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TECHNICAL MEMORANDUM

DATE: January 13, 2012 **Project 605.31**

TO: Greg Ghidotti
RESOLUTION COPPER MINING LLC

FROM: Charlie King, Janis Fleming, Kate Duke, and Todd Keay
MONTGOMERY & ASSOCIATES

SUBJECT: RESULTS OF DRILLING, CONSTRUCTION, AND TESTING OF HYDROLOGIC TEST WELLS HRES-16, HRES-17, AND HRES-18 RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA

In accordance with a request from Mr. Greg Ghidotti, Resolution Copper Mining LLC (RCM), Montgomery & Associates (M&A) has prepared this Technical Memorandum to summarize results of drilling, construction, and testing at hydrologic test wells HRES-16, HRES-17, and HRES-18. The wells were installed to characterize hydrogeologic conditions in the Apache Leap Tuff (ALT) on the east side of Devils Canyon near the JI Ranch Fault. HRES-16 is a larger diameter well (nominal 8-inch) that was completed to provide a location for long-term aquifer testing in the ALT aquifer. Monitoring data obtained from HRES-16, HRES-17, and HRES-18 have been incorporated into the RCM hydrologic monitoring program.

HRES-16 SUMMARY

A summary of drilling, construction, and testing operations and results for HRES-16 is provided below:

1. Hydrologic test well HRES-16 is located on land owned by the State of Arizona, in Township 2 South, Range 13 East, in the NE ¼ of the NW ¼ of the SE ¼ of Section 4 ((D-2-13)04dba), on the east side of Devils Canyon, near the JI Ranch Fault and the intersection of Hidden Graben and Rawhide Graben.
2. Well HRES-16 was drilled and constructed during the period June 21 through July 3, 2011.

3. Total drilled depth is 358.1 meters below land surface (bls).
4. Geologic units encountered during drilling from land surface to total depth include ALT (Tal; 0 to 344.0 meters) and Tertiary Whitetail Conglomerate (Tw; 344.0 to 358.1 meters).
5. HRES-16 was completed within the Tal with two perforated intervals from 110.0 to 270.0 and from 289.3 to 347.2 meters bls; non-pumping water level was 113.00 meters bls on November 22, 2011.
6. Following installation of production casing, a 5-hour airlift test was conducted to develop the well and provide preliminary aquifer parameters and water quality in the ALT aquifer at this location; recovery data was not suitable for analysis.
7. A water sample was collected for laboratory chemical analyses near the end of the airlift test.

HRES-17 SUMMARY

A summary of drilling, construction, and testing operations and results for HRES-17 is provided below:

1. Hydrologic test well HRES-17 is located on land owned by the U.S. Forest Service, in Township 1 South, Range 13 East, in the SW ¼ of the SW ¼ of the SE ¼ of Section 26 ((D-1-13)26dcc), on the east side of Devils Canyon near the JI Ranch Fault.
2. Well HRES-17 was drilled and constructed during the period July 8 through July 18, 2011.
3. Total drilled depth is 443.5 meters bls.
4. Geologic units encountered during drilling from land surface to total depth include Tal (0 to 428.4 meters) and Tw (428.4 to 443.5 meters).
5. HRES-17 was completed within the Tal with a single perforated interval from 221.1 to 405.3 meters bls; non-pumping water level was 226.20 meters bls on November 22, 2011.
6. Following installation of production casing, a 4-hour airlift test was conducted to develop the well and provide preliminary aquifer parameters and water quality at this location; this test yielded an estimated transmissivity of 11 meters squared per day (m^2/d).
7. A water sample was collected for laboratory chemical analyses near the end of the airlift test.

HRES-18 SUMMARY

A summary of drilling and construction operations for HRES-18 is provided below:

1. Hydrologic test well HRES-18 is located on land owned by the State of Arizona, in Township 2 South, Range 13 East, in the NE ¼ of the NW ¼ of the NW ¼ of Section 3 ((D-2-13)03bba), on the east side of Devils Canyon near the JI Ranch Fault.

2. Well HRES-18 was drilled and constructed during the period July 22 through July 28, 2011.
3. Total drilled depth is 324.9 meters bls.
4. Geologic units encountered during drilling from land surface to total depth include Tal (0 to 299.3 meters) and Tw (299.3 to 324.9 meters).
5. HRES-18 was completed within the Tal with a single perforated interval from 140.8 to 286.5 meters bls; non-pumping water level was 209.51 meters bls on November 22, 2011.
6. Following installation of production casing, airlift surging was conducted to develop the well; the well did not sustain discharge so an airlift test was not conducted.

INTRODUCTION

Hydrologic test wells HRES-16, HRES-17, and HRES-18 were drilled and constructed during the period June 21 through July 28, 2011. The wells were drilled to:

- evaluate groundwater conditions in the ALT aquifer on the east side of Devils Canyon near the JI Ranch Fault
- provide groundwater level and groundwater quality monitoring locations
- provide a larger diameter hydrologic test well at the intersection between the Hidden Graben and Rawhide Graben (HRES-16)

Hydrologic test wells HRES-16, HRES-17, and HRES-18 were drilled into the Tw and completed to permit hydrologic testing within the Tal. Well HRES-16 is located on land owned by the State of Arizona, in Township 2 South, Range 13 East, in the NE ¼ of the NW ¼ of the SE ¼ of Section 4 ((D-2-13)04dba), on the east side of Devils Canyon, near the JI Ranch Fault and the intersection of Hidden Graben and Rawhide Graben. Well HRES-17 is located on land owned by the U.S. Forest Service, in Township 1 South, Range 13 East, in the SW ¼ of the SW ¼ of the SE ¼ of Section 26 ((D-1-13)26dcc), on the east side of Devils Canyon near the JI Ranch Fault. Well HRES-18 is located on land owned by the State of Arizona, in Township 2 South, Range 13 East, in the NE ¼ of the NW ¼ of the NW ¼ of Section 3 ((D-2-13)03bba), on the east side of Devils Canyon near the JI Ranch Fault. **Figure 1** shows the locations for HRES-16, HRES-17, and HRES-18. **Figures 2 through 4** are schematic diagrams of well construction for the test wells. Other data summarized on the schematic diagrams include: hydrogeologic units, drilling penetration rate, water production rate during drilling operations, drilling method, fracture summary logs, borehole geophysical logs, and groundwater levels. Detailed lithologic logs for the test wells are provided in **Appendix A**.

DRILLING OPERATIONS

Hydrologic test wells HRES-16, HRES-17, and HRES-18 were drilled and constructed by Boart Longyear Drilling Services (Boart Longyear) of Salt Lake City, Utah, using a Lang LM-140 (Rig LK35A) top-head drive rotary drill rig. The wells were drilled in accordance with technical specifications prepared by M&A. RCM personnel coordinated drilling contractor activities and purchase of well construction materials. Daily drilling reports were prepared by Boart Longyear personnel and were submitted to RCM for review. M&A personnel described drill cuttings samples and provided on-site monitoring during critical phases of drilling and construction of the wells. RCM provided daily summaries of drilling progress. Daily summary data are provided in **Appendix B**.

Wells HRES-16, HRES-17, and HRES-18 were drilled to 358.1, 443.5, and 324.9 meters bls, respectively, and blank and perforated casing was installed to the designed depths. Final completion of the wells was designed by M&A based on review of lithologic and hydrologic conditions encountered during drilling operations, and borehole geophysical logs.

Drilling Method

The boreholes for HRES-16, HRES-17, and HRES-18 were drilled using the conventional air rotary method for the surface casing borehole, and the dual-wall air reverse circulation and air-assisted flooded reverse circulation methods for the production intervals of the boreholes. Depths, drilling methods, and bit types and sizes are summarized in **Table 1**.

TABLE 1. SUMMARY OF DRILLING METHODS AND BOREHOLE DIAMETERS HYDROLOGIC TEST WELLS HRES-16, HRES-17 AND HRES-18

Well	Depth Interval (meters)	Drilling Method	Bit Type	Borehole Diameter (inches)
HRES-16	0 – 19.5	conventional air rotary	tricone	20-1/2
	19.5 – 50.3	reverse circulation air percussion	hammer	14-3/4
	50.3 – 205.7	reverse circulation air percussion	hammer	12-1/2
	205.7 – 358.1	air-assisted flooded reverse circulation	tricone	12-1/4
HRES-17	0 – 12.2	conventional air rotary	tricone	17-1/4
	12.2 – 443.5	reverse circulation air percussion	hammer	10
HRES-18	0 – 12.2	conventional air rotary	tricone	17-1/4
	12.2 – 324.9	reverse circulation air percussion	hammer	10

For the production portion of the borehole at HRES-16, HRES-17, and HRES-18, the dual-wall air reverse circulation method was used to allow for measurement of groundwater production during drilling. At HRES-16, at a depth of 205.7 meters bls, the drilling method was

changed to the air-assisted flooded reverse method for the remainder of the borehole due to restricted water storage on site.

Drilling Fluid and Drill Cuttings Management

Air and water were used during drilling operations for the production interval of the boreholes. When air methods were used, the drilling fluids were discharged to a cyclone to separate air from the fluid stream. The remaining drilling fluid and cuttings then flowed through a vibrating screen to remove coarse material. Formation fluids were removed from the site using vacuum trucks, and then deposited at a designated storage facility at the RCM West Plant site. Drill cuttings from the Tal were collected in the bucket of a back-hoe and then spread on site. Drill cuttings from the Tw were stored on site and then removed from site using vacuum trucks to be deposited at the RCM West Plant site.

Monitoring of Drilling Conditions

During drilling operations, drill penetration rate was monitored by Boart Longyear by recording drill start and stop times for each 6.1-meter drill rod. A summary of drill penetration rate data for each well is shown on **Figures 2 through 4**. In addition to drill penetration rate, rotational torque was monitored by drilling personnel, and zones of variable or increasing torque were noted as a potential indicator of fracturing. The field data recorded by Boart Longyear are on file at M&A. Borehole deviation surveys were conducted on a regular basis using a Totco mechanical drift recorder. At HRES-16, borehole deviation was 1.0 degree or less for the depth interval from land surface to 243.8 meters bls using the dual-wall air reverse circulation drilling method. Maximum borehole deviation was 1.75 degrees at a depth of 274.3 meters bls using the air-assisted flooded reverse circulation drilling method. At HRES-17, borehole deviation reached 1.0 degree by 61.0 meters bls and 2 degrees by 121.9 meters bls. Borehole deviation remained between 2.0 and 2.5 degrees for the depth interval from 121.9 to 396.2 meters bls. At HRES-18, borehole deviation reached 1.0 degree at 91.4 meters bls. Borehole deviation ranged between 0.7 and 1.25 degrees for the depth interval from 91.4 to 324.9 meters bls.

Monitoring of Lithologic Conditions

Drill cuttings samples were collected at 10-foot intervals and placed in labeled bags. Lithologic descriptions for each sample were prepared in the field by M&A personnel. Splits of each sample were placed in plastic chip trays and were provided to RCM. Bulk cuttings samples have been stored by RCM. Detailed lithologic descriptions are given in **Appendix A**.

Monitoring of Groundwater Conditions

When the dual-wall air reverse circulation drilling method was used, it was possible to monitor for the presence of groundwater and to determine approximately where groundwater inflow zones were encountered. Observations of natural groundwater production were made

after drilling out each 6.1-meter drill rod. Prior to measurement of production rate, injection water was cut off from the airstream, and air circulation was continued for 10 to 15 minutes. When discharge stabilized, discharge rate was measured using a 2-gallon bucket and a stop watch. Water production could not be monitored during air-assisted flooded reverse circulation drilling at HRES-16.

Groundwater production was measured in the depth interval from 19.5 to 205.7 meters bls at HRES-16, and from 12.2 meters bls to total depth at HRES-17 and HRES-18. Flow measurements are provided on **Figures 2 through 4**. First measurable water production rate at HRES-16 was 0.2 liters per second (L/s) at a depth of 132.6 meters bls. Groundwater production rate varied between 0.2 and 1.1 L/s for the depth interval from 132.6 to 205.7 meters bls. Maximum measured groundwater production rate was 1.1 L/s at 199.6 and 205.7 meters bls. First measurable water production rate at HRES-17 was 0.4 L/s at a depth of 254.5 meters bls. Groundwater production rate varied between 0.4 and 1.1 L/s for the depth interval from 254.5 to 443.5 meters bls. Maximum measured groundwater production rate was 1.1 L/s at 388.6 meters bls. Only trace water was produced at HRES-18 for the depth interval from 273.1 meters bls to total depth.

Discharge water for the wells was monitored for changes in water quality parameters (temperature, pH, specific conductance, and sand content). At HRES-16, temperature of the discharge water ranged from 21.0 to 28.7 degrees Celsius (^{o}C) and showed a decreasing trend with drilled depth. Specific electrical conductance ranged from 274.9 to 339.6 microsiemens per centimeter (µS/cm). The pH meter was not functioning during drilling at HRES-16. At HRES-17, the temperature of the discharge water ranged from 20.9 to 25.7 ^{o}C. The pH ranged from 7.65 to 8.79. Specific electrical conductance ranged from 204.4 to 406.7 µS/cm.

BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logging was conducted when the boreholes for HRES-16, HRES-17, and HRES-18 reached total depth. Borehole geophysical logging services were provided by Southwest Exploration Services, LLC (SWE) of Gilbert, Arizona. Borehole geophysical logging was conducted at HRES-16 on July 2, at HRES-17 on July 15, and at HRES-18 on July 27, 2011. The suite of geophysical logs obtained at HRES-16 and HRES-17 included: short and long normal resistivity (E-logs), spontaneous potential, natural gamma ray, caliper, sonic, single point resistance, fluid resistivity, temperature, and optical borehole imaging (OBI). An acoustic borehole imaging (ABI) log was also obtained at HRES-17. An ABI log was not collected at HRES-16 due to an obstruction in the borehole when logging was conducted. At the time of logging of HRES-18, fluid level in the borehole was 259.1 meters bls and the lower 25 meters of the borehole was filled with sloughed material. Because of the limited saturated borehole interval (259 to 300 meters bls) the only logs obtained were natural gamma ray, caliper, fluid resistivity, temperature, and OBI. **Table 2** shows logs obtained and depth intervals for each type of log. SWE submitted field logs in digital and hard copy format to

RCM staff. Final logs were submitted electronically. Summary geophysical logs for HRES-16, HRES-17, and HRES-18 are provided on **Figures 2 through 4**.

TABLE 2. SUMMARY OF BOREHOLE GEOPHYSICAL LOGS OBTAINED AT WELLS HRES-16, HRES-17, AND HRES-18

Geophysical Log	HRES-16 Depth Interval (meters, bls)	HRES-17 Depth Interval (meters, bls)	HRES-18 Depth Interval (meters, bls)
Caliper	0 – 354	0 – 441	0 – 300
Temperature	115 – 355	226 – 442	259.1 – 300
Fluid resistivity	114 – 355	226 – 442	259.1 – 300
Natural gamma ray	0 – 354	0 – 440	0 – 299
Short-long normal resistivity	124 – 355	225 – 442	N/A
Single point resistance	124 – 355	225 – 440	N/A
Spontaneous Potential	124 – 355	225 – 440	N/A
Sonic	114 – 355	226 – 442	N/A
Borehole Imaging (OBI or ABI)	OBI 19.5 – 114.2	ABI 227.2 – 441.3 OBI 11.1 – 415	OBI 12 – 300.7

N/A= not obtained; OBI = Optical borehole image; ABI = Acoustic borehole image

ANALYSIS OF GEOLOGIC CONDITIONS

Geologic Contacts

Geologic contacts were picked based on analysis of drill cutting samples, geophysical logs, and information obtained during drilling. Detailed lithologic descriptions based on drill cuttings samples are provided in **Appendix A**. Geophysical logs were used to confirm the formation depth intervals given in **Table 3** and shown on **Figures 2, 3, and 4**.

TABLE 3. SUMMARY OF GEOLOGIC UNITS DRILLED FOR HYDROLOGIC TEST WELLS HRES-16, HRES-17, AND HRES-18			
	Depth Interval (meters)		
Geologic Formation	HRES-16	HRES-17	HRES-18
Apache Leap Tuff – White Unit (Talw)	0 – 64.0	0 – 70.1	Not present
Apache Leap Tuff – Gray Unit (Talg)	64.0 – 216.4	70.1 – 298.7	0 – 198.1
Apache Leap Tuff – Brown Unit (Talb)	216.4 – 328.7	298.7 – 402.3	198.1 – 298.5
Apache Leap Tuff – Vitrophyre (Talv)	328.7 – 338.5	402.3 – 425.5	Not present
Apache Leap Tuff – Basal tuff (Talbt)	338.5 – 344.0	425.5 – 428.4	298.5 – 299.3
Whitetail Conglomerate (Tw)	344.0 – 358.1	428.4 – 443.5	299.3 – 324.9

Apache Leap Tuff (Tal)

At HRES-16 the Tal is 344.0 meters thick and consists of White Unit (Talw) from land surface to 64.0 meters bls, Gray Unit (Talg) from 64.0 to 216.4 meters bls, Brown Unit (Talb) from 216.4 to 328.7 meters bls, vitrophyre (Talv) from 328.7 to 338.5 meters bls, and basal tuff (Talbt) from 338.5 to 344.0 meters bls. The Talw, Talg, Talb, and Talbt are dacite porphyry tuff with phenocrysts of potassium and plagioclase feldspar, quartz, and biotite, and trace amounts of pumice and lithic fragments (or more if specified). At HRES-16 the Talw is a partially welded crystal-rich tuff with approximately 60 percent pinkish-gray and white, aphanitic to microcrystalline groundmass, 38 percent phenocrysts, and 2 percent very light gray pumice. The Talg is a welded crystal-rich tuff with 65 percent pinkish-gray to pinkish-brown, microcrystalline groundmass, 34 percent phenocrysts, and 1 percent very light gray pumice. The Talb is a densely welded crystal-rich tuff with approximately 60 percent pinkish-brown and orange-brown, glassy to cryptocrystalline groundmass and 40 percent phenocrysts. The Talv is a black glassy porphyritic vitrophyre with the same phenocryst assemblage as the tuff. The Talbt is an unwelded tuff with approximately 80 percent very light gray to pale pink aphanitic groundmass and 20 percent phenocrysts.

At HRES-17 the Tal is 428.4 meters thick and consists of Talw from land surface to 70.1 meters bls, Talg from 70.1 to 298.7 meters bls, Talb from 298.7 to 402.3 meters bls, Talv from 402.3 to 425.5 meters bls, and Talbt from 425.5 to 428.4 meters bls. At HRES-17 the Talw is a partially welded crystal-rich tuff with approximately 60 percent pinkish-white and red, aphanitic groundmass, 40 percent phenocrysts, and trace very light gray pumice. The Talg is a welded crystal-rich tuff with 55 percent reddish-brown cryptocrystalline groundmass, 45 percent phenocrysts, and trace very light gray pumice. The Talb is a densely welded crystal-rich tuff with approximately 65 percent brown and orange-brown, glassy to cryptocrystalline groundmass, 33 percent phenocrysts, and 2 percent lithic fragments. The percentage of lithic fragments increases towards the vitrophyre. The Talv is a black glassy porphyritic vitrophyre with the same phenocryst assemblage as the tuff. There is a small layer of Talbt within the vitrophyre

from 411.5 to 414.5 meters bls. The Talbt is an unwelded tuff with approximately 70 percent grayish-brown aphanitic groundmass and 30 percent phenocrysts.

At HRES-18 the Tal is 299.3 meters thick and consists of Talg from land surface to 198.1 meters bls, Talb from 198.1 to 298.5 meters bls, and Talbt from 298.5 to 299.3 meters bls. The Talw and Talv are not present. The Talg is a welded crystal-rich tuff with 55 percent pinkish-gray to reddish-gray, microcrystalline groundmass and 45 percent phenocrysts. The Talb is a densely welded crystal-rich tuff with approximately 60 percent reddish-brown and rusty orange, glassy to cryptocrystalline groundmass and 40 percent phenocrysts. The Talbt is an unwelded tuff with approximately 75 percent pale pink aphanitic groundmass and 25 percent phenocrysts.

