, J, MW, No, No, Wa, SR-R
| 23  | 11  | 2   | 2   | 1   | 1   | Becomes moderately fractured
| 24  | 12  | 2   | 2   | 1   | 1   | 1: 25, J, T, No, No, Wa, SR
| 25  | 13  | 2   | 2   | 1   | 1   | 2: 40, J, T, No, No, Wa-St, SR
| 26  | 14  | 2   | 2   | 1   | 1   | 3: 5-10, J, MW, No, No, Wa, SR
| 27  | 15  | 2   | 2   | 1   | 1   | 4: 80, J, N, No, No, Wa-ir, SR
| 28  | 16  | 2   | 2   | 1   | 1   | 5: 30, J, T, Ca, Pa, Pt-Wa, SR
| 29  | 17  | 2   | 2   | 1   | 1   | Crushed zone
| 30  | 18  | 2   | 2   | 1   | 1   | 6: 65, J, MW, Sd, Pa, Wa, SR

### MATERIAL DESCRIPTION

- **VOLCANIC BRECCIA**: green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches.
- **TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)** -- (continued)

### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>14</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>15</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>16</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>17</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>18</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>19</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>20</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>21</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>22</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
<tr>
<td>23</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches. TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) -- (continued)</td>
</tr>
</tbody>
</table>

### FIELD NOTES AND TEST RESULTS

- **ROCK** does not meet soundness criteria for RQD calculation.
- **Mohs Hardness** = 3
- **UCS** = 221 psi
- **Bulk Density** = 138.44pcf

**Brazilian Tensile Strength Test**

**Punch Penetration Index Test**

**Cerchar Abrasiveness Test**

**Clayey coating** is from when return hose got disconnected during run.
**Log of Soil and Core Boring BI-03**

**Project**: Klamath River Renewal Project  
**Project Location**: Copco and Iron Gate Reservoirs  
**Project Number**: 6053920

---

### ROCK CORE

<table>
<thead>
<tr>
<th>Elevation, feet</th>
<th>Depth, feet</th>
<th>Run No.</th>
<th>Box No.</th>
<th>Recovery, %</th>
<th>Fractures per Foot</th>
<th>R Q D, %</th>
<th>Fracture Drawing No.</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2276</td>
<td>29</td>
<td>5</td>
<td>2</td>
<td>100</td>
<td>0</td>
<td>48°</td>
<td></td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately to highly weathered; weak to moderately strong; moderately fractured; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches</td>
</tr>
<tr>
<td>-2274</td>
<td>30</td>
<td>2</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
<td>--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)</td>
</tr>
<tr>
<td>-2272</td>
<td>31</td>
<td>4</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
<td>At 30.1ft. Becomes intensely fractured, weak to moderately strong, locally very weak to weak</td>
</tr>
<tr>
<td>-2270</td>
<td>32</td>
<td>6</td>
<td>4</td>
<td>100</td>
<td>0</td>
<td>54°</td>
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<td>1: 5, J, N, No, No, Pl-Wa, SR</td>
</tr>
<tr>
<td>-2268</td>
<td>33</td>
<td>3</td>
<td>4</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
<td>2: 20, J, N-MW, No, No, Wa, SR</td>
</tr>
<tr>
<td>-2266</td>
<td>34</td>
<td>4</td>
<td>5</td>
<td>100</td>
<td>0</td>
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<td>3: 35, J, N, Ca+Sd, Fe, Pl, S</td>
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<td>-2264</td>
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<td>6</td>
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<td>4: 30, J, N, No, No, Pl, SR</td>
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</table>

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### SOIL SAMPLES

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Lithology</th>
</tr>
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<tbody>
<tr>
<td>-2276</td>
<td>VOLCANIC BRECCIA; green gray (5G 6/1); moderately to highly weathered; weak to moderately strong; moderately fractured; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches</td>
</tr>
<tr>
<td>-2274</td>
<td>--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)</td>
</tr>
<tr>
<td>-2272</td>
<td>Becomes highly weathered; weak; crushed along a fracture?</td>
</tr>
<tr>
<td>-2270</td>
<td>Volcanic breccia with Fe stained highly weathered rind</td>
</tr>
</tbody>
</table>

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### FIELD NOTES AND TEST RESULTS

**TOTAL DEPTH = 35.1 FEET**

---

*Rock does not meet soundness criteria for RQD calculation*
APPENDIX B  PACKER TEST DATA
Boring  B-203
Surface El. (ft)  2305
Groundwater El. (ft)  2330
Test No.  1
Test Interval Center Elevation (ft)  2268.5
Test Interval Length, L (ft)  20.0
Max. Measured Pressure, P_MAX (psi)  62.0
Reference Pressure, P_0 (psi)  145
Representative Lugeon Value  0

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%P_MAX</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, ( \psi )</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
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<tr>
<td>1</td>
<td>50%</td>
<td>36.00</td>
<td>0.019990005</td>
<td>0.00</td>
<td>0.0000</td>
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<tr>
<td>2</td>
<td>75%</td>
<td>43.00</td>
<td>0.02387695</td>
<td>0.02</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>75%</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

![Graph showing flow loss vs. pressure factor](image-url)
<table>
<thead>
<tr>
<th>Boring</th>
<th>B-203</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Test</td>
<td></td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>2259.5</td>
</tr>
<tr>
<td>Surface El. (ft)</td>
<td>2305</td>
</tr>
<tr>
<td>Groundwater El. (ft)</td>
<td>2330</td>
</tr>
<tr>
<td>Test No.</td>
<td>2</td>
</tr>
<tr>
<td>Test Interval Center Elevation (ft)</td>
<td>2249.5</td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>20.0</td>
</tr>
<tr>
<td>Max. Measured Pressure, P_{MAX} (psi)</td>
<td>78.3</td>
</tr>
<tr>
<td>Reference Pressure, P_{o} (psi)</td>
<td>145</td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%P_{MAX}</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, (\psi)</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>42.00</td>
<td>0.023321672</td>
<td>12.78</td>
<td>0.6390</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>58.00</td>
<td>0.032206119</td>
<td>20.64</td>
<td>1.0320</td>
<td>32</td>
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<td>3</td>
<td>100%</td>
<td>78.33</td>
<td>0.04349677</td>
<td>31.70</td>
<td>1.5850</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>75%</td>
<td>58.33</td>
<td>0.032391212</td>
<td>18.90</td>
<td>0.9450</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
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<td>0.023593311</td>
<td>7.46</td>
<td>0.3730</td>
<td>16</td>
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<td>0</td>
</tr>
</tbody>
</table>

![Graph showing flow loss vs. pressure factor](image-url)
<table>
<thead>
<tr>
<th>Boring</th>
<th>B-203</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Test</td>
<td>Elevation (ft)</td>
</tr>
<tr>
<td>Bottom of Test</td>
<td>Elevation (ft)</td>
</tr>
<tr>
<td>Test No.</td>
<td>3</td>
</tr>
<tr>
<td>Test Interval Center Elevation (ft)</td>
<td>2229.5</td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>20.0</td>
</tr>
<tr>
<td>Max. Measured Pressure, $P_{\text{MAX}}$ (psi)</td>
<td>99.0</td>
</tr>
<tr>
<td>Reference Pressure, $P_{0}$ (psi)</td>
<td>145</td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%$P_{\text{MAX}}$</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, $\psi$</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>50.00</td>
<td>0.027763896</td>
<td>1.34</td>
<td>0.0670</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>73.00</td>
<td>0.040535288</td>
<td>1.88</td>
<td>0.0940</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>99.00</td>
<td>0.054972514</td>
<td>1.22</td>
<td>0.0610</td>
<td>1</td>
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<td>4</td>
<td>75%</td>
<td>#N/A</td>
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<tr>
<td>5</td>
<td>50%</td>
<td>#N/A</td>
<td></td>
<td></td>
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<td></td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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</tr>
</tbody>
</table>

![Graph showing flow loss (gal/min/ft) vs. Pressure Factor]
<table>
<thead>
<tr>
<th>Boring</th>
<th>B-203</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface El. (ft)</td>
<td>2305</td>
</tr>
<tr>
<td>Groundwater El. (ft)</td>
<td>2330</td>
</tr>
<tr>
<td>Test No.</td>
<td>4</td>
</tr>
<tr>
<td>Test Interval Center Elevation (ft)</td>
<td>2209.5</td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>20.0</td>
</tr>
<tr>
<td>Max. Measured Pressure, $P_{\text{MAX}}$ (psi)</td>
<td>118.0</td>
</tr>
<tr>
<td>Reference Pressure, $P_0$ (psi)</td>
<td>145</td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%$P_{\text{MAX}}$</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, $\psi$</th>
<th>Flow, $q$ (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>59.00</td>
<td>0.032761397</td>
<td>0.92</td>
<td>0.0460</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>59.00</td>
<td>0.032761397</td>
<td>0.92</td>
<td>0.0460</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>90.00</td>
<td>0.049975012</td>
<td>2.02</td>
<td>0.1010</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>118.00</td>
<td>0.065522794</td>
<td>3.10</td>
<td>0.1550</td>
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<tr>
<td>4</td>
<td>75%</td>
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<td>0.049975012</td>
<td>1.42</td>
<td>0.0710</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>65.00</td>
<td>0.036093065</td>
<td>0.32</td>
<td>0.0160</td>
<td>0</td>
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<tr>
<td>0</td>
<td>0</td>
<td>65.00</td>
<td>0.036093065</td>
<td>0.32</td>
<td>0.0160</td>
<td>0</td>
</tr>
</tbody>
</table>

![Graph showing flow loss and pressure factor relationship](image-url)

The graph illustrates the relationship between flow loss (gal/min/ft) and pressure factor, with data points marked as follows:

- Point 1: Pressure Factor 0.02, Flow Loss 0.04
- Point 2: Pressure Factor 0.03, Flow Loss 0.06
- Point 3: Pressure Factor 0.05, Flow Loss 0.12
- Point 4: Pressure Factor 0.06, Flow Loss 0.14
- Point 5: Pressure Factor 0.07, Flow Loss 0.16

This visual representation aids in understanding the pressure factor and its impact on flow loss in the context of the test data.
<table>
<thead>
<tr>
<th>Boring</th>
<th>B-203</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Test</td>
<td></td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>2200.0</td>
</tr>
<tr>
<td>Bottom of Test</td>
<td></td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>2185.0</td>
</tr>
<tr>
<td>Top of Test</td>
<td></td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>105</td>
</tr>
<tr>
<td>Bottom of Test</td>
<td></td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>120</td>
</tr>
<tr>
<td>Angle from Vertical</td>
<td>0</td>
</tr>
<tr>
<td>Test No.</td>
<td>5</td>
</tr>
<tr>
<td>Test Interval Center</td>
<td>2192.5</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td></td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>15.0</td>
</tr>
<tr>
<td>Max. Measured Pressure, $P_{MAX}$ (psi)</td>
<td>135.7</td>
</tr>
<tr>
<td>Reference Pressure, $P_0$ (psi)</td>
<td>145</td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%$P_{MAX}$</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, $\psi$</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>78.00</td>
<td>0.043311677</td>
<td>0.02</td>
<td>0.0013</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>102.33</td>
<td>0.05682344</td>
<td>0.14</td>
<td>0.0093</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>135.67</td>
<td>0.075332704</td>
<td>1.22</td>
<td>0.0813</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

![Graph of Flow Loss vs Pressure Factor]
<table>
<thead>
<tr>
<th>Boring</th>
<th>B-206</th>
<th>Top of Test Elevation (ft)</th>
<th>2263.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface El. (ft)</td>
<td>2336.62231</td>
<td>Bottom of Test Elevation (ft)</td>
<td>2254.3</td>
</tr>
<tr>
<td>Groundwater El. (ft)</td>
<td>2328.02231</td>
<td>Top of Test Depth (ft)</td>
<td>85</td>
</tr>
<tr>
<td>Test No.</td>
<td>1</td>
<td>Bottom of Test Depth (ft)</td>
<td>95</td>
</tr>
<tr>
<td>Test Interval Center Elevation (ft)</td>
<td>2258.7</td>
<td>Angle from Vertical (deg)</td>
<td>30</td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>10.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Measured Pressure, $P_{\text{MAX}}$ (psi)</td>
<td>77.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference Pressure, $P_0$ (psi)</td>
<td>145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%$P_{\text{MAX}}$</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, $\psi$</th>
<th>Flow, $q$ (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
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<tr>
<td>3</td>
<td>100%</td>
<td>77.88</td>
<td>0.043245044</td>
<td>0.34</td>
<td>0.0338</td>
<td>1</td>
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<td>75%</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
<td>#N/A</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Graph showing the relationship between Flow Loss (gal/min/ft) and Pressure Factor.
**Boring**  B-206  
**Surface El. (ft)** 2336.62231  
**Groundwater El. (ft)** 2328.02231  
**Test No.** 2  
**Test Interval Center Elevation (ft)** 2267.3  
**Test Interval Length, L (ft)** 10.0  
**Max. Measured Pressure, P_MAX (psi)** 73.0  
**Reference Pressure, P_0 (psi)** 145  
**Representative Lugeon Value** 0

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%P_MAX</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, ψ</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>#N/A</td>
<td>#N/A</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>#N/A</td>
<td>#N/A</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>72.96</td>
<td>0.040513077</td>
<td>0.02</td>
<td>0.0024</td>
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<tr>
<td>4</td>
<td>75%</td>
<td>#N/A</td>
<td>#N/A</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>#N/A</td>
<td>#N/A</td>
<td></td>
<td></td>
<td>-</td>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

**Top of Test**  
**Elevation (ft)** 2271.7  
**Bottom of Test Elevation (ft)** 2263.0  
**Top of Test Depth (ft)** 75  
**Bottom of Test Depth (ft)** 85  
**Angle from Vertical (deg)** 30

**Graph**

- **Flow Loss (gal/min/ft)** vs. **Pressure Factor**
  - Data points: (0, 0), (0.0005, 0.001), (0.001, 0.0015), (0.002, 0.002), (0.003, 0.0025), (0.004, 0.003), (0.005, 0.0035), (0.006, 0.004), (0.007, 0.0045)
  - Data point: (0.003, 0)
Boring | BI-02
---|---
Surface El. (ft) | 2334.3
Groundwater El. (ft) | 2329.5
Test No. | 1
Test Interval Center Elevation (ft) | 2277.3
Test Interval Length, L (ft) | 20.0
Max. Measured Pressure, $P_{\text{MAX}}$ (psi) | 61.1
Reference Pressure, $P_0$ (psi) | 145
Representative Lugeon Value | 0

Top of Test Elevation (ft) | 2287.3
Bottom of Test Elevation (ft) | 2267.3
Top of Test Depth (ft) | 47
Bottom of Test Depth (ft) | 67
Angle from Vertical (deg) | 0

<table>
<thead>
<tr>
<th>Step No.</th>
<th>$%P_{\text{MAX}}$</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, $\psi$</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>39.02</td>
<td>0.021669027</td>
<td>0.00</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
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<td>47.15</td>
<td>0.025180984</td>
<td>0.00</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
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<td>61.06</td>
<td>0.033903789</td>
<td>0.01</td>
<td>0.0003</td>
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</tr>
<tr>
<td>4</td>
<td>75%</td>
<td>47.24</td>
<td>0.026232069</td>
<td>0.00</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>50%</td>
<td>38.13</td>
<td>0.021173117</td>
<td>0.00</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

![Graph showing Flow Loss (gal/min/ft) vs Pressure Factor]
## Test Data

### Boring BI-03

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Top of Test Elevation (ft)</td>
<td>2287.1</td>
</tr>
<tr>
<td>Bottom of Test Elevation (ft)</td>
<td>2267.1</td>
</tr>
<tr>
<td>Top of Test Depth (ft)</td>
<td>15.1</td>
</tr>
<tr>
<td>Bottom of Test Depth (ft)</td>
<td>35.1</td>
</tr>
<tr>
<td>Angle from Vertical (deg)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Test Details

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test No.</td>
<td>1</td>
</tr>
<tr>
<td>Test Interval Center Elevation</td>
<td>2277.1</td>
</tr>
<tr>
<td>Test Interval Length, L (ft)</td>
<td>20.0</td>
</tr>
<tr>
<td>Max. Measured Pressure, P&lt;sub&gt;MAX&lt;/sub&gt; (psi)</td>
<td>42.4</td>
</tr>
<tr>
<td>Reference Pressure, P&lt;sub&gt;0&lt;/sub&gt; (psi)</td>
<td>145</td>
</tr>
<tr>
<td>Representative Lugeon Value</td>
<td>4</td>
</tr>
</tbody>
</table>

### Step Data

<table>
<thead>
<tr>
<th>Step No.</th>
<th>%P&lt;sub&gt;MAX&lt;/sub&gt;</th>
<th>Measured Pressure (psi)</th>
<th>Pressure Factor, ψ</th>
<th>Flow, q (gal/min)</th>
<th>Flow loss (gal/min/ft)</th>
<th>Lugeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>50%</td>
<td>21.16</td>
<td>0.011748459</td>
<td>0.13</td>
<td>0.0065</td>
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</tr>
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<td>75%</td>
<td>32.61</td>
<td>0.018106835</td>
<td>0.61</td>
<td>0.0306</td>
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</tr>
<tr>
<td>3</td>
<td>100%</td>
<td>42.36</td>
<td>0.023519129</td>
<td>1.66</td>
<td>0.0832</td>
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<tr>
<td>4</td>
<td>75%</td>
<td>31.62</td>
<td>0.017556</td>
<td>0.76</td>
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<td>2</td>
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<td>5</td>
<td>50%</td>
<td>21.16</td>
<td>0.01175168</td>
<td>0.14</td>
<td>0.0070</td>
<td>1</td>
</tr>
</tbody>
</table>

### Graph

The graph illustrates the relationship between pressure factor and flow loss, with data points for different steps. The x-axis represents the pressure factor, and the y-axis represents the flow loss in gallons per minute per foot. The data points for steps 1, 2, 3, 4, and 5 are marked with corresponding numbers.
APPENDIX C   TELEVIEWER DATA
October 11, 2018

AECOM
300 Lakeside Drive, Suite 400
Oakland, CA 94612, USA

Subject: Borehole Televiewer Logging Survey
Klamath River Project
Iron Gate Reservoir
Siskiyou County, California

NORCAL Job No: NS185074

Attention: Ben Kozlowicz

This report presents the findings of a borehole geophysical investigation performed by NORCAL Geophysical Consultants, Inc. at the Klamath River Project at the northeast end of Iron Gate Reservoir. This investigation was part of a geotechnical study to assess subsurface conditions along a propose water tunnel alignment. The survey was performed on two separate mobilizations during the period of August 16 through 23, 2018 by NORCAL Professional Geophysicist William J. Henrich PGp 893. Logistical support and safety information were provided onsite by Mr. Tim VandeVoorde, Engineering Geologist of AECOM.

1.0 SITE DESCRIPTION

Our work concerned 2 boreholes situated near the north and south shore at the very northeastern end of Iron Gate Reservoir (see Plate 1, Borehole Location Map). The purpose of this investigation was to help determine rock mass characteristics that included orientations and depth distribution of bedrock discontinuities. The site was underlain by unconsolidated river deposits, basalt flows and tuff breccia.

2.0 SCOPE

Geophysical borehole logging was conducted in two drilled boreholes labeled as B-202 and B-206. The geophysical logging methods consisted of acoustic televiewer and caliper. The scope of work included a report detailing analysis, methods, and presentation of results.
3.0 BOREHOLE CONDITIONS

Both boreholes were inclined 60 degrees from horizontal. They contained shallow Hwt. 4.5-inch diameter steel conductor casings from depths of 9 to 29.5-ft bgs. The casing was installed to prevent caving from unconsolidated river deposits. Below the conductor casing the boreholes were advanced with a HQ-diamond coring method. The HQ open bore diameter was approximately 3.82-inches. The principle rock types consisted of relatively hard, well consolidated basalt and highly weathered, weak tuff breccia. The latter geologic unit tended to cave and create washouts of the borehole wall. This impeded the advancement of the acoustic televiwer in Borehole B-202.

4.0 GEOPHYSICAL LOGGING EQUIPMENT AND METHODOLOGY

NORCAL conducted geophysical borehole logging using a digital MICROLOGGER2 System manufactured by Robertson Geologging, Ltd. This system consisted of the following components:

- control console,
- computer,
- motorized cable winch,
- Televiwer (acoustic)
- caliper

4.1 TELEVIEWER

Complete descriptions of the methodology, data acquisition and data analysis procedures are presented in Appendix A.

4.2 CALIPER

Caliper logs are a measure of the borehole diameter versus depth. The tool was used both as a survey technique to assess the relative consolidation of bedrock and provide parameter input to a computer program that calculates discontinuity dip. The caliper tool consists of three interconnected mechanical arms that are spring loaded against the borehole wall. The horizontal deflections of the arms gauge the borehole diameter in units of inches with depth. The logging measurement was made in the up hole direction at a speed of approximately 12-ft per minute. The data sampling rate for this instrumentation was every 0.2-ft.
5.0 RESULTS AND INTERPRETATION

Caliper and teviewer field logs are presented in Appendix B. Specific interpreted log plots (Televiewer Analysis of Dips) from the televiewer logging are presented in Appendix C. Supporting numerical tables (Discontinuity Tables) that tabulated depth, dip angles, dip azimuths, aperture thickness where applicable and fracture classification are presented in Appendix D.

Over 95 percent of all discontinuities subjected to orientation analysis were classified as fractures. The remaining percentage were attributed to lithologic contacts between basalt and tuff breccia. Fracture classifications are discussed in Appendix A. The discontinuities classified as fractures were present only in the basalt unit in Borehole B-206. No discontinuities in the tuff breccia in the lower portion of this borehole and the entire logged open borehole section of B-202 were observed. This is because this unit, based on very low BHTV amplitude returns and variable borehole diameters (washouts), is highly weathered and poorly consolidated. As a result, this geologic unit was not capable of supporting brittle fractures. Note that not all visible fractures-joints on the televiewer images were chosen for orientation analysis. This was because these non-selected features were either too fragmented or feint to be considered representative. We did subdivide or classify the fractures-joints based on the appearance of the televiewer image and related caliper responses.

6.0 STANDARD OF CARE

The scope of NORCAL’s services for this project consisted of using geophysical methods to characterize the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.
Thank you for the opportunity to participate on this project.

Sincerely,

NORCAL Geophysical Consultants, Inc.

[Signature]

William J. Henrich
Professional Geophysicist PGp 893

[Signature]

Donald J. Kirker
Professional Geophysicist PGp 997

Appendix A: Borehole Imaging Televiewer Surveying and Data Processing
Appendix B: Field Logs Televiewer and Caliper Survey, Boreholes B-202 and B-206
Appendix C: Interpreted Televiewer Plot, Borehole B-208
Appendix D: Discontinuity Table Borehole B-206
Appendix A:

Televiewer Analysis Boreholes B-202 and B-206
APPENDIX A

BOREHOLE TELEVIEWER SURVEY

1.0 METHODOLOGY

Televiewers are downhole tools that are used to produce radial images of the interior of a borehole. The images are composited sequentially using computer software to produce continuous color images. These images are like unfolded, or unwrapped, cylinders displayed on a two-dimensional surface. The “unwrapped” radial images are referenced to magnetic north by an on-board magnetic compass. In addition, an on-board three-axis magnetic inclinometer determines the inclination and azimuth of the borehole.

Televiewer images can be used to detect bedrock discontinuities (joints, fractures, bedding planes, geologic contacts, etc.) in boreholes and determine their frequency, depths and orientations. Interpretable discontinuities appear as thin sinusoidal forms that stretch across the image. Interactively fitting lines to these sinusoids provides data that computer software uses to determine the orientation and dip of the discontinuities. The midpoint or half amplitude of the sinusoid is taken as the depth of the discontinuity.

There are two types of televiewers; optical and acoustic. Optical televiewers (OPTV) use a digital optical sensor to produce radial images to a vertical resolution as fine as 0.004 feet and a radial resolution to 720 pixels. However, they can only be used in dry holes or in water filled holes with sufficient clarity to create an interpretable high resolution image. Acoustic televiewers (BHTV) require a water column to act as a medium for the transmission and reception of acoustic signals. The water does not have to be optically clear. In operation the BHTV transmits an ultrasonic signal into the borehole fluid and detects ultrasonic energy that is reflected from the borehole wall. Sidewall borehole images are created by measuring variations in the two-way travel time of the ultrasonic pulses as well as variations in the amplitude of the reflected signals.

2.0 DATA ACQUISITION

Prior to Televiewer logging we checked the correct operation of the onboard tool compass of bearing direction against the readings provided by a Brunton Compass. This procedure involves setting the probe vertically in a jig with a bar situated in the south (magnetic) direction and recording a time-drive record so that the bar forms a straight line down the center of the waterfall image. Alternately,
we incline the probe (greater than 45 degrees from vertical) in an arbitrary direction and compare the bearing displayed in test mode to the bearing indicated on the Brunton compass face. Variations of 1 to 2 degrees in azimuth between the tool display and Brunton Compass bearing confirms the tool's compass is operating satisfactorily.

Given that all boreholes maintained a shallow fluid level, image logging was accomplished with the acoustic method. We acquired acoustic BHTV data at a rate of approximately 1000 two-way pulses times per second. The tool was raised/lowered at a rate of 4.5-ft per minute. This resulted in a BHTV depth sample interval of 0.006 ft. Two logs were acquired in each borehole; one in the up direction and one in the down direction. This allowed us to demonstrate the tool's compass stability by comparing the orientations of common features between the two logs.

3.0 DATA ANALYSIS

We used the computer program WELLCAD (Version 5.1, ALT, and Luxemburg) to display BHTV images and to calculate the orientations of interpreted discontinuities (e.g. fractures, joints, bedding). Corrections for the magnetic declination in the survey area required adding 14.3 degrees to the magnetic compass bearings in order to orient the borehole images to true north (see Figure A-1 below). Since borehole diameter is a major reduction parameter in determining dip magnitude, we input caliper log measurements. In each borehole, discontinuity analyses were performed interactively on sections of the unwrapped optical or acoustic amplitude images as viewed on a computer monitor. An interpretable discontinuity on a two-dimensional unwrapped borehole televiewer log appears as a recognizable sinusoidal trace that usually extends across the full width of the borehole image. The sinusoidal shape is a manifestation of planar discontinuities intercepting a three-dimensional cylindrical borehole. Planar discontinuities can be geologic features that include discrete fractures or joints, bedding planes and planar intrusions such as veins and geologic contacts. The traces of discontinuities identified on the image logs were

Figure A-1: Magnetic Declination Illustration for Eastern Iron Gate Reservoir.
fitted with a bendable sinusoid overlying the trace, as shown in Figure A-2. This provided data that were used by WELLCAD to calculate a plane representing the orientation of the discontinuity in terms of dip direction and dip magnitude. This process was repeated for every significant discontinuity until the entire borehole was interpreted. At this stage, the apparent dip direction and dip magnitude of the identified discontinuities were converted to true geographic dip azimuth and dip magnitude by factoring the borehole tilt (inclination) and azimuth at the depth of the discontinuity.

![Image of BHTV section with sinusoid overlays](image)

**Figure A-2:** A sample BHTV section showing observable discontinuity traces (left) versus the same image (right) with the addition of interpreted sinusoidal overlays (solid red and green colored traces).

Based on observations of the core and discussions with the on-site geologist, as well as our own experience identifying planar features in acoustic televiwer images, we classified discontinuity features into three fracture/joints categories as follows:
1) "Open continuous fractures". These have characteristics that are relatively wide (measureable >> 1mm) apparent apertures, continuous sinusoidal traces across the circumference of the borehole wall and show relief/breakage along the borehole wall. This relief is usually shown as diameter enlargements on the caliper log.

2) "Thin partial to continuous fracture". These features are "thin" (indicative of very small apertures 1 mm or less) partial or discontinuous across the full 360 degrees span of the image to continuous. Feature traces can be irregular (non-sinusoidal) especially if the dip angles are greater than 60 degrees.

3) "Lithologic Contacts". Boundaries between basalt and tuff breccia.

We did not tabulate (interpret) cemented or highly discontinuous or fragmented fractures.

4.0 PRESENTATIONS

Field Logs showing the two completed BHTV logging runs referenced to magnetic North are presented in Appendix B. Two televiwer images are presented to show the stability of the compass orientation of common fracture features between separate logging runs. The Televiewer Analysis for B-206 referenced to true geographic North, is presented in Appendix C. This plot is several pages long, with header information presented at the top of the first page only. The plot contains several columns of information described, from left to right, as follows:

COLUMN 1 – DEPTH AXIS

The depth axis indicates the relative vertical distance below the ground surface. Ground surface was set equal to zero feet. Depth values are positive and increase in the downward direction.

COLUMN 2 - TELEVIEWER IMAGE

This is an unwrapped false color (BHTV) image representing the interior of the borehole wall. On the BHTV images the relationship between color and signal amplitude is indicated by the color bar at the top of the header. Dark shades (blue) indicate relatively low amplitude and the brighter shades (yellow) indicate relatively high amplitudes. BHTV images are oriented relative to true North as indicated by the azimuth information presented in the header where North, East, South and West correspond to 0°, 90°, 180° and 270°, respectively. The diameter of the borehole is indicated by the white dashed line superimposed on the image. Solid and dashed color lines superimposed on
sinusoidal fracture/joint traces depict interpreted discontinuities. The colors of the lines relate to the fracture/joint classification as follows, red = open continuous fractures, teal = “thin”, partial to complete fractures and blue = lithologic contacts. Note, that due to the wide apparent thickness of some fractures, we expanded the line trace into a broader hachured sinusoidal section.

