INTRODUCTION

This atlas, and the three companion Denver Basin Atlases are the result of a comprehensive Hydrologic study of the Denver basin which was accomplished for the promulgation of rules and regulations as required by Colorado Senate Bill 5 (1985), (Section 37-90-137 (9)(b) C.R.S.). The rules and regulations were effective as of December 30, 1985; amended January 30, 1987. These atlases represent an expansion and refinement of previous work by the U. S. Geological Survey and the Colorado Division of Water Resources which was published as U.S.G.S. Hydrologic Atlases HA-643 (Dawson Aquifer); HA-646 (Denver Aquifer); HA-647 (Arapahoe Aquifer); and HA-650 (Laramie-Fox Hills Aquifer), 1981. Differences between the previous atlases and this publication are due to a combination of a refinement of aquifer boundary identification based on hydrologic separation and over an 100% increase in the amount of data available.

In order to accurately map the aquifer boundaries throughout the basin, it was first necessary to construct a series of hydrogeologic cross-sections based on geophysical logs. Fifteen cross-sections were constructed using approximately 250 geophysical well logs. From these, basin-wide correlations were made and aquifer boundaries were drawn. After completion of the cross-sections, additional logs were correlated to the sections and became data points from which structural contour maps of the tops and bases of the aquifers were drawn. In all, over 3000 geophysical logs were analyzed. Maps showing the sandstone and siltstone for each aquifer were also prepared from data obtained from the logs. These "isolith" maps show total thickness of sandstone and siltstone and must be used in conjunction with water level or piezometric head maps to find the saturated thickness.

The locations of surface outcrops were obtained from various published geologic reports, projections of subsurface data and original field work by the staff of the Division of Water Resources.

The structural contour maps and isolith maps were utilized as in-put for a finite difference computer model which was used to determine the location of the non-tributary line as defined in Sections 37-90-103 (10.5) and 37-90-137 (9)(c), C.R.S. as amended. The terms "tributary" and "non-tributary" refer to the legal definition and not the hydrologic definition of the word.

DESCRIPTION OF THE DENVER BASIN

The Denver ground water basin underlies an area of approximately 6,700 square-miles. The basin boundary is generally defined as the lower or outermost boundary or outcrop of the Laramie-Fox Hills Aquifer. It extends southward from Greeley to a point approximately 25 miles southeast of Colorado Springs, and eastward from the Front Range to Limon, Colorado. Four major bedrock aquifers occur in the basin. In descending order, these are the Dawson, Denver, Arapahoe and Laramie-Fox Hills aquifers. These aquifers are known or potential sources of water to wells constructed for domestic, livestock, industrial, commercial, municipal, and irrigation purposes.

The lower limit of the Denver Basin is not extended below the base of the Laramie-Fox Hills Aquifer because virtually all of the estimated ground water in storage in the region's bedrock aquifers is contained in it and the overlying aquifers. The South Platte River between La Salle and Masters approximates the northern boundary of the basin because the river approximates the location of a structural feature known as the Greeley Arch. This arch separates the Denver Basin from the similar Cheyenne Basin to the north due to the fact that the Laramie-Fox Hills Aquifer has been significantly thinned or is missing along the crest of the arch.

SITE SPECIFIC DATA

These maps have been prepared utilizing standard geologic practices and are within the acceptable limits of accuracy. Data obtained at specific sites may vary from extrapolated data presented on these maps.

ACKNOWLEDGMENTS

The preparation of the atlases required extensive work by many people. The following individuals deserve special recognition for their work during development of the Denver Basin Rules and Regulations:

