# ATTACHMENT 7

## Well Construction Details and Confirmation of Designation of Groundwater Types

**Resolution Copper Project and Land Exchange**
**Environmental Impact Statement**

USDA Forest Service
Tonto National Forest
Arizona

October 11, 2018

# Process Memorandum to File

## Summary and Analysis of Groundwater-Dependent Ecosystems

This document is deliberative and is prepared by the third-party contractor in compliance with the National Environmental Policy Act and other laws, regulations, and policies to document ongoing process and analysis steps. This document does not take the place of any Line Officer's decision space related to this project.

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| Well | Aquifer Designation by RCM | Total Depth of Well[1] (ft bls) | Open Intervals (ft bls) | Lithology Interpretation from Borehole[2] (ft bls) | Confirmation of Aquifer Designation |
|---|---|---|---|---|---|
| JI Ranch Corral | Shallow alluvial/perched | 83 | 10 - 83 | Alluvium: 0 - ?<br>Apache Leap Tuff: ? - 83 | Open interval through alluvium and upper Apache Leap Tuff; source of groundwater to well is alluvium[3] |
| JI Ranch Middle | Shallow alluvial/perched | 53 | 1 - 53 | Alluvium: 0 - ?<br>Apache Leap Tuff: ? - 53 | Open interval through alluvium and upper Apache Leap Tuff; source of groundwater to well is alluvium |
| Hackberry Windmill | Shallow alluvial/perched | 46 | All open | Alluvium: 0 - ?<br>Apache Leap Tuff: ? - 46 | Open interval through alluvium and upper Apache Leap Tuff; source of groundwater to well is alluvium |
| HRES-01 | Apache Leap Tuff | 1597.5 | 1055 - 1077<br>1360 - 1403<br>1577.5 - 1597.5 | Apache Leap Tuff: 0 – 1676<br>Whitetail Conglomerate: 1676 – 1885 | Open intervals all within Apache Leap Tuff |

[1] Well construction details as summarized from Montgomery & Associates, 2016. Hydrochemistry Addendum, Groundwater and Surface Water, Upper Queen Creek/Devils Canyon Study Area. August 11, 2016. (Table 1) [Project Record #0001002]

[2] Lithology interpretations summarized from Montgomery & Associates, 2016. Hydrograph Set for Current Hydrogeologic Monitoring Network. July 11, 2016. [Project Record #0000926]

[3] Physical evidence that the source of water is the alluvium includes:

a) Water levels in nearby Apache Leap Tuff wells are substantially deeper than these three shallow wells. In the case of the two JI Ranch Wells, HRES-06 (an Apache Leap Tuff well) has a water level of 390 feet below ground surface, compared to about 20 feet in the JI Ranch Wells. In the case of the Hackberry Windmill well, HRES-05 and HRES-07 (two Apache Leap Tuff wells) have water levels of roughly 320-380 feet below ground surface, compared to 5 feet in the Hackberry well.

b)Water level hydrographs in these wells show occasional abrupt declines during the dry season, interpreted as the alluvium drying up until it can be replenished by infiltration of storm flows.

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|---|---|---|---|---|---|
| HRES-02 | Apache Leap Tuff | 1587 | 655.9 - 677.7<br>1026.1 - 1047.9<br>1265.7 - 1310 | Apache Leap Tuff: 0 – 1496<br>Whitetail Conglomerate: 1496 – 1587 | Open intervals all within Apache Leap Tuff |
| HRES-03d | Apache Leap Tuff | 1500 | 1456.5 - 1500 | Apache Leap Tuff: 0 – 2008<br>Whitetail Conglomerate: 2008 – 2116 | Open intervals all within Apache Leap Tuff |
| HRES-04 | Apache Leap Tuff | 1440 | 584.4 - 624.4<br>724.4 - 764.4<br>1284.3 - 1304.3<br>1419.3 - 1440 | Apache Leap Tuff: 0 – 1683<br>Whitetail Conglomerate: 1683 – 1747 | Open intervals all within Apache Leap Tuff |
| HRES-05 | Apache Leap Tuff | 1055 | 385 - 425<br>585 - 605<br>1015 – 1035<br>[Plugged at 440 feet as of 2011] | Apache Leap Tuff: 0 – 1063<br>Whitetail Conglomerate: 1063 - 1147 | Open intervals all within Apache Leap Tuff |
| HRES-06 | Apache Leap Tuff | 800 | 340 - 800 | Apache Leap Tuff: 0 – 1129<br>Whitetail Conglomerate: 1129 - 1500 | Open intervals all within Apache Leap Tuff |
| HRES-07 | Apache Leap Tuff | 1041 | 335 - 749<br>812 - 1019 | Apache Leap Tuff: 0 – 1029<br>Whitetail Conglomerate: 1029 - 1068 | Open intervals all within Apache Leap Tuff |
| HRES-08 | Apache Leap Tuff | 1022 | 194 - 297<br>793 – 1000<br>[Plugged at 320 feet as of 2011] | Apache Leap Tuff: 0 – 271<br>Whitetail Conglomerate: 271 – 1230<br>Naco Limestone: 1230 - 1455 | Open intervals primarily within Apache Leap Tuff (77 feet), with some overlap into Whitetail Conglomerate (26 feet) |
| HRES-09 | Apache Leap Tuff | 1122 | 271 - 1078 | Apache Leap Tuff: 0 – 1096<br>Whitetail Conglomerate: 1096 - 1125 | Open intervals all within Apache Leap Tuff |
| HRES-10 | Apache Leap Tuff | 1119 | 158 - 398<br>698 – 1099<br>[Plugged at 460 feet as of 2011] | Gila Conglomerate: 0 - 65<br>Apache Leap Tuff: 65 - 1357<br>Whitetail Conglomerate: 1357 - 1546 | Open intervals all within Apache Leap Tuff |