COLUMN 3 - DIPS PLOT

The Dips Plot indicates the dip of discontinuities and their direction of maximum dip. These parameters are indicated by small symbols called “tadpoles” which consist of colored circles or squares with a straight line (tail) extending from them. The position of the tadpole indicates the degree of dip, from 0° on the left to 90° on the right, according to the scale shown at the top of the column. The direction that the tail is pointing indicates the direction of dip where straight up is true north and 90° to the right indicates due east. The tadpole symbol colors relate to the three classifications of fractures and joints. A Discontinuity Legend in the sub-header related the colors to the classification. The numerical values of dip azimuth and dip angle are also presented in discontinuity tables presented at the end of this appendix.

COLUMN 4 - CORE PLOT

This plot is a graphic rendering of the BHTV image into a 3-D core based on amplitude variations. This is basically what the image shown in Column 2 would look like if it was re-wrapped to form a cylinder where the vertical center line of the cylinder represents true north (0°), the right edge represents west (270°) and the left edge represents east (90°). South (180°) is out of view behind the core. Although the color spectrum of the core is the same as that used for the BHTV image, the core reconstruction tends to compress the amplitude spectrum into a darker range. This has the effect of making the core appear to be reddish rather than yellow. Planes drawn through the interpreted discontinuities illustrate the relative dip and dip direction of the discontinuities.

COLUMN 5 - BOREHOLE DEVIATION

This plot indicates the azimuth and tilt of the borehole. The solid blue line represents the dip direction, from 0° to 360°, according to the header scale labeled “Azimuth”. The dotted green line represents the angle of the borehole from true vertical according to the header scale labeled “Tilt”. This scale ranges from 0° to 4°.
5.0 DISCONTINUITY TABLES

The dip azimuth and dip angle of all interpreted discontinuities from the televiewer analysis plot are tabulated Appendix D. The tables present 5 column headers listed left to right as follows: Depth, Dip Azimuth, Dip Angle, Corrected Aperture and Discontinuity Classification. A brief description of the meaning of these terms is presented below.

**Depth** – relates to the center of discontinuity's sinusoid in feet below ground surface.

**Dip Azimuth** – dip direction of the discontinuity in degrees from true North.

**Dip Angle** – inclination of the plane of the discontinuity in degrees from horizontal.

**Corrected Aperture** – true thickness of fracture/joint corrected for dip measured in tenths of inches. In this survey, we used this processing facility to indicate the true thickness of weathered/ altered fractures.

**Discontinuity Classification** – number designating classification type of fracture/joint (see Legend for explanation).
Appendix B:

Field Logs Teviewer and Caliper Survey
Boreholes B-202 and B-206
Appendix C:

Televiewer Analysis Plot
Borehole B-206
Caliper Trace Scale 3-8 in.

RIVER ALLUVIUM - COBBLES down to 23-ft bgs
Appendix D:

Discontinuity Table
Boreholes B-206
## DISCONTINUITY LEGEND

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Note: "na" = true thickness of discontinuity aperture not determined
Light Brown SILT (slightly plastic) (Siltstone)

NOTE: All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.
### Log of Shelby Tube

CTL No.: 020-272  
Date: 1/15/2019  
Company Name: AECOM  
Run By: MD  
Project Name: Klamath River Dam  
Reduced By: RU  
Project No.: 60537920  
Boring: BC-13  
Sample: S04  
Depth (ft.): 22'

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**NOTE:** All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.
NOTE: All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.
22 February, 2019

Job No. 1902023
Cust. No. 12259

Mr. John Hunt
Inspection Services Inc.
1798 University Avenue
Berkeley, CA 94703-1514

Subject: Project No.: 60537920
Project Name: Klamath River Dam Removal Project
Corrosivity Analysis – CalTrans Test Methods

Dear Mr. Hunt:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on February 05, 2019. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, Sample No.003 is classified as “severely corrosive” and the remaining samples are classified as “corrosive”. All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations reflect none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentrations reflect none detected & 26 mg/kg and are determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soils ranged from 7.84 to 8.97, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call JDH Corrosion Consultants, Inc. at (925) 927-6630.

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,

CERCO ANALYTICAL, INC.

J. Darby Howard, Jr. P.E.
President

JDH/djl
Enclosure
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<td>N.D.</td>
<td>N.D.</td>
</tr>
<tr>
<td>1902023-002</td>
<td>B-19, S-01 &amp; S-02 @ 5-11.5'</td>
<td>-</td>
<td>7.97</td>
<td>980</td>
<td>-</td>
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<td>-</td>
<td>7.84</td>
<td>470</td>
<td>-</td>
<td>N.D.</td>
<td>N.D.</td>
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Method:  
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<tr>
<th>CT 226 (a)</th>
<th>CT 643 (b)</th>
<th>CT 643 (c)</th>
<th>-</th>
<th>CT 422 (d)</th>
<th>CT 417 (e)</th>
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<tbody>
<tr>
<td></td>
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Reporting Limit:  
| - | - | 14-Feb-2019 & 19-Feb-2019 | 15 | 15 |

Date Analyzed:  
| - | 8-Feb-2019 | 8-Feb-2019 |

* Results Reported on an "As Received" Basis
N.D. - None Detected
(a) Rev. July 2010  
(b) Rev. June 2007  
(c) Rev. November 2006

Quality Control Summary - All laboratory quality control parameters were found to be within established limits
## Chain of Custody

**Full Name:** John Hunt  
**Company:** ISL Berkeley  
**Sample Source:** Klamath River Dam Removal Project

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Sample Id.</th>
<th>Date</th>
<th>Time</th>
<th>Matrix</th>
<th>Contain. Size</th>
<th>Preserv. Qty.</th>
<th>pH</th>
<th>Sulfate</th>
<th>Chloride</th>
<th>Resistivity-Minimum</th>
<th>Brief Evaluation</th>
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<tbody>
<tr>
<td>001</td>
<td>B-6 5-21</td>
<td>1-1</td>
<td>5-6.5</td>
<td>1-1</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>002</td>
<td>B-19 5-21</td>
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<td>5-6.5</td>
<td>1-1</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td>003</td>
<td>B-20 5-32</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

**Matrix:**  
- DW - Drinking Water  
- GW - Ground Water  
- SW - Surface Water  
- WW - Waste Water  
- Water  
- SL - Sludge  
- S - Soil  
- Product

**Abbreviations:**  
- HB - Hosebib  
- PV - Petcock Valve  
- PT - Pressure Tank  
- PH - Pump House  
- RR - Restroom  
- GL - Glass  
- PL - Plastic  
- ST - Sterile

**Comments:**  
THERE IS AN ADDITIONAL CHARGE FOR METAL/POLY TUBES

8/6/2009
### Moisture-Density-Porosity Report

**Cooper Testing Labs, Inc. (ASTM D7263b)**

<table>
<thead>
<tr>
<th>Boring</th>
<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
<th>Actual Gs</th>
<th>Assumed Gs</th>
<th>Moisture, %</th>
<th>Wet Unit wt, pcf</th>
<th>Dry Unit wt, pcf</th>
<th>Dry Bulk Dens, pcf, (g/cc)</th>
<th>Saturation, %</th>
<th>Total Porosity, %</th>
<th>Volumetric Water Cont, θw, %</th>
<th>Volumetric Air Cont., θa, %</th>
<th>Void Ratio</th>
</tr>
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<tbody>
<tr>
<td>BC-01</td>
<td>BC-01</td>
<td>6.5</td>
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<td>2.70</td>
<td>2.70</td>
<td>43.1</td>
<td>91.0</td>
<td>45.8</td>
<td>0.73</td>
<td>99.3</td>
<td>72.8</td>
<td>72.3</td>
<td>0.5</td>
<td>2.68</td>
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<td>12.5-13</td>
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<td>2.70</td>
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<td>0.48</td>
<td>98.3</td>
<td>82.4</td>
<td>81.0</td>
<td>1.4</td>
<td>4.68</td>
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<td>S04</td>
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<td>83.7</td>
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<td>40.6</td>
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<td>0.69</td>
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<td>S05</td>
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<td>Gray Elongated</td>
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<td>83.7</td>
<td>54.8-55.3</td>
<td>94.5</td>
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<td>2.8</td>
<td>2.8</td>
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<td>40.6</td>
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<td>25.4</td>
<td>125.2</td>
<td>99.9</td>
<td>0.48</td>
<td>99.4</td>
<td>40.8</td>
<td>40.6</td>
<td>0.2</td>
<td>2.8</td>
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<tr>
<td>BC-03</td>
<td>S-02</td>
<td>5.5-6.0</td>
<td>Dark Olive Brown</td>
<td>25.4</td>
<td>2.68</td>
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<td>40.8</td>
<td>40.6</td>
<td>0.2</td>
<td>2.8</td>
</tr>
</tbody>
</table>

**Note:** All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

---

**Figure:** Moisture-Density

The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity.
### Moisture-Density-Porosity Report

Cooper Testing Labs, Inc. (ASTM D7263b)

<table>
<thead>
<tr>
<th>Boring</th>
<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
<th>Actual G_s</th>
<th>Assumed G_s</th>
<th>Moisture, %</th>
<th>Wet Unit wt, pcf</th>
<th>Dry Unit wt, pcf</th>
<th>Dry Bulk Dens.(g/cc)</th>
<th>Saturation, %</th>
<th>Total Porosity, %</th>
<th>Volumetric Water Cont., %</th>
<th>Volumetric Air Cont., %</th>
<th>Void Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC-03</td>
<td>S05</td>
<td>24.5</td>
<td>Light Olive Brown Elastic SILT</td>
<td>2.70</td>
<td></td>
<td>80.3</td>
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<td>3</td>
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<td>54</td>
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<td>178.6</td>
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<tr>
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<tr>
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<tr>
<td>BI-03</td>
<td>S-1</td>
<td>3.5</td>
<td>Olive Gray Poorly Graded GRAVEL w/ Silt &amp; Sand</td>
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</tr>
</tbody>
</table>

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

**Moisture-Density**

The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity.
## Moisture-Density-Porosity Report

Cooper Testing Labs, Inc. (ASTM D7263b)

<table>
<thead>
<tr>
<th>CTL Job No:</th>
<th>Project No.</th>
<th>By: RU</th>
</tr>
</thead>
<tbody>
<tr>
<td>020-272</td>
<td>60537920</td>
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<table>
<thead>
<tr>
<th>Client:</th>
<th>Date:</th>
<th>Project Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AECOM</td>
<td>01/18/19</td>
<td>Klamath</td>
</tr>
</tbody>
</table>

### Boring:
- BC-13
- Sample:
  - S03
  - S04
  - S06
- Depth, ft:
  - 17
  - 22
  - 40

### Visual Description:
- Light Brown SILT (Siltstone) (slightly plastic)
- Pale Olive SILT (slightly plastic)
- Olive Brown Clayey SAND

<table>
<thead>
<tr>
<th>Actual G_s</th>
<th>Assumed G_s</th>
<th>Moisture, %</th>
<th>Wet Unit wt, pcf</th>
<th>Dry Unit wt, pcf</th>
<th>Dry Bulk Dens. pb, (g/cc)</th>
<th>Saturation, %</th>
<th>Total Porosity, %</th>
<th>Volumetric Water Cont, θw, %</th>
<th>Volumetric Air Cont., θa, %</th>
<th>Void Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.70</td>
<td>2.70</td>
<td>30.1</td>
<td>78.8</td>
<td>60.6</td>
<td>0.97</td>
<td>45.5</td>
<td>64.1</td>
<td>34.9</td>
<td>1.79</td>
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<tr>
<td></td>
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<td>2.70</td>
<td>59.1</td>
<td>74.4</td>
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<td>0.75</td>
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<td>72.3</td>
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<td>1.59</td>
<td>79.7</td>
<td>41.3</td>
<td>8.4</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (G_s) was used then the saturation, porosities, and void ratio should be considered approximate.

### Moisture-Density

The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity.
### Moisture-Density-Porosity Report

Cooper Testing Labs, Inc. (ASTM D7263b)

**CTL Job No:** 020-251b  
**Project No.:** 60537920  
**By:** RU  
**Client:** AECOM  
**Date:** 06/13/18  
**Project Name:** Klamath River Dam Removal Project

<table>
<thead>
<tr>
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<th>BI-02</th>
<th>BI-02</th>
<th>BI-02</th>
<th>BI-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>S1</td>
<td>S2</td>
<td>S3</td>
<td>S-1</td>
</tr>
<tr>
<td>Depth, ft:</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Visual Description:**

- Dark reddish brown sandy fat CLAY
- Yellowish brown sandy fat CLAY
- Yellowish brown sandy fat CLAY
- Olive gray poorly graded GRAVEL w/ Silt & Sand

<table>
<thead>
<tr>
<th>Series</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
</table>

**Actual \( G_s \)**

**Assumed \( G_s \)**

**Moisture, %**

- 27.8
- 28.7
- 38.4
- 12.0

**Wet Unit wt, pcf**

- 2.6
- 2.7
- 2.8

**Dry Unit wt, pcf**

**Dry Bulk Dens. \( \rho_b \), (g/cc)**

**Saturation, %**

**Total Porosity, %**

**Volumetric Water Cont. \( \theta_w \), %**

**Volumetric Air Cont., \( \theta_a \), %**

**Void Ratio**

**Note:** All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (\( G_s \)) was used then the saturation, porosities, and void ratio should be considered approximate.

---

### Moisture-Density

The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity.

![Moisture-Density Graph](image-url)
## MOISTURE & DENSITY TEST

<table>
<thead>
<tr>
<th>Boring #</th>
<th>Sample #</th>
<th>Depth (ft.)</th>
<th>Soil type: (visual)</th>
<th>Date tested:</th>
<th>Tested by:</th>
<th>Specimen height (in.)</th>
<th>Wt. of specimen + tare (gm)</th>
<th>Tare wt. (gm)</th>
<th>Diameter (in.)</th>
<th>Wet wt. of soil + dish wt. (gm)</th>
<th>Dry wt. of soil + dish wt. (gm)</th>
<th>Wt. of dish (gm)</th>
<th>Wet Density (pcf)</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content (%)</th>
<th>Gs (Assumed)</th>
<th>Void Ratio</th>
<th>Saturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-2</td>
<td>S-01</td>
<td>27-27.5</td>
<td>Gray silty sand with gravel</td>
<td>01/23/19</td>
<td>JH</td>
<td>5.17</td>
<td>805.91</td>
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<td>2.42</td>
<td>1157.51</td>
<td>1032.81</td>
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<td>S-01</td>
<td>5-6.5</td>
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<td>824.75</td>
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<td>1002.84</td>
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<td>50.8</td>
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<td>B-6</td>
<td>S-02</td>
<td>10-11.5</td>
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<td>01/23/19</td>
<td>JH</td>
<td>4.5</td>
<td>384.60</td>
<td>361.35</td>
<td>2.42</td>
<td>446.32</td>
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<td>28.6</td>
<td>50.8</td>
<td>2.70</td>
<td>1.666</td>
<td>82.4</td>
</tr>
<tr>
<td>B-6</td>
<td>S-03</td>
<td>15-16.5</td>
<td>Dark gray clayey sand</td>
<td>01/26/19</td>
<td>JH</td>
<td>3.9</td>
<td>384.60</td>
<td>361.35</td>
<td>2.42</td>
<td>384.60</td>
<td>317.89</td>
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<td>13.5</td>
<td>28.6</td>
<td>2.70</td>
<td>1.666</td>
<td>82.4</td>
</tr>
<tr>
<td>B-6</td>
<td>S-04</td>
<td>30-31.5</td>
<td>Reddish brown clayey gravel with sand</td>
<td>01/26/19</td>
<td>JH</td>
<td>6.1</td>
<td>384.60</td>
<td>361.35</td>
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<td>384.60</td>
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<td>82.4</td>
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<td>B-6</td>
<td>S-05</td>
<td>40-41.5</td>
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<td>JH</td>
<td>2.70</td>
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<td>361.35</td>
<td>2.42</td>
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<td>2.70</td>
<td>1.666</td>
<td>82.4</td>
</tr>
<tr>
<td>B-6</td>
<td>S-06</td>
<td>45-46.5</td>
<td>Gray gravel</td>
<td>01/26/19</td>
<td>JH</td>
<td>2.70</td>
<td>384.60</td>
<td>361.35</td>
<td>2.42</td>
<td>384.60</td>
<td>317.89</td>
<td>384.60</td>
<td>129.0</td>
<td>2.70</td>
<td>28.6</td>
<td>2.70</td>
<td>1.666</td>
<td>82.4</td>
</tr>
</tbody>
</table>

### Additional data:
- Wt. of dry soil + dish before washing (gm)
- Wt. of dry soil + dish after washing (gm)
- % Passing #200 sieve
- USCS symbol
## MOISTURE & DENSITY TEST

**Client:** AECOM  
**Project:** Klamath River Dam Removal Project  
**ISI Lab No.:** G-63174  
**Job no.:** 60537920

| Boring # | Sample # | Depth (ft.) | Soil type: (visual) | Date tested | Tested by | Specimen height (in.) | Wt. of specimen + tare (gm) | Tare wt. (gm) | Diameter (in.) | Wet wt. of soil + dish wt. (gm) | Dry wt. of soil + dish wt. (gm) | Wt. of dish (gm) | Wet Density (pcf) | Dry Density (pcf) | Moisture Content (%) | Gs (Assumed) | Void Ratio | Saturation (%) | Additional data |
|----------|----------|------------|---------------------|-------------|-----------|-----------------------|-------------------------------|---------------|----------------|---------------------------------|--------------------------|------------------|-------------------|-------------------|-------------------|-------------|---------------|-----------------|
| B-7      | S-02     | 16.5-18    | Gray clayey sand with organics | 01/26/19    | JH        | 5.67                  | 359.80                       | 0.00          | 2.42           | 113.16                         | 269.65                  | 85.87            | 115.1             | 94.4              | 49.1              | 2.70        | 0.786         | 75.6            |
| B-8      | S-01     | 13-14.5    | Grayish brown clay with sand | 01/26/19    | JH        |                       | 124.99                       | 0.00          | 2.42           | 100.69                         | 100.69                  | 50.55            |                   |                   | 24.9              | 2.70        |               |                 |
| B-8      | S-02     | 16-17.5    | Dark grayish brown clayey sand | 01/26/19    | JH        |                       | 133.28                       | 0.00          | 2.42           | 95.27                          | 95.27                   | 50.56            |                   |                   | 66.5              | 2.70        |               |                 |
| B-8      | S-03     | 20-21.5    | Grayish brown clayey sand     | 01/26/19    | JH        |                       | 499.55                       | 0.00          | 2.42           | 113.85                         | 113.85                  | 51.16            |                   |                   | 31.0              | 2.70        |               |                 |
| B-8      | S-04     | 25-25.5    | Grayish brown clayey sand     | 01/26/19    | JH        |                       | 457.34                        | 0.00          | 2.42           | 469.95                         | 469.95                  | 188.28           |                   |                   | 10.5              | 2.70        |               |                 |
| B-10     | S-02     | 25.5-27    | Mottled grayish brown sandy clay | 01/26/19   | JH        |                       | 237.77                        | 0.00          | 2.42           | 428.90                         | 428.90                  | 457.34           |                   |                   | 8.3               | 2.70        |               |                 |
| B-19     | S-01     | 5-6.5      | Mottled grayish brown sandy clay | 01/26/19   | JH        |                       | 1074.57                       | 0.00          | 2.42           | 204.03                         | 204.03                  | 85.87            |                   |                   | 22.0              | 2.70        |               |                 |
| B-19     | S-03     | 15-16.5    | Mottled grayish brown sandy clay | 01/26/19   | JH        |                       | 939.01                        | 0.00          | 2.42           | 939.01                         | 939.01                  | 356.12           |                   |                   | 23.3              | 2.70        |               |                 |

**Wt. of dry soil + dish before washing (gm):**

**Wt. of dry soil + dish after washing (gm):**

**% Passing #200 sieve**

**USCS symbol**
### Visual Description
Brown Sandy Fat CLAY

### Actual and Assumed Specific Gravities

<table>
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<tr>
<th>Series</th>
<th>Actual G_s</th>
<th>Assumed G_s</th>
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<td>2.70</td>
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### Moisture Content

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<th>Moisture, %</th>
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### Wet and Dry Unit Weights

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<th>Wet Unit wt, pcf</th>
<th>Dry Unit wt, pcf</th>
<th>Dry Bulk Dens.ρb, (g/cc)</th>
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<tbody>
<tr>
<td>1</td>
<td>114.1</td>
<td>92.3</td>
<td>1.48</td>
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### Saturation and Porosity

<table>
<thead>
<tr>
<th>Series</th>
<th>Saturation, %</th>
<th>Total Porosity, %</th>
<th>Volumetric Water Cont., θw, %</th>
<th>Volumetric Air Cont., θa, %</th>
<th>Void Ratio</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>77.3</td>
<td>45.3</td>
<td>35.0</td>
<td>10.3</td>
<td>0.83</td>
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Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

---

**Moisture-Density-Porosity Report**

Cooper Testing Labs, Inc. (ASTM D7263b)

### Graph

The Zero Air-Voids curves represent the dry density at 100% saturation for each value of specific gravity.
## MOISTURE & DENSITY TEST

| Boring # | Sample # | Depth ( ft.) | Soil type: ( visual ) | Date tested: | Test by: | Specimen height ( in. ) | Wt. of specimen + tare ( gm ) | Tare wt. ( gm ) | Diameter ( in. ) | Wt. of soil + dish wt. ( gm ) | Dry wt. of soil + dish wt. ( gm ) | Wt. of dish ( gm ) | Dish ID | Wet Density ( pcf ) | Dry Density ( pcf ) | Moisture Content ( % ) | Gs ( Assumed ) | Void Ratio | Saturation ( % ) |
|----------|----------|-------------|-----------------------|--------------|--------|------------------------|-------------------------------|----------------|----------------|-----------------------------|-----------------------------|----------------|--------|----------------------|----------------------|------------------------|----------------|------------|----------------|--------|
| B-19     | S-04     | 20-21.5     | Grayish brown clayey gravel with sand | 01/26/19     | JH     |                       | 1187.41                      | 680.92                      |                | 186.22                      | 22.8                        |                |        |                      |                      | 35.7                   |
| B-20     | S-03     | 15-16.5     | Grayish brown sandy clay | 01/26/19     | JH     |                       | 680.92                      | 765.13                      |                | 186.22                      | 23.0                        |                |        |                      |                      | 35.7                   |
| B-20     | S-04     | 20-21.5     | Grayish brown clayey sand | 01/26/19     | JH     |                       | 680.92                      | 765.13                      |                | 186.22                      | 23.0                        |                |        |                      |                      | 35.7                   |
| B-20     | S-05     | 25-26.5     | Grayish brown clayey sand with gravel | 01/26/19     | JH     |                       | 680.92                      | 765.13                      |                | 186.22                      | 18.0                        |                |        |                      |                      | 23.0                   |

**Wet Density ( pcf )**

**Dry Density ( pcf )**

**Moisture Content ( % )**

22.8  35.7  23.0  18.0

**Gs ( Assumed )**

2.70  2.70  2.70  2.70  2.70  2.70  2.70  2.70

**Void Ratio**


**Saturation ( % )**


**Additional data:**

- Wt. of dry soil + dish before washing ( gm )
- Wt. of dry soil + dish after washing ( gm )
- % Passing # 200 sieve
- USCS symbol
<table>
<thead>
<tr>
<th>Boring:</th>
<th>BC-02</th>
<th>BC-03</th>
<th>BC-04</th>
<th>BC-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>S-01</td>
<td>S-01</td>
<td>S-01</td>
<td>S02</td>
</tr>
<tr>
<td>Depth, ft.:</td>
<td>1-2</td>
<td>1</td>
<td>1.5</td>
<td>7</td>
</tr>
<tr>
<td>Soil Type:</td>
<td>Dark Olive Brown Clayey GRAVEL w/ Sand</td>
<td>Dark Olive Brown Clayey SAND</td>
<td>Dark Olive Brown Sandy CLAY</td>
<td></td>
</tr>
</tbody>
</table>

| Wt. Ret. on #4 Sieve, gm | 556.7 | 16.7 | 22.3 | 15.6 |
| Wt. Ret. on #200 Sieve, gm | 774.5 | 177.4 | 291.7 | 205.6 |

| % Gravel | 51.9 | 3.1 | 4.3 | 3.2 |
| % Sand   | 20.3 | 30.2 | 51.4 | 39.3 |
| % Silt & Clay | 27.7 | 66.6 | 44.3 | 57.5 |

**Remarks:** As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).
#200 Bulk Sieve Wash Analysis
ASTM D 1140m

<table>
<thead>
<tr>
<th>Job No.: 020-251</th>
<th>Project No.: 60537920</th>
<th>Run By: MD</th>
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<tbody>
<tr>
<td>Client: AECOM</td>
<td>Date: 6/14/2018</td>
<td>Checked By: DC</td>
</tr>
<tr>
<td>Project: Klamath River Dam Removal Project</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Boring:</th>
<th>Sample:</th>
<th>Depth, ft.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC-07</td>
<td>S-02</td>
<td>4-4.5</td>
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</table>

<table>
<thead>
<tr>
<th>Soil Type:</th>
<th>Bulk Sample wt. lb.</th>
<th>Wt of Dish &amp; Dry Soil &lt;#4, gm</th>
<th>Weight of Dish, gm</th>
<th>Weight of Dry Soil &lt;#4, gm</th>
<th>Wt. Ret. on #4 Sieve, lb</th>
<th>Wt. Ret. on #200 Sieve, gm</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Silt &amp; Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Dark Olive Brown Sandy Fat CLAY w/ Gravel</td>
<td>218.0</td>
<td>389.5</td>
<td>171.0</td>
<td>218.5</td>
<td>33.1</td>
<td>52.3</td>
<td>15.2</td>
<td>20.3</td>
<td>64.5</td>
</tr>
</tbody>
</table>

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).
ASTM D-1140
PERCENT PASSING NO. 200 SIEVE REPORT
Method A
Specimens Soaked Overnight without Deflocculating Agent
Dry Mass Determined Directly

**Client Name**  AECOM

**Project Name**  Klamath River Dam Removal Project

**Project Number**  60537920

<table>
<thead>
<tr>
<th>Boring Number</th>
<th>B-6</th>
<th>B-6</th>
<th>B-8</th>
<th>B-10</th>
<th>B-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Number</td>
<td>S-03</td>
<td>S-05</td>
<td>S-04</td>
<td>S-02</td>
<td>S-03</td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>15-16.5</td>
<td>40-41.5</td>
<td>25-25.5</td>
<td>25.5-27</td>
<td>15-16.5</td>
</tr>
<tr>
<td>Percent of Soil Finer than No. 200 Sieve</td>
<td>36.2</td>
<td>2.4</td>
<td>27.6</td>
<td>15.7</td>
<td>67.8</td>
</tr>
<tr>
<td>Visual Classification</td>
<td>Dark gray clayey sand</td>
<td>Grayish brown gravel with sand</td>
<td>Dark grayish brown clayey sand</td>
<td>Grayish brown clayey sand</td>
<td>Grayish brown sandy clay</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>01/26/19</th>
<th>01/26/19</th>
<th>01/26/19</th>
<th>01/26/19</th>
<th>01/26/19</th>
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</thead>
<tbody>
<tr>
<td>Weight of Dry Soil + Pan (before wash)</td>
<td>317.9</td>
<td>945.1</td>
<td>470.0</td>
<td>428.9</td>
<td>550.9</td>
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<tr>
<td>Weight of Dry Soil + Pan (after wash)</td>
<td>233.5</td>
<td>927.2</td>
<td>392.2</td>
<td>375.1</td>
<td>303.7</td>
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<tr>
<td>Weight of Pan</td>
<td>84.9</td>
<td>187.9</td>
<td>188.3</td>
<td>85.3</td>
<td>186.2</td>
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#200 Sieve Wash Analysis
ASTM D 1140

<table>
<thead>
<tr>
<th>Job No.:</th>
<th>Project No.:</th>
<th>Run By:</th>
<th>MD</th>
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<td>Client:</td>
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<td>AECOM</td>
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<td>Project:</td>
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<td>Klamath River Renewal Project</td>
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<table>
<thead>
<tr>
<th>Boring:</th>
<th>Sample:</th>
<th>Depth, ft.:</th>
<th>Soil Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-15</td>
<td>S3</td>
<td>15-16.5</td>
<td>Brown Clayey GRAVEL w/ Sand</td>
</tr>
</tbody>
</table>

| Wt of Dish & Dry Soil, gm | 687.3 |
| Weight of Dish, gm        | 172.2 |
| Weight of Dry Soil, gm     | 515.1 |
| Wt. Ret. on #4 Sieve, gm   | 218.3 |
| Wt. Ret. on #200 Sieve, gm | 357.6 |
| % Gravel                  | 42.4  |
| % Sand                    | 27.0  |
| % Silt & Clay             | 30.6  |

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).
**ASTM D-1140**  
**PERCENT PASSING NO. 200 SIEVE REPORT**  
Method A  
Specimens Soaked Overnight without Deflocculating Agent  
Dry Mass Determined Directly