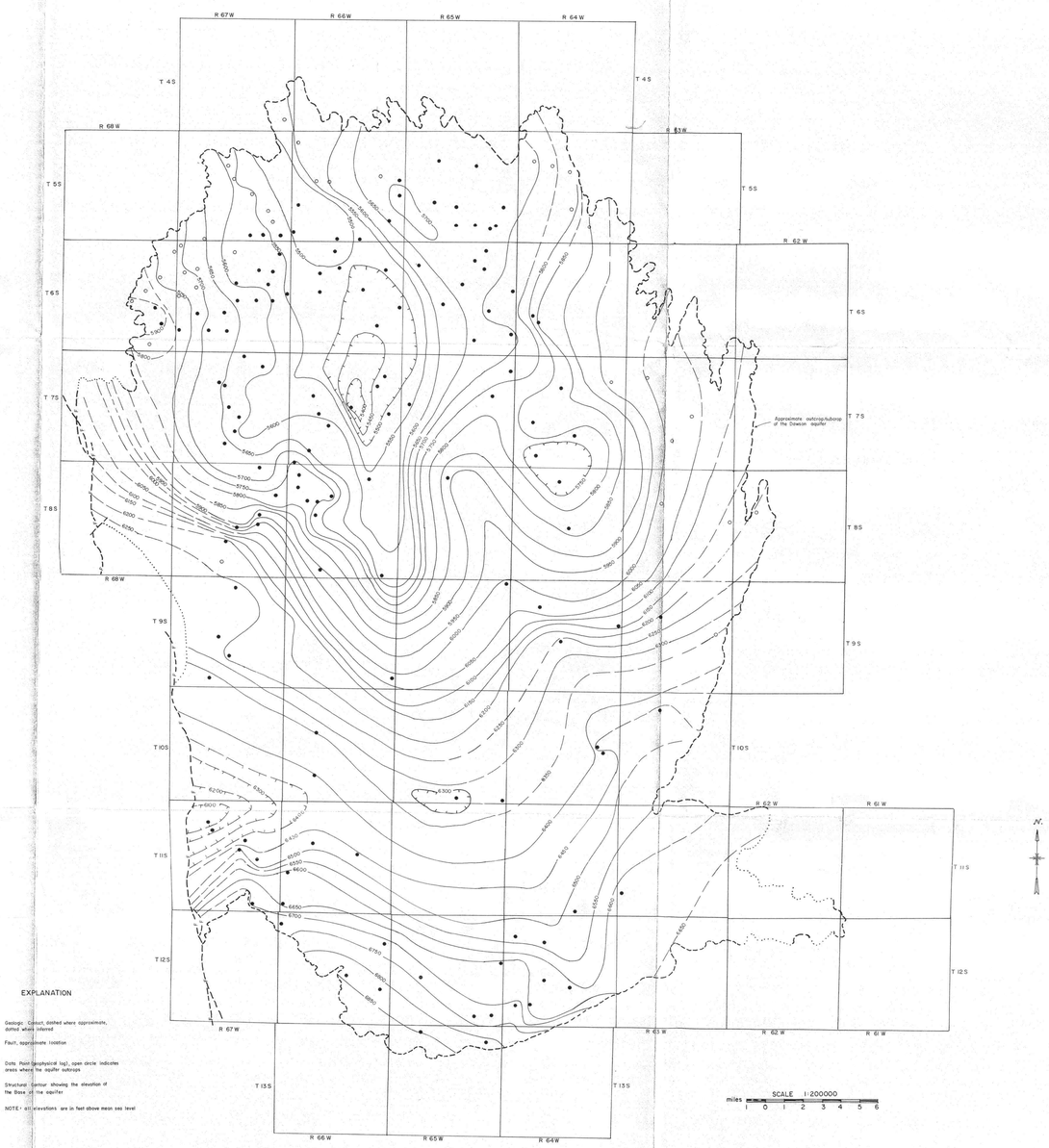
Dewayne Schroeder was responsible for development and application of the Denver Basin Computer Model. Results of this work were used to prepare maps showing the location of non-tributary ground water. Carolyn Amato was in charge of drafting and layout of the maps. Richard Bell provided quality control and identification of stream alluvium. Finally, Robert Longenbaugh provided the overall coordination of this project and was responsible for its completion within the time specified in Senate Bill 5 (1985).

DAWSON AQUIFER

The Dawson Aquifer is the uppermost principal aquifer in the Denver Basin and covers an area of approximately 1400 square miles. It ranges in thickness from zero at its outer boundary to about 1200 feet in the central part of the Basin. The Dawson is at or near land surface throughout its entire areal extent with the exception of mesas and ridges in the Castle Rock area where it is overlain by the Castle Rock conglomerate. The aquifer is made up of predominantly conglomeratic, very coarse grain arkosic sandstones interbedded with clay shale and clay. The sandstones are generally poor to moderately consolidated and vary from light to gray to yellowish brown in color. Deeply buried clay shales and clay are normally gray to pale green-gray. Outcrop colors are frequently varicolored ranging from white to red and purple. Near the western edge of the Denver Basin between Sedalia and Pikeview, the Dawson Aquifer consists of massive conglomeratic, arkosic sandstone with subordinate clay shale and clay. Toward the east, discontinuous clay shale and clay layers increase in thickness and number and interfinger with sandstones in an irregular pattern.

In the northern half of the area covered by the Dawson Aquifer, identification of a continuous mappable clay shale layer has resulted in subdividing the aquifer into upper and lower aquifer members. The clay shale layer, which functions as a hydrostratigraphic barrier within the Dawson Formation, varies from 50 to over 150 feet in thickness. The barrier grades laterally southward into sandstones and conglomerates. The southward change from a two aquifer system to one continuous aquifer occurs gradually throughout a zone two to three miles wide. Therefore, the boundary of divided Dawson shown on Figure 1B, 1C, and 1D is actually the approximate innermost mappable division of the aquifer within a zone of gradation which may be two to three miles wide. Thickness of the upper member ranges from zero at the aquifer margins to about 600 feet; thickness of the lower member varies from 50 to over 400 feet.

The predominant water-yielding strata of the Dawson Aquifer are saturated conglomeratic, arkosic sandstones. These water-yielding beds locally are irregularly shaped and distributed; hence, yields of wells located in one area might differ from wells located in an adjacent area. Wells properly completed in the Dawson Aquifer yield small to large quantities of water depending upon well location and hydraulic properties of the saturated material penetrated. In some areas the lower member of the Dawson Aquifer might not contain sufficient sandstone to insure a reliable water supply. Generally, higher capacity wells can be expected along the western edge of the Denver Basin between Sedalia and Pikeview.



STRUCTURAL CONTOUR MAP OF THE BASE OF THE DAWSON AQUIFER

FIGURE 1A