

**KANSAS GEOLOGICAL SURVEY
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AN EVALUATION OF A PROPOSED RECHARGE SITE ALONG THE
PAWNEE RIVER WEST OF BURDETTE, KANSAS USING SURFACE
GEOELECTRIC METHODS

by

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Introduction

In October 1982 the Kansas Geological Survey conducted a field investigation for Groundwater Management District No. 5 to determine the nature of the shallow subsurface materials in the Pawnee River Valley in Pawnee County. The purpose of this investigation was to assess the feasibility of using the site picked by the District's Board for recharging the shallow alluvial aquifer with surface water.

The proposed recharge site is located in the Pawnee River bottoms near the Pawnee-Hodgeman County line in SW 1/4 Section 29, T21S, R20W, one mile west of Burdett, Kansas (Fig. 1). The topography of the site vicinity is generally flat except in the vicinity of the active channel of the river and in the vicinity of an abandoned meander where the land surface slopes considerably (Fig. 2). Drillers' logs of nearby wells in the valley indicate that the alluvium consists of sand, silt, and clay and tends to be finer grained near the surface. The bedrock below the alluvium consists of the shales and sandstones of the Dakota Formation.

The surface electrical resistivity method was chosen to explore the alluvial materials for significant permeable zones in the proposed site vicinity because the area could be surveyed quickly and economically. Vertical electrical soundings (VES) were taken at 13 sites in the study area with the Schlumberger array (Fig. 2). The Schlumberger array was used because the effect of near-surface lateral inhomogeneities on the measured apparent

