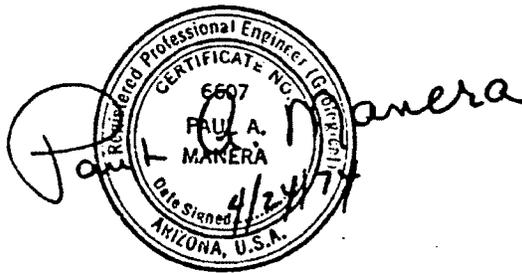


REVIEW OF THE  
GEOLOGY AND HYDROLOGY  
OF LITTLE SYCAMORE CREEK  
YAVAPAI COUNTY, ARIZONA

for  
Cyprus Bagdad Copper Company

by  
Paul A. Manera, P.E.



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## INTRODUCTION

### Location

The two contiguous ten acre plots under study are the SW $\frac{1}{4}$  SE $\frac{1}{4}$  SW $\frac{1}{4}$  and the SE $\frac{1}{4}$  SW $\frac{1}{4}$  SW $\frac{1}{4}$  Section 29, T. 14 $\frac{1}{2}$  N., R. 8 W., G & SR B & M, as shown in Figure 1. The study area is in the Little Sycamore Creek drainage shown on the U.S.G.S. Bagdad Quadrangle map (15-minute series).

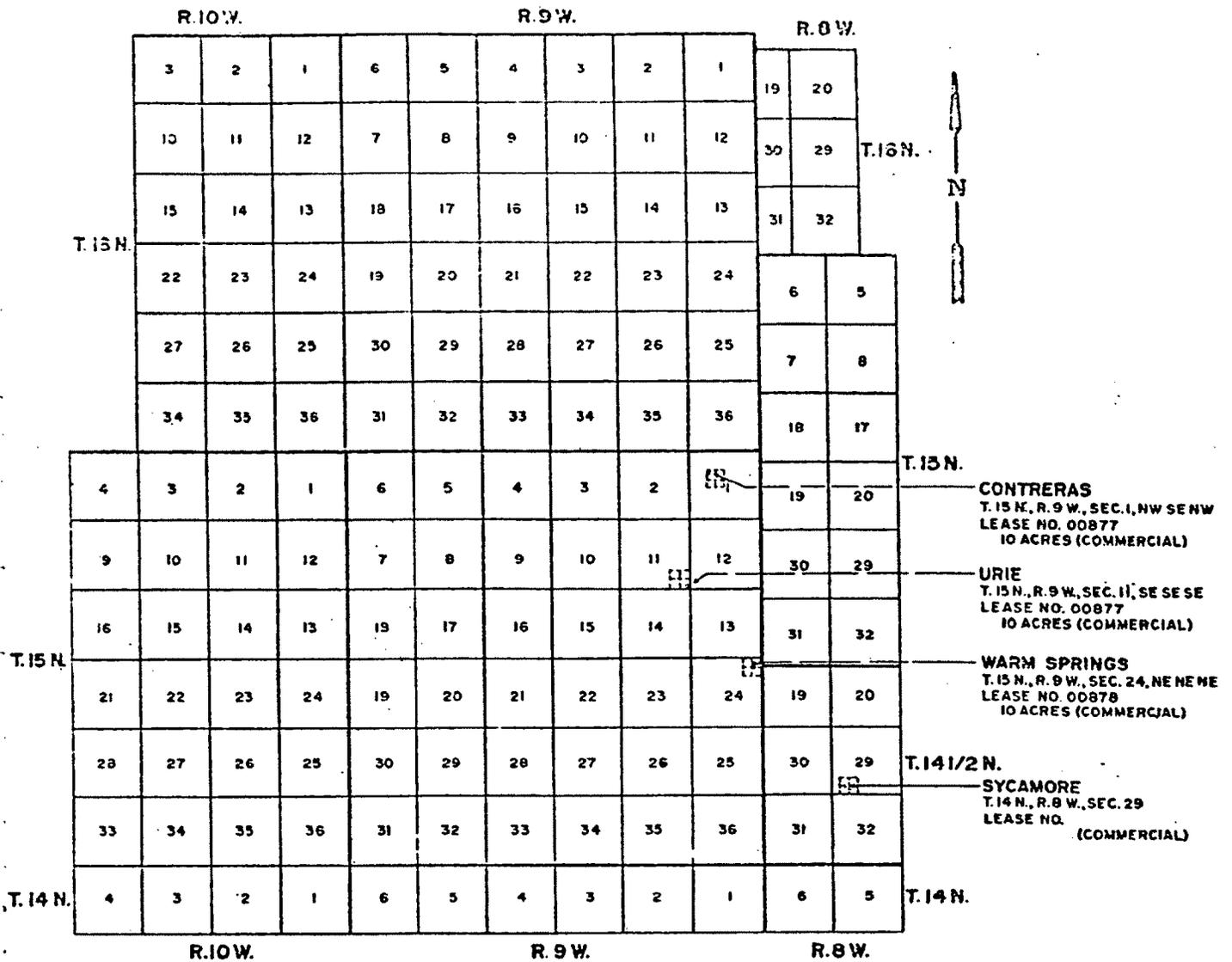
### Purpose and Scope

The purpose of this report is to outline the geologic and hydrologic characteristics of the two wells which have been drilled in this area and the immediate adjacent area. The scope of the report is to review the data collected by Samuel F. Turner and/or Manera and to synthesize it into one format.

