

**DRAFT
TECHNICAL MEMORANDUM**

DATE: October 23, 2012 **PROJECT:** 605.741

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RESOLUTION COPPER MINING, LLC

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SUBJECT: HYDROGEOLOGIC DATA SUBMITTAL, TAILINGS
PREFEASIBILITY STUDY, WHITFORD, SILVER KING, AND
HAPPY CAMP SITES

In accordance with arrangements with Mr. Sergio Gonzalez, Resolution Copper Mining, LLC (RCM), this draft technical memorandum has been prepared to summarize hydrogeologic data and provide an assessment of hydrogeologic conditions and water uses in the vicinity of the Whitford, Silver King, and Happy Camp sites (Near West area) for the RCM Tailings Prefeasibility Study (PFS). The Near West study area and locations for the three potential tailings storage locations are shown on **Figure 1**.

SUMMARY

1. Methods and Data Sources: Well and hydrogeologic data were compiled for a study area encompassing approximately 270 square kilometers in the vicinity of the Whitford, Silver King, and Happy Camp sites. The principal sources of well data were the Arizona Department of Water Resources (ADWR) 35-Well Registry, 55-Well Registry, and Groundwater Site Inventory (GWSI) databases. Available drillers' logs for wells in the study area were retrieved from the ADWR imaged well records within the study area. Additional geologic logs were provided by RCM for mineral exploration boreholes drilled by others. Geologic maps were obtained from Arizona Geological Survey and U.S. Geological Survey

(USGS). Additional information was obtained from previously published reports prepared for RCM, a field reconnaissance visit to the Whitford, Silver King, and Happy Camp sites August 9-10, 2012, and a groundwater level monitoring round in the region conducted by RCM in August 2012.

Well and spring locations are shown on **Figure 1**, regional hydrogeologic features are shown on **Figure 2**, hydrogeologic sections A-A' and B-B' through the Silver King and Happy Camp sites are shown on **Figures 3 and 4**, and August 2012 groundwater level elevations are shown on **Figure 5**.

2. Hydrogeologic Units: The potential tailings storage sites are underlain by the following principal hydrogeologic units, in order of increasing age:

- Quaternary alluvial deposits on the canyon floors and localized landslide deposits; hydraulic conductivity is estimated to be moderate to high.
- Tertiary sedimentary rocks composed of conglomerate (Gila Conglomerate) and sandstone; hydraulic conductivity is estimated to be low except where enhanced along bedding planes and fracture zones.
- Tertiary volcanic rocks composed of tuff and basalt flows; hydraulic conductivity is estimated to be low to moderate except where enhanced along interflow zones and fracture zones.
- Tertiary and Cretaceous crystalline igneous rocks; hydraulic conductivity is estimated to be low.
- Paleozoic sedimentary rocks consisting of limestone, dolomite, siltstone, shale, and quartzite; hydraulic conductivity is estimated to be low except where enhanced along bedding planes and fracture zones.
- Younger Precambrian sedimentary and igneous rocks consisting of quartzite, shale, limestone, and diabase; hydraulic conductivity is estimated to be low except where enhanced along bedding planes and fracture zones.
- Older Precambrian rocks consisting of crystalline igneous and metamorphic rocks; hydraulic conductivity is estimated to be low.

For the Whitford site, the principal mapped hydrogeologic units include Quaternary landslide deposits on the west side of Reavis Trail Canyon, a Tertiary granitoid stock in the central part of the site, and older Precambrian schist on the eastern, western, and southern edges of the site. A Precambrian granite outcrop occurs at the northwest limb of the proposed site in Reavis Trail Canyon.

For the Silver King site, the principal mapped hydrogeologic units include Quaternary alluvial deposits on the canyon floor along the axis of the canyon, a Tertiary basalt flow unit near the southwest edge of the site, Cretaceous quartz diorite in the northeast part of the site, Paleozoic units in the southeast part of the site, younger Precambrian sedimentary and volcanic rocks on the southeast flank of Silver King Canyon, and Precambrian schist on the northwest flank of Silver King Canyon.

For the Happy Camp site, the principal mapped hydrogeologic units include Quaternary alluvial deposits on the floor of Silver King Canyon near the southeast edge of the site, Tertiary conglomerate across most of the site, Tertiary tuff in Happy Camp Canyon in the north part of the site, Tertiary basalt on the south edge of the site, and younger Precambrian sedimentary rocks in the northwest part of the site.

3. Occurrence and Movement of Groundwater: Groundwater level measurements for the study area were obtained from ADWR databases, including the GWSI database, and the 35-Well and 55-Well Registries. Water level measurements were obtained at selected wells during the field reconnaissance August 9-10, and RCM conducted a groundwater level monitoring round in the region in August 2012. These data were used to assess the occurrence and movement of groundwater for this report. Groundwater in the vicinity of the Whitford, Silver King, and Happy Camp sites moves generally from northeast to southwest (**Figure 5**).

One registered well occurs in the Whitford watershed (Cottonwood well), which was visited on August 9, 2012. Depth to water level was 10.9 meters below land surface (bls). One spring is reported to occur within the Whitford watershed. The spring, designated Black Spring on the USGS 7.5 minute topographic map (2004 version), is located just south of the drainage divide near the head of Reavis Trail Canyon (northwest quarter of Section 29, Township 1 North, Range 12 East), at an elevation of about 1,345 meters above mean sea level (amsl). The spring was not visited during the reconnaissance visit in August 2012. The Google Earth images for the area show a stand of vegetation that may mark the location for the spring.

Five registered wells occur in the Silver King, Happy Camp, and Rice Water Canyon watersheds; reported groundwater levels range from 7.6 to 39.6 meters bls. The Silver King #1 well (**Figure 5**) was visited on August 10, 2012, and depth to water level was measured at 9.3 meters bls. A windmill at the site is operational and supplies a trough and stockpond. Water quality parameters were measured: temperature of the discharge water was 26.4 degrees Celsius (°C), pH was 7.04, and specific conductance was 1,214 microSiemens per centimeter (µS/cm). The Rice Well is located in the southwest part of the Happy Camp site (**Figure 5**), and was included in the RCM August 2012 water level monitoring round; depth to groundwater level was 16.7 meters bls.

Four springs are reported to occur within the Silver King and Happy Camp watersheds and were visited on August 9, 2012. Happy Camp Spring occurs on the floor of Happy Camp

Canyon; flow from the spring was estimated at 0.3 liters per second (L/s). There is a spring zone in the Conley Spring drainage in the Silver King area, and although the spring was dry on the day of the field visit, there are travertine-cemented cobbles in the channel and riparian vegetation in the vicinity of the spring. Bitter Spring is located in Fortuna Wash, and I-Berry Spring is located in Peachville Wash. Elevations at Happy Camp and Bitter Springs are consistent with groundwater level elevations for the regional aquifer system, but groundwater supplying I-Berry Spring appears to be a part of a local perched aquifer system dependent on local rainfall and is not believed to be part of the regional aquifer system.

The presence of Happy Camp and Bitter Springs and the relatively shallow water levels (about 10 meters bls) in the Cottonwood and Silver King wells indicate that groundwater occurs at small depths beneath the canyon floors, and is likely part of the regional groundwater flow system.

4. Groundwater Uses: The two registered wells in the Whitford and Bear Tank Canyon watersheds are stock wells. Of the five registered wells in the Silver King, Happy Camp, and Rice Water Canyon watersheds, two are registered as stock wells, two are registered as commercial or industrial wells, and is registered as a domestic well.

The nearest reported groundwater withdrawals to the Silver King site are for wells (D-1-13) 17dcb, (D-1-12)36bbc, and (D-1-13)32bbd (**Figure 1**). Wells 36bbc and 32bbd are RCM dewatering locations at Shafts No. 3 and 9, and the other is an Integrity Land & Cattle, LLC well (**Table 1**). Reported annual withdrawals from the RCM wells have ranged from 0 to 1,047 acre-feet. Well 17dcb has not been pumped since 2002.

The nearest reported groundwater withdrawals to the Happy Camp site are for wells (D-2-11) 01cdc, (D-2-11)01dcd, (D-2-12)07aba, (D-2-12)08daa, and (D-2-12)10ba (**Figure 1**). Reported owners of these wells include Frank Herron, Boyce Thompson Southwest Arboretum (2 wells), Harborlite Corporation dewatering location, and Harry and Helen Smith Trustees, respectively (**Table 1**). Of these five wells, the largest volumes of groundwater withdrawals have been from the Harborlite dewatering location; reported annual withdrawals for this well have ranged from 76.1 to 273.8 acre-feet.

5. Assessment of Potential for Migration of Tailings Water: For the Whitford site, migration of tailings water would be very limited in the Tertiary intrusive or older Precambrian rocks. While the Quaternary landslide deposits are likely highly permeable, they are underlain by the older Precambrian crystalline rocks which are generally unfractured and of very small hydraulic conductivity.

For the Silver King site, the highest potential for migration of tailings water occurs in the Quaternary alluvium along the floor of the canyon. The alluvium is underlain by younger Precambrian rocks, which would have small hydraulic conductivity except along fracture zones where hydraulic conductivity would be enhanced. During the later stages of tailings deposition in the Silver King site, substantial seepage could also occur along the eastern edge

of the Silver King site, where tailings would directly overlie Paleozoic sedimentary rocks that may locally have enhanced hydraulic conductivity along bedding planes, and along possible fractures and solution features.

For the Happy Camp site, potential for migration of tailings water in the Gila Conglomerate, which underlies most of the site, is likely to be very small. The greatest potential for migration of tailings water is in the volcanic rocks in the north and south parts of the Happy Camp main site and in the north part of the Happy Camp cleaner tailings site.

METHODS

Well records and hydrogeologic data were compiled for a study area encompassing approximately 270 square kilometers, shown on **Figure 1**. Data were compiled from public sources, previous investigations conducted for RCM, and field reconnaissance visits to the Whitford Canyon, Silver King Canyon, and Happy Camp sites. The principal sources of public data were published reports and databases of ADWR, Arizona Geological Survey, and USGS.

An inventory of wells was prepared using the ADWR well registry and GWSI databases. Information related to groundwater levels, groundwater uses, and reported annual groundwater withdrawals were also obtained from the ADWR databases. Well and spring locations in the study area are shown on **Figure 1**. Annual groundwater withdrawals from wells in the study area are summarized in **Table 1**. The well numbering system used in this report is given in **Appendix A**. Information from the 35-Well Registry, 55-Well Registry, and GWSI listings for the study area are provided in **Appendices B, C, and D**, respectively. The well inventories from the individual databases were not combined into a single well inventory; therefore duplicate or inconsistent information likely occurs between the databases.

Regional hydrogeologic features are shown on **Figure 2**, along with local geologic features for the area of the Whitford Canyon and Silver King Canyon watersheds. Surface geology shown on **Figure 2** is based on the geologic map by Spencer and others (1998), but was modified within the Whitford and Silver King Canyon watershed boundaries to reflect additional structural features shown on geologic maps by Peterson (1969) and Spencer and Richard (1995). Detailed descriptions of geologic units shown on the geologic map are given in **Appendix E**.

Available drillers' logs for wells in the study area were retrieved from the ADWR imaged well records within a 4-kilometer distance around the Whitford and Silver King Canyon watersheds and are provided in **Appendix F**. Drillers' logs are available for 49 wells in the study area. In addition, geologic logs and records were provided by RCM for exploration boreholes drilled by others, and are given in **Table 2 and Appendix F**, respectively. Locations of these exploration boreholes are shown on **Figure 2**.

Field reconnaissance visits to Whitford, Silver King, and Happy Camp sites were conducted August 9-10, 2012. Field activities included inspection of geologic units, structural features, wells, and surface water features; and measurements of pH, temperature, and specific conductance of groundwater from springs and pumping wells.

HYDROGEOLOGIC FRAMEWORK

The study area occurs within the Transition Zone physiographic province of central Arizona. The Transition Zone is characterized by deeply incised drainages and rugged topography. The Whitford site is located within the Whitford Canyon watershed and the Silver King site is located within the Silver King Canyon watershed. The Happy Camp main site is located mostly in the Happy Camp Canyon watershed and partly in the Rice Water Canyon watershed to the west. The Happy Camp cleaner tailings site is located within the lower part of the Whitford Canyon watershed (Potts Canyon) to the east, and the Bear Tank Canyon watershed to the west, and the Benson Spring Canyon watershed to the south.

The Whitford Canyon watershed is oriented north-northeast to south-southwest. Whitford Canyon begins at the confluence of Reavis Trail and Wood Camp Canyons. The Whitford Canyon drainage heads south from the confluence then heads southwest through Barnett Camp and into Potts Canyon. All of the drainages are ephemeral. The Whitford Canyon watershed begins about 13 kilometers north of Queen Creek near the head of Reavis Trail and Wood Camp Canyons at an elevation of about 1,550 meters amsl and ends about 5 kilometers west of Superior at the confluence of Potts Canyon and Queen Creek at an elevation of 730 meters amsl. The watershed drains an area of approximately 47 square kilometers. The Bear Tank Canyon watershed is located west of the Whitford Canyon watershed and drains an area of approximately 13 square kilometers.

The principal geologic units at the Whitford Canyon site, in order of increasing age, include Quaternary or Tertiary landslide deposits on the west side of Reavis Trail Canyon, Tertiary intrusive rocks north of the confluence of Reavis Trail and Wood Camp Canyons, and Precambrian igneous and metamorphic rocks surrounding the Tertiary intrusive (**Figure 2**). Detailed descriptions of geologic units shown on **Figure 2** are given in **Appendix E**. There are no major structural features within the Whitford Canyon site.



Photograph A. Whitford Canyon looking north



Photograph B. Whitford Canyon looking south

The Silver King Canyon watershed is oriented northeast to southwest. The watershed comprises Silver King Wash and several smaller tributary washes, all of which are ephemeral. Silver King Canyon watershed begins about 10 kilometers northeast of Queen Creek at an elevation of about 1,525 meters amsl at the heads of Peachville, Fortuna, Silverado, Yellowjack, Comstock, and Conley Spring Washes. The tributaries drain into Silver King Wash which heads southwest to its confluence with Queen Creek. The watershed ends about 3 kilometers west of Superior at the confluence with Queen Creek at an elevation of 756 meters amsl. The watershed drains an area of approximately 16.6 square kilometers.

The principal geologic units at the Silver King Canyon site, in order of increasing age, include Quaternary alluvial deposits on the floor of Silver King Wash, Tertiary volcanic and sedimentary rocks, Cretaceous intrusive igneous rocks, Paleozoic sedimentary rocks, and Precambrian igneous, sedimentary, and metamorphic rocks.

The Happy Camp Canyon watershed is oriented northeast to southwest. The watershed begins about 8.3 kilometers northeast of Queen Creek at an elevation of about

1,362 meters amsl, and ends about 2.5 kilometers west of Superior at the confluence with Queen Creek at an elevation of about 732 meters amsl. The watershed drains an area of approximately 11.5 square kilometers.

The principal geologic units at the Happy Camp site, in order of increasing age, include Quaternary alluvial deposits on the floor of Silver King Wash, Tertiary volcanic and sedimentary rocks, and Precambrian igneous and sedimentary rocks (**Figure 2**). Detailed descriptions of geologic units shown on **Figure 2** are given in **Appendix E**. Hydrogeologic cross sections of the Happy Camp and Silver King sites are shown on **Figures 3 and 4**.

The major structural features in the study area are the Concentrator, Main, and Conley Spring Faults (**Figure 2**), located in the southwest part of the Silver King site. These are normal faults down-thrown on the west side (Peterson, 1969; Spencer and others, 1998) (**Figure 3**).



Photograph C. Silver King Canyon looking northwest. Peachville Mountain in the background

Quaternary Alluvial Deposits

Mapped Quaternary alluvial deposits occur chiefly along Silver King Wash and Queen Creek, but also include landslide deposits on the steep western slopes of Reavis Trail Canyon in the Whitford Canyon watershed. The alluvial deposits within Silver King Canyon comprise a veneer of poorly sorted gravel and sand originating from the surrounding highlands, and extend from the central part of the Silver King site, along the east edge of the Happy Camp site, to Queen Creek. Unmapped Quaternary alluvium also occurs in some areas along canyon floors in the Whitford Canyon and Happy Camp Canyon, and where present would have very small thickness. The alluvial deposits likely have moderate to high hydraulic conductivity.

Geologic units that are classified within the Quaternary alluvial deposits include:

- **Qy – Low Terrace and Alluvial Fan Deposits (Holocene)**
 - Exposed in the channel of Silver King Wash
 - Alluvial deposits that have incipient soil development comprising sand to boulders



Photograph D. Alluvial deposits (Qy) in Silver King Wash

- **Ql – Moderately Dissected Alluvial Fan and Terrace Deposits (Late Pleistocene)**
 - Exposed on the west side of Silver King Wash, along the southeast edge of the Happy Camp site
 - Alluvial deposits that have moderate soil development comprising sand to boulders
- **Qm – Dissected Alluvial Fan and Terrace Deposits (Middle Pleistocene)**
 - Exposed on the east side of Silver King Wash, southeast of the Happy Camp site
 - Alluvial deposits that have strong soil development comprising sand to boulders
- **Qml – Middle Alluvium, Undifferentiated (Late to Middle Pleistocene)**
 - Composite unit that contains Ql and Qm exposed between the Happy Camp site and Queen Creek
 - Alluvial deposits that have moderately to strongly developed soils
- **Qo – Deeply Dissected Alluvial Fan Remnants (Early Pleistocene)**
 - Exposed in the Whitford Canyon watershed, between the Silver King and Whitford Canyon sites, near the junction of the Concentrator and Conley Spring Faults
 - Undifferentiated surficial deposits
- **QTI – Landslide Deposits (Holocene or Pliocene)**
 - Exposed on the west slopes of Reavis Trail Canyon in the Whitford Canyon site
 - Poorly consolidated to unconsolidated deposits comprising mud to large boulders

Tertiary Sedimentary and Volcanic Rocks

The Tertiary sedimentary and volcanic rocks occur chiefly in the Happy Camp site, and extend south to Queen Creek and east to the Concentrator Fault (**Figure 2**). These rocks likely have small hydraulic conductivity, except along bedding plans and steeply-dipping structural features where hydraulic conductivity may be substantially larger. Geologic units exposed at the Happy Camp site that are classified within the Tertiary sedimentary and volcanic rocks include:

- **Tcu – Conglomerate (Miocene)**
 - Exposed throughout most of the Happy Camp main and cleaner tailings sites
 - Moderately to well indurated conglomerate (Gila Conglomerate), consisting of sub-rounded to sub-angular cobbles to boulders; grades downward into Tsu



Photograph E. Joint in Tertiary Gila Conglomerate (Tcu) in Happy Camp Canyon

- **Tsu – Sandstone (Miocene)**
 - Exposed southeast and southwest of Happy Camp main site
 - Medium to fine-grained sandstone; grades upward into Tcu; overlies Tb
- **Tt – Poorly Welded Tuff (Miocene)**
 - Exposed in Happy Camp Canyon north of Happy Camp Spring
 - Non-welded to poorly welded tuff of uncertain affinity



Photograph F. Tuffaceous volcanics (Tt) north of Happy Camp

- **Tfp – Felsic Lava Flows (Middle to Early Miocene)**
 - Exposed in north part of Happy Camp cleaner tailings site
 - Quartz latite and rhyolite lava flows of the Picketpost Mountain volcanics



**Photographs G and H. Felsic volcanics (Tfp) (left) and water pocket (right)
Barnett Camp area**

- **Tb – Basaltic Rocks (Middle to Early Miocene)**
 - Exposed in south part of Happy Camp main site, in areas south of Happy Camp main and cleaner tailings sites, and along the Concentrator Fault in the Silver King site
 - Basalt lava flows and flow breccias
- **Tal – Apache Leap Tuff (Early Miocene)**
 - Exposed near the northeast margin of Silver King Canyon site
 - Crystal-rich, ash-flow tuff, unwelded to densely welded
- **Tev – Volcanic Rocks (Early Miocene)**
 - Exposed near the northeast margin of Silver King Canyon site and the northeast margin of Whitford Canyon site
 - Lava flows of rhyolite and perlite obsidian
- **Tsl – Pre-Volcanic Sedimentary Rocks (Miocene to Late Oligocene)**
 - Exposed near the northeast margin of Silver King Canyon site
 - Pre-volcanic clastic rocks (Whitetail Conglomerate) consisting of massive conglomerate, mudstone, evaporite, and sandstone

Tertiary and Cretaceous Intrusive Rocks

A Tertiary granitoid stock occurs in the central part of the Whitford Canyon site, a Tertiary-Cretaceous porphyry intrusive occurs near the northeast edge of the Whitford Canyon site, and a Cretaceous quartz diorite stock occurs in the northeast part of the Silver King Canyon site (**Figure 2**). These rocks likely have small hydraulic conductivity. Geologic units exposed within Whitford Canyon and Silver King Canyon sites (**Figure 2**) that are classified within the Tertiary and Cretaceous intrusive rocks include:

- **Tg2 – Granitoid Stock of Wood Camp Canyon (Miocene)**
 - Exposed in the center of the Whitford Canyon site
 - Fine-grained aplitic to granophyric granite
- **TKpg – Porphyry of Government Hill (Late Cretaceous or Paleocene)**
 - Exposed near the northeast edge of the Whitford Canyon site
 - Quartz monzonite porphyry
- **Kqd – Quartz Diorite of Peachville Wash (Late Cretaceous)**
 - Exposed across the northeast part the Silver King Canyon site
 - Medium to fine-grained quartz diorite, intrudes Pinal Schist, Apache Group and Paleozoic strata



Photograph I. Quartz diorite of Peachville Wash (Kqd)

Paleozoic Sedimentary Rocks

Paleozoic sedimentary rocks are exposed along the northeast margin of the Silver King Canyon site. The units are fractured and, thus, likely have small to moderate secondary hydraulic conductivity. The beds dip moderately to the east and southeast (**Figure 2 and 3**). Rocks exposed within the Silver King Canyon site that are classified within this group include:

- **Pn – Naco Formation (Pennsylvanian)**
 - Exposed along the east edge of the Silver King Canyon site adjacent to the Conley Spring Fault
 - Fossiliferous fine-grained limestone interbedded with marl and shale
- **MCs – Undifferentiated Escabrosa Limestone, Martin Formation, and Bolsa Quartzite (Mississippian, Devonian, and Cambrian)**
 - Exposed along the east edge of Silver King Canyon site
 - Consists of the following units: Escabrosa Limestone, Martin Formation, and Bolsa Quartzite; these units dip moderately to the east and southeast

Younger Precambrian (Middle Proterozoic) Sedimentary and Igneous Rocks

The younger Precambrian rocks are exposed in the northwest part of the Happy Camp main site and in the northeast and southeast parts of the Silver King site. The igneous unit likely has low hydraulic conductivity, whereas the sedimentary units are highly fractured

and, thus, likely have small to moderate secondary hydraulic conductivity. The beds dip moderately to the east and southeast (**Figure 2**). Rocks exposed within the Happy Camp and Silver King sites that are classified within this group include:

- **Yd – Diabase (Middle Proterozoic)**
 - Exposed in the northwest part of the Happy Camp main site, and along the east part of Silver King Canyon site
 - Dark gray dikes with typical sub-ophitic, diabasic texture; major sills intrude Dripping Spring Quartzite, Mescal Limestone, Pioneer Shale, and Troy Quartzite
- **Yad – Apache Group, Troy Quartzite, and Diabase (Middle Proterozoic):**
 - Exposed in the northwest part of the Happy Camp main site
 - Consists of the following units: Diabase, Troy Quartzite, Mescal Limestone, Dripping Spring Quartzite, and Pioneer Shale; these units dip moderately to the east and southeast
- **Ya – Apache Group (Middle Proterozoic):**
 - Exposed between the Whitford and Happy Camp sites, and along the east part of Silver King Canyon watershed
 - Consists of the following units: Mescal Limestone, Dripping Spring Quartzite, and Pioneer Shale; these units dip moderately to the east and southeast



Photograph J. Contacts between Precambrian diabase (left), Apache Group (center), and Paleozoic units (right)

Older Precambrian (Early Proterozoic) Igneous and Metamorphic Rocks

The older Precambrian rocks are exposed throughout the Whitford site and in the west part of the Silver King site. The hydraulic conductivity of these rocks is likely very small and mainly controlled through secondary structural features (**Figure 2**). Rocks that are classified within this group include:

- **Xgd – Granodiorite to Granite (Early Proterozoic)**
 - Exposed in the northwestern part of the Whitford Canyon site
- **Xp – Pinal Schist (Early Proterozoic)**
 - Exposed in most of the Whitford Canyon site and in the west part of the Silver King Canyon site
 - Generally consists of fine-grained quartz-muscovite-chlorite \pm biotite semi-schist to phyllite
- **Xpc – Pinal Schist Calc-silicate and Amphibolite Facies (Early Proterozoic):**
 - Exposed in a small area in the south part of the Whitford Canyon site
 - Consists of interlayered amphibolite, marble, and psammite
- **Xpp – Pinal Schist Phyllite Facies (Early Proterozoic):**
 - Exposed near Queen Creek south of the Happy Camp cleaner tailings site
 - Consists of massive, platy, slightly schistose phyllite



Photograph K. Pinal Schist (Xp)

HYDRAULIC CONDUCTIVITY OF PRINCIPAL GEOLOGIC UNITS

Hydraulic conductivity for geologic units in the project area has been estimated from hydrologic tests at wells in the study area; estimated hydraulic conductivity values are summarized in **Table 3**.

Hydraulic conductivity for the Gila Conglomerate (Tcu) has been estimated based on 14 hydrologic tests conducted at monitor wells in the West Plant area. Estimates of hydraulic conductivity of the conglomerate (excluding one test for a mudstone unit within the conglomerate), range from 1.1×10^{-7} to 6×10^{-9} centimeters per second (cm/sec); arithmetic mean is 3.0×10^{-6} cm/sec and geometric mean is 4.8×10^{-7} cm/sec. Estimated hydraulic conductivity of the mudstone unit (one test) within the Gila Conglomerate is 1.3×10^{-9} cm/sec.

Hydraulic conductivity for the mid- to early-Miocene Tertiary Picketpost Mountain volcanic units was estimated to be 1×10^{-5} cm/sec based on a constant-rate pumping test at well DHRES-04.

Hydraulic conductivity for the Apache Leap Tuff (Tal) has been estimated based on 22 hydrologic tests at the HRES series of wells. Estimated hydraulic conductivity ranges from 2×10^{-7} to 6×10^{-3} cm/sec; arithmetic mean is 5×10^{-4} cm/sec and geometric mean is 5×10^{-5} cm/sec.

Hydraulic conductivity for younger Precambrian sedimentary rocks and diabase (Yad) was estimated to be 4×10^{-6} cm/sec based on a constant-rate pumping test at well DHRES-09. A pumping test at well DHRES-13, which penetrates the same rock units and also Pinal Schist (Xpc), indicated a similar hydraulic conductivity of 1×10^{-6} cm/sec.

OCCURRENCE AND MOVEMENT OF GROUNDWATER

Groundwater level measurements for the study area were obtained from ADWR databases, including the GWSI database, and the 55 and 35 well registries. Measurements from the GWSI are obtained by ADWR for index wells, and are considered reliable. Measurements from the 55 and 35 well registries are often reported by the driller or pump contractor at the time of drilling or equipping of the well, are considered less reliable than measurements from the GWSI, and also may not be representative of current or recent groundwater conditions. A groundwater level monitoring round was conducted by RCM personnel in August 2012 as part of the Superior basin and Queen Creek corridor study. These groundwater level measurements are shown on **Figure 5**. **Figure 5** shows groundwater level elevation contours based on the best available data for shallow groundwater system in the Superior basin. Inspection of **Figure 5** indicates that groundwater beneath the Silver King and Happy Camp areas moves generally from northeast to southwest. Average hydraulic gradient is in the magnitude of 20 meters per kilometer.

There is one registered well in the Whitford Canyon watershed and one registered well in the Bear Tank Canyon watershed. During the site visit on August 10, 2012, the Cottonwood Well [(D-1-12)16db] in Whitford Canyon watershed was inspected (**Photograph L**) (**Figure 2**). Groundwater level was measured at 10.9 meters bls; temperature of the groundwater was 34.0 degrees Celsius ($^{\circ}\text{C}$), pH was 7.68, and specific conductance was 2,211 $\mu\text{S}/\text{cm}$. The Noble Well [(D-1-12) 19cb] in Bear Tank Canyon watershed was not visited.



Photograph L. Cottonwood Well and tank

During the August 10, 2012 site visit, an unregistered well was located near the head of Wood Camp Canyon adjacent to a stone cabin (**Photograph M**). The well is a former windmill well, that was 5 feet in diameter and about 15 feet deep. It is located in Township 1 North, Range 12 East, in the SE $\frac{1}{4}$, of the SE $\frac{1}{4}$, of the NW $\frac{1}{4}$ of Section 33. The presence of drill cuttings on the ground suggests that the well was recently deepened. An 8-inch casing is installed in the well.



Photograph M. Stone cabin and well

Within the Whitford Canyon watershed, there is one reported spring. Black Spring is reported to be located just south of the drainage divide near the head of Reavis Trail Canyon in the NW 1/4 of Section 29, Township 1 North, Range 12 East, at an elevation of about 1,347 meters amsl. While the spring was not visited in August 2012, Google Earth images for the area show a stand of vegetation that may mark the location for the spring. The groundwater supplying this reported spring may be part of local perched aquifer system dependent on recent local rainfall and is not believed to be part of the regional aquifer system. Perlite Spring is located north of the Happy Camp cleaner tailings site (**Figure 1**). There are two reported springs in the Bear Tank Canyon watershed, Perlite Spring and an unnamed spring. The springs in Bear Tank Canyon watershed were not visited during the August 2012 field reconnaissance.