Whitetail Conglomerate (Tw)

The uppermost 14.1, 15.1, and 25.6 meters of the Tw was penetrated at wells HRES-16, HRES-17, and HRES-18, respectively, and included Conglomerate Unit (Tw3) only. The Tw3 is moderately lithified, clast-supported conglomerate with a gravel fraction that consists of quartzite, schist, basalt, limestone, diabase, and quartz. At HRES-16, the gravel fraction consists mostly of quartzite, at HRES-17, the gravel fraction consists mostly of quartzite and schist, and at HRES-18, the gravel fraction consists mostly of quartzite and basalt. At HRES-18, the interval from 299.3 to 307.8 meters bls is approximately 95 percent sandy siltstone. At HRES-16 and HRES-18, the contact between the Tal and the Tw was confirmed by a decrease in normal resistivity and single point resistance. At HRES-18, the contact between the Tal and the Tw was also evident on the OBI log.

Degree of Fracturing

Fracture summary logs were prepared using geophysical logs including ABI, OBI, sonic, and E-logs. Where available, the ABI or OBI logs were the primary sources for the fracture summary logs. If ABI or OBI logs were not available, sonic logs were used to classify fractures. E-logs were used to confirm fracture zones. Fractures were qualitatively classified as minor, moderate, or major based on inspection of the logs. Minor fractures include joints and flow layer margins with no mineral filling generally less than 1 inch across. Moderate fractures include joints and faults with mineral filling or open voids ranging from about 1 to 6 inches across. Major fractures include faults or fault zones with mineral filling or open voids larger than about 6 inches across. Where ABI or OBI logs were not available, fractures zones were assigned using the sonic log to zones where acoustic travel time was larger than background. Intensity of the fracture was assigned based upon thickness of the anomalous zone. Major fractures were assigned to wide zones of slower acoustic travel. Fracture summary logs are shown on **Figures 2 through 4**.

At HRES-16, HRES-17, and HRES-18, fracturing in the Tal was indicated by fracture-fill minerals (calcite, quartz, gypsum, and orange montmorillonite) and mineral staining (iron oxide and manganese oxide) on fracture surfaces. At least trace evidence of fracturing was noted in

drill cuttings for most of the Tal. The ABI and OBI logs indicate that fractures are present throughout the Tal at all these wells and that most of the fractures are low angle with some high angle features. In the unsaturated portion of the Tal, the OBI logs indicate common minor to moderate fracturing with some major fractures. At HRES-16 and HRES-18, evidence of fracturing is sparse and mostly minor in the saturated portion of the borehole. At HRES-17, fracturing in the saturated portion of the borehole is minor to moderate and much more abundant. The geophysical logs showed no evidence of fracturing within the Tw.

WELL CONSTRUCTION

Construction at HRES-16 began with installation of 16-inch diameter surface casing. At HRES-17 and HRES-18 construction began with installation of 12-1/4-inch diameter blank steel surface casing. At HRES-16, 19.5 meters of surface casing was installed and cemented in place, and at HRES-17 and HRES-18, 12.2 meters of surface casing was installed. The production interval for HRES-16 was constructed using 8-5/8-inch outside diameter (1/4-inch wall thickness), blank and perforated, threaded and coupled steel casing. The production interval for HRES-17 and HRES-18 was constructed using 4-1/2-inch outside diameter (1/4-inch wall thickness), blank and perforated, flush-threaded steel casing. Perforations in all slotted casing are 1/8-inch wide by 3-inch long machine-cut slots, two slots per round, four rounds per foot, staggered (eight slots per foot). At HRES-16, the bottom joint of casing was welded to a steel end cap. At HRES-17 and HRES-18, the bottom joint of casing was torch cut, tapered, and welded closed. A summary of casing installation is provided in **Table 4**.

TABLE 4. SUMMARY OF PRODUCTION CASING INSTALLATION DEPTHS FOR HYDROLOGIC TEST WELLS HRES-16, HRES-17, AND HRES-18

	HRES-16	HRES-17	HRES-18
Perforated Interval(s) (meters, bls)	110.0 – 270.0 289.3 – 347.2	221.1 – 405.3	140.8 – 286.5
Total Casing Depth (meters)	353.6	410.0	292.6

Materials used for filter pack and seals for well construction included 1/4-inch to 3/8-inch gravel, 3/8-inch bentonite chips, 8x12 silica sand, and cement-bentonite grout. All materials were installed using a tremie pipe.

At HRES-16, a cement basket was installed in the annular space at a depth of 45.9 meters bls. Bentonite chips were installed on top of the cement basket, and a cement-bentonite grout seal was installed from the top of the bentonite chips to land surface. The annular space between

the bottom of the cement basket and the bottom of the borehole is open. A schematic diagram of well construction is shown on **Figure 2**.

Prior to casing installation at HRES-17 and HRES-18, the bottom of each borehole was backfilled with gravel to the contact between the Tal and Tw, and a bentonite seal was installed on top of the gravel (**Figures 3 and 4**). At HRES-18, about 2 meters of gravel pack was installed on top of the bentonite seal.

Following casing installation at HRES-17, gravel pack was installed in the annular space adjacent to the screened interval in the depth interval from 208.8 to 426.7 meters bls, and bentonite chips and cement-bentonite grout were placed from the top of the gravel to land surface. Top of the gravel pack was capped with silica sand prior to placing the bentonite chips and grout seal to minimize intrusion of grout into the gravel pack. A schematic diagram of well construction is shown on **Figure 3**.

At HRES-18, a cement basket was installed in the annular space at a depth of 13.7 meters bls. Bentonite chips were installed on top of the cement basket, and a cement-bentonite grout seal was installed from the top of the bentonite chips to land surface. The annular space beneath the cement basket is open. A schematic diagram of well construction is shown on **Figure 4**.

Following well construction, airlift pumping was conducted to develop the wells. Following development, airlift testing was conducted at HRES-16 and HRES-17. Details and results of testing are described in the following section. At HRES-18, airlifting could not be sustained and therefore testing was not conducted.

Surface completions consist of an extension of the surface casing to approximately 1 meter above land surface. The casing extension is welded in place and secured with a locking cap. Horizontal and vertical well coordinates for the top of surface casing and center of the well caps were surveyed by Civiltec Engineering, Inc. of Phoenix, Arizona, on August 3, 2011. Survey data and computed land surface elevations are provided in **Table 5**.

TABLE 5. SUMMARY OF SURVEY RESULTS FOR HYDROLOGIC TEST WELLS HRES-16, HRES-17, AND HRES-18

	HRES-16	HRES-17	HRES-18
	(meters)	(meters)	(meters)
Easting	498191.584	499117.698	498910.445
Northing	3682726.769	3685208.326	3683442.970
Elevation Top of Surface Casing	1216.225	1338.970	1246.869
Elevation Land Surface	1215.29	1338.06	1246.03

Datum: UTM Zone 12 North (NAD27)-NGVD29

PUMP INSTALLATION AND INSTRUMENTATION

Dedicated pump assemblies were installed in hydrologic test wells HRES-16 and HRES-17 by Duncan Pump, of Phoenix, Arizona on December 10 and 9, 2011, respectively. The wells are equipped with stainless steel Grundfos electric pumps and motors. The pumps are installed on 1-1/2-inch galvanized steel API column pipe with galvanized steel couplings. Each well is equipped with a 1-1/4-inch PVC (Schedule 80) sounder access tube which extends from the wellhead to the top of the pump. The access tubes are capped on the bottom and factory slotted in the lowermost 6.1 meters. The pump, motor, and column pipe are suspended from a steel and rubber sanitary well seal installed at the wellhead. Details for each well are described below.

Well HRES-16 was equipped with a Model 25S75-39 pump with a 7.5-horsepower, 460-volt, three-phase Model MS4000 electric motor (Product No. 79355511). The pump was installed at a depth of approximately 279 meters bls. A Level TROLL 500 pressure transducer datalogger (S/N 194508; 100 psi, non-vented), manufactured by In-Situ Inc., of Ft. Collins, Colorado is installed at HRES-16.

Well HRES-17 was equipped with a Model 25S100-52 pump with a 10-horsepower, 460-volt, three-phase Model MS4000 electric motor (Product No. 79355512) at a depth of approximately 298 meters bls. One 1-1/4-inch PVC sounder access tube is installed. A Level TROLL 500 (S/N 193574; 100 psi, non-vented) is installed at HRES-17.

Well HRES-18 was not equipped with a dedicated pump due to low yield. A Level TROLL 500 (S/N 194449; 100 psi, non-vented) is installed at HRES-18.

HYDRAULIC TESTING

Initial characterization of the ALT aquifer at wells HRES-16 and HRES-17 was accomplished by conducting short-term airlift tests in the cased wells. Airlift testing was conducted to develop the wells and provide data for computing preliminary aquifer parameters. Well HRES-18 did not sustain discharge during airlift development so an airlift test was not conducted. Constant-rate pumping tests will be conducted at wells HRES-16 and HRES-17 in early 2012 using dedicated pumping equipment. Operational details and results of airlift testing are included below.

Airlift Tests

Short-term airlift tests were conducted at HRES-16 and HRES-17 following well construction. Discharge volumes and airlift rates were calculated by periodic measurement of storage tank levels. Due to the discharge head configuration, groundwater levels could not be measured during airlift pumping; however, groundwater level was measured prior to each test and during the recovery period. During recovery, water level was measured through the open

airline (dual-wall or AQ drill pipe) using an electric water level sounder. Recovery data were analyzed using the Theis recovery method (1935) implemented in the computer-based analytical aquifer test software AQTESOLV® for Windows, version 4.50.004 (Glenn M. Duffield, HydroSOLVE, Inc., 2008).

HRES-16 Cased Well Airlift Test

Following casing installation at well HRES-16, a 5-hour airlift test was conducted to develop the well and to investigate hydraulic parameters and water quality in the ALT aquifer at this location. The screened intervals are from 110.0 to 270.0 and from 289.3 to 347.2 meters bls. Depth to pre-pumping water level was 113.7 meters bls. Airlifting started at 00:32 and stopped at 05:32 on July 4, 2011. In the first approximately 100 minutes of airlifting, the discharge rate decreased from approximately 6.7 to 1.5 L/s; for the remainder of the pumping period the discharge rate ranged between 1.5 and 0.9 L/s. A graph of the recovery data is shown on **Figure 5**. Recovery data were not suitable for analysis using straight-line methods. Operational details are summarized in **Table 6**.

HRES-17 Cased Well Airlift Test

Following casing installation at well HRES-17, a 4-hour airlift test was conducted to develop the well and to investigate hydraulic parameters and water quality in the ALT aquifer at this location. Screened interval is from 221.1 to 405.3 meters bls. Depth to pre-pumping water level was 226.1 meters bls. Airlifting started at 01:14 and stopped at 05:14 on July 19, 2011. The discharge rate ranged from 0.7 to 2.1 L/s; average rate was 1.1 L/s. A graph of the recovery data and analysis are shown on **Figure 6**. Straight-line analysis using the Theis (1935) recovery method yields an estimated transmissivity of 11 m^2/d. Operational details and test results are summarized in **Table 6**.

TABLE 6. SUMMARY OF RESULTS FROM AIRLIFT TESTS AT HYDROLOGIC TEST WELLS HRES-16 AND HRES-17

Well Identifier	Test Interval (meters bls), Test Type, Test Date	Test Duration (minutes)	Pre-pumping Water Level (meters, bls)	Discharge Rate (L/s)	Transmissivity (m^2/d)
HRES-16	113.7 – 270.0 289.3 – 347.2 cased well 04 Jul 2011	300	113.7	Range: 6.7 to 0.9	Not calculated
HRES-17	226.1 – 405.3 cased well 19 Jul 2011	240	226.1	Average: 1.1	11

GROUNDWATER SAMPLING

Water quality parameters (temperature, pH, and specific conductance) were measured and recorded during the tests using a Myron-L parameter meter that was calibrated prior to each test. Groundwater samples were collected near the end of each test. Sample identifiers and water quality parameters for samples collected during testing operations are provided in **Table 7**. Data from groundwater samples collected toward the end of airlift tests are generally used as screening samples or to obtain an initial idea of water quality. Data considered to be most representative of the hydrochemical composition of formation water are those generated from samples collected at the end of pumping tests. Results of water sample analyses will be provided and discussed in a future report.

TABLE 7. WATER SAMPLES COLLECTED DURING TESTING OPERATIONS AT HYDROLOGIC TEST WELLS HRES-16 AND HRES-17

Sample Identifier	Sample Description	Date	Time	Field Parameters		
				Temp (°C)	pH (s.u.)	Specific Conductance (µS/cm)
RESE-1003141	HRES-16 cased airlift	04-Jul-11	05:15	27.1	8.29	341.8
RESE-1003148	HRES-17 cased airlift	19-Jul-11	05:00	27.8	8.47	505.7

REFERENCES CITED

HydroSOLVE, Inc., 2008, **AQTESOLV for Windows 95/98/NT/2000/XP/Vista:** HydroSOLVE, Inc., Reston, Virginia, version 4.50.004 – Professional.

Theis, C.V., 1935, **The relationship between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage:** American Geophysical Union, Transactions, vol. 16, pp. 519-524; reprinted in Society of Petroleum Engineers, Pressure Transient Testing Methods, SPE Reprint Series (14), pp. 27-32, Dallas, Texas.

490,000 R. 12 E. 495,000 R. 13 E. 500,000 R. 14 E.

T. 1 S. T. 2 S. T. 3 S.

3,690,000 3,685,000 3,680,000 3,675,000

Top of the World
Corral
Middle
HRES-06
JI Ranch
HRES-14
DHRES-11
HRES-12
Queen Creek
HRES-15
Oak Flat
HRES-03
HRES-17
DHRES-14
DHRES-09
Shaft No. 3
DHRES-10
Shaft No. 9
HRES-01
Oak Flat
DHRES-04
DHRES-03
DHRES-05
DHRES-02
HRES-02
HRES-04
DHRES-01
DHRES-08
A-06
HRES-18
HRES-16
DHRES-13
Town of Superior
DHRES-07
HRES-09
HRES-05
HRES-13
Devils Canyon
HRES-07
MJ-11
Hackberry Windmill
Hackberry Canyon
HRES-10
DHRES-06
HRES-08
HRES-11
Arnett Creek
Mineral Creek
Gila County
Pinal County
1,400
1,600
60
177

EXPLANATION

- Watershed Boundary
- Perennial Reach

Groundwater Monitoring Sites

- Shallow Alluvial Aquifer Monitor Well
- Apache Leap Tuff Aquifer Monitor Well
- Deep Groundwater System Monitor Well
- Shaft

Elevation Range
(meters above mean sea level)

- 1,600 - 1,800
- 1,400 - 1,600
- 1,200 - 1,400
- 1,000 - 1,200
- 800 - 1,000
- 600 - 800

N

0 0.5 1 1.5 2
Miles

Resolution Copper Mining

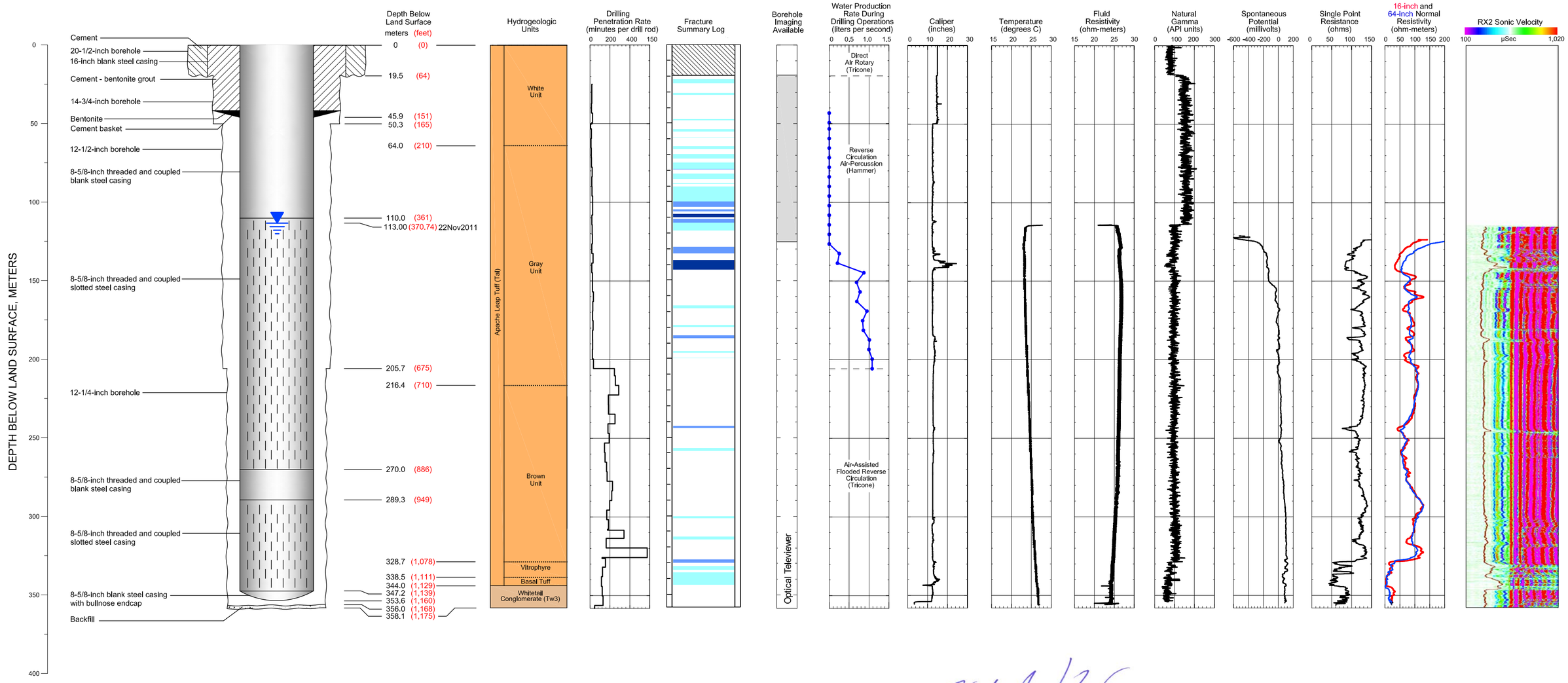
HRES-16, HRES-17 AND HRES-18 WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2012

FIGURE 1

\GIS-Tuc\Projects\605\605.3\Welloc_HRES_16_17_18.mxd\09Jan2012



CADASTRAL: (D-2-13) 04dba	ADWR NO: 55-913342
NORTHING: 3682726.769	EASTING: 498191.584
LAND SURFACE ELEVATION: 1215.29	
DATUM: NAD 27 HORIZONTAL: UTM 12 VERTICAL: NGVD 29 METERS	

Non-Pumping Water Level

EXPLANATION

- No Data
- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing

REGISTERED GEOLOGIST
CERTIFICATE NO.
25063
TODD
KEAY
Date Signed 1/31/2012
ARIZONA U.S.A.
Expires 6/30/2012