### Previous Work

Prior to and/or during 1959 Turner made a study of the springs and seeps in the Bagdad area. As a portion of this study Turner made an analysis of the aerial photographs (Army Map Service photographs, scale 1 mile to the inch) to determine the geologic structure with particular emphasis on the faulting in the area. This analysis was followed by field study and electrical resistivity geophysics. On the basis of this data Sycamore Well 1 was drilled.

Subsequently, Manera conducted a field investigation and an electrical resistivity survey to locate an additional well site. Sycamore Well 2 was then drilled as a follow up to this work.



CYPRUS - BAGDAD COPPER COMPANY  
WATER WELL SITES

FIGURE 1

## GEOLOGY AND HYDROLOGY

### Seeps

Originally, attention was drawn to Little Sycamore Creek by the presence of phreatophytes and two small seeps shown as springs on the Bagdad Quadrangle. At that point in time (prior to 1959) the two seeps combined issued less than one (1) gallon per minute but it was a year-around supply for animals.

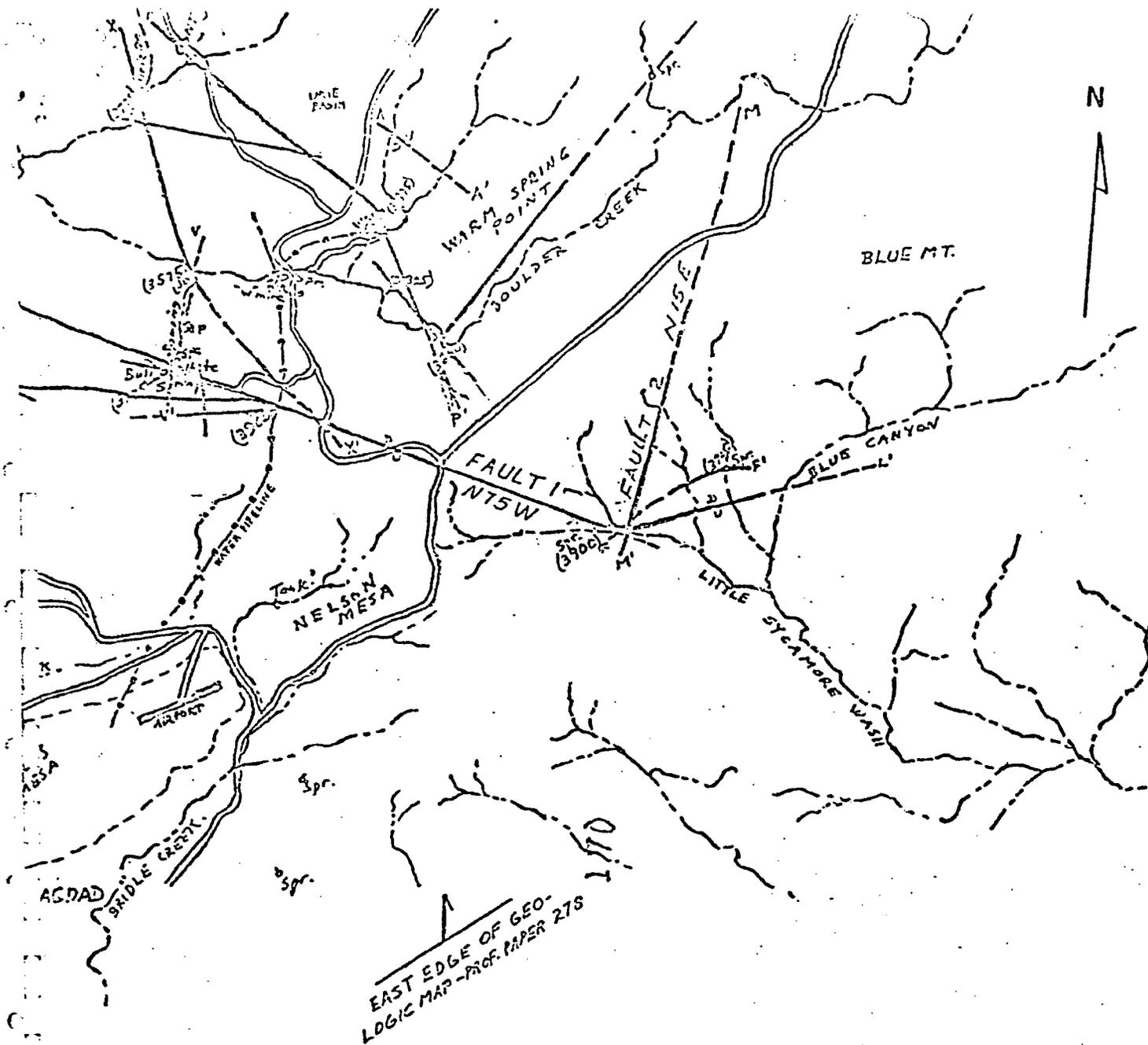
### Geologic Structure

The analysis of the aerial photographs indicated one major fault, one secondary fault and one or more minor faults intersecting in or near Little Sycamore Wash in Section 29, T. 14½ N., R. 8 W. The faulting, as determined from the aerial photographs, is shown on Figure 2. The upper Sycamore seep is located in a fine grained intrusive rock. The strike of the shear zone is N 72° W with a dip of 86° to the north. This correlates with the fault direction of N 75° W established by Turner in his earlier studies. The lower Sycamore seep is located in the shear zone of the secondary fault (Fault 2 on Figure 2). The strike of the shear zone was measured at N 20° E with vertical shearing compared to Turner's projection of N 15° E. The intersection of the two faults is slightly south of the present stream bed.

### Electrical Resistivity Geophysics

An electrical resistivity survey was run along the wash bottom to determine the width of the shear zones, the subsurface location of the shear zones and the location of the intersection of the two faults.

The geophysical data indicated the shear zones and the areas between the shear zones. The areas between the shear zones have a thin veneer of alluvial fill over a relatively solid bedrock complex.



CYPRUS BAGDAD COPPER CO.  
 SKETCH MAP FROM AERIAL  
 PHOTOGRAPHS SHOWING THE  
 FAULT INTERSECTION AT  
 SYCAMORE CREEK

DATA FROM TURNER & ASSOCIATES  
 SCALE 1/60,000 (APPROXIMATE)

FIGURE 2

### Hydrologic Characteristics

The two wells were drilled in the shear zones of the faults. The fault shear zones in the Bagdad area are water-bearing conduits. This has been shown in several areas.

Sycamore Well 1 was constructed in the SE $\frac{1}{4}$  SW $\frac{1}{4}$  SW $\frac{1}{4}$  Section 29, T. 14 $\frac{1}{2}$  N., R. 8 W.

|                           |  |
|---------------------------|--|
| Total depth               | 580 feet                                       |