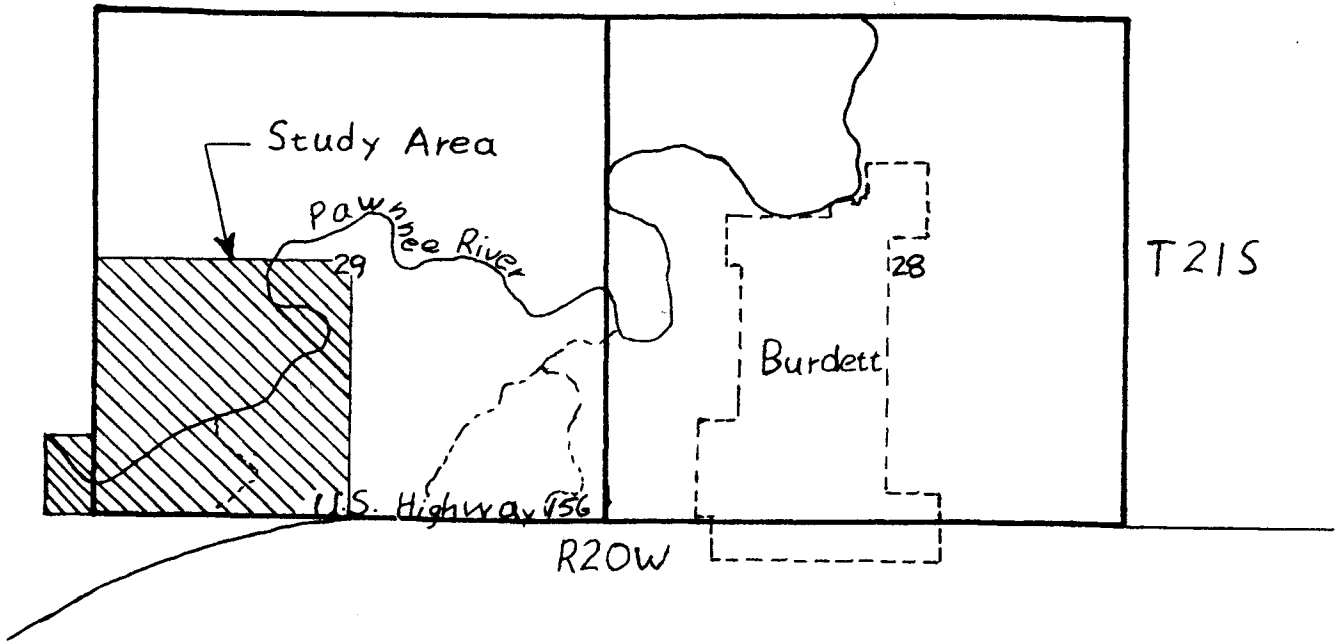


FIGURE 1

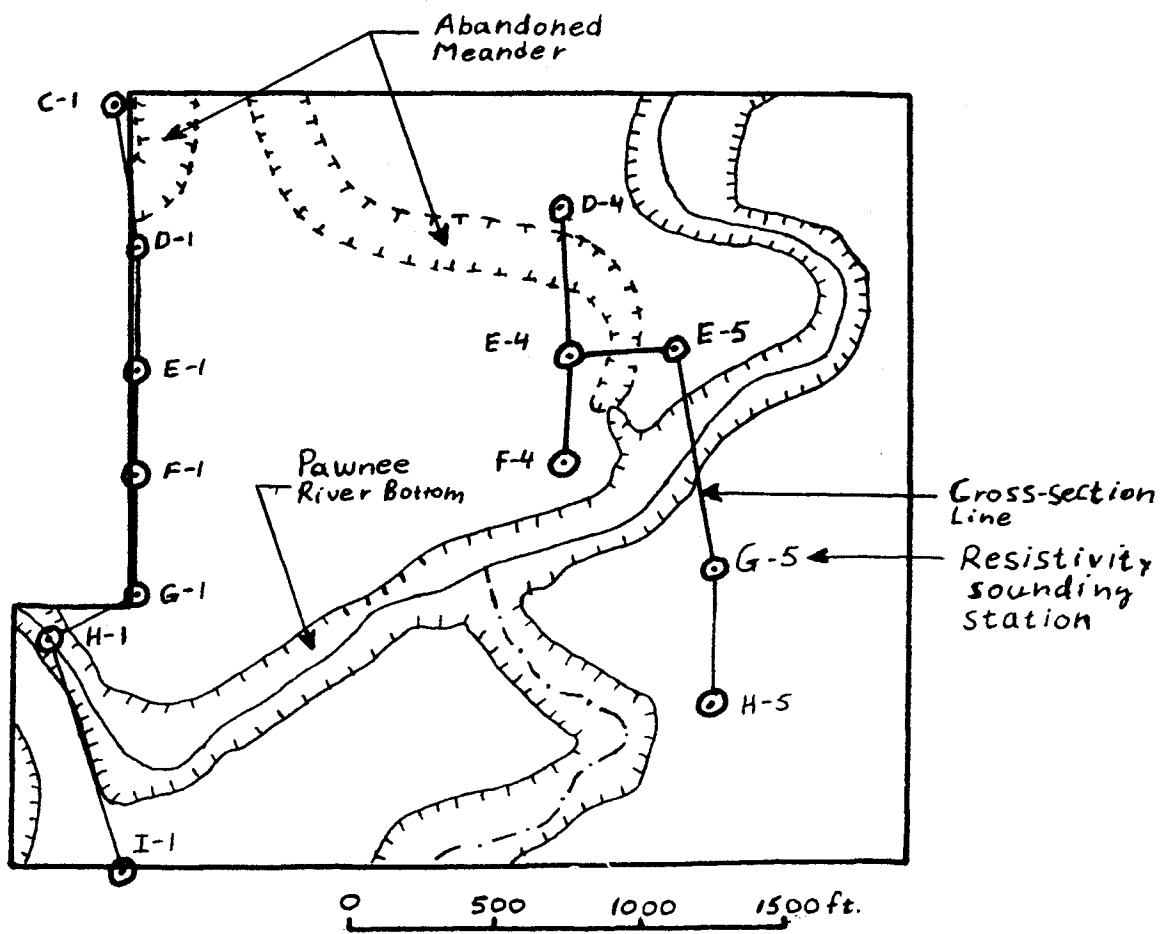


FIGURE 2

resistivity can be partially eliminated and because fewer personnel are required. The resistivity unit used for this investigation was a Bison Signal Enhanced Model 2390 resistivity measuring system. An analysis of each apparent resistivity curve was carried out using an automatic inversion computer program written by Zohdy (1973). The inversion program calculates an earth model consisting of a sequence of geoelectric layers that corresponds to the field curve. Details concerning the automatic procedure can be found in Zohdy (1975).

Results

Figures 3, 4 and 5 are north-south cross-sections constructed along the east and west boundaries of the proposed recharge site. The contour lines represent the distribution of resistivity in ohm-feet below the land surface traversed by each cross-section line. Generally areas of higher resistivity (greater than 200 ohm-feet) indicate coarse grained sediments (sand, gravel, sandstone) and areas of lower resistivity (less than 100 ohm-feet) are interpreted to be fine-grained sediments (silt, clay, shale). The bedrock surface below the alluvium is shown on the cross-sections as a dashed line and was interpreted from the contoured distribution of resistivity.