<table>
<thead>
<tr>
<th>Client Name</th>
<th>AECOM</th>
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<tbody>
<tr>
<td>Project Name</td>
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<tr>
<td>Project Number</td>
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<table>
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<th>Parameter</th>
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<tr>
<td>Sample Number</td>
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<td>Percent of Soil Finer than No. 200 Sieve</td>
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<tr>
<td>Visual Classification</td>
<td>Grayish brown clayey sand with gravel</td>
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<tr>
<td>Date</td>
<td>01/26/19</td>
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<tr>
<td>Weight of Dry Soil + Pan (before wash)</td>
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<td>Weight of Dry Soil + Pan (after wash)</td>
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<tr>
<td>Weight of Pan</td>
<td>187.6</td>
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</table>
### Grain Size Distribution Report

#### Source: BC-04
- Sample No.: S-03
- Elev./Depth: 11-12.5'

#### Source: BC-07
- Sample No.: S-04
- Elev./Depth: 13'

#### Source: BC-10
- Sample No.: S-01
- Elev./Depth: 9.5'

#### REMARKS:
- Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

#### Soil Description
- **Reddish Brown Clayey Sand**
- **Dark Olive Brown Well-Graded Sand with Silt & Gravel**
- **Dark Olive Brown Well-Graded Gravel**

#### Particle Size Distribution Report

<table>
<thead>
<tr>
<th>SIEVE number size</th>
<th>PERCENT FINER</th>
<th>SIEVE size (inches)</th>
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<tbody>
<tr>
<td></td>
<td>% COBBLES</td>
<td>% GRANULES</td>
</tr>
<tr>
<td>% COBBLES</td>
<td>% GRANULES</td>
<td>% SAND</td>
</tr>
<tr>
<td>○</td>
<td>□</td>
<td>△</td>
</tr>
<tr>
<td>9.4</td>
<td>50.1</td>
<td>40.5</td>
</tr>
<tr>
<td>#4</td>
<td>#10</td>
<td>#30</td>
</tr>
<tr>
<td>#10</td>
<td>#30</td>
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<tr>
<td>#50</td>
<td>#100</td>
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</tr>
</tbody>
</table>

#### Remarks:
- Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.
## Particle Size Distribution Report

### % COBBLES
- 61.4

### % SAND
- 29.6

### % SILT
- 9.0

### % CLAY
- 29.6

### USCS
- GP-GM

### AASHTO
- 26

### PL
- 41

### LL
- 41

### SOIL DESCRIPTION
- Olive Gray Poorly Graded GRAVEL w/ Silt & Sand

### REMARKS:
- Source: B1-03
- Sample No.: S-01
- Elev./Depth: 3.5'

### Client:
- AECOM

### Project:
- Klamath River Dam Removal Project - 60537920

### Project No.:
- 020-251

### COOPER TESTING LABORATORY

---

### D60
- 10.6

### D30
- 2.52

### D10
- 0.101

### Cc
- 5.92

### Cu
- 105.44

---

### Source:
- BI-03

### Sample No.:
- S-01

### Elev./Depth:
- 3.5'
Particle Size Distribution Report

<table>
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<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
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</tr>
<tr>
<td>#30</td>
<td>100.0</td>
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</tr>
<tr>
<td>#40</td>
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<td>#50</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>99.0</td>
<td></td>
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<tr>
<td>#200</td>
<td>98.5</td>
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<tr>
<td>#270</td>
<td>90.6</td>
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<tr>
<td>0.0274 mm.</td>
<td>87.8</td>
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<tr>
<td>0.0176 mm.</td>
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<tr>
<td>0.0104 mm.</td>
<td>73.4</td>
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<tr>
<td>0.0076 mm.</td>
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<tr>
<td>0.0041 mm.</td>
<td>55.8</td>
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<tr>
<td>0.0029 mm.</td>
<td>48.3</td>
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<td>0.0021 mm.</td>
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<tr>
<td>0.0013 mm.</td>
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* (no specification provided)

Soil Description
Olive Gray Elastic SILT

Atterberg Limits
- PL = 51
- LL = 85
- PI = 34

Coefficients
- D₈₅ = 0.0115
- D₆₀ = 0.0048
- D₅₀ = 0.0031
- Cₜ₃₀ =
- Cₜ₁₅ =
- Cₜ₁₀ =

Classification
- USCS = MH
- AASHTO =

Remarks

Sample No.: S-04  Source of Sample: BC-01  Date: 6/5/18  Elev./Depth: 21.5'

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

COOPER TESTING LABORATORY

Project No.: 020-251  Figure
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
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</thead>
<tbody>
<tr>
<td>#10</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#30</td>
<td>99.8</td>
<td></td>
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<tr>
<td>#40</td>
<td>99.7</td>
<td></td>
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<tr>
<td>#50</td>
<td>99.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>99.4</td>
<td></td>
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</tr>
<tr>
<td>#200</td>
<td>99.3</td>
<td></td>
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</tr>
<tr>
<td>#270</td>
<td>99.2</td>
<td></td>
<td></td>
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<tr>
<td>0.0285 mm.</td>
<td>93.5</td>
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<tr>
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<tr>
<td>0.0013 mm.</td>
<td>41.5</td>
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</tr>
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* (no specification provided)

Soil Description
Gray Elastic SILT

Atterberg Limits
PL = 59
LL = 105
PI = 46

Coefficients
D85 = 0.0090
D60 = 0.0032
D50 = 0.0018
D30 =
D15 =
C =
C =

Classification
USCS = MH
AASHTO =

Remarks

Sample No.: S-05
Source of Sample: BC-02
Date: 6/5/18
Elev./Depth: 14.5'

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251
Figure

COOPER TESTING LABORATORY
# Particle Size Distribution Report

## Soil Description

Gray Elastic SILT

## Atterberg Limits

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<tr>
<th>Limit</th>
<th>Value</th>
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<tbody>
<tr>
<td>PL</td>
<td>85</td>
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<tr>
<td>LL</td>
<td>187</td>
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<tr>
<td>PI</td>
<td>102</td>
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## Coefficients

<table>
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<th>Value</th>
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<td>0.0085</td>
</tr>
<tr>
<td>D&lt;sub&gt;60&lt;/sub&gt;</td>
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</tr>
<tr>
<td>D&lt;sub&gt;50&lt;/sub&gt;</td>
<td>0.0047</td>
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<tr>
<td>D&lt;sub&gt;30&lt;/sub&gt;</td>
<td>0.0018</td>
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<tr>
<td>D&lt;sub&gt;15&lt;/sub&gt;</td>
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</tr>
<tr>
<td>D&lt;sub&gt;5&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;u&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;c&lt;/sub&gt;</td>
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## Classification

USCS = MH  
AASHTO =

## Remarks

(no specification provided)

### Particle Size Distribution

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
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<tbody>
<tr>
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<tr>
<td>#30</td>
<td>99.7</td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>99.6</td>
<td></td>
</tr>
<tr>
<td>#50</td>
<td>99.6</td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>99.5</td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>99.5</td>
<td></td>
</tr>
<tr>
<td>#270</td>
<td>99.4</td>
<td></td>
</tr>
<tr>
<td>0.0331 mm.</td>
<td>99.1</td>
<td></td>
</tr>
<tr>
<td>0.0210 mm.</td>
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<tr>
<td>0.0122 mm.</td>
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<td>0.0089 mm.</td>
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<td>0.0067 mm.</td>
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<td>0.0049 mm.</td>
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<tr>
<td>0.0035 mm.</td>
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<tr>
<td>0.0025 mm.</td>
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</tr>
<tr>
<td>0.0016 mm.</td>
<td>27.6</td>
<td></td>
</tr>
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</table>

### Source of Sample

**Project:**  
Klamath River Dam Removal Project - 60537920

**Client:**  
AECOM

**Sample No.:** S-09

**Location:**

**Source of Sample:** BC-02

**Date:** 6/5/18

**Elev./Depth:** 44.5'

---

**COOPER TESTING LABORATORY**

**Project No.:** 020-251

**Figure:**
Particle Size Distribution Report

---

**Soil Description**

Light Olive Brown Elastic SILT

---

**Atterberg Limits**

- PL = 59
- LL = 69
- PI = 10

**Coefficients**

- D_{85} = 0.0091
- D_{60} = 0.0049
- D_{50} = 0.0039
- D_{30} = 0.0021
- D_{15} =
- C_u =
- C_c =

**Classification**

USCS = MH

AASHTO =

---

**Remarks**

---

**Sample No.:** S-05  **Source of Sample:** BC-03  **Date:** 6/5/18

**Elev./Depth:** 24.5'

---

**Client:** AECOM  **Project:** Klamath River Dam Removal Project - 60537920

**Project No.:** 020-251  **Figure**
Particle Size Distribution Report

Soil Description
Pale Brown Mottled Gray Elastic SILT

Atterberg Limits
\[ \text{PL} = 85 \quad \text{LL} = 120 \quad \text{PI} = 35 \]

Coefficients
\[ D_{85} = 0.0050 \quad D_{60} = 0.0018 \quad D_{50} = D_{30} = 0.62 \]
\[ C_u = C_c = C_{15} = C_{10} = 0 \]

Classification
USCS = MH \quad AASHTO =

Remarks

Sample No.: S-08 \quad Source of Sample: BC-04 \quad Date: 5/16/18
Elev./Depth: 32.5(Tip-16”)

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No: 020-251
Figure
Particle Size Distribution Report

Soil Description
Light Olive Brown Elastic SILT

Atterberg Limits
PL = 88
LL = 200
PI = 112

Coefficients
D_{85} = 0.0044
D_{60} = 0.0032
D_{50} = 0.0030
D_{30} = 0.0026
D_{15} =
D_{10} =
C_{c} =

Classification
USCS = MH
AASHTO =

Remarks

% COBBLES | % GRAVEL | % SAND | % SILT | % CLAY
---|---|---|---|---
0.0 | 0.0 | 1.0 | 76.4 | 22.6

SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO)
---|---|---|---
#10 | 100.0 | | |
#30 | 99.8 | | |
#40 | 99.6 | | |
#50 | 99.5 | | |
#100 | 99.3 | | |
#200 | 99.0 | | |
#270 | 98.9 | | |
0.0343 mm. | 97.3 | | |
0.0218 mm. | 95.9 | | |
0.0126 mm. | 94.5 | | |
0.0089 mm. | 93.9 | | |
0.0063 mm. | 92.4 | | |
0.0046 mm. | 86.5 | | |
0.0034 mm. | 64.6 | | |
0.0026 mm. | 29.3 | | |
0.0016 mm. | 16.9 | | |

* (no specification provided)

Sample No.: S-05  Source of Sample: BC-08A  Date: 6/5/18
Location:  Elev./Depth: 54'

Client: AECOM  Project: Klamath River Dam Removal Project - 60537920
Project No: 020-251  Figure
## Particle Size Distribution Report

### Soil Description
- Dark Gray Elastic SILT

### Atterberg Limits
- PL: 53
- LL: 74
- PI: 21

### Coefficients
- D85 = 0.0270
- D60 = 0.0124
- D50 = 0.0088
- C30 = 0.0043
- C15 = 
- Cc =

### Classification
- USCS: MH
- AASHTO:

### Remarks

### Particle Size Distribution Table

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT (X=NO)</th>
<th>PASS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>#10</td>
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<td></td>
</tr>
<tr>
<td>#30</td>
<td>99.9</td>
<td></td>
<td></td>
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<td>#40</td>
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<td>#200</td>
<td>99.7</td>
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<td>0.0081 mm.</td>
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<td>0.0043 mm.</td>
<td>30.2</td>
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<tr>
<td>0.0030 mm.</td>
<td>24.3</td>
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<tr>
<td>0.0022 mm.</td>
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</tr>
<tr>
<td>0.0013 mm.</td>
<td>15.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (no specification provided)

### Sample Details
- **Sample No.:** S-05
- **Source of Sample:** BC-09
- **Date:** 6/5/18
- **Elev./Depth:** 23(Tip-5")

### Project Details
- **Client:** AECOM
- **Project:** Klamath River Dam Removal Project - 60537920
- **Project No.:** 020-251

**COOPER TESTING LABORATORY**
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
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<th>SPEC. * PERCENT</th>
<th>PASS? (X=NO)</th>
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</tr>
<tr>
<td>3/8 in.</td>
<td>91.0</td>
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<td></td>
</tr>
<tr>
<td>#4</td>
<td>89.1</td>
<td></td>
<td></td>
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<tr>
<td>#10</td>
<td>83.2</td>
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<td></td>
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<tr>
<td>#30</td>
<td>79.0</td>
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<tr>
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* (no specification provided)

Soil Description
Dark Reddish Brown Sandy Fat CLAY

Atterberg Limits
PL = 28
LL = 78
PI = 50

Coefficients
D_85 = 2.56
D_60 = 0.0267
D_50 = 0.0084

Classification
USCS = CH
AASHTO =

Remarks

Sample No.: S-01
Source of Sample: BI-02
Date: 6/6/18
Elev./Depth: 5'

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251
Figure
Particle Size Distribution Report

**Soil Description**
Yellowish Brown Sandy Fat CLAY

**Atterberg Limits**
- PL = 28
- LL = 58
- PI = 30

**Coefficients**
- D85 = 0.917
- D60 = 0.0612
- D50 = 0.0226
- D30 = 0.0032
- D15 = 
- Cc = 
- Classification
USCS = CH
AASHTO =

**Remarks**

**Sample No.:** S-02  
**Source of Sample:** BI-02  
**Date:** 6/6/18  
**Elev./Depth:** 10'

**Client:** AECOM  
**Project:** Klamath River Dam Removal Project - 60537920

**Project No.:** 020-251  
**Figure**
Particle Size Distribution Report

% COBBLES | % GRAVEL | % SAND | % SILT | % CLAY
0.0       | 7.6      | 39.5   | 31.5   | 21.4

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
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<tr>
<td>1 in.</td>
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<td>3/8 in.</td>
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<tr>
<td>0.0013 mm.</td>
<td>19.3</td>
<td></td>
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</table>

* (no specification provided)

Soil Description
Yellowish Brown Sandy Fat CLAY

Atterberg Limits
PL = 27
LL = 51
Pl = 24

Coefficients
D85 = 0.492
D60 = 0.113
D50 = 0.0601
D30 = 0.0067
D15 =
C15 =
C50 =

Classification
USCS = CH
AASHTO =

Remarks
Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

Sample No.: S-03
Source of Sample: BI-02
Date: 6/6/18
Elev./Depth: 15'

COOPER TESTING LABORATORY
Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No.: 020-251
Figure
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>GRAIN SIZE - mm</th>
<th>PERCENT FINER</th>
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</tr>
<tr>
<td>10</td>
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<tr>
<td>0.1</td>
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<table>
<thead>
<tr>
<th>% COBBLES</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>USCS</th>
<th>AASHTO</th>
<th>PL</th>
<th>LL</th>
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<tr>
<td>#100</td>
<td>11.4</td>
</tr>
<tr>
<td>#200</td>
<td>9.0</td>
</tr>
</tbody>
</table>

SOIL DESCRIPTION
○ Olive Gray Poorly Graded GRAVEL w/ Silt & Sand

REMARKS:
○

Source: BI-03
Sample No.: S-01
Elev./Depth: 3.5'

COOPER TESTING LABORATORY
Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No.: 020-251
Figure
Particle Size Distribution Report

Soil Description
Dark Reddish Brown Sandy Fat CLAY

Atterberg Limits
\[ PL = 28 \quad LL = 78 \quad PI = 50 \]

Coefficients
\[ D_{85} = 2.56 \quad D_{60} = 0.0267 \quad D_{50} = 0.0084 \]
\[ D_{30} = D_{15} = D_{10} = C_{c} = \]

Classification
USCS = CH \quad AASHTO =

Remarks

Sample No.: S-01 \quad Source of Sample: BI-02 \quad Date: 6/6/18
Location: \quad Elev./Depth: 5'

<table>
<thead>
<tr>
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* (no specification provided)

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No: 020-251
### Particle Size Distribution Report

**Soil Description**
Yellowish Brown Sandy Fat CLAY

**Atterberg Limits**
- \( PL = 28 \)
- \( LL = 58 \)
- \( PI = 30 \)

**Coefficients**
- \( D_{85} = 0.917 \)
- \( D_{60} = 0.0612 \)
- \( D_{50} = 0.0226 \)
- \( C_{u} = 0.0032 \)
- \( C_{c} = 0.15 \)

**Classification**
- USCS = CH
- AASHTO =

**Remarks**

### Particle Size Distribution

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**Sample No.:** S-02  
**Source of Sample:** BI-02  
**Date:** 6/6/18  
**Elev./Depth:** 10'

**Client:** AECOM  
**Project:** Klamath River Dam Removal Project - 60537920  
**Project No.:** 020-251  
**Figure:**
Particle Size Distribution Report

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* (no specification provided)

Soil Description
Yellowish Brown Sandy Fat CLAY

Atterberg Limits
- PL = 27
- LL = 51
- PI = 24

Coefficients
- D_85 = 0.492
- D_60 = 0.113
- D_50 = 0.0601
- D_30 = 0.0067
- D_15 =
- D_10 =
- C_u =
- C_c =

Classification
USCS = CH
AASHTO =

Remarks
Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

Sample No.: S-03  Source of Sample: BI-02  Date: 6/6/18
Location:  Elev./Depth: 15'

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No.: 020-251  Figure
### Particle Size Distribution Report

**Soil Description**

Gray silty sand with gravel

**Atterberg Limits**

- **PL** = 13.5779
- **LL** = 10.0161
- **D_90** = 3.2642

**Coefficients**

- **D_50** = 19.723
- **D_30** = 0.5334
- **D_10** = 4.3
- **C_u** = 8.2
- **C_c** = 2

**Classification**

- **USCS** = **SM**
- **AASHTO** =

**Remarks**


### Source of Sample:

- **Sample Number:** S-01
- **Depth:** 27-27.5

### Client:

- **AECOM**

### Project:

- **Klamath River Dam Removal Project**
- **Project No:** 60537920
- **Project No:** 2301-069.0

### Date:

- **2-1-19**

### Figure:

- **3001-069.0**

### Tested By:

- **JH**

### Checked By:

- **JH**
Particle Size Distribution Report

Brown clay with sand

Atterberg Limits

\[
\begin{align*}
\text{PL} &= 3.2821 \\
\text{LL} &= 5.3211 \\
\text{D}_{90} &= 6.40 \\
\text{D}_{50} &= 1.201 \\
\text{D}_{10} &= 0.01 \\
\text{Cu} &= 1.92 \\
\text{Cc} &= 1.92 \\
\text{USCS} &= \text{CL} \\
\text{AASHTO} &= \\
\end{align*}
\]

Soil Description

Brown clay with sand

Remarks

Particle Size Distribution Report

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<th>SPEC.* PERCENT</th>
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Source of Sample: B-5
Sample Number: S-01

SUCCS: CL
AASHTO:

Remarks

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
Project No: 2301-069,0

Tested By: JH
Checked By: JH
**Soil Description**
Grayish brown silty sand with organics

**Atterberg Limits**

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**Per Cent Spec.**

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**Classification**

USCS = SM

AASHTO =

**Remarks**

**SIEVE**

Client: AECOM

Project: Klamath River Dam Removal Project

60537920

Project No: 2301-069.0

Tested By: JH

Checked By: JH
**Soil Description**

Reddish brown clayey gravel with sand

**Atterberg Limits**

\[
\begin{align*}
PL &= \text{ (not provided) } \\
LL &= \text{ (not provided) } \\
\end{align*}
\]

**Coefficients**

- \( D_{25} = 42.1617 \)
- \( D_{50} = 36.9884 \)
- \( D_{50} = 13.2018 \)
- \( D_{10} = 0.3044 \)
- \( C_u = C_C = \text{ (not provided) } \)

**Classification**

- USCS = GC
- AASHTO =

**Remarks**

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**Particle Size Distribution Report**

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* (no specification provided)

**Source of Sample:** B-6  
**Sample Number:** S-04  
**Depth:** 30-31.5  
**Date:** 2-1-19  
**Client:** AECOM  
**Project:** Klamath River Dam Removal Project  
**Project No:** 2301-069.0  
**Figure**
### Particle Size Distribution Report

**Soil Description**

Gray gravel

**Atterberg Limits**

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**Classification**

USCS = GP

**Remarks**

(No specification provided)

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<tr>
<td>1</td>
<td>58</td>
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<tr>
<td>3/4</td>
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<td>3/8</td>
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<tr>
<td>#200</td>
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* (No specification provided)

**Source of Sample**: B-6
**Sample Number**: S-06
**Depth**: 45-46.5
**Date**: 2-1-19

**Client**: AECOM
**Project**: Klamath River Dam Removal Project
60537920
**Project No**: 2301-069.0
**Figure**

**Tested By**: JH
**Checked By**: JH
### Soil Description

Gray clayey sand with organics

### Atterberg Limits

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
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<tbody>
<tr>
<td>PL</td>
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<tr>
<td>LL</td>
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<tr>
<td>D90</td>
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<td>D50</td>
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<td>D10</td>
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<tr>
<td>USCS</td>
<td>SC</td>
</tr>
</tbody>
</table>

### Classification

AASHTO =

### Remarks

(no specification provided)
Particle Size Distribution Report

Soil Description
Black silt with sand and organics

Atterberg Limits

PL =  
LL =  
PL =  

Coefficients

D_90 = 3.2357
D_50 = 0.4711
D_10 = 0.0163

Classification

USCS = ML
AASHTO =

Remarks

Source of Sample: B-8
Sample Number: S-02
Depth: 16-17.5
Date: 2-11-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0
Figure

Tested By: JH
Checked By: JH
Particle Size Distribution Report

Soil Description

Brown sandy clay

Atterberg Limits

PL = 22  LL = 62  PI = 40

Coefficients

D₉₀ = 0.4406  D₅₀ = 0.2283  D₃₀ = 0.0154
D₁₀ = C₅₀ = C₇₅ = 0.0326

Classification

USCS = CH  AASHTO = A-7-6(27)

Remarks

Source of Sample: B-14  Depth: 6.4-7.9
Sample Number: S-01

Client: AECOM
Project: Klamath River Dam Removal Project  60537920
Project No: 2301-069.0  Figure

Tested By: JH  Checked By: JH
### Soil Description

Brown sandy silt

### Atterberg Limits

- $PL = \text{ (no specification provided) }$
- $LL = \text{ (no specification provided) }$
- $Pl = \text{ (no specification provided) }$

### Coefficients

- $D_{90} = 0.6889$
- $D_{85} = 0.3736$
- $D_{80} = 0.0243$
- $D_{50} = 0.0057$
- $D_{40} = 0.0057$
- $D_{30} = 0.0057$
- $D_{10} = 0.0057$
- $C_{u} = \text{ (no specification provided) }$
- $C_{c} = \text{ (no specification provided) }$

### Classification

- USCS: ML
- AASHTO: \text{ (no specification provided) }

### Remarks

- \text{ (no specification provided) }

---

**Source of Sample:** B-19  
**Date:** 2-11-19  
**Sample Number:** S-01  
**Client:** AECOM  
**Project:** Klamath River Dam Removal Project  
**Project No:** 2301-069.0  
**Figure**
Particle Size Distribution Report

Soil Description
Mottled grayish brown sandy clay

Atterberg Limits
PL = 0.7332
LL = 0.3954

Classification
USCS = CL

Coeficients
D90 = 0.1112
D50 = 0.6619
D10 = 0.1823
C15 = 0.2814
C60 = 0.3114

Remarks

Source of Sample: B-19
Sample Number: S-03
Depth: 15-16.5
Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0

Tested By: JH
Checked By: JH
Particle Size Distribution Report

**Soil Description**
Grayish brown clayey gravel with sand

**Atterberg Limits**

\[ \begin{align*}
\text{LL} &= \frac{D_{90} - D_{10}}{D_{90} - D_{50}} \\
\text{Pl} &= \frac{D_{50} - D_{10}}{D_{90} - D_{10}}
\end{align*} \]

**Coefficients**

\[ \begin{align*}
D_{90} &= 22.3903 \\
D_{50} &= 20.1843 \\
D_{10} &= 2.5659 \\
D_{s} &= 0.01726 \\
D_{c} &= 4.7896 \\
C_{u} &= 2.15 \\
C_{c} &= 4.7896
\end{align*} \]

**Classification**

USCS = GC
AASHTO =

**Remarks**

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.* PERCENT</th>
<th>PASS?</th>
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</thead>
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* (no specification provided)

Source of Sample: B-19
Sample Number: S-04
Depth: 20-21.5
Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0
Figure

Tested By: JH
Checked By: JH
### Soil Description

Brown sandy clay

### Atterberg Limits

\[
\begin{align*}
\text{PL} &= \text{LL} = \text{PI} \\
D_{90} &= 2.7420 \\
D_{50} &= 1.7874 \\
D_{10} &= 0.0191 \\
C_{u} &= 0.0025 \\
C_{c} &= 0.0448
\end{align*}
\]

### Coefficients

\[
\begin{align*}
D_{90} &= 2.7420 \\
D_{50} &= 1.7874 \\
D_{10} &= 0.0191
\end{align*}
\]

### Classification

USCS = CL

### AASHTO

### Remarks

### Particle Size Distribution Report

#### SIEVE SIZE

<table>
<thead>
<tr>
<th>PERCENT FINER</th>
<th>SPEC. PERCENT</th>
<th>PASS?</th>
<th>SIZE</th>
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<td>3/8</td>
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<td>#4</td>
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<tr>
<td>#200</td>
<td>64</td>
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<td>#200</td>
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<tr>
<td>0.0292 mm.</td>
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<tr>
<td>0.0191 mm.</td>
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<td>0.0013 mm.</td>
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* (no specification provided)

**Source of Sample:** B-20  **Date:** 2-11-19

**Sample Number:** S-02  **Client:** AECOM

**Project:** Klamath River Dam Removal Project  **Project No:** 2301-069.0

2-11-19

**Figure**

Tested By: JH  Checked By: JH
**Particle Size Distribution Report**

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
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<th>SPEC.* PERCENT</th>
<th>PASS? (X=NO)</th>
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<td>3/8</td>
<td>93</td>
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<tr>
<td>#4</td>
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<tr>
<td>#200</td>
<td>44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (no specification provided)

**Soil Description**
Grayish brown clayey sand

**Atterberg Limits**
- PL =
- LL =

**Coefficients**
- $D_{90} = 7.0418$
- $D_{50} = 4.1173$
- $D_{10} = 0.1119$
- $C_U = C_C =$

**Classification**
- USCS = SC
- AASHTO =

**Remarks**

**Source of Sample:** B-20
**Sample Number:** S-04
**Date:** 2-1-19

**Client:** AECOM
**Project:** Klamath River Dam Removal Project
**Project No:** 2301-069.0

**Tested By:** JH
**Checked By:** JH
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

Source:
- **BC-01** Sample No.: S-02 Elevation/Depth: 6.5'
- **BC-01** Sample No.: S-04 Elevation/Depth: 21.5'
- **BC-02** Sample No.: S-05 Elevation/Depth: 14.5'
- **BC-02** Sample No.: S-09 Elevation/Depth: 44.5'
- **BC-03** Sample No.: S-01 Elevation/Depth: 1'

Remarks:
- ➕
- ▲
- ●
- ■
- ◆

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY
### LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;40</th>
<th>%&lt;200</th>
<th>USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Olive Brown Elastic SILT</td>
<td>69</td>
<td>59</td>
<td>10</td>
<td>100.0</td>
<td>100.0</td>
<td>MH</td>
</tr>
<tr>
<td>Pale Brown Mottled Gray Elastic SILT</td>
<td>120</td>
<td>85</td>
<td>35</td>
<td>99.4</td>
<td>99.1</td>
<td>MH</td>
</tr>
<tr>
<td>Very Dark Olive Brown Sandy Fat CLAY w/ Gravel</td>
<td>60</td>
<td>24</td>
<td>36</td>
<td></td>
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</tr>
<tr>
<td>Dark Reddish Brown Sandy Fat CLAY</td>
<td>56</td>
<td>24</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark Gray Elastic SILT</td>
<td>74</td>
<td>53</td>
<td>21</td>
<td>99.9</td>
<td>99.7</td>
<td>MH</td>
</tr>
</tbody>
</table>

**Remarks:**
- Source: BC-03  
  Sample No.: S-05  
  Elev./Depth: 24.5’
- Source: BC-04  
  Sample No.: S-08  
  Elev./Depth: 32.5(Tip-16”)
- Source: BC-07  
  Sample No.: S02  
  Elev./Depth: 4-4.5’
- Source: BC-08  
  Sample No.: S-01  
  Elev./Depth: 3.0’
- Source: BC-09  
  Sample No.: S-05  
  Elev./Depth: 23(Tip-5”)

**Project No.:** 020-251  
**Client:** AECOM  
**Remarks:**
-  
-  
-  
-  
-  

**COOPER TESTING LABORATORY**
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
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<tbody>
<tr>
<td>Light Olive Brown Elastic SILT</td>
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<td>88</td>
<td>112</td>
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<td>99.0</td>
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<td>Dark Reddish Brown Sandy Fat CLAY</td>
<td>78</td>
<td>28</td>
<td>50</td>
<td>77.6</td>
<td>68.3</td>
<td>CH</td>
</tr>
<tr>
<td>Yellowish Brown Sandy Fat CLAY</td>
<td>58</td>
<td>28</td>
<td>30</td>
<td>79.1</td>
<td>62.5</td>
<td>CH</td>
</tr>
<tr>
<td>Yellowish Brown Sandy Fat CLAY</td>
<td>51</td>
<td>27</td>
<td>24</td>
<td>83.9</td>
<td>52.9</td>
<td>CH</td>
</tr>
<tr>
<td>Olive Gray Poorly Graded GRAVEL w/ Silt &amp; Sand</td>
<td>41</td>
<td>26</td>
<td>15</td>
<td>15.9</td>
<td>9.0</td>
<td>GP-GM</td>
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Source: BC-08A  Sample No.: S-05  Elev./Depth: 54’
Source: BI-02  Sample No.: S-01  Elev./Depth: 5’
Source: BI-02  Sample No.: S-02  Elev./Depth: 10’
Source: BI-02  Sample No.: S-03  Elev./Depth: 15’
Source: BI-03  Sample No.: S-01  Elev./Depth: 3.5’

Client: AECOM

Remarks:

COOPER TESTING LABORATORY
### LIQUID AND PLASTIC LIMITS TEST REPORT

#### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Elevation/Depth</th>
<th>Source</th>
<th>Source</th>
<th>Source</th>
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<tbody>
<tr>
<td>S-05</td>
<td>54'</td>
<td>BC-08A</td>
<td>BI-02</td>
<td>BI-02</td>
<td>BI-02</td>
<td>BI-03</td>
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<td>S-01</td>
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<td>BI-02</td>
<td>BI-02</td>
<td>BI-02</td>
<td>BI-03</td>
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<tr>
<td>S-02</td>
<td>10'</td>
<td>BI-02</td>
<td>BI-02</td>
<td>BI-02</td>
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<td>BI-03</td>
<td>BI-03</td>
</tr>
<tr>
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<td>15'</td>
<td>BI-02</td>
<td>BI-02</td>
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<td>BI-02</td>
<td>BI-03</td>
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</tr>
<tr>
<td>S-01</td>
<td>3.5'</td>
<td>BI-03</td>
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</tbody>
</table>

#### Source Codes:
- **•**: Light Olive Brown Elastic SILT
- **■**: Dark Reddish Brown Sandy Fat CLAY
- **▲**: Yellowish Brown Sandy Fat CLAY
- **♦**: Yellowish Brown Sandy Fat CLAY
- **▼**: Olive Gray Poorly Graded GRAVEL w/ Silt & Sand

#### Test Report:

**Remarks:**

1. Source: BC-08A  Sample No.: S-05  Elev./Depth: 54'
2. Source: BI-02  Sample No.: S-01  Elev./Depth: 5'
3. Source: BI-02  Sample No.: S-02  Elev./Depth: 10'
4. Source: BI-02  Sample No.: S-03  Elev./Depth: 15'
5. Source: BI-03  Sample No.: S-01  Elev./Depth: 3.5'

**Client:** AECOM

**Project:** Klamath River Dam Removal Project - 60537920

**Remarks:**

- •
- ■
- ▲
- ♦
- ▼

**Dashed line indicates the approximate upper limit boundary for natural soils**
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
<th>USCS</th>
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</thead>
<tbody>
<tr>
<td>Dark brown clay with sand</td>
<td>69</td>
<td>22</td>
<td>47</td>
<td></td>
<td></td>
<td>CH</td>
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</tbody>
</table>

Project No. 2301-069.0  Client: AECOM
Project: Klamath River Dam Removal Project
60537920

Source of Sample: B-8  Depth: 13-14.5  Sample Number: S-01

Tested By: JH  Checked By: JH
### LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils.