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|---|---|---|---|---|---|
| HRES-11 | Apache Leap Tuff | 1078 | 598 - 1078 | Apache Leap Tuff: 0 – 1075<br>Whitetail Conglomerate: 1075 – 1111 | Open intervals primarily within Apache Leap Tuff (477 feet), with negligible overlap into Whitetail Conglomerate (3 feet) |
| HRES-12 | Apache Leap Tuff | 1988 | 1767 - 1967 | Apache Leap Tuff: 0 – 2010<br>Tertiary Early Volcanics and Sediments: 2010-2140 | Open intervals all within Apache Leap Tuff |
| HRES-13 | Apache Leap Tuff | 900 | 423 - 860 | Apache Leap Tuff: 0 – 875<br>Whitetail Conglomerate: 875 - 915 | Open intervals all within Apache Leap Tuff |
| HRES-14 | Apache Leap Tuff | 1460 | 962 - 1440 | Apache Leap Tuff: 0 – 1480<br>Tertiary Early Volcanics: 1480 - 1643 | Open intervals all within Apache Leap Tuff |
| HRES-15 | Apache Leap Tuff | 1977 | 679 - 1530<br>1750 - 1958 | Apache Leap Tuff: 0 – 1759<br>Tertiary Early Volcanics and Sediments: 1759 – 1964<br>Whitetail Conglomerate: 1968 - 2018 | Open intervals within Apache Leap Tuff (851 feet), as well as Tertiary units (208 feet), all still above Whitetail Conglomerate |
| HRES-17 | Apache Leap Tuff | 1345 | 726 - 1330 | Apache Leap Tuff: 0 – 1405<br>Whitetail Conglomerate: 1405 - 1455 | Open intervals all within Apache Leap Tuff |
| A-06 | Apache Leap Tuff | 1665 | 10 - 1665 | Apache Leap Tuff: 0 – 1475<br>Whitetail Conglomerate: 1475 – 1665 | Open intervals primarily within Apache Leap Tuff (1465 feet), with some overlap into Whitetail Conglomerate (190 feet) |
| CT | Apache Leap Tuff | 100 | Unknown | From nearby well HRES-10:<br>Gila Conglomerate 0 – 65<br>Apache Leap Tuff: 65-100 | Uncertain; likely open to both Gila Conglomerate and upper Apache Leap Tuff |
| MJ-11 | Apache Leap Tuff | 786 | 10.2 - 786 | Alluvium: 0 - ?<br>Apache Leap Tuff: ? - 786 | Open intervals all within Apache Leap Tuff |

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| DHRES-01 | Deep | 6018 | 4793 - 4978<br>5304 - 5489<br>5594 - 5618<br>5814 - 5938 | Apache Leap Tuff: 0 – 1685<br>Whitetail Conglomerate: 1685 – 4537<br>Cretaceous Volcanoclastics: 4537 - 6018 | Open intervals all within units below Whitetail Conglomerate |
| DHRES-02 | Deep | 6555 | 3506 - 3732<br>5904 - 6007<br>6430 - 6533 | Apache Leap Tuff: 0 – 1616<br>Whitetail Conglomerate: 1616 – 3435<br>Cretaceous Volcanoclastics: 3435 – 6060<br>Younger Precambrian: 6060 – 6713 | Open intervals all within units below Whitetail Conglomerate |
| DHRES-06 | Deep | 2690 | 1636 - 2649 | Apache Leap Tuff: 0 – 269<br>Whitetail Conglomerate: 269 – 1220<br>Paleozoic Sedimentary: 1220 – 2570<br>Younger Precambrian: 2570 - 2891 | Open intervals all within units below Whitetail Conglomerate |
| DHRES-09 | Deep | 2130 | 431 - 911<br>1611 - 1671<br>1971 - 2071 | Younger Precambrian: 0 – 2071<br>Older Precambrian: 2071 - 2175 | Open intervals all within units below Whitetail Conglomerate |
| DHRES-11 | Deep | 6700 | 4910 - 6679 | Apache Leap Tuff: 0 – 2031<br>Tertiary Early Volcanics and Sediments: 2031 – 2480<br>Whitetail Conglomerate: 2480 – 3375<br>Paleozoic Sedimentary: 3375 – 5221<br>Younger Precambrian: 5221 - 6724 | Open intervals all within units below Whitetail Conglomerate |
| DHRES-13 | Deep | 3550 | 1768 - 2296<br>2457 - 3530 | Paleozoic Sedimentary: 0 – 262<br>Younger Precambrian: 262 – 2901<br>Older Precambrian: 2901 – 3265<br>Younger Precambrian: 3265 – 3464<br>Pinal Schist: 3464 – 3495 | Open intervals all within units below Whitetail Conglomerate |

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|---|---|---|---|---|---|
| | | | | Younger Precambrian: 3495 - 3571 | |
| DHRES-15 | Deep | 3633 | 2875 - 3633 | Apache Leap Tuff: 0 – 1050<br>Whitetail Conglomerate: 1050 – 2330<br>Paleozoic Sedimentary: 2330 – 3610<br>Younger Precambrian: 3610 - 3920 | Open intervals all within units below Whitetail Conglomerate |