

Abstract

The depth of the Equus Beds aquifer in southwestern Harvey County and northwestern Sedgwick County was developed to supply water to the city of Wichita and...

1940) groundwater levels and to update changes in aquifer storage since 1940. Maps of related groundwater-level and water-level changes are presented.

Acknowledgments

The author acknowledges the invaluable assistance of Debra Ary of the city of Wichita and Tim Boese of Equus Beds Groundwater Management District No. 2 (GMD2). Their technical reviews contributed to improved technical and editorial clarity of the report.

Hydrogeology of the Study Area

The approximately 165 square-mile study area is located northwest of Wichita, Kansas in Harvey and Sedgwick Counties (fig. 1). It is bounded on the south-west by the Arkansas River and on the northeast by the Little Arkansas River.

covered by the High Plains aquifer in Kansas (fig. 1). The Equus Beds aquifer is an important source of water for the city of Wichita, Kansas (U.S. Geological Survey, 2010).

The water level altitudes depicted in the potentiometric-surface map of the shallow and deep layers of the Equus Beds aquifer were calculated by subtracting the depth to water below land surface in a well from the altitude of land surface at the well.

Methods

Aquifer Layers

For the purposes of this report, wells completed and screened in the Equus Beds aquifer were assigned to either the shallow or deep aquifer layers. These layer assignments were based on the lithology and depth of the aquifer zone designations and on well completion and screen depths.

Water-Level Changes

The water-level change at a well since August 1940 was determined by subtracting the water level measured in July 2011 from the depth to water below land surface at the same well in August 1940.

Storage-Volume Change

Change in storage volume for the purposes of this report is defined as the change in saturated aquifer volume multiplied by the specific yield of the aquifer. Specific yield is the ratio of (1) the volume of water a rock or soil will yield to gravity to (2) the volume of rock or soil (Lohman and others, 1972).

(Kansas Geological Survey, 2011), and well data collected by the USGS are stored in important source files available at the USGS National Water Research Institute.

Water-Level Altitudes

The shallow and deep layers of the Equus Beds aquifer were calculated by subtracting the depth to water below land surface in a well from the altitude of land surface at the well.

Groundwater Levels and Storage Volume

Groundwater-level declines can result from a combination of factors, and the primary factors in the study area being recharge and decreased recharge resulting from changes in land use.

Precipitation

Precipitation for the study area for 2010 and 2011 was estimated as the arithmetic average of precipitation for the five Cooperative weather stations in or near Haledale, Hutchinson, Mount Hope, Newton, and Wichita.

Potentiometric Surfaces of the Shallow and Deep Aquifer Layers, July 2011

The potentiometric-surface contours of the shallow and deep layers of the Equus Beds aquifer (figs. 2 and 4, respectively) indicate movement of water in the aquifer is generally from west to east across the study area.

Storage-Volume Change, July 2011

Storage-volume change is greatly affected by irrigation and city pumping. Commonly, only about one-third of irrigation pumping from the Equus Beds aquifer is used for the largest crop (corn).

Study Area

The storage volume of water in the Equus Beds aquifer declined in the study area from August 1940 to July 2011 by about 20,000 acre-ft (fig. 2, table 1). The storage volume in the study area in July 2011 was about 115,000 acre-ft less than in August 1940, and about 105,000 acre-ft less than in January 2011.

Water-Level Changes, August 1940 to July 2011

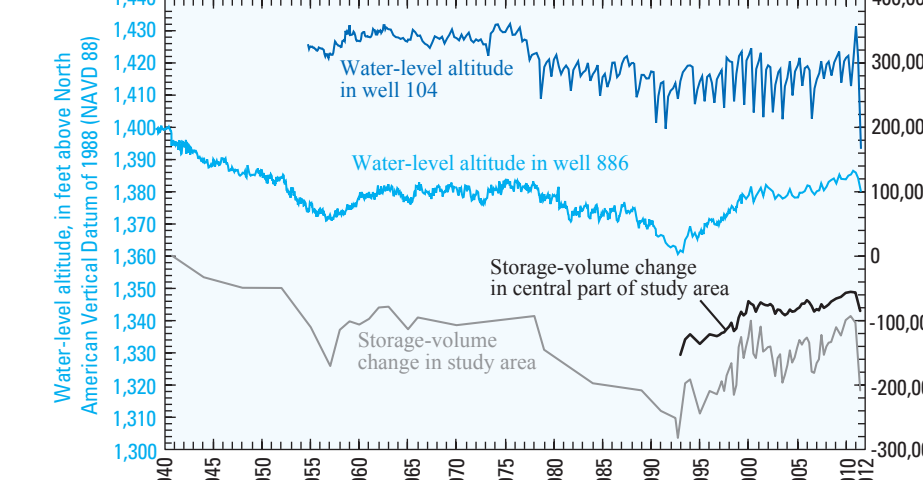


Figure 2. Water-level altitudes in monitoring wells 104 and 888 in the Equus Beds aquifer storage-volume change in the study area and the central part of the study area.