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<th>WATER CONTENT</th>
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<tr>
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<td>63.2</td>
<td>10</td>
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<table>
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<tr>
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<th>PLASTICITY INDEX</th>
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**MATERIAL DESCRIPTION**

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<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>%&lt;#40</th>
<th>%&lt;#200</th>
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<td>●</td>
<td>62</td>
<td>22</td>
<td>40</td>
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**Project No.** 2301-069.0  **Client:** AECOM

**Project:** Klamath River Dam Removal Project

**Source of Sample:** B-14  **Depth:** 6.4-7.9  **Sample Number:** S-01

**Remarks:**

**Tested By:** JH  **Checked By:** JH
**MATERIAL DESCRIPTION** | **LL** | **PL** | **PI** | **%<#40** | **%<#200** | **USCS**
---|---|---|---|---|---|---
[ ] Brown clay | 54 | 22 | 32 |  |  | CH

**Project No.** 2301-069.0  **Client:** AECOM  **Remarks:**

**Project:** Klamath River Dam Removal Project 60537920  
**Source of Sample:** B-19  **Depth:** 10-11.5  **Sample Number:** S-02

**Tested By:** JH  **Checked By:** JH
LIQUID AND PLASTIC LIMITS TEST REPORT

Dashed line indicates the approximate upper limit boundary for natural soils

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>LL</th>
<th>PL</th>
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Project No. 2301-069.0  Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Source of Sample: B-20  Depth: 5-6.5  Sample Number: S-01

Tested By: JH  Checked By: JH
Consolidation Test
ASTM D2435

Job No.: 020-251
Boring: BC-04
Run By: MD
Client: AECOM
Sample: S-08
Reduced: PJ
Project: 60537920
Depth, ft.: 32.5 (Tip-2")
Checked: PJ/DC
Date: 6/1/2018

Soil Type: Pale Brown Mottled Gray Elastic SILT

Assumed Gs
Initial | Final
---|---
2.6 | 2.6

Moisture %:
Initial | Final
149.5 | 104.4

Dry Density, pcf:
Initial | Final
32.1 | 43.7

Void Ratio:
Initial | Final
4.058 | 2.715

% Saturation:
Initial | Final
95.8 | 100.0

Remarks:

Strain-Log-P Curve

Strain, %

Effective Stress, psf

10 | 100 | 1000 | 10000 | 100000
**Consolidation Test**  
ASTM D2435

Job No.: 020-251  
Boring: BC-09  
Run By: MD  
Client: AECOM  
Sample: S-09  
Reduced: PJ  
Project: 60537920  
Depth, ft.: 68-70.5 (Tip-20")  
Checked: PJ/DC  
Date: 6/1/2018

**Soil Type:** Dark Greenish Gray CLAY (Silty)

**Strain-Log-P Curve**

<table>
<thead>
<tr>
<th>Assumed Gs</th>
<th>Initial</th>
<th>Final</th>
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<tbody>
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<td>2.6</td>
<td>88.4</td>
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<td>Dry Density, pcf</td>
<td>2.340</td>
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<td>Void Ratio</td>
<td>% Saturation</td>
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<td>98.2</td>
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**Remarks:**
## Triaxial Unconsolidated-Undrained (ASTM D2850m)

### Sample 1
- **MC, %**: 160.5
- **Dry Dens, pcf**: 30.5
- **Sat. %**: 95.9
- **Void Ratio**: 4.519
- **Diameter in**: 2.87
- **Height, in**: 6.08
- **Cell, psi**: 49.1
- **BP, psi**: 38.5
- **Stress Ratio**: 3.256
- **Strain, %**: 5.0
- **Deviator ksf**: 3.444
- **Excess PP**: 0.000

### Sample 2
- **MC, %**: 163.5
- **Dry Dens, pcf**: 31.1
- **Sat. %**: 100.0
- **Void Ratio**: 4.414
- **Diameter, in**: 2.84
- **Height, in**: 6.08
- **Cell, psi**: 49.1
- **BP, psi**: 38.5

### Sample 3
- **P, ksf**: 3.248
- **Q, ksf**: 1.722
- **Stress Ratio**: 3.256
- **Rate in/min**: 0.0588
- **Total C**: N/A ksf
- **Total Phi**: N/A Degrees
- **Eff. C**: N/A ksf
- **Eff. Phi**: N/A Degrees

### Remarks:
- Strengths picked at 5% strain.
- *Sample was back-pressure saturated prior to shear.*
# Triaxial Unconsolidated-Undrained

(ASTM D2850m)

<table>
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<th>Job No.: 020-251</th>
<th>020-251</th>
<th>Date: 5/25/2018</th>
<th>Date: 5/25/2018</th>
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<td>Client: AECOM</td>
<td>AECOM</td>
<td>BY: MD/DC</td>
<td>BY: MD/DC</td>
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<tr>
<td>Project: 60537920</td>
<td>60537920</td>
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</tr>
<tr>
<td>Sample 1) BC-09_S-05 @ 23(Tip-13&quot;) Dark Gray Elastic SILT</td>
<td>Sample 1) BC-09_S-05 @ 23(Tip-13&quot;) Dark Gray Elastic SILT</td>
<td>Sample 1) BC-09_S-05 @ 23(Tip-13&quot;) Dark Gray Elastic SILT</td>
<td>Sample 1) BC-09_S-05 @ 23(Tip-13&quot;) Dark Gray Elastic SILT</td>
</tr>
<tr>
<td>Sample 2)</td>
<td>Sample 2)</td>
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<tr>
<td>Sample 3)</td>
<td>Sample 3)</td>
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<tr>
<td>Sample 4)</td>
<td>Sample 4)</td>
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</tr>
</tbody>
</table>

**REMARKS:** Strengths picked at 5% strain.

*Sample was back-pressure saturated prior to shear.

### Stress-Strain Response

- **Sample:** 1 2 3 4
- **MC, %:** 76.3 76.6
- **Dry Dens, pcf:** 54.0 54.9
- **Sat. %:** 97.1 100.0
- **Void Ratio:** 2.121 2.068
- **Diameter, in:** 2.87 2.85
- **Height, in:** 6.05 6.03
- **Cell, psi:** 54.8
- **BP, psi:** 48.5

**Final**

- **MC, %:** 76.6
- **Dry Dens, pcf:** 54.9
- **Sat. %:** 100.0
- **Void Ratio:** 2.068
- **Diameter, in:** 2.85
- **Height, in:** 6.03
- **Cell, psi:** 54.8
- **BP, psi:** 48.5

**Effective Stresses At:**

- **Strain, %:** 5.0
- **Deviator ksf:** 3.118
- **Excess PP:** 0.000
- **Sigma 1:** 4.025
- **Sigma 3:** 0.907
- **P, ksf:** 2.466
- **Q, ksf:** 1.559
- **Stress Ratio:** 4.437
- **Rate in/min:** 0.0588
- **Total C:** N/A ksf
- **Total Phi:** N/A Degrees
- **Eff. C:** N/A ksf
- **Eff. Phi:** N/A Degrees
Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

Unconsolidated-Undrained Triaxial Test
ASTM D2850

Sample Data

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>Moisture %</td>
<td>76.6</td>
<td>34.4</td>
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<tr>
<td>Dry Den,pcf</td>
<td>48.3</td>
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<tr>
<td>Void Ratio</td>
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<td>Saturation %</td>
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<td>Height in</td>
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<td>Diameter in</td>
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<td>in/min</td>
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Job No.: 020-272
Client: AECOM
Project: 60537920
Boring: BC-13  BC-14
Sample: S04  S02
Depth ft: 22(Tip-12")  7(Tip-1")

Visual Soil Description

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Olive Brown CLAY w/ Sand</td>
</tr>
<tr>
<td>2</td>
<td>Light Yellowish Brown Sandy CLAY w/ Claystone</td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
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</tbody>
</table>

Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.
**Triaxial Unconsolidated-Undrained**  
(ASTM D2850m)

<table>
<thead>
<tr>
<th>Sample</th>
<th>1</th>
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<th>4</th>
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</thead>
<tbody>
<tr>
<td>MC, %</td>
<td>21.9</td>
<td>39.9</td>
<td>21.1</td>
<td>21.7</td>
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<tr>
<td>Dry Dens, pcf</td>
<td>77.6</td>
<td>79.6</td>
<td>78.1</td>
<td>78.0</td>
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<tr>
<td>Sat. %</td>
<td>52.3</td>
<td>100.0</td>
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<tr>
<td>Void Ratio</td>
<td>1.090</td>
<td>1.038</td>
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<td>Diameter, in</td>
<td>2.87</td>
<td>2.84</td>
<td>2.87</td>
<td>2.84</td>
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<tr>
<td>Height, in</td>
<td>6.09</td>
<td>6.09</td>
<td>6.09</td>
<td>6.09</td>
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<tr>
<td>Cell, psi</td>
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<td>92.8</td>
<td>92.8</td>
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</table>

**Final**

| Strain, % | 10.0 |
| Deviator ksf | 1.299 |
| Excess PP  | 0.000 |
| Sigma 1    | 1.846 |
| Sigma 3    | 0.547 |
| P, ksf     | 1.196 |
| Q, ksf     | 0.649 |
| Stress Ratio | 3.373 |
| Rate in/min | 0.060 |

**Effective Stresses At:**

| Total C   | N/A  |
| Total Phi | N/A  |
| Eff. C    | N/A  |
| Eff. Phi  | N/A  |

**REMARKS:** Strengths picked at 10% strain.  
*Sample was back-pressure saturated prior to shear.*
**Triaxial Unconsolidated-Undrained**

**Sample: 1 2 3 4**

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<tr>
<td>Height, in</td>
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<tr>
<td>Cell, psi</td>
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<tr>
<td>BP, psi</td>
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**Final**

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<tr>
<td>MC, %</td>
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<tr>
<td>Sat. %</td>
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<td>Void Ratio</td>
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<td>Diameter, in</td>
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<td>Cell, psi</td>
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<tr>
<td>BP, psi</td>
<td>79.0</td>
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</tbody>
</table>

**Effective Stresses At:**

| Strain, % | 10.0 |
| Deviator ksf | 3.148 |
| Excess PP | 0.000 |
| Sigma 1 | 4.905 |
| Sigma 3 | 1.757 |
| P, ksf | 3.331 |
| Q, ksf | 1.574 |
| Stress Ratio | 2.792 |
| Rate in/min | 0.0592 |
| Total C | N/A |
| Total Phi | N/A |
| Eff. C | N/A |
| Eff. Phi | N/A |

REMARKS: Strengths picked at 10% strain.

*Sample was back-pressure saturated prior to shear.*
Triaxial Unconsolidated-Undrained
(ASTM D2850m)

Sample: 1 2 3 4
MC, % 72.2
Dry Dens, pcf 39.4
Sat. % 60.3
Void Ratio 3.116
Diameter, in 2.87
Height, in 6.08

Sample 1)
BC-13_s05 @ 30.5(Tip-11") Pale Brown SILT (slightly plastic) w/ CaCO3 deposits (Weathered Rock)
Sigma 1 5.463
Sample 2)
Sigma 3 2.347
Sample 3)
P, ksf 3.905
Sample 4)
Q, ksf 1.558
Stress Ratio 2.327
Rate in/min 0.0588
Total C N/A ksf
Total Phi N/A Degrees
Eff. C N/A ksf
Eff. Phi N/A Degrees

REMARKS: Strengths picked at 5% strain.
*Sample was back-pressure saturated prior to shear.
**Triaxial Unconsolidated-Undrained**  
(ASTM D2850m)

**Job No.:** 020-272  
**Date:** 12/19/2018

**Client:** AECOM  
**BY:** MD/DC

**Project:** 60537920

**Sample:**  
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<th>1</th>
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<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC, %</td>
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<td>Dry Dens, pcf</td>
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<tr>
<td>Sat. %</td>
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<tr>
<td>Height, in</td>
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**Final**

<table>
<thead>
<tr>
<th>Sample</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>MC, %</td>
<td>72.9</td>
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<tr>
<td>Dry Dens, pcf</td>
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<tr>
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<td>Cell, psi</td>
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<tr>
<td>BP, psi</td>
<td>69.0</td>
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</tr>
</tbody>
</table>

**Effective Stresses At:**

| Strain, % | 10.0 |
| Deviator ksf | 3.984 |
| Excess PP | 0.000 |
| Sigma 1 | 4.690 |
| Sigma 3 | 0.706 |
| P, ksf | 2.698 |
| Q, ksf | 1.992 |
| Stress Ratio | 6.646 |
| Rate in/min | 0.0587 |
| Total C | N/A ksf |
| Total Phi | N/A Degrees |
| Eff. C | N/A ksf |
| Eff. Phi | N/A Degrees |

**REMARKS:** Strengths picked at 10% strain.  
*Sample was back-pressure saturated prior to shear.*
Remarks: The sample was delivered as singular 13" x 16" block. The specimens were trimmed into a brass tube 2" x 4". The orientation of the outcrop block was unknown. All samples were trimmed in the same approximate orientation. The material is highly structured and cemented. It disperses when exposed to water. All three specimens behaved differently during shear.
Specimen 1

Boring BC-02
Sample S-06
Depth 19.5" (Tip-2"
Visual Description Gray CLAY (Silty)

MC (%) 147.5
Dry Density (pcf) 31.6
Saturation (%) 92.6
Void Ratio 4.139
Diameter (in) 2.86
Height (in) 6.07

Total C #DIV/0! ksf
Total phi #DIV/0! degrees
Eff. C #DIV/0! ksf
Eff. Phi #DIV/0! degrees

©

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

Shear Stress, ksf

Normal Stress, ksf

Stress-Strain Response

Deviator Stress, psf

Strain, %

Specimen 1
Specimen 2
Specimen 3
Specimen 4

Total Tangent
Effective Tangent

CTL Number: 020-251
Client Name: AECOM
Project Name: Klamath River Dam Removal Project
Project Number: 60537920
Date: 5/30/2018 By: MD/DC

Total C #DIV/0! ksf
Total phi #DIV/0! degrees
Eff. C #DIV/0! ksf
Eff. Phi #DIV/0! degrees

Specimen 2

MC (%) 147.6
Dry Density (pcf) 33.6
Saturation (%) 100.0
Void Ratio 3.838
Diameter (in) 2.79
Height (in) 6.02

Cell Pressure (psi) 86.4
Back Pressure (psi) 80.5

Effective Stresses At:

Strain (%) 5.0
Deviator (ksf) 1.716
Excess PP (psi) 4.2
Sigma 1 (ksf) 1.966
Sigma 3 (ksf) 0.250
P (ksf) 1.108
Q (ksf) 0.858
Stress Ratio 7.869
Rate (in/min) 0.0005
**Consolidated Undrained Triaxial Compression with Pore Pressure**

**ASTM D4767**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>1</th>
<th>2</th>
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<tr>
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<tr>
<td>Sample</td>
<td>S-08</td>
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<tr>
<td>Depth</td>
<td>34.5&quot; (Tip-6&quot;)</td>
<td></td>
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<tr>
<td>Visual Description</td>
<td>Pale Brown CLAY (Silty)</td>
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<tr>
<td>MC (%)</td>
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<td>Dry Density (pcf)</td>
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<td>Saturation (%)</td>
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<td>Void Ratio</td>
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<td>Diameter (in)</td>
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<td>Height (in)</td>
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**Final**

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<td>Dry Density (pcf)</td>
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<td>Cell Pressure (psi)</td>
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<td>Back Pressure (psi)</td>
<td>80.1</td>
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**Effective Stresses At:**

| Strain (%)  | 5.0  |
| Deviator (ksf) | 3.832 |
| Excess PP (psi) | 5.0  |
| Sigma 1 (ksf)  | 4.368 |
| Sigma 3 (ksf)  | 0.536 |
| P (ksf)       | 2.452 |
| Q (ksf)       | 1.916 |
| Stress Ratio  | 8.153 |
| Rate (in/min) | 0.0005 |

**CTL Number:** 020-251

**Client Name:** AECOM

**Project Name:** Klamath River Dam Removal Project

**Project Number:** 60537920

**Date:** 5/14/2018

**By:** MD/DC
Specimen 1

**Boring**
- BC-03

**Sample**
- S-06

**Depth**
- 39.5-42 (Tip-11")
- 39.5-42 (Tip-4")

**Visual Description**
- Dark Gray CLAY (Silty)
- Dark Gray CLAY

<table>
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<tr>
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<td>BC-03</td>
<td>BC-03</td>
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<tr>
<td><strong>Sample</strong></td>
<td>S-06</td>
<td>S-06</td>
<td></td>
<td></td>
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<tr>
<td><strong>Depth</strong></td>
<td>39.5-42 (Tip-11&quot;)</td>
<td>39.5-42 (Tip-4&quot;)</td>
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<tr>
<td><strong>Visual Description</strong></td>
<td>Dark Gray CLAY (Silty)</td>
<td>Dark Gray CLAY</td>
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<tr>
<td><strong>MC (%)</strong></td>
<td>84.9</td>
<td>90.1</td>
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<tr>
<td><strong>Dry Density (pcf)</strong></td>
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<td><strong>Saturation (%)</strong></td>
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<td><strong>Void Ratio</strong></td>
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<td><strong>Diameter (in)</strong></td>
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<tr>
<td><strong>Height (in)</strong></td>
<td>6.06</td>
<td>6.08</td>
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</tbody>
</table>

**Final**
- **MC (%)**: 83.0, 87.9
- **Dry Density (pcf)**: 51.4, 49.4
- **Saturation (%)**: 100.0, 100.0
- **Void Ratio**: 2.158, 2.285
- **Diameter (in)**: 2.85, 2.83
- **Height (in)**: 6.02, 6.04
- **Cell Pressure (psi)**: 90.5, 91.6
- **Back Pressure (psi)**: 79.5, 81.2

**Effective Stresses At:**
- **Strain (%)**: 5.0, 5.0
- **Deviator (ksf)**: 3.966, 3.607
- **Excess PP (psi)**: 5.3, 5.0
- **Sigma 1 (ksf)**: 4.775, 4.386
- **Sigma 3 (ksf)**: 0.809, 0.779
- **P (ksf)**: 2.792, 2.582
- **Q (ksf)**: 1.983, 1.804
- **Stress Ratio**: 5.901, 5.632
- **Rate (in/min)**: 0.0005, 0.0005
Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

Specimen

Boring BC-03
Sample S-10
Depth 90 (Tip-13")
Visual Description Dark Gray CLAY

MC (%) 119.8
Dry Density (pcf) 35.8
Saturation (%) 88.1
Void Ratio 3.533
Diameter (in) 2.87
Height (in) 6.08

MC (%) 116.3
Dry Density (pcf) 40.3
Saturation (%) 100.0
Void Ratio 3.023
Diameter (in) 2.69
Height (in) 6.16

Date: 5/21/2018
By: MD/DC

Consolidation Test Results

Total C #DIV/0! ksf
Total phi #DIV/0! degrees
Eff. C #DIV/0! ksf
Eff. Phi #DIV/0! degrees

Effective Stresses At:

Strain (%) 5.0
Deviator (ksf) 5.012
Excess PP (psi) 14.0
Sigma 1 (ksf) 5.788
Sigma 3 (ksf) 0.777
P (ksf) 3.283
Q (ksf) 2.506
Stress Ratio 7.452
Rate (in/min) 0.0005
### Stress-Strain Response

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<thead>
<tr>
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<td>Boring Sample</td>
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<td>BC-04</td>
<td>S-04</td>
<td>S-04</td>
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<td>Depth</td>
<td>12.5-14(Tip-15&quot;)</td>
<td>12.5-14.5(Tip-4&quot;)</td>
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<td>Visual Description</td>
<td>Brown Weathered Rock</td>
<td>Dark Brown Clayey GRAVEL (Weathered Rock)</td>
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<td>MC (%)</td>
<td>60.8</td>
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<td>Dry Density (pcf)</td>
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<td>Saturation (%)</td>
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<td>Void Ratio</td>
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<td>2.86</td>
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<td>Height (in)</td>
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</tr>
</tbody>
</table>

### Consolidated Undrained Triaxial Compression with Pore Pressure

#### ASTM D4767

### Excess PP (psi)

- Specimen 1: -8.1
- Specimen 2: -7.3
- Specimen 3: -6.1
- Specimen 4: -5.3

### Total C

- Specimen 1: 16.872
- Specimen 2: 11.080
- Specimen 3: 1.741
- Specimen 4: 1.594

### Sigma 1 (ksf)

- Specimen 1: 9.306
- Specimen 2: 6.337
- Specimen 3: 7.565
- Specimen 4: 4.743

### Rate (in/min)

- Specimen 1: 0.0005
- Specimen 2: 0.0005

### Stress Ratio

- Specimen 1: 9.688
- Specimen 2: 6.949

### Total Tangent

### Effective Tangent

### CTL Number:

020-251

### Client Name:

AECOM

### Project Name:

Klamath River Dam Removal Project

### Project Number:

6053920

### Date:

6/6/2018

### By:

MD/DC

### Effective Stresses At:

<table>
<thead>
<tr>
<th>Strain (%)</th>
<th>Deviator (ksf)</th>
<th>Excess PP (psi)</th>
<th>Sigma 1 (ksf)</th>
<th>Sigma 3 (ksf)</th>
<th>P (ksf)</th>
<th>Q (ksf)</th>
<th>Stress Ratio</th>
<th>Rate (in/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>15.130</td>
<td>-8.1</td>
<td>16.872</td>
<td>1.741</td>
<td>9.306</td>
<td>7.565</td>
<td>9.688</td>
<td>0.0005</td>
</tr>
<tr>
<td>5.0</td>
<td>9.485</td>
<td>-7.3</td>
<td>11.080</td>
<td>1.594</td>
<td>6.337</td>
<td>4.743</td>
<td>6.949</td>
<td>0.0005</td>
</tr>
</tbody>
</table>
Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

**Specimen 1**

- **Boring**: BC-04
- **Sample**: S-5
- **Depth**: 17.5 (tip-6')
- **Visual Description**: Light Gray CLAY
- **MC (%)**: 104.7
- **Dry Density (pcf)**: 42.1
- **Saturation (%)**: 94.2
- **Void Ratio**: 3.000
- **Diameter (in)**: 2.87
- **Height (in)**: 6.08

**Specimen 2**

- **MC (%)**: 105.4
- **Dry Density (pcf)**: 43.8
- **Saturation (%)**: 100.0
- **Void Ratio**: 2.846
- **Diameter (in)**: 2.82
- **Height (in)**: 6.07

**Specimen 3**

- **MC (%)**: Back Pressure (psi): 84.0
- **Dry Density (pcf)**: 80.2
- **Saturation (%)**: 8.336
- **Void Ratio**: 5.0
- **Diameter (in)**: 3.612
- **Height (in)**: 2.838

**Specimen 4**

- **MC (%)**: 5.677
- **Dry Density (pcf)**:
- **Saturation (%)**: -1.6
- **Void Ratio**: 6.450
- **Diameter (in)**: 0.774
- **Height (in)**: 3.612

**Effective Stresses At:**

- **Strain (%)**: Stress Ratio: 8.336
- **Deviator (ksf)**: Rate (in/min): 0.0005
- **Excess PP (psi)**: 5.677
- **Sigma 1 (ksf)**: 8.336
- **Sigma 2 (ksf)**: 6.450
- **Sigma 3 (ksf)**: 0.774
- **P (ksf)**: 2.838
- **Q (ksf)**: 3.612
- **Effective phi**: 3.612

**CTC Number**: 020-251
**Client Name**: AECOM
**Project Name**: Klamath River Dam Removal Project
**Project Number**: 60537920
**Date**: 5/14/2018
**By**: MD/DC
Specimen: 1  2  3  4
Boring: BC-04
Sample: S-06
Depth: 22.5 (Tip-2"
Visual Description: Greenish Gray CLAY (Silty)/ SILT (slightly plastic)
MC (%): 154.6
Dry Density (pcf): 31.7
Saturation (%): 97.4
Void Ratio: 4.127
Diameter (in): 2.87
Height (in): 6.07

CTL Number: 020-251
Client Name: AECOM
Project Name: Klamath River Dam Removal Project
Project Number: 60537920
Date: 5/30/2018
By: MD/DC

Total C: #DIV/0! ksf
Total phi: #DIV/0! degrees
Eff. C: #DIV/0! ksf
Eff. Phi: #DIV/0! degrees

Effective Stresses At:
Strain (%): 5.0
Deviator (kfsf): 3.153
Excess PP (psi): 2.5
Sigma 1 (ksf): 3.511
Sigma 3 (ksf): 0.358
P (ksf): 1.935
Q (ksf): 1.576
Stress Ratio: 9.796
Rate (in/min): 0.0005
**Consolidated Undrained Triaxial Compression with Pore Pressure**

**ASTM D4767**

### Specimen 1

<table>
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<tr>
<th>Boring</th>
<th>BC-04</th>
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<td>Sample</td>
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<tr>
<td>Depth</td>
<td>32.5 (Tip-10&quot;)</td>
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<tr>
<td>Visual Description</td>
<td>Pale Brown Mottled Gray Elastic Silt</td>
</tr>
</tbody>
</table>

| MC (%) | 117.2 |
| Dry Density (pcf) | 36.9 |
| Saturation (%) | 89.7 |
| Void Ratio | 3.397 |
| Diameter (in) | 2.87 |
| Height (in) | 6.08 |

### Specimen 2

| MC (%) | 115.5 |
| Dry Density (pcf) | 40.5 |
| Saturation (%) | 100.0 |
| Void Ratio | 3.004 |
| Diameter (in) | 2.76 |
| Height (in) | 6.01 |

### Specimen 3

| MC (%) | #DIV/0! |
| Dry Density (pcf) | #DIV/0! |
| Saturation (%) | #DIV/0! |
| Void Ratio | #DIV/0! |
| Diameter (in) | #DIV/0! |
| Height (in) | #DIV/0! |

### Specimen 4

| MC (%) | #DIV/0! |
| Dry Density (pcf) | #DIV/0! |
| Saturation (%) | #DIV/0! |
| Void Ratio | #DIV/0! |
| Diameter (in) | #DIV/0! |
| Height (in) | #DIV/0! |