| Casing                    | 16 inch to 480 feet<br>12 inch 480 to 527 feet |
| Static water level        | 11.4 feet                                      |
| Yield when drilled (1963) | 75 gpm   |
| Yield December 1974       | 70 gpm   |
| Drawdown 1974             | 269 feet                                       |
| Collar elevation          | 3901 feet.                                     |

*→ 3860' - 1974*

Sycamore Well 2 was drilled in the SW $\frac{1}{4}$  SE $\frac{1}{4}$  SW $\frac{1}{4}$  Section 29, T. 14 $\frac{1}{2}$  N., R. 8 W.

|                        |  |
|------------------------|--|
| Total depth            | 401 feet   |
| Casing                 | 16 inch to 302 feet<br>Open hole 302 to 401 feet |
| Static water level     | 62 feet  |
| Yield December 1974    | 18 gpm   |
| Drawdown December 1974 | 108 feet   |

*3*

### Water Quality

Partial water analyses run in 1959 and 1972 indicate little or no change in water quality during that period. The total soluble salts and the fluoride content are well inside the U.S. Public Health Drinking Water Standards.

PARTIAL CHEMICAL ANALYSIS  
OF WATERS FROM SYCAMORE WELL 1

| Date    | Cond. | T.S.S. | T.H.<br>as<br>CaCO <sub>3</sub> | Cal-<br>cium | Mag-<br>nesium | So-<br>dium | Car-<br>bonate | Bicar-<br>bonate | Chlo-<br>ride | Sul-<br>fate | Fluo-<br>ride | Temp.<br>OF. |
|---------|-------|--------|---------------------------------|--------------|----------------|-------------|----------------|------------------|---------------|--------------|---------------|--------------|
| 8/5/59  | 460   | 320    | 250                             | -            | -              | -           | 10             | 250              | 165           | 4            | -             | 71           |
| 1/25/72 | 435   | 305    | 140                             | 42           | 8              | -           | 0              | 182              | 25            | 8            | 0.45          |              |

Table 1

## CONCLUSIONS

The two wells in Little Sycamore Wash in the SW $\frac{1}{4}$  Section 29, T. 14 $\frac{1}{2}$  N., R. 8 W., have a combined production capability of 88 gpm. The water is recharged from precipitation to the shear zones of faults and transported to the wells with the shear zones acting as conduits.

Several wells have been drilled in shear zones of faults in the Bagdad area. Historically as these wells have been pumped the yield decreases. The exact volume of decrease in yield varies from fault zone to fault zone. During the period 1960 to 1975 heavy pumping has not completely drained any producing fault zone or caused a well to go "dry". The reduction in yield is dependent upon the transmissivity of the crushed zone. The longevity of the water supply is an unknown but long period of time. Historically, the wells in the Bagdad area have been producing for in excess of 15 years under heavy withdrawal rates.

The water quality appears satisfactory for human consumption.