There are five registered wells in the Silver King, Happy Camp, and Rice Water Canyon watersheds. Construction details are available for one domestic well, two industrial wells, and one stock well. Reported depths for these wells range from 12 to 122 meters bls, and reported groundwater levels range from 7.6 to 39.6 meters bls (**Appendix C**). The Silver King Well [(D-1-12)27aad] was inspected on August 10, 2012. The windmill is operational and supplies a trough and stock pond (**Photograph N**). Depth to groundwater level was measured at 9.3 meters bls; temperature of the groundwater was 26.4°C, pH was 7.04, and specific conductance was 1,214 µS/cm. The Rice Well [(D-1-12)31dd] is reportedly located in Rice Water Canyon but was not visited during the August 2012 reconnaissance. RCM personnel report a depth to groundwater level of 16.7 m, and a groundwater level elevation of 739.4 meters amsl, at the Rice Well (August 2012).



Photograph N. Silver King Well and stock pond

Within the Silver King and Happy Camp watersheds, there are four reported spring locations. The springs include Happy Camp Spring, Bitter Spring, I-Berry Spring, and Conley Spring. Happy Camp Spring is located on the floor of Happy Camp Canyon, within the Gila Conglomerate (Tcu) (**Figure 2**). During the site visit on August 10, 2012, the spring area consisted of a dammed section of a stream channel with sediment built up behind the dam (**Photograph O**). A discharge pipe extends from behind the dam to a stock pond located downstream. Discharge to the pond was estimated to be about 0.3 liters per second; temperature was 27.5°C, pH was 6.73, and specific conductance was 790 $\mu\text{S}/\text{cm}$.



Photograph O. Dam in wash at Happy Camp Spring

Bitter Spring is an improved spring located in the Fortuna Wash drainage, within the Kqd about 30 meters downstream from the contact between the Kqd and Xp (**Figure 2**). The site was visited on August 9, 2012. The spring is developed with a spring box, a solar powered submersible electric pump, storage tank, and cattle trough (**Photograph P**). Depth to groundwater level at the spring box was 2.7 meters bls. Water quality parameters were measured from the cattle trough; temperature was 31.3°C, pH was 8.32, and specific conductance was 1,327 $\mu\text{S}/\text{cm}$.



Photograph P. Bitter Spring

In Conley Spring Wash, a spring zone was observed. Within the spring zone there were travertine-cemented cobbles of Apache Leap Tuff, limestone, diabase, basalt, and quartzite. The spring was dry, but the presence of riparian vegetation including cattails, tobacco tree, pentstemon, hackberry, and a small dead cottonwood tree suggests that at times there is flow or seepage in the zone (**Photograph Q**).



Photograph Q. Conley Spring with riparian vegetation (left) and travertine cemented cobbles in spring zone (right)

I-Berry Spring is an improved spring located in the Peachville Wash drainage within the Kqd. RCM personnel reported a depth to groundwater level of 5.3 meters bls in August 2012. The groundwater supplying this reported spring may be part of local perched aquifer system dependent on recent local rainfall and is not believed to be part of the regional aquifer system.

The presence of Happy Camp, Bitter, and I-Berry Springs and the shallow water levels (about 10 meters bls) in Cottonwood and Silver King Wells indicate that groundwater level occurs at small depths beneath the canyon floor, and possibly at depths of several tens of meters beneath the canyon sides. The Paleozoic and younger Precambrian sedimentary rocks likely contain a persistent but highly compartmentalized groundwater system due to the faulting and juxtaposition of sedimentary rocks, diabase and schist. Regional direction of groundwater movement for this system is believed to be generally from northeast to southwest (**Figure 5**).

Groundwater level data and results of calibration of the RCM integrated groundwater flow model suggest that the Concentrator Fault acts as a barrier to groundwater movement. Comparison of water level elevations in deep wells east of the Concentrator Fault to water level elevations in wells completed to similar depths west of the fault suggests the fault acts as a barrier to groundwater movement. To calibrate the RCM integrated groundwater flow model, horizontal hydraulic conductivity assigned to rock units along the Concentrator Fault were reduced by two orders of magnitude compared to conductivities assigned to the same rock units outside the fault zone (Schlumberger Water Services, 2010). Vertical hydraulic conductivity was not reduced in the flow model.

The deep groundwater system is believed to be highly compartmentalized. Due to dewatering operations, water levels in the mine workings within the RCM graben are about 500 meters bmsl. Water levels in wells outside the RCM graben are several thousand meters higher.

GROUNDWATER USES

Information on groundwater uses in the study area was obtained from the ADWR GWSI database and 55-Well Registry. The majority of groundwater uses are reported to be stock uses for most wells in the region surrounding Whitford Canyon and Silver King Canyon watersheds. Monitoring, industrial, or domestic uses are reported for a smaller percentage of wells in the study area (**Figure 1; Appendices B through D**).

Most of the wells in the study area are classified as “exempt” wells, which are equipped to pump less than 35 gallons per minute, and are exempt from the requirement to report groundwater withdrawals to ADWR. There are no reported groundwater withdrawals within Whitford Canyon, Silver King Canyon, or Bear Tank Canyon watersheds. Reported groundwater withdrawals for non-exempt wells in the wider study area are summarized in **Table 1** for the period 1993 through 2010. The reported groundwater withdrawals and well owners include:

• (D-1-12)36bbc	Resolution Copper Mining LLC	Shaft No. 3
• (D-1-13)17dcb	Integrity Land & Cattle, LLC	
• (D-1-13)32bbd	Resolution Copper Mining LLC	Shaft No. 9
• (D-2-11)01cdc	Frank Herron	
• (D-2-11)01dcd	Boyce Thompson Southwest Arboretum	
• (D-2-12) 07aba	Boyce Thompson Southwest Arboretum	
• (D-2-12)08daa	Harborlite Corporation	
• (D-2-12)10ba	Harry & Helen Smith Trustees	

The largest volumes of groundwater withdrawals have been from the wells owned RCM and Integrity Land & Cattle, LLC. The RCM withdrawals are for dewatering at Shaft No. 3 and Shaft No. 9. The well owned by Integrity Land & Cattle, LLC has not been pumped since 2002.

ASSESSMENT OF POTENTIAL FOR MIGRATION OF TAILINGS WATER

Hydrogeologic data compiled for the present investigation were used to assess the potential for migration of tailings water in geologic units beneath potential tailings impoundments. The potential for migration will be controlled by hydraulic conductivity of the underlying rock units and by hydraulic gradients that will act as the driving force to move tailings water into and through geologic units

The only geologic units in the study area with large hydraulic conductivity are the Quaternary alluvial and colluvial deposits. For all other geologic units, hydraulic conductivity is related chiefly to degree and interconnection of fractures associated with structural features. For the volcanic rocks in the north and south parts of the Happy Camp main site and the north part of the Happy Camp cleaner tailings site, hydraulic conductivity may also be related to the nature and spacing of bedding planes between volcanic units.

Hydraulic gradients will depend partly on depth to groundwater level, which ranges from a few meters or less in the topographically low areas to several tens of meters beneath the sides of the canyons. Vertical hydraulic gradients acting to move tailings water downward into underlying geologic units would be smaller beneath the floors of canyons than beneath the sides of canyons.

The largest potential for migration of tailings water is along the canyon floor at the south end of the Silver King site, where tailings would directly overlie Quaternary alluvium. Substantial seepage could also occur in Tertiary volcanic rocks in the north and south parts of the Happy Camp main site and in the northeast part of the Happy Camp cleaner tailings site. These rocks may contain bedding planes and structural features that would correspond to zones of enhanced hydraulic conductivity. During the later stages of tailings deposition in the Silver King site, substantial seepage could also occur along the eastern edge of the Silver King Canyon site, where tailings would directly overlie Paleozoic sedimentary rocks that may locally have enhanced hydraulic conductivity along bedding planes, and along possible fractures and solution features.

Moderate potential for migration of tailings water is associated with the younger Precambrian sedimentary rocks in the north part of the Happy Camp site and south part of the Silver King site, where fracture zones may occur resulting in locally enhanced hydraulic conductivity. Although the Concentrator Fault appears to act as a barrier to groundwater movement in the deeper flow system in the vicinity of Superior, it is possible that this fault and the Main and Conley Spring Faults, which pass through the south part of the Silver King site, may have resulted in local zones of fracturing and enhanced hydraulic conductivity.

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**TABLE 1. SUMMARY OF GROUNDWATER WITHDRAWALS
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	55 WELL REGISTRY NUMBER	OWNER/COMPANY	.....ANNUAL GROUNDWATER WITHDRAWALS (acre-feet).....																	
			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
(D-01-12) 36bbc	525311	Resolution Copper Mining LLC	374	228.5	116.2	213	4.1	435.81	---	---	---	---	---	---	---	---	---	878.8	1047	Shaft No. 3	
(D-01-13) 17dcb	609674	Integrity Land & Cattle, LLC	2084.58	1433.71	1119.96	1604.2	1193	1208.7	1304	1479	1259	1791	---	---	---	---	---	---	---		
(D-01-13) 32bbd	525312	Resolution Copper Mining LLC	781	569.7	863.3	590.8	713.4	---	29.72	50.73	20.46	41.22	16.92	25.9	0	50.15	58.58	64.13	883.2	1040	Shaft No. 9
(D-02-11) 01cdc	627522	Frank Herron	3	6.5	1.3	3.9	6.96	6.22	1.9	2.5	11	---	---	---	---	---	---	6.04	9.71	8.915	
(D-02-11) 01dcd	560518	Boyce Thompson Southwest Arboretum	---	---	---	---	---	31	17.6	40.2	21.7	41	31.3	28.3	30	12.8	16.9	30.8	53	31.8	
(D-02-12) 07aba	624605	Boyce Thompson Southwest Arboretum	---	43.1	44.5	47	56.5	37.19	48.7	34.77	37	24.3	37.3	30.5	40	46.4	29.7	36.6	34.8	23	
(D-02-12) 08daa	588114	Harborlite Corporation	---	---	---	---	---	---	---	---	103.4	---	76.1	---	---	---	91.4	116.2	95.7	273.8	
(D-02-12) 10ba	602821	Harry & Helen Smith Trustees	12	11	10	11	12	14	15	17	19	18	12	14	13	14	24	7	6	9.9	

--- = No groundwater withdrawals reported

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**TABLE 2. SUMMARY OF BOREHOLE LITHOLOGIC LOGS
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

BOREHOLE IDENTIFIER	CADASTRAL LOCATION	55 WELL REGISTRY NUMBER	GEOLOGIC DATA FROM KENNECOTT				DRILLER NOTES FROM ADWR IMAGED WELL RECORDS
			INTERVAL		GEOLOGIC AGE	..... GEOLOGIC UNIT
			TOP (m, bls) ^a	BOTTOM (m, bls)			
AC-1	(D-02-12)08bca	546429	0.0	264.3	Tertiary	Volcanic Rocks	Minor water at 20 meters below land surface Artesian flow at 384 meters
			264.3	290.2	Tertiary	Apache Leap Tuff	
			290.2	364.2	Tertiary	Whitetail Conglomerate	
			364.2	373.7	Precambrian	Diabase	
			373.7	375.8	Precambrian	Quartzite	
			375.8	398.7	Precambrian	Diabase	
			398.7	406.3	Precambrian	Quartzite	
			406.3	408.4	Tertiary	Volcanic Rocks / Dike (?)	
			408.4	470.9	Precambrian	Diabase	
AC-2	(D-02-12)08ddd	546429	0.0	540.7	Tertiary	Volcanic Rocks	Minor water at 67 meters below land surface
			540.7	670.6	Tertiary	Apache Leap Tuff	
			670.6	831.2	Tertiary	Whitetail Conglomerate	
			831.2	929.3	Precambrian	Sedimentary Rocks	
			929.3	988.5	Precambrian	Quartzite	
AC-3	(D-02-12)05cda	553490	0.0	341.7	Quaternary-Tertiary	Alluvial Sediments and Volcanic Rocks	Depth to water at 24 meters below land surface
			341.7	396.2	Tertiary	Apache Leap Tuff	
			396.2	484.8	Tertiary	Whitetail Conglomerate	
			484.8	691.3	Precambrian	Diabase	
AC-4	(D-02-12)08aaa	552443	0.0	500.5	Quaternary-Tertiary	Alluvial Sediments, Gila Conglomerate, and Volcanic Rocks	Artesian flow at 854 meters
			500.5	648.6	Tertiary	Apache Leap Tuff	
			648.6	666.0	Tertiary	Whitetail Conglomerate	
			666.0	671.2	Precambrian	Troy Quartzite and Diabase	
			671.2	681.5	Precambrian	Diabase	
			681.5	821.1	Precambrian	Sedimentary Rocks	
			821.1	902.2	Precambrian	Quartzite	
			902.2	916.8	Precambrian	Diabase	
			916.8	921.4	Precambrian	Quartzite	
			921.4	931.0	Precambrian	Diabase	
			931.0	980.9	Precambrian	Quartzite	
			980.9	996.7	Precambrian	Diabase	
			996.7	1012.2	Precambrian	Quartzite	
			1012.2	1048.8	Precambrian	Diabase	
			1048.8	1068.3	Precambrian	Quartzite	
			1068.3	1074.4		Breccia	
			1074.4	1079.9	Precambrian	Quartzite	
			1079.9	1092.7		Breccia	
			1092.7	1124.4	Precambrian	Quartzite	
			1124.4	1130.8		Breccia	
			1130.8	1188.7	Precambrian	Quartzite	
			1188.7	1211.6	Precambrian	Diabase	
			1211.6	1214.6		Breccia	
			1214.6	1225.6	Precambrian	Diabase	

**TABLE 2. SUMMARY OF BOREHOLE LITHOLOGIC LOGS
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

BOREHOLE IDENTIFIER	CADASTRAL LOCATION	55 WELL REGISTRY NUMBER	GEOLOGIC DATA FROM KENNECOTT				DRILLER NOTES FROM ADWR IMAGED WELL RECORDS
			INTERVAL		GEOLOGIC AGE	..... GEOLOGIC UNIT
			TOP (m, bls) ^a	BOTTOM (m, bls)			
AC-5	(D-02-12)06daa	552444	0.0	409.7	Tertiary	Volcanic Rocks	Depth to water at 24 meters below land surface
			409.7	524.0	Precambrian	Diabase	
			524.0	604.4	Precambrian	Quartzite	
			604.4	784.3	Precambrian	Diabase	
AC-6	(D-02-12)05abc	552442	0.0	428.2	Quaternary-Tertiary	Alluvial Sediments, Gila Conglomerate, and Volcanic Rocks	Depth to water at 30 meters below land surface
			428.2	531.0	Precambrian	Sedimentary Rocks	
			531.0	554.4	Cretaceous (Tertiary?)	Quartz Eye Porphyry	
			554.4	621.8	Precambrian	Diabase	
B-1	(D-01-12)33	---	0.00	438.91	Tertiary	Gila Conglomerate with Interbedded Sandstone and Volcanic Rocks	
			438.91	632.46	Tertiary	Apache Leap Tuff	
			632.46	765.05	Tertiary	Whitetail Conglomerate	
			765.05	798.58	Precambrian	Dripping Spring Quartzite	
			798.58	1005.84	Precambrian	Diabase	
			1005.84	1072.90	Precambrian	Dripping Spring Quartzite	
			1072.90	1434.69	Precambrian	Diabase	
B-2	(D-01-12)34b	---	0.00	932.69	Tertiary	Gila Conglomerate with Interbedded Volcanic Rocks	
			932.69	1216.15	Tertiary	Apache Leap Tuff	
			1216.15	1224.08	Tertiary	Whitetail Conglomerate	
			1224.08	1258.82	Devonian	Martin Formation	
			1258.82	1295.40	Cambrian	Bolsa Quartzite	
			1295.40	1344.17	Precambrian	Troy Quartzite	
			1344.17	1447.80	Precambrian	Mescal Limestone	
			1447.80	1493.52	Precambrian	Dripping Spring Quartzite	
			1493.52	1508.76	Laramide	Quartz eye porphyry	
			1508.76	1514.86	Precambrian	Dripping Spring Quartzite	
			1514.86	1682.50	Precambrian	Diabase	
			1682.50	1700.78	Precambrian	Dripping Spring Quartzite	
1700.78	1810.51	Precambrian	Diabase				
B-6	(D-02-12)06abd	---	0.0	188.1	Tertiary	Volcanic Rocks	
			188.1	257.9	Tertiary	Apache Leap Tuff	
			257.9	323.4	Tertiary	Whitetail Conglomerate	
			323.4	473.1	Precambrian	Diabase	
			473.1	498.4	Precambrian	Dripping Spring Quartzite	
			498.4	520.0	Precambrian	Diabase	
B-7	(D-01-12)33d	---	520.0	611.1	Precambrian	Dripping Spring Quartzite	
			0.00	559.61	Tertiary	Gila Conglomerate with Interbedded Volcanic Rocks	
			559.61	822.66	Tertiary	Apache Leap Tuff	
			822.66	947.01	Precambrian	Diabase	
			947.01	971.70	Precambrian	Basalt	
			971.70	1089.66	Precambrian	Mescal Limestone	
			1089.66	1171.35	Precambrian	Dripping Spring Quartzite	
			1171.35	1249.98	Precambrian	Diabase	

^a m, bls = meters below land surface

--- = not available

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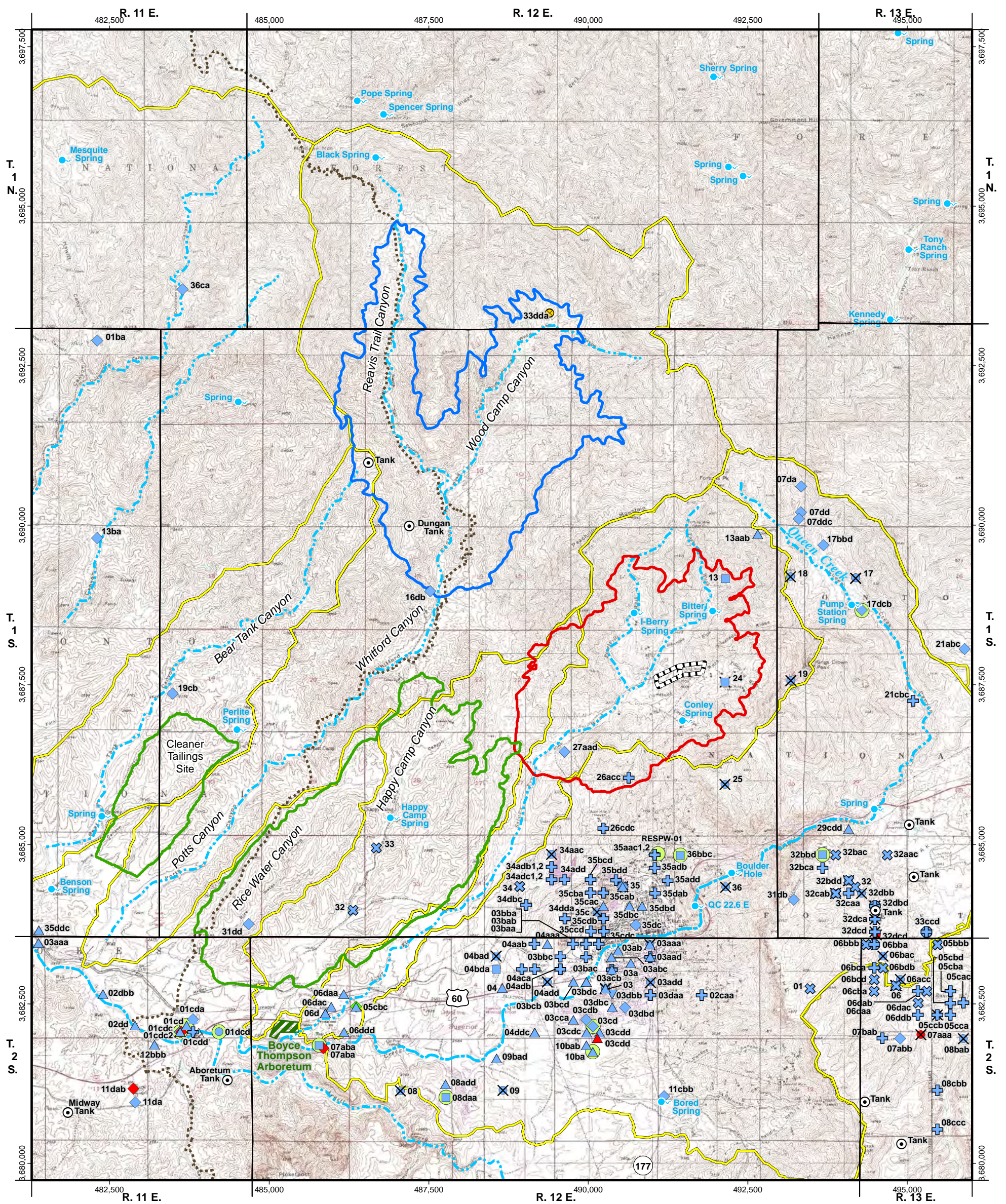


**TABLE 3. SUMMARY OF REPORTED HYDRAULIC CONDUCTIVITY VALUES FOR GEOLOGIC UNITS
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

WELL(S)	HYDRAULIC CONDUCTIVITY (cm/sec) ^a	TEST TYPE	GEOLOGIC UNIT TESTED	SOURCE(S)
Smelter Pond POC	3.4×10^{-5}		Alluvium	Golder & Assoc., 2008
MCC-1	3.8×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-2	1.1×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-3B	1.3×10^{-9}		Mudstone	Golder & Assoc., 2008
MCC-3C	6.2×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-4	2.2×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-6A	1.7×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-6B	9.9×10^{-8}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-6C	7.1×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
MCC-9	1.1×10^{-5}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
GAI-02-01	1.4×10^{-6}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
GAI-02-02	2.3×10^{-5}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
Settling Ponds 1, 2	1.1×10^{-6}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
Tailings Pond 5 POC	4.5×10^{-7}		Gila Conglomerate (Tcu)	Golder & Assoc., 2008
DHRES-05	6×10^{-9}	Falling-head slug	Gila Conglomerate (Tcu)	M&A, 2011a
DHRES-04	1×10^{-5}	Constant-rate pumping	Tertiary Picketpost Mountain volcanic units	M&A, 2011a
HRES series ^b	Range: 2×10^{-7} to 6×10^{-3} Arithmetic Mean: 5×10^{-4} Geometric Mean: 5×10^{-5}	Constant-rate pumping tests (18), falling-head slug tests (2), and airlift tests (2)	Apache Leap Tuff (Tal)	M&A, 2005, 2008, 2010, 2011a, 2011b, 2011c, 2012a, 2012b
DHRES-09	4×10^{-6}	Constant-rate pumping	Younger Precambrian sedimentary rocks and diabase (Yad)	M&A, 2011d
DHRES-13	1×10^{-6}	Constant-rate pumping	Younger Precambrian sedimentary rocks and diabase (Yad), and Older Precambrian Pinal Schist (Xpc)	M&A, 2011e

^a cm/sec = centimeters per second

^b HRES Series: HRES-01 through HRES-07, HRES-09 through HRES-13, Oak Flat well, and wells A-06 and MJ-11



EXPLANATION

10aac
● Well Location and Identifier

Source of Well Data (by color)

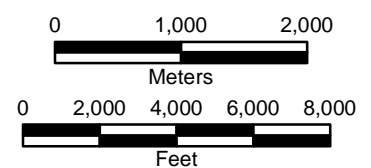
- ADWR GWSI Database
- ADWR 55 Well Registry
- ADWR 35 Well Registry
- ⊗ Unregistered Well Located During Field Reconnaissance

Water Uses (by symbol)

- Recreation
- ▲ Domestic
- Commercial or Industrial
- ◆ Irrigation or Stock
- ⊕ Monitoring, Test, or Remediation
- ⊗ Mineral Exploration
- ▼ Production
- ⊗ Undetermined or Unused

- | | |
|--|--|
| | Watershed Boundary |
| | Stream |
| | Arizona Trail |
| | Spring |
| | Stock Tank |
| | Historic/Current Point of Groundwater Withdrawal |
| | Silver King Canyon Site |
| | Whitford Canyon Site |
| | Happy Camp Site |
| | Resolution Claims |

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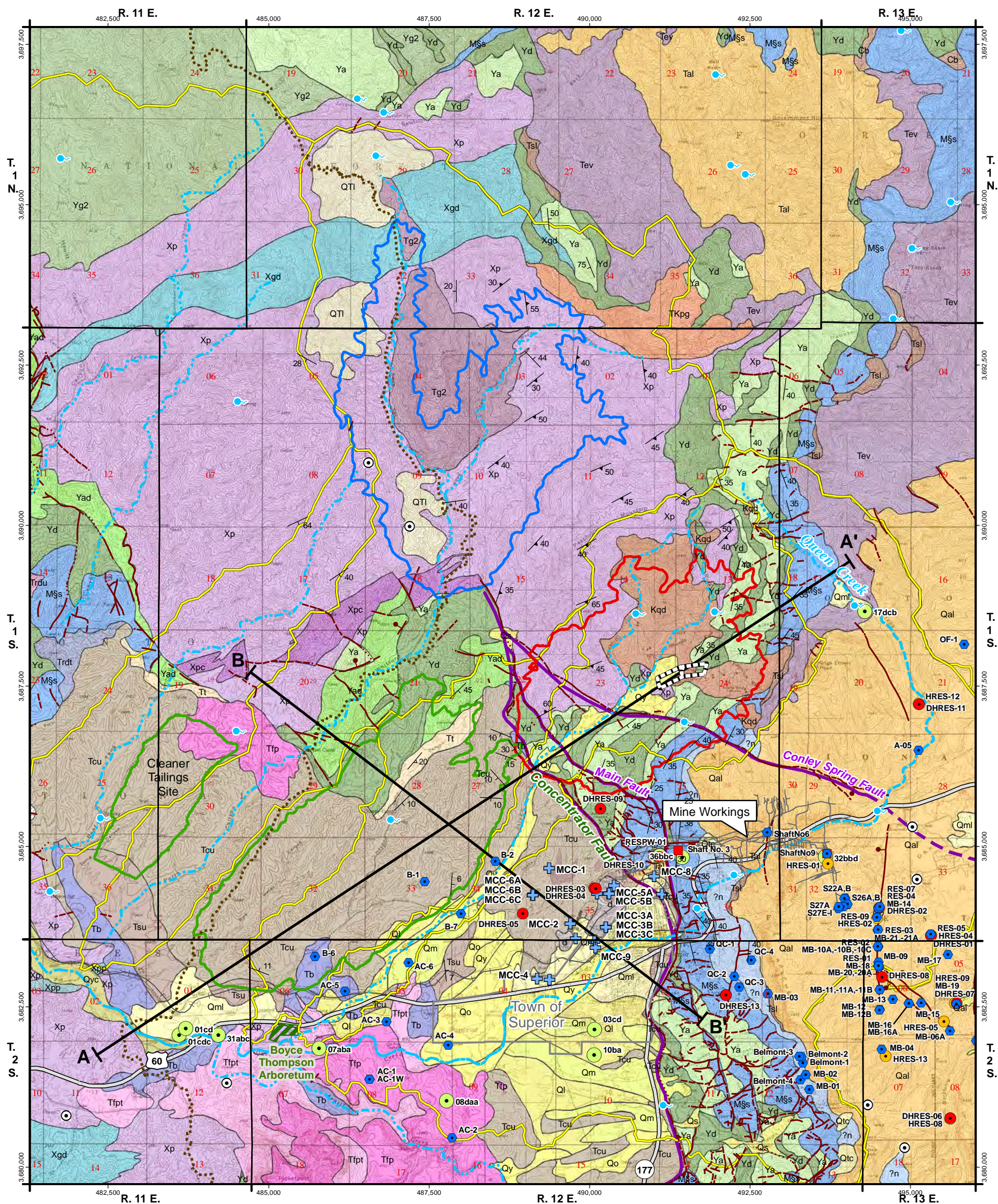


WELL AND SPRING LOCATIONS
















2012

FIGURE 1 |






















EXPLANATION





















- | | |
|---|--|
|  | Apache Leap Tuff Aquifer Monitor Well |
|  | Deep Groundwater System Monitor Well |
|  | West Plant Monitor Well |
|  | Shaft |
|  | Historic/Current Point of Groundwater Withdrawal |
|  | Exploration Borehole |
|  | Spring |
|  | Watershed Boundary |
|  | Silver King Canyon Site |
|  | Whitford Canyon Site |
|  | Happy Camp Site |
|  | Arizona Trail |
|  | Resolution Claims |

Geologic Structural Features

- Fault; dashed where approximately located; dotted where concealed. Bar and Ball on Downthrown Side.
- Strike and Dip of Beds
- Strike and Dip of Metamorphic Foliation
- Strike and Dip of Igneous Foliation