### Stress-Strain Response

- **Total Tangent**
- **Effective Tangent**

### CTL Number

| 020-251 |

### Client Name

| AECOM |

### Project Name

Klamath River Dam Removal Project

### Project Number

| 60537920 |

### Date

| 5/17/2018 |

### By

MD/DC

### Total C

| #DIV/0! ksf |

### Total phi

| #DIV/0! degrees |

### Eff. C

| #DIV/0! ksf |

### Eff. Phi

| #DIV/0! degrees |

### Effective Stresses At:

| Strain (%) | 5.0 |
| Deviator (ksf) | 4.005 |
| Excess PP (psi) | 4.2 |
| Sigma 1 (ksf) | 4.390 |
| Sigma 3 (ksf) | 0.385 |
| P (ksf) | 2.388 |
| Q (ksf) | 2.003 |
| Stress Ratio | 11.403 |
| Rate (in/min) | 0.0005 |
### Specimen 1

**Boring:** BC-04  
**Sample:** S-10  
**Depth:** 52.5 (Tip-4")  
**Visual Description:** Blush Gray CLAY (Silty)/ SILT (slightly plastic)

<table>
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<th>4</th>
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<tr>
<td>Sample</td>
<td>S-10</td>
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<tr>
<td>Depth</td>
<td>52.5 (Tip-4&quot;)</td>
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<tr>
<td>Visual Description</td>
<td>Blush Gray CLAY (Silty)/ SILT (slightly plastic)</td>
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</table>

**MC (%):** 153.6  
**Dry Density (pcf):** 32.1  
**Saturation (%):** 97.9  
**Void Ratio:** 4.156  
**Diameter (in):** 2.87  
**Height (in):** 6.08

### Final

**MC (%):** 151.2  
**Dry Density (pcf):** 33.0  
**Saturation (%):** 100.0  
**Void Ratio:** 4.007  
**Diameter (in):** 2.84  
**Height (in):** 6.03

**Cell Pressure (psi):** 90.6  
**Back Pressure (psi):** 80.6

### Stress-Strain Response

**Deviator Stress, psf:** 3.260  
**Excess PP (psi):** 6.3  
**Sigma 1 (ksf):** 3.784  
**Sigma 3 (ksf):** 0.523  
**P (ksf):** 2.154  
**Q (ksf):** 1.630  
**Stress Ratio:** 7.229  
**Rate (in/min):** 0.0005

**Effective Stresses At:**

- **Strain (%):** 5.0  
- **Deviator (ksf):** 3.260  
- **Excess PP (psi):** 6.3  
- **Sigma 1 (ksf):** 3.784  
- **Sigma 3 (ksf):** 0.523  
- **P (ksf):** 2.154  
- **Q (ksf):** 1.630  
- **Stress Ratio:** 7.229  
- **Rate (in/min):** 0.0005

**CTL Number:** 020-251  
**Client Name:** AECOM  
**Project Name:** Klamath River Dam Removal Project  
**Project Number:** 60537920  
**Date:** 5/25/2018  
**By:** MD/DC
**Specimen 1**

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<td>Visual Description</td>
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<tr>
<td>Void Ratio</td>
</tr>
<tr>
<td>Diameter (in)</td>
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<td>Height (in)</td>
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<table>
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<td>Saturation (%)</td>
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<td>Void Ratio</td>
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<tr>
<td>Diameter (in)</td>
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<tr>
<td>Height (in)</td>
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**Final**

<table>
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<th>Specimen 1</th>
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<tbody>
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<tr>
<td>Height (in)</td>
</tr>
<tr>
<td>Cell Pressure (psi)</td>
</tr>
<tr>
<td>Back Pressure (psi)</td>
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**Consolidated Undrained Triaxial Compression with Pore Pressure**

**ASTM D4767**

![Stress-Strain Response](image)

**Total**

<table>
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<tr>
<th>Specimen</th>
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<tr>
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<td>S-04</td>
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<td>Depth</td>
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<td>14.5 (Tip-1&quot;)</td>
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<tr>
<td>Visual Description</td>
<td>Olive CLAY/SILT (slightly plastic)</td>
<td>Olive Mottled Yellow Clayey SAND/Sandy CLAY</td>
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</tr>
<tr>
<td>MC (%)</td>
<td>135.1</td>
<td>30.0</td>
<td></td>
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</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>35.4</td>
<td>92.8</td>
<td></td>
<td></td>
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<tr>
<td>Saturation (%)</td>
<td>97.0</td>
<td>99.2</td>
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</tr>
<tr>
<td>Void Ratio</td>
<td>3.760</td>
<td>0.816</td>
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</tr>
<tr>
<td>Diameter (in)</td>
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<td>2.87</td>
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<tr>
<td>Height (in)</td>
<td>5.83</td>
<td>6.09</td>
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<td></td>
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</table>

**Effective Stresses At:**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Strain (%)</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deviator (ksf)</td>
<td>2.725</td>
<td>1.900</td>
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<tr>
<td>Excess PP (psi)</td>
<td>2.6</td>
<td>-0.4</td>
</tr>
<tr>
<td>Sigma 1 (ksf)</td>
<td>2.899</td>
<td>2.431</td>
</tr>
<tr>
<td>Sigma 3 (ksf)</td>
<td>0.173</td>
<td>0.531</td>
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<tr>
<td>P (ksf)</td>
<td>1.536</td>
<td>1.481</td>
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<tr>
<td>Q (ksf)</td>
<td>1.363</td>
<td>0.950</td>
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<tr>
<td>Stress Ratio</td>
<td>16.726</td>
<td>4.577</td>
</tr>
<tr>
<td>Rate (in/min)</td>
<td>0.0005</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

---

**Date:** 5/24/2018

**By:** MD/DC

**CTL Number:** 020-251

**Client Name:** AECOM

**Project Name:** Klamath River Dam Removal Project

**Project Number:** 60537920

---

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Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

Specimen 1

Boring: BC-09
Sample: S-05
Depth: 23 (Tip-5)
Visual Description: Dark Gray Elastic SILT

MC (%): 79.5
Dry Density (pcf): 51.9
Saturation (%): 97.1
Void Ratio: 2.130
Diameter (in): 2.87
Height (in): 6.07

Specimen 2

MC (%): 79.4
Dry Density (pcf): 53.0
Saturation (%): 100.0
Void Ratio: 2.065
Diameter (in): 2.85
Height (in): 6.04

Specimen 3

MC (%): #DIV/0!
Dry Density (pcf): #DIV/0!
Saturation (%): #DIV/0!
Void Ratio: #DIV/0!
Diameter (in): #DIV/0!
Height (in): #DIV/0!

Specimen 4

MC (%): #DIV/0!
Dry Density (pcf): #DIV/0!
Saturation (%): #DIV/0!
Void Ratio: #DIV/0!
Diameter (in): #DIV/0!
Height (in): #DIV/0!

CTL Number: 020-251
Client Name: AECOM
Project Name: Klamath River Dam Removal Project
Project Number: 60537920
Date: 5/30/2018
By: MD/DC

Total C: #DIV/0! ksf
Total phi: #DIV/0! degrees
Eff. C: #DIV/0! ksf
Eff. Phi: #DIV/0! degrees

Effective Stresses At:
Strain (%): 5.0
Deviator (ksf): 3.348
Excess PP (psi): 2.2
Sigma 1 (ksf): 3.969
Sigma 3 (ksf): 0.621
P (ksf): 2.295
Q (ksf): 1.674
Stress Ratio: 6.396
Rate (in/min): 0.0005
Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

<table>
<thead>
<tr>
<th>Specimen</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring</td>
<td>BC-09</td>
<td>BC-09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>S-09</td>
<td>S-09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>68-70.5(Tip-10&quot;)</td>
<td>68-70.5(Tip-4&quot;)</td>
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</tr>
<tr>
<td>Visual Description</td>
<td>Dark Greenish Gray CLAY (Silty)/SILT (slightly plastic)</td>
<td>Dark Greenish Gray CLAY (Silty)/SILT (slightly plastic)</td>
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<tr>
<td>MC (%)</td>
<td>92.0</td>
<td>95.5</td>
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<tr>
<td>Dry Density (pcf)</td>
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<td>46.1</td>
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<td>Saturation (%)</td>
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<td>Void Ratio</td>
<td>2.436</td>
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<tr>
<td>Height (in)</td>
<td>6.06</td>
<td>6.06</td>
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<td></td>
</tr>
<tr>
<td>MC (%)</td>
<td>90.6</td>
<td>93.7</td>
<td></td>
<td></td>
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<tr>
<td>Dry Density (pcf)</td>
<td>48.4</td>
<td>47.2</td>
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<tr>
<td>Saturation (%)</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Void Ratio</td>
<td>2.355</td>
<td>2.436</td>
<td></td>
<td></td>
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<tr>
<td>Diameter (in)</td>
<td>2.84</td>
<td>2.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (in)</td>
<td>6.03</td>
<td>6.02</td>
<td></td>
<td></td>
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<tr>
<td>Cell Pressure (psi)</td>
<td>94.2</td>
<td>94.1</td>
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</tr>
<tr>
<td>Back Pressure (psi)</td>
<td>80.1</td>
<td>79.7</td>
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</tbody>
</table>

**Stress-Strain Response**

- **Indicators**: Total Tangent, Effective Tangent
- **Samples**: Specimen 1, Specimen 2, Specimen 3, Specimen 4

**Data**

| CTL Number: | 020-251 |
| Client Name: | AECOM |
| Project Name: | Klamath River Dam Removal Project |
| Project Number: | 60537920 |
| Date: | 6/6/2018 |
| By: | MD/DC |

**Total C #DIV/0! ksf**

**Total phi #DIV/0! degrees**

**Eff. C #DIV/0! ksf**

**Eff. Phi #DIV/0! degrees**

**Effective Stresses At:**

- **Strain (%)**: 5.0
- **Deviator (ksf)**: 4.134
- **Excess PP (psi)**: 9.1
- **Sigma 1 (ksf)**: 4.860
- **Sigma 3 (ksf)**: 0.726
- **P (ksf)**: 2.793
- **Q (ksf)**: 2.067
- **Stress Ratio**: 6.693
- **Rate (in/min)**: 0.0005
Specimen 1 2 3 4
Boring BC-13
Sample S02
Depth 12(Tip-0.5')
Visual Description Pale Brown SILT (slightly plastic) (Weathered Rock)
MC (%) 23.3
Dry Density (pcf) 59.6
Saturation (%) 35.1
Void Ratio 1.725
Diameter (in) 2.87
Height (in) 6.09

Cells and Area:
Total C: ksf
Total phi: degrees
Eff. C: ksf
Eff. Phi: degrees

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

Stress-Strain Response

Shear Stress, ksf
Normal Stress, ksf
Deviator Stress, psf
Strain, %

0 5 10 15 20 25
0 500 1000 1500 2000 2500 3000 3500 4000

Total Tangent
Effective Tangent

MC (%) 63.5
Dry Density (pcf) 61.2
Saturation (%) 100.0
Void Ratio 1.651
Diameter (in) 2.83
Height (in) 6.11
Cell Pressure (psf) 136.9
Back Pressure (psf) 129.7

Strain (%) 10.0
Deviator (ksf) 3.431
Excess PP (psi) 1.8
Sigma 1 (ksf) 4.206
Sigma 3 (ksf) 0.775
P (ksf) 2.491
Q (ksf) 1.716
Stress Ratio 5.425
Rate (in/min) 0.0005

Effective Stresses At:

CTL Number: 020-272
Client Name: AECOM
Project Name: Klamath River Dam Removal Project
Project Number: 60537920
Date: 1/2/2019
By: MD/DC

©
<table>
<thead>
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<tbody>
<tr>
<td>Boring</td>
<td>BC-14</td>
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<td></td>
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</tr>
<tr>
<td>Sample</td>
<td>501</td>
<td></td>
<td></td>
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<tr>
<td>Depth</td>
<td>5(Tip-1&quot;)</td>
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<tr>
<td>Visual Description</td>
<td>Pale Brown SILT w/ Gravel (Weathered Rock)</td>
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<tr>
<td>MC (%)</td>
<td>23.3</td>
<td>66.8</td>
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<td>Dry Density (pcf)</td>
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<tr>
<td>Saturation (%)</td>
<td>34.5</td>
<td>100.0</td>
<td></td>
<td>1.804</td>
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<td>Void Ratio</td>
<td>1.823</td>
<td>1.84</td>
<td>6.16</td>
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<td>Diameter (in)</td>
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<td>Height (in)</td>
<td>6.09</td>
<td>6.16</td>
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</table>

**Final**

| MC (%) | 66.8 |
| Dry Density (pcf) | 60.1 |
| Saturation (%) | 100.0 |
| Void Ratio | 1.804 |
| Diameter (in) | 2.84 |
| Height (in) | 6.16 |
| Cell Pressure (psf) | 132.4 |
| Back Pressure (psf) | 129.4 |

**Effective Stresses At:**

| Strain (%) | 10.0 |
| Deviator (psf) | 2.587 |
| Excess PP (psf) | -1.7 |
| Sigma 1 (psf) | 3.269 |
| Sigma 3 (psf) | 0.682 |
| P (psf) | 1.976 |
| Q (psf) | 1.293 |
| Stress Ratio | 4.791 |
| Rate (in/min) | 0.0005 |
### Specimen 1

**Boring:** BC-14  
**Sample:** S04  
**Depth:** 12 (Tip-1"")  
**Visual Description:** Olive Brown Sandy SILT w/ Gravel (Weathered Rock)

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<th>Specimen</th>
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<tr>
<td><strong>Boring</strong></td>
<td>BC-14</td>
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<tr>
<td><strong>Sample</strong></td>
<td>S04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>12 (Tip-1&quot;)</td>
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<tr>
<td><strong>Visual Description</strong></td>
<td>Olive Brown Sandy SILT w/ Gravel (Weathered Rock)</td>
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<thead>
<tr>
<th>Specimen</th>
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<td><strong>MC (%)</strong></td>
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<td><strong>Dry Density (pcf)</strong></td>
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<tr>
<td><strong>Saturation (%)</strong></td>
<td>39.5</td>
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<tr>
<td><strong>Void Ratio</strong></td>
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<td><strong>Height (in)</strong></td>
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### Final

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<td><strong>Dry Density (pcf)</strong></td>
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<td><strong>Saturation (%)</strong></td>
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<td><strong>Void Ratio</strong></td>
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<td><strong>Diameter (in)</strong></td>
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<tr>
<td><strong>Height (in)</strong></td>
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<td><strong>Cell Pressure (psi)</strong></td>
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<tr>
<td><strong>Back Pressure (psi)</strong></td>
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### Effective Stresses At:

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<td><strong>Strain (%)</strong></td>
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<td><strong>Deviator (ksf)</strong></td>
<td>3.284</td>
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<tr>
<td><strong>Excess PP (psi)</strong></td>
<td>-0.5</td>
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<tr>
<td><strong>Sigma 1 (ksf)</strong></td>
<td>4.272</td>
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<td><strong>Sigma 3 (ksf)</strong></td>
<td>0.989</td>
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<td><strong>P (ksf)</strong></td>
<td>2.630</td>
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<td><strong>Q (ksf)</strong></td>
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<td><strong>Rate (in/min)</strong></td>
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</table>
List of Photos
Photo 1: 020-272 BC-13 S01 @ 7' (Tip-4'') After TXUU.JPG
Photo 2: 020-272 BC-13 S01 @ 7' (Tip-4'') Before TXUU.JPG
Photo 3: 020-272 BC-13 S02 @ 12' (Tip-0.5'') After TXCUPP #1.JPG
Photo 4: 020-272 BC-13 S02 @ 12' (Tip-0.5'') After TXCUPP #2.JPG
Photo 5: 020-272 BC-13 S02 @ 12' (Tip-0.5'') Before TXCUPP.JPG
Photo 6: 020-272 BC-13 S04 @ 22' (Tip-12'') After TXUU.JPG
Photo 7: 020-272 BC-13 S04 @ 22' (Tip-12'') Before TXUU.JPG
Photo 8: 020-272 BC-13 S04 @ 22' (Tip-18.5'') After TXUU.JPG
Photo 9: 020-272 BC-13 S04 @ 22' (Tip-18.5'') Before TXUU.JPG
Photo 10: 020-272 BC-13 S05 @ 30.5' (Tip-0.5'') Before TXCUPP.JPG
Photo 11: 020-272 BC-13 S05 @ 30.5' (Tip-11'') After TXUU #1.JPG
Photo 12: 020-272 BC-13 S05 @ 30.5' (Tip-11'') After TXUU #2.JPG
Photo 13: 020-272 BC-13 S05 @ 30.5' (Tip-11'') Before TXUU.JPG
Photo 14: 020-272 BC-14 S01 @ 5' (Tip-1'') After TXCUPP #1.JPG
Photo 15: 020-272 BC-14 S01 @ 5' (Tip-1'') After TXCUPP #2.JPG
Photo 16: 020-272 BC-14 S01 @ 5' (Tip-1'') Before TXCUPP.JPG
Photo 17: 020-272 BC-14 S02 @ 7' (Tip-1'') After TXUU #1.JPG
Photo 18: 020-272 BC-14 S02 @ 7' (Tip-1'') After TXUU #2.JPG
Photo 19: 020-272 BC-14 S02 @ 7' (Tip-1'') Before TXUU.JPG
Photo 20: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #1.JPG
Photo 21: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #2.JPG
Photo 22: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #3.JPG
Photo 23: 020-272 BC-14 S03 @ 9' (Tip-1'') Before TXCUPP.JPG
Photo 24: 020-272 BC-14 S04 @ 12' (Tip-1'') After TXCUPP #1.JPG
Photo 25: 020-272 BC-14 S04 @ 12' (Tip-1'') After TXCUPP #2.JPG
Photo 26: 020-272 BC-14 S04 @ 12' (Tip-1'') Before TXCUPP.JPG
Photo 27: 202-251 BC-02 S06 @ 19.5' (tip-2'') After TXCUPP #1.JPG
Photo 28: 202-251 BC-02 S06 @ 19.5' (tip-2'') After TXCUPP #2.JPG
Photo 29: 202-251 BC-02 S06 @ 19.5' (tip-2'') Before TXCUPP.JPG
Photo 30: 202-251 BC-02 S08 @ 34.5' (tip-6'') After TXCUPP #1.JPG
Photo 31: 202-251 BC-02 S08 @ 34.5' (tip-6'') After TXCUPP #2.JPG
Photo 32: 202-251 BC-03 S06 @ 39.5' (tip-4'') After TXCUPP #1.JPG
Photo 33: 202-251 BC-03 S06 @ 39.5' (tip-4'') After TXCUPP #2.JPG
Photo 34: 202-251 BC-03 S06 @ 39.5' (tip-4'') Before TXCUPP.JPG
Photo 35: 202-251 BC-03 S06 @ 39.5' (tip-11'') After TXCUPP #1.JPG
Photo 36: 202-251 BC-03 S06 @ 39.5' (tip-11'') After TXCUPP #2.JPG
Photo 37: 202-251 BC-03 S06 @ 39.5' (tip-11'') Before TXCUPP.JPG
Photo 38: 202-251 BC-03 S10 @ 90' (tip-13'') After TXCUPP #1.JPG
Photo 39: 202-251 BC-03 S10 @ 90' (tip-13'') After TXCUPP #2.JPG
Photo 40: 202-251 BC-03 S10 @ 90' (tip-13'') Before TXCUPP.JPG
Photo 41: 202-251 BC-04 S04 @ 12.5' (tip-4'') After TXCUPP #1.JPG
Photo 42: 202-251 BC-04 S04 @ 12.5' (tip-4'') After TXCUPP #2.JPG
Photo 43: 202-251 BC-04 S04 @ 12.5' (tip-4'') Before TXCUPP.JPG
AECOM
60537920
BC-14 S02
@7' (Tip-1")
Before
BC-14
S03@ 9’ (tip-1”)
After
Photo 46: 202-251 BC-04 S04 @ 12.5' (tip-15") Before TXCUPP.JPG
Photo 47: 202-251 BC-04 S05 @ 17.6’ (tip-6”) After TXCUPP #1.JPG
Photo 53: 202-251 BC-04 S08 @ 32.5’ (tip-10”) After TXCUPP #1.JPG
S10 (tip-18")
After

Photo 59: 202-251 BC-04 S10 @ 52.5' (tip-18") After TXCUPP #1.JPG
Photo 62: 202-251 BC-05 S04 @ 14.5' (tip-1'') After TXCUPP #1.JPG
Photo 65: 202-251 BC-05 S04 @ 14.5’ (tip-16”) After TXCUPP #1.JPG
BC-02 S06 @ 19.5'

BC-02 S08 @ 34.5'

Scale in inches
0 = Top of Tube
BC-03 S10 @ 90'

Scale in inches
0 = Top of Tube
BC-13 S04 @ 22'

BC-13 S05 @ 30.5'
### Moisture Content

**Project Name**: Klamath River Dam Removal  
**Location**: Klamath River  
**Client**: Klamath River Renewal Corporation  
**Client Project No.**: 60537920  
**Registry No.**: 2018-22  
**Report No.**: 2018-22-4-1  
**Report Date**: 5/17/2018  
**Drill Hole and Depth**: BI-02; 27-27.9 ft  
**Rock Type**: Volcanic Breccia  
**Geologic Unit**: N/A  
**Moisture Condition**: As-received

<table>
<thead>
<tr>
<th>Method A: Caliper</th>
<th>Diameter (mm)</th>
<th>Length (mm)</th>
<th>Initial Weight (g)</th>
<th>Dry Weight (g)</th>
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<th>Unit Weight (pcf)</th>
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<th>Dry Unit Weight (pcf)</th>
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<th>Weight (g)</th>
<th>Saturated Weight (g)</th>
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<th>Dry Unit Weight (kN/m³)</th>
<th>Dry Unit Weight (pcf)</th>
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**Performed by**: Dr. Fulvio Tonon, P.E., Ph.D.  
**Checked by**: Gloria Tonon-Kozma, P.E.

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Moisture Content
ASTM D2216-10

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<td>BI-02; 48.9-50.3 ft</td>
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<tr>
<td>Rock Type</td>
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Date Received: 4/24/2018     Date Opened: 4/24/2018     Date Tested: 4/27-30/2018

Method A: Caliper

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<th>Diameter (mm)</th>
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Moisture Content (%) | Unit Weight (kN/m^3) | Unit Weight (pcf) | Dry Unit Weight (kN/m^3) | Dry Unit Weight (pcf) |
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Method B: Buoyancy

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Moisture Content (%) | Unit Weight (kN/m^3) | Unit Weight (pcf) | Dry Unit Weight (kN/m^3) | Dry Unit Weight (pcf) |
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2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@tononeng.com
<table>
<thead>
<tr>
<th>Moisture Content (%)</th>
<th>Unit Weight (kN/m³)</th>
<th>Unit Weight (pcf)</th>
<th>Dry Unit Weight (kN/m³)</th>
<th>Dry Unit Weight (pcf)</th>
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Method A: Caliper

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Method B: Buoyancy

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**Method A: Caliper**

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<th>Dry Weight (g)</th>
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**Moisture Content (%)** | **Unit Weight (kN/m³)** | **Unit Weight (pcf)** | **Dry Unit Weight (kN/m³)** | **Dry Unit Weight (pcf)**
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**Method B: Buoyancy**

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<th>Weight (g)</th>
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<tbody>
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**Moisture Content (%)** | **Unit Weight (kN/m³)** | **Unit Weight (pcf)** | **Dry Unit Weight (kN/m³)** | **Dry Unit Weight (pcf)**
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Checked by: Gloria Tonon-Kozma, P.E.

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# Moisture Content

Moisture Content

ASTM D2216-10

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<td>Geologic Unit</td>
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**Method A: Caliper**

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<th>Diameter (mm)</th>
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**Moisture Content (%)**

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<th>Moisture Content (%)</th>
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<th>Unit Weight (pcf)</th>
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**Method B: Buoyancy**

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<th>Weight (g)</th>
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**Bulk Density**
ISRM Suggested Methods 1977

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<tr>
<th>Diameter</th>
<th>Length</th>
<th>Weight</th>
<th>Bulk Density</th>
<th>Bulk Density</th>
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<td>(mm)</td>
<td>(mm)</td>
<td>(g)</td>
<td>(kN/m³)</td>
<td>(pcf)</td>
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<td>60.54</td>
<td>97.72</td>
<td>637.28</td>
<td>22.22</td>
<td>141.42</td>
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<th>Diameter (mm)</th>
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<td>891.59</td>
<td>23.51</td>
<td>149.67</td>
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<tr>
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<td>(mm)</td>
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<tr>
<td>60.58</td>
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<td>783.13</td>
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<td>134.96</td>
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# Point Load Strength Test

**ASTM D 5731 - 08**

**Tonon USA**

Engineering, Measurements and Testing, LLC

Web: tononeng.com

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<tr>
<td>Moisture Condition</td>
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---

**Date Received:** 4/24/2018  **Date Opened:** 4/24/2018  **Date Tested:** 4/30/2018

---

<table>
<thead>
<tr>
<th>Distance, D</th>
<th>Load, P</th>
<th>Corrected Point Load Index (D/50)^0.45 ( P/D^2 )</th>
<th>Direction of Loading</th>
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<tbody>
<tr>
<td>mm</td>
<td>in</td>
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**Average Point Load Strength in Direction A**: 0.38 MPa  54.79 psi

**Average Point Load Strength in Direction B**: 0.55 MPa  80.12 psi

---

**Point Load Strength Anisotropy Index**: 1.46

**A** = Parallel to core axis  **B** = Orthogonal to core axis

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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2028 E Ben White BLVD #240-2660  
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E.  
Phone: +1-512-200-3051  
E-mail: fulvio@tononeng.com
<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Order</th>
<th>Depth of Test</th>
<th>Boring</th>
<th>Date</th>
<th>Depth Interval</th>
<th>Rock Type</th>
<th>Diameter (D)</th>
<th>Distance Between Contact Points (mm)</th>
<th>Distance Between Contact Points (cm)</th>
<th>Length - Contact Points to End of Sample, L (in)</th>
<th>Test Type</th>
<th>Failure Load, P (kN)</th>
<th>Uncorrected Point Load, I, sc (MPa)</th>
<th>Size Correction Factor, F</th>
<th>Point Load, I, sc (MPa)</th>
<th>Uniaxial Compressive Strength, sc (MPa)</th>
<th>Weathering</th>
<th>Notes</th>
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<td>0.56</td>
<td>0.70</td>
<td>1.06</td>
<td>0.80</td>
<td>MW-SW</td>
<td>720</td>
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</tbody>
</table>

Notes:
1. Based on Drill Logs
2. ASTM D5731 calls for L/D > 0.5 for diametral test.
3. d = diametral, a = axial, b = block, ir = irregular lump
4. Fresh from testing apparatus
5. F = (D/50)0.45 (ASTM D5731 - for diametral test)
6. IS = P/D² (ASTM D5731 - for diametral test)
7. IS(50) = IS x F (ASTM D5731)
8. Load, P (kN) = 1.58 x F x IS (Max Load - Immediate Load)
9. Loading rate: 0.05 in per minute
10. Temperature: 10-22°C
11. Depth of Test: 4/11/2018
12. Fractured between platens (see photo)
Top  Sample  4/11/18
BI-02  21.9-22.6

Klamath River Dam Removal
Top
Sample
BI-02 21.9-22.6
4/11/18
Klamath River Dam Removal
Top Sample 4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj.
Top Sample 4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj
BI-02  37.2 - 37.7

Klamath River Dam Replacement Proj.
Top Sample
BI-02 37.2 - 37.7
4/11/18

Klamath River Dam Replacement Proj.
Photo 9: IMG_1474.JPG

Top Sample 4/11/18

BI-02 42.5 - 43.1

Klamath River Dam Replacement Proj.
Sample

BI-02  54.7 - 55.4

4/11/18

Klamath River Dam Replacement Proj.
Top
Sample

BI-02
54.7 - 55.4

Klamath River Dam Replacement Proj
Top Sample
BI-02  57.0-57.6

Klamath River Dam Replacement Proj.
Photo 15: IMG_1480.JPG

Top Sample 4/11/18
BI-02 57.0-57.6

Klamath River Dam Replacement Proj
Top Sample 4/11/18
BI-02  57.0-57.6

Klamath River Dam Replacement Proj.
Photo 18: IMG_1483.JPG

Top Sample 4/11/18
BI-02 63.7-64.7

Klamath River Dam Replacement Proj.
Sample
BI-03 10.1 - 10.5

Klamath River Dam Replacement Proj
Top Sample BI-03 10.1 - 10.5

Klamath River Dam Replacement Project 4/11/18
Sample
BI-03 21.0 - 21.5

Klamath River Dam Replacement Proj
Top

Sample

BI-03  29.5 - 30.1

4/11/18

Klamath River Dam Replacement Proj.
Top Sample 4/4/18
BI-03 32.0 - 33.5
Klamath River Dam Replacement Proj.
### FOR ANISOTROPIC ROCK:

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<tr>
<th>Description</th>
<th>Value</th>
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<tr>
<td>Loading Orientation Rel. to Bedding</td>
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#### SAMPLE DIMENSIONS

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<th>Value (mm)</th>
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<tr>
<td>Length Perpendicular to Loading, L</td>
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</tr>
<tr>
<td>Diameter Parallel to Loading, D</td>
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</tr>
<tr>
<td>Diameter at Failure, D'</td>
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#### STRENGTH DATA

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<th>Description</th>
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<tr>
<td>Peak Load, P, lbs</td>
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<td>Uncorr. Pt. Load Strength Index,(I_s), MPa</td>
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#### MOISTURE CONTENT DATA