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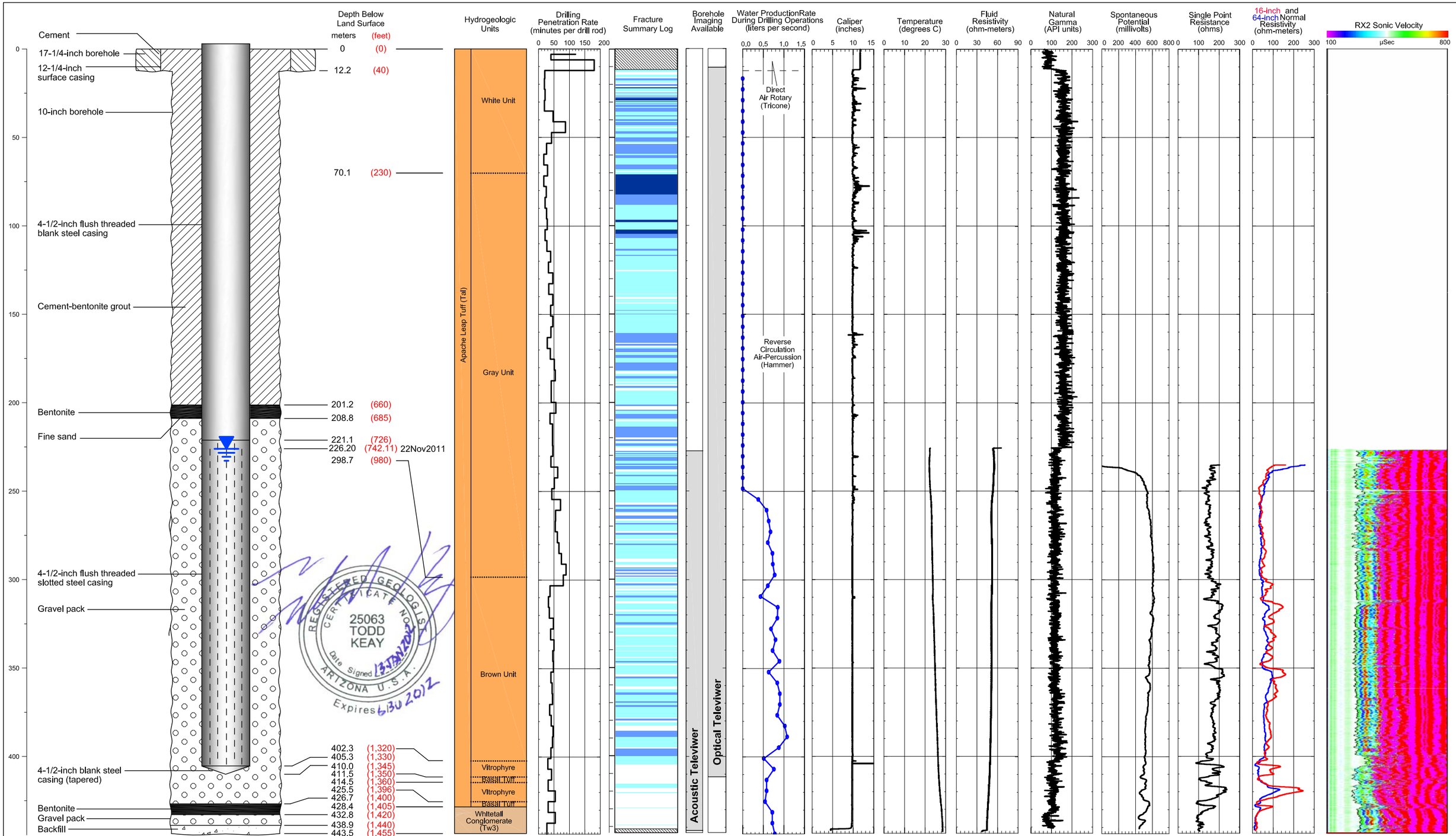
Water Resource Consultants

HRES-16
SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: January 13, 2012

FIGURE 2

605\WellSchematics_2011\HRES-16wsLOGS\13Jan2012



CADASTRAL: (D-1-13) 26dcc	ADWR NO: 55-913427
NORTHING: 3685208.326	EASTING: 499117.698
LAND SURFACE ELEVATION: 1338.06	
DATUM: NAD 27 HORIZONTAL: UTM 12 VERTICAL: NGVD 29 METERS	

Non-Pumping Water Level

EXPLANATION

- No Data
- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing

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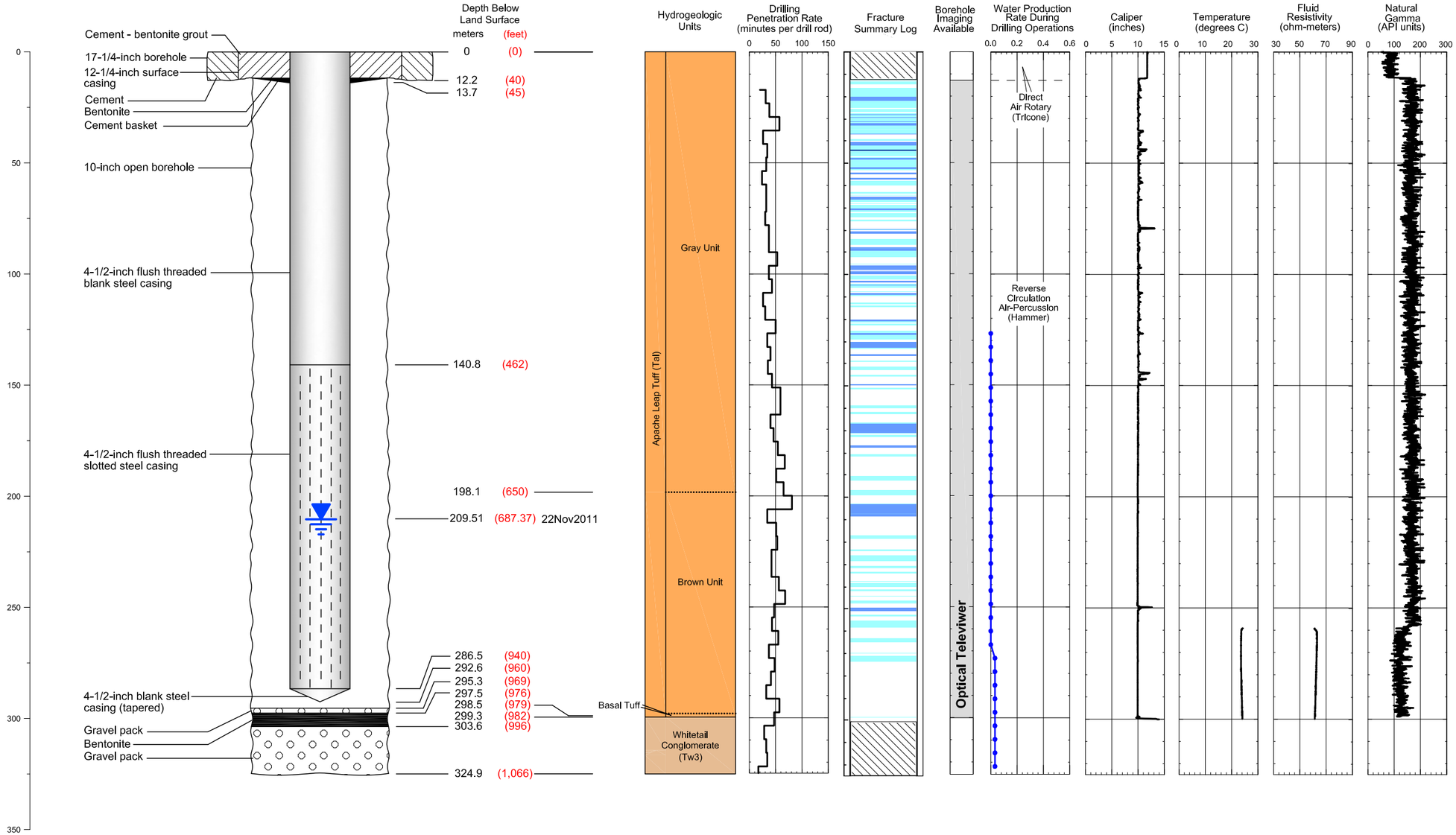
HRES-17

SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: Jan. 13, 2012

FIGURE 3

605\WellSchematics_2011\HRES-17-WS-LOGS13Jan2012



Note: Geology depths not based on geophysics

CADASTRAL: (D-2-13) 03bba	ADWR NO: 55-913308
NORTHING: 3683442.970	EASTING: 498910.445
LAND SURFACE ELEVATION: 1246.03	
DATUM: NAD 27 HORIZONTAL: UTM 12 VERTICAL: NGVD 29 METERS	

Non-Pumping Water Level

EXPLANATION
- No Data
- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing

REGISTERED GEOLOGIST
CERTIFICATE NO.
25063
TODD
KEAY
Date Signed 13 JANUARY 2012
ARIZONA U.S.A.
Expires 6/30/2012

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Water Resource Consultants

HRES-18
SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: Jan 13, 2012

FIGURE 4

605\WellSchematics_2011\HRES-18-WS-LOGS\13Jan2012

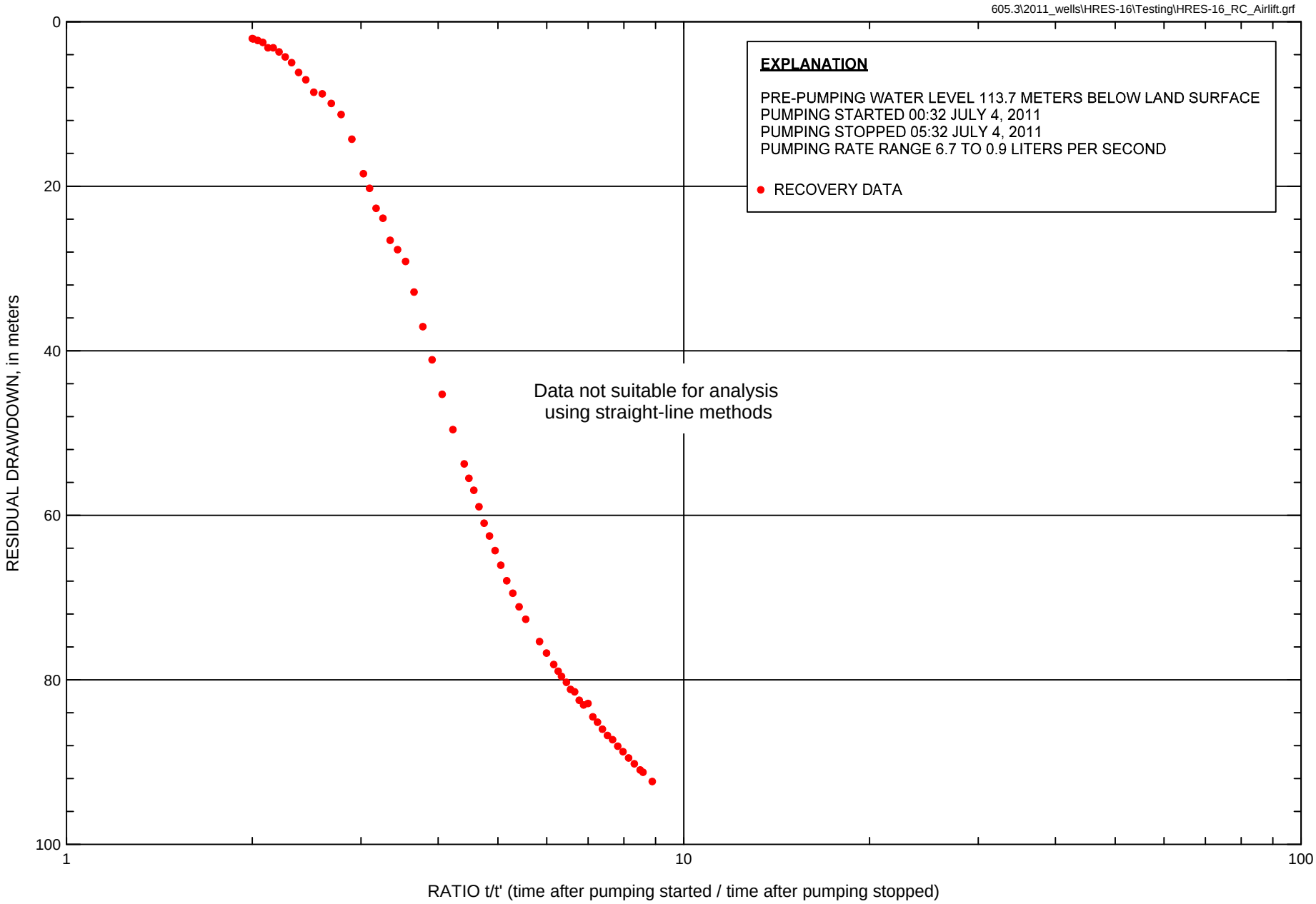

FIGURE 5. RECOVERY GRAPH FOR 5-HOUR AIRLIFT TEST AT CASED WELL HRES-16 RESOLUTION PROJECT

MONTGOMERY & ASSOCIATES

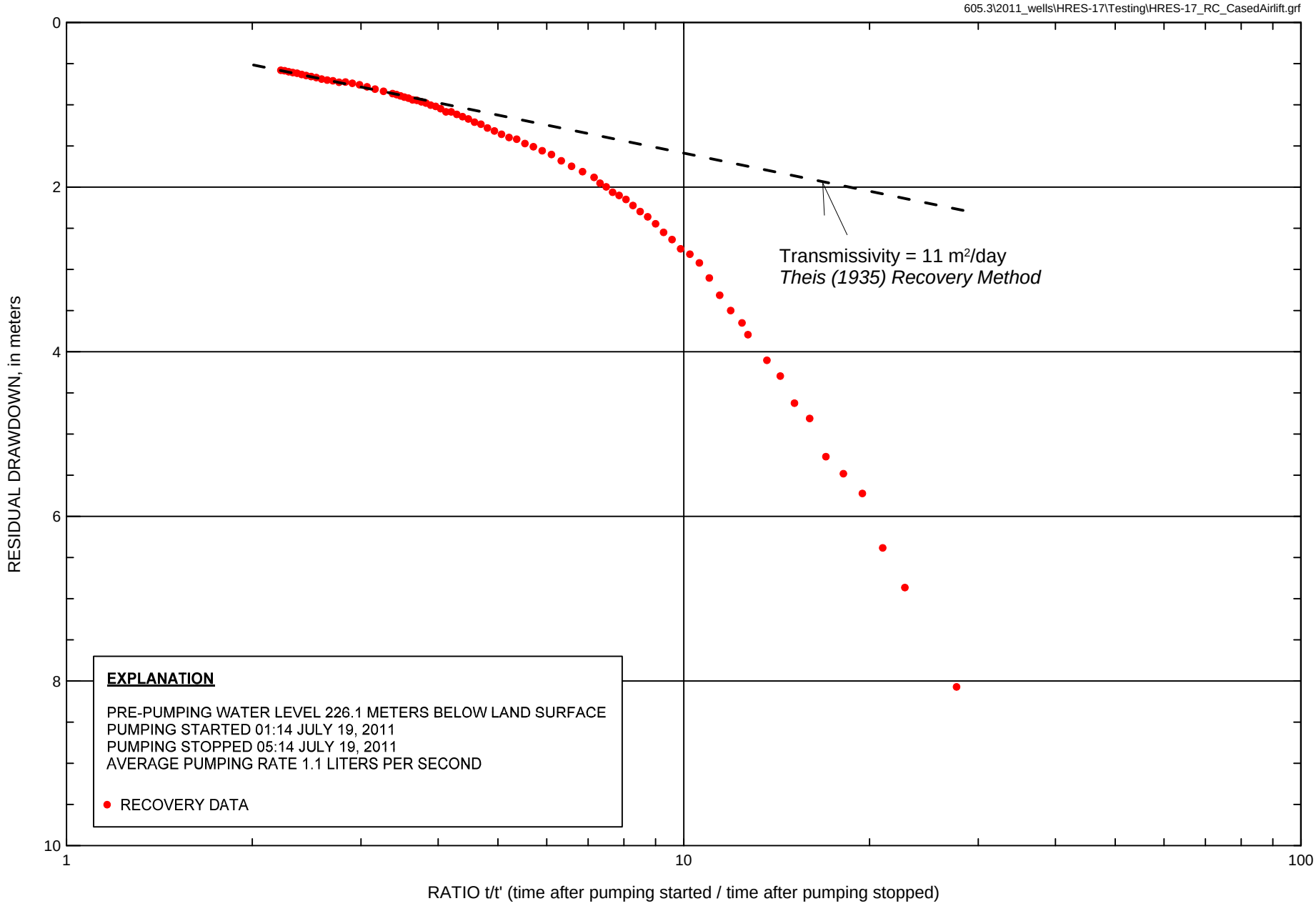

FIGURE 6. RECOVERY GRAPH FOR 4-HOUR AIRLIFT TEST AT CASED WELL HRES-17 RESOLUTION PROJECT

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LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
0 - 10	0.0 - 3.0	White Unit; light reddish brown [5YR6/3]; well lithified; 90% crystal-rich, porphyritic tuff with 60% pinkish-gray to white, aphanitic to microcrystalline groundmass; 37% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; up to 3% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 10% light brown silt, trace iron oxide	DIRECT AIR ROTARY; Munsell Color Version: 2000 rev. ed.; subangular to subrounded chips up to 4.0 cm
10 - 20	3.0 - 6.1	White Unit; light reddish brown [5YR6/3]; well lithified; 85% crystal-rich, porphyritic tuff with 60% pinkish-gray to white, aphanitic to microcrystalline groundmass; 39% up to 3 mm sized phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 15% light brown silt, trace iron oxide	subangular to subrounded chips up to 4.4 cm
20 - 30	6.1 - 9.1	White Unit; light reddish brown [5YR6/3]; well lithified; 80% crystal-rich, porphyritic tuff with 60% pinkish-gray to white, aphanitic to microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 20% light brown silt and silt balls, trace iron oxide	subangular to subrounded chips up to 3.5 cm
30 - 40	9.1 - 12.2	White Unit; light reddish brown [5YR6/3]; well lithified; 80% crystal-rich, porphyritic tuff with 65% pinkish-gray to white, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy black, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 20% light brown silt and silt balls	subangular to subrounded chips up to 2.4 cm
40 - 50	12.2 - 15.2	White Unit; reddish brown [5YR5/3]; well lithified; 75% crystal-rich, porphyritic tuff with 65% pinkish-gray to white, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 25% light brown silt and silt balls, trace gypsum, trace iron oxide	subangular to subrounded chips up to 1.9 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
50 - 60	15.2 - 18.3	White Unit; reddish brown [5YR5/3]; well lithified; 75% crystal-rich, porphyritic tuff with 65% pinkish-gray to white, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 25% light brown silt and silt balls, trace iron oxide	subangular to subrounded chips up to 1.1 cm
60 - 70	18.3 - 21.3	White Unit; light reddish brown [5YR6/3]; well lithified; 90% crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	weathered, 10% light brown silt and silt balls, trace iron oxide	DUAL-WALL REVERSE CIRCULATION AIR HAMMER; subangular to subrounded chips up to 0.8 cm
70 - 80	21.3 - 24.4	White Unit; light reddish brown [5YR6/3]; well lithified; 90% crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	trace iron oxide (limonite), 10% light brown silt	subangular to subrounded chips up to 1.2 cm
80 - 90	24.4 - 27.4	White Unit; light reddish brown [5YR6/3]; well lithified; 90% crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	trace iron oxide (limonite), 10% light brown silt	subangular to subrounded chips up to 0.9 cm
90 - 100	27.4 - 30.5	White Unit; light reddish brown [5YR6/3]; well lithified; 80% crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	trace iron oxide (limonite), 20% light brown silt	subangular to subrounded chips up to 0.6 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
100 - 110	30.5 - 33.5	White Unit; light reddish brown [5YR6/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite), trace gypsum	subangular to subrounded chips up to 0.4 cm, mostly sand sized
110 - 120	33.5 - 36.6	White Unit; light reddish brown [5YR6/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; increasing lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm
120 - 130	36.6 - 39.6	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments up to 0.8 cm; reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 1.4 cm
130 - 140	39.6 - 42.7	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 33% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments up to 0.8 cm; reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 1.4 cm
140 - 150	42.7 - 45.7	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.3 cm, mostly sand sized

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
150 - 160	45.7 - 48.8	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.4 cm, mostly sand sized
160 - 170	48.8 - 51.8	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	DUAL-WALL REVERSE CIRCULATION AIR HAMMER; mostly sand sized subangular to subrounded chips up to 1.2 cm
170 - 180	51.8 - 54.9	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.9 cm, mostly sand sized
180 - 190	54.9 - 57.9	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm, mostly sand sized
190 - 200	57.9 - 61.0	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm, mostly sand sized

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
200 - 210	61.0 - 64.0	White Unit; reddish brown [5YR5/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 43% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm, mostly sand sized
APACHE LEAP TUFF - Gray Unit (Talg)				
210 - 220	64.0 - 67.1	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-gray, aphanitic to microcrystalline groundmass; 37% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 3% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm, mostly sand sized
220 - 230	67.1 - 70.1	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-gray, aphanitic to microcrystalline groundmass; 37% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 3% very light gray pumice; trace basalt lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm, mostly sand sized
230 - 240	70.1 - 73.2	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-gray, aphanitic to microcrystalline groundmass; 37% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 3% very light gray pumice; trace basalt lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.9 cm, mostly sand sized
240 - 250	73.2 - 76.2	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray, aphanitic to microcrystalline groundmass; 37% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite; and up to 10% orange-brown groundmass; 3% very light gray pumice; increasing lithic fragments up to 1.0 cm; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.1 cm, mostly sand sized