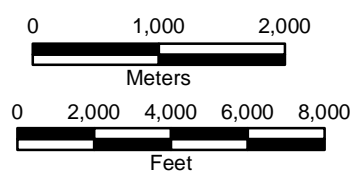
Geologic Units

- | | |
|---|--|
|  | d-Holocene Disturbed Surficial Deposits |
|  | Qyc- Holocene Active Alluvium |
|  | Qtc-Holocene & Pleistocene Tallus & Colluvium |
|  | Qy-Holocene Low Terrace & Alluvial Fan Deposits |
|  | Qml-Late Pleistocene to Middle Pleistocene Alluvium Undifferentiated |
|  | Qm-Mid Pleistocene Dissected Alluvial Fan & Terrace Deposits |
|  | Ql-Late Pleistocene Moderately Dissected Alluvial Fan & Terrace Deposits |
|  | Qo-Early Pleistocene Deeply Dissected Alluvium Undifferentiated |
|  | Qs-Quaternary Surficial Deposits |
|  | Qtc-Holocene & Pleistocene Talus & Colluvium |
|  | Qal-Quaternary Alluvium |
|  | QTI-Holocene or Pliocene Landslide Deposits |
|  | Tcu-Miocene Conglomerate |
|  | Tsu-Miocene Sandstone |
|  | Tt-Miocene Tuff (poorly welded) |
|  | Tfp-Mid Miocene to Early Miocene Felsic Lava Flows Picketpost Mountain |
|  | Tfpt-Mid Miocene to Early Miocene Tuffs Picketpost Mountain |
|  | Tb-Mid Miocene to Early Miocene Basalt Picket Post Mountain |
|  | Tg2-Miocene Granitoid Stock of Wood Camp Canyon |

- | | | |
|---|---|---|
|  | Trdu-Middle Miocene Undifferentiated Felsic Lava | |
|  | Tal-Early Miocene Apache Leap Tuff | |
|  | Trdt-Early Miocene Undifferentiated Felsic Tuffs | |
|  | Tev-Early Miocene Volcanic Rocks | 0 |
|  | Tsl-Miocene to Late Oligocene Clastic Rocks |  |
|  | TKpg-Late Cretaceous or Paleocene Porphyry of Government Hill | 0 |
|  | Kqd-Late Cretaceous Quartz Diorite of Peachville Wash |  |
|  | ?n-Naco Formation | |
|  | M\$S-Mississippian/Devonian/Cambrian Undifferentiated Escabrosa, Martin & Bolsa | |
|  | Cb-Bolsa Quartzite | |
|  | Yad-Mid Proterozoic Apache Group, Troy Quartzite & Diabase | |
|  | Yd-Mid Proterozoic Diabase | |
|  | Ya-Mid Proterozoic Apache Group | |
|  | Yg2-Mid Proterozoic Porphyritic Biotite Granite | |
|  | Xgd-Early Proterozoic Granodiorite to Granite | |
|  | Xp-Early Proterozoic Pinal Schist | |
|  | Xpc-Pinal Schist Calc - Silicate & Amphibolite Facies | |
|  | Xpp-Pinal Schist - Phyllite Facies | |

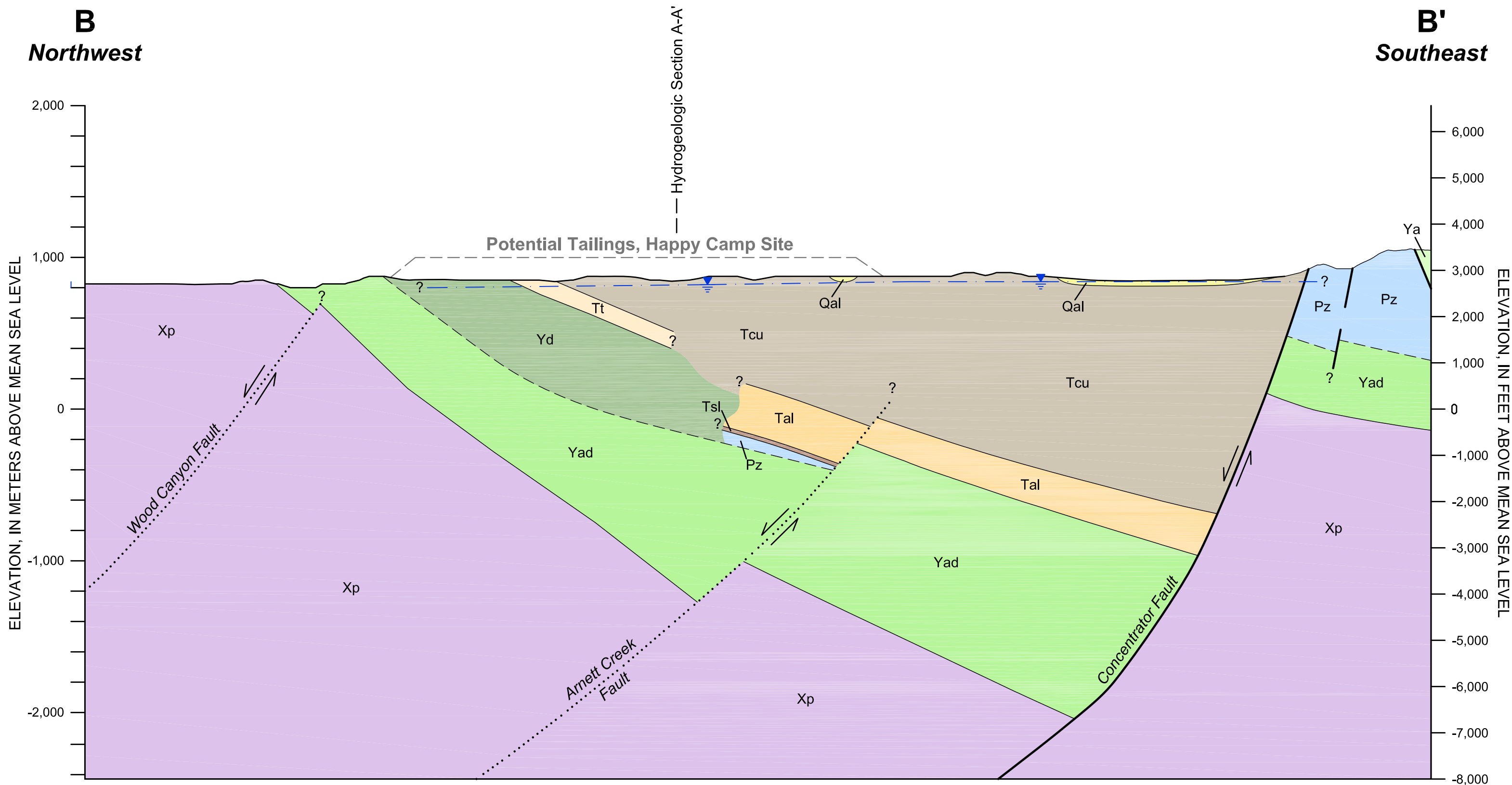
(Geology from Spencer and others, 1998; Faults from Peterson, 1969, and Spencer and Richard, 1995)

DRAFT



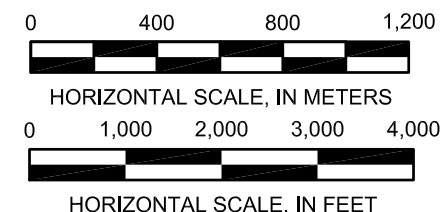
B
Northwest

B'
Southeast



EXPLANATION

Qal	Quaternary Alluvium	Pz	Paleozoic Sedimentary Units
Tcu	Miocene Conglomerate	Yad	Mid Proterozoic Apache Group, Troy Quartzite and Diabase
Tt	Miocene Tuff	Yd	Mid Proterozoic Diabase
Tal	Early Miocene Apache Leap Tuff	Xp	Early Proterozoic Pinal Schist
Tsl	Miocene to Late Oligocene Sedimentary Rocks		
			Groundwater Level



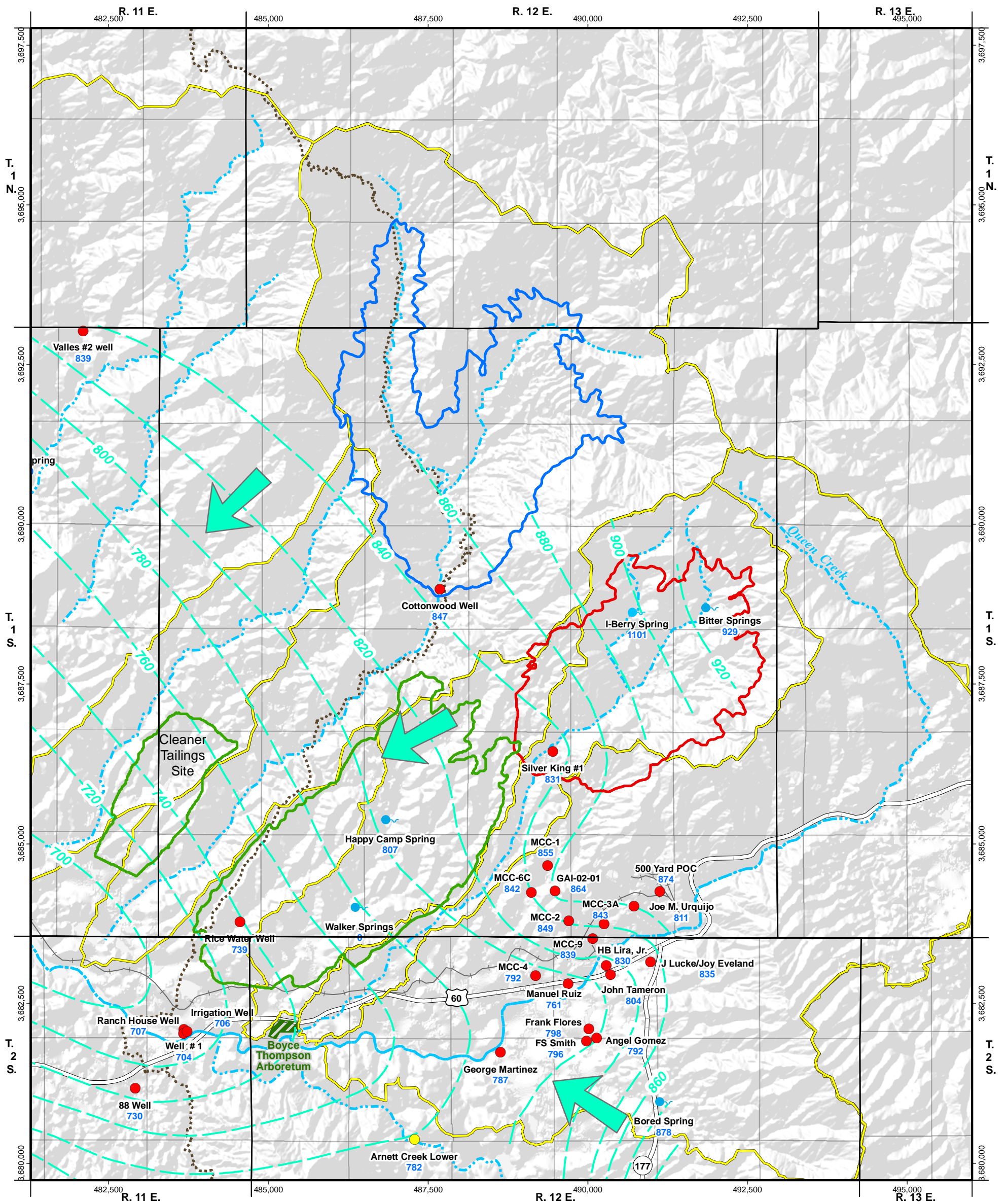
HYDROGEOLOGIC SECTION B-B'



2012

FIGURE 4

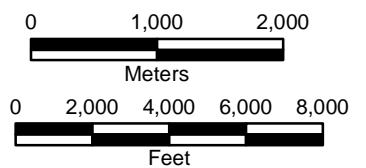
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EXPLANATION

- Ranch House Well**
707 ● Well Location and Identifier
Water Level Elevation, in meters above mean sea level
- Bored Spring**
● Spring and Identifier
- 900 — Water Level Elevation Contour, in meters above mean sea level
- General Direction of Groundwater Movement
- Watershed Boundary
- Stream
- Arizona Trail
- Silver King Canyon Site
- Whitford Canyon Site
- Happy Camp Site
- Resolution Claims

DRAFT



Resolution Copper Mining

**WATER LEVEL ELEVATIONS
AUGUST 2012**

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2012

FIGURE 5

APPENDIX A

WELL NUMBERING SYSTEM

WELL NUMBERING SYSTEM

The well numbers used in this study are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the State into four quadrants. These quadrants are designated, counter-clockwise, by the capital letters A, B, C, and D. All land north and east of the point of origin is in quadrant A; all land north and west of the point of origin is in quadrant B; all land south and west is in quadrant C; and all land south and east is in quadrant D. The first digit of a well number indicates the township, the second digit the range, the third digit the section in which the well is located. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes the 160-acre tract or quarter section; the second 40-acre tract or quarter-quarter section; the third letter denotes the 10-acre tract or quarter-quarter-quarter section. These letters are also assigned in a counter-clockwise direction, beginning in the northeast quarter. As **Figure A-1** shows, well number (D-01-12) 27aad designates the well as being in the Southeast 1/4 of the Northeast 1/4 of the Northeast 1/4, Section 27, Township 1 South, Range 12 East. Where more than one well is within a 10-acre tract, consecutive numbers, beginning with "1" are added as suffixes.

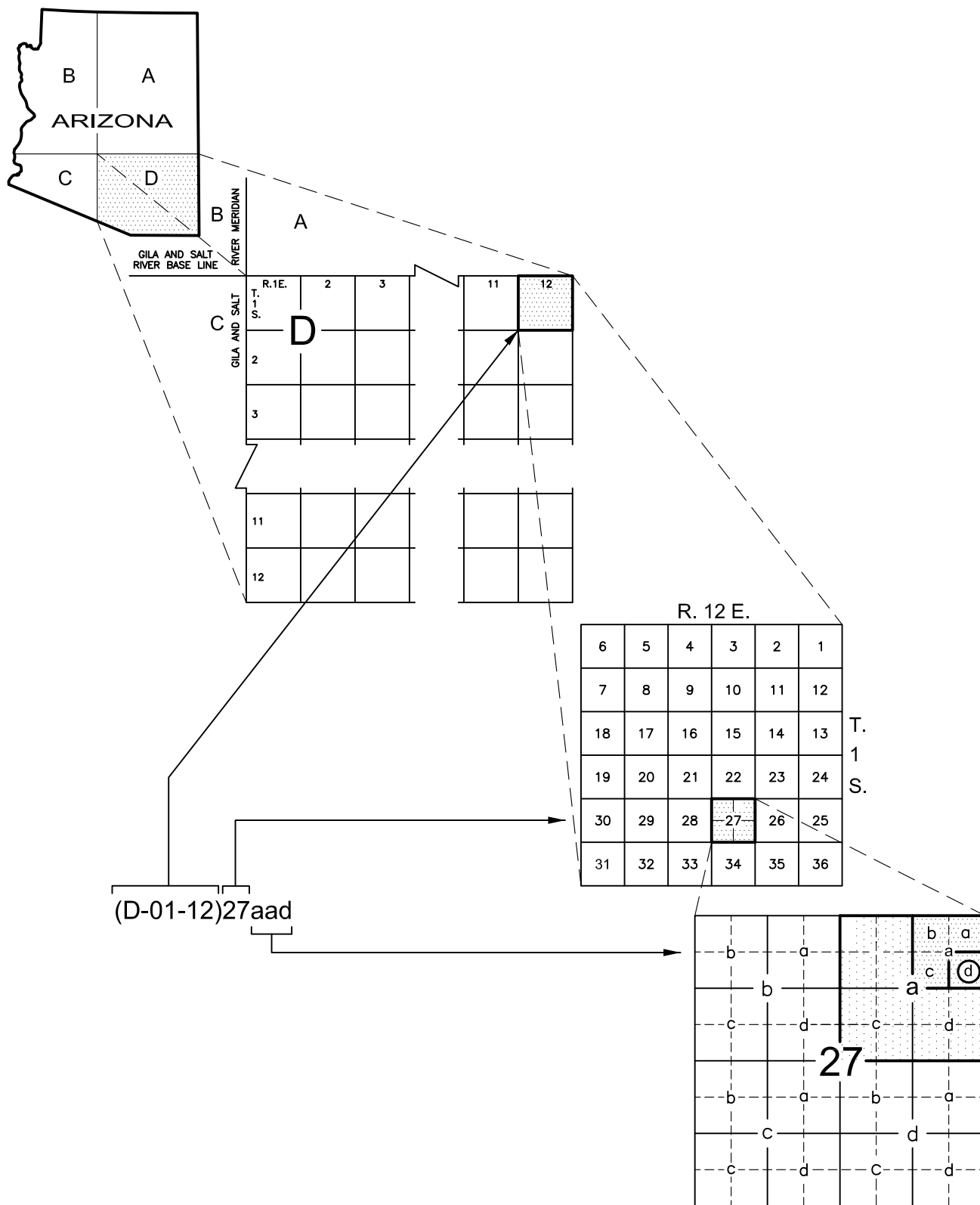


FIGURE A-1. WELL NUMBERING DIAGRAM

APPENDIX B

SUMMARY OF WELL RECORDS FROM ADWR 35-WELL REGISTRY

**TABLE B-1. SUMMARY OF WELL RECORDS FROM ADWR 35-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....				ALTITUDE OF LAND SURFACE (ft, msl) ^c	.....NON-PUMPING WATER LEVEL.....				PUMPING RATE (gpm) ^e	WATER USE ^f	LOGS ^g	REMARKS
					DIAMETER (inches)	DEPTH (feet)	MATERIAL ^b	PERFORATED INTERVAL (ft, bls)		DEPTH (ft, bls)	DEPTH (m, bls) ^d	DATE MEASURED	ALTITUDE (ft, msl)				
(D-01-11) 35abc	67972	MARTIN, W H	1/1/1950	110	8	0-110	Z	---	---	40	12.2	1/1/1950	---	15	D	D	---
(D-02-12) 03aad	74432	VINDIOLA, JOE M	3/20/1979	117	4	0-117	B	100-117	---	---	---	---	---	---	D	D	---
(D-02-12) 05cbc	78468	AZ BRD OF REGENTS	11/1/1963	120	8 6	0-87 87-120	P	---	---	45	13.7	11/1/1963	---	21	I	D	---

^a ft, bls = feet below land surface

^b Casing Material:

B = Plastic or PVC

P = Steel

Z = Other

^c ft, msl = feet above mean sea level

^d m, bls = meters below land surface

^e gpm = gallons per minute

--- = no available data

^f Water Use:

D = Domestic

I = Irrigation

^g Logs:

D = Driller's

APPENDIX C

SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			ALTITUDE (ft, msl)	PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED					
(A-01-11) 36ca	600826	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Cottonwood Windmill 48-115
(A-01-12) 36bac	907314	CARLOTA COPPER COMPANY	---	---	---	---	---	---	---	---	---	---	NONE	---	not on map; wrong location; should be A-1-13
(A-01-13) 19bbd	542238	BHP COPPER INC,	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; wrong location and canceled
(A-01-13) 19bbd	542239	BHP COPPER INC,	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; wrong location and canceled
(A-01-13) 19bbd	542240	BHP COPPER INC,	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; wrong location and canceled
(A-01-13) 19bbd	542241	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; wrong location and canceled
(A-01-13) 31	218084	CARLOTA COPPER COMPANY, SUBSIDIARY OF QUADRA MINING, LTD.	---	---	---	---	---	---	---	---	---	---	T	---	not on map; geotechnical borings RH001 through RH003; wrong location-- actually in Cactus-Carlota pit; duplicate of 909429
(A-01-13) 31	909429	CARLOTA COPPER COMPANY, SUBSIDIARY OF QUADRA MINING, LTD.	---	---	---	---	---	---	---	---	---	---	NONE	---	not on map; geotechnical borings RH001 through RH003; wrong location-- actually in Cactus-Carlota pit; duplicate of 218084
(A-01-13) 31cbc	533259	CARLOTA COPPER COMPANY	2/4/1992	200	6	200	---	140	42.7	2/4/1992	---	---	MON	D	not on map; MW-7; wrong location, should be A-1-14
(D-01-11) 01ba	600800	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Valles Well #2 48-025
(D-01-11) 11ca	600799	TONTO NATL FOREST	1/1/1966	---	---	---	---	---	---	---	---	---	S	---	Byous Windmill 48-035; outside boundary
(D-01-11) 13ba	600828	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Preston Windmill 48-045
(D-01-11) 35ddc	514505	BERRY, GENE	6/10/1986	100	5	100	---	60	18.3	6/10/1986	---	---	D	D	
(D-01-12) 02caa	218637	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; DHRES-E; wrong location; drilled as DHRES-13 in D-2-12
(D-01-12) 02ccc	550994	GOMEZ, JESUS,	9/1/1995	760	8	760	---	125	38.1	9/1/1995	---	---	D	D	not on map; wrong location; should be in Tucson
(D-01-12) 03baa	906344	RESOLUTION COPPER MINING, LLC	1/30/2007	12	2	12	---	5	1.5	1/30/2007	---	---	MON	D	not on map; wrong location; later drilled as DHRES-13 in D-2-12
(D-01-12) 03bdb	631205	PADILLA, F N	---	---	---	---	---	---	---	---	---	---	I,D	---	not on map; wrong location; should be D-2-12
(D-01-12) 03bdb	631206	PADILLA, F N	---	---	---	---	---	---	---	---	---	---	I,D	---	not on map; wrong location; should be D-2-12
(D-01-12) 13	801491	PETTJOHN, C E	1/1/1900	80	6	50	---	130	39.6	1/1/1900	---	150	IND, MIN	---	
(D-01-12) 13aab	562908	CHARLES E PETTJOHN	6/3/1998	400	2	20	---	---	---	---	---	---	D	D	
(D-01-12) 13aab	581594	JOHN H DALTON SR	---	---	---	---	---	---	---	---	---	---	---	---	not on map; denied permission to drill
(D-01-12) 16db	600935	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Cottonwood Well 48-125
(D-01-12) 19cb	600827	TONTO NATL FOREST	6/30/1956	---	---	---	---	---	---	---	---	---	S	---	Noble Windmill 48-135
(D-01-12) 24	801492	PETTJOHN, C E	1/1/1900	80	6	50	---	30	9.1	1/1/1900	---	150	IND, MIN	---	
(D-01-12) 24	909919	OMYA ARIZONA INC.	---	---	---	---	---	---	---	---	---	---	NONE	---	3 mineral exploration wells; no wells installed
(D-01-12) 25	519696	BHP COPPER INC,	12/11/1987	397	---	---	---	---	---	---	---	---	NONE	D	2 HOLES; mineral exploration well; hole 15 abandoned
(D-01-12) 26acc	912289	RESOLUTION	8/7/2010	2130	4	2130	---	100	30.5	8/7/2010	---	---	MON	D	DHRES-09; wrong location in 55-registry; better location in monitor well table
(D-01-12) 26cdc	558204	BHP COPPER	8/26/1996	430	---	---	---	---	---	---	---	---	MON	D	monitor well MCC-7
(D-01-12) 27aad	501253	TONTO NATL FOREST	10/21/1981	40	6	40	---	25	7.6	10/21/1981	---	2	S	D	Silver King Well
(D-01-12) 31dd	600883	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Rice Well 48-155
(D-01-12) 32	914002	FREEPORT MCMORAN COPPER & GOLD SUPERIOR	---	---	---	---	---	---	---	---	---	---	NONE	---	First part of boreholes drilled by Layne Christensen Co. #7, boreholes completed by National EWP, Inc. #823; better location per M&A field reconnaissance
(D-01-12) 33	914003	FREEPORT MCMORAN COPPER & GOLD - SUPERIOR	---	---	---	---	---	---	---	---	---	---	NONE	---	better location per M&A field reconnaissance
(D-01-12) 34	594161	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration
(D-01-12) 34	594163	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration
(D-01-12) 34aac	522271	SOUTHWEST GAS CORP,	12/2/1988	120	---	---	---	---	---	---	---	---	NONE	D	cathodic protection
(D-01-12) 34adb	548184	RESOLUTION COPPER MINING LLC	3/26/1995	93	4	35	---	42	12.8	3/26/1995	---	---	MON	D	monitor well MCC-3
(D-01-12) 34adb	550412	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-1B
(D-01-12) 34adc	594157	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	MON	---	
(D-01-12) 34adc	594159	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	MON	---	
(D-01-12) 34add	591860	BHP BILLITON	---	440	---	200	---	187	57.0	---	---	---	T	D	North Well
(D-01-12) 34dbc	218677	RESOLUTION COPPER MINING LLC	3/7/2009	3018	5	3021	---	---	---	---	---	---	MON	D	DHRES-05 before modification
(D-01-12) 34dbc	550404	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-6D
(D-01-12) 34dbc	550405	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; monitor well MCC-6B duplicate
(D-01-12) 34dbc	550406	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	not on map; monitor well MCC-6C duplicate
(D-01-12) 34dbc	558205	RESOLUTION COPPER MINING LLC	7/16/1996	600	5	580	---	42	12.8	7/16/1996	---	---	MON	D	monitor well MCC-6B
(D-01-12) 34dbc	558206	RESOLUTION COPPER MINING LLC	7/24/1996	225	5	220	---	48	14.6	7/24/1996	---	---	MON	D	monitor well MCC-6A
(D-01-12) 34dbc	563621	RESOLUTION COPPER MINING LLC	8/19/1997	55	---	30	---	30	9.1	8/19/1997	---	---	MON	D	monitor well MCC-6C
(D-01-12) 34dbc	912420	RESOLUTION COPPER	8/28/2010	4018	4	4018	---	270	82.3	8/28/2010	---	---	MON	D	DHRES-05 after 2010 modification
(D-01-12) 34dda	550410	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-2B
(D-01-12) 34dda	550411	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-2D

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			ALTITUDE (ft, msl)	PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED					
(D-01-12) 34dda	558209	RESOLUTION COPPER MINING LLC	8/21/1996	225	---	---	---	145	44.2	8/21/1996	---	0	NONE	D	not on map; 1 geotechnical HOLE/ABND-8-21-96; canceled
(D-01-12) 35	519005	RESOLUTION COPPER MINING LLC	9/21/1987	---	---	---	---	---	---	---	---	---	NONE	D	9 HOLES: mineral exploration; all abandoned
(D-01-12) 35	594162	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration
(D-01-12) 35	594164	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration
(D-01-12) 35	621501	VAUGHAN,B G	1/1/1935	100	10	100	---	25	7.6	1/1/1935	---	45	S	---	---
(D-01-12) 35	633593	URQUIJO, JOE M and IRMA V	11/21/1996	300	6	300	---	240	73.2	11/21/1996	---	10	I,D	---	deepend 11/21/96; previously 75 ft
(D-01-12) 35	906297	RESOLUTION COPPER MINING, LLC	2/2/2007	20	---	---	---	15	4.6	2/2/2007	---	---	NONE	D	geotech boring; abandoned
(D-01-12) 35aaa	218766	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	---	OME	---	not on map; Shaft No. 8 production well--not drilled; 912941 completed 3/22/2012
(D-01-12) 35aac	912484	RESOLUTION COPPER MINING LLC	11/28/2010	4233	4	4233	---	2466	751.6	11/28/2010	---	---	MON	D	DHRES-10
(D-01-12) 35aac	912941	RESOLUTION COPPER MINING	3/22/2012	4012	32	4012	3156.75	3154	961.3	2/22/2012	2.75	---	MON	D	RESPW-01 (Shaft No. 8 production well)
(D-01-12) 35adb	558203	RESOLUTION COPPER COMPANY	8/7/1996	121	5	120	---	50	15.2	8/7/1996	---	---	MON	D	MCC-8
(D-01-12) 35add	907034	RESOLUTION COPPER COMPANY	5/24/2007	190	10	185	---	60	18.3	5/24/2007	---	---	MON	---	Settling pond 1 & 2 alert well
(D-01-12) 35bbc	914375	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	NOI only, no completion report
(D-01-12) 35bcc	200644	BHP SUPERIOR OPERATIONS	---	---	---	---	---	---	---	---	---	---	NONE	---	NOI to drill and abandon 10 geotech borings
(D-01-12) 35bcd	218676	RESOLUTION COPPER MINING LLC	2/28/2009	2340	5	2340	---	---	---	2/28/2009	---	---	MON	D	DHRES-04
(D-01-12) 35bcd	910437	RESOLUTION COPPER MINING LLC.	2/16/2009	1962	3	1940	---	---	0.0	2/16/2009	---	---	MON	D	DHRES-03; 218637?
(D-01-12) 35bdd	910699	RESOLUTIN COPPER MINING LLC	5/12/2009	88	5	81	---	67	20.4	5/12/2009	---	---	MON	D	WELL CAPPED
(D-01-12) 35c	561537	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	NONE	---	mineral exploration
(D-01-12) 35cab	550403	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-5D
(D-01-12) 35cab	550407	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-5B
(D-01-12) 35cab	558207	RESOLUTION COPPER MINING LLC	7/29/1996	100	5	92	---	48	14.6	7/29/1996	---	---	MON	D	monitor well MCC-5B
(D-01-12) 35cac	560980	SHACKELFORD, LEROY,H	4/15/1997	240	4	240	---	---	---	---	---	7	D	D	---
(D-01-12) 35cba	907036	RESOLUTION COPPER COMPANY	5/29/2007	130	10	125	---	120	36.6	5/29/2007	---	---	MON	D	Tailing pond 5
(D-01-12) 35cba	910698	RESOLUTION COPPER MINING LLC	5/12/2009	180	10	21	---	110	33.5	5/12/2009	---	---	MON	D	The 7/23/09 modification was after the fact, driller realized mistake and came forward to correct it voluntarily. No drilling authority actually went out as the procedure was already completed. Drill log for initial and modified drilling submitted on 7/23/2009. LC; TP-5
(D-01-12) 35cbb	548188	RESOLUTION COPPER MINING LLC	3/29/1995	325	4	233	---	59	18.0	3/29/1995	---	---	MON	D	MCC-5A; abandoned 11/28/2006
(D-01-12) 35ccd	906303	RESOLUTION COPPER MINING, LLC	1/29/2007	17	2	17	---	8	2.4	1/29/2007	---	---	MON	D	WELL CAPPED
(D-01-12) 35cdb	550409	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-3D
(D-01-12) 35cdb	550413	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-3B
(D-01-12) 35cdb	550414	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	monitor well MCC-3A
(D-01-12) 35cdb	558208	RESOLUTION COPPER MINING LLC	7/27/1996	390	5	380	---	8	2.4	7/27/1996	---	---	MON	D	monitor well MCC-3B
(D-01-12) 35cdc	548186	RESOLUTION COPPER MINING LLC	3/23/1995	500	4	500	---	0	0.0	3/23/1995	---	---	MON	D	monitor well MCC-3
(D-01-12) 35cdc	563622	RESOLUTION COPPER MINING LLC	8/20/1997	122	4	82	---	44	13.4	8/20/1997	---	---	MON	D	monitor well MCC-3C
(D-01-12) 35cdc	906298	RESOLUTION COPPER MINING, LLC	1/25/2007	27	2	27	---	17	5.2	1/25/2007	---	---	MON	D	WELL CAPPED; LSP-6
(D-01-12) 35dab	907035	RESOLUTION COPPER COMPANY	6/4/2007	140	10	140	---	---	---	---	---	---	MON	D	500 yd well
(D-01-12) 35dba	914372	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	NOI only, no completion report
(D-01-12) 35dba	914374	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	NOI only, no completion report
(D-01-12) 35dbc	807409	WALKER, GLADYS,M	1/10/1997	265	6	---	---	200	61.0	1/10/1997	---	15	D	---	DEEPEN. ORIGINAL LEGAL WAS ENTERED INTO WELLS 55 INCORRECTLY.RL
(D-01-12) 35dbc	914373	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	---	MON	---	NOI only, no completion report
(D-01-12) 35dbd	803944	NADER, GERTRUDE L	4/14/1968	125	8	125	---	10	3.0	4/14/1968	---	30	D	---	---
(D-01-12) 35dc	650993	GUERRA,G E	---	42	---	4	---	36	11.0	---	---	25	I	---	---
(D-01-12) 36	519007	RESOLUTION COPPER MINING LLC	10/24/1987	---	---	---	---	---	---	---	---	---	NONE	D	6 HOLES: 5 mineral exploration holes drilled and abandoned
(D-01-12) 36bbc	525311	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MIN	---	Shaft No. 3
(D-01-13) 07ccc	86780	AUTSON,R	---	---	---	---	---	---	---	---	---	---	D	---	canceled
(D-01-13) 07da	600812	TONTO NATL FOREST	12/31/1980	---	---	---	---	---	---	---	---	---	S	---	Upper Queen Horizontal well 48-175
(D-01-13) 07dd	600813	TONTO NATL FOREST	1/1/1980	---	---	---	---	---	---	---	---	---	S	---	Queen Horizontal well 48-165
(D-01-13) 07ddc	609689	INTEGRITY LAND AND CATTLE, LLC	---	180	2	180	---	5	1.5	---	---	35	S	---	JI RANCH
(D-01-13) 17	907478	OMYA ARIZONA INC.	9/10/2007	---	---	---	---	---	---	---	---	---	NONE	---	14 mineral exploration holes
(D-01-13) 17	909920	OMYA ARIZONA INC.	11/30/2008	---	---	---	---	---	---	---	---	---	NONE	---	2 mineral exploration holes
(D-01-13) 17bbd	609683	INTEGRITY LAND AND CATTLE, LLC	---	180	2	180	---	---	---	---	---	10	S	---	JI RANCH
(D-01-13) 17dcb	609674	INTEGRITY LAND AND CATTLE, LLC	---	30	60	30	---	15	4.6	---	---	45	S	---	Pump Station well and Pump Station Spring (J. C. Gibson)

