

**Upper Arkansas River Conservation
Project Reconnaissance Study**

Appendix B

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August 2005

APPENDIX B

To assure that there is not confusion regarding the distinction between the High Plains Aquifer and the Ogallala Aquifer, the following text was prepared.

The High Plains Aquifer consists mainly of one or more hydraulically connected geologic units of late tertiary or quaternary age. The principal geologic units in the High Plains Aquifer, one of which is the Ogallala Formation, are shown in Figure B-1 and summarized in the generalized geologic section presented in Table B-1, taken directly from the 1984 U.S. Geological Survey (USGS) Professional Paper 1400-B, prepared by Gutentag et al., *Geohydrology of the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming*. Table B-1 was included because it provides good information regarding the physical characteristics of various geologic units that may be encountered at potential recharge sites.

**Table B-1
Generalized Section of Geologic Units in the High Plains**

System	Series	Geologic Unit	Thickness (in feet)	Physical character
QUATERNARY	Pleistocene and Holocene	Valley-fill deposits	0 to 60	Stream-laid deposits of gravel, sand, silt, and clay associated with the most recent cycle of erosion and deposition along present streams. Forms part of High Plains aquifer where hydraulically connected to underlying Quaternary and Tertiary deposits.
		Dune sand	0 to 300	Fine to medium sand with small amounts of clay, silt, and coarse sand formed into hills and ridges by the wind. Forms part of High Plains aquifer where saturated.
		Loess	0 to 250	Silt with lesser amounts of very fine sand and clay deposited as windblown dust.
	Pleistocene	Unconsolidated alluvial deposits	0 to 550	Stream-laid deposits of gravel, sand, silt, and clay locally cemented by calcium carbonate into caliche or mortar beds. Forms part of High Plains aquifer where hydraulically connected laterally or vertically to Tertiary deposits.
TERTIARY	Miocene	Ogallala Formation	0 to 700	Poorly sorted clay, silt, sand, and gravel generally unconsolidated; forms caliche layers or mortar beds when cemented by calcium carbonate. Includes units equivalent to the locally used terms "Ash Hollow," "Kimball," "Sidney Gravel," and "Valentine" Members or Formations assigned to the Ogallala Formation or "Group," and Delmore and Laverne Formations. Ogallala comprises large part of High Plains aquifer where saturated.
		Arikaree Group	0 to 1000	Predominantly massive very fine to fine-grained sandstone with localized beds of volcanic ash, silty sand, siltstone, claystone, sandy clay, limestone, marl, and mortar beds. Includes units assigned to the Hemingford Group of Lugin (1938), Marsland Formation, Rosebud Formation used in South Dakota by Harksen and Macdonald (1969), and Sheep Creek Formation. Also includes units equivalent to Gering Formation, Harrison Sandstone, and Monroe Creek Sandstone. Forms part of the High Plains aquifer.
	Oligocene	White River Group	0 to 700	Upper unit, Brule Formation, predominantly massive siltstone containing sandstone beds and channel deposits of sandstone with localized lenticular beds of volcanic ash, claystone, and fine sand. The Brule Formation is considered part of the High Plains aquifer only where it contains saturated sandstones or interconnected fractures. Lower unit, Chadron Formation, mainly consists of varicolored, bentonitic, loosely to moderately cemented clay and silt that contains channel deposits of sandstone and conglomerate.
CRETACEOUS	Upper Cretaceous	Undifferentiated rocks	0 to 8000	Shales, chalks, limestones, and sandstones. Upper part may contain lignite and coal beds. Unit includes Belle Fourche and Carlisle Shales, Codell and Fox Hills Sandstones, Frontier Formation, Graneros Shale, Greenhorn Limestone, Lance Formation, Niobrara Chalk or Formation, and Pierre Shale.
	Lower Cretaceous	Undifferentiated rocks	0 to 700	Fine- to medium-grained, thin-bedded to massive cliff-forming sandstone interbedded with shale. Black and varicolored shale and thin- to thick-bedded limestone. Includes units equivalent to Fredericksburg and Washita Groups; Dakota and Purgatoire Formations; Antlers Sand of Hill (1894), Cheyenne, Fall River, Lakota, Mesa Rica, and Newcastle Sandstones; and Fuson, Kiowa, Mowry, Skull Creek, and Tucumcari Shales.
JURASSIC	Middle and Upper Jurassic	Undifferentiated rocks	0 to 600	Varicolored shale, fine- to very coarse grained sandstone, limestone, dolomite, and conglomerate. Includes units equivalent to Entrada and Exeter Sandstones, and Morrison and Sundance Formations.
TRIASSIC	Upper Triassic	Dockum Group	0 to 2000	Upper unit, Trujillo Formation, varicolored siltstone, claystone, conglomerate, fine-grained sandstone, and limestone. Lower unit, Tecovas Formation, varicolored fine- to medium grained sandstone with some claystone and interbedded shale. Include units equivalent to Chinle and Redondo Formations, and Santa Rosa Sandstone.
PERMIAN	Lower and Upper Permian	Undifferentiated rocks	300 to 3000	Interbedded predominantly red-shale, siltstone, sandstone, gypsum, anhydrite, dolomite, bedded salt, and local limestone beds. Includes Artesia, Council Grove, Nippewalla Groups; Quartermaster Formation, Sumner and Whitehorse Groups.

The Ogallala Formation is the principal geologic unit in the High Plains Aquifer, with maximum thicknesses of about 700 feet. Irrigation wells with yields of 1,000 gallons per minute (gpm) or more can be developed from about 100 feet of saturated sand and gravel in places. In parts of western Kansas, wells pumping 100 gpm are developed in areas with as little as 20 feet of saturated sand and gravel (Gutentag et al 1984).

Unconsolidated alluvial deposits of quaternary age are in hydraulic connection with tertiary deposits throughout the study area. In much of the study area, quaternary alluvial deposits directly overlie the Ogallala Formation. Dune-sand deposits are typical in the regional study area. In southwestern Kansas, the water table generally is below the dune-sand deposits, which are important recharge areas for the High Plains Aquifer. Valley-fill alluvial deposits consist of unconsolidated gravel, sand, silt, and clay associated with the most recent cycle of erosion and deposition along present streams (Gutentag et al 1984).

REFERENCE

Gutentag, E.D., F.J. Heimes, N.C. Krothe, R.R. Luckey, and J.B. Weeks. 1984. "Geohydrology of the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming." *U.S. Geological Survey Professional Paper 1400-B*. U.S. Geological Survey. Washington, D.C.

**Figure B-1
Principal Geologic Units in the High Plains Aquifer**