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
250 - 260	76.2 - 79.2	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.1 cm, mostly sand sized
260 - 270	79.2 - 82.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.0 cm, mostly sand sized
270 - 280	82.3 - 85.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.4 cm, mostly sand sized
280 - 290	85.3 - 88.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.2 cm, mostly sand sized
290 - 300	88.4 - 91.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.2 cm, mostly sand sized

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
300 - 310	91.4 - 94.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.1 cm, mostly sand sized
310 - 320	94.5 - 97.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray and trace white, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.0 cm, mostly sand sized
320 - 330	97.5 - 100.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 0.9 cm, mostly sand sized
330 - 340	100.6 - 103.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.6 cm, mostly sand sized
340 - 350	103.6 - 106.7	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.3 cm, mostly sand sized

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
350 - 360	106.7 - 109.7	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.4 cm, mostly sand sized
360 - 370	109.7 - 112.8	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments up to 1.1 cm; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.1 cm, mostly sand sized
370 - 380	112.8 - 115.8	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; very trace lithic fragments up to 1.1 cm; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.6 cm, mostly sand sized; cutting size increasing
380 - 390	115.8 - 118.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.6 cm, mostly sand sized
390 - 400	118.9 - 121.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.5 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
400 - 410	121.9 - 125.0	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 2.1 cm
410 - 420	125.0 - 128.0	Gray Unit; reddish gray [5YR5/2]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-gray with trace orange-brown, aphanitic to microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite), very trace gypsum	subangular to subrounded chips up to 1.5 cm
420 - 430	128.0 - 131.1	Gray Unit; reddish gray [5YR5/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 5% orange-brown groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.8 cm
430 - 440	131.1 - 134.1	Gray Unit; reddish gray [5YR5/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 5% orange-brown groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.7 cm
440 - 450	134.1 - 137.2	Gray Unit; reddish gray [5YR5/2]; well lithified; 98% crystal-rich, porphyritic tuff with 55% pinkish-gray, aphanitic to microcrystalline groundmass; 5% orange-brown groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; reaction to acid: none	2% gypsum, trace iron oxide (limonite)	subangular to subrounded chips up to 2.1 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
450 - 460	137.2 - 140.2	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 2.0 cm
460 - 470	140.2 - 143.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.5 cm
470 - 480	143.3 - 146.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; 98% crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 1.3 cm; reaction to acid: none	2% orange silty clay, trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 2.0 cm; trace o-ring rubber
480 - 490	146.3 - 149.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; 99% crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 1.5 cm; reaction to acid: none	1% orange silty clay, trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 2.3 cm; trace o-ring rubber
490 - 500	149.4 - 152.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 1.2 cm; reaction to acid: weak	trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 1.3 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
500 - 510	152.4 - 155.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 1.3 cm; reaction to acid: weak to moderate	trace iron oxide (hematite and limonite), trace calcite	subangular to subrounded chips up to 1.2 cm
510 - 520	155.4 - 158.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 0.7 cm; reaction to acid: weak to moderate	very trace iron oxide (hematite and limonite), trace gypsum	subangular to subrounded chips up to 1.2 cm; trace o-ring rubber
520 - 530	158.5 - 161.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 0.5 cm; reaction to acid: weak	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.0 cm
530 - 540	161.5 - 164.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.0 cm
540 - 550	164.6 - 167.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	trace iron oxide (hematite and limonite), trace calcite	subangular to subrounded chips up to 1.5 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
550 - 560	167.6 - 170.7	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 0.8 cm
560 - 570	170.7 - 173.7	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	trace iron oxide (hematite and very trace limonite); trace gypsum, trace calcite	subangular to subrounded chips up to 0.9 cm
570 - 580	173.7 - 176.8	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.2 cm; trace o-ring rubber
580 - 590	176.8 - 179.8	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.4 cm
590 - 600	179.8 - 182.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 2.4 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
600 - 610	182.9 - 185.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	trace iron oxide (hematite and increasing limonite), trace calcite	subangular to subrounded chips up to 1.8 cm
610 - 620	185.9 - 189.0	Gray Unit; dark reddish brown [5YR3/3]; well lithified; 97% crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	3% orange silty clay, trace iron oxide (hematite and increasing limonite)	subangular to subrounded chips up to 2.0 cm
620 - 630	189.0 - 192.0	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and decreasing limonite), very trace calcite	subangular to subrounded chips up to 1.0 cm
630 - 640	192.0 - 195.1	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak to moderate	trace iron oxide (hematite and very trace limonite)	subangular to subrounded chips up to 0.7 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
640 - 650	195.1 - 198.1	Gray Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown to gray with trace orange-brown, aphanitic to microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; very trace lithic fragments; reaction to acid: weak to strong	trace iron oxide (hematite and limonite), trace calcite	subangular to subrounded chips up to 1.1 cm
650 - 660	198.1 - 201.2	Gray Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite), trace calcite, trace gypsum	subangular to subrounded chips up to 1.3 cm
660 - 670	201.2 - 204.2	Gray Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	trace iron oxide (hematite), trace gypsum	subangular to subrounded chips up to 1.4 cm
670 - 680	204.2 - 207.3	Gray Unit; dark reddish gray [5YR4/2]; well lithified; 95% crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: weak	5% orange silty clay, trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 0.3 cm
680 - 690	207.3 - 210.3	Gray Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.3 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
690 - 700	210.3 - 213.4	Gray Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 34% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.3 cm
700 - 710	213.4 - 216.4	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
710 - 720	216.4 - 219.5	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 0.2 cm
720 - 730	219.5 - 222.5	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite), trace calcite, trace orange silty clay	subangular to subrounded chips up to 0.4 cm
730 - 740	222.5 - 225.6	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm; trace o-ring rubber
740 - 750	225.6 - 228.6	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.1 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
750 - 760	228.6 - 231.6	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite), trace gypsum	subangular to subrounded chips up to 0.2 cm
760 - 770	231.6 - 234.7	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
770 - 780	234.7 - 237.7	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
780 - 790	237.7 - 240.8	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: very weak	trace gypsum	subangular to subrounded chips up to 0.3 cm
790 - 800	240.8 - 243.8	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
800 - 810	243.8 - 246.9	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: weak to moderate	very trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
810 - 820	246.9 - 249.9	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
820 - 830	249.9 - 253.0	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.2 cm
830 - 840	253.0 - 256.0	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-brown, microcrystalline groundmass; 35% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite; trace magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.7 cm
840 - 850	256.0 - 259.1	Brown Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm
850 - 860	259.1 - 262.1	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 44% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite), trace orange silty clay	subangular to subrounded chips up to 1.0 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
860 - 870	262.1 - 265.2	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 44% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 0.6 cm
870 - 880	265.2 - 268.2	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 44% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 0.8 cm
880 - 890	268.2 - 271.3	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 44% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: very weak	trace iron oxide (hematite)	subangular to subrounded chips up to 0.7 cm
890 - 900	271.3 - 274.3	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 44% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments up to 0.5 cm; reaction to acid: very weak	trace iron oxide (hematite), trace calcite	subangular to subrounded chips up to 1.2 cm
900 - 910	274.3 - 277.4	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
910 - 920	277.4 - 280.4	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite), very trace calcite	subangular to subrounded chips up to 0.9 cm
920 - 930	280.4 - 283.5	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.9 cm
930 - 940	283.5 - 286.5	Brown Unit; dark reddish gray [5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 0.8 cm
940 - 950	286.5 - 289.6	Brown Unit; weak red [2YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 5% orange-brown groundmass; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite), trace fracture surface with drusy quartz	subangular to subrounded chips up to 1.1 cm
950 - 960	289.6 - 292.6	Brown Unit; weak red [2YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 5% orange-brown groundmass; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite), very trace green, unidentified mineral	subangular to subrounded chips up to 2.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
960 - 970	292.6 - 295.7	Brown Unit; weak red [2YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 5% orange-brown groundmass; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 1.4 cm
970 - 980	295.7 - 298.7	Brown Unit; weak red [2YR4/2]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish-brown, microcrystalline groundmass; 39% phenocrysts of white, anhedral feldspar, translucent quartz, bronzy, euhedral biotite, trace magnetite; 5% orange-brown groundmass; 1% very light gray pumice; trace lithic fragments; reaction to acid: none	trace iron oxide (limonite)	subangular to subrounded chips up to 2.3 cm
980 - 990	298.7 - 301.8	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and limonite), trace calcite	subangular to subrounded chips up to 1.1 cm
990 - 1,000	301.8 - 304.8	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.2 cm
1,000 - 1,010	304.8 - 307.8	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 0.9 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,010 - 1,020	307.8 - 310.9	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 0.4 cm
1,020 - 1,030	310.9 - 313.9	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.3 cm
1,030 - 1,040	313.9 - 317.0	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.1 cm
1,040 - 1,050	317.0 - 320.0	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.6 cm
1,050 - 1,060	320.0 - 323.1	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 1.8 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-16
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Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,060 - 1,070	323.1 - 326.1	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish-brown with trace orange-brown, aphanitic to microcrystalline groundmass; 40% phenocrysts of white, anhedral feldspar, translucent quartz, and bronzy, euhedral biotite, trace magnetite; increasing lithic fragments; reaction to acid: none to very weak	trace iron oxide (hematite and limonite), very trace calcite	subangular to subrounded chips up to 0.8 cm
1,070 - 1,080	326.1 - 329.2	Brown Unit; reddish brown [5YR4/4] and yellowish red [5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% orangish-brown, glassy to cryptocrystalline groundmass, and 37% up to 1 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace magnetite; 12% lithic fragments of maroon siltstone, gray and dark gray quartzite; 1% light gray pumice/fiamme fragments; reaction to acid: none to weak	trace calcite veinlet	subangular chips up to 0.9 cm; very trace tool marks
1,080 - 1,090	329.2 - 332.2	Brown Unit and vitrophyre; reddish brown [5YR5/4], yellowish red [5YR5/6], and black [N2.5]; well lithified; 55% porphyritic tuff with 70% orangish-brown, glassy to cryptocrystalline groundmass, and 40% up to 1 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace magnetite; 40% black, glassy, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; 5% lithic fragments; reaction to acid: none to weak	trace iron oxide (hematite), very trace quartz veinlet	subangular chips up to 0.7 cm
APACHE LEAP TUFF - Vitrophyre (Talv)				
1,090 - 1,100	332.2 - 335.3	Vitrophyre; black [N2.5] and strong brown [7.5YR5/6]; well lithified; 70% black, glassy, porphyritic vitrophyre with phenocrysts of quartz, feldspar, biotite; 30% porphyritic tuff with 70% orange, glassy groundmass, and 30% phenocrysts of feldspar, quartz, and biotite; reaction to acid: none to very weak	trace quartz veinlet, trace white calcite veinlet, very trace iron oxide (hematite)	subangular chips up to 0.6 cm
1,100 - 1,110	335.3 - 338.3	Vitrophyre; black [N2.5] and strong brown [7.5YR5/6]; well lithified; 75% black, glassy, porphyritic vitrophyre with phenocrysts of quartz, feldspar, biotite; 25% porphyritic tuff with 70% orange, glassy groundmass, and 30% phenocrysts of feldspar, quartz, and biotite; reaction to acid: none to very weak	very trace white quartz veinlet, very trace clear calcite veinlet, very trace iron oxide (hematite); very trace nontronite	subangular chips up to 0.8 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Basal Tuff (Talbt)				
1,110 - 1,120	338.3 - 341.4	Basal Tuff; brown [7.5YR5/2]; well lithified; 78% porphyritic tuff with 80% whitish-gray, aphanitic groundmass, and 18% <1 mm sized phenocrysts of feldspar, quartz, biotite, 2% lithic fragments; 15% porphyritic, densely welded tuff with orangish-brown, glassy groundmass; 5% black, glassy, porphyritic groundmass; 2% gray silty clay; reaction to acid: none	trace quartz veinlet	subangular chips up to 0.7 cm
1,120 - 1,130	341.4 - 344.4	Basal Tuff; brown [7.5YR5/2]; well lithified; porphyritic tuff with 80% whitish-gray to pale pink, aphanitic groundmass, and 20% up to 1 mm sized phenocrysts of feldspar, quartz, black biotite; 2% gray silty clay; reaction to acid: none	trace iron oxide (hematite)	subangular chips up to 0.9 cm; 2% contamination of black, glassy vitrophyre
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,130 - 1,140	344.4 - 347.5	Conglomerate Unit no. 3; dark brown [7.5YR3/2], pale red [2.5YR6/2], and red [2.5YR4/6]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 99% clasts of 95% gray, brown, and reddish-brown, very fine-grained to fine-grained quartzite and arkosic quartzite, 4% light gray limestone, 1% diabase; 1% matrix chips of reddish-brown siltstone; overall sample is 9% fines of brown silt, 66% sand, 25% gravel; reaction to acid: very strong	minor iron oxide (hematite) on clasts	subangular to subrounded chips up to 1.9 cm
1,140 - 1,150	347.5 - 350.5	Conglomerate Unit no. 3; dark brown [7.5YR3/2] and pale red [2.5YR6/2]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 97% clasts of 94% dark gray, brown, reddish-brown, and reddish-pink quartzite, 4% black diabase, 1% light to dark gray limestone, 1% black basalt, trace quartz; 3% matrix chips of brown sandstone and siltstone; overall sample is 66% sand, 19% gravel, 15% fines of brown silt; reaction to acid: very strong	some iron oxide (hematite) on clasts	subangular to subrounded chips up to 0.7 cm; 20% contamination of tuff with pale pink, aphanitic groundmass, very trace vitrophyre
1,150 - 1,160	350.5 - 353.6	Conglomerate Unit no. 3; dusky red [2.5YR3/2] and pale red [2.5YR6/2]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 55% clasts of 90% brown, reddish-brown, and reddish-pink quartzite, 4% light gray to gray limestone, 4% diabase, 2% white quartz; 45% matrix chips of brown sandstone; overall sample is 66% sand, 24% fines of brown silt, 10% gravel; reaction to acid: very strong	some iron oxide (hematite) on clasts	subangular to subrounded chips up to 1.2 cm; 35% contamination of tuff with pale pink groundmass

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,160 - 1,170	353.6 - 356.6	Conglomerate Unit no. 3; pale red [2.5YR6/2] and dusky red [2.5YR3/2]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 99% clasts of 94% brown, reddish-brown, gray, and reddish-pink quartzite, 4% light gray to gray limestone, 2% diabase, trace white quartz, trace silvery schist; 1% matrix chips of brown sandstone; overall sample is 66% sand, 19% fines of brown silt, 15% gravel; reaction to acid: very strong	some iron oxide (hematite) on clasts	subangular to subrounded chips up to 1.6 cm; 28% contamination of tuff with pale pink groundmass, very trace vitrophyre
1,170 - 1,175	356.6 - 358.1	Conglomerate Unit no. 3; dusky red [2.5YR3/2], pale red [2.5YR6/2], and red [2.5YR4/6]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 99% clasts of 79% brown, reddish-brown, and red quartzite, 7% light gray to gray limestone, 10% black basalt, 4% diabase, trace gray silvery schist; 1% matrix chips of reddish-brown siltstone; overall sample is 66% sand, 20% gravel, 14% fines of brown silt; reaction to acid: very strong	some iron oxide (hematite) on clasts	subangular to subrounded chips up to 2.4 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
0 - 10	0.0 - 3.0	White Unit; reddish gray [5YR5/2]; well lithified; 75% porphyritic tuff with 60% tan to white, aphanitic groundmass; 36% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite; 3% pink, microcrystalline groundmass; 1% very light gray pumice; reaction to acid: none	weathered, 25% of sample is light brown silt, minor iron oxide (hematite and trace limonite), some biotite weathered out	DIRECT AIR ROTARY; Munsell Color Version: 2000 rev. ed.; angular to subangular chips up to 2.5 cm
10 - 20	3.0 - 6.1	White Unit; pinkish gray [5YR6/2]; well lithified; 95% porphyritic tuff with 60% tan to white, aphanitic groundmass; 38% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); 1% pink, microcrystalline groundmass; 1% very light gray pumice; trace lithic fragments of brown and black siltstone; reaction to acid: none	weathered, 5% of sample is light brown silt, trace iron oxide (hematite and very trace limonite), trace orange-brown silt coating fracture surfaces	angular to subangular chips up to 3.0 cm; very trace tool marks
20 - 30	6.1 - 9.1	White Unit; pinkish gray [5YR6/2]; well lithified; 90% porphyritic tuff with 60% tan to pinkish-white, aphanitic groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace very light gray pumice; trace lithic fragments of brown and black siltstone; reaction to acid: none	weathered, 10% of sample is light brown silt, trace iron oxide (hematite and very trace limonite), trace iron oxide (hematite) stained tuff, groundmass stained bright red	angular to subangular chips up to 3.0 cm
30 - 40	9.1 - 12.2	White Unit; reddish brown [5YR5/3]; well lithified; 65% porphyritic tuff with 60% tan to pinkish-white, aphanitic groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace very light gray pumice; trace lithic fragments of brown and black siltstone; reaction to acid: none	weathered, 35% of sample is light brown silt, 2% of sample coated in up to 1 mm thick brown silt, trace orange-brown silt	subangular chips up to 2.1 cm, mostly up to 0.3 cm
40 - 50	12.2 - 15.2	White Unit; reddish gray [5YR5/2]; well lithified; porphyritic tuff with 55% tan to pinkish-white, aphanitic groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black), and 5% pink, microcrystalline groundmass; trace very light gray pumice; trace lithic fragments of brown and black siltstone and gray chert; reaction to acid: none	minor iron oxide (hematite and trace limonite), very trace white gypsum	DUAL-WALL REVERSE CIRCULATION AIR HAMMER; subangular chips up to 0.9 cm