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<td>Pan wt. (g)</td>
<td>20.16</td>
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<tr>
<td>Total wet wt. (g)</td>
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<td>Total dry wt. (g)</td>
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Test types:
- 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D = 30-85 mm; D/W between 1/3 and 1
### POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

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<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
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<td>17.2-17.5</td>
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<tr>
<td>B-01</td>
<td>R6</td>
<td>17.2-17.5</td>
<td>Brown Rock</td>
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<td>B-01</td>
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<td>R6</td>
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<th>Test Type ID</th>
<th>Bedding Angle Relative to Axis</th>
<th>Loading Orientation Rel. to Bedding</th>
<th>Width Perpendicular to Loading, W, mm</th>
<th>Length Perpendicular to Loading, L, mm</th>
<th>Diameter Parallel to Loading, D, mm</th>
<th>Diameter at Failure, D', mm</th>
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**FOR ANISOTROPIC ROCK:**

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<th>Loading Orientation Rel. to Bedding</th>
<th>Width, mm</th>
<th>Length, mm</th>
<th>Diameter, mm</th>
<th>Diameter at Failure, mm</th>
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**SAMPLE DIMENSIONS**

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<th>Length Perpendicular to Loading, L, mm</th>
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**STRENGTH DATA**

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<td>0.97</td>
<td>0.89</td>
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<tr>
<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, Mpa</td>
<td>0.05</td>
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<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, psi</td>
<td>7</td>
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</table>

**MOISTURE CONTENT DATA**

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>20.56</td>
<td>20.56</td>
<td>20.56</td>
<td>20.56</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>152.32</td>
<td>152.32</td>
<td>152.32</td>
<td>152.32</td>
</tr>
<tr>
<td>Total dry wt. (g)</td>
<td>145.93</td>
<td>145.93</td>
<td>145.93</td>
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<tr>
<td>Moisture Content, %</td>
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<td>5.1</td>
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</table>

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump

Diametral - L/D ratio > 1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
**POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731**

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Date:** 3/12/2019  
**Project Name:** Klamath River Renewal Project  
**By:** PJ

**Boring:** B-04  
**Sample:** R5  
**Depth, ft:** 26.2-26.5  
**Visual Description:** Brown Rock

<table>
<thead>
<tr>
<th>Test Type</th>
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<tbody>
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<td>Test Type ID</td>
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**FOR ANISOTROPIC ROCK:**

- **Bedding Angle Relative to Axis:** None  
- **Loading Orientation Rel. to Bedding:** N/A

**SAMPLE DIMENSIONS**

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<tr>
<th>Dimension</th>
<th>Value</th>
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<tbody>
<tr>
<td>Width Perpendicular to loading, W, mm</td>
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</tr>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
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</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>69</td>
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</table>

**STRENGTH DATA**

<table>
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<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Peak Load, P, kN</td>
<td>0.137</td>
</tr>
<tr>
<td>Peak Load, P, lbs</td>
<td>30.8</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_s$, MPa</td>
<td>0.033</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_s$, psi</td>
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</tr>
<tr>
<td>Size Correction Factor, $F$</td>
<td>1.12</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_s(50)$, Mpa</td>
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<td>Corr. Pt. Load Strength Index, $I_s(50)$, psi</td>
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**MOISTURE CONTENT DATA**

<table>
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<th>Parameter</th>
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<tbody>
<tr>
<td>Moisture Condition of Specimen</td>
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</tr>
<tr>
<td>Pan No.</td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>19.85</td>
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<tr>
<td>Total wet wt. (g)</td>
<td>116.78</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
<td>107.55</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>10.5</td>
</tr>
</tbody>
</table>

| Comments               | Invalid point. Did not fail through both loading points. |

**Test types:**  
1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio > 1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### Point Load Strength Index of Rock - ASTM D 5731

**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/12/2019  
**By:** PJ

**Boring:**  
Sample: R7  
Depth, ft: 26.2-26.9  
Visual Description: Gray Rock

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
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<th>Axial</th>
<th>Diametral</th>
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<th>Axial</th>
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#### For Anisotropic Rock:

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<tr>
<th>Bedding Angle Relative to Axis</th>
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<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading Orientation Rel. to Bedding</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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#### Sample Dimensions

<table>
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<th>Width Perpendicular to Loading, W, mm</th>
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<th>60</th>
<th>60</th>
<th>60</th>
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<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
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<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>26</td>
<td>43</td>
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<tr>
<td>Diameter at Failure, D', mm</td>
<td>54</td>
<td>54</td>
<td>56</td>
<td>55</td>
<td>30</td>
<td>38</td>
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#### Strength Data

<table>
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<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Peak Load, P, lbs</td>
<td>5848.6</td>
<td>6196.4</td>
<td>5548.3</td>
<td>4386.2</td>
<td>4325.8</td>
<td>4755.8</td>
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<td>Uncorr. Pt. Load Strength Index, Is, MPa</td>
<td>8.030</td>
<td>8.507</td>
<td>7.345</td>
<td>5.912</td>
<td>8.396</td>
<td>7.287</td>
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<td>1164.6</td>
<td>1233.9</td>
<td>1065.3</td>
<td>857.5</td>
<td>1217.7</td>
<td>1056.9</td>
</tr>
<tr>
<td>Size Correction Factor, F</td>
<td>1.06</td>
<td>1.06</td>
<td>1.07</td>
<td>1.06</td>
<td>0.98</td>
<td>1.03</td>
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<td>8.51</td>
<td>9.02</td>
<td>7.85</td>
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<td>8.23</td>
<td>7.54</td>
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<td>Corr. Pt. Load Strength Index, Is(50), psi</td>
<td>1235</td>
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#### Moisture Content Data

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<tbody>
<tr>
<td>Total wet wt. (g)</td>
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<td>187.35</td>
<td>187.35</td>
<td>187.35</td>
<td>187.35</td>
<td>187.35</td>
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<tr>
<td>Total dry wt (g)</td>
<td>186.12</td>
<td>186.12</td>
<td>186.12</td>
<td>186.12</td>
<td>186.12</td>
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<td>Moisture Content, %</td>
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<td>0.8</td>
<td>0.8</td>
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### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio > 1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### CTL Job No: 020-277
### Project No.: 60537920
### Client: AECOM
### Project Name: Klamath River Renewal Project
### Date: 3/12/2019
### By: PJ

#### Boring:
- B-05
- R11
- B-05
- R11
- B-05
- R11

#### Sample:
- R11
- R11
- R11
- R11

#### Depth, ft:
- 36.9-37.3
- 36.9-37.3
- 36.9-37.3
- 36.9-37.3

#### Visual Description:
- Gray Rock
- Gray Rock
- Gray Rock
- Gray Rock

#### Test Type
<table>
<thead>
<tr>
<th></th>
<th>Diametral</th>
<th>Diametral</th>
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<th>Axial</th>
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<td>Test Type ID</td>
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#### FOR ANISOTROPIC ROCK:

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<th>None</th>
<th>None</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedding Angle Relative to Axis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loading Orientation Rel. to Bedding</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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#### SAMPLE DIMENSIONS

<table>
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<tr>
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<th>60</th>
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<th>60</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width Perpendicular to loading, W, mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>56</td>
<td>55</td>
<td>26</td>
<td>32</td>
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#### STRENGTH DATA

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<th>14.521</th>
<th>18.344</th>
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<tbody>
<tr>
<td>Peak Load, P, kN</td>
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</tr>
<tr>
<td>Peak Load, P, lbs</td>
<td>7446.3</td>
<td>7201.3</td>
<td>3264.5</td>
<td>4123.9</td>
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<td>Uncorr. Pt. Load Strength Index, I&lt;sub&gt;s&lt;/sub&gt;, MPA</td>
<td>9.858</td>
<td>9.707</td>
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<td>7.504</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, I&lt;sub&gt;s&lt;/sub&gt;, psi</td>
<td><strong>1429.8</strong></td>
<td><strong>1407.9</strong></td>
<td><strong>1060.3</strong></td>
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<table>
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<tr>
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<th>0.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size Correction Factor, F</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index&lt;sub&gt;is(50)&lt;/sub&gt;, Mpa</td>
<td>10.54</td>
<td>10.33</td>
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</tr>
<tr>
<td>Corr. Pt. Load Strength Index&lt;sub&gt;is(50)&lt;/sub&gt;, psi</td>
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#### MOISTURE CONTENT DATA

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<tr>
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<th>As Received</th>
<th>As Received</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>22.95</td>
<td>22.95</td>
<td>22.95</td>
<td>22.95</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>152.73</td>
<td>152.73</td>
<td>152.73</td>
<td>152.73</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
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<td>152.3</td>
<td>152.3</td>
<td>152.3</td>
</tr>
<tr>
<td>Moisture Content, %</td>
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<td>0.3</td>
<td>0.3</td>
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</table>

#### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
Diamental - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

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<thead>
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<th>Boring:</th>
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<th>B-05</th>
<th>B-05</th>
<th>B-05</th>
<th>B-05</th>
<th>B-05</th>
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</thead>
<tbody>
<tr>
<td>Sample:</td>
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<td>R15</td>
<td>R15</td>
<td>R15</td>
<td>R15</td>
<td>R15</td>
</tr>
<tr>
<td>Depth, ft:</td>
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<td>46.1-46.8</td>
<td>46.1-46.8</td>
<td>46.1-46.8</td>
<td>46.1-46.8</td>
<td>46.1-46.8</td>
</tr>
<tr>
<td>Visual Description:</td>
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<td>Gray Rock</td>
<td>Gray Rock</td>
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<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
<th>Diametral</th>
<th>Diametral</th>
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**FOR ANISOTROPIC ROCK:**

<table>
<thead>
<tr>
<th>Bedding Angle Relative to Axis</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
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<tr>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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**SAMPLE DIMENSIONS**

<table>
<thead>
<tr>
<th>Width Perpendicular to Loading, W, mm</th>
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<th>60</th>
<th>60</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
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<td>30</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Diameter Parallel to Loading, D, mm</td>
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<td>Diameter at Failure, D’, mm</td>
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<td>35</td>
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**STRENGTH DATA**

<table>
<thead>
<tr>
<th>Peak Load, P, kN</th>
<th>24.093</th>
<th>33.912</th>
<th>27.929</th>
<th>24.365</th>
<th>22.269</th>
<th>21.115</th>
</tr>
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<tbody>
<tr>
<td>Peak Load, P, lbs</td>
<td>5416.3</td>
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<td>6278.7</td>
<td>5477.5</td>
<td>5006.3</td>
<td>4746.8</td>
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<td>Uncorr. Pt. Load Strength Index, Ist, MPa</td>
<td>7.171</td>
<td>10.093</td>
<td>8.166</td>
<td>7.251</td>
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<td>9.871</td>
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<td>Uncorr. Pt. Load Strength Index, Ist, psi</td>
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<td>Size Correction Factor, F</td>
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<tr>
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**MOISTURE CONTENT DATA**

<table>
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<tr>
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<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>19.79</td>
<td>19.79</td>
<td>19.79</td>
<td>19.79</td>
<td>19.79</td>
<td>19.79</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>138.47</td>
<td>138.47</td>
<td>138.47</td>
<td>138.47</td>
<td>138.47</td>
<td>138.47</td>
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<tr>
<td>Total dry wt (g)</td>
<td>137.97</td>
<td>137.97</td>
<td>137.97</td>
<td>137.97</td>
<td>137.97</td>
<td>137.97</td>
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<tr>
<td>Moisture Content, %</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
Diametral - L/D ratio > 1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
# POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Date:** 3/12/2019  
**Project Name:** Klamath River Renewal Project  
**By:** PJ

<table>
<thead>
<tr>
<th>Boring:</th>
<th>B-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>R6</td>
</tr>
<tr>
<td>Depth, ft:</td>
<td>29.3-29.6</td>
</tr>
</tbody>
</table>

**Visual Description:** Red Rock

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type ID</td>
<td>1</td>
</tr>
</tbody>
</table>

**FOR ANISOTROPIC ROCK:**

<table>
<thead>
<tr>
<th>Bedding Angle Relative to Axis</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading Orientation Rel. to Bedding</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**SAMPLE DIMENSIONS**

- Width Perpendicular to loading, W, mm: 60
- Length Perpendicular to Loading, L, mm: 30
- Diameter Parallel to Loading, D, mm: 60
- Diameter at Failure, D', mm: 56

**STRENGTH DATA**

- Peak Load, P, kN: 0.22
- Peak Load, P, lbs: 49.5
- Uncorr. Pt. Load Strength Index, $I_s$, MPa: 0.065
- Uncorr. Pt. Load Strength Index, $I_g$, psi: 9.5
- Size Correction Factor, F: 1.07
- Corr. Pt. Load Strength Index, $I_s(50)$, Mpa: 0.07
- Corr. Pt. Load Strength Index, $I_g(50)$, psi: 10

**MOISTURE CONTENT DATA**

- Moisture Condition of Specimen: As Received
- Pan No.
- Pan wt. (g): 21.71
- Total wet wt. (g): 148.91
- Total dry wt (g): 139.87
- Moisture Content, %: 7.7

**Comments:** Invalid point. Did not fail through both loading points.

**Test types:** 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump

- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### Point Load Strength Index of Rock - ASTM D 5731

<table>
<thead>
<tr>
<th>Boring</th>
<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-08</td>
<td>R1</td>
<td>37.1-37.6</td>
<td>Gray Rock</td>
</tr>
<tr>
<td>B-08</td>
<td>R1</td>
<td>37.1-37.6</td>
<td>Gray Rock</td>
</tr>
<tr>
<td>B-08</td>
<td>R1</td>
<td>37.1-37.6</td>
<td>Gray Rock</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
<th>Diametral</th>
<th>Axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type ID</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Bedding Angle Relative to Axis
- None
- None
- None

#### Loading Orientation Relative to Bedding
- N/A
- N/A
- N/A

#### SAMPLE DIMENSIONS

| Width Perpendicular to Loading, W, mm | 60 | 60 | 60 |
| Length Perpendicular to Loading, L, mm | 30 | 30 |     |
| Diameter Parallel to Loading, D, mm | 60 | 60 | 36  |
| Diameter at Failure, D', mm | 58 | 59 | 46  |

#### STRENGTH DATA

| Peak Load, P, kN | 0.692 | 0.484 | 0.327 |
| Peak Load, P, lbs | 155.6 | 108.8 | 73.5 |
| Uncorr. Pt. Load Strength Index, $I_s$, MPa | 0.199 | 0.137 | 0.093 |
| Uncorr. Pt. Load Strength Index, $I_s$, psi | 28.8 | 19.8 | 13.5 |

#### Size Correction Factor, $F$
- 1.08
- 1.08
- 1.08

#### Corr. Pt. Load Strength Index, $I_{s(50)}$, Mpa
- 0.21
- 0.15
- 0.10

#### MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>19.25</td>
<td>19.25</td>
<td>19.25</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>168.79</td>
<td>168.79</td>
<td>168.79</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
<td>156.2</td>
<td>156.2</td>
<td>156.2</td>
</tr>
</tbody>
</table>

| Moisture Content, % | 9.2 | 9.2 | 9.2 |

#### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
1. Diametral - L/D ratio > 1
2. Axial - L/D ratio 1/3 to 1
3. Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
**POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731**

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/12/2019  
**By:** PJ

- **Boring:** B-08  
- **Sample:** R2  
- **Depth, ft:** 38.6-38.9  
- **Visual Description:** Gray Rock

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type ID</td>
<td>1</td>
</tr>
</tbody>
</table>

**FOR ANISOTROPIC ROCK:**

- **Bedding Angle Relative to Axis:** None  
- **Loading Orientation Rel. to Bedding:** N/A

**SAMPLE DIMENSIONS**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width Perpendicular to loading, W, mm</td>
<td>60</td>
</tr>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>58</td>
</tr>
</tbody>
</table>

**STRENGTH DATA**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Load, P, kN</td>
<td>1.122</td>
</tr>
<tr>
<td>Peak Load, P, lbs</td>
<td>252.2</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_p$, MPa</td>
<td>0.322</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_p$, psi</td>
<td>46.8</td>
</tr>
<tr>
<td>Size Correction Factor, F</td>
<td>1.08</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_{p(50)}$, Mpa</td>
<td>0.35</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_{p(50)}$, psi</td>
<td>50</td>
</tr>
</tbody>
</table>

**MOISTURE CONTENT DATA**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Condition of Specimen</td>
<td>As Received</td>
</tr>
<tr>
<td>Pan No.</td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>20.6</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>298.27</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
<td>282.19</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>6.1</td>
</tr>
</tbody>
</table>

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio>1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
## Point Load Strength Index of Rock - ASTM D 5731

**Boring:** B-08  
**Sample:** R4  
**Depth, ft:** 50.2-50.6  
**Visual Description:** Gray Rock

### Test Type
- **Type:** Diametral  
- **ID:** 1

### FOR ANISOTROPIC ROCK:
- **Bedding Angle Relative to Axis:** None  
- **Loading Orientation Rel. to Bedding:** N/A

### SAMPLE DIMENSIONS
- **Width Perpendicular to loading, W, mm:** 60  
- **Length Perpendicular to Loading, L, mm:** 30  
- **Diameter Parallel to Loading, D, mm:** 60  
- **Diameter at Failure, D', mm:** 59

### STRENGTH DATA
- **Peak Load, P, kN:** 3.384  
- **Peak Load, P, lbs:** 760.8  
- **Uncorr. Pt. Load Strength Index, $I_s$, MPa:** 0.956  
- **Uncorr. Pt. Load Strength Index, $I_s$, psi:** 138.6  
- **Size Correction Factor, $F$:** 1.08  
- **Corr. Pt. Load Strength Index, $I_s(50)$, Mpa:** 1.03  
- **Corr. Pt. Load Strength Index, $I_s(50)$, psi:** 150

### MOISTURE CONTENT DATA
- **Moisture Condition of Specimen:** As Received  
- **Pan No.:**  
- **Pan wt. (g):** 22.27  
- **Total wet wt. (g):** 391.5  
- **Total dry wt (g):** 378.35  
- **Moisture Content, %:** 3.7

### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump

Diametral - L/D ratio>1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
**POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731**

<table>
<thead>
<tr>
<th>CTL Job No:</th>
<th>020-277</th>
<th>Project No.:</th>
<th>60537920</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client:</td>
<td>AECOM</td>
<td>Date:</td>
<td>3/13/2019</td>
</tr>
<tr>
<td>Project Name:</td>
<td>Klamath River Renewal Project</td>
<td>By:</td>
<td>PJ</td>
</tr>
</tbody>
</table>

**Boring:**

- B-10

**Sample:**

- R1

**Depth, ft:**

- 30.4-30.7

**Visual Description:**

- Gray Rock

**FOR ANISOTROPIC ROCK:**

- Bedding Angle Relative to Axis: None
- Loading Orientation Rel. to Bedding: N/A

**SAMPLE DIMENSIONS**

- Width Perpendicular to loading, W, mm: 60
- Length Perpendicular to Loading, L, mm: 30
- Diameter Parallel to Loading, D, mm: 60
- Diameter at Failure, D', mm: 56

**STRENGTH DATA**

- Peak Load, P, kN: 9.55
- Peak Load, P, lbs: 2146.9
- Uncorr. Pt. Load Strength Index, $I_p$, MPa: 2.842
- Uncorr. Pt. Load Strength Index, $I_p$, psi: 412.2
- Size Correction Factor, $F$: 1.07
- Corr. Pt. Load Strength Index, $I_p(50)$, Mpa: 3.04
- Corr. Pt. Load Strength Index, $I_p(50)$, psi: 441

**MOISTURE CONTENT DATA**

- Moisture Condition of Specimen: As Received
- Pan No.
- Pan wt. (g): 22.44
- Total wet wt. (g): 267.19
- Total dry wt (g): 259.78
- Moisture Content, %: 3.1

**Test types:**

1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump

- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D = 30-85 mm; D/W between 1/3 and 1
# Point Load Strength Index of Rock - ASTM D 5731

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/13/2019  
**By:** PJ

<table>
<thead>
<tr>
<th>Boring</th>
<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-10</td>
<td>R3</td>
<td>33.4-33.7</td>
<td>Gray Rock</td>
</tr>
<tr>
<td>B-10</td>
<td>R3</td>
<td>33.4-33.7</td>
<td>Gray Rock</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Test Type ID</th>
<th>Diametral</th>
<th>Axial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FOR ANISOTROPIC ROCK:**

| Bedding Angle Relative to Axis | None | None |
| Loading Orientation Rel. to Bedding | N/A | N/A |

**SAMPLE DIMENSIONS**

| Width Perpendicular to loading, W, mm | 60 | 60 |
| Length Perpendicular to Loading, L, mm | 30 |     |
| Diameter Parallel to Loading, D, mm | 60 | 44 |
| Diameter at Failure, D', mm | 56 | 42 |

**STRENGTH DATA**

| Peak Load, P, kN | 0.374 | 0.101 |
| Peak Load, P, lbs | 84.1 | 22.7 |
| Uncorr. Pt. Load Strength Index, I_P, MPA | 0.111 | 0.031 |
| Uncorr. Pt. Load Strength Index, I_P, psi | 16.1 | 4.6 |
| Size Correction Factor, F | 1.07 | 1.06 |
| Corr. Pt. Load Strength Index, I_P(50), MPA | 0.12 | 0.03 |
| Corr. Pt. Load Strength Index, I_P(50), psi | 17 | 5 |

**MOISTURE CONTENT DATA**

| Moisture Condition of Specimen | As Received | As Received |
| Pan No. | Pan wt. (g) | 22.32 | 22.32 |
| Total wet wt. (g) | 159.18 | 159.18 |
| Total dry wt (g) | 144.98 | 144.98 |
| Moisture Content, % | 11.6 | 11.6 |

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio > 1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D = 30-85 mm; D/W between 1/3 and 1
# Point Load Strength Index of Rock - ASTM D 5731

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/13/2019  
**By:** 3/13/2019

<table>
<thead>
<tr>
<th>Boring:</th>
<th>B-10</th>
<th>B-10</th>
<th>B-10</th>
<th>B-10</th>
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</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>R4</td>
<td>R4</td>
<td>R4</td>
<td>R4</td>
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<tr>
<td>Depth, ft:</td>
<td>37.1-37.4</td>
<td>37.1-37.4</td>
<td>37.1-37.4</td>
<td>37.1-37.4</td>
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<tr>
<td>Visual Description:</td>
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<td>Gray Rock</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
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## Test Type

<table>
<thead>
<tr>
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<th>Diametral</th>
<th>Axial</th>
<th>Axial</th>
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<tbody>
<tr>
<td>Test Type ID</td>
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<td>2</td>
</tr>
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## FOR ANISOTROPIC ROCK:

<table>
<thead>
<tr>
<th>Bedding Angle Relative to Axis</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading Orientation Rel. to Bedding</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

## SAMPLE DIMENSIONS

| Width Perpendicular to loading, W, mm | 60 | 60 | 60 | 60 |
| Length Perpendicular to Loading, L, mm | 30 | 30 | 30 | 30 |
| Diameter Parallel to Loading, D, mm | 60 | 60 | 37 | 36 |
| Diameter at Failure, D', mm | 58 | 56 | 33 | 28 |

## STRENGTH DATA

| Peak Load, P, kN | 0.435 | 0.521 | 0.225 | 0.313 |
| Peak Load, P, lbs | 97.8 | 117.1 | 50.6 | 70.4 |
| Uncorr. Pt. Load Strength Index, $I_p$, MPa | 0.125 | 0.155 | 0.089 | 0.146 |
| Uncorr. Pt. Load Strength Index, $I_p$, psi | 18.1 | 22.5 | 12.9 | 21.2 |
| Size Correction Factor, F | 1.08 | 1.07 | 1.00 | 0.97 |
| Corr. Pt. Load Strength Index, $I_{p(50)}$, MPa | 0.13 | 0.17 | 0.09 | 0.14 |
| Corr. Pt. Load Strength Index, $I_{p(50)}$, psi | 20 | 24 | 13 | 20 |

## MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>22.12</td>
<td>22.12</td>
<td>22.12</td>
<td>22.12</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>154</td>
<td>154</td>
<td>154</td>
<td>154</td>
</tr>
<tr>
<td>Total dry wt. (g)</td>
<td>140.19</td>
<td>140.19</td>
<td>140.19</td>
<td>140.19</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>11.7</td>
<td>11.7</td>
<td>11.7</td>
<td>11.7</td>
</tr>
</tbody>
</table>

## Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio>1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### CTL Job No: 020-277

**Project No.:** 60537920  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/13/2019  
**By:** PJ

#### Sample Information
<table>
<thead>
<tr>
<th>Boring:</th>
<th>B-10</th>
<th>B-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>R7</td>
<td>R7</td>
</tr>
<tr>
<td>Depth, ft:</td>
<td>49-49.5</td>
<td>49-49.5</td>
</tr>
<tr>
<td>Visual Description:</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
</tr>
</tbody>
</table>

#### Test Type & Configuration

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
<th>Axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type ID</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

#### FOR ANISOTROPIC ROCK:

- **Bedding Angle Relative to Axis:** None
- **Loading Orientation Rel. to Bedding:** N/A

#### SAMPLE DIMENSIONS

- **Width Perpendicular to loading, W, mm:** 60  
- **Length Perpendicular to Loading, L, mm:** 30  
- **Diameter Parallel to Loading, D, mm:** 60  
- **Diameter at Failure, D’, mm:** 58

#### STRENGTH DATA

<table>
<thead>
<tr>
<th>Peak Load, P, kN</th>
<th>2.077</th>
<th>1.996</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Load, P, lbs</td>
<td>466.9</td>
<td>448.7</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_s$, MPa</td>
<td>0.597</td>
<td>0.901</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_s$, psi</td>
<td>86.6</td>
<td>130.7</td>
</tr>
<tr>
<td><strong>Size Correction Factor, F</strong></td>
<td>1.08</td>
<td>0.97</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, Mpa</td>
<td>0.64</td>
<td>0.88</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, psi</td>
<td>93</td>
<td>127</td>
</tr>
</tbody>
</table>

#### MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pan No.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pan wt. (g)</strong></td>
<td>22.33</td>
<td>22.33</td>
</tr>
<tr>
<td><strong>Total wet wt. (g)</strong></td>
<td>379.89</td>
<td>379.89</td>
</tr>
<tr>
<td><strong>Total dry wt (g)</strong></td>
<td>357.27</td>
<td>357.27</td>
</tr>
<tr>
<td><strong>Moisture Content, %</strong></td>
<td>6.8</td>
<td>6.8</td>
</tr>
</tbody>
</table>

#### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio > 1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### Test Types

<table>
<thead>
<tr>
<th>Type</th>
<th>ID</th>
<th>Diametral</th>
<th>Axial</th>
<th>Diametral</th>
<th>Axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Test Type ID</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FOR ANISOTROPIC ROCK:

- **Bedding Angle Relative to Axis**: None
- **Loading Orientation Rel. to Bedding**: N/A

### Sample Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
<th>Sample 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Length, mm</td>
<td>30</td>
<td>30</td>
<td>30</td>
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<td></td>
</tr>
<tr>
<td>Diameter, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>46</td>
<td>40</td>
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<tr>
<td>Diameter at Failure, mm</td>
<td>59</td>
<td>57</td>
<td>59</td>
<td>45</td>
<td>36</td>
</tr>
</tbody>
</table>

### Strength Data

<table>
<thead>
<tr>
<th>Load, kN</th>
<th>12.808</th>
<th>20.405</th>
<th>17.108</th>
<th>16.519</th>
<th>15.518</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load, lbs</td>
<td>2879.4</td>
<td>4587.2</td>
<td>3846.0</td>
<td>3713.6</td>
<td>3488.6</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, MPa</td>
<td>3.618</td>
<td>5.966</td>
<td>4.833</td>
<td>4.805</td>
<td>5.643</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, psi</td>
<td>524.8</td>
<td>865.4</td>
<td>700.9</td>
<td>696.9</td>
<td>818.4</td>
</tr>
<tr>
<td>Size Correction Factor, F</td>
<td>1.08</td>
<td>1.07</td>
<td>1.08</td>
<td>1.07</td>
<td>1.02</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, MPa</td>
<td>3.91</td>
<td>6.40</td>
<td>5.23</td>
<td>5.16</td>
<td>5.76</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, psi</td>
<td>567</td>
<td>929</td>
<td>758</td>
<td>749</td>
<td>836</td>
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### Moisture Content Data

<table>
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<tr>
<th>Condition</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
<th>Sample 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan wt. (g)</td>
<td>22.32</td>
<td>22.32</td>
<td>22.32</td>
<td>22.32</td>
<td>22.32</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>215.87</td>
<td>215.87</td>
<td>215.87</td>
<td>215.87</td>
<td>215.87</td>
</tr>
<tr>
<td>Total dry wt. (g)</td>
<td>215.69</td>
<td>215.69</td>
<td>215.69</td>
<td>215.69</td>
<td>215.69</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump

- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D = 30-85 mm; D/W between 1/3 and 1
### POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

<table>
<thead>
<tr>
<th>Boring:</th>
<th>B-14</th>
<th>B-14</th>
<th>B-14</th>
<th>B-14</th>
<th>B-14</th>
<th>B-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>R6</td>
<td>R6</td>
<td>R6</td>
<td>R6</td>
<td>R6</td>
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<tr>
<td>Visual Description:</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
<td>Gray Rock</td>
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<table>
<thead>
<tr>
<th>Test Type</th>
<th>Diametral</th>
<th>Diametral</th>
<th>Diametral</th>
<th>Axial</th>
<th>Axial</th>
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#### FOR ANISOTROPIC ROCK:

<table>
<thead>
<tr>
<th>Bedding Angle Relative to Axis</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
<th>None</th>
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</thead>
<tbody>
<tr>
<td>Loading Orientation Rel. to Bedding</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### SAMPLE DIMENSIONS

<table>
<thead>
<tr>
<th>Width Perpendicular to loading, W, mm</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
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<td>60</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

#### STRENGTH DATA

<table>
<thead>
<tr>
<th>Peak Load, P, kN</th>
<th>0.196</th>
<th>0.188</th>
<th>0.169</th>
<th>0.046</th>
<th>0.053</th>
<th>0.054</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Load, P, lbs</td>
<td>44.1</td>
<td>42.3</td>
<td>38.0</td>
<td>10.3</td>
<td>11.9</td>
<td>12.1</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_p$, MPa</td>
<td>0.058</td>
<td>0.055</td>
<td>0.049</td>
<td>0.015</td>
<td>0.014</td>
<td>0.020</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, $I_p$, psi</td>
<td>8.5</td>
<td>8.0</td>
<td>7.0</td>
<td>2.2</td>
<td>2.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Size Correction Factor, F</td>
<td>1.07</td>
<td>1.07</td>
<td>1.08</td>
<td>1.04</td>
<td>1.09</td>
<td>1.02</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_p^{(50)}$, Mpa</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, $I_p^{(50)}$, psi</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
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</table>

#### MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>209.08</td>
<td>209.08</td>
<td>209.08</td>
<td>209.08</td>
<td>209.08</td>
<td>209.08</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
<td>195.76</td>
<td>195.76</td>
<td>195.76</td>
<td>195.76</td>
<td>195.76</td>
<td>195.76</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
</tr>
</tbody>
</table>

#### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
<table>
<thead>
<tr>
<th>CTL Job No: 020-277</th>
<th>Project No.: 60537920</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client: AECOM</td>
<td>Date: 3/13/2019</td>
</tr>
<tr>
<td>Project Name: Klamath River Renewal Project</td>
<td>By: PJ</td>
</tr>
</tbody>
</table>

**Boring:** B-14  
**Sample:** R7  
**Depth, ft:** 20.8-21.2  
**Visual Description:** Gray Rock

**Test Type:** Diametral  
**Test Type ID:** 1

### FOR ANISOTROPIC ROCK:

**Bedding Angle Relative to Axis:** None  
**Loading Orientation Rel. to Bedding:** N/A

### SAMPLE DIMENSIONS

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width Perpendicular to loading, W, mm</td>
<td>58</td>
</tr>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>58</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>56</td>
</tr>
</tbody>
</table>

### STRENGTH DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Load, P, kN</td>
<td>0.284</td>
</tr>
<tr>
<td>Peak Load, P, lbs</td>
<td>63.8</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, I_s, MPa</td>
<td>0.087</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, I_s, psi</td>
<td>12.7</td>
</tr>
<tr>
<td>Size Correction Factor, F</td>
<td>1.06</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, I_s(50), Mpa</td>
<td>0.09</td>
</tr>
<tr>
<td>Corr. Pt. Load Strength Index, I_s(50), psi</td>
<td>13</td>
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</tbody>
</table>

### MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Condition of Specimen</td>
<td>As Received</td>
</tr>
<tr>
<td>Pan No.</td>
<td></td>
</tr>
<tr>
<td>Pan wt. (g)</td>
<td>21.98</td>
</tr>
<tr>
<td>Total wet wt. (g)</td>
<td>194.83</td>
</tr>
<tr>
<td>Total dry wt (g)</td>
<td>185.6</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>5.6</td>
</tr>
</tbody>
</table>

**Comments:**

**Test types:** 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio > 1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
**Point Load Strength Index of Rock - ASTM D 5731**

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Date:** 3/13/2019  
**By:** PJ

**Sample Info:**
- **Boring:** B-14  
- **Sample:** R8  
- **Depth, ft:** 23.7-23.9  
- **Visual Description:** Gray Rock

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type ID</td>
<td>2</td>
</tr>
</tbody>
</table>

**FOR ANISOTROPIC ROCK:**
- **Bedding Angle Relative to Axis:** None  
- **Loading Orientation Rel. to Bedding:** N/A

**SAMPLE DIMENSIONS**
- **Width Perpendicular to loading, W, mm:** 60  
- **Length Perpendicular to Loading, L, mm:**  
- **Diameter Parallel to Loading, D, mm:** 51  
- **Diameter at Failure, D’, mm:** 49

**STRENGTH DATA**
- **Peak Load, P, kN:** 0.037  
- **Peak Load, P, lbs:** 8.3  
- **Uncorr. Pt. Load Strength Index, I_s, MPa:** 0.010  
- **Uncorr. Pt. Load Strength Index, I_s, psi:** 1.4  
- **Size Correction Factor, F:** 1.10  
- **Corr. Pt. Load Strength Index, I_{s(50)}, Mpa:** 0.01  
- **Corr. Pt. Load Strength Index, I_{s(50)}, psi:** 2

**MOISTURE CONTENT DATA**
- **Moisture Condition of Specimen:** As Received  
- **Pan No.:**  
- **Pan wt. (g):** 22.23  
- **Total wet wt. (g):** 109.95  
- **Total dry wt (g):** 104.99  
- **Moisture Content, %:** 6.0

**Comments:** Invalid test. Did not fail through both loading points.

**Test types:** 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D = 30-85 mm; D/W between 1/3 and 1
# Point Load Strength Index of Rock - ASTM D 5731

**Test Type**
- Diametral
- Axial

**Test Type ID**
- 1
- 2

## FOR ANISOTROPIC ROCK:
- Bedding Angle Relative to Axis: None
- Loading Orientation Relative to Bedding: N/A

## SAMPLE DIMENSIONS
- **Width Perpendicular to Loading, W, mm**: 60
- **Length Perpendicular to Loading, L, mm**: 60
- **Diameter Parallel to Loading, D, mm**: 30
- **Diameter at Failure, D', mm**: 57

## STRENGTH DATA
- **Peak Load, P, kN**: 1.627
- **Peak Load, P, lbs**: 365.8
- **Uncorr. Pt. Load Strength Index, Iₚ, MPa**: 0.476
- **Uncorr. Pt. Load Strength Index, Iₚ, psi**: 69.0
- **Size Correction Factor, F**: 1.07
- **Corr. Pt. Load Strength Index, Iₚ(50), MPa**: 0.51
- **Corr. Pt. Load Strength Index, Iₚ(50), psi**: 74

## MOISTURE CONTENT DATA
- **Moisture Condition of Specimen**: As Received
- **Pan No.**: 020-277
- **Pan wt. (g)**: 22.3
- **Total wet wt. (g)**: 127.05
- **Total dry wt (g)**: 124.19
- **Moisture Content, %**: 2.8

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
- Diametral - L/D ratio > 1
- Axial - L/D ratio 1/3 to 1
- Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
## POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

<table>
<thead>
<tr>
<th>CTL Job No:</th>
<th>020-277</th>
</tr>
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<tbody>
<tr>
<td>Project No.</td>
<td>60537920</td>
</tr>
<tr>
<td>Client:</td>
<td>AECOM</td>
</tr>
<tr>
<td>Project Name:</td>
<td>Klamath River Renewal Project</td>
</tr>
<tr>
<td>Date:</td>
<td>3/13/2019</td>
</tr>
<tr>
<td>By:</td>
<td>PJ</td>
</tr>
</tbody>
</table>

### Boring:
- B-15
- B-15
- B-15
- B-15
- B-15
- B-15

### Sample:
- R4
- R4
- R4
- R4
- R4
- R4

### Depth, ft:
- 33-33.5
- 33-33.5
- 33-33.5
- 33-33.5
- 33-33.5
- 33-33.5

### Visual Description:
- Gray Rock
- Gray Rock
- Gray Rock
- Gray Rock
- Gray Rock
- Gray Rock

### Test Types:
- Diametral
- Diametral
- Diametral
- Axial
- Axial
- Axial

### Test Type ID:
- 1
- 1
- 1
- 2
- 2
- 2

### FOR ANISOTROPIC ROCK:

#### Bedding Angle Relative to Axis:
- None
- None
- None
- None
- None
- None

#### Loading Orientation Rel. to Bedding:
- N/A
- N/A
- N/A
- N/A
- N/A
- N/A

### SAMPLE DIMENSIONS

<table>
<thead>
<tr>
<th>Width Perpendicular to Loading, W, mm</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>44</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Diameter at Failure, D', mm</td>
<td>59</td>
<td>57</td>
<td>57</td>
<td>42</td>
<td>39</td>
<td>26</td>
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### STRENGTH DATA

<table>
<thead>
<tr>
<th>Peak Load, P, kN</th>
<th>0.72</th>
<th>0.84</th>
<th>1.048</th>
<th>1.447</th>
<th>1.044</th>
<th>0.099</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Load, P, lbs</td>
<td>161.9</td>
<td>188.8</td>
<td>235.6</td>
<td>325.3</td>
<td>234.7</td>
<td>22.3</td>
</tr>
<tr>
<td>Uncorr. Pt. Load Strength Index, I_s, MPa</td>
<td>0.203</td>
<td>0.246</td>
<td>0.306</td>
<td>0.451</td>
<td>0.350</td>
<td>0.050</td>
</tr>
</tbody>
</table>

#### Uncorr. Pt. Load Strength Index, I_s, psi
- 29.5
- 35.6
- 44.4
- 65.4
- 50.8
- 7.2

#### Size Correction Factor, F
- 1.08
- 1.07
- 1.07
- 1.06
- 1.04
- 0.95

#### Corr. Pt. Load Strength Index, I_s(50), psi
- 0.22
- 0.26
- 0.33
- 0.48
- 0.36
- 0.05

#### MOISTURE CONTENT DATA

<table>
<thead>
<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
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</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
<td></td>
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<tr>
<td>Total wet wt. (g)</td>
<td>128.99</td>
<td>128.99</td>
<td>128.99</td>
<td>128.99</td>
<td>128.99</td>
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<td>Total dry wt (g)</td>
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<td>124.4</td>
<td>124.4</td>
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<tr>
<td>Moisture Content, %</td>
<td>4.5</td>
<td>4.5</td>
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</table>

### Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
Diametral - L/D ratio > 1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
## POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

**CTL Job No:** 020-277  
**Client:** AECOM  
**Project Name:** Klamath River Renewal Project  
**Project No.:** 60537920  
**Date:** 3/13/2019  
**By:** PJ

<table>
<thead>
<tr>
<th>Boring</th>
<th>Sample</th>
<th>Depth, ft</th>
<th>Visual Description</th>
<th>Test Type</th>
<th>Test Type ID</th>
<th>Bedding Angle Relative to Axis</th>
<th>Loading Orientation Rel. to Bedding</th>
<th>Width Perpendicular to Loading, W, mm</th>
<th>Length Perpendicular to Loading, L, mm</th>
<th>Diameter Parallel to Loading, D, mm</th>
<th>Diameter at Failure, D', mm</th>
<th>Peak Load, P, kN</th>
<th>Peak Load, P, lbs</th>
<th>Uncorr. Pt. Load Strength Index, I_s, MPa</th>
<th>Uncorr. Pt. Load Strength Index, I_s, psi</th>
<th>Size Correction Factor, F</th>
<th>Corr. Pt. Load Strength Index, I_s(50), Mpa</th>
<th>Corr. Pt. Load Strength Index, I_s(50), psi</th>
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</thead>
<tbody>
<tr>
<td>B-15</td>
<td>R6</td>
<td>43.1-43.6</td>
<td>Gray Rock</td>
<td>Diametral</td>
<td>1</td>
<td>None</td>
<td>N/A</td>
<td>60</td>
<td>30</td>
<td>60</td>
<td>57</td>
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<td>253.8</td>
<td>0.330</td>
<td>47.9</td>
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<td>R6</td>
<td>43.1-43.6</td>
<td>Gray Rock</td>
<td>Diametral</td>
<td>1</td>
<td>None</td>
<td>N/A</td>
<td>60</td>
<td>30</td>
<td>60</td>
<td>57</td>
<td>1.549</td>
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<td>30</td>
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<td>R6</td>
<td>43.1-43.6</td>
<td>Gray Rock</td>
<td>Axial</td>
<td>2</td>
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<td>N/A</td>
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<td>30</td>
<td>60</td>
<td>30</td>
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<td>173.3</td>
<td>0.374</td>
<td>54.2</td>
<td>0.96</td>
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### FOR ANISOTROPIC ROCK:

<table>
<thead>
<tr>
<th>Width Perpendicular to loading, W, mm</th>
<th>Length Perpendicular to Loading, L, mm</th>
<th>Diameter Parallel to Loading, D, mm</th>
<th>Diameter at Failure, D', mm</th>
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</thead>
<tbody>
<tr>
<td>60</td>
<td>30</td>
<td>60</td>
<td>57</td>
</tr>
<tr>
<td>60</td>
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<tr>
<td>60</td>
<td>30</td>
<td>60</td>
<td>57</td>
</tr>
</tbody>
</table>

### SAMPLE DIMENSIONS

- **Width Perpendicular to loading, W, mm**: 60, 60, 60, 60, 60, 60
- **Length Perpendicular to Loading, L, mm**: 30, 30, 30, 30, 30, 30
- **Diameter Parallel to Loading, D, mm**: 60, 60, 60, 32, 35, 30
- **Diameter at Failure, D', mm**: 57, 57, 55, 30, 32, 27

### STRENGTH DATA

- **Peak Load, P, kN**: 1.129, 1.549, 1.129, 1.336, 1.359, 0.771
- **Peak Load, P, lbs**: 253.8, 348.2, 253.8, 300.3, 305.5, 173.3
- **Uncorr. Pt. Load Strength Index, I_s, MPa**: 0.330, 0.453, 0.342, 0.583, 0.556, 0.374
- **Uncorr. Pt. Load Strength Index, I_s, psi**: 47.9, 65.7, 49.6, 84.5, 80.6, 54.2
- **Size Correction Factor, F**: 1.07, 1.07, 1.06, 0.98, 0.99, 0.96
- **Corr. Pt. Load Strength Index, I_s(50), Mpa**: 0.35, 0.49, 0.36, 0.57, 0.55, 0.36
- **Corr. Pt. Load Strength Index, I_s(50), psi**: 51, 70, 53, 83, 80, 52

### MOISTURE CONTENT DATA

- **Pan wt. (g)**: 20.45, 20.45, 20.45, 20.45, 20.45, 20.45
- **Total wet wt. (g)**: 238.89, 238.89, 238.89, 238.89, 238.89, 238.89
- **Total dry wt (g)**: 228.86, 228.86, 228.86, 228.86, 228.86, 228.86
- **Moisture Content, %**: 4.8, 4.8, 4.8, 4.8, 4.8, 4.8

### Comments:

- **Test types**: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
- **Diametral - L/D ratio >1**
- **Axial - L/D ratio 1/3 to 1**
- **Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1**
### FOR ANISOTROPIC ROCK:

<table>
<thead>
<tr>
<th>Bedding Angle Relative to Axis</th>
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<th>None</th>
<th>None</th>
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<td>N/A</td>
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### SAMPLE DIMENSIONS

<table>
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<tr>
<th>Width Perpendicular to Loading, W, mm</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
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<th>60</th>
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<tbody>
<tr>
<td>Length Perpendicular to Loading, L, mm</td>
<td>30</td>
<td>30</td>
<td>30</td>
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<td>Diameter Parallel to Loading, D, mm</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>33</td>
<td>41</td>
<td>34</td>
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<tr>
<td>Diameter at Failure, D', mm</td>
<td>59</td>
<td>60</td>
<td>59</td>
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### STRENGTH DATA

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<th>Peak Load, P, kN</th>
<th>0.583</th>
<th>0.78</th>
<th>0.413</th>
<th>1.206</th>
<th>2.038</th>
<th>1.52</th>
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<tr>
<td>Peak Load, P, lbs</td>
<td>131.1</td>
<td>175.4</td>
<td>92.8</td>
<td>271.1</td>
<td>458.2</td>
<td>341.7</td>
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<tr>
<td>Uncorr. Pt. Load Strength Index, $I_s$, MPa</td>
<td>0.165</td>
<td>0.217</td>
<td>0.117</td>
<td>0.526</td>
<td>0.702</td>
<td>0.686</td>
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<table>
<thead>
<tr>
<th>Uncorr. Pt. Load Strength Index, $I_s$, psi</th>
<th>23.9</th>
<th>31.4</th>
<th>16.9</th>
<th>76.3</th>
<th>101.8</th>
<th>99.5</th>
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<tr>
<td>Size Correction Factor, F</td>
<td>1.08</td>
<td>1.09</td>
<td>1.08</td>
<td>0.98</td>
<td>1.03</td>
<td>0.97</td>
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<tr>
<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, Mpa</td>
<td>0.18</td>
<td>0.24</td>
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<td>0.73</td>
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<tr>
<td>Corr. Pt. Load Strength Index, $I_{s(50)}$, psi</td>
<td>26</td>
<td>34</td>
<td>18</td>
<td>75</td>
<td>105</td>
<td>97</td>
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### MOISTURE CONTENT DATA

<table>
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<tr>
<th>Moisture Condition of Specimen</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan No.</td>
<td></td>
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<tr>
<td>Pan wt. (g)</td>
<td>20.98</td>
<td>20.98</td>
<td>20.98</td>
<td>20.98</td>
<td>20.98</td>
<td>20.98</td>
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<tr>
<td>Total wet wt. (g)</td>
<td>165.97</td>
<td>165.97</td>
<td>165.97</td>
<td>165.97</td>
<td>165.97</td>
<td>165.97</td>
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<tr>
<td>Total dry wt (g)</td>
<td>158.36</td>
<td>158.36</td>
<td>158.36</td>
<td>158.36</td>
<td>158.36</td>
<td>158.36</td>
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<tr>
<td>Moisture Content, %</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
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Comments:

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump
Diametral - L/D ratio >1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
### POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

**CTL Job No:** 020-277  
**Project No.:** 60537920  
**Client:** AECOM  
**Date:** 3/20/2019  
**Project Name:** Klamath River Renewal Project  
**By:** PJ

| Boring:   | B-19       |
| Sample:   | R1         |
| Depth, ft.| 31.3-32.2  |
| Visual Description: | Brown Rock |

**Test Type:** Diametral  
**Test Type ID:** 1

**FOR ANISOTROPIC ROCK:**

- **Bedding Angle Relative to Axis:** None
- **Loading Orientation Rel. to Bedding:** N/A

**SAMPLE DIMENSIONS**

- **Width Perpendicular to loading, W, mm:** 61
- **Length Perpendicular to Loading, L, mm:** 30
- **Diameter Parallel to Loading, D, mm:** 61
- **Diameter at Failure, D', mm:** 59

**STRENGTH DATA**

- **Peak Load, P, kN:** 0.582
- **Peak Load, P, lbs:** 130.8
- **Uncorr. Pt. Load Strength Index, I_s, MPa:** 0.162
- **Uncorr. Pt. Load Strength Index, I_s, psi:** 23.5
- **Size Correction Factor, F:** 1.09
- **Corr. Pt. Load Strength Index, I_s(50), Mpa:** 0.18
- **Corr. Pt. Load Strength Index, I_s(50), psi:** 25

**MOISTURE CONTENT DATA**

- **Moisture Condition of Specimen:** As Received
  
<table>
<thead>
<tr>
<th>Pan No.</th>
<th>Pan wt. (g)</th>
<th>Total wet wt. (g)</th>
<th>Total dry wt (g)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>19.52</td>
<td>97.66</td>
<td>91.38</td>
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</table>

- **Moisture Content, %:** 8.7

**Comments:**

Test types: 1- Diametral, 2- Axial, 3- Block, 4- Irregular Lump  
Diametral - L/D ratio>1  
Axial - L/D ratio 1/3 to 1  
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1
Uniaxial Compression Test without Stress-Strain Curves and Moduli
ASTM D7012 - 14e1

Tonon USA:
Engineering, Measurements and Testing, LLC
Web: tononeng.com

Project Name: Klamath River Dam Removal
Location: Klamath River
Client: Klamath River Renewal Corporation
Client Project No.: 60537920
Registry No.: 2018-22
Report No.: 2018-22-1-1
Report Date: 5/17/2018
Drill hole and Depth: BI-02; 27-27.9 ft
Rock Type: Volcanic Breccia
Geologic Unit: N/A
Moisture Condition: As-received

<table>
<thead>
<tr>
<th>Stress Rate</th>
<th>0.5 MPa/s</th>
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</thead>
<tbody>
<tr>
<td>Diameter of Specimen</td>
<td>60.54 mm</td>
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<tr>
<td>Height of Specimen</td>
<td>97.72 mm</td>
</tr>
<tr>
<td>Load at Peak</td>
<td>16.69 kN</td>
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<tr>
<td>Unconfined Compressive Strength</td>
<td>5.80 MPa</td>
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</tbody>
</table>

Type of Failure: Non-Structural

Note: The provided sample had a height-to-diameter ratio less than 2

Date Received: 4/24/2018
Date Opened: 4/24/2018
Date Tested: 4/30/2018

Photo Before Test
Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.
Checked by: Gloria Tonon-Kozma, P.E.

This report shall not be partially reproduced without the written consent of Tonon USA, LLC.
Picture of the sample upon arrival at Tonon USA Laboratory: no core piece allowed preparation of a specimen with a height-to-diameter ratio between 2 and 2.5.
### Project Information

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
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</thead>
<tbody>
<tr>
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<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
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<tr>
<td>Client Project No.</td>
<td>60537920</td>
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<tr>
<td>Registry No.</td>
<td>2018-22</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
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<tr>
<td>Drill hole and Depth</td>
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<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
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<td>Geologic Unit</td>
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<tr>
<td>Moisture Condition</td>
<td>As-received</td>
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### Stress-Strain Curves and Moduli

<table>
<thead>
<tr>
<th>Stress Rate</th>
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<tbody>
<tr>
<td>Diameter of Specimen</td>
<td>60.85 mm</td>
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<td>Height of Specimen</td>
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<tr>
<td>Load at Peak</td>
<td>34.80 kN</td>
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<tr>
<td>Unconfined Compressive Strength</td>
<td>11.97 MPa</td>
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</table>

### Type of Failure

- Non-Structural

---

**Photo Before Test**

**Photo After Test**

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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### Uniaxial Compression Test without Stress-Strain Curves and Moduli

#### ASTM D7012 - 14e1

**Project Name:** Klamath River Dam Removal  
**Location:** Klamath River  
**Client:** Klamath River Renewal Corporation  
**Client Project No.:** 60537920  
**Registry No.:** 2018-22  
**Report No.:** 2018-22-1-3  
**Report Date:** 5/17/2018  
**Drill hole and Depth:** BI-02; 55.4-56.3 ft  
**Rock Type:** Volcanic Breccia  
**Geologic Unit:** N/A  
**Moisture Condition:** As-received  

<table>
<thead>
<tr>
<th>Stress Rate</th>
<th>0.5 MPa/s</th>
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<tbody>
<tr>
<td>Diameter of Specimen</td>
<td>60.68 mm (2.39 in)</td>
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<tr>
<td>Height of Specimen</td>
<td>128.33 mm (5.05 in)</td>
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<tr>
<td>Load at Peak</td>
<td>45.59 kN (10,248 lbf)</td>
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<tr>
<td>Unconfined Compressive Strength</td>
<td>15.77 MPa (2,288 psi)</td>
</tr>
<tr>
<td>Type of Failure</td>
<td>Non- Structural</td>
</tr>
</tbody>
</table>

---

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

---

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### Uniaxial Compression Test without Stress-Strain Curves and Moduli

**ASTM D7012 - 14e1**

#### Project Details

<table>
<thead>
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<th>Project Name</th>
<th>Klamath River Dam Removal</th>
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<tbody>
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<td>Location</td>
<td>Klamath River</td>
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<td>Client</td>
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<td>Report No.</td>
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<td>Rock Type</td>
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<td>Geologic Unit</td>
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<tr>
<td>Moisture Condition</td>
<td>As-received</td>
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#### Stress Conditions

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<th>0.5 MPa/s</th>
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<tbody>
<tr>
<td>Diameter of Specimen</td>
<td>60.59 mm</td>
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<td>Height of Specimen</td>
<td>129.81 mm</td>
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<tr>
<td>Load at Peak</td>
<td>4.39 kN</td>
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<tr>
<td>Unconfined Compressive Strength</td>
<td>1.52 MPa</td>
</tr>
</tbody>
</table>

#### Test Results

<table>
<thead>
<tr>
<th>Unconfined Compressive Strength</th>
<th>221 psi</th>
</tr>
</thead>
</table>

#### Type of Failure

Non-Structural

---

**Stress Rate**

- 0.5 MPa/s

**Diameter of Specimen**

- 60.59 mm (2.39 in)

**Height of Specimen**

- 129.81 mm (5.11 in)

**Load at Peak**

- 4.39 kN (987 lbf)

**Unconfined Compressive Strength**

- 1.52 MPa (221 psi)

**Type of Failure**

- Non-Structural

---

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

This report shall not be partially reproduced without the written consent of Tonon USA, LLC.
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
</tr>
<tr>
<td>Client Project No.</td>
<td>60537920</td>
</tr>
<tr>
<td>Registry No.</td>
<td>2018-22</td>
</tr>
<tr>
<td>Report No.</td>
<td>2018-22-1-5</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
</tr>
<tr>
<td>Drill hole and Depth</td>
<td>BI-03; 21.5-22.9 ft</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>Geologic Unit</td>
<td>N/A</td>
</tr>
<tr>
<td>Moisture Condition</td>
<td>As-received</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stress Rate</th>
<th>0.5 MPa/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of Specimen</td>
<td>60.58 mm 2.39 in</td>
</tr>
<tr>
<td>Height of Specimen</td>
<td>125.67 mm 4.95 in</td>
</tr>
<tr>
<td>Load at Peak</td>
<td>6.99 kN 1,571 lbf</td>
</tr>
<tr>
<td>Unconfined Compressive Strength</td>
<td>2.43 MPa 352 psi</td>
</tr>
<tr>
<td>Type of Failure</td>
<td>Non-Structural</td>
</tr>
</tbody>
</table>

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

Unconfined Compressive Strength (psi) 14975

Young's Modulus (E) (psi) 4,450,000

Sample Height, in. 5.00
Sample Diameter, in. 2.39
Height / Diameter 2.1
Sample Area, in² 4.50
Wet Density,pcf 160.2
Dry Density,pcf 159.1
Moisture Content, % 0.7
Strain Rate, % / min 0.25

Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (°C): Ambient

Remarks:
Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277C  Boring: B-08  Date: 3/12/2019
Client: AECOM  Sample: R3  By: PJ
Project Name: Klamath River Renewal Project  Depth, ft.: 46.1-47  Checked: DC
Project No.: 60537920

Visual Description: Gray Rock
Moisture Condition at Test: Sample was washed and in a moist state.
Test Temperature, (°C): Ambient
Remarks:

| Sample Height, in. | 5.03 |
| Sample Diameter, in. | 2.40 |
| Height / Diameter | 2.1 |
| Sample Area, in² | 4.54 |
| Wet Density, pcf | 162.2 |
| Dry Density, pcf | 159.3 |
| Moisture Content, % | 1.8 |
| Strain Rate, % / min | 0.25 |

Unconfined Compressive Strength (psi)  15268
Young's Modulus (E) (psi)  3,300,000

![Graph of Compressive Stress vs. Axial Strain](image)
### Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

**CTL Job No.:** 020-277E  
**Boring:** B-13  
**Date:** 3/12/2019  
**Client:** AECOM  
**Sample:** R5  
**By:** PJ  

**Project Name:** Klamath River Renewal Project  
**Depth, ft.:** 17.6-18.5  
**Checked:** DC  

**Project No.:** 60537920

**Visual Description:** Gray Rock  
**Moisture Condition at Test:** Sample was washed and in a moist state.  
**Test Temperature, (°C):** Ambient  

**Remarks:**

<table>
<thead>
<tr>
<th>Sample Height, in.</th>
<th>5.04</th>
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</thead>
<tbody>
<tr>
<td>Sample Diameter, in.</td>
<td>2.40</td>
</tr>
<tr>
<td>Height / Diameter</td>
<td>2.1</td>
</tr>
<tr>
<td>Sample Area, in²</td>
<td>4.52</td>
</tr>
<tr>
<td>Wet Density, pcf</td>
<td>141.3</td>
</tr>
<tr>
<td>Dry Density, pcf</td>
<td>140.1</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>0.9</td>
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<tr>
<td>Strain Rate, % / min</td>
<td>0.25</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Unconfined Compressive Strength (psi)</th>
<th>6528</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young's Modulus (E) (psi)</td>
<td>1,630,000</td>
</tr>
</tbody>
</table>

**Compressive Stress, psi**

**Axial Strain, %**
Unconfined Compressive Strength and Young’s Modulus of Rock Core (ASTM D7012D)

Sample Height, in. 4.95
Sample Diameter, in. 2.40
Height / Diameter 2.1
Sample Area, in² 4.53
Wet Density, pcf 163.7
Dry Density, pcf 157.9
Moisture Content, % 3.7
Strain Rate, % / min 0.25