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			ALTITUDE (ft, msl)	PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED					
(D-01-13) 18	909921	OMYA ARIZONA INC.	12/5/2008	---	---	---	---	---	---	---	---	---	NONE	---	1 mineral exploration hole
(D-01-13) 19	909922	OMYA ARIZONA INC.	11/26/2008	---	---	---	---	---	---	---	---	---	NONE	---	1 mineral exploration hole
(D-01-13) 21abc	609682	INTEGRITY LAND AND CATTLE, LLC	11/1/1964	1200	6	---	---	360	109.7	11/1/1964	---	35	S	---	JI RANCH
(D-01-13) 21cbc	912601	RESOLUTION COPPER	3/3/2011	6724	---	6700	---	1010	307.8	3/3/2011	---	---	MON	D	DHRES-11
(D-01-13) 21cbc	912917	RESOLUTION COPPER MINING LLC	2/18/2011	2140	5	1987	---	206.21	62.9	3/2/2011	---	---	MON	D	HRES-12
(D-01-13) 29cdd	609673	INTEGRITY LAND AND CATTLE, LLC	8/9/1924	18	48	18	---	6	1.8	8/9/1924	---	80	S,D	---	JI RANCH Gibson well
(D-01-13) 31db	600804	TONTO NATL FOREST	1/1/1956	---	---	---	---	---	---	---	---	---	S	---	Arnett Well 48-265
(D-01-13) 32	206156	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration: NOI for 3 holes; 32bdd, 32dbd, and 32dca
(D-01-13) 32	526327	MAGMA COPPER CO,	---	---	---	---	---	---	---	---	---	---	NONE	---	canceled
(D-01-13) 32	557633	BHP COPPER INC,	---	---	---	---	---	---	---	---	---	---	NONE	---	2 HOLES/NOT DRILLED; canceled
(D-01-13) 32aac	912634	RESOLUTION COPPER MINING LLC	---	6735	4	3802	---	---	---	---	---	---	OME	---	RES-22
(D-01-13) 32bac	912625	RESOLUTION COPPER MINING LLC	---	7310	4	3609	---	---	---	---	---	---	OME	---	RES-23
(D-01-13) 32bbd	525312	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MIN	---	Shaft No. 9
(D-01-13) 32bca	201852	RESOLUTION COPPER MINING LLC	2/13/2004	1600	5	1600	---	---	---	---	---	---	MON	D	HRES-01
(D-01-13) 32bdd	213994	RESOLUTION COPPER MINING LLC	---	7634	4	3327	---	---	---	---	---	---	OME	---	RES-6
(D-01-13) 32bdd	512401	U OF A HYDR/WTR RESOUR	10/1/1985	---	---	---	---	---	---	---	---	---	NONE	D	3 WELLS: 60, 107, and 153 feet
(D-01-13) 32bdd	516107	UNIV OF AZ	11/10/1986	146	4	5	---	---	---	---	---	---	NONE	D	HYDROLOGY 6 WELLS:
(D-01-13) 32caa	217417	RESOLUTION COPPER MINING, LLC	---	6485	10	6485	---	300	91.4	---	---	---	MON	---	RES #18
(D-01-13) 32cab	217418	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	---	OME	---	RES #19
(D-01-13) 32cab	218877	RESOLUTION COPPER MINING, LLC	---	1535	6	1535	---	---	---	---	---	---	OME	---	RES 19
(D-01-13) 32cab	536975	UNIVERSITY OF ARIZONA/DEPT OF HYDROLOGY	1/6/1993	662	6	---	---	634	193.2	1/6/1993	---	---	NONE	D	1 HOLE: abandoned 1/28/2000
(D-01-13) 32cab	546847	UNIVERSITY OF ARIZON,A	12/16/1994	560	8	560	---	555	169.2	12/16/1994	---	---	NONE	D	geotechnical hole
(D-01-13) 32cab	911951	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	OME	---	mineral exploration
(D-01-13) 32dbb	914053	RESOLUTION COPPER MINING	---	---	---	---	---	---	---	---	---	---	NONE	---	mineral exploration
(D-01-13) 32dbd	206873	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	NONE	---	THREE HOLES: RES-6, RES-7, & RES-8 RES-8 WAS COMPLETED ON 8/3/2005 AS 55-206873. RES-6 WILL BE DEEPENED AND ASSIGNED TO NEW WELL REGISTRATION NUMBER 55-213994. RES-7 WILL BE MODIFIED TO A MONITOR WELL AND WILL BE ASSIGNED TO NEW WELL REGISTRATION NUMBER
(D-01-13) 32dbd	213993	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	RES-7 THIS WELL WAS ORIGINALLY DRILLED AS AN EXPLORATION WELL UNDER 55-206873 (1 OF 3 HOLES). OWNER WANTS TO MODIFY ONE HOLE TO BE A MONITOR WELL.
(D-01-13) 32dbd	217407	RESOLUTION COPPER MINING LLC	9/11/2008	6713	5	65555	---	1935	589.8	9/11/2008	---	---	MON	D	DHRES-02
(D-01-13) 32dbd	551745	RESOLUTION COPPER MINING LLC	2/13/1996	---	---	---	---	---	---	---	---	---	NONE	D	2 mineral exploration HOLES; abandoned
(D-01-13) 32dbd	590833	RESOLUTION COPPER MINING LLC	1/30/2003	---	4	3789	---	---	---	---	---	---	NONE	D	RES-04
(D-01-13) 32dbd	913244	RESOLUTION COPPER MINING LLC	---	7477	4	3369	---	---	---	---	---	---	OME	---	RES-09
(D-01-13) 32dca	201850	RESOLUTION COPPER MINING LLC	2/19/2004	1310	5	1310	---	295	89.9	3/26/2004	---	---	MON	D	HRES-02
(D-01-13) 32dca	599453	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	---	---	RES-6
(D-01-13) 32dcd	532680	MAGMA COPPER CO,	---	---	---	---	---	---	---	---	---	---	NONE	---	1 WELL; canceled
(D-01-13) 32dcd	562940	BHP COPPER INC	2/4/1998	2945	4	2945	---	5354	1631.9	2/4/1998	---	---	NONE	---	3 HOLES. Disregard action code 815 on 10/8/98 Capped
(D-01-13) 32dcd	587213	RESOLUTION COPPER MINING LLC	---	---	4	5820	---	---	---	---	---	---	T	D	RES-3
(D-01-13) 33ccd	201849	RESOLUTION COPPER MINING LLC	3/5/2004	1440	5	1440	---	401	122.2	3/26/2004	---	---	MON	D	HRES-04
(D-01-13) 33ccd	217151	RESOLUTION COPPER MINING, LLC	4/15/2008	6872	14	36872	---	---	---	---	---	---	OME	D	RES-015
(D-01-13) 33ccd	217406	RESOLUTION COPPER MINING LLC	6/23/2008	6002	7	6002	---	1916	584.0	6/23/2008	---	---	T	D	DHRES-01
(D-01-13) 33ccd	592574	RESOLUTION COPPER MINING LLC	1/19/2003	7563	4	4767	---	2400	731.5	1/19/2003	---	---	OME	D	RES-5
(D-02-11) 01cd	627523	HERRON, J C	1/1/1920	60	8	60	---	40	12.2	1/1/1920	---	40	D,S	---	
(D-02-11) 01cda	215463	FRANCIS PHYLLIS HERRON	---	---	---	---	---	---	---	---	---	---	I	---	
(D-02-11) 01cda	908053	FRANK HERRON	10/28/2007	400	5	400	---	68	20.7	10/28/2007	---	35	D	D	PUMP INSTALLED
(D-02-11) 01cdc	582656	JAMES & PHYLLIS HERRON	---	---	---	---	---	---	---	---	---	---	I	---	
(D-02-11) 01cdc	582657	FRANK HERRON	---	150	5	150	---	---	---	---	---	25	D	D	
(D-02-11) 01cdc	627522	FRANK HERRON	---	60	8	60	---	40	12.2	---	---	500	I	---	This well was never abandoned per letter from owners. dlt 12/24/2008
(D-02-11) 01cdc	627524	FRANK HERRON	1/1/1946	60	8	60	---	40	12.2	1/1/1946	---	10	D,S	---	this well was never abandoned per owner. dlt 4/1/2009

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			ALTITUDE (ft, msl)	PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED					
(D-02-11) 01cdd	904495	ADOT, ATTN: NORM WETZ	3/22/2006	60	2	60	---	36	11.0	---	---	---	MON	D	58-108812.0004. Well inspection conducted on 7/24/02 by Mike Ball & Al Ramsey of ADWR. Well location found to be off by approximately one mile. Inspection confirmed the existence of a 3" thick cement grout surface seal to a depth of 15 inches below grade. Legal description corrected in WELLS 55. Citation to be sent to driller for failing to submit log (A.R.S. ? 45-600.A). File update conducted on 7/26/02. mib
(D-02-11) 01dcd	560518	BOYCE THOMPSON SW AR,	---	---	---	---	---	---	---	---	---	300	R	---	
(D-02-11) 02dbb	519775	KAREN & NEIL BLINDAUER	1/27/1988	100	6	100	---	30	9.1	1/27/1988	---	20	D	D	
(D-02-11) 02dd	600868	TONTO NATL FOREST,	1/1/1932	---	---	---	---	---	---	---	---	9	D,I	---	
(D-02-11) 03aaa	504943	HAMRICK,D C	3/9/1983	104	8	100	---	44	13.4	3/9/1983	---	15	D	D	
(D-02-11) 11da	600808	TONTO NATL FOREST,	9/16/1940	---	---	---	---	---	---	---	---	---	S	---	
(D-02-11) 12bbb	570829	SHAWN & BITSY WILSON	5/8/1999	240	4	240	---	200	61.0	5/8/1999	---	---	D	D	
(D-02-12) 01	912847	RESOLUTION COPPER MINING LLC	---	4223	---	---	---	---	---	---	---	---	OME	---	RES-24
(D-02-12) 02caa	912725	RESOLUTION COPPER MINING LLC	---	629	10	20	---	---	---	---	---	---	MON	---	DHRES-12; abandoned
(D-02-12) 02caa	912770	RESOLUTION COPPER MINING LLC	2/16/2011	3571	7	3550	---	664	202.4	2/16/2011	---	---	MON	D	DHRES-13
(D-02-12) 03	621753	BRYANT,P T	1/1/1973	128	6	128	---	30	9.1	1/1/1973	---	5	NONE	---	
(D-02-12) 03	634028	TAMERON,F O	---	30	---	---	---	---	---	---	---	---	NONE	---	
(D-02-12) 03	634259	LIRA JR,H B	1/1/1937	28	2	20	---	7	2.1	1/1/1937	---	10	D	---	
(D-02-12) 03	636294	ZAVALA,S V	3/15/1969	60	3	---	---	10	3.0	3/15/1969	---	20	D	---	
(D-02-12) 03	640302	MARTINEZ,G	---	54	---	---	---	40	12.2	---	---	12	D	---	
(D-02-12) 03	804528	PINO, DIEGO R,	6/22/1978	160	6	160	---	85	25.9	6/22/1978	---	25	D,I	---	
(D-02-12) 03	906296	RESOLUTION COPPER MINING, LLC	2/1/2007	51	8	---	---	15	4.6	2/1/2007	---	---	NONE	D	geotechnical holes
(D-02-12) 03a	635650	MENDOZA,H M	1/1/1962	70	60	5	---	50	15.2	1/1/1962	---	1	D	---	
(D-02-12) 03aaa	529320	SOUTHWEST GAS CORP,	11/13/1990	160	---	---	---	---	---	---	---	---	NONE	D	1 WELL CAP-11-26-90:
(D-02-12) 03aaa	529358	TAMERON, RICHARD,	---	---	---	---	---	---	---	---	---	---	D	---	canceled
(D-02-12) 03aaa	639388	MARTINEZ,M R	1/1/1924	35	4	---	---	25	7.6	1/1/1924	---	---	D	---	
(D-02-12) 03aaa	643719	SMITH,H	1/1/1958	236	8	236	---	30	9.1	1/1/1958	---	20	D	---	
(D-02-12) 03aad	575547	TREJO OIL COMPANY	9/30/1999	30	5	30	---	26	7.9	9/30/1999	---	---	T	D	mw-2
(D-02-12) 03aad	575548	TREJO OIL COMPANY	6/15/1999	30	5	14	---	---	---	---	---	---	MON	D	MW-1 @ Tiger Mart #115, 805 West Highway 60, Superior, AZ. mib
(D-02-12) 03aad	635958	LUCKE J & JOY EVELAND	1/1/1979	117	4	117	---	---	---	---	---	---	D	---	
(D-02-12) 03ab	639051	CARTER,H W	---	48	8	48	---	20	6.1	---	---	35	D	---	
(D-02-12) 03abc	643720	LAYNE,G D	1/1/1907	30	36	30	---	15	4.6	1/1/1907	---	---	D	---	
(D-02-12) 03abd	528212	D-C ENTERPRISES,	---	---	---	---	---	---	---	---	---	---	D	---	canceled
(D-02-12) 03abc	213949	TREJO INVESTMENT	1/4/2007	33	3	33	---	28	8.5	1/4/2007	---	---	REM	D	AIR SPARGE WELL # 1; WELL CAPPED
(D-02-12) 03acb	575549	TREJO OIL COMPANY	11/17/1999	20	5	20	---	16	4.9	11/17/1999	---	---	T	D	mw-3
(D-02-12) 03acb	586003	TREJO OIL COMPANY	5/9/2001	30	4	15	---	12	3.7	5/9/2001	---	---	T	D	MW-5; abandoned
(D-02-12) 03acb	590392	TREJO OIL COMPANY	4/18/2002	20	4	10	---	16	4.9	4/18/2002	---	---	T	D	mw-6
(D-02-12) 03acb	643721	LAYNE,S D	1/1/1907	28	36	28	---	14	4.3	1/1/1907	---	---	D	---	
(D-02-12) 03add	606678	JOSEPHINE J SAWAIA	---	---	---	---	---	---	---	---	---	---	---	---	
(D-02-12) 03baa	906299	RESOLUTION COPPER MINING, LLC	1/26/2007	22	2	22	---	8	2.4	1/26/2007	---	---	MON	D	WELL CAPPED LSP-05
(D-02-12) 03baa	906300	RESOLUTION COPPER MINING, LLC	1/31/2007	17	2	17	---	4	1.2	1/31/2007	---	---	MON	D	WELL CAPPED
(D-02-12) 03baa	906360	RESOLUTION COPPER MINING LLC	2/1/2007	14	2	14	---	6	1.8	2/1/2007	---	---	MON	D	WELL CAPPED
(D-02-12) 03bab	563620	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	---	MON	---	MCC-9
(D-02-12) 03bab	906302	RESOLUTION COPPER MINING, LLC	1/23/2007	27	2	27	---	10	3.0	1/23/2007	---	---	MON	D	WELL CAPPED
(D-02-12) 03bac	906301	RESOLUTION COPPER MINING, LLC	1/24/2007	82	2	82	---	8	2.4	1/24/2007	---	---	MON	D	WELL CAPPED
(D-02-12) 03bba	907155	RESOLUTION COPPER MINING LIMITED	6/15/2007	35	3	35	---	---	---	---	---	---	MON	D	WELL CAPPED
(D-02-12) 03bbb	594158	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	MON	---	slag; NOI only; no completion report
(D-02-12) 03bbb	594160	BHP COPPER INC	---	---	---	---	---	---	---	---	---	---	MON	---	slag; NOI only; no completion report
(D-02-12) 03bbc	591861	BHP BILLITON	5/3/2002	100	---	53	---	36	11.0	5/2/2002	---	---	T	D	South Well
(D-02-12) 03bcb	545883	ADOT-EQUIP SERVICES,	12/13/1994	38	4	38	---	15	4.6	12/13/1994	---	---	MON	D	
(D-02-12) 03bcb	545884	ADOT-EQUIP SERVICES,	12/13/1994	38	4	38	---	15	4.6	12/13/1994	---	---	MON	D	
(D-02-12) 03bcb	545926	ADOT-EQUIP SERVICES,	12/12/1994	38	4	38	---	15	4.6	12/12/1994	---	---	MON	D	
(D-02-12) 03bcb	545927	ADOT-EQUIP SERVICES,	12/12/1994	38	4	38	---	15	4.6	12/12/1994	---	---	MON	D	
(D-02-12) 03bcd	559434	RUIZ, MANUEL JR,	8/31/1996	400	6	400	---	110	33.5	8/31/1996	---	20	D,I	D	
(D-02-12) 03bcd	86423	BESICK,S	1/1/1981	320	8	320	---	102	31.1	1/1/1981	---	---	D	---	

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			ALTITUDE (ft, msl)	PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED					
(D-02-12) 03bdc	529316	TAMERON, JOHN,A	1/16/1991	350	7	350	---	320	97.5	1/16/1991	---	20	D	D	
(D-02-12) 03cca	638029	WILLIAM OLIVER	5/15/1967	140	6	140	---	40	12.2	5/15/1967	---	12	D,I	---	
(D-02-12) 03cod	86403	BYRD,W J	---	---	---	---	---	---	---	---	---	---	D	---	canceled
(D-02-12) 03cd	602822	SMITH,F S	11/1/1954	300	8	270	---	260	79.2	11/1/1954	---	15	S	---	
(D-02-12) 03cdb	635076	FLOREZ,F M	1/1/1968	300	8	300	---	270	82.3	1/1/1968	---	10	I	---	
(D-02-12) 03cdc	528516	GOMEZ, ANGEL,	8/4/1990	360	7	360	---	320	97.5	8/4/1990	---	10	D	D	
(D-02-12) 03cdd	506271	AXA VASQUEZ	9/20/1983	320	8	320	---	280	85.3	9/20/1983	---	20	D	D	
(D-02-12) 03daa	482329	TREJO OIL COMPANY	---	---	---	---	---	---	---	---	---	---	REM	---	SVE-3
(D-02-12) 03daa	482330	TREJO OIL COMPANY	---	---	---	---	---	---	---	---	---	---	REM	---	SVEW-2
(D-02-12) 03daa	482331	TREJO OIL COMPANY	---	---	---	---	---	---	---	---	---	---	REM	---	SVEW-1
(D-02-12) 03dbb	200978	SOUTHWEST GAS CORPORATION	12/14/2003	100	12	---	---	---	---	---	---	---	OP	D	WELL ADDRESS IS 1001 BELMONT AVE, SUPERIOR
(D-02-12) 03dbc	613780	PADILLA,O R	---	50	---	---	---	---	---	---	---	---	D	---	
(D-02-12) 03dbd	643722	TOMERLIN SR,J R	---	208	6	---	---	---	---	---	---	---	I	---	
(D-02-12) 04	633771	HING,A O	1/1/1958	80	2	50	---	20	6.1	1/1/1958	---	5	D	---	
(D-02-12) 04aaa	541251	YBARRA, FRANCISCO,E	1/7/1994	168	10	161	---	20	6.1	1/7/1994	---	---	D	D	
(D-02-12) 04aab	563618	BHP COPPER,	8/16/1997	590	5	510	---	50	15.2	8/16/1997	---	---	MON	D	
(D-02-12) 04aab	563619	BHP COPPER,	---	713	---	---	---	---	---	---	---	---	NONE	---	ABND 08/27/97; canceled
(D-02-12) 04aca	550408	BHP COPPER INC,	---	---	---	---	---	---	---	---	---	---	MON	---	MCC-4A
(D-02-12) 04aca	558210	BHP COPPER,	8/13/1996	420	---	---	---	120	36.6	8/13/1996	---	---	NONE	D	1 HOLE/ABND-8-13-96; canceled
(D-02-12) 04adb	548187	BHP COPPER INC,	4/1/1995	225	4	135	---	138	42.1	4/1/1995	---	---	MON	D	MCC-4
(D-02-12) 04add	200643	BHP SUPERIOR OPERATIONS	---	---	---	---	---	---	---	---	---	---	NONE	---	mineral exploration 10 holes
(D-02-12) 04add	907037	RESOLUTION COPPER COMPANY	5/31/2007	60	5	55	---	53	16.2	5/31/2007	---	---	MON	D	NOI only, no completion report
(D-02-12) 04bad	508525	AZ PUBLIC SERVICE, MICHAEL TORRES	7/20/1984	150	---	---	---	---	---	---	---	---	NONE	D	anode
(D-02-12) 04bda	553898	HARBORLITE CORP,	10/20/1996	760	6	760	---	700	213.4	10/20/1996	---	25	C	D	
(D-02-12) 04dcd	571999	JOHN NORIEGA	---	---	---	---	---	---	---	---	---	---	D	---	NOI only, no completion report
(D-02-12) 04ddc	556793	MASHAW, GREGORY,	11/21/1996	220	6	220	---	40	12.2	11/21/1996	---	---	D,I	D	
(D-02-12) 04ddc	592991	JOHN R & SUSAN N YBARRA	9/10/2002	200	5	200	---	110	33.5	9/10/2002	---	10	D	D	
(D-02-12) 05	552442	KENNECOTT EXPLORTN,	11/28/1995	---	---	---	---	---	---	---	---	---	NONE	D	2 HOLES/ABND-3-8-96; canceled
(D-02-12) 05cbc	618724	AZ BOARD OF REGENTS	11/1/1963	120	8	120	---	45	13.7	11/1/1963	---	21	D	---	
(D-02-12) 05cda	553490	KENNECOTT EXPLORATN,	3/5/1996	80	---	---	---	---	---	---	---	---	NONE	D	1 HOLE/ABND-3-5-96; canceled
(D-02-12) 06d	635628	ARIZONA STATE PARKS	10/1/1940	130	6	20	---	40	12.2	10/1/1940	---	35	I,S,D	---	
(D-02-12) 06d	635629	ARIZONA STATE PARKS	4/10/1973	125	6	20	---	35	10.7	4/10/1973	---	35	I,S,D	---	
(D-02-12) 06daa	552444	KENNECOTT EXPLORATN,	1/25/1996	80	---	---	---	---	---	---	---	---	NONE	D	1 HOLE/ABND-3-16-96; canceled
(D-02-12) 06daa	635758	CHARLES P & BEVERLY M TRIMBLE	7/26/1968	96	12	25	---	37	11.3	7/26/1968	---	---	D	---	
(D-02-12) 06dac	218525	RICHARD & TINA ROSE	1/16/2009	200	5	200	---	45	13.7	1/16/2009	---	---	D	D	
(D-02-12) 06ddd	507771	AVENDANO, DANIEL,D	4/20/1984	95	6	12	---	50	15.2	4/20/1984	---	10	D	D	
(D-02-12) 07aba	624605	BOYCE THOMPSON SW AR	1/1/1925	21	4	21	---	18	5.5	1/1/1925	---	175	IND,D	---	
(D-02-12) 08	528041	HARBORLITE CORP,	5/31/1990	110	2	---	---	---	---	---	---	---	NONE	D	7-11-90; canceled
(D-02-12) 08	546429	KENNECOTT EXPLOR,	3/22/1995	---	---	---	---	---	---	---	---	---	NONE	D	2 HOLES: abandoned
(D-02-12) 08add	520421	CASTLEBERRY, OLIN,E	2/8/1989	195	8	195	---	40	12.2	2/8/1989	---	---	D	D	
(D-02-12) 08daa	588114	HARBORLITE CORPORATION	---	---	---	---	---	---	---	---	---	---	IND	---	
(D-02-12) 09	528040	HARBORLITE CORP,	5/31/1990	105	2	---	---	---	---	---	---	---	NONE	D	7-11-90; canceled
(D-02-12) 09	553393	HARBORLITE CORP,	2/4/1996	---	---	---	---	---	---	---	---	---	NONE	---	4 mineral exploration HOLES: Abandoned 2-4-96
(D-02-12) 09bad	558551	MARTINEZ, GEORGE & OLGA	8/9/1996	145	6	145	---	15	4.6	8/9/1996	---	---	D	D	
(D-02-12) 09bbb	552443	KENNECOTT EXPLORTN,	3/1/1996	---	---	---	---	0	0.0	3/1/1996	---	---	NONE	D	1 HOLE/ABND-3-14-96; canceled
(D-02-12) 10ba	602821	HARRY E. SMITH AND HELEN E. SMITH, TRUSTEES	4/10/1973	300	10	300	---	240	73.2	4/10/1973	---	30	I,S,D	---	
(D-02-12) 10bab	86388	LIRA, D	2/13/1981	275	1	270	---	90	27.4	2/13/1981	---	15	D	---	
(D-02-12) 11cbb	624610	RESOLUTION COPPER MINING LLC	1/1/1977	74	8	74	---	7	2.1	1/1/1977	---	16	S	---	
(D-02-13) 05bbb	213991	RESOLUTION COPPER MINING, LLC	10/2/2008	7754	10	7754	---	---	---	---	---	---	OME	---	RES 13
(D-02-13) 05bbb	911938	RESOLUTION COPPER MINING LLC	---	6703	4	3205	---	---	---	---	---	---	OME	---	RES 21
(D-02-13) 05cac	913052	RESOLUTION COPPER MINING LLC	8/20/2011	1085	9	40	---	400	121.9	---	---	---	MON	D	PHRES-03
(D-02-13) 05cac	913053	RESOLUTION COPPER MINING LLC	8/20/2011	1145	9	40	---	460	140.2	---	---	---	MON	D	PHRES-04
(D-02-13) 05cba	911875	RESOLUTION COPPER MINING LLC	4/12/2010	1122	8	1122	---	255	77.7	4/12/2010	---	---	MON	D	HRRES-09
(D-02-13) 05cba	911954	RESOLUTION COPPOER MINING LLC	10/8/2010	5207	4	5207	---	1220	371.9	10/8/2010	---	---	MON	D	DHRES-07