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Resolution Copper Mining
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
50 - 60	15.2 - 18.3	White Unit; reddish gray [5YR5/2] and light reddish brown [5YR6/3]; well lithified; porphyritic tuff with 59% pinkish-white and reddish-brown, aphanitic to microcrystalline groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); 1% very light gray pumice; trace up to 1 cm sized lithic fragments of brown and black siltstone, gray chert, and weathered diabase; reaction to acid: none	trace iron oxide (hematite and limonite), very trace milky white gypsum	subangular chips up to 2.1 cm
60 - 70	18.3 - 21.3	White Unit; reddish gray [5YR5/2] and light reddish brown [5YR6/3]; well lithified; porphyritic tuff with 59% pinkish-white and reddish-brown, aphanitic to microcrystalline groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); 1% very light gray pumice; trace up to 1 cm sized lithic fragments of brown and black siltstone and weathered diabase; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular chips up to 1.8 cm
70 - 80	21.3 - 24.4	White Unit; reddish gray [5YR5/2] and light reddish brown [5YR6/3]; well lithified; porphyritic tuff with 59% pinkish-white and reddish-brown, aphanitic to microcrystalline groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); 1% very light gray pumice; trace up to 0.6 cm sized lithic fragments of brown siltstone and gray chert; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular chips up to 2.0 cm
80 - 90	24.4 - 27.4	White Unit; reddish gray [5YR5/2]; well lithified; porphyritic tuff with 59% pinkish-white and reddish-brown, aphanitic to microcrystalline groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); 1% very light gray pumice; trace lithic fragments of brown siltstone and gray chert; reaction to acid: none	trace iron oxide (hematite) on biotite	subangular chips up to 2.0 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
90 - 100	27.4 - 30.5	White Unit; reddish brown [2.5YR5/3]; well lithified; 99% porphyritic tuff with 60% pinkish-white and reddish-brown, aphanitic to microcrystalline groundmass; 40% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace very light gray pumice; trace lithic fragments of gray and reddish-brown siltstone; reaction to acid: none	1% tan montmorillonite, trace iron oxide (hematite) on biotite	subangular chips up to 1.8 cm
100 - 110	30.5 - 33.5	White Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; porphyritic tuff with 55% pinkish-red, microcrystalline groundmass, trace light pink groundmass; 45% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace very light gray pumice; trace lithic fragments of gray and reddish-brown siltstone; reaction to acid: none	trace tan montmorillonite, trace iron oxide (hematite) on biotite, very trace iron oxide (limonite)	subangular chips up to 1.8 cm
110 - 120	33.5 - 36.6	White Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; porphyritic tuff with 55% pinkish-red, microcrystalline groundmass, trace light pink groundmass; 45% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace very light gray slightly flattened pumice; very trace lithic fragments of gray and reddish-brown siltstone; reaction to acid: none	trace tan montmorillonite, trace iron oxide (hematite) on biotite	subangular chips up to 2.2 cm
120 - 130	36.6 - 39.6	White Unit; reddish brown [2.5YR4/3]; well lithified; porphyritic tuff with 55% pinkish-red, microcrystalline groundmass, trace light pink groundmass; 45% up to 1 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; trace very light gray slightly flattened pumice; very trace lithic fragments of gray and reddish-brown siltstone; reaction to acid: none	trace iron oxide (hematite) on biotite, very trace iron oxide (hematite), very trace tan montmorillonite	subangular chips up to 0.9 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
130 - 140	39.6 - 42.7	White Unit; reddish brown [2.5YR4/3]; well lithified; porphyritic tuff with 55% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, and 45% pinkish-red, microcrystalline groundmass, trace light pink groundmass; trace very light gray slightly flattened pumice; very trace lithic fragments of gray and reddish-brown siltstone; reaction to acid: none	trace iron oxide (hematite) on biotite margins, very trace tan montmorillonite	subangular chips up to 1.4 cm
140 - 150	42.7 - 45.7	White Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 55% pinkish-red and reddish-brown, microcrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white and pinkish-white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; trace light gray pumice; reaction to acid: none	1% tan montmorillonite, very trace iron oxide (hematite) on biotite, very trace iron oxide (hematite) on fracture surfaces	subangular chips up to 1.2 cm
150 - 160	45.7 - 48.8	White Unit; reddish brown [2.5YR5/3]; well lithified; 97% crystal-rich, porphyritic, dacite tuff with 55% pinkish-red and reddish-brown, microcrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white and pinkish-white feldspar, translucent quartz, bronzy to black, euhedral biotite; trace light gray pumice; trace lithic fragments of gray and black siltstone; reaction to acid: none	3% yellowish-tan montmorillonite, trace iron oxide (hematite) on biotite	subangular chips up to 1.1 cm
160 - 170	48.8 - 51.8	White Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 55% pinkish-red and reddish-brown, microcrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite; trace light gray pumice; trace lithic fragments of gray and black siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surfaces	subangular chips up to 1.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
170 - 180	51.8 - 54.9	White Unit; reddish brown [2.5YR5/3]; well lithified; 98% crystal-rich, porphyritic, dacite tuff with 54% pinkish-red and reddish-brown, microcrystalline groundmass, trace light pink groundmass; 45% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite; 1% light gray pumice; trace lithic fragments of gray and black siltstone and gray quartzite; reaction to acid: none	2% yellowish-tan montmorillonite, very trace montmorillonite on fracture surface	subangular chips up to 1.3 cm
180 - 190	54.9 - 57.9	White Unit; reddish brown [2.5YR5/3]; well lithified; 95% crystal-rich, porphyritic, dacite tuff with 54% pinkish-red and reddish-brown, microcrystalline groundmass, trace light pink groundmass; 45% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite; 1% light gray pumice, trace flattened pumice; trace lithic fragments of gray, brown and black siltstone and gray quartzite; reaction to acid: none	5% yellowish-tan montmorillonite, very trace iron oxide (limonite)	subangular chips up to 1.8 cm
190 - 200	57.9 - 61.0	White Unit; reddish brown [2.5YR5/3] and light reddish brown [2.5YR6/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 55% light pinkish-red, microcrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace light gray pumice; trace lithic fragments of gray, brown and black siltstone and gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace iron oxide (hematite and limonite)	subangular chips up to 1.5 cm
200 - 210	61.0 - 64.0	White Unit; reddish brown [2.5YR5/3] and light reddish brown [2.5YR6/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 55% light pinkish-red, microcrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); trace light gray pumice; trace lithic fragments of gray, brown and black siltstone and gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (hematite) on biotite margins, very trace iron oxide (hematite)	subangular chips up to 1.4 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
210 - 220	64.0 - 67.1	White Unit; reddish brown [2.5YR5/3] and strong brown [2.5YR5/6]; well lithified; 87% crystal-rich, porphyritic, dacite tuff with 58% light pinkish-red, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray, brown and black siltstone, and gray quartzite; reaction to acid: none	13% yellowish-tan montmorillonite, trace montmorillonite on fracture surfaces, trace yellowish-tan weathered tuff, trace iron oxide staining (hematite)	subangular chips up to 1.3 cm
220 - 230	67.1 - 70.1	White Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% light pinkish-red, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite; trace light gray pumice; trace lithic fragments of gray, brown and black siltstone and gray quartzite; reaction to acid: none	trace iron oxide (hematite), trace yellowish-tan weathered tuff, very trace yellowish-tan and yellowish-white gypsum	subangular chips up to 1.0 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
230 - 240	70.1 - 73.2	Gray Unit; reddish brown [2.5YR5/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	1% yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.6 cm
240 - 250	73.2 - 76.2	Gray Unit; weak red [2.5YR5/2]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite (mostly black); very trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, trace iron oxide staining (hematite)	subangular chips up to 1.1 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
250 - 260	76.2 - 79.2	Gray Unit; weak red [2.5YR5/2] and reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.5 cm
260 - 270	79.2 - 82.3	Gray Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.7 cm
270 - 280	82.3 - 85.3	Gray Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass, very trace light pink groundmass; 42% up to 2 mm sized phenocrysts of milky white, feldspar, translucent quartz, bronzy to black, euhedral biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface	subangular chips up to 2.1 cm
280 - 290	85.3 - 88.4	Gray Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, bronzy to black biotite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace milky white, opaque vein quartz	subangular chips up to 2.5 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
290 - 300	88.4 - 91.4	Gray Unit; reddish brown [2.5YR5/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass, very trace light pink groundmass; 42% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite; very trace light gray pumice; trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface	subangular chips up to 2.5 cm
300 - 310	91.4 - 94.5	Gray Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% pinkish-red and reddish-brown, microcrystalline groundmass; 42% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 2.3 cm
310 - 320	94.5 - 97.5	Gray Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% pinkish-red and reddish-brown, microcrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite	subangular chips up to 1.9 cm, mostly up to 0.3 cm
320 - 330	97.5 - 100.6	Gray Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% pinkish-red and reddish-brown, microcrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite	subangular chips up to 1.7 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
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Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
330 - 340	100.6 - 103.6	Gray Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% pinkish-red and reddish-brown, microcrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	1% up to 2.7 cm sized yellowish-tan montmorillonite, trace manganese oxide	subangular chips up to 3.6 cm
340 - 350	103.6 - 106.7	Gray Unit; reddish brown [2.5YR5/3] and reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace up to 3.2 cm sized yellowish tan montmorillonite	subangular chips up to 3.8 cm, mostly up to 0.9 cm
350 - 360	106.7 - 109.7	Gray Unit; reddish brown [2.5YR4/3] and red [2.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of 63% milky white, anhedral feldspar, 35% translucent quartz, 2% black biotite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface	subangular chips up to 3.8 cm
360 - 370	109.7 - 112.8	Gray Unit; reddish brown [2.5YR4/3] and red [2.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 3.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
370 - 380	112.8 - 115.8	Gray Unit; reddish brown [2.5YR4/3] and red [2.5YR5/6]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	1% yellowish-tan montmorillonite	subangular chips up to 1.5 cm
380 - 390	115.8 - 118.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace pale pink and yellowish-white gypsum, very trace iron oxide (limonite), very trace iron oxide (hematite) on biotite margins	subangular chips up to 2.2 cm
390 - 400	118.9 - 121.9	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite and chert; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace pale pink gypsum on fracture surface	subangular chips up to 1.4 cm
400 - 410	121.9 - 125.0	Gray Unit; reddish brown [2.5YR4/4] and yellowish brown [10YR5/6]; well lithified; 84% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite and chert; reaction to acid: none	15% yellowish-tan and orange-brown montmorillonite, 1% yellow weathered tuff, trace iron oxide (hematite), very trace white gypsum, very trace manganese oxide	subangular chips up to 2.2 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
410 - 420	125.0 - 128.0	Gray Unit; reddish brown [2.5YR4/4]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline, groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite and chert; reaction to acid: none to very weak	1% yellowish-tan montmorillonite, trace iron oxide (hematite)	subangular chips up to 2.0 cm
420 - 430	128.0 - 131.1	Gray Unit; reddish brown [2.5YR4/4]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; trace lithic fragments of gray and black siltstone and gray chert; reaction to acid: none	1% yellowish-tan montmorillonite, very trace iron oxide (hematite and limonite) on fracture surface	subangular chips up to 1.6 cm
430 - 440	131.1 - 134.1	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 97% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; trace lithic fragments of gray and black siltstone and gray chert; reaction to acid: none	3% yellowish-tan montmorillonite	subangular chips up to 1.4 cm
440 - 450	134.1 - 137.2	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray and black siltstone and chert; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.5 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
450 - 460	137.2 - 140.2	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 98% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray and black siltstone and chert; reaction to acid: none to weak	2% yellowish-tan montmorillonite, trace iron oxide (hematite), very trace pale pink gypsum, very trace clear calcite	subangular chips up to 1.5 cm
460 - 470	140.2 - 143.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; 1% light gray pumice; trace lithic fragments of gray and black siltstone and gray chert; reaction to acid: very weak to strong	1% yellowish-tan montmorillonite, trace iron oxide (hematite), trace white calcite vein	subangular chips up to 1.5 cm
470 - 480	143.3 - 146.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite; 1% light gray pumice; trace lithic fragments of gray siltstone; very trace tuff with <1 mm sized phenocrysts; reaction to acid: none to strong	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, trace clear to milky white calcite vein, trace iron oxide (hematite and very trace limonite)	subangular chips up to 2.3 cm
480 - 490	146.3 - 149.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray siltstone; reaction to acid: none to strong	trace yellowish-tan montmorillonite	subangular chips up to 1.5 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
490 - 500	149.4 - 152.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray siltstone; reaction to acid: none	very trace yellowish-tan montmorillonite	subangular chips up to 1.3 cm
500 - 510	152.4 - 155.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass, very trace light orange groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.3 cm
510 - 520	155.4 - 158.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass, trace dark brown groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace iron oxide (hematite)	subangular chips up to 1.4 cm
520 - 530	158.5 - 161.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass, trace dark brown groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	very trace yellowish-tan montmorillonite	subangular chips up to 1.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
530 - 540	161.5 - 164.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 52% reddish-brown, microcrystalline to cryptocrystalline groundmass; 48% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace iron oxide (hematite), very trace white gypsum	subangular chips up to 1.6 cm
540 - 550	164.6 - 167.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 98% crystal-rich, porphyritic, dacite tuff with 55% reddish-brown, microcrystalline to cryptocrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	2% yellowish-tan montmorillonite, trace tan siltstone, very trace white gypsum	subangular chips up to 1.0 cm
550 - 560	167.6 - 170.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 97% crystal-rich, porphyritic, dacite tuff with 55% reddish-brown, microcrystalline to cryptocrystalline groundmass; 45% up to 2 mm sized phenocrysts of milky white, anhedral feldspar, translucent quartz, black, euhedral biotite, very trace hornblende, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray siltstone; reaction to acid: none	3% yellowish-tan montmorillonite	subangular chips up to 1.6 cm
560 - 570	170.7 - 173.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 59% reddish-brown, microcrystalline to cryptocrystalline groundmass; 41% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; trace light gray pumice; reaction to acid: none	trace yellowish-tan montmorillonite, trace iron oxide (hematite)	subangular chips up to 1.2 cm
570 - 580	173.7 - 176.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% reddish-brown, microcrystalline to cryptocrystalline groundmass, very trace light orange groundmass; 42% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; trace light gray pumice; reaction to acid: none	trace yellowish-tan and orange-brown montmorillonite, very trace yellowish-tan montmorillonite on fracture surface, very trace iron oxide (hematite and limonite)	subangular chips up to 1.7 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
580 - 590	176.8 - 179.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace white gypsum	subangular chips up to 1.1 cm; sunny weather
590 - 600	179.8 - 182.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace white gypsum, very trace iron oxide (limonite)	subangular chips up to 1.4 cm
600 - 610	182.9 - 185.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, only 1% black biotite, trace bronzy biotite, very trace magnetite; trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (hematite) on biotite margins	subangular chips up to 1.6 cm
610 - 620	185.9 - 189.0	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass, very trace light pink groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, only 1% black biotite, trace bronzy biotite, very trace magnetite; trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite	subangular chips up to 1.0 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
620 - 630	189.0 - 192.0	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none		subangular chips up to 2.1 cm
630 - 640	192.0 - 195.1	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown, microcrystalline to cryptocrystalline groundmass, trace light orange groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite, very trace iron oxide (limonite), very trace white gypsum	subangular chips up to 1.6 cm; new bit; very trace gold paint
640 - 650	195.1 - 198.1	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% brown and reddish-brown, microcrystalline to cryptocrystalline groundmass, trace light orange groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace white gypsum	subangular chips up to 1.2 cm
650 - 660	198.1 - 201.2	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% brown and reddish-brown, cryptocrystalline groundmass, trace light orange and pink groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; very trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; very trace magnetite; reaction to acid: none		subangular chips up to 1.0 cm, mostly up to 0.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
660 - 670	201.2 - 204.2	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% brown and reddish-brown, cryptocrystalline groundmass, trace light orange and pink groundmass; 40% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite; very trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; very trace magnetite; reaction to acid: none to very weak	very trace yellowish-tan montmorillonite, very trace calcite	subangular chips up to 1.3 cm
670 - 680	204.2 - 207.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace light orange and pink groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; very trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none to very weak	very trace calcite	subangular chips up to 1.1 cm
680 - 690	207.3 - 210.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace light pink groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; very trace light gray, flattened pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace white gypsum, very trace iron oxide (limonite)	subangular chips up to 2.9 cm, mostly up to 0.8 cm
690 - 700	210.3 - 213.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace light orange and pink groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace bronzy biotite, very trace magnetite; very trace light gray, flattened pumice; trace lithic fragments of gray quartzite; reaction to acid: none	very trace iron oxide (limonite)	subangular chips up to 1.8 cm, mostly up to 1.1 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
700 - 710	213.4 - 216.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace light orange groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace iron oxide (limonite)	subangular chips up to 1.9 cm
710 - 720	216.4 - 219.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 98% crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace light orange groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	2% yellowish-tan montmorillonite	subangular chips up to 1.6 cm
720 - 730	219.5 - 222.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 56% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 44% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace pale pink gypsum on fracture surface	subangular chips up to 1.2 cm
730 - 740	222.5 - 225.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 42% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	very trace yellowish-tan montmorillonite	subangular chips up to 1.4 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
740 - 750	225.6 - 228.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 58% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 42% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace iron oxide (hematite and limonite), very trace yellowish-tan montmorillonite	subangular chips up to 1.7 cm
750 - 760	228.6 - 231.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quartzite; reaction to acid: none	trace yellowish-tan and orange montmorillonite, very trace white and pale pink gypsum, very trace iron oxide (hematite and limonite)	subangular chips up to 1.1 cm
760 - 770	231.6 - 234.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; very trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none	1% yellowish-tan montmorillonite, very trace fracture fill on fracture surface, very trace white gypsum	subangular chips up to 1.2 cm
770 - 780	234.7 - 237.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none	trace yellowish-tan and orange montmorillonite, very trace iron oxide (hematite) on biotite margins, very trace white gypsum	subangular chips up to 1.7 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
780 - 790	237.7 - 240.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none to very weak	trace yellowish-tan montmorillonite, very trace calcite, very trace white gypsum	subangular chips up to 1.5 cm
790 - 800	240.8 - 243.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none to strong	very trace yellowish-tan montmorillonite, very trace iron oxide (hematite), very trace calcite, trace white gypsum	subangular chips up to 1.1 cm
800 - 810	243.8 - 246.9	Gray Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and reddish-brown, cryptocrystalline groundmass, trace orange-red groundmass; 38% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray quartzite, brown siltstone; reaction to acid: none to strong	very trace white gypsum, very trace clear to white calcite, very trace yellowish-tan montmorillonite	subangular chips up to 1.8 cm
810 - 820	246.9 - 249.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 98% crystal-rich, porphyritic, dacite tuff with 59% orange-brown and reddish-brown, cryptocrystalline groundmass, very trace light pink groundmass; 41% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none to strong	2% yellowish-tan montmorillonite, trace clear calcite, very trace white gypsum, very trace iron oxide (limonite)	subangular chips up to 3.6 cm, mostly up to 0.9 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
820 - 830	249.9 - 253.0	Gray Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 59% orange-brown and reddish-brown, cryptocrystalline groundmass; 41% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace light gray pumice; very trace lithic fragments of gray quartzite and brown siltstone; very trace magnetite; reaction to acid: none to weak	1% yellowish-tan montmorillonite, trace white calcite, very trace white gypsum, very trace iron oxide (limonite)	subangular chips up to 2.5 cm, mostly up to 1.4 cm
830 - 840	253.0 - 256.0	Gray Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 59% orange-brown and reddish-brown, cryptocrystalline groundmass; 41% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace light gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: very weak to strong	1% white calcite vein up to 0.7 cm, trace iron oxide (hematite and limonite), trace yellowish-tan montmorillonite, very trace white gypsum	subangular chips up to 1.0 cm
840 - 850	256.0 - 259.1	Gray Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 59% orange-brown and reddish-brown, cryptocrystalline groundmass; 41% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; very trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: very weak to strong	trace white calcite vein, very trace iron oxide (hematite), very trace hematite on biotite margins	angular to subangular chips up to 1.9 cm
850 - 860	259.1 - 262.1	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown and orange-brown, cryptocrystalline groundmass; 40% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: very weak to strong	trace yellowish-tan montmorillonite, trace white calcite vein, trace iron oxide (hematite and very trace limonite)	angular to subangular chips up to 2.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
860 - 870	262.1 - 265.2	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown and orange-brown, cryptocrystalline groundmass; 40% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: weak	trace yellowish-tan montmorillonite, trace iron oxide (limonite), very trace white calcite up to 1 cm	angular to subangular chips up to 2.2 cm
870 - 880	265.2 - 268.2	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown and orange-brown, cryptocrystalline groundmass; 40% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; trace magnetite; reaction to acid: weak to strong	trace yellowish-tan montmorillonite, trace white to clear calcite vein, very trace white gypsum	subangular chips up to 0.9 cm
880 - 890	268.2 - 271.3	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown and orange-brown, cryptocrystalline groundmass; 40% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: very weak to strong	trace white calcite vein, trace iron oxide (hematite) on biotite margins, very trace yellowish-tan montmorillonite	angular to subangular chips up to 1.5 cm
890 - 900	271.3 - 274.3	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% reddish-brown and orange-brown, cryptocrystalline groundmass; 40% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: weak	trace white calcite vein, very trace iron oxide (limonite)	angular to subangular chips up to 1.4 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
900 - 910	274.3 - 277.4	Gray Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown and orange-brown, cryptocrystalline groundmass, trace pale pink groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: moderate	trace yellowish-tan montmorillonite, trace white calcite vein, very trace white gypsum, very trace iron oxide (hematite) on biotite margins	angular to subangular chips up to 1.9 cm
910 - 920	277.4 - 280.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown and orange-brown, cryptocrystalline groundmass, trace orange groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace gray pumice; trace lithic fragments of gray quarztite and brown siltstone; reaction to acid: none	trace iron oxide (limonite), very trace yellowish-tan montmorillonite	angular to subangular chips up to 1.5 cm
920 - 930	280.4 - 283.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; 1% gray pumice; trace lithic fragments of gray quarztite and brown siltstone; very trace magnetite; reaction to acid: none to strong	trace white calcite vein up to 0.7 cm, very trace white gypsum	angular to subangular chips up to 1.5 cm
930 - 940	283.5 - 286.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; 1% gray pumice; trace lithic fragments of gray quartzite and brown siltstone; reaction to acid: none to weak	trace white gypsum, trace white calcite vein, trace iron oxide (hematite) on biotite margins, very trace yellowish-tan montmorillonite, very trace iron oxide (hematite and limonite)	angular to subangular chips up to 1.1 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
940 - 950	286.5 - 289.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; 1% gray pumice; trace lithic fragments of brownish-black siltstone and gray quartzite; reaction to acid: none to weak	trace iron oxide (hematite), very trace white calcite vein	angular to subangular chips up to 1.2 cm
950 - 960	289.6 - 292.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 64% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; very trace gray pumice; trace lithic fragments of brown and reddish-brown siltstone and gray quartzite; reaction to acid: none to weak	very trace white calcite vein, very trace white gypsum	subangular chips up to 1.3 cm
960 - 970	292.6 - 295.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 64% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; very trace gray pumice; trace lithic fragments of brown and reddish-brown siltstone and gray quartzite; reaction to acid: none to strong	trace white calcite vein, trace brown montmorillonite, trace iron oxide (hematite) on biotite margins, very trace iron oxide (hematite and limonite)	subangular chips up to 1.6 cm
970 - 980	295.7 - 298.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 64% brown, cryptocrystalline groundmass, 1% orange-brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; very trace gray pumice; trace lithic fragments of brown and reddish-brown siltstone and gray quartzite; reaction to acid: weak to strong	trace white calcite, very trace white gypsum, very trace iron oxide (hematite)	subangular chips up to 1.5 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
980 - 990	298.7 - 301.8	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown, cryptocrystalline groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace lithic fragments of reddish-brown siltstone and gray quartzite; very trace gray pumice; reaction to acid: strong	trace white calcite, very trace white gypsum, very trace iron oxide (hematite)	subangular chips up to 1.4 cm
990 - 1,000	301.8 - 304.8	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown, cryptocrystalline groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, trace magnetite; trace lithic fragments of reddish-brown siltstone and grayish-black quartzite; very trace gray pumice; reaction to acid: none to strong	trace yellowish-tan montmorillonite, trace iron oxide (hematite) on biotite margins, trace iron oxide (hematite and very trace limonite), very trace manganese oxide	subangular chips up to 1.8 cm
1,000 - 1,010	304.8 - 307.8	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown, cryptocrystalline groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; very trace gray flattened pumice; trace lithic fragments of reddish-brown siltstone and grayish-black quartzite; reaction to acid: weak	trace white calcite, trace yellowish-tan montmorillonite, very trace white gypsum, very trace manganese oxide	subangular chips up to 1.2 cm
1,010 - 1,020	307.8 - 310.9	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and orange-brown, cryptocrystalline groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, black, less than 1% euhedral biotite, very trace magnetite; very trace gray flattened pumice; trace lithic fragments of reddish-brown siltstone and grayish-black quartzite; reaction to acid: very weak	trace yellowish-tan montmorillonite, trace iron oxide (hematite and limonite), very trace clear to white calcite	subangular chips up to 1.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,020 - 1,030	310.9 - 313.9	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and orange-brown, glassy to cryptocrystalline groundmass, trace orange groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; very trace gray flattened pumice; trace lithic fragments of reddish-brown siltstone and grayish-black quartzite; reaction to acid: weak	trace iron oxide (hematite), trace white gypsum, trace yellowish-tan montmorillonite, very trace nontronite, very trace clear calcite	subangular chips up to 1.0 cm
1,030 - 1,040	313.9 - 317.0	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and orange-brown, glassy to cryptocrystalline groundmass, trace orange groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; 1% lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: very weak	trace yellowish-tan montmorillonite, very trace white gypsum, very trace iron oxide (limonite)	subangular chips up to 1.3 cm
1,040 - 1,050	317.0 - 320.0	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and orange-brown, glassy to cryptocrystalline groundmass, trace orange groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; 1% lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: very weak	trace iron oxide (hematite and very trace limonite), very trace yellowish-tan montmorillonite, very trace white calcite	subangular chips up to 1.4 cm
1,050 - 1,060	320.0 - 323.1	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and orange-brown, glassy to cryptocrystalline groundmass, trace light brown groundmass, and 35% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: none to strong	very trace white calcite, very trace manganese oxide, very trace yellowish-white gypsum, very trace yellowish-tan montmorillonite	subangular chips up to 1.5 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,060 - 1,070	323.1 - 326.1	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 67% brown and orange-brown, glassy to cryptocrystalline groundmass, trace light brown groundmass, and 34% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: strong	very trace white calcite on fracture surface, very trace yellowish-tan montmorillonite	subangular chips up to 1.8 cm
1,070 - 1,080	326.1 - 329.2	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 67% brown and orange-brown, glassy to cryptocrystalline groundmass, trace light brown groundmass, and 34% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: none to strong	trace iron oxide (hematite and limonite), very trace yellowish-tan montmorillonite, calcite in unwashed sample	subangular chips up to 1.5 cm
1,080 - 1,090	329.2 - 332.2	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 67% brown and orange-brown, glassy to cryptocrystalline groundmass, trace light brown groundmass, and 34% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; 1% lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; reaction to acid: none to moderate	very trace white calcite on fracture surface, very trace yellowish-tan montmorillonite	angular to subangular chips up to 3.5 cm, mostly up to 1.9 cm
1,090 - 1,100	332.2 - 335.3	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 67% brown and orange-brown, glassy to cryptocrystalline groundmass, 1% orange groundmass, and 33% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; 1% lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace light gray fiamme; reaction to acid: none to strong	trace yellowish-tan montmorillonite, very trace white gypsum on fracture surface, calcite in unwashed sample	angular to subangular chips up to 1.4 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,100 - 1,110	335.3 - 338.3	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 67% brown and orange-brown, glassy to cryptocrystalline groundmass, 1% orange groundmass, and 33% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; trace lithic fragments of reddish-brown siltstone and grayish-black quartzite; very trace light gray fiamme; reaction to acid: none to weak	trace iron oxide (hematite), trace yellowish-tan montmorillonite, very trace on fracture surface, very trace white calcite, very trace calcite on fracture surface	angular to subangular chips up to 1.1 cm
1,110 - 1,120	338.3 - 341.4	Brown Unit; reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic, dacite tuff with 66% brown and orange-brown, glassy to cryptocrystalline groundmass, 1% orange groundmass, and 32% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite, very trace magnetite; 1% lithic fragments of reddish-brown siltstone, gray and grayish-black quartzite; very trace light gray fiamme; reaction to acid: weak	1% yellowish-tan montmorillonite, very trace montmorillonite on fracture surface, very trace white calcite on fracture surface, very trace manganese oxide	angular to subangular chips up to 1.7 cm
1,120 - 1,130	341.4 - 344.4	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and orange-brown, glassy to cryptocrystalline groundmass, and 34% up to 1.5 mm sized phenocrysts of milky white feldspar, translucent quartz, and black, euhedral biotite; trace gray fiamme; trace lithic fragments of gray quartzite; reaction to acid: none to very weak	very trace iron oxide (hematite), very trace white calcite on fracture surface, very trace yellowish-tan montmorillonite	angular to subangular chips up to 0.8 cm
1,130 - 1,140	344.4 - 347.5	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and orange-brown, glassy to cryptocrystalline groundmass, and 34% up to 1 mm sized phenocrysts of milky white feldspar, translucent quartz, 2% black, euhedral biotite; trace gray fiamme; trace lithic fragments of gray quartzite; reaction to acid: none to weak	trace iron oxide (hematite and very trace limonite), trace yellowish-tan montmorillonite, very trace white gypsum on fracture surface, very trace clear calcite	angular to subangular chips up to 1.6 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,140 - 1,150	347.5 - 350.5	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 1 mm sized phenocrysts of milky white feldspar, translucent quartz, 2% black, euhedral biotite; very trace gray fiamme; trace lithic fragments of gray quartzite; reaction to acid: none to weak	trace iron oxide (hematite and very trace limonite), trace white gypsum, very trace orange gypsum, very trace white to clear calcite	angular to subangular chips up to 1.2 cm
1,150 - 1,160	350.5 - 353.6	Brown Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, 2% black, euhedral biotite; very trace gray fiamme; trace lithic fragments of gray quartzite; very trace magnetite; reaction to acid: none to weak	trace iron oxide (hematite and very trace limonite), very trace yellowish-white gypsum, very trace tan and orange-yellow montmorillonite, very trace clear calcite	angular to subangular chips up to 1.0 cm
1,160 - 1,170	353.6 - 356.6	Brown Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, 2% black, euhedral biotite; very trace gray fiamme; very trace lithic fragments of gray quartzite, brown siltstone; reaction to acid: very weak	trace iron oxide (hematite and very trace limonite), very trace yellowish-tan montmorillonite	angular to subangular chips up to 1.5 cm
1,170 - 1,180	356.6 - 359.7	Brown Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white feldspar, translucent quartz, 2% black, euhedral biotite; trace tuff with grayish-brown groundmass; trace gray fiamme; trace lithic fragments of gray quartzite, brown siltstone; reaction to acid: moderate to strong	minor iron oxide (hematite), trace white calcite, very trace yellowish-tan and tan montmorillonite	angular to subangular chips up to 1.4 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,180 - 1,185	359.7 - 361.2	Brown Unit; reddish brown [2.5YR4/3] and reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 66% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; trace tuff with grayish-brown groundmass; trace gray fiamme; trace lithic fragments of gray quartzite, brown siltstone; reaction to acid: moderate	minor iron oxide (hematite) on fracture surface, very trace iron oxide (limonite), very trace yellowish-tan montmorillonite, very trace manganese oxide, very trace white calcite, very trace on fracture surface, very trace orange quartz	angular to subangular chips up to 1.3 cm
1,190 - 1,200	362.7 - 365.8	Brown Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; 1% lithic fragments of brownish-gray quartzite, brown siltstone; trace tuff with grayish-brown groundmass; trace gray fiamme; reaction to acid: none to very weak	trace iron oxide (hematite), calcite in unwashed sample, very trace white vein quartz, very trace manganese oxide, very trace yellowish-tan montmorillonite, very trace white gypsum	angular to subangular chips up to 1.3 cm
1,200 - 1,210	365.8 - 368.8	Brown Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% brown and reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; 1% lithic fragments of brownish-gray quartzite, brown siltstone; very trace gray fiamme; reaction to acid: none to moderate	very trace iron oxide (hematite), very trace white calcite on fracture surface	angular to subangular chips up to 1.2 cm
1,210 - 1,220	368.8 - 371.9	Brown Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 65% reddish-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; 1% lithic fragments of brownish-gray quartzite, brown siltstone; very trace gray fiamme; reaction to acid: none to weak	trace iron oxide (hematite), very trace white gypsum	angular to subangular chips up to 0.8 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,220 - 1,230	371.9 - 374.9	Brown Unit; red [2.5YR4/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 64% brown and orange-brown, glassy to cryptocrystalline groundmass, and 34% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; 2% lithic fragments of brown and purplish-brown siltstone, gray and grayish-black quartzite; very trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	trace iron oxide (hematite)	angular to subangular chips up to 0.8 cm
1,230 - 1,240	374.9 - 378.0	Brown Unit; reddish brown [2.5YR4/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown and orange-brown, glassy to cryptocrystalline groundmass, and 32% up to 2 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 2% black, euhedral biotite; 5% lithic fragments of brown and purplish-brown siltstone, gray and grayish-black quartzite; trace gray fiamme; trace magnetite; reaction to acid: none to very weak	very trace white calcite, very trace white vein quartz	angular to subangular chips up to 0.9 cm
1,240 - 1,250	378.0 - 381.0	Brown Unit; red [2.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown and orange-brown, glassy to cryptocrystalline groundmass, and 32% <1 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 1% black, euhedral biotite; 5% lithic fragments of brown and purplish-brown siltstone and grayish-black quartzite; trace gray fiamme; trace magnetite; reaction to acid: none to weak	very trace iron oxide (hematite)	angular to subangular chips up to 1.0 cm
1,250 - 1,260	381.0 - 384.0	Brown Unit; brown [7.5YR5/4]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, glassy to cryptocrystalline groundmass, and 32% <1 mm sized phenocrysts of milky white and pale pink feldspar, translucent quartz, 1% black, euhedral biotite; 5% lithic fragments of brown and purplish-brown siltstone, gray and grayish-black quartzite; trace gray fiamme; trace magnetite; reaction to acid: none to weak	very trace iron oxide (hematite), very trace white vein quartz	angular to subangular chips up to 1.6 cm