Along the east side of the recharge site the coarse-grained sediments are thickest beneath VES site E-5 and F-4 (Figs. 3 and 4). Ten to 20 feet of sand appears to be present just above the bedrock surface at VES sites D-4, G-5, and E-4. The presence of this basal sand above the bedrock surface is difficult to confirm because the resistivity contrast between the sandy sediments and the sandstones in the underlying Dakota Formation may not be sufficient for definition of the bedrock surface. The high resistivities seen

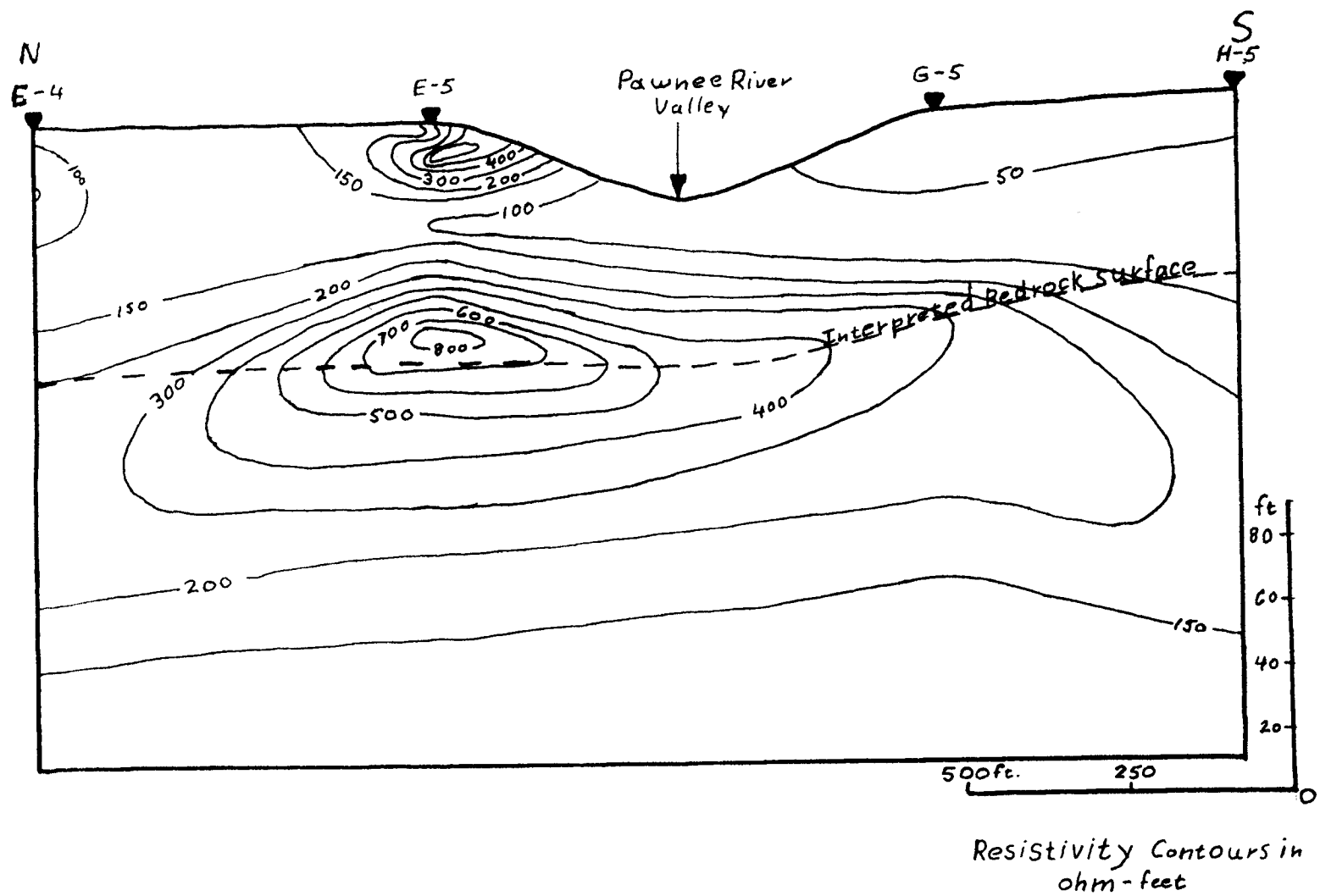


FIGURE 3

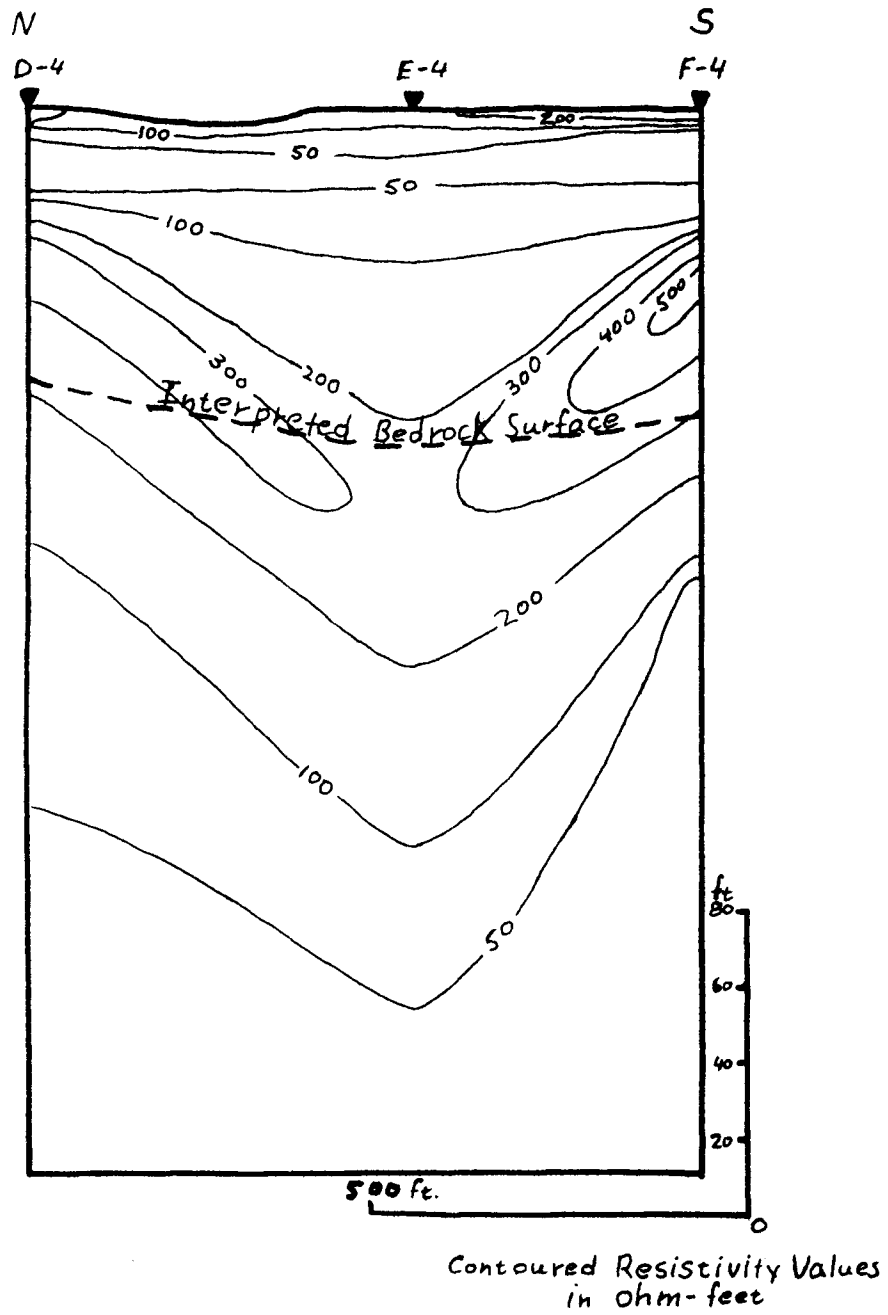


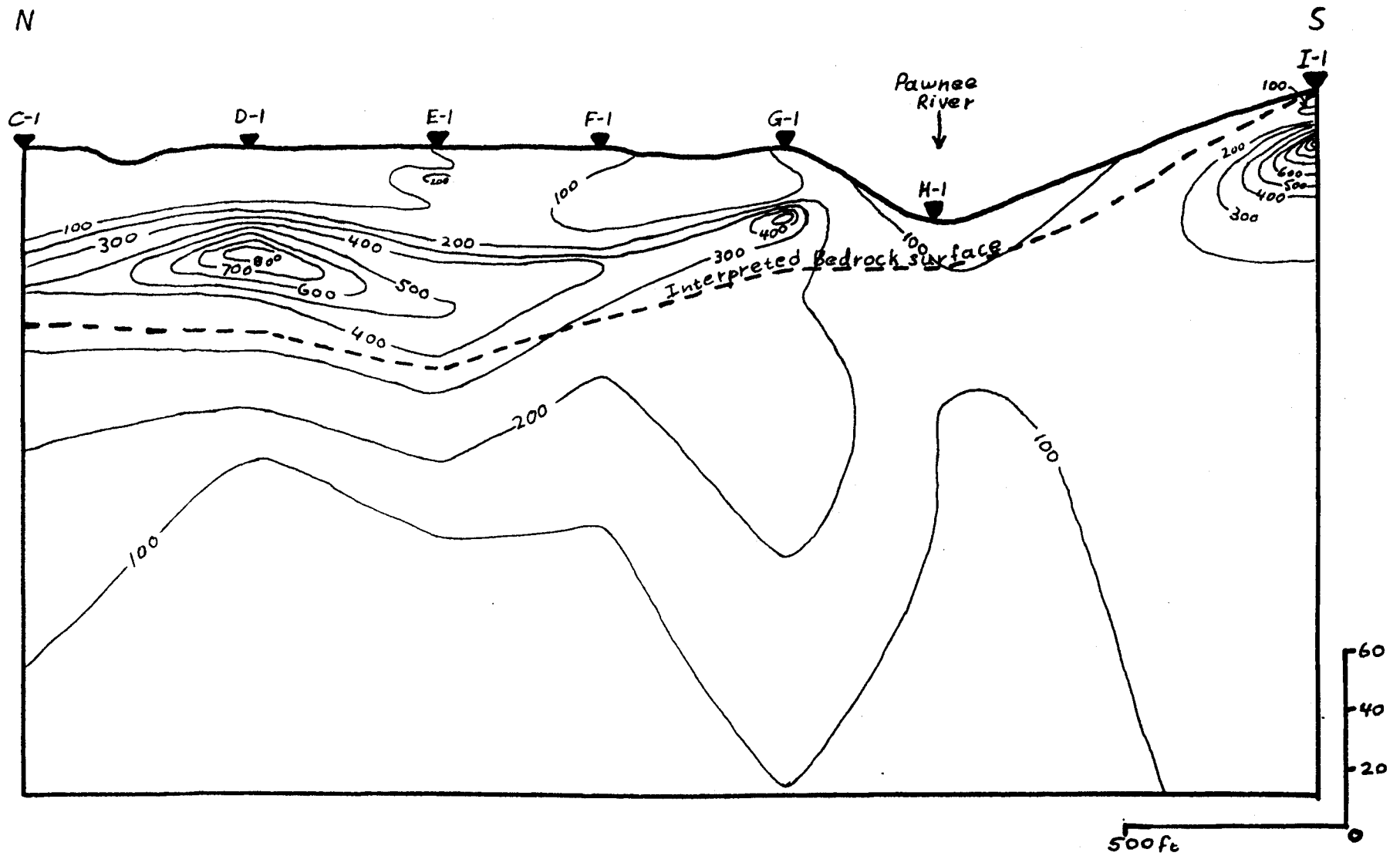
FIGURE 4

in the cross-section could be sandstone and not alluvial sands. The sediments directly below the river bottom are fine-grained from the distribution of resistivity.

Figure 5 is resistivity cross-section along the western boundary of the proposed site. The location of the bedrock surface across most of the cross-section was interpreted from the contoured distribution of resistivity. One VES site, I-1, was located on a Dakota Sandstone outcrop just south of the river. At this site a high resistivity sandstone body in the Dakota is present near the land surface. To the north in the Valley, the sediments in the upper part of the cross-section appear to be fine-grained because the resistivity values are generally low. A considerable thickness of sand appears to be present below site D-1 and extending northward away from the proposed site and some sand may also be present below VES site G-1. Additionally, the sediments appear to be fine-grained below the bottom of the river.

Conclusions

The results of the field investigation show that coarse-grained sediments are present in the subsurface adjacent to the Pawnee River bottom. Zones of higher resistivity correspond to these sediments or could correspond to sandstones in the Dakota Formation. It is difficult at this time to determine how extensive these sediments are because not enough soundings were made around the proposed site. Some test drilling in the area should be done to assess the nature and depth to the top of the Dakota bedrock surface and to confirm the existence of the coarse-grained sediments in the alluvium.



Resistivity Contours in ohm-feet

FIGURE 5

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