**TABLE C-1. SUMMARY OF WELL RECORDS FROM ADWR 55-WELL REGISTRY
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		ALTITUDE OF LAND SURFACE (ft, msl) ^b	....NON-PUMPING WATER LEVEL....			PUMPING RATE (gpm) ^d	WATER USE ^e	LOGS ^f	WELL COMMENTS
					DIAMETER (inches)	DEPTH (feet)		DEPTH (ft, bls)	DEPTH (m, bls) ^c	DATE MEASURED				
(D-02-13) 05cbd	913051	RESOLUTION COPPER MINING LLC	8/19/2011	1100	9	60	---	360	109.7	---	---	MON	D	PHRES-02
(D-02-13) 05cca	913050	RESOLUTION COPPER	8/19/2011	1160	9	40	---	260	79.2	---	---	MON	D	PHRES-01
(D-02-13) 05ccb	201848	RESOLUTION COPPER MINING LLC	3/11/2004	1147	4	1055	---	321	---	3/26/2004	---	MON	D	HRES-05
(D-02-13) 05ccb	615243	AZ STATE LAND DEPT,	---	---	4	---	---	---	---	---	---	---	---	---
(D-02-13) 06	212592	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	MIN	---	ONE OF THESE HOLES ("RES-10") WAS MODIFIED TO A MONITOR WELL (55-213992). SLR 10/12/06
(D-02-13) 06	532681	BHP COPPER INC,	8/7/1992	---	---	---	---	---	---	---	---	NONE	D	CAP-4-22-92/11-19-91
(D-02-13) 06	551163	BHP COPPER INC,	3/9/1996	---	---	---	---	---	---	---	---	NONE	D	4 HOLES:
(D-02-13) 06	552943	BHP COPPER INC,	6/6/1996	---	---	---	---	---	---	---	---	NONE	D	2 HOLES:
(D-02-13) 06	557634	BHP COPPER INC,	11/1/1996	---	---	---	---	---	---	---	---	NONE	D	3 HOLES:
(D-02-13) 06	562941	BHP COPPER INC	12/10/1997	---	---	---	---	400	121.9	---	---	NONE	---	3 HOLES: abandoned
(D-02-13) 06acc	912952	RESOLUTION COPPER MINING, LLC	---	7497	12	7497	---	---	---	---	---	NONE	---	RES-25
(D-02-13) 06b	591060	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	NONE	---	mineral exploration NOI only
(D-02-13) 06bac	912873	RESOLUTION COPPER MINING	---	7497	---	---	---	---	---	---	---	NONE	---	RES-25
(D-02-13) 06bba	217150	RESOLUTION COPPER MINING, LLC	4/20/2008	5429	5	3369	---	---	---	---	---	OME	D	RES-016; WELL CAPPED
(D-02-13) 06bba	597972	RESOLUTION COPPER MINING LLC	---	5160	5	3235	---	2500	762.0	---	---	T	D	SLR: THIS WELL WAS ORIGINALLY DRILLED UNDER 55-587214 AS THE SECOND MINERAL EXPLORATION HOLE. SINCE THERE WERE 2 HOLES ASSOCIATED WITH ONE REGISTRATION NUMBER, A NEW NUMBER HAS BEEN CREATED FOR THE SECOND HOLE IN ORDER TO PROCESS THE NOI TO MODIFY. THIS WELL IS NAMED RES-2
(D-02-13) 06bbb	216751	RESOLUTION COPPER MINING LLC	---	7261	10	---	---	---	---	---	---	OME	---	RES-14; Action History shows NOIs received to abandon and Abandonment Authority Issued. However, this well has not been abandoned. Only the deepened portions of the well have been abandoned when the deepened portion/project was completed 9/6/11 - bew
(D-02-13) 06bbb	221331	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	NONE	---	Res 32
(D-02-13) 06bca	587214	RESOLUTION COPPER MINING LLC	9/28/2002	---	4	5686	---	---	---	---	---	T	D	SLR: TWO HOLES WERE ORIGINALLY DRILLED UNDER THE EXPLORATION NOI: RES-1 AND RES-2, SITES C AND D. THE NOI TO MODIFY BOTH WELLS IS REASON TO CREATE A NEW NUMBER FOR THE SECOND HOLE. THEREFORE, RES-1 IS ASSOCIATED WITH 55-587214 AND RES-2 IS ASSOCIATED WITH 55-597972
(D-02-13) 06bcd	912953	RESOLUTION COPPER MINING	---	4367	4	4367	---	320	97.5	---	---	NONE	---	RES-28
(D-02-13) 06bdb	221330	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	NONE	---	RES-31
(D-02-13) 06c	537526	MAGMA COPPER CO,	6/9/1993	---	---	---	---	4667	1422.5	6/9/1993	---	NONE	D	ABAND-6-16-93; canceled
(D-02-13) 06cba	221332	RESOLUTION COPPER MINING, LLC	---	---	---	---	---	---	---	---	---	NONE	---	Res 33
(D-02-13) 06daa	216752	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	OME	---	RES-11
(D-02-13) 06dab	213992	RESOLUTION COPPER MINING LLC	---	---	---	---	---	---	---	---	---	MON	---	RES-10; THIS WELL WAS ORIGINALLY DRILLED AS AN EXPLORATION WELL UNDER 55-212592 (1 OF 10 HOLES). OWNER WANTS TO MODIFY ONE HOLE TO BE A MONITOR WELL ASSIGNED TO 55-213992.
(D-02-13) 06dac	217258	RESOLUTION COPPER MINING, LLC	4/29/2008	7842	14	7842	---	---	---	---	---	OME	D	RES-017; WELL CAPPED
(D-02-13) 06ddb	912102	RESOLUTION COPPER MINING LLC	9/30/2010	6320	2	6320	---	---	---	---	---	MON	D	DHRES-8
(D-02-13) 07abb	609675	INTEGRITY LAND AND CATTLE, LLC	---	1400	4	1400	---	300	91.4	---	35	S	---	---
(D-02-13) 07bab	912967	RESOLUTION COPPER MINING LLC	3/6/2011	900	4	900	---	471	143.6	3/6/2011	---	MON	D	HRES-13
(D-02-13) 08bab	615245	AZ STATE LAND DEPT	---	---	4	---	---	---	---	---	---	---	---	---
(D-02-13) 08cbb	907946	RESOLUTION COPPER MINING LLC	11/28/2007	1455	5	1022	---	455	138.7	11/28/2007	---	MON	D	HRES-08
(D-02-13) 08ccc	911688	RESOLUTION COPPER MINING, LLC	4/29/2010	2689	5	1635	---	797	242.9	4/29/2010	---	MON	D	DHRES-06

^a ft, bls = feet below land surface

^b ft, msl = feet above mean sea level

^c m, bls = meters below land surface

^d gpm = gallons per minute

--- = no available data

^e Water Use:

D = Domestic

I = Irrigation

S = Stock

MIN = Mining

IND = Industrial

C = Commercial

R = Recreation

NONE = None

T = Test

MON = Monitoring

REM = Remediation

OME = Other - Mineral Explore

OP = Other - Production

^f Logs:

D = Driller's

APPENDIX D

SUMMARY OF WELL RECORDS FROM ADWR GROUNDWATER SITE INVENTORY (GWSI)

**TABLE D-1. SUMMARY OF WELL RECORDS FROM ADWR GROUNDWATER SITE INVENTORY (GWSI)
NEAR WEST TAILINGS PREFEASIBILITY STUDY
RESOLUTION COPPER MINING, PINAL COUNTY, ARIZONA**

CADASTRAL LOCATION	ADWR WELL REGISTRY NUMBER	OWNER	DATE COMPLETED	DEPTH DRILLED (ft, bls) ^a	.....CASING.....		.....PERFORATIONS.....		ALTITUDE OF LAND SURFACE (ft, msl) ^c	ALTITUDE OF LAND SURFACE (m, msl) ^d	.....NON-PUMPING WATER LEVEL.....					PUMPING RATE (gpm) ^f	DATE PUMPED	WATER USE ^g	LOGS	REMARKS
					DIAMETER (inches)	DEPTH (feet)	INTERVAL (ft, bls)	TYPE ^b			DATE MEASURED	DEPTH (ft, bls)	DEPTH (m, bls) ^e	ALTITUDE (ft, msl)	ALTITUDE (m, msl)					
(D-01-11) 35dbc	502051	ROSE, R	---	100	4	---	---	---	2265	690.4	12/15/1997	---	---	---	---	---	---	U	---	Obstructed at 38.4
(D-01-11) 35dca1	---	---	---	---	4	---	---	---	2040	621.8	12/4/2002	---	---	---	---	---	---	D, S	---	Dry
(D-01-11) 35dca2	---	---	---	---	---	---	---	---	2040	621.8	2/13/2009	38.7	11.8	2001.3	610.0	---	---	D	---	1982 on pad
(D-01-13) 28ddb1	526592	USFS	4/28/1990	1108	16 10	0-? 0-936	---	---	4076	1242.4	12/14/2006	289.9	88.4	3786.1	1154.0	---	---	U	---	---
(D-01-13) 32dcd	---	MAGMA COPPER COMPANY	---	---	2.5	---	---	---	4020	1225.3	11/18/1994	231.9	70.7	3788.1	1154.6	---	---	U	---	---
(D-02-11) 01cdc2	627524	HERRON, JAMES	---	60	4	---	---	---	2420	737.6	2/13/2009	32.2	9.8	2387.8	727.8	---	---	I, S	---	---
(D-02-11) 11dab	600808	USFS	---	---	---	---	---	---	2405	733.0	2/13/2009	3.72	1.1	2401.28	731.9	---	---	S	---	---
(D-02-12) 03cdd	---	---	---	---	8 6	---	---	---	2740	835.2	2/11/2009	124.4	37.9	2615.6	797.2	---	---	D	---	---
(D-02-12) 07aba	624605	BOYCE TRHOMPSON ARBORETUM	1/1/1925	43	120	---	---	---	2440	743.7	12/8/2009	10.1	3.1	2429.9	740.6	---	---	I	---	---
(D-02-13) 07aaa	609675	ASARCO	---	1400	3.5	---	---	---	4040	1231.4	11/18/1994	461.5	140.7	3578.5	1090.7	---	---	U	---	---

^a ft, bls = feet below land surface

^c ft, msl = feet above mean sea level

^g Water Use:

^b Perforation Type:

^d m, msl = meters above mean sea level

D = Domestic

P = Perforated or slotted

^e m, bls = meters below land surface

I = Irrigation

^f gpm = gallons per minute

S = Stock

--- = no available data

U = Unused

APPENDIX E

DETAILED DESCRIPTIONS OF GEOLOGIC UNITS (from Spencer and others, 1998)

APPENDIX E

DETAILED DESCRIPTIONS OF GEOLOGIC UNITS (from Spencer and others, 1998)

Quaternary Alluvial Deposits (Holocene to early Pleistocene)

d: Disturbed surficial deposits (Holocene) – Gravel, broken rock and rearranged surficial deposits, generally associated with mining activity.

Qal: Alluvium (Quaternary) – Undifferentiated alluvium

Qs: Surficial deposits (Quaternary) – Undifferentiated surficial deposits, generally in mountain areas; includes talus, colluvium and various ages of alluvium.

Qtc: Talus and colluvium (late Holocene to Middle Holocene) – Unconsolidated talus and colluvium on slopes. Consists of locally derived angular to subangular cobbles and boulders with variable amounts of sand or mud matrix. Unconformably overlies all older units.

Qyc: Active alluvium (Holocene) – Very young deposits in the channels of ephemeral streams draining piedmonts, mountain areas, and basin floors are labeled Qyc. Qyc deposits are composed of minimally oxidized sand, silt, pebbles, cobbles, and boulders. Qyc deposits are typically coarse and very poorly sorted within mountain areas and on upper piedmonts, with particles ranging from silt to cobbles or boulders; in areas subject to overbank flooding, however, Qyc deposits are primarily sand and silt. Qyc deposits are typically composed of sand, silt, and pebbles on lower piedmonts, and are primarily sand on basin floors. Drainage patterns of Qyc channels are generally dendritic in the mountains and on upper piedmonts. Within the larger Qyc channels and on the lower piedmonts and basin floors distributary and anastomosing channel patterns are common. Many Qyc channels on lower piedmonts have discontinuous entrenched and unentrenched reaches. Some of the Qyc channels on piedmonts have rectilinear drainage patterns that suggest anthropogenic causes, such as railroad tracks, diversion ditches and dams, or channels that have developed out of two-track roads and cattle trails. Most Qyc channels on basin floors have been obscured or obliterated by agricultural cultivation. These former channels are identified by broad, shallow swales and young, sandy soils.

Qyc alluvium is generally well-stratified and lacks any appreciable soil formation. Qyc soils are classified as Torrifluvents or Torriorthents. Most of the channel surfaces are modern in age, but vegetated bars may be several hundred years old. Vegetation tends to be concentrated along modern drainages because of the relatively greater supply of moisture. Some of the larger drainages that originate in the mountains support streamflow in the

mountains and upper piedmont areas during the winter and spring. These drainages may sustain relatively large and lush riparian vegetation, such as cottonwood, sycamore, desert willow and tamarisk. Most Qyc channels on piedmonts only flow during or immediately after rainfall events. These channels typically are lined with palo verde, mesquite, or ironwood. Qyc surfaces are prone to flooding unless structures have been constructed to divert water from them. Areas mapped as Qyc on lowermost piedmonts and basin floors were formerly quite flood prone, but have for the most part been protected by flood-control structures. Due to relatively frequent wetting and high permeability, areas mapped as Qyc have high potential for ground-water recharge.

Qy: Low terrace and alluvial fan deposits (Holocene) – Holocene alluvial deposits that have incipient soil development are mapped as Qy. Unit Qy consists primarily of low terraces along active washes in the montane and upper piedmont areas and broad alluvial fans on lower piedmonts. Active channels are also included in unit Qy where they could not be consistently differentiated from slightly older deposits, primarily on active alluvial fans and in some montane stream reaches. In the mountains and on upper piedmonts particle sizes range from fine sand to boulders; on lower piedmonts, sand, silt, and pebbles predominate. Qy deposits typically are associated with narrow stream channels and low terraces on upper piedmonts and within the mountains. In contrast, Qy alluvial fans cover much of the middle and lower piedmonts of the Mesa Quadrangle. Drainage networks on Qy alluvial-fan surfaces on middle and lower piedmonts typically are distributary or anastomosing, with discontinuous entrenched and unentrenched reaches. In upper piedmont and intramontane areas, Qy deposits are associated with dendritic drainage networks. Qy terraces and alluvial fans typically are about 1 to 2 m above active channels.

Qy soils are weakly developed and commonly primary fluvial bedforms are preserved. Pedogenesis is generally limited to surface enrichment of silt from eolian sources, slight oxidation, and weak calcium carbonate accumulation. Surface colors typically are light brown to yellowish brown (10 YR), with minimal reddening deeper in the soil profile. Surfaces have minimal or no rock varnish or desert pavement development. Qy soils contain cambic, calcic (Stage I or less; morphologic stages of calcium carbonate accumulation are after Gile and others, 1981, and Machette, 1985), and Cox horizons [Birkeland, 1984], and classify as Torrifluvents, Torriorthents, Camborthids, and Calciorthids. Based primarily on soil development, Qy surfaces are estimated to be younger than 10 ka. Unit Qy encompasses units Ya, Ya1, Ya1a, and Ya1b of Huckleberry [1992, 1993a, 1993b, 1994a, 1994b]. We correlate Qy deposits with the Q4, Q3c, and Q3b surfaces (< 8 ka) in the lower Colorado River valley (LCR) [Bull, 1991]; and with the Fillmore alluvium (< 7 ka) in southern New Mexico near Las Cruces (SNM) [Gile and others, 1981].

Qy includes many active channels too small to map at this scale, relatively low stream terraces that may be inundated during large floods, and active alluvial fans on the middle and lower piedmont. Due to relatively high permeability and the variable potential for inundation, all areas mapped as Qy should be considered as potentially flood prone unless geomorphologic / hydrologic / hydraulic analyses indicate they are not.

Ql: Moderately dissected alluvial fan and terrace deposits (Late Pleistocene) – Late Pleistocene alluvial fan surfaces and terraces with moderate soil development are mapped as unit Ql. These deposits are common along mountain streams and on piedmonts. Ql units are typically alluvial fans on middle and lower piedmonts and terraces on upper piedmonts and in mountain areas. Alluvial sediment sizes range from sand to cobbles and boulders, coarser in upper piedmont and mountain areas. Drainage patterns on Ql surfaces are dendritic, with surface dissection varying from about 1 to 4 m. Desert pavement and rock varnish development is quite variable, ranging from nonexistent to moderate. Subdued depositional bar-and-swale surface topography is common.

Ql soils are more strongly developed than Qy soils, but their characteristics vary substantially. Ql surface colors typically are similar to or slightly redder than Qy surfaces (light brown to reddish yellow). Ql soils commonly contain argillic horizons (zones of clay accumulation) that are weakly to moderately strongly developed. These upper horizons of Ql soils are slightly (strong brown, 7.5 YR) to obviously (yellowish red, 5 YR) reddened relative to their parent material. Calcic horizon morphologies are also quite variable, ranging from Stage I-III development. Ql soils classify as Haplargids, Camborthids, and Calciorthids.

Unit Ql includes deposits of several different ages, probably ranging from slightly greater than 10 ka to as much as 100 to 200 ka. Unit Ql is equivalent to unit Ma2 of Huckleberry [1992, 1993a, 1993b, 1994a, 1994b]. We correlate Ql deposits with the Q2c (12-70 ka) and Q2b (70-200 ka) surfaces of the LCR [Bull, 1991] Isaac's Ranch (8-15 ka) and Jornada II (25-125 ka) surfaces of the SNM [Gile and others, 1981]. The substantial time span covered by unit Ql helps to explain the considerable morphological variability displayed by Ql soils. All Ql soils have developed at least in part during times when the regional climate was wetter and cooler than the Holocene, but the oldest soils may be an order of magnitude older than the youngest soils. Although well developed, none of these soils have not yet reached the stage of pedogenic development when subsequent soil formation is impeded by plugged and indurated horizons. These late Pleistocene soils thus display greater morphological variability compared to older soils with strong argillic horizons or petrocalcic horizons.

Ql units generally are not flood prone, except immediately adjacent to active washes. In lower piedmont areas where topographic relief is minimal, some areas mapped as Ql may be subject to inundation during extreme floods or may become subject to inundation as a result of relatively minor changes in the stream systems. Areas mapped as Ql generally have low recharge potential because their soils have generally low permeability and they are isolated from major washes.

Qm: Dissected alluvial-fan and terrace deposits (Middle Pleistocene) – Dissected middle Pleistocene alluvial-fan and terrace deposits with strong soil development. Relict Qm alluvial fans cover much of the middle and upper piedmonts throughout the Mesa Quadrangle. Small Qm fans and terraces are also fairly common along streams and in small basins in mountain areas. Sediment grain sizes range from sand to boulders, fining downstream. Qm alluvial-fan surfaces typically have dendritic drainage and are heavily dissected by streams that head on

them. Qm surfaces typically are 2 to 10 m above modern channels, with dissection decreasing downslope as Qm surfaces converge with younger surfaces. Desert pavement and rock varnish development are typically strong on stable Qm surfaces, but may be variable or weak on surfaces that have experienced significant erosion.

Qm soils typically exhibit strong soil development. Surface color range from strong brown to reddish brown. Qm soils typically contain reddened argillic horizons (strong brown to yellowish red, 7.5 YR to 5 YR) that are moderately to strongly enriched in pedogenic clay. Calcic horizon development typically is fairly strong (Stage II-IV); some Qm units have petrocalcic horizons (caliche). These soils classify as Calciorthids, Paleorthids, Haplargids, and Paleargids.

Estimated age of Qm deposits is at least 250 ka, and more likely 500 to 700 ka. Unit Qm is equivalent to unit Ma1 of Huckleberry [1992, 1993a, 1993b, 1994a, 1994b]. Soils associated with the Qm unit are much more strongly developed than those associated with Ql, implying that Qm is substantially older than Ql. The Qm unit is correlated with Q2a surfaces (400-700 ka) of the LCR [Bull, 1991] the Jornada I (250-400 ka) and possibly Doña Ana (> 400 ka) surfaces of SNM [Gile and others, 1981].

Areas mapped as Qm are generally not flood prone except in and adjacent to washes. Because of their relatively impermeable argillic and petrocalcic horizons, Qm surfaces are not areas of significant ground-water recharge.

Qml: Middle alluvium, undifferentiated (Late Pleistocene to Middle Pleistocene) – Composite map unit that contains both middle Pleistocene (Qm) and late Pleistocene (Ql) terrace and alluvial-fan deposits. Qml is used in montane areas that were mapped on a reconnaissance basis. In these areas, it is difficult to confidently distinguish between middle and late Pleistocene terraces without extensive field investigations and soil descriptions. Areas mapped as Qml are not prone to flooding except in and immediately adjacent to washes, and they are not areas of significant recharge.

Qo: Deeply dissected alluvial-fan remnants (Early Pleistocene) – Deeply dissected remnants of very old Quaternary alluvial fans with strong soil development are mapped as Qo. These relict alluvial fans exist in some upper piedmont areas in the south-central and eastern parts of the Mesa Quadrangle. Qo surfaces commonly are deeply dissected into a series of alluvial-fan remnants that mark the highest stand of basin deposits along the upper piedmont. Qo surfaces typically are 6 to 25 m above modern channels. Older deposits underlying and downslope from preserved Qo surfaces are mapped as Tertiary basin-fill deposits (Ts). In the eastern quarter of the Mesa Quadrangle, however, basin-fill deposits exist at levels substantially higher than Qo surfaces. Qo deposits typically are coarse and very poorly sorted, with grain sizes ranging from sand to boulders. Desert pavement on Qo surfaces varies from none to moderate; rock varnish varies from none to strong.

Qo soils range from moderately to very strongly developed, depending on their preservation. In areas where fairly extensive Qo surfaces are preserved, Qo soils typically include reddish brown to red (5 YR to 2.5 YR), clay-rich argillic horizons and petrocalcic horizons (caliche; Stage III-V). In areas where Qo remnants are of limited extent, or on slopes below planar fan surfaces, argillic horizons may have been removed by erosion leaving a calcic or petrocalcic horizon and caliche fragments at the surface. Qo soils classify as Paleargids (well-preserved argillic horizons), Durorthids, and Paleorthids. The common presence of petrocalcic fragments on Qo surfaces indicates erosion or bioturbation of the original surface.

Age of Qo alluvium is estimated to be 1 to 2 Ma. Unit Qo is generally equivalent to unit Oa of Huckleberry [1992, 1993a, 1993b, 1994a, 1994b]. However, unit Qo is somewhat more restricted than unit Oa because it includes only those areas where some remnant of the original alluvial-fan surface is preserved; if no planar fan surface is preserved, deeply dissected surficial deposits are inferred to be of Tertiary age (unit Ts). Qo correlates with the Q1 surface in the LCR [Bull, 1991] and possibly the Doña Ana surface of the middle Rio Grande Valley [Gile and others, 1981]. Both of these surfaces have open-ended age estimates (> 1.2 Ma for Q1 and > 400 ka for Dona Ana). Qo also correlates with the Martinez surface [Menges and McFadden, 1981; Morrison, 1981], a very high alluvial surface common to the basins of southeastern Arizona. Menges and McFadden [1981] estimate the age of the Martinez surface as 1-3 Ma based on very strong soil formation and magnetostratigraphy of underlying sediments.

Areas mapped as Qo are not flood prone. Impermeable argillic and petrocalcic horizons and relatively steep slopes associated with unit Qo limit the amount of groundwater recharge in these areas.

QTI: Landslide deposits (Holocene or Pliocene) – Poorly consolidated to unconsolidated, very poorly sorted mud to large boulders, characterized by a hummocky surface littered with boulders. Foliation in boulders of foliated rock varies greatly between outcrops. Contacts of landslide deposits range from sharp to gradational.

Tertiary Sedimentary Rocks (Miocene)

Tcu: Conglomerate (Miocene) – Conglomerate units overlying Miocene volcanic rocks in the Superior Quadrangle. In the Superior Basin, rocks included in this unit are moderately to well indurated conglomerate consisting of sub-rounded to subangular cobbles to boulders. Sparse planar sandy pebble to cobble conglomerate beds and, near the base of the unit, tuffaceous sandstone beds define bedding orientation. Underlies deeply (5-10 m) incised surfaces, which are littered with boulders weathered from the deposit. Largest boulders are up to about 2 m in diameter. Clasts consist of Pinal Schist, various granitoids (Yr, XYg), Apache Group, Paleozoic carbonate and clastic strata, massive white vein quartz, and Tertiary volcanic rocks.

Tsu: Sandstone (Miocene) – Tan to pale brown, poorly sorted and poorly bedded medium to fine grained sandstone. Overlies basalt (Tb) depositionally. Sandstone grades stratigraphically upward into conglomerate of map unit Tcu; contact placed where conglomerate constitutes greater than 50% of outcrop.

Tsl: Sedimentary rocks, Clastic (Miocene to Late Oligocene) – Pre-volcanic clastic rocks in central Arizona have been previously included in the Whitetail Formation [Ransome, 1904]. In view of the fact that the namesake location is now labeled Eastwater Canyon on published maps, a type section was never defined, the original type area is now buried by dumps at the Pinto Valley Mine, and that the age and correlation of various pre-volcanic clastic units called Whitetail is uncertain, the name is not used here. The thickest and most extensive accumulation of pre-volcanic clastic rocks is preserved in a dismembered basin above the Grayback Normal fault [Richard and Spencer, 1998] in the area north and west of the Ray Mine. This sequence consists mostly of massive conglomerate, but also includes mudstone, evaporite, and sandstone. The basal part of the section is generally massive conglomerate to sedimentary breccia, composed of clasts from adjacent underlying rock units. Rock avalanche deposits are present near the base of the section in several areas (e.g. Tx units in Tsl along Mineral Creek north of the Ray Mine). West of the Ray Mine in Walnut Canyon, the base of the section is massive, angular clast conglomerate consisting of clasts of Pinal Schist. The matrix is lithic sand to mudstone, apparently composed of disaggregated Pinal schist. The conglomerate is matrix or clast supported, and weakly to moderately indurated. Blocks of schist are up to about 3 m in diameter. These deposits are interpreted to include talus, coarse alluvium and debris flow deposits. In this area, the contact with underlying Pinal Schist gradational through shattered schist and is commonly faulted. Monolithologic sedimentary breccia-type conglomerates typically grade up into massive conglomerate with more rounded clasts derived from a variety of sources. In some areas, different facies of conglomerate can be mapped based on predominant clast types. Bedding in the conglomerate is difficult to discern except in sparse sandstone lenses. Fine grained facies of this sequence have been described from the southern part of the outcrop area. Light gray to red brown laminated mudstone is interbedded with very thin beds of fine-grained sandstone and lenses of pebble to cobble conglomerate. Some conglomerate lenses consist entirely of angular clasts of Pinal Schist; others contain granite (Yg and TKtc), Pinal Schist, and carbonate or quartzite clasts from the Apache Group or Paleozoic section. Gypsum and halite(?) are very thinly interbedded with buff siltstone to mudstone. Outcrops of evaporitic mudstones are highly disrupted because of mobility of anhydrite and salt, and original sedimentary structures have not been observed. The detailed relationship between the various facies is unknown.

Tertiary Volcanics (Middle Miocene to Early Miocene)

Tt: Poorly welded tuff (Miocene) – Massive to well bedded, non-welded to poorly welded tuff of uncertain affinity. Typically very light gray or white color. Crystal and lithic content variable. Tuff along northeast side of Superior Basin includes some Apache Leap Tuff.

Tfp: Felsic volcanic rocks (Miocene) – Felsic lava flows with associated vitrophyre, autobreccia, and tuff. Colors vary from dark gray to black for massive vitrophyre to white, light gray, or yellow in devitrified or deuterically altered parts of flows. Flow banding, amygdules, and brecciated zones are common. Rocks typically have phenocrysts of quartz, two feldspars, and sparse biotite or hornblende; tiny magnetite crystals are a common accessory. Quartz ranges from euhedral to resorbed. Phenocrysts make up to ~40% of rock in some units. Contacts with associated hypabyssal intrusions or endogeneous dome complexes are difficult to locate. Chemical analyses in Creasey et al., 1983 indicate the lavas in the western part of the map area are rhyolite. Interbedded with associated pyroclastic 37 deposits of unit Ttw, and intruded by hypabyssal rhyolite of unit Tfpi. Overlain by conglomerate (Ts).

Tfpt: Tuffs (Middle Miocene to Early Miocene) – Thin to thick tuff beds, locally with interbedded conglomerate. Tuffs are generally moderately to well indurated, but non-welded. Stratigraphic sequences vary in different parts of the map area. East of South Butte the sequence of tuffs includes: (1) a crystal rich tuff bed containing <2 mm-diameter biotite, quartz, feldspar, and hornblende(?) crystals, numerous pumice fragments that weather to form 1-5 cm pits on outcrop surfaces due to preferential weathering, and moderately abundant volcanic lithic fragments with a diameter of <1 cm; and (2) a tuff containing 1% 1-2 mm-diameter biotite crystals, abundant <3 mm-diameter quartz and feldspar crystals, and 10-20%, 1-3 cm volcanic-lithic fragments.