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Resolution Copper Mining
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,260 - 1,270	384.0 - 387.1	Brown Unit; strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 62% brown and orange-brown, glassy to cryptocrystalline groundmass, and 32% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 6% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray to grayish-black quartzite; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	trace iron oxide (hematite)	angular to subangular chips up to 1.3 cm
1,270 - 1,280	387.1 - 390.1	Brown Unit; brown [7.5YR5/4] and strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, glassy to cryptocrystalline groundmass, and 34% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 3% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray to grayish-black quartzite; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	very trace clear vein quartz, very trace white calcite	angular to subangular chips up to 1.3 cm
1,280 - 1,290	390.1 - 393.2	Brown Unit; brown [7.5YR5/4] and strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 61% brown, glassy to cryptocrystalline groundmass, and 31% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 8% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray to grayish-black quartzite; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	very trace iron oxide (hematite and limonite)	angular to subangular chips up to 0.8 cm
1,290 - 1,300	393.2 - 396.2	Brown Unit; brown [7.5YR5/4] and strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 63% brown, glassy to cryptocrystalline groundmass, and 32% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 5% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray to grayish-black quartzite; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	trace iron oxide (hematite), very trace clear to white quartz	angular to subangular chips up to 1.2 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
1,300 - 1,310	396.2 - 399.3	Brown Unit; brown [7.5YR5/4] and strong brown [7.5YR5/6]; well lithified; 90% crystal-rich, porphyritic, dacite tuff with 65% grayish-brown, glassy to cryptocrystalline groundmass, and 35% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 10% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray to grayish-black quartzite, purplish-gray chert; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	very trace white calcite	angular to subangular chips up to 0.6 cm
1,310 - 1,320	399.3 - 402.3	Brown Unit; strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% light brown, glassy to cryptocrystalline groundmass, 28% <1 mm sized phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 12% lithic fragments of reddish-brown, purplish-brown and brown siltstone, gray quartzite, purplish-gray chert; trace gray fiamme; very trace magnetite; reaction to acid: none to very weak	trace iron oxide (hematite), very trace white quartz	angular to subangular chips up to 1.0 cm
APACHE LEAP TUFF - Vitrophyre (Talv)				
1,320 - 1,330	402.3 - 405.4	Vitrophyre; black [N2.5]; well lithified; 80% black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; 20% light brown tuff and lithic fragments of purplish-gray chert, red siltstone, gray and tan quartzite; reaction to acid: none		angular to subangular chips up to 1.0 cm
1,330 - 1,340	405.4 - 408.4	Vitrophyre; black [N2.5]; well lithified; 90% black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; 10% light brown tuff and lithic fragments of gray chert, red siltstone, gray and tan quartzite; reaction to acid: none to very weak	very trace iron oxide (hematite)	angular to subangular chips up to 1.6 cm
1,340 - 1,350	408.4 - 411.5	Vitrophyre; black [N2.5]; well lithified; 98% black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; 2% lithic fragments of gray and tan quartzite; reaction to acid: none		angular to subangular chips up to 0.8 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Vitrophyre (Talv)				
1,350 - 1,360	411.5 - 414.5	Basal Tuff; brown [7.5YR5/2] and strong brown [7.5YR5/6]; well lithified; 86% porphyritic tuff with 70% grayish-brown and orange, aphanitic groundmass, and 30% phenocrysts of milky white to pale pink feldspar, translucent quartz, and black, euhedral biotite; 7% black, porphyritic vitrophyre; 7% lithic fragments; reaction to acid: none to very weak	trace clear vein quartz	angular to subangular chips up to 1.1 cm
1,360 - 1,370	414.5 - 417.6	Vitrophyre; black [N2.5]; well lithified; 98% black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; 2% lithic fragments; reaction to acid: none	very trace white quartz, trace green serpentine	angular chips up to 1.4 cm; 8% contamination of light brown tuff
1,370 - 1,380	417.6 - 420.6	Vitrophyre; black [N2.5]; well lithified; black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; reaction to acid: none	very trace pale green gypsum, trace green serpentine	angular chips up to 0.9 cm; trace contamination of light brownish-orange tuff
1,380 - 1,390	420.6 - 423.7	Vitrophyre; black [N2.5]; well lithified; black, porphyritic vitrophyre with phenocrysts of quartz, feldspar, and biotite; trace pink and gray quartzite; reaction to acid: none	very trace clear to white quartz, trace green serpentine	angular chips up to 1.3 cm
1,390 - 1,400	423.7 - 426.7	Vitrophyre; brown [7.5YR5/2]; well lithified; 90% porphyritic tuff with 70% brown, glassy groundmass, 30% <1 mm sized phenocrysts of feldspar, quartz, biotite; 10% black, porphyritic vitrophyre with phenocrysts of feldspar, quartz, and biotite; reaction to acid: none		angular chips up to 1.1 cm
APACHE LEAP TUFF - Basal Tuff (Talbt)				
1,400 - 1,410	426.7 - 429.8	Basal Tuff; NO SAMPLE		sample bag was not the interval 1400-1410 ft
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,410 - 1,420	429.8 - 432.8	Conglomerate Unit no. 3; dark reddish brown [2.5YR3/3]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 90% clasts of 56% gray, brown, pink, and reddish-brown quartzite, 44% gray silvery schist; 10% matrix chips of dark brown siltstone, trace reddish-brown siltstone, trace white quartz, trace reddish-brown sandy siltstone; overall sample is 60% gravel, 20% fines of brown silt, 20% sand; reaction to acid: moderate	trace iron oxide (hematite)	angular chips up to 1.7 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-17
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,420 - 1,430	432.8 - 435.9	Conglomerate Unit no. 3; dark reddish brown [2.5YR3/3]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 80% clasts of 62% gray, brown, pink, and reddish-brown quartzite, 38% gray silvery schist with very trace garnet, 20% matrix chips of dark brown siltstone, trace reddish-brown siltstone, trace white quartz, trace reddish-brown sandy siltstone, trace brown sandstone; overall sample is 60% gravel, 20% fines of brown silt, 20% sand; reaction to acid: strong	minor iron oxide (hematite)	angular chips up to 3.8 cm
1,430 - 1,440	435.9 - 438.9	Conglomerate Unit no. 3; dark reddish brown [2.5YR3/3]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 70% clasts of 71% gray, brown, pink, and reddish-brown quartzite, 29% gray silvery schist with very trace garnet, trace white quartz; 30% matrix chips of dark brown siltstone, trace reddish-brown siltstone, trace reddish-brown sandy siltstone, trace brown sandstone, trace orange-red chert, very trace diabase; overall sample is 35% fines of brown silt, 35% gravel, 30% sand; reaction to acid: very strong	minor iron oxide (hematite)	angular chips up to 1.7 cm
1,440 - 1,450	438.9 - 442.0	Conglomerate Unit no. 3; dark reddish brown [2.5YR3/3] and red [2.5YR5/6]; weakly to moderately lithified; 99% clast-supported conglomerate; cut chips are 70% clasts of 71% gray, brown, pink, and reddish-brown quartzite, 15% gray silvery schist with very trace garnet, 14% orange-pink arkosic quartzite, white quartz, very trace diabase; 30% matrix chips of dark brown siltstone, reddish-brown siltstone, reddish-brown sandy siltstone, and brown sandstone; overall sample is 75% sand, 15% fines of brown silt, 10% gravel; reaction to acid: very strong	1% white calcite, minor iron oxide (hematite)	angular chips up to 1.4 cm
1,450 - 1,455	442.0 - 443.5	Conglomerate Unit no. 3; dark reddish gray [10R3/1]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 65% clasts of 77% brown silty quartzite, brown, purplish-brown, and reddish-brown siltstone, 15% gray silvery schist, 8% orange-pink arkosic quartzite, very trace limestone; 35% matrix chips of dark brown siltstone; overall sample is 50% sand, 43% fines of brown silt, 7% gravel; reaction to acid: very strong	minor iron oxide (hematite)	angular chips up to 0.8 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
0 - 10	0.0 - 3.0	Gray Unit; light reddish brown [2.5YR5/3]; well lithified; 80% crystal-rich, porphyritic tuff with 60% pinkish-gray microcrystalline groundmass; 38% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 2% very light gray pumice; trace lithic fragments; reaction to acid: none	weathered, 20% silt, trace iron oxide (limonite), hematite rims around biotite	DIRECT AIR ROTARY; Munsell Color Version: 2000 rev. ed.; subangular to subrounded chips up to 2.8 cm
10 - 20	3.0 - 6.1	Gray Unit; light reddish brown [2.5YR5/3]; well lithified; 90% crystal-rich, porphyritic tuff with 60% pinkish-gray microcrystalline groundmass; 38% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 2% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, 10% silt, trace iron oxide (limonite), hematite rims around biotite	subangular to subrounded chips up to 2.2 cm
20 - 30	6.1 - 9.1	Gray Unit; weak red [2.5YR5/2]; well lithified; 75% crystal-rich, porphyritic tuff with 60% pinkish-gray microcrystalline groundmass; 38% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 2% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, 25% silt, trace light tan silt balls, trace iron oxide (limonite)	subangular to subrounded chips up to 1.7 cm
30 - 40	9.1 - 12.2	Gray Unit; weak red [2.5YR5/2]; well lithified; 70% crystal-rich, porphyritic tuff with 60% pinkish-gray microcrystalline groundmass; 38% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 2% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, 30% silt, trace light tan silt balls, trace iron oxide (limonite)	subangular to subrounded chips up to 2.0 cm
40 - 50	12.2 - 15.2	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, trace iron oxide (limonite)	DUAL-WALL REVERSE CIRCULATION AIR HAMMER; subangular to subrounded chips up to 0.9 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
50 - 60	15.2 - 18.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims aorund biotite	subangular to subrounded chips up to 1.8 cm
60 - 70	18.3 - 21.3	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite	subangular to subrounded chips up to 1.5 cm
70 - 80	21.3 - 24.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: weak	weathered, trace iron oxide (limonite), hematite rims around biotite	subangular to subrounded chips up to 1.3 cm
80 - 90	24.4 - 27.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite, very trace gypsum	subangular to subrounded chips up to 1.0 cm
90 - 100	27.4 - 30.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite, very trace gypsum	subangular to subrounded chips up to 1.1 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
100 - 110	30.5 - 33.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; very trace light pink groundmass; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite, very trace gypsum	mostly sand sized subangular to subrounded chips up to 1.2 cm
110 - 120	33.5 - 36.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% pinkish red to pinkish orange microcrystalline groundmass; 44% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone and basalt; very trace light pink groundmass; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite, very trace gypsum	subangular to subrounded chips up to 1.0 cm
120 - 130	36.6 - 39.6	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace gypsum	subangular to subrounded chips up to 1.1 cm
130 - 140	39.6 - 42.7	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace gypsum	subangular to subrounded chips up to 1.1 cm
140 - 150	42.7 - 45.7	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, very trace limonite), trace gypsum	mostly sand sized subangular to subrounded chips up to 1.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
150 - 160	45.7 - 48.8	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, very trace limonite), trace gypsum, trace fracture fill material	mostly sand sized subangular to subrounded chips up to 1.2 cm
160 - 170	48.8 - 51.8	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, very trace limonite), trace gypsum	mostly sand sized subangular to subrounded chips up to 1.0 cm
170 - 180	51.8 - 54.9	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; 1% very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, very trace limonite), trace gypsum	mostly sand sized subangular to subrounded chips up to 0.8 cm
180 - 190	54.9 - 57.9	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; very trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	weathered, trace iron oxide (limonite), hematite rims around biotite, trace gypsum	mostly sand sized subangular to subrounded chips up to 1.0 cm
190 - 200	57.9 - 61.0	Gray Unit; reddish brown [5YR4/4]; well lithified; crystal-rich, porphyritic tuff with 60% pinkish orange microcrystalline groundmass; 39% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; very trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, very trace limonite), trace gypsum, trace pink gypsum	mostly sand sized subangular to subrounded chips up to 1.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
200 - 210	61.0 - 64.0	Gray Unit; reddish brown [5YR4/3]; well lithified; 95% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	5% silt, very trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 0.8 cm; chip size decreasing, chip volume decreasing
210 - 220	64.0 - 67.1	Gray Unit; reddish brown [5YR4/3]; well lithified; 91% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	9% silt, trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 1.0 cm; chip size decreasing, chip volume decreasing
220 - 230	67.1 - 70.1	Gray Unit; reddish brown [5YR4/3]; well lithified; 95% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	5% silt, trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 0.9 cm
230 - 240	70.1 - 73.2	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 1.5 cm
240 - 250	73.2 - 76.2	Gray Unit; weak red [2.5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite), very trace gypsum, trace yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.5 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
250 - 260	76.2 - 79.2	Gray Unit; weak red [2.5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite), very trace gypsum, very trace tan-yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.4 cm
260 - 270	79.2 - 82.3	Gray Unit; weak red [2.5YR4/2]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite), very trace gypsum, trace tan-yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.4 cm
270 - 280	82.3 - 85.3	Gray Unit; weak red [2.5YR4/2]; well lithified; 93% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	7% tan-yellow silty clay, trace iron oxide (hematite, limonite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 1.3 cm
280 - 290	85.3 - 88.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 95% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	5% tan-yellow silty clay, trace iron oxide (hematite, very trace limonite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 1.2 cm
290 - 300	88.4 - 91.4	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 98% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	2% tan-yellow silty clay, trace iron oxide (hematite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 1.1 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
300 - 310	91.4 - 94.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 99% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	1% tan-yellow silty clay, trace iron oxide (hematite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 0.9 cm
310 - 320	94.5 - 97.5	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 92% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	8% tan-yellow silty clay, trace iron oxide (hematite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 1.0 cm
320 - 330	97.5 - 100.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; 92% crystal-rich, porphyritic tuff with 60% reddish-brown microcrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	8% tan-yellow silty clay, trace iron oxide (hematite), very trace gypsum	mostly sand sized subangular to subrounded chips up to 0.7 cm
330 - 340	100.6 - 103.6	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace gypsum, trace tan-yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.4 cm
340 - 350	103.6 - 106.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace gypsum, trace tan-yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.0 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
350 - 360	106.7 - 109.7	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace gypsum, trace tan-yellow silty clay	mostly sand sized subangular to subrounded chips up to 1.4 cm
360 - 370	109.7 - 112.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 0.8 cm
370 - 380	112.8 - 115.8	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 0.8 cm
380 - 390	115.8 - 118.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	mostly sand sized subangular to subrounded chips up to 1.0 cm
390 - 400	118.9 - 121.9	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.1 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
400 - 410	121.9 - 125.0	Gray Unit; reddish brown [2.5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown microcrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite), very trace tan-yellow clay	subangular to subrounded chips up to 0.9 cm
410 - 420	125.0 - 128.0	Gray Unit; dark reddish brown [5YR3/2]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite)	subangular to subrounded chips up to 1.2 cm
420 - 430	128.0 - 131.1	Gray Unit; dark reddish brown [5YR3/2]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite)	subangular to subrounded chips up to 1.0 cm
430 - 440	131.1 - 134.1	Gray Unit; dark reddish brown [5YR3/2]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite, limonite)	subangular to subrounded chips up to 1.2 cm
440 - 450	134.1 - 137.2	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.8 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
450 - 460	137.2 - 140.2	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 0.7 cm
460 - 470	140.2 - 143.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm
470 - 480	143.3 - 146.3	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm
480 - 490	146.3 - 149.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray microcrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite), trace gypsum	subangular to subrounded chips up to 0.9 cm