Unconfined Compressive Strength (psi) 343
Young’s Modulus (E) (psi) 388,900

Visual Description: Gray Rock
Moisture Condition at Test: Sample was washed and in a moist state.
Test Temperature, (°C): Ambient
Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Axial Strain, %
Compressive Stress, psi

<table>
<thead>
<tr>
<th>Compressive Stress, psi</th>
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</thead>
<tbody>
<tr>
<td>0.00</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Axial Strain, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Client: AECOM

Project Name: Klamath River Renewal Project

Project No.: 60537920

Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (°C): Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

### Unconfined Compressive Strength (psi)

<table>
<thead>
<tr>
<th>Sample Height, in.</th>
<th>4.98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Diameter, in.</td>
<td>2.40</td>
</tr>
<tr>
<td>Height / Diameter</td>
<td>2.1</td>
</tr>
<tr>
<td>Sample Area, in²</td>
<td>4.54</td>
</tr>
<tr>
<td>Wet Density,pcf</td>
<td>165.7</td>
</tr>
<tr>
<td>Dry Density,pcf</td>
<td>160.3</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>3.4</td>
</tr>
<tr>
<td>Strain Rate, % / min</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Unconfined Compressive Strength (psi): 7517

Young's Modulus (E) (psi): 4,330,000

### Unconfined Compressive Strength and Young’s Modulus of Rock Core (ASTM D7012D)
Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

Sample Height, in. 4.95
Sample Diameter, in. 2.34
Height / Diameter 2.1
Sample Area, in² 4.30
Wet Density, pcf 144.2
Dry Density, pcf 136.3
Moisture Content, % 5.8
Strain Rate, % / min 0.25

Unconfined Compressive Strength (psi) 1546
Young's Modulus (E) (psi) 221,400

Visual Description: Gray Rock
Moisture Condition at Test Sample was washed and in a moist state.
Test Temperature, (°C) Ambient
Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.
Unconfined Compressive Strength and Young's Modulus of Rock Core  
(ASTM D7012D)

Sample Height, in.  5.03
Sample Diameter, in.  2.37
Height / Diameter  2.1
Sample Area, in²  4.41
Wet Density, pcf  145.6
Dry Density, pcf  140.1
Moisture Content, %  3.9
Strain Rate, % / min  0.25

Unconfined Compressive Strength  2985
(ksi)

Young's Modulus (E)  535,700
(ksi)

Visual Description: Gray Rock
Sample was washed and in a moist state.
Test Temperature, (°C)  Ambient
Remarks: Spalling occurred at ends of sample during trimming. Therefore, 
the measured density is approximate.
Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

<table>
<thead>
<tr>
<th>Sample Height, in.</th>
<th>5.09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Diameter, in.</td>
<td>2.35</td>
</tr>
<tr>
<td>Height / Diameter</td>
<td>2.2</td>
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<tr>
<td>Sample Area, in^2</td>
<td>4.33</td>
</tr>
<tr>
<td>Wet Density,pcf</td>
<td>142.9</td>
</tr>
<tr>
<td>Dry Density,pcf</td>
<td>134.9</td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>5.9</td>
</tr>
<tr>
<td>Strain Rate, % / min</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Unconfined Compressive Strength (psi) | 2130

Young's Modulus (E) (psi) | 224,500

![Graph showing compressive stress and axial strain](image-url)
# Brazilian Tensile Strength Test

**ASTM D3967 - 16**

**Tonon USA:**
Engineering, Measurements and Testing, LLC
Web: tononeng.com

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
<th>Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)</th>
<th>0.11 MPa/sec</th>
<th>957 psi/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
<td>Diameter (D)</td>
<td>60.94 mm</td>
<td>2.40 in</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
<td>Thickness (t)</td>
<td>22.88 mm</td>
<td>0.90 in</td>
</tr>
<tr>
<td>Client Project No.</td>
<td>60537920</td>
<td>Maximum Load (P)</td>
<td>6.53 kN</td>
<td>1,468 lbf</td>
</tr>
<tr>
<td>Registry No.</td>
<td>2018-22</td>
<td>Tensile strength (flat platens)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Report No.</td>
<td>2018-22-2-1</td>
<td>Tensile strength (curved platens)</td>
<td>1.90 MPa</td>
<td>275 psi</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
<td>Direction of Loading</td>
<td>Orthogonal to the Borehole Axis</td>
<td></td>
</tr>
<tr>
<td>Drill Hole and Depth</td>
<td>BI-02; 47-48.9 ft</td>
<td>Type of Failure</td>
<td>Non-Structural</td>
<td></td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
<td>Conformance to dimensional Requirements</td>
<td>0.2 ≤ ( \frac{t}{D} ) ≤ 0.75</td>
<td>0.38</td>
</tr>
<tr>
<td>Geologic Unit</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Condition</td>
<td>As-received</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Date Received:** 4/24/2018  **Date Opened:** 4/24/2018  **Date Tested:** 4/30/2018

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
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</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
</tr>
<tr>
<td>Client Project No.</td>
<td>60537920</td>
</tr>
<tr>
<td>Registry No.</td>
<td>2018-22</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
</tr>
<tr>
<td>Drill Hole and Depth</td>
<td>BI-02; 52-54.7 ft</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>Geologic Unit</td>
<td>N/A</td>
</tr>
<tr>
<td>Moisture Condition</td>
<td>As-received</td>
</tr>
<tr>
<td>Rate of loading</td>
<td>0.11 MPa/sec, 957 psi/min</td>
</tr>
<tr>
<td>Diameter (D)</td>
<td>60.84 mm, 2.40 in</td>
</tr>
<tr>
<td>Thickness (t)</td>
<td>24.67 mm, 0.97 in</td>
</tr>
<tr>
<td>Maximum Load (P)</td>
<td>5.25 kN, 1,180 lbf</td>
</tr>
<tr>
<td>Tensile strength (flat platens)</td>
<td>$\sigma_f = \frac{2P}{\pi tD}$</td>
</tr>
<tr>
<td>Tensile strength (curved platens)</td>
<td>$\sigma_f = \frac{1.272P}{\pi tD}$</td>
</tr>
<tr>
<td>Type of Failure</td>
<td>Non-Structural</td>
</tr>
<tr>
<td>Conformance to dimensional Requirements</td>
<td>$0.2 \leq \frac{t}{D} \leq 0.75$</td>
</tr>
<tr>
<td>Date Received</td>
<td>4/24/2018</td>
</tr>
<tr>
<td>Date Opened</td>
<td>4/24/2018</td>
</tr>
<tr>
<td>Date Tested</td>
<td>4/30/2018</td>
</tr>
</tbody>
</table>

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**Brazilian Tensile Strength Test**
ASTM D3967 - 16

**Project Name**: Klamath River Dam Removal  
**Location**: Klamath River  
**Client**: Klamath River Renewal Corporation  
**Client Project No.**: 60537920  
**Registry No.**: 2018-22  
**Report No.**: 2018-22-2-3  
**Report Date**: 5/17/2018  
**Drill Hole and Depth**: BI-03; 18.4-20.1 ft  
**Rock Type**: Volcanic Breccia  
**Geologic Unit**: N/A  
**Moisture Condition**: As-received

<table>
<thead>
<tr>
<th>Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)</th>
<th>0.11 MPa/sec</th>
<th>957 psi/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (D)</td>
<td>60.74 mm</td>
<td>2.39 in</td>
</tr>
<tr>
<td>Thickness (t)</td>
<td>26.84 mm</td>
<td>1.06 in</td>
</tr>
<tr>
<td>Maximum Load (P)</td>
<td>1.51 kN</td>
<td>339 lbf</td>
</tr>
<tr>
<td>Tensile strength (flat platens)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Tensile strength (curved platens)</td>
<td>0.38 MPa</td>
<td>54 psi</td>
</tr>
<tr>
<td>Direction of Loading</td>
<td>Orthogonal to the Borehole Axis</td>
<td></td>
</tr>
<tr>
<td>Type of Failure</td>
<td>Non-Structural</td>
<td></td>
</tr>
<tr>
<td>Conformance to dimensional Requirements</td>
<td>$0.2 \leq \frac{t}{D} \leq 0.75$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{t}{D} = 0.44$</td>
<td>OK</td>
</tr>
</tbody>
</table>

**Date Received**: 4/24/2018  
**Date Opened**: 4/24/2018  
**Date Tested**: 4/30/2018

**Photo Before Test**  
**Photo After Test**

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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## Brazilian Tensile Strength Test

**ASTM D3967 - 16**

### Project Information

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
</tr>
<tr>
<td>Client Project No.</td>
<td>60537920</td>
</tr>
<tr>
<td>Registry No.</td>
<td>2018-22</td>
</tr>
<tr>
<td>Report No.</td>
<td>2018-22-2-4</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
</tr>
<tr>
<td>Drill Hole and Depth</td>
<td>BI-03; 22.9-24.2 ft</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>Geologic Unit</td>
<td>N/A</td>
</tr>
<tr>
<td>Moisture Condition</td>
<td>As-received</td>
</tr>
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</table>

### Test Parameters

<table>
<thead>
<tr>
<th>Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)</th>
<th>0.11 MPa/sec</th>
<th>957 psi/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (D)</td>
<td>60.26 mm</td>
<td>2.37 in</td>
</tr>
<tr>
<td>Thickness (t)</td>
<td>33.83 mm</td>
<td>1.33 in</td>
</tr>
<tr>
<td>Maximum Load (P)</td>
<td>0.55 kN</td>
<td>124 lbf</td>
</tr>
</tbody>
</table>

### Strength Calculations

- Tensile strength (flat platens): \( \sigma_t = \frac{2P}{\pi tD} \)
- Tensile strength (curved platens): \( \sigma_t = \frac{1.272P}{\pi tD} \)

### Additional Information

- Type of Failure: Non-Structural
- Conformance to dimensional Requirements: \( 0.2 \leq \frac{t}{D} \leq 0.75 \)
  - \( \frac{t}{D} = 0.56 \)
  - OK

### Photos

- Photo Before Test
- Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
</tr>
<tr>
<td>Client Project No.</td>
<td>60537920</td>
</tr>
<tr>
<td>Registry No.</td>
<td>2018-22</td>
</tr>
<tr>
<td>Report No.</td>
<td>2018-22-5-1</td>
</tr>
<tr>
<td>Report Date</td>
<td>5/17/2018</td>
</tr>
<tr>
<td>Drill Hole and Depth</td>
<td>BI-02; 51.3-51.7 ft</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
</tr>
<tr>
<td>Formation</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Condition</td>
<td>Cut by Slab Saw</td>
</tr>
<tr>
<td>Apparatus, Pin R.-H.</td>
<td>West Cerchar, 55/56</td>
</tr>
<tr>
<td>Direction of Scratch</td>
<td>Perpendicular to Core Axis</td>
</tr>
<tr>
<td>Pin Wear (mm)</td>
<td></td>
</tr>
<tr>
<td>0.156</td>
<td>0.145</td>
</tr>
<tr>
<td>0.142</td>
<td>0.124</td>
</tr>
<tr>
<td>0.144</td>
<td>0.133</td>
</tr>
<tr>
<td>0.162</td>
<td>0.129</td>
</tr>
<tr>
<td>0.150</td>
<td>0.140</td>
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<td>Average (mm)</td>
<td>0.143</td>
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<td>CAIs</td>
<td>1.43</td>
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<td>CAI</td>
<td>1.89</td>
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<td>Classification</td>
<td>Medium Abrasiveness</td>
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<td>Date Received :</td>
<td>4/24/2018</td>
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<tr>
<td>Date Opened :</td>
<td>4/24/2018</td>
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<td>Date Tested:</td>
<td>4/30/2018</td>
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</table>

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Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.
# Cerchar Abrasiveness Test

**ASTM D7625 - 10**

**Tonon USA:**
Engineering, Measurements and Testing, LLC
Web: tononeng.com

**Cerchar Abrasiveness Test**

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
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<tbody>
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<td>2018-22</td>
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<tr>
<td>Drill Hole and Depth</td>
<td>BI-03; 25.1-26.1 ft</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
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<tr>
<td>Formation</td>
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<tr>
<td>Surface Condition</td>
<td>Cut by Slab Saw</td>
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<tr>
<td>Apparatus, Pin R.-H.</td>
<td>West Cerchar, 55/56</td>
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<td>Direction of Scratch</td>
<td>Perpendicular to Core Axis</td>
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<tr>
<td>Pin Wear (mm)</td>
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<tr>
<td></td>
<td>0.083</td>
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<td>0.104</td>
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<tr>
<td></td>
<td>0.100</td>
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<tr>
<td>Average (mm)</td>
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<tr>
<td>CAIs</td>
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<tr>
<td>CAI</td>
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<tr>
<td>Classification</td>
<td>Medium Abrasiveness</td>
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**Photo After Test**

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.  
Checked by: Gloria Tonon-Kozma, P.E.

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---

2028 E Ben White BLVD #240-2660  
Austin, TX 78741  

2018-22-6, R12, Cerchar Test, AECOM Klamath River  
Page 2 of 2
A sample from borehole BI-02; 51.7-52 ft was analyzed under the polarized microscope to determine its mineralogical composition from a 25 X 40 mm (0.9 X 1.58 in) thin section.

Visual inspection of the sample suggests an igneous origin.

**ROCK NAME: BRECCIATED-ALTERED BASALT** (according to EN 12670).

![Aspect of the studied sample (hand specimen)](image)

**Fig. 1** - Aspect of the studied sample (hand specimen).
Hand specimen – Visual inspection: It is a mafic, greenish and dusty material with a very weak behavior. It is composed of a dark and very fine groundmass with phenocrysts that are millimetric in size, and light to dark colored.

According to the Rock-Color Chart of the Geological Society of America, the groundmass color is Grayish Green (5G 5/2), and the phenocrysts are Grayish Green (10G 4/2) to Light Bluish Gray (5B 7/1).

The rock fizzes under hydrochloric acid, and it can be scratched by a metal tip.

Probable Origin: It is an altered Plagioclase-rich basaltic rock.

Mineralogy: Plagioclase, Clay Minerals, Olivine, Opaque Minerals, Volcanic Glass, Carbonates

Textures: The rock has a porphyric texture with a very fine and dark groundmass, in which there are Plagioclase crystals, rare Olivine crystals, Opaque Minerals, and many alteration Clay Minerals (predominantly Phyllosilicates such as Chlorite).

Plagioclase is the most common mineral phase: crystals are quite large and well zoned. Because of their golden color, clay minerals can be hardly distinguished from the groundmass, except for Chlorite that can be locally seen in amorphous greenish individuals.

Olivine are mainly made up of Oxides of the Hematite group.

Spotted Carbonates may be also identified.

Alteration and Mineral Suturing Condition: The rock is highly altered: even the largest phenocrysts show traces of intense alteration acted upon by clayey minerals; Plagioclase crystals are intensively fractured. These fractures are commonly filled with secondary clayey material in a “quasi-stylolitic” pattern.

Discontinuities: The rock shows a very pervasive fracture system: many of these fractures have not been filled with secondary mineralization, and they predominantly cross the groundmass. Fractures crossing phenocrysts are instead filled with clay minerals.
### Description of Individual Minerals:

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Mineral Content (%)</th>
<th>Mohs Hardness</th>
<th>Grain Size (mm)</th>
<th>Description and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plagioclase</td>
<td>33.3</td>
<td>6</td>
<td>1.10</td>
<td>As individual crystals</td>
</tr>
<tr>
<td>Chlorite</td>
<td>1.67</td>
<td>2.5</td>
<td>0.05</td>
<td>Very variable in size, alteration single crystals</td>
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<tr>
<td>Oxides</td>
<td>6.67</td>
<td>5.5</td>
<td>0.02-0.8</td>
<td>Spotted Hematite individuals</td>
</tr>
<tr>
<td>Glass</td>
<td>50</td>
<td>5</td>
<td>Sub-micrometric</td>
<td>Makes up the groundmass</td>
</tr>
<tr>
<td>Clay</td>
<td>8.33</td>
<td>4</td>
<td>Sub-micrometric</td>
<td>Phyllosilicates, unresolvable at a microscopic scale</td>
</tr>
</tbody>
</table>

Weighted Average: 4.2

-
Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample, showing an altered Plagioclase (Plg) crystal near to a big Hematite crystal (Opq).

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.
**Fig. 4** - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase grain, crossed by many fractures, all filled with Clay Minerals (Cly). Some Chlorite individuals (Chl) may be identified in the upper part of the picture.

**Fig. 5** - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 4, but under crossed polars.
Fig. 6 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A selected area of the section with a well-developed fracture system (Frt).

Fig. 7 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 6, but under crossed polars.
A sample from borehole BI-03; 20.8-21 ft was analyzed under the polarized microscope to determine its mineralogical composition from a 25 X 40 mm (0.9 X 1.58 in) thin section.

Visual inspection of the sample suggests an igneous origin.

**ROCK NAME: ALTERED VOLCANIC BRECCIA** (according to EN 12670).

![Image of a thin section sample]

**Fig. 1** - Aspect of the studied sample (hand specimen).
Hand specimen – Visual inspection: It is a greenish mafic rock. It appears to be very weak, and it shows a dusty appearance. It is composed of a dark green groundmass with spotted whitish to bluish phenocrysts.

According to the Rock-Color Chart of the Geological Society of America, the groundmass color is Grayish Green (5G 5/2); clasts have colors ranging from Dark Greenish Gray (4G 4/1) to Light Bluish Gray (5B 7/1). The matter also shows alterations that are Dark Greenish Yellow (10Y 6/6).

The rock fizzes under hydrochloric acid, and it can be scratched by a metal tip.

Probable Origin: It is an altered volcanic breccia.


Textures: It is a mafic porphyritic rock with a chaotic structure: no preferred orientation may be identified.

Plagioclase is the most common constituent mineral: its crystals range from sub-millimetric in size to glassy and are usually well shaped. Zonation is irregular.

Some of the clasts are made up of extraneous volcanic clasts; they can be easily identified because of their color variation when compared to the rest of the thin section: these clasts display a different mafic content.

Secondary mineral phases are made up of rare Augite-Pyroxene, Chlorite, Carbonates and Opaque Minerals.

Very common, but not resolvable at a microscopic observation scale, are Volcanic Glass and Clay Minerals. Clay Minerals also represent the main alteration substance of the rock, which affects both the groundmass and the clasts.

Alteration and Mineral Suturing Condition: The sample shows a substantial clayey alteration, with clear Chlorite individuals associated with very fine-grained Clay Minerals. Spotted secondary Carbonates can be found as fracture filling material.

Crystals in this thin section have well defined rims, but they are also affected by pervasive fractures both within the crystals and all around their boundaries.

Discontinuities: The rock is heavily fractured, with two classes of discontinuities: a first one made up of empty cracks crossing the groundmass and the crystals, and a second one made up of Carbonate-filled fractures, sometimes surrounding single crystals or clasts.
## Description of Individual Minerals:

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Mineral Content (%)</th>
<th>Mohs Hardness</th>
<th>Grain Size (mm)</th>
<th>Description and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plagioclase</td>
<td>28.33</td>
<td>6</td>
<td>0.6</td>
<td>As single individuals or as the main part of many external clast groundmass</td>
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<tr>
<td>Chlorite</td>
<td>1.67</td>
<td>2</td>
<td>0.3</td>
<td>As individuals of secondary crystallization</td>
</tr>
<tr>
<td>Opaque Minerals</td>
<td>5</td>
<td>5.5</td>
<td>0.1</td>
<td>Spotted individuals of Hematite</td>
</tr>
<tr>
<td>Glass</td>
<td>41.67</td>
<td>5</td>
<td>Sub-micrometric</td>
<td>Makes up the groundmass</td>
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<tr>
<td>Pyroxene</td>
<td>1.67</td>
<td>5</td>
<td>0.2</td>
<td>Rare sub-euhedral crystals</td>
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<tr>
<td>Carbonates</td>
<td>5</td>
<td>4</td>
<td>0.06</td>
<td>As fracture filling material</td>
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<tr>
<td>Clay Minerals</td>
<td>16.67</td>
<td>2</td>
<td>Sub-micrometric</td>
<td>Phyllosilicates of secondary alteration</td>
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<tr>
<td>Weighted Average:</td>
<td>4.3</td>
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<td></td>
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</tr>
</tbody>
</table>
Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample. The most common minerals are: Plagioclase (Plg), Clay Minerals (Cly), Opaque Minerals (Opq), and Chlorite (Chl). Also highlighted here are some structural features, such as fractures (Frt) and voids (Vd).

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.
Fig. 4 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of a volcanic clast. A common feature of all the clasts in this thin section is the presence of fractures surrounding clast boundaries (follow the green dashed line). In this case the fracture is filled with secondary Carbonates (Cbt).

Fig. 5 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 4, but under crossed polars.
Fig. 6 - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase crystal, showing grain alteration and suturing features: fractures cross the crystal and are also filled with Clay Minerals.

Fig. 7 - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 6, but under crossed polars.
Mohs Hardness

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
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<td>Client Project No.</td>
<td>60537920</td>
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<td>Registry No.</td>
<td>2018-22</td>
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<tr>
<td>Report No.</td>
<td>2018-22-8-1</td>
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<tr>
<td>Report Date</td>
<td>5/17/2018</td>
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<tr>
<td>Drill Hole and Depth</td>
<td>BI-02; 27-27.9 ft</td>
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<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
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<tr>
<td>Geologic Unit</td>
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<tr>
<td>Moisture Condition</td>
<td>As-received</td>
</tr>
</tbody>
</table>

Date received : 4/24/2018  Date Opened : 4/24/2018  Date Tested: 4/24/2018

Mohs Hardness

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<tr>
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<tbody>
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</table>

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.  Checked by: Gloria Tonon-Kozma, P.E.

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Date received : 4/24/2018  
Date Opened : 4/24/2018  
Date Tested: 4/24/2018

**Mohs Hardness**

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Mohs Hardness

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Mohs Hardness

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Date received : 4/24/2018  Date Opened : 4/24/2018  Date Tested: 4/24/2018

Mohs Hardness

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| Date received       | 4/24/2018 |
| Date Opened         | 4/24/2018 |
| Date Tested         | 4/24/2018 |

**Mohs Hardness**

| 3 |

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Checked by: Gloria Tonon-Kozma, P.E.

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### Project Name
Klamath River Dam Removal

### Location
Klamath River

### Client
Klamath River Renewal Corporation

### Client Project No.
60537920

### Registry No.
2018-22

### Report No.
2018-22-8-1

### Drill Hole and Depth
BI-02; 50.3-51.3 ft

### Rock Type
Volcanic Breccia

### Geologic Unit
N/A

### Moisture Condition
As-received

### Penetration rate
0.001 in/sec

### Diameter of specimen
60.65 mm, 2.39 in

### Height of specimen
64.62 mm, 2.54 in

### Load at peak
27.81 kN, 6,251 lbf

### 45 Degree (Standard) Index
175

### Peak Slope Index
39

### Date Received
4/24/2018

### Date Opened
4/24/2018

### Date Tested
5/4/2018

---

**Test Data**

**45 deg Slope**

**Peak Slope**

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<tr>
<td>50</td>
<td>1.00</td>
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Photo After Test

Performed by: Dr. Fulvio Tonon, P.E., Ph.D. 

Checked by: Gloria Tonon-Kozma, P.E.

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<table>
<thead>
<tr>
<th>Project Name</th>
<th>Klamath River Dam Removal</th>
<th>Penetration rate</th>
<th>0.001 in/sec</th>
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<tbody>
<tr>
<td>Location</td>
<td>Klamath River</td>
<td>Diameter of specimen</td>
<td>60.4 mm 2.38 in</td>
</tr>
<tr>
<td>Client</td>
<td>Klamath River Renewal Corporation</td>
<td>Height of specimen</td>
<td>67.53 mm 2.66 in</td>
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<td>Client Project No.</td>
<td>60537920</td>
<td>Load at peak</td>
<td>19.46 kN 4,373 lbf</td>
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<tr>
<td>Registry No.</td>
<td>2018-22</td>
<td>45 Degree (Standard) Index</td>
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<td>2018-22-8-2</td>
<td>Peak Slope Index</td>
<td>18</td>
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<td>5/17/2018</td>
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<tr>
<td>Drill Hole and Depth</td>
<td>BI-03; 24.2-25.1 ft</td>
<td></td>
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<tr>
<td>Rock Type</td>
<td>Volcanic Breccia</td>
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<tr>
<td>Geologic Unit</td>
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<tr>
<td>Moisture Condition</td>
<td>As-received</td>
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Date Received: 4/24/2018  Date Opened: 4/24/2018  Date Tested: 5/4/2018

![Penetration vs Load Graph](image-url)
Photo After Test

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Checked by: Gloria Tonon-Kozma, P.E.

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B-01: 9.0 feet to 25.5 feet Depth (Box 1 of 1)

B-03: 22.3 feet to 27.3 feet Depth (Box 1 of 1)
B-04: 11.0 feet to 31.5 feet Depth (Box 1 of 1)
B-05: 7.0 feet to 37.3 feet Depth (Box 1 of 2)

B-05: 37.3 feet to 50.0 feet Depth (Box 2 of 2)
B-06: 52.0 feet to 57.0 feet Depth (Box 1 of 1)

B-07: 19.0 feet to 31.8 feet Depth (Box 1 of 1)
B-08: 35.8 feet to 47.8 feet Depth (Box 1 of 2)

B-07: 47.8 feet to 52.8 feet Depth (Box 2 of 2)
B-10: 29.5 feet to 44.3 feet Depth (Box 1 of 2)

B-10: 44.3 feet to 52.0 feet Depth (Box 2 of 2)
B-13: 2.0 feet to 21.1 feet Depth (Box 1 of 1)

B-14: 8.0 feet to 28.6 feet Depth (Box 1 of 1)
B-15: 21.0 feet to 40.6 feet Depth (Box 1 of 2)

B-15: 40.6 feet to 51.5 feet Depth (Box 2 of 2)
B-16: 0.0 feet to 15.4 feet Depth (Box 1 of 2)

B-16: 15.4 feet to 24.5 feet Depth (Box 2 of 2)
B-17: 15.0 feet to 29.1 feet Depth (Box 1 of 2)

B-17: 29.1 feet to 41.5 feet Depth (Box 2 of 2)
B-19: 30.0 feet to 37.5 feet Depth (Box 1 of 1)

B-20: 40.0 feet to 47.0 feet Depth (Box 1 of 1)
B-201: 23.5 feet to 37.5 feet Depth (Box 1 of 2)

B-201: 37.5 feet to 50.5 feet Depth (Box 2 of 2)
B-202: 14 feet to 45 feet Depth (Box 1 of 6)

B-202: 45.5 feet to 61.3 feet Depth (Box 2 of 6)
B-202: 61.3 feet to 71.7 feet Depth (Box 3 of 6)

B-202: 71.7 feet to 83.9 feet Depth (Box 4 of 6)
B-202: 83.9 feet to 95.5 feet Depth (Box 5 of 6)

B-202: 95.5 feet to 100.5 feet Depth (Box 6 of 6)
B-203: 2.0 feet to 31.5 feet Depth (Box 1 of 7)

B-203: 31.5 feet to 46.5 feet Depth (Box 2 of 7)
B-203: 46.5 feet to 60.5 feet Depth (Box 3 of 7)

B-203: 60.5 feet to 75.5 feet Depth (Box 4 of 7)
B-203: 75.5 feet to 90.5 feet Depth (Box 5 of 7)

B-203: 90.5 feet to 105.5 feet Depth (Box 6 of 7)
B-203: 105.5 feet to 120 feet Depth (Box 7 of 7)
B-205: 19.5 feet to 30.6 feet Depth (Box 1 of 5)

B-205: 30.6 feet to 39.7 feet Depth (Box 2 of 5)
B-205: 39.7 feet to 49.5 feet Depth (Box 3 of 5)

B-205: 49.5 feet to 59.5 feet Depth (Box 4 of 5)
B-205: 59.5 feet to 62 feet Depth (Box 5 of 5)
B-206: 20 feet to 36.5 feet Depth (Box 1 of 6)

B-206: 36.5 feet to 47.4 feet Depth (Box 2 of 6)
B-206: 47.4 feet to 60.0 feet Depth (Box 3 of 6)

B-206: 60.0 feet to 73.6 feet Depth (Box 4 of 6)
B-206: 73.6 feet to 88.8 feet Depth (Box 5 of 6)

B-206: 88.8 feet to 100.0 feet Depth (Box 6 of 6)
B-207: 15.2 feet to 30.8 feet Depth (Box 1 of 5)

B-207: 30.8 feet to 49.4 feet Depth (Box 2 of 5)
B-207: 49.4 feet to 62.0 feet Depth (Box 3 of 5)

B-207: 62.0 feet to 77.0 feet Depth (Box 4 of 5)
B-207: 77.0 feet to 81.1 feet Depth (Box 5 of 5)
B-208: 20.0 feet to 56.0 feet Depth (Box 1 of 3)

B-208: 56.0 feet to 72.5 feet Depth (Box 2 of 3)
B-208: 72.5 feet to 80.0 feet Depth (Box 3 of 3)
BI-02: 17.5 feet to 34.0 feet Depth (Box 1 of 4)

BI-02: 34.0 feet to 46.7 feet Depth (Box 2 of 4)
BI-02: 46.7 feet to 61.1 feet Depth (Box 3 of 4)

BI-02: 61.1 feet to 67.0 feet Depth (Box 4 of 4)
BI-03: 5.5 feet to 20.1 feet Depth (Box 1 of 2)

BI-03: 20.1 feet to 35.1 feet Depth (Box 2 of 2)