

Table 3.--Hydrology of geologic formations overlying Salado Formation.

System	Stratigraphic unit		Distribution and thickness	General hydrologic properties and use	Source and movement of water	Significance of water in unit in solution of halite, anhydrite, and gypsum
	Formation	Principal water-yielding unit				
Quaternary	Alluvium along Pecos River	Sand and gravel beds	Exposed mainly west of Pecos River between Carlsbad and Malaga Bend; as much as 200 feet thick.	Yields moderate to large quantities of water to wells; short-term pumping tests made at time of completion of wells indicate yields as much as 2,000 gpm (gallons per minute); supplies water for most of irrigation wells and for domestic, municipal, and industrial wells.	Recharged by Dark Canyon Draw, Black River, and other streams draining Guadalupe Ridge, by upward-moving water from Capitan Limestone near Carlsbad, by upward-moving water from Rustler Formation, and by precipitation on outcrop; water in alluvium moves toward and discharges into Pecos River.	Water in alluvium has little effect on solution of halite in mining area east of Pecos River; west of river, water in alluvium combining with that in Gatuna Formation is important in solution of halite and in determining southwestern extent of halite in Salado Formation.
	Gatuna Formation	Sand and gravel beds	Forms discontinuous outcrops mainly in central and southern parts of area between Pecos River and outcrops of Santa Rosa Formation; fills sinks and features caused by solution of gypsum, anhydrite, and halite in Rustler and Salado Formations; more than 800 feet thick.	Yields small quantities of water to a few stock wells known to penetrate unit; if wells penetrate full saturated thickness of unit they might yield a few hundred gallons per minute.	Recharged by precipitation falling on outcrop and by water moving into unit from Rustler Formation; water in formation combines with water in Rustler Formation to form multiple aquifer system; part of water in aquifer system moving southward from Clayton Basin is diverted toward Nash Draw by Gatuna Formation and by rocks of the Rustler Formation fractured extensively by large-scale solution activity in that area.	Because Gatuna Formation fills large features caused by solution of underlying gypsum and halite, water moving through formation may have been important in formation and enlargement of these features.
Tertiary	Santa Rosa Sandstone	Sandstone	Present only along eastern border of area; about 300 feet thick.	Yields small quantities of water to a few stock wells.	Recharged by precipitation on outcrop; water in unit moves generally westward toward Clayton Basin or Nash Draw or eastward out of area toward Laguna Plata or San Simon Sink.	In areas where extensive fracturing occurs water percolates downward and comes into contact with soluble beds in Rustler Formation; in areas where underlying Dewey Lake Redbeds are not extensively fractured, redbeds restrict downward movement of water from Santa Rosa Sandstone to Rustler Formation.
Permian	Dewey Lake Redbeds	Claystone to silty sandstone	Present in east-central part of area; about 600 feet thick where unit is overlain by Santa Rosa Sandstone but only 100 to 300 feet thick in much of outcrop area.	Generally the unit is not sufficiently permeable to yield water to wells; few stock wells in western part of T. 23 S., R. 31 E. may obtain small quantities of water from unit; unless fractured, unit forms barrier to movement of ground water, and in places unit separates water in Santa Rosa Sandstone from that in underlying Rustler Formation.	Where unit is sufficiently fractured to transmit water, it is recharged directly by precipitation on outcrop and indirectly by water moving downward into the unit from Santa Rosa Sandstone; water moves through unit mainly along fractures.	Quantity of water in unit too small to have appreciable effect on the solution of gypsum and halite in the underlying formations.
	Rustler Formation (including the Magenta and Culebra Dolomite Members but not the basal solution breccia zone)	Gypsum, anhydrite, claystone, dolomite, and halite	Drops out extensively over most of western and central parts of the area; present in subsurface throughout eastern part of area; thickness ranges from 0 to 400 feet; average thickness is about 200 feet.	Principal water-yielding formation of area; supplies water to many stock wells; poor chemical quality of water precludes its use for domestic purposes.	Recharged directly by precipitation falling on outcrop, by small ephemeral streams draining outcrops of Dewey Lake Redbeds, and indirectly by water moving into formation from Gatuna Formation; water moves through formation mainly along fractures and solution channels; in general, ground water in formation moves southward and southwestward and is discharged into Pecos River.	Water moving through Rustler is most significant in solution of gypsum and halite in that formation and in solution of halite in underlying Salado Formation.
		Magenta Dolomite Member	Where not eroded unit is about 30 feet thick.	Yields small amounts of water to a few stock wells; some water encountered in unit during excavation of some mine shafts and in wells drilled for Project Gnome.		
		Culebra Dolomite Member	Where not eroded unit is 30-40 feet thick.	Unit is main aquifer of area and supplies water for many stock wells; some water encountered in unit during excavation of most mine shafts and in all wells drilled for Project Gnome; reported to yield from a few to 700 gpm (Cooper, 1962, p. 36) at Gnome site coefficient of transmissibility ranges from 1.2 to 4,000 gpd (gallons per day) per foot; differences in transmissibility are due mainly to differences in development of solution channels in unit.		
	Basal solution breccia zone (of Rustler Formation)	Solution breccia	Present along contact of Rustler and Salado Formations; crops out only in western part of area; present in subsurface in most of area; thickness is variable and ranges from 25 to 250 feet.	Brine in solution breccia is too highly mineralized to be utilized for any purpose; brine discharges into Pecos River and contaminates flow of river; coefficient of transmissibility of solution breccia zone calculated to be about 60,000 gpd per foot (Hale and others, 1954, p. 22).	Recharged principally from overlying units of Rustler Formation; brine is encountered mainly in Nash Draw area and at scattered places elsewhere; brine moves generally southward and southwestward toward Pecos River; brine discharges to river at and near Malaga Bend where amount of discharge is estimated as 200 gpm (Theis and others, 1942, p. 69).	Brine represents most of current solution of halite in Rustler and Salado Formations in potash mining area and adjoining area north and east of mines, a total area of more than 1,250 square miles; in potash mining area most of dissolved material in brine is obtained from halite of Salado Formation; amount of sodium chloride that enters Pecos River at Malaga Bend from solution breccia zone was estimated by Theis and others (1942, p. 69) to be 342 tons per day and by P. R. Stevens, W. F. Hardt, C. A. Wilson, and C. L. Knapp (written commun., 1970) as 370 tons per day.