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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
490 - 500	149.4 - 152.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% pinkish-gray cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite, limonite), very trace pink gypsum	subangular to subrounded chips up to 1.3 cm
500 - 510	152.4 - 155.4	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-gray cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite and very trace limonite)	subangular to subrounded chips up to 1.2 cm
510 - 520	155.4 - 158.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-gray cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 0.7cm
520 - 530	158.5 - 161.5	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-gray cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.3 cm
530 - 540	161.5 - 164.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-gray cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; very trace volcanic glass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.1 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
540 - 550	164.6 - 167.6	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone; very trace volcanic glass; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm
550 - 560	167.6 - 170.7	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	trace iron oxide (hematite)	subangular to subrounded chips up to 1.0 cm
560 - 570	170.7 - 173.7	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	trace iron oxide (hematite and very trace limonite)	subangular to subrounded chips up to 1.1 cm
570 - 580	173.7 - 176.8	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	trace iron oxide (hematite and very trace limonite)	subangular to subrounded chips up to 1.2 cm
580 - 590	176.8 - 179.8	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 65% reddish-gray cryptocrystalline groundmass; 35% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.8 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
590 - 600	179.8 - 182.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 65% reddish-gray cryptocrystalline groundmass; 35% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.4 cm
600 - 610	182.9 - 185.9	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with up to 55% pinkish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.0 cm
610 - 620	185.9 - 189.0	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with up to 55% pinkish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 0.9 cm
620 - 630	189.0 - 192.0	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with up to 55% pinkish-gray cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace orange groundmass; reaction to acid: none	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.1 cm

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Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
630 - 640	192.0 - 195.1	Gray Unit; reddish brown [5YR4/3]; well lithified; crystal-rich, porphyritic tuff with 49% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; 1% orange groundmass; reaction to acid: weak	trace iron oxide (hematite and very trace limonite)	subangular to subrounded chips up to 1.3 cm
640 - 650	195.1 - 198.1	Gray Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 49% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy to black biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; 1% orange groundmass; reaction to acid: weak to very weak	trace iron oxide (hematite and very trace limonite), trace calcite, very trace white gypsum, very trace vein quartz	subangular to subrounded chips up to 0.6 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
650 - 660	198.1 - 201.2	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 49% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: weak	trace iron oxide (hematite and very trace limonite), trace calcite, very trace white gypsum	subangular to subrounded chips up to 1.3 cm; chips are flat
660 - 670	201.2 - 204.2	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 55% reddish-brown cryptocrystalline groundmass; 45% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: weak	trace iron oxide (hematite and very trace limonite), trace calcite, very trace white gypsum	subangular to subrounded chips up to 1.6 cm
670 - 680	204.2 - 207.3	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 45% reddish-brown cryptocrystalline groundmass; 55% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite and very trace very light gray pumice; very trace lithic fragments of siltstone and chert; trace magnetite; reaction to acid: weak	very trace iron oxide (hematite), very trace pink gypsum	subangular to subrounded chips up to 1.5 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
680 - 690	207.3 - 210.3	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite), very trace pink gypsum	subangular to subrounded chips up to 2.2 cm
690 - 700	210.3 - 213.4	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite), very trace pink gypsum	subangular to subrounded chips up to 1.3 cm
700 - 710	213.4 - 216.4	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite), very trace pink gypsum	subangular to subrounded chips up to 1.1 cm
710 - 720	216.4 - 219.5	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.0 cm
720 - 730	219.5 - 222.5	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite; trace very light gray pumice; trace lithic fragments of brown siltstone; trace magnetite; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.3 cm

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
730 - 740	222.5 - 225.6	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.6 cm
740 - 750	225.6 - 228.6	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.7 cm
750 - 760	228.6 - 231.6	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.0 cm
760 - 770	231.6 - 234.7	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.3 cm
770 - 780	234.7 - 237.7	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, more euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments of siltstone and chert; reaction to acid: none	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.4 cm

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Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
780 - 790	237.7 - 240.8	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments; reaction to acid: none	very trace iron oxide (hematite and limonite), trace pink gypsum	subangular to subrounded chips up to 1.6 cm
790 - 800	240.8 - 243.8	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments; reaction to acid: none	very trace iron oxide (hematite and limonite), trace white to pink gypsum	subangular to subrounded chips up to 1.2 cm
800 - 810	243.8 - 246.9	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 50% reddish-brown cryptocrystalline groundmass; 50% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; very trace lithic fragments; reaction to acid: weak	very trace iron oxide (hematite and limonite), trace gypsum	subangular to subrounded chips up to 1.3 cm
810 - 820	246.9 - 249.9	Brown Unit; brown [7YR3/4]; well lithified; 99% crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	1% white to pink gypsum, very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.7 cm
820 - 830	249.9 - 253.0	Brown Unit; brown [7YR3/4]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	very trace iron oxide (hematite and limonite), trace white to pink gypsum	subangular to subrounded chips up to 0.8 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
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DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
830 - 840	253.0 - 256.0	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	trace iron oxide (hematite and limonite), very trace gypsum	subangular to subrounded chips up to 0.9 cm
840 - 850	256.0 - 259.1	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	trace iron oxide (hematite and limonite), very trace white gypsum, trace manganese oxide	subangular to subrounded chips up to 1.2 cm
850 - 860	259.1 - 262.1	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	very trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.4 cm
860 - 870	262.1 - 265.2	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.1 cm
870 - 880	265.2 - 268.2	Brown Unit; dark reddish brown [5YR3/3]; well lithified; crystal-rich, porphyritic tuff with 60% reddish-brown cryptocrystalline groundmass; 40% phenocrysts up to 2 mm of anhedral, white feldspar, translucent quartz, euhedral, bronzy biotite, trace magnetite; trace very light gray pumice; trace lithic fragments; reaction to acid: very weak to weak	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
880 - 890	268.2 - 271.3	Brown Unit; yellowish red [5YR4/6]; well lithified; crystal-rich, porphyritic tuff with 65% pinkish-gray to rusty orange cryptocrystalline groundmass; 35% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; trace lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite), very trace gypsum	subangular to subrounded chips up to 0.9 cm
890 - 900	271.3 - 274.3	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 59% rusty orange and 11% pinkish-gray cryptocrystalline groundmass; 30% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; trace lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite), very trace gypsum	subangular to subrounded chips up to 1.0 cm
900 - 910	274.3 - 277.4	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: weak to very weak	trace iron oxide (hematite and limonite), very trace calcite crystals	subangular to subrounded chips up to 1.2 cm
910 - 920	277.4 - 280.4	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: weak to very weak	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.2 cm
920 - 930	280.4 - 283.5	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite crystals	subangular to subrounded chips up to 1.5 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Brown Unit (Talb)				
930 - 940	283.5 - 286.5	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite crystals	subangular to subrounded chips up to 1.1 cm
940 - 950	286.5 - 289.6	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite crystals	subangular to subrounded chips up to 1.0 cm
950 - 960	289.6 - 292.6	Brown Unit; yellowish red [5YR4/6]; well lithified; porphyritic tuff with 52% rusty orange and 16% greenish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite, very trace magnetite; 7% lithic fragments of siltstone and chert; reaction to acid: very weak	trace iron oxide (hematite and limonite), very trace calcite crystals	subangular to subrounded chips up to 0.7 cm
960 - 970	292.6 - 295.7	Brown Unit; yellowish red [5YR4/6]; well lithified; crystal-rich, porphyritic tuff with 75% yellowish-brown cryptocrystalline groundmass; 25% phenocrysts up to 2 mm of anhedral, white to pink feldspar, translucent quartz, euhedral, increasing bronzy biotite; increasing lithic fragments of siltstone, chert; reaction to acid: none to very weak		subangular to subrounded chips up to 1.1 cm
970 - 980	295.7 - 298.7	Brown Unit; strong brown [7.5YR5/6]; well lithified; crystal-rich, porphyritic, dacite tuff with 60% orangish-brown, glassy to cryptocrystalline groundmass, and 40% <1 mm sized phenocrysts of milky white feldspar, translucent quartz, black, euhedral biotite, trace magnetite; 7% lithic fragments of reddish-brown quartzite; 1% light gray fiamme; reaction to acid: none to very weak	very trace white calcite	subangular chips up to 1.2 cm

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Basal Tuff (Talbt)				
980 - 990	298.7 - 301.8	Basal Tuff; strong brown [7.5YR5/6]; well lithified; 70% porphyritic tuff with 75% pale pink, aphanitic groundmass, 22% <1 mm sized phenocrysts of feldspar, quartz, biotite, trace magnetite, 3% lithic fragments of brown quartzite; 15% porphyritic, dacite tuff with 65% orangish-brown, cryptocrystalline groundmass, and 35% <1 mm sized phenocrysts of feldspar, quartz, biotite; 15% reddish-brown well lithified sandy siltstone, trace clear quartz; reaction to acid: none to weak	very trace white calcite	subangular chips up to 0.8 cm
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
990 - 1,000	301.8 - 304.8	Conglomerate Unit no. 3; brown [7.5YR5/2]; weakly to moderately lithified; sandy siltsone; 96% reddish-brown, well lithified sandy siltstone; 4% gray and reddish-brown quartzite; trace clear quartz; reaction to acid: none		subangular chips up to 1.8 cm; 55% contamination of tuff with pale pink groundmass
1,000 - 1,010	304.8 - 307.8	Conglomerate Unit no. 3; brown [7.5YR5/2]; weakly to moderately lithified; siltstone; 91% maroon siltstone and quartzite; 9% reddish-brown sandy siltstone; trace white quartz; reaction to acid: none	trace iron oxide (hematite)	subangular chips up to 2.0 cm; 78% contamination of tuff with brown and pale pink groundmass
1,010 - 1,020	307.8 - 310.9	Conglomerate Unit no. 3; reddish brown [5YR5/4] and reddish brown [5YR4/4]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 95% clasts of 95% gray, brown, and reddish-brown quartzite, 4% black and weathered red diabase, 1% gray silvery schist, trace quartz eye porphyry, trace quartz; 5% matrix chips of reddish-brown sandy siltstone; overall sample is 67% sand, 25% gravel, 8% fines of reddish-brown silt; reaction to acid: strong	minor iron oxide (hematite and very trace limonite) on clasts, trace white to clear calcite	subangular to subrounded chips up to 1.6 cm; 7% contamination of brown tuff
1,020 - 1,030	310.9 - 313.9	Conglomerate Unit no. 3; very dark gray [7.5YR3/1] and brown [7.5YR4/3]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 58% clasts of 72% black basalt, 17% gray and brown, very fine-grained to fine-grained quartzite, 5% light gray and brownish-gray limestone, 4% gray, silvery schist, 2% diabase, trace quartz; 42% matrix chips of 95% grayish-brown sandstone, 5% maroon well lithified siltstone; overall sample is 50% sand, 41% fines of dark brown silt, 9% gravel; reaction to acid: strong	some iron oxide (hematite)	subangular to subrounded chips up to 1.3 cm; 1% contamination of basal tuff

LITHOLOGIC DESCRIPTION OF DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL HRES-18
Resolution Copper Mining
Pinal County, Arizona

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,030 - 1,040	313.9 - 317.0	Conglomerate Unit no. 3; very dark gray [7.5YR3/1], brown [7.5YR4/3], and dark yellowish brown [10YR4/6]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 88% clasts of 43% brown and gray quartzite, 34% black basalt, 17% tan limestone, 5% light gray limestone, 1% gray silvery schist, trace clear to white quartz; 12% matrix chips of 83% brown silty sandstone, 17% red and maroon siltstone; overall sample is 50% sand, 41% fines of dark brown silt, 9% gravel; reaction to acid: very strong	trace iron oxide (hematite), very trace calcite	subangular to subrounded chips up to 1.1 cm
1,040 - 1,050	317.0 - 320.0	Conglomerate Unit no. 3; very dark gray [7.5YR3/1] and light olive brown [2.5Y5/3]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 84% clasts of 89% light gray to gray and tan limestone, 9% brown and gray quartzite, 2% black diabase, very trace gray chert, very trace clear quartz; 16% matrix chips of 94% brown sandstone, 6% maroon well lithified siltstone; overall sample is 45% gravel, 40% fines of dark brown silt, 20% sand; reaction to acid: very strong	very trace iron oxide (hematite)	subangular to subrounded chips up to 1.6 cm; 1% contamination of basal tuff
1,050 - 1,060	320.0 - 323.1	Conglomerate Unit no. 3; brown [7.5YR4/3] and very dark gray [7.5YR3/1]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 88% clasts of 57% gray and brown quartzite, 32% black basalt, 9% gray silvery schist, 2% light gray to gray limestone, trace clear quartz; 12% matrix chips of 83% brown silty sandstone, 17% maroon siltstone; overall sample is 45% gravel, 40% fines of dark brown silt, 20% sand; reaction to acid: strong	some iron oxide (hematite and very trace limonite), very trace greenish-gray gypsum	subangular to subrounded chips up to 3.0 cm; 13% contamination of grayish-brown tuff
1,060 - 1,066	323.1 - 324.9	Conglomerate Unit no. 3; very dark gray [N3] and weak red [2.5YR4/2]; weakly to moderately lithified; clast-supported conglomerate; cut chips are 80% clasts of 52% gray and brown quartzite, 44% gray silvery schist, 3% black diabase, 1% white quartz, trace white quartzite, trace black basalt; 20% matrix chips of 50% brown silty sandstone, 50% brown and maroon well lithified siltstone; overall sample is 50% gravel, 45% fines of dark brown silt, 5% sand; reaction to acid: strong	trace iron oxide (hematite and limonite)	subangular to subrounded chips up to 1.4 cm; trace contamination of grayish-brown tuff