Extensive exposures of tuff 1.5 miles southeast of South Butte are mostly massive, with thin, well bedded intervals. This tuff is white, weathers orangish brown, contains sanidine, 5-10% quartz, and <1% biotite. Prominent cooling breaks are thin (2-10 cm) intervals of very thinly bedded to laminated tuff that weather to form ledges. At the southern end of the tuff outcrop area near upper Donnelly Wash, tuff contains fresh biotite, quartz, and granitoid lithic fragments. West of Box O Wash in this area, tuff contains 1-2 mm phenocrysts of quartz and biotite with sparse xenocrysts(?) of K-feldspar(?) up to 5 mm diameter. Directly south of Cochran massive, orange-weathering, volcanic lithic tuff(?) forms bold, rounded outcrops and contains abundant 2-20 cm fragments of variably flow-banded rhyolite with sparse quartz and sanidine crystals <3 mm in diameter. Biotite from tuff west of Box O Wash yielded a K-Ar date of 19.5 ± 0.4 Ma [Damon et al., 1996].

In the area southwest of the Ray Mine, tuff included in this unit has been named tuff of White Canyon [Dickinson, 1995]. The unit consists of white to light gray, very thin- to thin-bedded tuff that contains 1-2 mm crystals of quartz, feldspar, and minor biotite and magnetite in a fine-grained ash matrix. Sparse 1-3 cm lithic fragments are present. Little or no evidence of reworking after deposition is reported. Sparse conglomerate horizons are present near the base. Tuff forms resistant mesas and ridge tops. Equivalent to older tuff (Tto) of Creasy, et al. [1983]. Tuffs generally form the base of the section of Picketpost Mountain volcanics, overlying Pinal Schist, Apache Group, Tertiary conglomerate (unit Tsm), basalt lava (Tb) or Apache Leap tuff (Tal). Basal contact on Pinal Schist is erosional unconformity with

significant relief; contact on Tertiary units is typically a disconformity, but locally is an angular unconformity.

Tb: Basaltic rocks (Middle Miocene to Early Miocene) – Basalt lavas that are interbedded with middle Tertiary volcanic rocks. In the Teapot Mountain Quadrangle consists of dark gray basalt, basaltic or andesite lava flows, typically vesicular, and associated with red, scoriaceous deposits. Purplish to greenish gray, aphanitic to very fine-grained amygdaloidal basalt lava flows; consists of a mat of tiny (~0.015 mm) plagioclase needles, magnetite, and alteration products comprising carbonate, epidote, chlorite, clay, and hematite. Basalt lava flows and flow breccias near Queen Creek in the southern Picketpost Mountain quadrangle are dark gray and very fine-grained with 2-4% 1 mm diameter crystals of olivine (altered to iddingsite) and greenish pyroxene, in varying proportions. Flows are 1-4 m thick and locally vesicular; thin autobreccia zones are exposed at the base of some lava flows. Basalt forming Hackberry and Black mesas in the northern Superstition Mountains is very fine-grained, dark grey to black and contains 1-2 mm phenocrysts of clear plagioclase, olivine (locally altered to red iron oxides), and rare clear nepheline. In the Santan Mountains the unit consists of crystal-poor basalt lava flows, containing subhedral olivine phenocrysts up to 6 mm wide (altered to red opaques), dark green pyroxene and clear plagioclase laths up to 2-3 mm in diameter. The flows are locally brecciated and commonly vesicular. The sequence of lava flows is over 100 meters thick, and forms cliffs and steep, talus-covered hills. To the east the flows are thinner and interbedded with sedimentary rocks (Tsm). Mostly conformably overlies or interbedded with conglomerate (Tsm), overlies Apache Leap Tuff in northern Superstition Mountains.

Trdu: Undifferentiated felsic lava (Middle Miocene) – Includes lavas that resemble unit of Whitlow Canyon and unit of Buzzards Roost, as well as other unclassified lavas and some pyroclastic rocks.

Trdt: Tuff (Early Miocene) – Tuffs associated with undifferentiated felsic lava (Trdu).

Tal: Apache Leap Tuff (Early Miocene) – In typical, well exposed sections, a basal white non-welded to partly welded tuff (0-45 m thick) grades up section with increasing welding to black vitrophyre (1.5-15m thick); Vitrophyre is overlain by densely welded tuff; degree of welding decreases up section to poorly welded or locally non-welded at top. Tuff is crystal rich, with 35-45% phenocrysts of plagioclase (2-4 mm diameter, 24-32%), quartz (2-3 mm, 4-6%), biotite (1-3 mm, 3-5%), sanidine (2-3 mm, trace to 2%), hornblende (1 mm length, 0-1%), opaque oxide < 1 mm, trace- 2%). Accessory sphene is commonly discernible with a hand lens; zircon and apatite are also present. Plagioclase is typically subhedral, twinned and zoned, and is andesine or oligoclase. Quartz phenocrysts are rounded and deeply embayed. Biotite is euhedral to subhedral in thin books and flakes. Plagioclase decreases in abundance up section, while quartz and sanidine increase up section. Fiamme area strongly flattened, nearly invisible in the lower, strongly welded parts, and become more equant, only slightly flattened in the upper part. Fiamme are generally sparse. The lower, strongly welded parts are medium reddish brown in color, and the color lightens up section with decreasing welding.

Zones of vapor-phase alteration tend to be light gray in color. Overlies all older units with slight to strong angular unconformity on a surface of moderate relief. In several areas the contact is moderately to steeply tilted along faults that were apparently active during eruption. Contacts on Whitetail conglomerate are generally concordant, and appear conformable. (Richard and Spencer, 1998).

Tev: Volcanic rocks (Early Miocene) – Unit consists of undifferentiated volcanic rocks that underlie the Apache Leap Tuff in the Superior and Haunted Canyon Quadrangles [Peterson, 1960; 1969]. In the Superior quadrangle, these are described as lava flows of rhyolite and perlite obsidian. The rhyolite is light gray, flow banded or massive, and contains 1-5% phenocrysts of plagioclase, quartz, sanidine and biotite in an aphanitic groundmass. Black or brown perlite vitric zones are common at the top and bottom of lava flows. The unit includes some tuff and tuff breccia, and flows of andesite and trachyte. In the Haunted Canyon Quadrangle the unit consists of rhyolitic lava flows and associated pyroclastic and epiclastic rocks that have not been described. Overlies Whitetail conglomerate conformably, overlies pre-Tertiary rock on erosional unconformity with significant relief. Overlain by Apache Leap Tuff.

Tertiary and Cretaceous Intrusive Rocks (Miocene to Late Cretaceous)

Tg2: Granitoid stock of Wood Camp Canyon (Miocene) – Fine grained aplitic to granophyric granite with a groundmass consisting of 40% quartz and 60% feldspar; rock contains 2-3 mm diameter quartz phenocrysts, 4 mm long blocky K-feldspar phenocrysts and 1-2 mm anhedral plagioclase grains altered to chalky clay or sericite. Biotite, in 1 mm diameter books, is present in trace amounts. Contact with Pinal Schist is well exposed in Reavis Trail canyon at the south end of the pluton. The contact is sharp with a few thin dikes of granite cutting the schist. Pinal Schist is converted to hornfels within about 10 m of contact.

TKpg: Porphyry of Government Hill (Late Cretaceous or Paleocene) – Light brown to pale yellowish brown quartz monzonite porphyry. Phenocrysts of euhedral plagioclase, perthitic K-feldspar, and anhedral quartz are set in a very fine-grained groundmass of quartz and feldspar. Accessory minerals included biotite, epidote, magnetite, sphene, and apatite. Phenocrysts average 3-5 mm in diameter, largest are 10 mm in diameter. Quartz phenocrysts are deeply embayed, some with recrystallized grain margins. Alteration is extensive; plagioclase is albitized, biotite bleached, and secondary epidote, chlorite, and iron oxides are abundant. Miagrolitic cavities lined with epidote crystals are present, rarely these contain a single euhedral quartz crystal. Resistant to weathering, and forms steep slopes and cliffs. Intrudes Pinal schist and Apache group; overlain depositionally (and intruded?) by pre-Apache Leap Tuff felsic lavas.

Kqd: Quartz diorite of Peachville Wash (Late Cretaceous) – Medium to fine-grained, generally hypidiomorphic or panidiomorphic granular quartz diorite. Consists mostly of

euohedral to subhedral plagioclase and variable amounts of euohedral hornblende, pyroxene, and biotite; interstitial quartz ranges from trace to 15%. Includes two major rock types with gradational contacts. One is medium grained and contains 10-20% mafic minerals and 10-15% quartz. The other is fine-grained and contains 20-40% mafic minerals and trace to 10% quartz. Irregular masses of coarse grained rock containing euohedral hornblende up to 4 cm long or euohedral pyroxene up to 2 cm in diameter. Plagioclases slightly to moderately altered to sericite and clay; mafic minerals are altered to urallite, epidote, biotite and chlorite. Intrudes Pinal Schist, Apache Group and Paleozoic strata; overlain disconformably by Whitetail formation (Unit Tsl) and volcanic rocks.

Paleozoic Rocks

Pn: Naco Formation (Pennsylvanian) – Gray, blue-gray, tan and yellowish gray fine-grained limestone in 1.5-3 m-thick beds, interbedded with gray, pink and olive marl and shale. Limestone forms prominent, ledgy outcrop. Shaly units form swales between limestone ledges. Some beds are quite fossiliferous with a variety of brachiopods, corals, and bryozoan.

Ms: Sedimentary rocks (Mississippian, Devonian, and Cambrian) – Undifferentiated Bolsa Quartzite, Martin Formation and Escabrosa Limestone.

Bolsa Quartzite: Maroon-gray feldspathic sandstone. Grit and pebble conglomerate at the base grade up into medium- to fine-grained sandstone with siltstone partings up section. Planar tabular cross beds are common in quartzite beds in the lower part. Brick-red to light gray, fine- to medium-grained, well sorted and bedded sandstone. Abundant iron oxide gives rock red color. Commonly preserved in channels cut into underlying rock units. Lithologic distinction from Troy quartzite is cryptic; depositional contact on top of diabase is only sure way to distinguish units. Contact with Martin formation is abrupt transition to carbonate deposition.

Martin Formation: Brown, gray and tan dolomite and dolomitic limestone; chocolate brown sandy dolomite at the base; one or two coarse poorly-sorted sandstone beds are present; carbonate beds are laminated, massive and mottled. Gray carbonate units commonly have a petroliferous smell on fresh surfaces. Keith [1983] describes three units in the Martin Formation of the Teapot Mountains area, consistent with the measured section in Creasey et al. [1983]. The upper unit is a slope-forming thin- to medium-bedded fine-grained orange-tan silty dolomite with interbedded siltstone and shale; contains scattered hematite concretions and some corals. The middle unit consists of 30-50 feet of ledge-forming, fossiliferous, dark gray thin- to medium-bedded sandy limestone with corals, bryozoa, and abundant brachiopods and crinoid columnals. The sandy limestone overlies about 200 feet of slope-forming light gray to yellow gray thin bedded aphanitic dolomite and limestone. The lower unit consists of 20-35 feet of dark gray, medium-bedded, laminated, fetid dolomite. A basal sandstone, 0-40 feet thick,

correlated with the Becker's Butte Member of the Martin Formation is locally present. This sandstone is friable, well sorted, medium- to coarse-grained quartz arenite.

Escabrosa Limestone: Gray to blue-gray massive crystalline limestone in beds up to 3 m thick. Crinoid columnals abundant; corals abundant in some beds. Forms prominent, cliffy outcrops. Some parts contain abundant chert. Black chert bands prominent near base of formation. Minor interbedded silty or marly limestone. Top is variably developed karst zone with clasts of limestone in a red-brown clay matrix. Keith [1983] describes an upper unit he named the Eskiminzin formation that overlies karsted horizon at the top of the Escabrosa Limestone; this unit (0-110 feet thick) consists of pink to yellowish orange unfossiliferous fine-grained to aphanitic dolomite. Disconformably overlies Precambrian rocks, typically on a deeply weathered zone. Unconformably on Proterozoic diabase (Ydb) or Troy Quartzite. Upper contact with Naco formation is subtle change to more ledgy outcrop; when well exposed, a basal chert-pebble breccia is reported to be present at the base of the Naco Formation.

Cb: Bolsa Quartzite (Middle Cambrian) – Maroon-gray feldspathic sandstone. Grit and pebble conglomerate at the base grade up into medium- to fine-grained sandstone with siltstone partings up section. Planar tabular cross beds are common in quartzite beds in the lower part. Brick-red to light gray, fine- to medium-grained, well sorted and bedded sandstone. Abundant iron oxide gives rock red color. Commonly preserved in channels cut into underlying rock units. Lithologic distinction from Troy quartzite is cryptic; depositional contact on top of diabase is only sure way to distinguish units. Contact with Martin formation is abrupt transition to carbonate deposition.

Middle Proterozoic Rocks

Yad: Apache Group, Troy Quartzite and Diabase (Middle Proterozoic) – Undifferentiated Apache Group, Troy Quartzite, and intrusive diabase (Yd).

Yd: Diabase (Middle Proterozoic) – Dark grey dikes with typical sub-ophitic, diabasic texture. 35-45% 1-3mm plagioclase lathes in black groundmass of pyroxene; accessory magnetite(?) is common. Locally crude layering is defined by variation in ratio of plagioclase to groundmass and in size of plagioclase crystals. Intrudes Proterozoic granitoid, Pinal Schist, Apache Group, and Troy Quartzite.

Ya: Apache Group (Middle Proterozoic) – Undifferentiated Mescal Limestone, Dripping Spring Quartzite, Pioneer Formation, and basalt of Apache Group. May include minor amounts of Proterozoic Diabase (Unit Yd). Non-conformably overlies Pinal Schist (Xp), and Early or Middle Proterozoic granitic rocks.

Mescal Limestone (Middle Proterozoic) – Mescal Limestone (Middle Proterozoic) – Medium-bedded, tan to white dolomite or limestone, locally very cherty. Basal units of

poorly sorted quartz sand in argillaceous or dolomitic matrix; sedimentary breccia deposits related to solution of evaporite minerals present in many areas. This is overlain by thin- to thick-bedded dolomite or limestone, with variable amounts of chert as bedding parallel stringers, and calcareous shale partings. Dolomite is tan, limestone light gray to white. These strata are ordinarily 150-200 feet thick, and form most of the formation. A middle member of massive dolomite or limestone with structural features attributed to the growth of algal colonies during deposition is present in well preserved sections. An upper member of chert, feldspathic siltstone, and thin limestone is preserved in some areas. Light-gray, yellowish-gray and white medium to coarse-grained crystalline dolomite, some limestone in upper part of section; well, bedded, with beds 0.3 to 0.6 m thick. Chert is found in lenses, irregular globs and laminations. Rock with laminated chert weathers to form ribbed outcrops. Commonly intruded by diabase sills (Y db). Conformably overlies Dripping Spring Quartzite; conformably or disconformably overlain by basalt (Yb) or Troy Quartzite.

Dripping Spring Quartzite (Middle Proterozoic) – **Upper unit** (Middle Proterozoic) – Reddish brown to brownish red, thin bedded to laminated siltstone and very fine grained sandstone that readily parts along bedding planes. Locally the middle part is a black, laminated argillite. Some red-brown units contain 1-2cm diameter light tan or gray reduction spots, similar to those in the Pioneer Formation, but in the upper Dripping Spring, the spots tend to be larger in diameter and less abundant than in the Pioneer. **Lower unit** (Middle Proterozoic) – Tan to pink, medium to thin bedded feldspathic quartz arenite or feldspathic quartzite. Low- to moderate-angle trough cross beds are common. Ranges from coarse- to fine-grained, forming a fining upward sequence. In western exposures (west of Hewett Canyon) basal 5-10 meters consists of pale orange, medium to coarse grained, well bedded, partially cross bedded (10-40 cm thick cross bedded beds) quartzose sandstone with sparse, typically isolated quartzite pebbles and cobbles up to 5 cm diameter. Local pebble beds contain subrounded to rounded clasts of bull quartz, tan to brown quartzite, red jasper(?), and, possibly, brown silicic metavolcanic rocks. Prominent bluffs form top of this unit in Whitford Canyon. Barnes conglomerate; typically shattered in Millsite-Hewett canyon area.

Pioneer Formation (Middle Proterozoic) – Reddish brown to dusky purple sandstone, siltstone and minor shale; light gray to white reduction spots are characteristic. In this area, 10-20% of unit is red-brown arkosic fine-grained sandstone. Uppermost part is gray on fresh surface, brown weathering fine- to very fine-grained, almost porcelaneous sandstone. Most of formation is slope-forming. Overlain disconformably by Barnes Conglomerate of Dripping Spring Quartzite; contact is sharp. Non-conformably overlies Madera diorite or Pinal Schist.

Yg2: Porphyritic biotite granite (Middle Proterozoic) – This granite is probably equivalent to the type Ruin Granite exposed at the northeastern corner of the map area. The massive granite in upper Horrel Creek (Haunted Canyon 7.5' quadrangle) is described as consisting of euhedral pink K-feldspar phenocrysts 2-8 cm in diameter in a coarse-grained,

hypidiomorphic-granular groundmass of sodic plagioclase, microcline, quartz, and biotite, with accessory sphene, magnetite, apatite, and zircon. This granite locally grades to fine-grained, non-porphyritic quartz monzonite. Scattered pods of aplite and graphic granite are present [Peterson, 1960]. Depositionally overlain by Apache Group in northeastern part of outcrop area. Intrusive contacts with older rocks are not well described.

Early Proterozoic Rocks

Xgd: Granodiorite to granite (Early Proterozoic) – This unit consists of compositionally variable, generally equigranular and fine- to medium-grained quartz diorite, monzodiorite, granodiorite and granite. Granitoids in this unit have concordant to sub-concordant contacts with Pinal Schist, and range from massive to strongly foliated. Foliation commonly best developed near contacts with Pinal Schist, and all foliation is typically concordant to that in associated Pinal Schist.

In the northern San Tan Mountains consists of medium-grained equigranular granodiorite, granite, and quartz monzodiorite that contains abundant unaltered plagioclase, 5-15% biotite and rare hornblende. Characteristically contains numerous preferentially oriented, elongate enclaves (1's to 10's of meters) of Pinal Schist, and east-northeast trending epidotized, thin mylonite zones. Foliation becomes pervasive in the northeasternmost exposures. Small irregular bodies of diorite and monzodiorite are present, and are interpreted to be phases of the granodiorite [Ferguson and Skotnicki, 1996]. The mafic phases form dark, rounded hills with crumbly rock exposures, commonly on the low flanks of large hills underlain by granodiorite.

In the east-central part of the Mesa 30 by 60' quadrangle the unit consists of equigranular, unfoliated, medium- to fine-grained granite to granodiorite with local marginal aplitic zones. The rock generally contains 7-10% mica, including both biotite and muscovite, but their relative abundance varies greatly. More muscovite-rich granite, appears to have assimilated more Pinal Schist and is generally associated with gradational assimilation zones and broader contact aureoles. Rocks included in this unit have been mapped as Madera Diorite by Peterson (Superstition Wilderness), Creasey et al. [1983], and S. B. Keith [1983]. Intrusive contacts with Pinal Schist range from sharp contact with few screens of schist near the contact, and no apparent contact metamorphic aureole to heterogeneous mixed zones several 10's of m wide. In many places, the granitic rocks are foliated near contacts.

Xp: Pinal Schist (Early Proterozoic) – Several lithofacies are recognized, including: (1) pelitic facies consisting mostly of fine to very fine grained muscovite-biotite-chlorite-quartz-feldspar schist and phyllite; (2) psammitic facies, consisting mostly of fine-grained quartz-feldspar granofels and gneiss, with sparse mica; (3) calc-silicate gneiss, consisting of hornblende-epidote-calcite-quartz-feldspar gneiss and grano-fels, ranging from massive amphibolite to marble; and (4) quartzite, consisting of massive gray to black quartzite, commonly ferruginous. The pelitic and psammitic facies are the dominant

lithofacies. Metamorphic grade appears to be middle to lower greenschist facies. Metamorphic muscovite and biotite are abundant, but garnet, staurolite(?) and aluminosilicate (?) minerals have only been observed in contact aureoles near large Middle Proterozoic (?) plutons. The schist becomes medium-fine to fine grained in contact aureoles around concordant to slightly discordant plutons of granite to hornblende (Xgd, Xd, Xh). Intruded by Early (?) Proterozoic and younger plutons; overlain non-conformably by Middle Proterozoic Apache Group and younger strata. The Pinal Schist is the oldest rock recognized in central Arizona.

Xpc: Calc-silicate and amphibolite facies (Early Proterozoic) – Consists of interlayered amphibolite, marble, and psammite. Amphibolite is dark greenish gray, fine-grained amphibole-plagioclase rock. Marble is white, pinkish or tan, and occurs as discontinuous layers and irregular lenses in amphibolite or psammite. Unit is >50% amphibolite and marble. Grades into psammitic or pelitic Pinal Schist.

Xpp: Phyllite facies (Early Proterozoic) – Massive, platy, gray to silvery gray, slightly schistose phyllite forms concordant band across outcrops of more psammitic schist northeast from Gonzales Pass to Queen Creek. Sparse calc-silicate granofels consisting of fine-grained calcite-epidote-mica is associated with the phyllite.

APPENDIX F

WELL RECORDS

[illegible]

Driller W. C. D. D. D.
Name

Address

City Apache Jct. State Arizona 85226 Zip

Date _____



WELL REGISTRATION NUMBER
55 - 912289

DHRES-09

[illegible]

(D-1-12) 27aad

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

Driller Errol A. Smith
Name

P.O. Box 2185
Address

Date Globe, AZ 85504

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Date _____

ANSWERED MAY 21 2002

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

RECEIVED
SEP - 6 1996
RECORDS MGT

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: James L. Marie
1302 Westbury Ave
 Street
Woodbury CA 95776
 City State Zip Phone No.
James L. Marie
 Signature of Driller Date

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: Marie
1202 Kentucky Ave
 Street
Woodland CA 95776
 City State Zip Phone No.
Chip
 Signature of Driller Date

(D-1-12) 34dbc

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: John Hazlewood

306 Airport RD
Street

Milan	NM	87021	505-287-2986
City	State	Zip	Phone No.

Signature of Driller

Date _____

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 906297

[illegible]

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 912484

[illegible]

BROWN AND CALDWELL

Phoenix, Arizona

BORING LOG

55- 558203
(D-1-12) 35adb

Project Name: **BHP Superior**

Project Number: **3800.05**

Soil Boring ☐

Monitoring Well ☒

Boring/Well Number: **MCC-8**

Sheet **1** of **1**

Boring Location: **331805.78N(Lat) 1110550.18W(Long)**

Elevation and Datum: **3038.6 msl**

Drilling Contractor: **Water Development**

Driller:

Date Started: **7/30/96**

Date Finished: **8/7/96**

Drilling Equipment: **Dresser T70W**

Borehole Diameter: **7.5"**

Completed Depth: (feet) **121.0**

Water Depth: (feet) **dry**

Sampling Method: California Method ☐

Shelby Tube ☐

Split Spoon ☐

WELL CONSTRUCTION

Drilling Method: **Air Rotary**

Drilling Fluid: **Air**

Type and Diameter of Well Casing: **4.77" ID Schedule 80 PVC**

Backfill Material: **Type 5 Cement with 3% bentonite grout**

Slot Size: **0.02"**

Filter Material: **10-20 CSSI**

Logged By: **John Eliades**

Checked By:

Development Method: **Bail/Swab and pump**

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings	Remarks
					Sample	Lithology	Well		
		GILA CONGLOMERATE Clasts are composed predominantly of limestone, aphanitic volcanics, dusky red medium-grained dacite, and quartzite.							Type 5 cement with 3% bentonite grout seal from 0 to 40 feet
20		VOLCANIC TUFF (DACITE) Dacite is dusky red with calcite present as possible fracture fill.							4.77" ID Schedule 80 PVC casing from 0 TO 50 feet
40									20-40 Mesh sand pack from 40 to 45 feet
60		First water encountered during drilling at 53 feet bls. <i>well is dry per consultant 5/15/06 TH</i>							10-20 Mesh Colorado Silica sand pack from 45 to 121 feet
80									4.77" ID Schedule 80 PVC screen (0.02" slot size) from 50 to 110 feet
100									Total cased depth = 110 feet
120									Stopped drilling at 121 feet

BROWN AND CALDWELL

Phoenix, Arizona

BORING LOG

Well
w/ Abandonment Details

Project Name: **BHP Superior**

Project Number: **3800.05**

Soil Boring ☐

Monitoring Well ☒

Boring/Well Number:

MCC-8

Sheet **1** of **1**

Boring Location: **331805.78N(Lat) 1110550.18W(Long)**

Elevation and Datum: **3038.6 msl**

Drilling Contractor: **Water Development**

Driller:

Date Started: **7/30/96**

Date Finished: **8/7/96**

Drilling Equipment: **Dresser T70W**

Borehole Diameter: **7.5"**

Completed Depth: (feet) **121.0**

Water Depth: (feet) **dry**

Sampling Method: California Method ☐

Shelby Tube ☐

Split Spoon ☐

WELL CONSTRUCTION

Drilling Method: **Air Rotary**

Drilling Fluid: **Air**

Type and Diameter of Well Casing:

4.77" ID Schedule 80 PVC

Backfill Material: **Type 5 Cement with 3% bentonite grout**

Slot Size: **0.02"**

Filter Material: **10-20 CSSI**

Logged By: **John Eliades**

Checked By:

Development Method: **Bail/Swab and pump**

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings	Remarks
					Sample	Lithology	Well		
		MAY 15 2006							
		GILA CONGLOMERATE Clasts are composed predominantly of limestone, aphanitic volcanics, dusky red medium-grained dacite, and quartzite.							Type 5 cement with 3% bentonite grout seal from 0 to 40 feet
20		VOLCANIC TUFF (DACITE) Dacite is dusky red with calcite present as possible fracture fill.							4.77" ID Schedule 80 PVC casing from 0 to 50 feet
40									20-40 Mesh sand pack from 40 to 45 feet
60		First water encountered during drilling at 53 feet bls.							10-20 Mesh Colorado Silica sand pack from 45 to 121 feet
80									4.77" ID Schedule 80 PVC screen (0.02" slot size) from 50 to 110 feet
100									Total cased depth = 110 feet
120									Stopped drilling at 121 feet

0-110'
Tremie Pumped
Pozzolanic
Cement

BROWN AND CALDWELL

Phoenix, Arizona

BORING LOG

558203

Project Name: **BHP Superior**

Project Number: **3800.05**

Soil Boring ☐

Monitoring Well ☒

Boring/Well Number:

MCC-8

Sheet **1** of **1**

Boring Location: 331805.78N(Lat) 1110550.18W(Long)		Elevation and Datum: 3038.6 msl	
Drilling Contractor: Water Development	Driller:	Date Started: 7/30/96	Date Finished: 8/7/96
Drilling Equipment: Dresser T70W	Borehole Diameter: 7.5"	Completed Depth: (feet) 121.0	Water Depth: (feet) dry
Sampling Method: California Method <input type="checkbox"/> Shelby Tube <input type="checkbox"/> Split Spoon <input type="checkbox"/>		WELL CONSTRUCTION	
Drilling Method: Air Rotary	Drilling Fluid: Air	Type and Diameter of Well Casing: 4.77" ID Schedule 80 PVC	
Backfill Material: Type 5 Cement with 3% bentonite grout		Slot Size: 0.02"	Filter Material: 10-20 CSSI
Logged By: John Eliades	Checked By:	Development Method: Bail/Swab and pump	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings	Remarks
					Sample	Lithology	Well		
								PPM	
		GILA CONGLOMERATE Clasts are composed predominantly of limestone, aphanitic volcanics, dusky red medium-grained dacite, and quartzite.							Type 5 cement with 3% bentonite grout seal from 0 to 40 feet
20		VOLCANIC TUFF (DACITE) Dacite is dusky red with calcite present as possible fracture fill.							MAY 11 2006 4.77" ID Schedule 80 PVC casing from 0 TO 50 feet
40									20-40 Mesh sand pack from 40 to 45 feet
60		First water encountered during drilling at 53 feet bls. <i>well is dry per consultant 5/15/06 TH</i>							10-20 Mesh Colorado Silica sand pack from 45 to 121 feet
80									4.77" ID Schedule 80 PVC screen (0.02" slot size) from 50 to 110 feet
100									Total cased depth = 110 feet
120									Stopped drilling at 121 feet

BROWN AND CALDWELL
Phoenix, Arizona**BORING LOG***Well w/ Abandonment Details*Project Name: **BHP Superior**Project Number: **3800.05**Soil Boring ☐Monitoring Well ☒Boring/Well Number: **MCC-8**Sheet **1** of **1**

Boring Location: 331805.78N(Lat) 1110550.18W(Long)		Elevation and Datum: 3038.6 msl	
Drilling Contractor: Water Development	Driller:	Date Started: 7/30/96	Date Finished: 8/7/96
Drilling Equipment: Dresser T70W	Borehole Diameter: 7.5"	Completed Depth: (feet) 121.0	Water Depth: (feet) dry
Sampling Method: California Method <input type="checkbox"/> Shelby Tube <input type="checkbox"/> Split Spoon <input type="checkbox"/>		WELL CONSTRUCTION	
Drilling Method: Air Rotary		Type and Diameter of Well Casing: 4.77" ID Schedule 80 PVC	
Backfill Material: Type 5 Cement with 3% bentonite grout		Slot Size: 0.02"	Filter Material: 10-20 CSSI
Logged By: John Eliades		Development Method: Ball/Swab and pump	
Checked By: [Signature]			

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log			Readings	Remarks
					Sample	Lithology	Well		
		MAY 15 2006							
		GILA CONGLOMERATE Clasts are composed predominantly of limestone, aphanitic volcanics, dusky red medium-grained dacite, and quartzite.							Type 5 cement with 3% bentonite grout seal from 0 to 40 feet
20		VOLCANIC TUFF (DACITE) Dacite is dusky red with calcite present as possible fracture fill.							4.77" ID Schedule 80 PVC casing from 0 TO 50 feet
40									20-40 Mesh sand pack from 40 to 45 feet
60		First water encountered during drilling at 53 feet bls.							10-20 Mesh Colorado Silica sand pack from 45 to 121 feet
80									4.77" ID Schedule 80 PVC screen (0.02" slot size) from 50 to 110 feet
100									Total cased depth = 110 feet
120									Stopped drilling at 121 feet

0-110'
Tremie Pumped
Pozzolanic
Cement

MONITOR WELL MCL-8

Project <u>Superior Mine</u>	Location <u>Superior, AZ</u>	Elevation	Project No. <u>3800.04</u>
Drilling Co. <u>Water Development Corp</u>	Drilling Equipment <u>Dresser T70W</u>	Date Started <u>7/30/96</u>	Date Finished <u>8/7/96</u>
Conductor Casing <u>None</u>	Casing <u>4.77 inch ID</u> <u>Schedule 80 PVC</u>	Screen <u>4.77 inch ID</u> <u>Schedule 80 PVC</u>	
Filter Pack <u>10-20 mesh</u> <u>Colorado Silica Sand</u>	Logged By <u>John Eliades</u>	Drilling Method <u>air rotary</u>	
	Geophysical Logs <u>None</u>	Drilling Fluid <u>air</u>	
Annular Seal <u>cement grout to surface</u>	Development	Completion Depth <u>110 ft b/s</u>	
		Water Level <u>53 ft b/s</u>	

Description	Depth (ft)	Drill Rate	Remarks
Angular, poorly sorted, fine to coarse gravel composed predominantly of limestone with some aphanitic volcanics, dusky red medium-grained dacite and quartzite ↓	0	40 ft/hr	Note - Color codes are from the Munsell Soil Color charts with wet cuttings. Hit bedrock at 14 ft. chips of calcite in the cuttings possibly remnants from calcite filled fractures in the dacite.
	5		
	10		
Very fine sand with trace of fine angular gravel composed entirely of dusky red (2.5 YR 4/3) medium-grained dacite ↓	14		RECEIVED SEP - 6 1996 RECORDS MGT
	15		
	20		
Silt to fine angular gravel composed entirely of dusky red medium-grained dacite ↓	25		
	30		
	35		
	40		
	45		
	50		
	55		
	60		
	65		

[illegible]

Date _____

SECTION 5. GEOLOGIC LOG OF WELL

[illegible]

MCC-5

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Date _____

55-548186
(D-1-12)35cdc

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Street _____

City _____ State _____ Zip _____ Phone No. _____

Date _____

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name:

Street

City

State

Zip

Phone No. _____

~~Signature of Driller~~

Date _____

[illegible]

[illegible]

Driller Name: Jerry White

Street

City 7 State 1 Zip _____ Phone No. _____

Signature of Driller

Date _____

SECTION 5. GEOLOGIC LOG OF WELL

DWR 55-55 (REVISED 03/07/06) PAGE 3 OF 4

55- 201852

[illegible]

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein contained are true to the best of my knowledge and belief.

