Ref: Item VIII of C108

# GEOLOGIC DATA
# FRESH WATER AQUIFERS
# IN THE AREA OF THE
# PROPOSED ARROWHEAD GRAYBURG UNIT
# LEA COUNTY, NEW MEXICO

The proposed Arrowhead Grayburg Unit is located approximately 2 miles west of Eunice, and is immediately southeast of the Eunice Monument South Unit.

Fresh water zones within the proposed unit boundaries are the Quaternary alluvium, Pliocene Ogallala, and the Triassic Chinle and Santa Rosa formations.

The Quaternary aquifers are in recent sediments and are very localized in extent. They are made up of dune sands and sands filling channels or depressions in the underlying Ogallala. The sands are unconsolidated to semiconsolidated, fine- to medium-grained. They are found from the surface to depths of approximately 100 feet.

The Pliocene Ogallala aquifer underlies the Quaternary alluvium and is present across the entire area, but is not a major water source. The Ogallala is a calcareous, unconsolidated sand containing some silt, clay, and gravel. The Ogallala is found at approximately 60-125 feet.

The Triassic Chinle and Santa Rosa aquifers are the principal, fresh water bearing zones in this area. They are both fine- to medium-grained sandstones interbedded with red clays and siltstones. Within the proposed unit area, the Chinle is at a depth of approximately 50 feet, while the Santa Rosa top is found at depths that range from 825 to 850'.

Below the Santa Rosa are un-differentiated Permian and Triassic red beds. These "red beds" consist of red shales and red silty sandstones, and are not known to produce fresh water.

At the base of the Santa Rosa and the un-differentiated Permian and Triassic "red beds" is the Permian Rustler. At the top of the Rustler is an impermeable anhydrite bed, approximately 60-70 feet thick which provides an excellent barrier against contamination from brine waters in the underlying oil-producing formations. The Rustler anhydrite is at depths of approximately 1250 to 1275 feet. There are no known fresh water horizons below the Rustler anhydrite.

For the protection of all fresh water zones within the unit boundary, cement will be circulated to surface around casing on all new injection wells.

Reference - Ground Water Report 6, NMBM&G, 1961
DLL ENM01029.25jvc

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# GEOLOGICAL DATA
# INJECTION ZONES
# IN THE
# PROPOSED ARROWHEAD GRAYBURG UNIT

Queen - Approx. depth 3300' - 3600'*, approx. 300 gross feet.

The Queen Formation overlies the Grayburg and is composed of alternating layers of hard dolomite and sand lenses. Porous sands are the producing intervals in the Queen, and are present over the entire unit area. These sands produce oil or gas, depending on their structural position.

Grayburg - Approx. depth 3650' - 3900'*, approx. 250 feet.

The Grayburg is a massive dolomite interbedded with thin stringers of low permeability sandstone. The majority of oil production comes from intercrystalline porosity in the dolomite.

The range in depths to the top of the Grayburg is due to steep homoclinal dip to the southwest throughout the proposed unit area.

San Andres - Approx. depth 3900' - 4150'*, approx. 1200 gross feet.

The San Andres is a massive dolomite with intercrystalline porosity, which lies directly below the Grayburg. The San Andres does not contribute oil production to the field and will serve as a source of injection water. The base of the unitized interval will be -1500' subsea, near the base of the San Andres section.

There are no known faults cutting through the San Andres and Grayburg which would act as a conduit for gas, oil, or injection water to seep into fresh water horizons above the injection zones in the Grayburg and San Andres.

* Depth depends upon structural position of the well.

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