APPENDIX B-1. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-16

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
19-Jun	HRES-16	E. Jung	0.00	0.00	0.00	0.00	Power steering pump went out on the winch truck - currently waiting on replacement. Mobilization continues for equipment not on skids. Anticipate replacement winch truck by noon tomorrow, and complete site set-up by Wednesday morning.	Mobilization	N/A	N/A
20-Jun	HRES-16	E. Jung	0.00	0.00	0.00	0.00	Replacement winch truck arrived at 1000hrs and was inspected by Peeks Performance. Mobilization and site set-up continues. Rig and site inspections are scheduled for Wednesday morning.	Mobilization	N/A	N/A
21-Jun	HRES-16	E. Jung	0.00	0.00	0.00	0.00	Site was set up by 1400hrs and inspected by RCM representative and Peeks Performance from 1500-1700hrs. Commencement of drilling will take place by 1900hrs. Electricians are scheduled for follow up inspections at 0645hrs tomorrow.	20-1/2" Starter Tri-Cone	N/A	N/A
22-Jun	HRES-16	E. Jung	21.34	70.00	21.34	70.00	Drilled to 21.34m and began installation of surface casing at 0900hrs. Anticipate drilling to resume early tomorrow morning with a 14-3/4" hammer bit.	16" Surface Casing	N/A	Apache Leap Tuff (Tal)
23-Jun	HRES-16	E. Jung	21.34	70.00	0.00	0.00	Cemented surface casing by 0600hrs. Assembled BHA for drilling 14-3/4" and installed diverter flange. Resumed drilling at 1330hrs.	14-3/4" RC Hammer. Air w/ water injection.	N/A	Apache Leap Tuff (Tal)
24-Jun	HRES-16	D. Stalling	132.59	435.00	111.25	365.00	Drilled down to 50.3m with the 14-3/4" hammer then tripped out to replace bit with a 12-1/4" hammer. Drilling resumed early this morning. Currently drilling ~15min per rod. Surveys taken at 30.5m Inc .5°, 61.0m Inc .5° and 91.4m Inc .25°.	12-1/4" RC Hammer. Air w/ water injection.	Water production has been measured to be 4.5gpm at 132.6m.	Apache Leap Tuff (Tal)
25-Jun	HRES-16	D. Stalling	205.74	675.00	73.15	240.00	Decision was made to switch over to flooded reverse after bit trip. Crew tripped out drill string assembly by 1200hrs. Currently setting up new BHA with 12-1/4" tricone bit to drill flooded reverse. Surveys taken at 121.9m Inc .25°, 152.4 and 182.9m Inc 1°. Anticipate drilling to commence later this afternoon.	12-1/4" Tricone Flooded Reverse	Water production zone reached at 199.6m measured 17gpm. Static water level was measured at 114.8m between trip.	Apache Leap Tuff (Tal)

APPENDIX B-1. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-16

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
26-Jun	HRES-16	E. Jung	225.55	740.00	19.81	65.00	Tripped in to resume drilling flooded reverse - could not achieve circulation. Tripped out and added HQ line. Resumed drilling at ~midnight with a 3.5hr/rod penetration rate.	12-1/4" Tricone Flooded Reverse	Static water level was last measured at 128.9m bls. Utilizing water only, with full returns.	Apache Leap Tuff (Tal)
27-Jun	HRES-16	E. Jung	259.08	850.00	33.53	110.00	Currently drilling with a 3 to 3-1/2 hr per rod penetration rate. Took a survey at 213.35m Inc 1.0°.	12-1/4" Tricone Flooded Reverse	Static water level was last measured at 128.9m bls. Drilling with no mud products - full returns.	Apache Leap Tuff (Tal)
28-Jun	HRES-16	E. Jung	298.70	980.00	39.62	130.00	Drilling with an average penetration rate of ~3hrs/rod. Took surveys at 243.83m Inc 1.13°, and 274.31m Inc 1.75°.	12-1/4" Tricone Flooded Reverse	Static water level was last measured at 128.9m bls. Drilling with no mud products - full returns.	Apache Leap Tuff (Tal)
29-Jun	HRES-16	E. Jung	308.46	1012.00	9.75	32.00	Inner HQ air tube parted and fell into the back of the bit. Tripped out, removed cuttings from drill collars, and removed HQ pipe lodged into bit. Currently tripping in. Anticipate drilling to resume around midnight.	12-1/4" Tricone Flooded Reverse	N/A	Apache Leap Tuff (Tal)
30-Jun	HRES-16	E. Jung	326.14	1070.00	17.68	58.00	Penetration rate decreased to ~5hrs/rod - hard drilling. Currently ~82hrs on the bit.	12-1/4" Tricone Flooded Reverse	N/A	Apache Leap Tuff (Tal)
1-Jul	HRES-16	D. Stalling	349.91	1148.00	23.77	78.00	Drilling, making excellent progress with a penetration rate of 2hrs/rod. Crew has 7.9m left to drill before reaching TD. Currently coordinating to conduct geophysical logging tomorrow.	12-1/4" Tricone Flooded Reverse	N/A	Apache Leap Tuff (Tal) contact with **vitrophyre at 330.7m.** Vitrophyre contact with **Basal tuff at 336.8** and contact with **Whitetail conglomerate at 345.6m.**
2-Jul	HRES-16	D. Stalling	358.14	1175.00	8.23	27.00	Completed the hole and tripped out in preparation for geophysics. Southwest Exploration arrived on site for geophysical logging at 0730hrs. Anticipate completing geophysics this afternoon.	12-1/4" Open Hole	Static water level was measured at 114.3m	Whitetail conglomerate

APPENDIX B-1. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-16

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
3-Jul	HRES-16	E. Jung	358.14	1175.00	0.00	0.00	Completed geophysical logging. Tools were run successfully with the exception of ABI, which was obtaining less than ideal image in the large borehole, and would not pass beyond 130m. Ran 8-5/8" casing as per casing schedule. Currently finishing cement seal from 45.71m to surface. After 6-8hr cement cure time, crew will conduct air-lift testing/development.	8-5/8" Blank and Slotted Casing.	Static water level was last measured at 114.3m	Whitetail conglomerate
4-Jul	HRES-16	E. Jung	358.14	1175.00	0.00	0.00	Conducted air-lift testing from 0030hrs to 0530hrs, and recovery until 1030hrs. Crews began site break-down and mobilization to HRES-17 drill site.	8-5/8" Blank and Slotted Casing.	Initial pump rate of 80-90gpm decreased to 50gpm after an hour, and then stabilized at 20gpm after the second hour. Final parameters were: pH 8.29, ORP 4 mV, Temp 27.1 C, EC 340.6 µS - falling steadily. Initial water level was 114.65m bls. Recovery was approaching 124m bls at 1030hrs.	Whitetail conglomerate (Tw)
5-Jul	HRES-16	E. Jung	358.14	1175.00	0.00	0.00	Mobilization continues. Dozer assist for drill rig is scheduled for tomorrow afternoon. Site and rig inspections are scheduled for Thursday morning.	Mobilization	N/A	Whitetail conglomerate (Tw)

APPENDIX B-2. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-17

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
6-Jul	HRES-17	E. Jung	0.00	0.00	0.00	0.00	Mobilization continues. Drill rig mobilized to site at 1330hrs with dozer assist. Currently rigging up. Final site inspections are scheduled for 0800hrs tomorrow.	Mobilization	N/A	N/A
7-Jul	HRES-17	E. Jung	0.00	0.00	0.00	0.00	Site set-up will continue into the evening. Electrical inspections and final inspections by an RCM representative will occur tomorrow morning before commencement of drilling.	Mobilization	N/A	N/A
8-Jul	HRES-17	D. Stalling	0.00	0.00	0.00	0.00	Drilling began with the starter bit by 1030hrs after final electrical inspections were completed. Anticipate 14" surface casing to be set in place and cemented by later this evening.	17-1/4" Starter Tri-Cone bit	N/A	Apache Leap Tuff (Tal)
9-Jul	HRES-17	D. Stalling	12.19	40.00	12.19	40.00	Successfully set and cemented surface casing to 12.2m by 0200hrs. Crew is prepping BHA to begin drilling with 10" hammer bit. Anticipate drilling to commence early this afternoon.	10" Hammer RC Air w/ water injection.	N/A	Apache Leap Tuff (Tal)
10-Jul	HRES-17	E. Jung	150.88	495.00	138.68	455.00	Drilling with a penetration rate of 45min -1hr per rod. Took surveys at 30.48m Inc 0.75°, 60.96m Inc 1.0°, 91.44m Inc 1.5°, and 121.91m Inc 2.0°. Currently drilling with 138.68m (455ft) on hammer bit.	10" Hammer RC Air w/ water injection.	N/A	Apache Leap Tuff (Tal) ~13% yellow/tan weakly to moderately lithified siltstone from 64m - 67m, and on fracture surfaces. Up to 2.7cm chips of yellow/tan siltstone from 100.58m - 103.63m.
11-Jul	HRES-17	E. Jung	193.55	635.00	42.67	140.00	Survey at 152.4m showed an inclination of 2.0°. Tripped for bit at 193.55m and 20hrs on bit. Resumed drilling at cross shift with a penetration rate of 1.25hrs per rod. Currently drilling.	10" Hammer RC Air w/ water injection.	20min lift test on each rod currently producing 4gpm at 10min, and 1-2gpm at 20min. It is believed that this is make-up/drilling water, and not formation water.	Apache Leap Tuff (Tal)
12-Jul	HRES-17	E. Jung	284.99	935.00	91.44	300.00	Drilling with a penetration rate of 1.25-1.5hrs per rod. Took surveys at 182.87m, 213.35m, and 243.83m. All had an inclination of 2.0°. Currently drilling.	10" Hammer RC Air w/ water injection.	Encountered water at 254.5m, producing 7-10gpm. Water production at 285m was 11.5gpm.	Apache Leap Tuff (Tal) 237.7m - 244.94m, trace calcite. 244.94m - 246.89m, 1% calcite.

APPENDIX B-2. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-17

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
13-Jul	HRES-17	E. Jung	345.95	1135.00	60.96	200.00	Tripped for bit at 333.74m. Resumed drilling at 0900hrs with a 1.5hr per rod penetration rate. Took surveys at 274.31m Inc 2.25°, and 304.79m Inc 2.5°. Currently drilling.	10" Hammer RC Air w/ water injection.	Currently producing ~13-14gpm	Apache Leap Tuff (Tal)
14-Jul	HRES-17	E. Jung	440.44	1445.00	94.49	310.00	Reached TD of 440.44m at 1040hrs and began tripping out for geophysics. Took surveys at 335.26m Inc 2.25°, 365.74m Inc 2.5°, and 396.22m Inc 2.0°. Geophysics are scheduled to begin ~0800hrs tomorrow.	10" Hammer RC Air w/ water injection.	Water production was 13-14gpm to TD.	Apache Leap Tuff (Tal) brown unit contact with vitrophyre at 402.32m. Vitrophyre contact with basal tuff at 426.7m. Basal tuff contact with Whitetail Conglomerate (Tw) at 429.75.
15-Jul	HRES-17	A.Jergenson	440.44	1445.00	0.00	0.00	Geophysics are currently being run and anticipate completion by 1500hrs. After a well completion plan is determined, from the geophysics, crews will begin tripping in the casing followed by the tremie pipe and finish completing the well.	10" Open Hole	Last measured static water level is 226.29m bls.	Apache Leap Tuff (Tal) brown unit contact with vitrophyre at 402.32m. Vitrophyre contact with basal tuff at 426.7m. Basal tuff contact with Whitetail Conglomerate (Tw) at 429.75.
16-Jul	HRES-17	D. Stalling	440.44	1445.00	0.00	0.00	Completed geophysical logging by 1700hrs with all tools run successfully. Crew has tripped in tremie pipe to gravel pack the lower portion of well. Currently setting up to run in casing per casing design.	10" Open Hole	Last measured static water level is 226.29m bls.	Apache Leap Tuff (Tal) brown unit contact with vitrophyre at 402.32m. Vitrophyre contact with basal tuff at 426.7m. Basal tuff contact with Whitetail Conglomerate (Tw) at 429.75.
17-Jul	HRES-17	E. Jung	440.44	1445.00	0.00	0.00	Ran 4-1/2" casing per casing schedule. Currently completing gravel pack installation. Anticipate complete installation of annular materials and commencement of air-lift testing by mid-day tomorrow.	4-1/2" Blank and Slotted Casing.	Last measured static water level was 226.29m bls.	Whitetail Conglomerate (Tw)
18-Jul	HRES-17	E. Jung	440.44	1445.00	0.00	0.00	Completed annular installations by 0800hrs. Currently running 101 pipe, followed by AQ for air-lift testing. Anticipate air-lift and development to commence mid to late afternoon.	4-1/2" Blank and Slotted Casing.	Last measured static water level was 226.29m bls.	Whitetail Conglomerate (Tw)
19-Jul	HRES-17	E. Jung	440.44	1445.00	0.00	0.00	Conducted air-lift testing/development from 0100hrs - 0500hrs, and recovery until 0900hrs. Currently breaking down site and mobilizing to HRES-18.	4-1/2" Blank and Slotted Casing.	Final parameters were: pH 8.47, ORP 11mV, Temp 27.8C, EC 505.7 µS. Static water level was 227.7m bls before test, and was 228.21m bls after 4hrs recovery.	Whitetail Conglomerate (Tw)

APPENDIX B-3. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-18

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
20-Jul	HRES-18	E. Jung	0.00	0.00	0.00	0.00	Mobilization continues. Drill rig was moved to HRES-18 this morning. Final site and equipment inspections are scheduled for Friday morning.	N/A	N/A	N/A
21-Jul	HRES-18	A.Jergenson	0.00	0.00	0.00	0.00	Mobilization complete and site set-up continues. Final site and equipment inspections are scheduled for Friday morning. Anticipate drilling to begin after inspections are completed.	N/A	N/A	N/A
22-Jul	HRES-18	D. Stalling	1.22	4.00	1.22	4.00	Completed final site, electrical and equipment inspections from Peek's Performance, Marcanti Electric and RCM. Only one minor issue was found and was attended to immediately. Drilling with the starter bit commenced at 1130hrs. Anticipate setting and cementing surface casing tonight. Currently drilling.	17-1/4" Starter Tri-Cone bit	N/A	Apache Leap Tuff (Tal)
23-Jul	HRES-18	D. Stalling	11.89	39.00	10.67	35.00	Completed the installation and cementing of the 14" surface casing by 0830hrs. Currently waiting for cement to cure before drilling commences with the 10" hammer bit using water injection. Anticipate drilling by 1630hrs.	14" Surface casing	N/A	Apache Leap Tuff (Tal)
24-Jul	HRES-18	E. Jung	126.80	416.00	114.91	377.00	Drilling with good progress. Penetration rate is ~35-45 minutes per rod. Took surveys at 30.48m Inc 0.25°, 60.96m Inc 0.25°, and 91.44m Inc 1.0°. Anticipate trip for bit late tonight. Currently drilling.	10" Hammer RC Air w/ water injection	N/A	Apache Leap Tuff (Tal)
25-Jul	HRES-18	E. Jung	196.90	646.00	70.10	230.00	Penetration rate is ~45-60 minutes per rod. Took surveys at 121.9m Inc 0.75°, 152.4m Inc 1.25°, and 182.9m Inc 1.0°. Tripped for bit between 0430 - 1130hrs. Currently drilling.	10" Hammer RC Air w/ water injection	N/A	Apache Leap Tuff (Tal)

APPENDIX B-3. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-18

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
26-Jul	HRES-18	E. Jung	324.92	1066.00	128.02	420.00	Reached TD of hole, at 1600hrs and 324.92m. Geophysical logging is scheduled for tomorrow am. Currently tripping out.	10" Hammer RC Air w/ water injection	Hole produced zero to possible very trace (<0.5gpm) water to TD. Once drill string is tripped out of the hole, water level will be measured hourly until commencement of geophysical logging.	Apache Leap Tuff (Tal) contact with Whitetail Conglomerate (Tw) at ~312.71m. Vitrophyre and Basal Tuff units absent.
27-Jul	HRES-18	E. Jung	324.92	1066.00	0.00	0.00	Geophysical logging was conducted between 0800hrs - 1130hrs. Hit a bridge at 301m. It was decided that this was deep enough in the hole to obtain sufficient geophysical data without having to trip in the drill string, clear the hole, and have the logger return. Combo tool and OBI were run successfully, with good OBI data in ~45m of submergence. Drill crew will trip in the drill string to clear the bridge, and complete the well to TD.	10" Open Hole	Static water level on first logging tool run (~0815hrs) was 259m. On second run (~1100hrs), water level was 248m.	Whitetail Conglomerate (Tw)
28-Jul	HRES-18	E. Jung	324.92	1066.00	0.00	0.00	Tripped in drill string, cleared bridge at 298.7m, and ~1.2m of fill at bottom. Currently completing well per casing schedule. Anticipate an attempt at air-lift around midnight.	10" Open Hole	Hole produced zero to possible very trace (<0.5gpm) water to TD while drilling.	Whitetail Conglomerate (Tw)
29-Jul	HRES-18	J.Kent	324.92	1066.00	0.00	0.00	Completed well per casing schedule, and set up for the airlift test. Tripped in with the tremie pipe. Well could not sustain an airlift test, blew dry when the crew unloaded the hole. Currently tripping out the trimmie pipe.	10" Open Hole	N/A	Whitetail Conglomerate (Tw)
30-Jul	HRES-18	D. Stalling	324.92	1066.00	0.00	0.00	Crew will be breaking down and transporting equipment from site to the staging pad of HRES-14 in preparation for mobilization to the EP lay down yard. Currently hauling equipment with winch truck.	4-1/2" Blank and Slotted Casing.	N/A	Whitetail Conglomerate (Tw)
31-Jul	HRES-18	E. Jung	324.92	1066.00	0.00	0.00	Crews are staging equipment on the HRES-14 drill site near hwy 60, in preparation for a lane closure and transfer to tractor-semi-trailers later in the week.	Mobilization	N/A	N/A

APPENDIX B-3. DAILY DRILLING REPORT SUMMARY FOR HYDROLOGIC TEST WELL HRES-18

Date	Hole #	Reporter	Shift Change Depth (m)	Shift Change Depth (ft)	Progress in last 24 Hrs (m)	Progress in last 24 Hrs (ft)	Comments	Hole Type/Size	Hydro Data	Geology
1-Aug	HRES-18	E. Jung	0.00	0.00	0.00	0.00	Drill rig was mobilized safely from HRES-18 and staged near HRES-14 for de-mobilization to Salt Lake City later this week. Removal of accessory equipment from HRES-18 is almost complete.	Mobilization	N/A	N/A
2-Aug	HRES-18	E. Jung	0.00	0.00	0.00	0.00	All equipment has been moved from HRES-18 to HRES-14. Lane closure on hwy 60 is scheduled for Wednesday - Friday, 6am to 6pm, for transfer of equipment to Shaft 9/10 laydown area.	Mobilization	N/A	N/A