Driller GARY C. MUNCY Name
4329 W. DESERT COVE Address
GLENDALE AZ. 85304
City State Zip
Date 10-21-85

[illegible]

Driller Earl B. Lee
Name

BOYLES BROS. DRILLING CO.
7235 N. 67th Ave.
City Glendale, AZ 85301
Date 11-24-86

[illegible]

belief.

Driller Name: Michael Klein

21305 S. Lindsay Rd

Street

Chandler Az 85249

City State Zip

Date 2/11/93

(D-1-13) 32cab

[illegible]

Date _____

WELL REGISTRATION NUMBER
55- 217407

SECTION 5. GEOLOGIC LOG OF WELL

[illegible]

SECTION 5. GEOLOGIC LOG OF WELL

DWR 55-55-10/01 (REV) page 3 of 4

DWR 55-55 (REVISED 03/07/06) PAGE 3 OF 4

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

P.O. BOX 5478

Street

ORACLE, AZ 85623-5478

City

State

Zip

Phone No. _____

City _____ State _____ Zip _____ Phone No. _____
Signature of Driller J. A. Shullips Date 9-20-2000

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 904495

[illegible]

T02S-11E 02DBB

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein contained are true to the best of my knowledge and belief.

Driller

Name _____

1004 Cedar Ave

Address

Miam'

 A_2

85839

City

State

Zip

Date _____

1-28-88

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

SERVICE, INC.

Driller Name: ENVIRONMENTAL DRILLING & PUMP

64 WEST RED FERN ROAD

Street

QUEEN CREEK, AZ 85242

City	State	Zip	Phone No.
------	-------	-----	-----------

Signature of Driller

Signature of Driller

6-12-99

Date _____

[illegible]

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 906296

SECTION 5. GEOLOGIC LOG OF WELL			
DEPTH FROM SURFACE		Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)		
0	5	Silty clay	
5	8	Sand w/ gravel	✓
8	15	Sand w/ gravel (weathered Gila Conglomerate)	✓
0	15	Sand w/ gravel minor silt	
15	20	sand minor gravel	✓
20	45	very dense sand w/ gravel (weathered Gila Conglomerate)	✓
45	51	very dense sand w/ gravel (Gila Conglomerate)	✓
0	4	Gravelly clay	
4	5	Sand w/ gravel (Gila Conglomerate)	
0	2.5	sand (tailings)	
2.5	5	sand	
5	10	Sand - trace tailings.	
10	12.5	Sand minor clay (Gila Conglomerate)	✓
0	9	clayey sand	
9	15	tailing slime	
15	20	sand w/ minor gravel (Gila Conglomerate)	✓
0	5	Sand & clay	
5	10	Silty sand	✓
10	15	Clayey sand	✓
15	19	Sand minor gravel (Gila Conglomerate)	✓
0	3	Sand minor clay	
3	8	Sand minor fines	
8	9	Sand minor gravel (Gila Conglomerate)	

55-541251
(D-2-12)4aaa

[illegible]

Driller Name: Thomas K. Asell
1441 N-KAJO TA
 Street
CASA GRANDE, AZ, 85222
 City State Zip
 Date 1-21-94

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.


[illegible]

Driller Name: John Hazlewood

306 Airport Rd
Street

Milan NM 87021 505-287-2986
City State Zip Phone No.

City _____ State _____ Zip _____ Phone _____


Signature of Driller _____ Date _____

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: Gigi H. Main
 Street 1202 Kentucky Ave
 City Woodland State CA Zip 95776 Phone No. _____
 Signature of Driller Gigi Main Date _____

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

[illegible]

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: [Signature]

Street _____

City _____ State _____ Zip _____ Phone No. _____

Date _____

[illegible]

Driller Bob Brown Name
Box 141 Address
Cassadun City State Zip
Date 7-31-87

[illegible]

Driller Name: Jerry White
P.O. Box 37
Street
Apache Jct Az 85217
City State Zip
9182-0082 11-7-96
Phone No. Date
Signature of Driller

[illegible]

Date _____

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 NORTH THIRD STREET PHOENIX, ARIZONA 85004-3903
(602) 417-2470 FAX (602) 417-2422

*

APR - 8 1996

WELL ABANDONMENT COMPLETION REPORT

RECORDS MGT

A.R.S. §45-594; R12-15-816: Within 30 days after a well is abandoned, the well drilling contractor shall file a Well Abandonment Completion Report on a form prescribed and furnished by the Director.

1. Well Registration No. 55- 552442
2. Well Location: 2 ^N5 12 ^EW 5 NE $\frac{1}{4}$ SE $\frac{1}{4}$ SW
Township Range Section 10 Acre 40 Acre 160 Acre
3. Owner of the Well:
Name: KENNECOTT EXPLORATION COMPANY
1802 W. GRANT RD. STE 119 TUCSON AZ 85745
Address City State Zip
4. Owner of the Land:
Name: SAME AS ABOVE
Address City State Zip
5. Well Description: 1800' 3.032 1290' OF 94MM (Outer Casing) _____ (Inner Casing)
Hole Depth Diameter Type of Casing Diameter Type of Casing
6. Reason for abandonment: Completed Hole
7. Prior to abandonment, did the well have 20' of steel surface casing AND 20' of grout in the annular space surrounding surface casing? Yes _____ No X
8. If the answer to No. 6 is no, was the top 20' of casing removed prior to setting the cement plug? Yes X No _____
9. Identify the materials and methods used to abandon the well: THICK BENTONITE MUD FROM 20' TO 1800'
0'-20' CEMENT SURFACE PLUG
10. Is this Abandonment Completion Report filed in accordance with R12-15-816,F.? Yes X No _____
11. How deep does the cement plug extend below land surface? 20'
12. Was the well backfilled above the cement plug? Yes _____ No _____
13. Date abandonment completed: 3-8-96
14. Drilling Firm:
Name: CHRISTENSEN Boyles Corp. License No: 28
6527 W. NORTHVIEW GLENDALE AZ 85301
Address City State Zip

DATE: 4-2-96 SIGNATURE OF WELL DRILLER [Signature]

CANCELLED

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 NORTH THIRD STREET PHOENIX, ARIZONA 85004-3903

(602) 417-2470 FAX (602) 417-2422

APR - 8 1996

WELL ABANDONMENT COMPLETION REPORT

RECORDS MGT

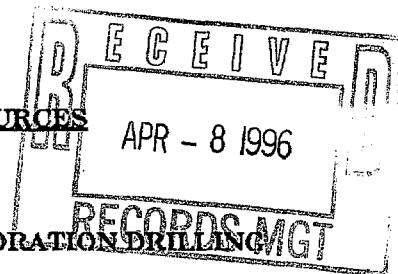
A.R.S. §45-594; R12-15-816: Within 30 days after a well is abandoned, the well drilling contractor shall file a Well Abandonment Completion Report on a form prescribed and furnished by the Director.

- Well Registration No. 55- 552442
- Well Location: 2 N 12 E 5 SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE
Township Range Section 10 Acre 40 Acre 160 Acre
- Owner of the Well:
Name: KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. STE 119 TUCSON AZ 85746
Address City State Zip
- Owner of the Land:
Name: SAME AS ABOVE
Address City State Zip
- Well Description: 2040' 3.032 1730' OF 4" (Outer Casing) _____ (Inner Casing)
Hole Depth Diameter Type of Casing Diameter Type of Casing
- Reason for abandonment: HOLE COMPLETED
- Prior to abandonment, did the well have 20' of steel surface casing AND 20' of grout in the annular space surrounding the surface casing? Yes _____ No X
- If the answer to No. 6 is no, was the top 20' of casing removed prior to setting the cement plug? Yes X No _____
- Identify the materials and methods used to abandon the well: THICK BENTONITE MUD FROM 2040' TO 20
0-20' CEMENT PLUG
- Is this Abandonment Completion Report filed in accordance with R12-15-816, F.? Yes X No _____
- How deep does the cement plug extend below land surface? 20'
- Was the well backfilled above the cement plug? Yes _____ No _____
- Date abandonment completed: 3-10-96
- Drilling Firm:
Name: CHRISTENSEN BOYLES CORP. License No: 28
6527 W. NORTHVIEW AVE GLENDALE AZ 8530
Address City State Zip

DATE: 4-2-96SIGNATURE OF WELL DRILLER [Signature]

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Name: Kennerott Exploration Company

Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip

2. Lessee or Operator Name: Same as above

Address: _____
Street City State Zip

3. Driller Name: Cristensen Boyles Corp.

Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip

4. Location: 2 12 5 NE 1/4 SE 1/4 SW 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552442 (REQUIRED)

DESCRIPTION OF WELL

5. Type of Casing (if installed): 1290' of 94mm casing. 1280' removed, 10' left @ 1280'-1290'

6. Abandonment method and material used if abandoned: Heavy bentonitic mud 20' to 1800';
0'-20' cement surface plug. Per DWR regulation R-12-15-816

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 10-20-95 To: 11-28-95

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: 100'
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Williams 4/2/96
Owner/Lessee's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered _____ By _____

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007

APR - 8 1996

RECORDS MGT

PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. suite 119 Tucson AZ 85745
Street City State Zip
- Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
- Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
- Location: 2 12 5 SW 1/4 NW 1/4 NE 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552442 (REQUIRED)

DESCRIPTION OF WELL

- Type of Casing (if installed): 1730' of 4" casing. All removed.
- Abandonment method and material used if abandoned: Heavy ^(thick) bentonite mud from 2040' to 20'. 20' plug of cement at surface

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

- Date of period drilled: From: 1-19-96 To: 2-13-96

LOG OF WELL

☐

Unconsolidated Formation

☒

Consolidated Formation

Depth to water in feet below land surface: Not Determined
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkin
Owner/Lessee's Signature

4-2-96
Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered _____ By _____

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

EXPLORATION WELL(s)

15 South 15th Avenue

EXPLORATION WELL(s)

FILING FEE \$10.00

Phoenix, Arizona 85007

FILING FEE \$10.00

OCT - 3 1995

NOTICE OF INTENTION TO DRILL AND ABANDON EXPLORATION WELL(s)

Section §45-596, Arizona Revised Statutes, and Rule 12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

1. Township 2 12 5
Range Section

In the case of a single well, list
10-acre subdivision.

1/4 1/4 1/4
10 ACRE 40 ACRE 160 ACRE

2. County Pinal

3. Kennecott Exploration Co.
Applicant Name

1802 W. Grant Rd. Suite 119
Address

Tucson, AZ 85745
City State Zip

4. Joey Wilkins
Name of Contact Person

Phone 520-670-1311

5. Owner of Well:
same as above
Name

Address
City State Zip

6. Purpose of well(s) drilled pursuant to this Notice:

Mineral Exploration X
Geotechnical
Cathodic Protection
Grounding

7. Number of wells 2
(See Condition 4 on reverse side)

8. Owner of Land of wellsite:

USFS, Globe Ranger District
Name

Route 1, Box 33
Address

Globe, AZ 85501
City State Zip

9. DESCRIPTION OF THE WELL:

Diameter 5 inches

Depth 3000' feet

Type of casing. If none, state:

Some steel casing (5" OD),
but temporary. 1 1/2" PVC
for geophysical logging.

10. Construction will start

Oct. 16 95
Month Day Year

11. Drilling Firm:

Cristensen Boyles Corp.
Name

6527 W. Northview Ave.
Address

Glendale AZ 85301
City State Zip

28
DWR License Number

Exploration
ROC License Category

12. Period well will remain in use:
- 2 - months

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D(2-12)5

Filed 10-3-95 By ak

Input ----- By -----

ENTERED OCT 17 1995

DUPLICATE

Mailed 10-16-95 By ak

Registration 55- 552442

AMA/INA Dh X

W/S U8 S/B 06

13. Proposed method of abandonment of well(s) after project is completed: In accordance with DWR

Rule R-12-15-816

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials or a petroleum storage area and tanks? Yes No X

GENERAL INSTRUCTIONS

- Fill out this form in **DUPLICATE** and send **WITH \$10.00 FEE** to 15 South 15th Avenue, Phoenix, AZ 85007.
- For specific instructions, limitations and conditions, see the reverse side of this form.

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

9 10 11

[Signature]

ells shall be in accordance with A.A.C.

- THIRD OF JULY 1964

ARIZONA DEPARTMENT OF WATER RESOURCES

500 North Third Street, Phoenix, Arizona 85004

Telephone (602) 417-2470

Fax (602) 417-2422

October 13, 1995



FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. S119
TUCSON, AZ. 85745

Re: Registration No. 55-552442 THRU 55-552444

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

A handwritten signature in cursive script that reads "Ellen Kane".
Ellen Kane

Water Resource Technician
Groundwater Section

**ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION**

500 North Third Street
Phoenix, Arizona 85004-3903

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-552442

AUTHORIZED DRILLER: CHRISTENSEN BOYLES CORP.

LICENSE NO: 28

NOTICE OF INTENTION TO DRILL MINERAL EXPLORATION WELLS HAS BEEN FILED WITH THE DEPARTMENT BY:

CONSULTANT:

WELL OWNER: KENNECOTT EXPLORATION CO.

The well(s) is/are to be located in the:

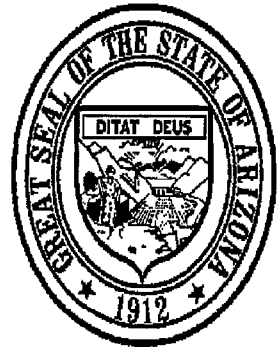
1/4 of the 1/4 of the 1/4 Section 5 Township 2S Range 12E

No. of wells in this project: 2

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 2ND DAY OF OCTOBER, 1996.

for _____ *KW*
CHIEF, GROUNDWATER MANAGEMENT SUPPORT

**THE DRILLER MUST FILE A LOG OF THE WELL
WITHIN 30 DAYS OF COMPLETION OF DRILLING**



RECEIPT

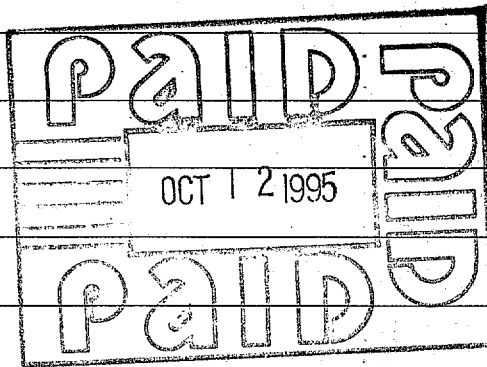
N2 23440

JOEY WILKINS
450 E. SHOOT
TUCSON, AZ. 85705

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004
(602) 417-2405

ENTRY CODE 55FILE NO. VARIOUS 552442 THRU 552444

ITEM DESCRIPTION	RATE	AMOUNT
NOI FEE	\$10.00	\$30.00
10/13/95/ek CK#30.00 #2643		\$30.00



CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL \$ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007

PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Name: USFS, Globe Ranger District
Address: Route 1, Box 33 Globe AZ 85501
Street City State Zip

2. Lessee or Operator Name: Kennecott Exploration Co.
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip

3. Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip

4. Location: 2 12 5 SE NE SW
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552442 (REQUIRED)

DESCRIPTION OF WELL

5. Type of Casing (if installed): 3 1/2" ^{Steel} Casing, abandoned in hole at 1190 to 1290
6. Abandonment method and material used if abandoned: Hole was filled with heavy bentonite and plugged with 20' of Cement at the surface.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 10-22-95 To: 11-28-95

LOG OF WELL

☐ Unconsolidated Formation

☐ Consolidated Formation
Depth to water in feet below land surface: Not
(if encountered or detected) Determined

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Doug Wilkins
Owner/Lessee's Signature

12-8-95
Date

**DO NOT WRITE IN THIS SPACE
OFFICE RECORD**

Registration No. _____

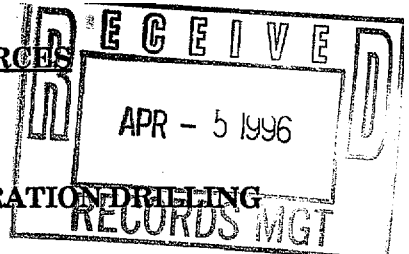
Received - - - - - By _____

Entered **ENTERED** By DEC 21 1995

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. suite 119 Tucson AZ 85745
Street City State Zip
- Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
- Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
- Location: 2 12 5 SW 1/4 NW 1/4 NE 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552442 (REQUIRED)

DESCRIPTION OF WELL

- Type of Casing (if installed): 1730' of 4" casing. All removed.
- Abandonment method and material used if abandoned: Heavy ^(thick) bentonitic mud from 2040' to 20'. 20' plug of cement at surface

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No _____

- Date of period drilled: From: 1-19-96 To: 2-13-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: Not Determined
(if encountered or detected)

ENTERED APR 5 1996

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered _____ By _____

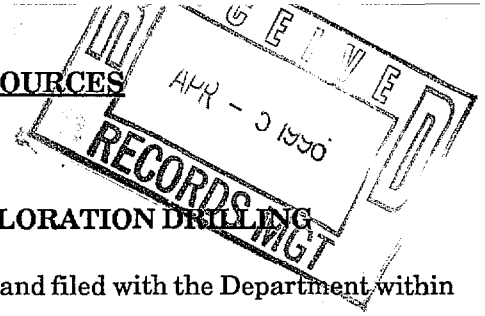
File No. _____

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkin 4-2-96
Owner/Lessee's Signature Date

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip

2. Lessee or Operator Name: Same as above
Address: _____
Street City State Zip

3. Driller Name: Cristensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip

4. Location: 2 12 5 NE 1/4 SE 1/4 SW 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552442 (REQUIRED)

DESCRIPTION OF WELL

5. Type of Casing (if installed): 1290' of 94mm casing. 1280' removed, 10' left @ 1280'
6. Abandonment method and material used if abandoned: (Thick) Heavy bentonitic mud 20' to 1800'
0'-20' cement surface plug. Per DWR regulation R-12-15-816

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ✓ No _____

7. Date of period drilled: From: 10-20-95 To: 11-28-95

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: 100'
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkins 4/2/96
Owner/Lessee's Signature Date

**DO NOT WRITE IN THIS SPACE
OFFICE RECORD**

Registration No. _____

Received _____ By _____

Entered _____ By _____

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

EXPLORATION WELL(s)

15 South 15th Avenue
Phoenix, Arizona 85007

EXPLORATION WELL(s)

FILING FEE \$10.00



FILING FEE \$10.00

NOTICE OF INTENTION TO DRILL AND ABANDON EXPLORATION WELL(s)

Section §45-596, Arizona Revised Statutes, and Rule 12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

2 W 12 E 5
1. Township | Range | Section

In the case of a single well, list
10-acre subdivision.

NE 1/4 SE 1/4 SW 1/4
10 ACRE 40 ACRE 160 ACRE

2. County Pinal

3. Kennecott Exploration Co.
Applicant Name

1802 W. Grant Rd. Suite 119
Address

Tucson AZ 85745
City State Zip

4. Joey Wilkins
Name of Contact Person

Phone 520 670 1311

5. Owner of Well:

Name

Same as above

Address

City State Zip

6. Purpose of well(s) drilled pursuant to this Notice:

Mineral Exploration X

Geotechnical _____

Cathodic Protection _____

Grounding _____

7. Number of wells 1
(See Condition 4 on reverse side)

8. Owner of Land of wellsite:

USFS, Globe Ranger District
Name

Route 1, Box 33
Address

Globe, AZ 85501
City State Zip

9. DESCRIPTION OF THE WELL:

Diameter 6 inches

Depth 3000 feet

Type of casing. If none, state:

Casing installed to 2000';
4 1/2" O.D. will be removed
upon hole completion, if
possible.

10. Construction will start

January 5 1996
Month Day Year

11. Drilling Firm:

Christensen Boyles Corp.
Name

6527 W. Northview Ave
Address

Glendale AZ 85301
City State Zip

28
DWR License Number

Exploration
ROC License Category

12. Period well will remain in use:
3 months

DO NOT WRITE IN THIS SPACE

OFFICE RECORD

File No. D(2-12) 5C DAFiled 12-27-95 By skInput ENTERED JAN 10 1996

DUPLICATE

Mailed 1-5-96 By skRegistration 55- 553490AMA/INA PHW/S 2.8 S/B 0.6

13. Proposed method of abandonment of well(s) after project is completed: In accordance with

DEC 27 1995

DWR Rule R-12-15-816

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials or a petroleum storage area and tanks? Yes _____ No X

GENERAL INSTRUCTIONS

- Fill out this form in **DUPLICATE** and send **WITH \$10.00 FEE** to 15 South 15th Avenue, Phoenix, AZ 85007.
- For specific instructions, limitations and conditions, see the reverse side of this form.

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Date

12-22-95

Signature of Applicant/Owner

Joey Wilkins

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with A.A.C. Rules R12-15-811 and Rules R12-15-816.
2. Drilling of well(s) shall be completed within one (1) year after the date of Notice.
3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these well(s), then the well(s) must be properly abandoned in accordance with Condition 1 above.
4. More than one well may be drilled under a single notice for mineral exploration and geotechnical wells so long as they are located within a single section.
5. A Project Completion Report and WELL ABANDONMENT COMPLETION REPORT must be filed for each mineral exploration hole within thirty (30) days of completion of drilling. A Well Driller Report for each hole drilled, must be filed by the driller within thirty (30) days of completion of drilling for geotechnical, cathodic protection and grounding.
6. The location of mineral exploration and geotechnical wells may be limited to the section, township and range. However, a complete legal description may be provided at the option of the well owner.
7. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.
8. Special construction standards required pursuant to R12-15-821: _____

9. To abandon a well in the course of drilling, the drilling contractor shall not remove the drilling rig from the well site, otherwise, a Notice of Intent to Abandon a Well must be filed prior to abandonment, and abandonment shall not commence until Department authority has been issued or, if during the course of drilling a well the Driller or owner elects to discontinue drilling and proceed with the abandonment of the well. The filing of a Well Abandonment Completion Report shall be filed within 30 days of abandonment, in accordance with R12-15-816.F.

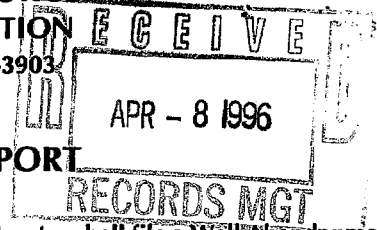
ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 NORTH THIRD STREET PHOENIX, ARIZONA 85004-3903

(602) 417-2470 FAX (602) 417-2422

WELL ABANDONMENT COMPLETION REPORT



A.R.S. §45-594; R12-15-816: Within 30 days after a well is abandoned, the well drilling contractor shall file a Well Abandonment Completion Report on a form prescribed and furnished by the Director.

1. Well Registration No. 55- 553490
2. Well Location: 2 N 12 E 5 NE 1/4 SE 1/4 SW 1/4
Township Range Section 10 Acre 40 Acre 160 Acre
3. Owner of the Well:
Name: KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. SUITE 119 TUCSON AZ 85745
Address City State Zip
4. Owner of the Land:
Name: SAME AS ABOVE
Address City State Zip
5. Well Description: 2798' 3.032 2000' OF 4" (Outer Casing) _____ (Inner Casing)
Hole Depth Diameter Type of Casing Diameter Type of Casing
6. Reason for abandonment: Completed Hole
7. Prior to abandonment, did the well have 20' of steel surface casing AND 20' of grout in the annular space surrounding the surface casing? Yes _____ No X
8. If the answer to No. 7 is no, was the top 20' of casing removed prior to setting the cement plug? Yes X No _____
9. Identify the materials and methods used to abandon the well: THICK BENTONITE MUD FROM 2798'
TO 20' / 20' TO SURFACE CEMENT PLUG.
10. Is this Abandonment Completion Report filed in accordance with R12-15-816,F.? Yes X No _____
11. How deep does the cement plug extend below land surface? 20'
12. Was the well backfilled above the cement plug? Yes _____ No _____
13. Date abandonment completed: 3-5-96
14. Drilling Firm:
Name: CHRISTENSEN BOYLES CORPORATION License No: 28
6527 W. NORTHVIEW AVE. GLENDALE AZ 85301
Address City State Zip

DATE: 4-2-96SIGNATURE OF WELL DRILLER [Signature]

DWR 55-58 (Rev 10/95)

CANCELLED

ENTERED APR 10 1996

ARIZONA DEPARTMENT OF WATER RESOURCES

500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422



FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

January 5, 1996

KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. S119
TUCSON, AZ. 85745

Re: Registration No. 55-553490

File No. D(2-12)5CDA

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Ellen Kane
Water Resource Technician
Groundwater Section

ARIZONA DEPARTMENT OF WATER RESOURCES

Hydrology Division

500 North Third Street, Phoenix, Arizona 85004

Telephone (602) 417-2448

Fax (602) 417-2425

January 2, 1996



FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Kennecott Exploration Company
1802 West Grant Road, Suite 119
Tucson, Arizona 85745

Attn: Joey Wilkins

RE: Drilling Mineral Exploration in T2S, R12E, Section 5

Dear Mr. Wilkins:

Your Notice of Intention to Drill and Abandon Mineral Exploration Well(s) is conditionally approved, because you plan to re-enter for future investigations.

Per R12-15-817.B.1

"If an exploration well which is to be left open for re-entry at a later date encounters groundwater, it shall be cased and capped in accordance with R12-15-811, R12-15-812, and R12-15-822. The minimal length of surface seal shall be either 20 feet, or five feet into the first encountered consolidated formation, whichever is less. If no groundwater is encountered, the well shall be cased, grouted and capped in such a manner so as to prevent contamination of the well bore from the surface."

Mineral exploration borehole(s) should not be used for purposes other than exploration. In the future, any variance request for conversion of mineral exploration borehole(s) to other purposes will not be approved.

If you have any questions, please contact Sharon Masek of my staff at (602) 417-2400 ext. # 7185.

Sincerely,

Greg Wallace
Chief Hydrologist

RECEIPT

Nº 25243

JOEY WILKINS
1802 W. GRANT RD. #119
TUCSON, AZ. 85745

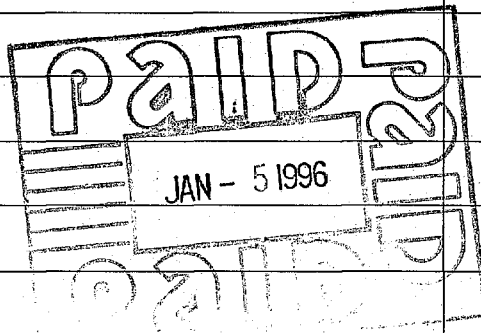
STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004
(602) 417-2405

ENTRY CODE 55

FILE NO. D(2-12)Scda 553490

THRU

ITEM DESCRIPTION	RATE	AMOUNT
NOI FEE		\$10.00
1/5/95/ek CK#1001		\$10.00



CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL \$ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 - Rev. 4/91

**ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004-3903**

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-53490

AUTHORIZED DRILLER: CHRISTENSEN BOYLES CORP.

LICENSE NO: 28

NOTICE OF INTENTION TO DRILL A MINERAL EXPLORATION WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: KENNECOTT EXPLORATION CO.

The well(s) is/are to be located in the:

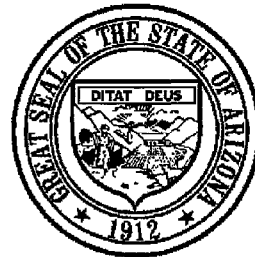
NE 1/4 of the SE 1/4 of the SW 1/4 Section 5 Township 2S Range 12E

No. of Wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 26TH DAY OF DECEMBER, 1996.


CHIEF, GROUNDWATER MANAGEMENT SUPPORT

**THE DRILLER MUST FILE A LOG OF THE WELL
WITHIN 30 DAYS OF COMPLETION OF DRILLING**



500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004

APR - 5 1996

SOURCES

APR - 5 1996

EXPLORATION DRILLING
RECORDS MGT

1. Owner Name: Kennecott Exploration Co.
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip

2. Lessee or Operator Name: Same as above

Address: _____

Street	City	State	Zip
--------	------	-------	-----

3. Driller Name: Christensen Royler Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip

4. Location: 2 ~~ES~~ 12 ~~EW~~ 5 NE 1/4 SE 1/4 SW 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 553490 (REQUIRED)

5. Type of Casing (if installed): 2000' of 4" steel. Remove upon hole completion

6. Abandonment method and material used if abandoned: ^(Thick) Heavy bentonitic mud from 2798' to 20', 20' cement plug at surface.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 1-8-96 To: 3-5-96

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: 80'
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Owner/Lessee's Signature 4-2-96
Date

DWR-55-57-7/91(Rev)

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

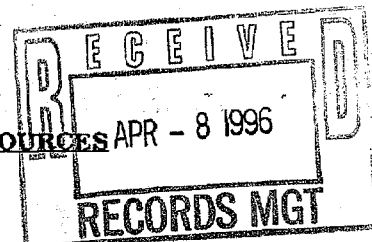
Registration No. _____

Received _____ By _____

Entered By

File No. **ENTERED APR 5 1996**

ARIZONA DEPARTMENT OF WATER RESOURCES

500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004

PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Co.
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip
 - Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
 - Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
 - Location: 2 12 5 NE 1/4 SE 1/4 SW 1/4
Township Range Section 10-Acre 40-Acre 160-Acre
- WELL REGISTRATION NO. 55- 553490 (REQUIRED)

DESCRIPTION OF WELL

- Type of Casing (if installed): 2000' of 4" steel. Remove upon hole completion.
- Abandonment method and material used if abandoned: Heavy ^(thick) bentonitic mud from 2798' to 20', 20' cement plug at surface.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 1-8-96 To: 3-5-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: 80'
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

[Signature] 4-2-96
Owner/Lessee's Signature Date

DWR-55-57-7/91 (Rev)

#

16029395818;

15206709775 =>

4-3-96 9:11;

SENT BY: KENNECOT EXP TUCSON;

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered _____ By _____

File No. **ENTERED APR 10 1996**

FILING FEE \$10.00

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with A.A.C. Rules R12-15-811 and Rules R12-15-816.
2. Drilling of well(s) shall be completed within one (1) year after the date of Notice.
3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these well(s), then the well(s) must be properly abandoned in accordance with Condition 1 above.
4. More than one well may be drilled under a single notice for mineral exploration and geotechnical wells so long as they are located within a single section.
5. A Project Completion Report and WELL ABANDONMENT COMPLETION REPORT must be filed for each mineral exploration hole within thirty (30) days of completion of drilling. A Well Driller Report for each hole drilled, must be filed by the driller within thirty (30) days of completion of drilling for geotechnical, cathodic protection and grounding.
6. The location of mineral exploration and geotechnical wells may be limited to the section, township and range. However, a complete legal description may be provided at the option of the well owner.
7. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.
8. Special construction standards required pursuant to R12-15-821: _____

9. To abandon a well in the course of drilling, the drilling contractor shall not remove the drilling rig from the well site, otherwise, a Notice of Intent to Abandon a Well must be filed prior to abandonment, and abandonment shall not commence until Department authority has been issued or, if during the course of drilling a well the Driller or owner elects to discontinue drilling and proceed with the abandonment of the well. The filing of a Well Abandonment Completion Report shall be filed within 30 days of abandonment, in accordance with R12-15-816.F.

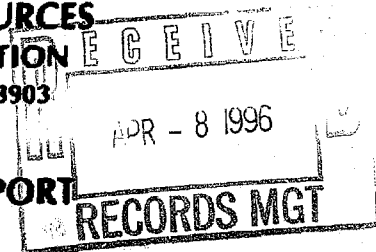
ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 NORTH THIRD STREET PHOENIX, ARIZONA 85004-3903

(602) 417-2470 FAX (602) 417-2422

WELL ABANDONMENT COMPLETION REPORT



A.R.S. §45-594; R12-15-816: Within 30 days after a well is abandoned, the well drilling contractor shall file a Well Abandonment Completion Report on a form prescribed and furnished by the Director.

- Well Registration No. 55- 552444
- Well Location: 2 Township N5 Range 12 EW Section 6 NE 10 Acre NE 40 Acre SE 160 Acre
- Owner of the Well:
Name: KENNECOTT EXPLORATION CO.
1802 W. GRANT RD STE 119 TUCSON AZ 85745
Address City State Zip
- Owner of the Land:
Name: SAME AS ABOVE
Address City State Zip
- Well Description: 2573' Hole Depth 3.032 Diameter 200' OF 4" Type of Casing (Outer Casing) Diameter (Inner Casing) Type of Casing
- Reason for abandonment: HOLE COMPLETED
- Prior to abandonment, did the well have 20' of steel surface casing AND 20' of grout in the annular space surrounding the surface casing? Yes No X
- If the answer to No. 6 is no, was the top 20' of casing removed prior to setting the cement plug? Yes X No
- Identify the materials and methods used to abandon the well: HEAVY THICK BENTONITE FROM 2573' TO 20', CEMENT PLUGS FROM 20' TO SURFACE
- Is this Abandonment Completion Report filed in accordance with R12-15-816,F.? Yes X No
- How deep does the cement plug extend below land surface? 20'
- Was the well backfilled above the cement plug? Yes No
- Date abandonment completed: 3-16-96
- Drilling Firm:
Name: CHRISTENSEN BOYLES CORP. License No: 28
6527 W. NORTHVIEW AVE GLENDALE AZ 85301
Address City State Zip

DATE: 4-2-96 SIGNATURE OF WELL DRILLER [Signature]

DWR 55-58 (Rev 10/95)

CANCELLED

ENTERED APR 10 1996

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007

APR - 8 1996

RECORDS MGT

PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Name: Kennecott Exploration Company
 Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
 Street City State Zip
2. Lessee or Operator Name: Same as above
 Address: _____
 Street City State Zip
3. Driller Name: Christensen Boyles Corp.
 Address: 6527 W. Northview Ave. Glendale AZ 85301
 Street City State Zip
4. Location: 2 12 6 NE 1/4 NE 1/4 SE 1/4
 Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552444 (REQUIRED)

DESCRIPTION OF WELL

5. Type of Casing (if installed): 200' of 4" steel; Abandoned 120' @ 80' to 200'.
6. Abandonment method and material used if abandoned: Heavy ^(thick) bentonitic mud pumped into hole from 2573' to 20'. 20' cement plug at surface

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 12-2-95 To: 1-25-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
 Depth to water in feet below land surface: 80'
 (if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkins
 Owner/Lessee's Signature

4-2-96
 Date

DWR-55-57-7/91 (Rev)

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered _____ By _____

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422



FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

October 13, 1995

KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. S119
TUCSON, AZ. 85745

Re: Registration No. 55-552442 THRU 55-552444

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,


Ellen Kane

Water Resource Technician
Groundwater Section

RECEIPT No 23440

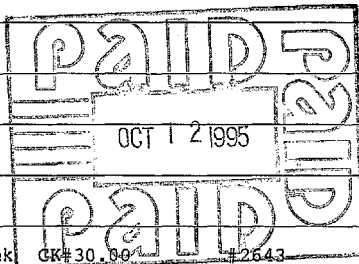
JOEY WILKINS
450 E. SMOOT
TUCSON, AZ. 85705

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004
(602) 417-2405

ENTRY CODE 55

FILE NO. VARIOUS 552442 THRU 552444

ITEM DESCRIPTION	RATE	AMOUNT
NOI FEE	\$10.00	\$30.00
10/13/95/ek	GR#30.00	\$30.00



CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL \$ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 - Rev. 4/91

**ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004-3903**

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-552444

AUTHORIZED DRILLER: CHRISTENSEN BOYLES CORP.

LICENSE NO: 28

**NOTICE OF INTENTION TO DRILL MINERAL EXPLORATION WELLS HAS BEEN FILED WITH THE DEPARTMENT BY:
CONSULTANT:**

WELL OWNER: KENNECOTT EXPLORATION

The well(s) is/are to be located in the:

NE 1/4 of the NE 1/4 of the SE 1/4 Section 6 Township 2S Range 12E

No. of wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 2ND DAY OF OCTOBER, 1996.

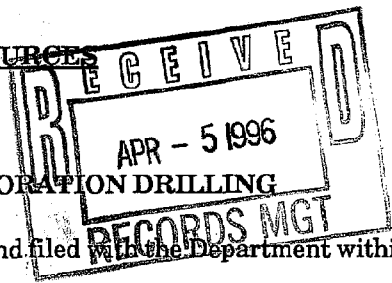
 **CHIEF, GROUNDWATER MANAGEMENT SUPPORT** *Ka*

**THE DRILLER MUST FILE A LOG OF THE WELL
WITHIN 30 DAYS OF COMPLETION OF DRILLING**



ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip
- Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
- Driller Name: Christensen Boyler Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
- Location: 2 12 6 NE 1/4 NE 1/4 SE 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552444 (REQUIRED)

DESCRIPTION OF WELL

- Type of Casing (if installed): 200' of 4" steel; Abandoned 120' @ 80' to 200'.
- Abandonment method and material used if abandoned: Heavy ^(thick) bentonitic mud pumped into hole from 2573' to 20'. 20' cement plug at surface

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ✓ No _____

- Date of period drilled: From: 12-2-95 To: 1-25-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: 80'
(if encountered or detected)

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkins 4-2-96
Owner/Lessee's Signature Date

DWR-55-57-7/91(Rev)

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received _____ By _____

Entered ENTERED By APR 5 1996

File No. _____

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007

PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Name: Kennecott Exploration Company
Address: 1515 Mineral Square Salt Lake City, UT 84112
Street City State Zip
2. Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
3. Driller Name: Christensen Boyles Corp.
Address: 6527 West Northview Ave Glendale AZ 85301
Street City State Zip
4. Location: 2 12 8 1/4 1/4 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55-546429 (REQUIRED)

DESCRIPTION OF WELL (see also, addendum)

5. Type of Casing (if installed): 3 1/2" steel to 870' in hole #1, 3 1/2" steel to 1033' in hole #2, both removed.
6. Abandonment method and material used if abandoned: Hole #1 was grouted with cement from 1975' to surface. Hole #2 was grouted from around 1700' to the surface with cement. About 1600' of 2 1/8" drilling steel was lost in the bottom of the hole @ 3243'.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

7. Date of period drilled: From: 1-4-95 To: 3-28-95

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: _____
(if encountered or detected) @ 65' in hole #1, minor water. Hole #1 became artesian at 1260' at 2-3 gal/min.
@ 220' in hole #2, minor water.

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wilkins 4-21-95
Owner/Lessee's Signature Date
agent for Kennecott Exploration

DO NOT WRITE IN THIS SPACE OFFICE RECORD	
Registration No.	<u>55-546429</u>
Received _____	By _____
Entered _____	By _____
File No.	ENTERED MAY 3 1995

NOTICE OF INTENTION TO DRILL AND ABANDON EXPLORATION WELL(s)

Section 45-596, Arizona Revised Statutes, and Rule 12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

1. Township 2 N Range 12 E Section 8
In the case of a single well, list 10-acre subdivision.
1/4 1/4 1/4
10 ACRE 40 ACRE 160 ACRE

6. Purpose of well(s) drilled pursuant to this Notice:

Mineral Exploration X
Geotechnical _____
Cathodic Protection _____
Grounding _____

9. DESCRIPTION OF THE WELL:

Diameter 8" inches
Depth 1500' feet
Type of casing. If none, state:

none

2. County PINAL

8. Owner of Land of wellsite:

U.S. Tonto N. Forest
Name

10. Construction will start

December 26 1994
Month Day Year

3. Kennecott Exploration
Applicant Name

1515 MINERAL SQ
Address

Address

SALT LAKE CITY, UT 84112
City State Zip

Globe AZ
City State Zip

11. Drilling Firm:

Christensen Boyles Corp.
Name

6527 West Northview Ave.
Address

Glendale AZ 85301
City State Zip

4. Linus Keating
Name of Contact Person

Phone 801-322-8345

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D12-1278

Filed 12-20-94 By AK

Input ENTERED 28 1994

DUPLICATE

Mailed 12-23-94 By AK

Registration 55-546429

AMA/INA PA

W/S 28 S/B 06

28
DWR License Number

Exploration
ROC License Category

5. Owner of Well:
Same as above
Name

Address

City State Zip

12. Period well will remain in use:
-1- months

13. Proposed method of abandonment of well(s) after project is completed: in accordance with DWR Rule R-12-15-816.

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials or a petroleum storage area and tanks? Yes _____ No X

GENERAL INSTRUCTIONS

- Fill out this form in **DUPLICATE** and send **WITH \$10.00 FEE** to 15 South 15th Avenue, Phoenix, AZ 85007.
- For specific instructions, limitations and conditions, see the reverse side of this form.

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

12-15-94
Date

Harry Wilkins
Signature of Applicant/Owner
Agent for Kennecott

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with A.A.C. Rules R12-15-811 and Rules R12-15-816.
2. Drilling of well(s) shall be completed within one (1) year after the date of Notice.
3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these well(s), then the well(s) must be properly abandoned in accordance with Condition 1 above.
4. More than one well may be drilled under a single notice for mineral exploration and geotechnical wells so long as they are located within a single section.
5. A Project Completion Report and WELL ABANDONMENT COMPLETION REPORT must be filed for each mineral exploration hole within thirty (30) days of completion of drilling. A Well Driller Report for each hole drilled, must be filed by the driller within thirty (30) days of completion of drilling for geotechnical, cathodic protection and grounding.
6. The location of mineral exploration and geotechnical wells may be limited to the section, township and range. However, a complete legal description may be provided at the option of the well owner.
7. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.
8. Special construction standards required pursuant to R12-15-821: _____

9. To abandon a well in the course of drilling, the drilling contractor shall not remove the drilling rig from the well site, otherwise, a Notice of Intent to Abandon a Well must be filed prior to abandonment, and abandonment shall not commence until Department authority has been issued or, if during the course of drilling a well the Driller or owner elects to discontinue drilling and proceed with the abandonment of the well. The filing of a Well Abandonment Completion Report shall be filed within 30 days of abandonment, in accordance with R12-15-816.F.

ARIZONA DEPARTMENT OF WATER RESOURCES

500 N 3RD. ST., PHOENIX, AZ. 85004

Telephone (602) 417-2470

Fax (602) 417-2401

December 22, 1994



FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

KENNECOTT CORP.
1515 MINERAL SQ.
SALT LAKE CITY, UT. 84112

Re: Registration No. 55-546429

File No. D(2-12)8

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location.

For you future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate. For additional information you may contact Operations Division at (602)542-1581.

Sincerely,

A handwritten signature in cursive script that reads "Ellen C. Kane".

Ellen C. Kane
Groundwater Permit Specialist

RECEIPT

15730

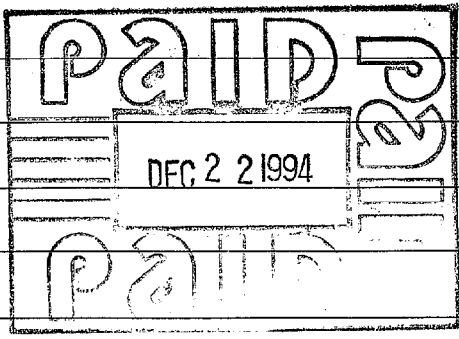
J. WILKINS
450 P. SMOOT
TUCSON, AZ. 85705

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
15 SOUTH 15TH AVENUE
PHOENIX, ARIZONA 85007
(602) 542-1581

ENTRY CODE ⁵⁵_____

FILE NO. D-2-1210 546420

THRU

ITEM DESCRIPTION	RATE	AMOUNT
FILING FEE FOR NOI TO DRILL WELLS		\$10.00
		
12/22/94/ek CR#2335		\$10.00

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL \$ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

**ARIZONA DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION**

500 North Third Street
Phoenix, Arizona 85004-3903
Phone (602) 417-2470

DUPLICATE

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO. 55-546429

AUTHORIZED DRILLER: BOYLES BROS. DRILLING CO.

LICENSE NO. 28

NOTICE OF INTENTION TO DRILL A MINERAL EXPLORATION WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

Owner of Well(s)

KENNECOTT EXPLORATION

1515 MINERAL SQ.

SALT LAKE CITY UT 84112

The well(s) is/are to be located in:

1/4 1/4 1/4
10 acre 40 acre 160 acre

Section 8

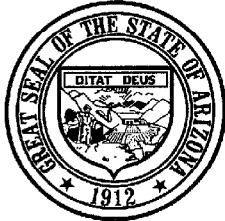
Township 2.0 NORTH

Range 12.0 EAST

NUMBER OF WELLS IN PROJECT: 2

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON DEC 19TH, 1995

THE DRILLER SHALL FILE A LOG OF THE WELL WITHIN 30 DAYS OF
COMPLETION OF DRILLING.





CHIEF, OPERATIONS DIVISION

Addendum

4-21-95

Well registration NO. 55-546429

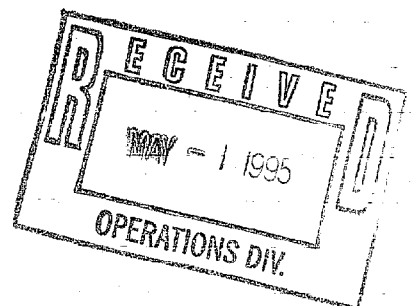
Drill hole #1 contains two holes in one. The first hole was drilled to 1545' but was blocked-off at 870' by a mass of 14 gauge plastic coated wire. The wire was placed into the drill hole during a down hole IP geophysical survey. In addition to the loss of nearly 3500' of this type of wire, four electrodes were also lost. These electrodes were fabricated from 3' x 1" PVC pipe wrapped in a lead blanket and filled with lead shot. This first hole was abandoned at 870'. A wedge was placed at 848' and a new hole began from that point to a final depth of 1975'. The artesian flow was completely sealed-off.

Drill hole #2 was lost at 3243', but only 1700' of BX pipe (2 1/8" steel) was recovered after several attempts.

~~That~~ The hole was abandoned with cement grout starting at the top of the pipe that was not recovered to the surface. The void from the top of the abandoned pipe to the hole's final depth of 3243' may have, in part, been partially grouted as the material was forced down the hole from 1700'.

Joey Wilkins
Joey Wilkins
Kennecott Exploration

If there are any questions, please call me at
602 690 0289 in Tucson, AZ



ARIZONA DEPARTMENT OF WATER RESOURCES

EXPLORATION WELL(s)

15 South 15th Avenue
Phoenix, Arizona 85007

EXPLORATION WELL(s)

FILING FEE \$10.00



OCT - 3 1995 FILING FEE \$10.00

NOTICE OF INTENTION TO DRILL AND ABANDON EXPLORATION WELL(s)

Section §45-596, Arizona Revised Statutes, and Rule 12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

2 W 12 E 9
1. Township | Range | Section

In the case of a single well, list
10-acre subdivision.

NW 1/4 NW 1/4 NW 1/4
10 ACRE 40 ACRE 160 ACRE

2. County Pinal

3. Kennecott Exploration Co.
Applicant Name

1802 W. Grant Rd. Suite 119
Address

Tucson AZ 85745
City State Zip

4. Joey Wilkins
Name of Contact Person

Phone 520-670-1311

5. Owner of Well:
Same as above
Name

Address
City State Zip

6. Purpose of well(s) drilled pursuant to this Notice:

Mineral Exploration X
Geotechnical _____
Cathodic Protection _____
Grounding _____

7. Number of wells 1
(See Condition 4 on reverse side)

8. Owner of Land of wellsite:

USFS, Globe Ranger District
Name

Route 1 Box 33
Address

Globe AZ 85501
City State Zip

9. DESCRIPTION OF THE WELL:

Diameter 5 inches
Depth 3500' feet
Type of casing. If none, state:
Steel Casing (5" OD) if necessary,
but temporary. 1 1/2" PVC
for geophysical logging.

10. Construction will start

Oct. 16 95
Month Day Year

11. Drilling Firm:

Cristensen Boyles Corp.
Name

6527 W. Northview Ave.
Address

Glendale AZ 85301
City State Zip

28
DWR License Number

Exploration
ROC License Category

12. Period well will remain in use:

- 2 - months

13. Proposed method of abandonment of well(s) after project is completed: In accordance with DWR
Rule R-12-15-816

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials or a petroleum storage area and tanks? Yes _____ No X

GENERAL INSTRUCTIONS

- Fill out this form in **DUPLICATE** and send **WITH \$10.00 FEE** to 15 South 15th Avenue, Phoenix, AZ 85007.
- For specific instructions, limitations and conditions, see the reverse side of this form.

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Date

9-29-95

Signature of Applicant/Owner

Joey Wilkins
agent for Kennecott

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with A.A.C. Rules R12-15-811 and Rules R12-15-816.
2. Drilling of well(s) shall be completed within one (1) year after the date of Notice.
3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these well(s), then the well(s) must be properly abandoned in accordance with Condition 1 above.
4. More than one well may be drilled under a single notice for mineral exploration and geotechnical wells so long as they are located within a single section.
5. A Project Completion Report and WELL ABANDONMENT COMPLETION REPORT must be filed for each mineral exploration hole within thirty (30) days of completion of drilling. A Well Driller Report for each hole drilled, must be filed by the driller within thirty (30) days of completion of drilling for geotechnical, cathodic protection and grounding.
6. The location of mineral exploration and geotechnical wells may be limited to the section, township and range. However, a complete legal description may be provided at the option of the well owner.
7. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.
8. Special construction standards required pursuant to R12-15-821: _____

9. To abandon a well in the course of drilling, the drilling contractor shall not remove the drilling rig from the well site, otherwise, a Notice of Intent to Abandon a Well must be filed prior to abandonment, and abandonment shall not commence until Department authority has been issued or, if during the course of drilling a well the Driller or owner elects to discontinue drilling and proceed with the abandonment of the well. The filing of a Well Abandonment Completion Report shall be filed within 30 days of abandonment, in accordance with R12-15-816.F.

APR - 8 1996

RECORDS MGT

WELL ABANDONMENT COMPLETION REPORT

A.R.S. §45-594; R12-15-816: Within 30 days after a well is abandoned, the well drilling contractor shall file a Well Abandonment Completion Report on a form prescribed and furnished by the Director.

- Well Registration No. 55- 552443
- Well Location: 2 N15 12 EW 9 NW 10 NW 160
Township Range Section 10 Acre 40 Acre 160 Acre
- Owner of the Well:
Name: KENNECOTT EXPLORATION CO.
1802 W. GRANT RD - STE 119 TUCSON AZ 85745
Address City State Zip
- Owner of the Land:
Name: SAME AS ABOVE
Address City State Zip
- Well Description: 3800' 3.032 2274' OF 94MM (Outer Casing) (Inner Casing)
Hole Depth Diameter Type of Casing Diameter Type of Casing
- Reason for abandonment: Hole completed
- Prior to abandonment, did the well have 20' of steel surface casing AND 20' of grout in the annular space surrounding the surface casing? Yes No X
- If the answer to No. 6 is no, was the top 20' of casing removed prior to setting the cement plug? Yes X No
- Identify the materials and methods used to abandon the well: CEMENTED Hole from 3800' to 2150'
HEAVY THICK BENTONITE from 2150' to 1000', CEMENT from 1000' to SURFACE
- Is this Abandonment Completion Report filed in accordance with R12-15-816, F.? Yes X No
- How deep does the cement plug extend below land surface? 1000'
- Was the well backfilled above the cement plug? Yes No
- Date abandonment completed: 3-14-96
- Drilling Firm:
Name: CHRISTENSEN Boyles CORP. License No: 28
6527 W. NORTHVIEW GLENDALE AZ 85301
Address City State Zip

DATE: 4-2-96

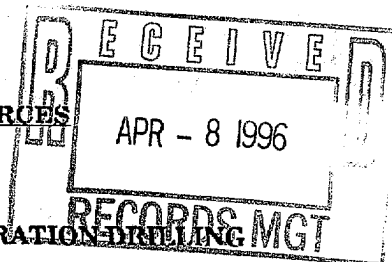
SIGNATURE OF WELL DRILLER

CANCELLED

ENTERED APR 10 1996

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



PROJECT COMPLETION REPORT FOR MINERAL EXPLORATION DRILLING

This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip
- Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
- Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
- Location: 2 12 9 NW 1/4 NW 1/4 NW 1/4
Township Range Section 10-Acre 40-Acre 160-Acre

WELL REGISTRATION NO. 55- 552443 (REQUIRED)

DESCRIPTION OF WELL

- Type of Casing (if installed): 2274' of 94mm casing, abandoned 120' @ 2154'-2274'
- Abandonment method and material used if abandoned: Cemented hole from 3800' to 2150',
(thick) heavy bentonitic mud from 2150' to 1000', cement from 1000' to surface.
All artesian flow was completely abated by cement column.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No _____

- Date of period drilled: From: 11-8-95 To: 3-1-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: Artesian flow
(if encountered or detected) Source at 2800' below
surface.

I state that this report is filed in compliance with A.R.S.
§45-600 and is complete and correct to the best of my
knowledge and belief.

Jay Wilkins 4-2-96
Owner/Vessel's Signature Date

DWR-55-57-7(9)(Rev)

DO NOT WRITE IN THIS SPACE OFFICE RECORD	
Registration No. _____	
Received _____	By _____
Entered _____	By _____
File No. _____	

ARIZONA DEPARTMENT OF WATER RESOURCES

500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422



PIFF SYMINGTON
Governor

RITA P. PEARSON
Director

October 13, 1995

KENNECOTT EXPLORATION CO.
1802 W. GRANT RD. S119
TUCSON, AZ. 85745

Re: Registration No. 55-552442 THRU 55-552444

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

A handwritten signature in cursive script, appearing to read "Ellen Kane".
Ellen Kane

Water Resource Technician
Groundwater Section

RECEIPT

No 23440

JOEY WILKINS
450 E. SMOOT
TUCSON, AZ. 85705

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004
(602) 417-2405

ENTRY CODE 55

FILE NO. VARIOUS 552442 THRU 552444

ITEM DESCRIPTION	RATE	AMOUNT
NOI FEE	\$10.00	\$30.00
10/13/95/ekl GK#30.00 #2643		\$30.00

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL \$ _____

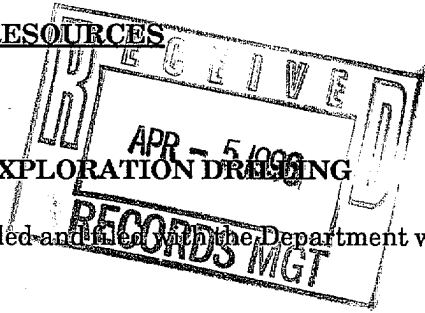
CHIT NO. _____ RECEIVED BY _____ DATE _____

**500 North Third Street
Phoenix, Arizona 85004-3903**

**THE DRILLER MUST FILE A LOG OF THE WELL
WITHIN 30 DAYS OF COMPLETION OF DRILLING**

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue
Phoenix, Arizona 85007



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This report must be prepared by the owner in all detail for each hole drilled and filed with the Department within 30 days following completion of the well drilling project.

- Owner Name: Kennecott Exploration Company
Address: 1802 W. Grant Rd. Suite 119 Tucson AZ 85745
Street City State Zip
- Lessee or Operator Name: Same as above
Address: _____
Street City State Zip
- Driller Name: Christensen Boyles Corp.
Address: 6527 W. Northview Ave. Glendale AZ 85301
Street City State Zip
- Location: 2 12 9 NW 1/4 NW 1/4 NW 1/4
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(thick) heavy bentonitic mud from 2150' to 1000', cement from 1000' to surface.
All artesian flow was completely abated by cement column.

Was well abandoned in the course of drilling pursuant to R12-15-816, F.? Yes ☒ No ☐

- Date of period drilled: From: 11-8-95 To: 3-1-96

LOG OF WELL

☐ Unconsolidated Formation

☒ Consolidated Formation
Depth to water in feet below land surface: Artesian flow
(if encountered or detected) source at 2800' below
surface.

I state that this report is filed in compliance with A.R.S. §45-600 and is complete and correct to the best of my knowledge and belief.

Jay Wickens 4-2-96
Owner/Lessee's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. _____

Received By _____

ENTERED APR 5 1996
Entered By _____

File No. _____