Water-Level Changes, August 1940 to July 2011

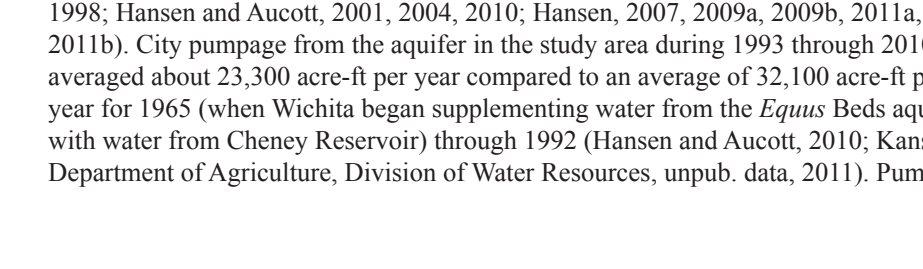


Figure 3. Water-level changes in monitoring wells 104 and 888 in the Equus Beds aquifer.

Storage-Volume Change, July 2011



Figure 4. Storage-volume change in the Equus Beds aquifer near Wichita, south-central Kansas, August 1940 to July 2011.

central part of the study area in 2010, irrigation pumping was about 8,700 acre-ft, city pumping about 110,000 acre-ft, and pumping for other uses about 10,000 acre-ft.

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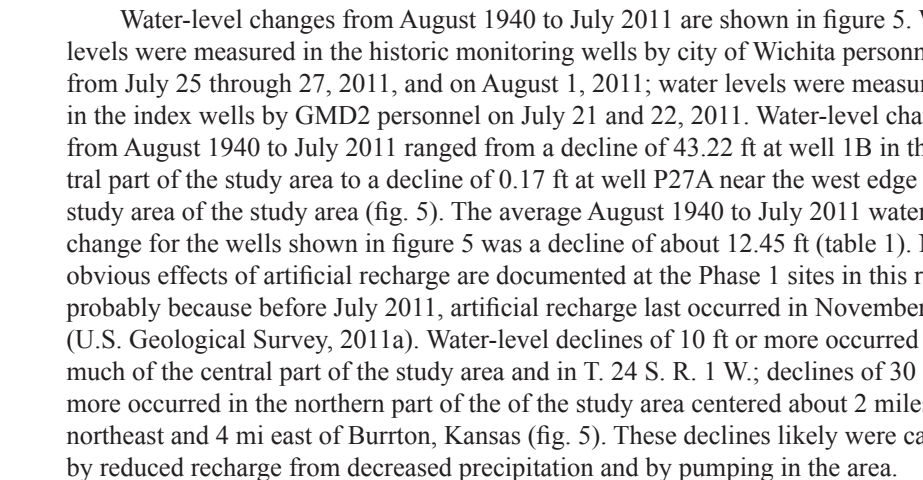


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Storage-Volume Change, July 2011

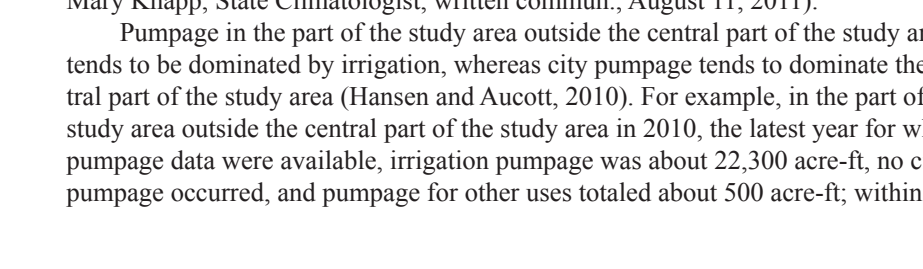


Figure 4. Storage-volume change in the Equus Beds aquifer near Wichita, south-central Kansas, August 1940 to July 2011.

Table 1 includes average water-level changes for the wells used to make the water-level change maps associated with the storage-volume changes that are also shown in table 1.

Storage-Volume Change, July 2011

Storage-volume change is greatly affected by irrigation and city pumping. Commonly, only about one-third of irrigation pumping from the Equus Beds aquifer is used for the largest crop (corn).

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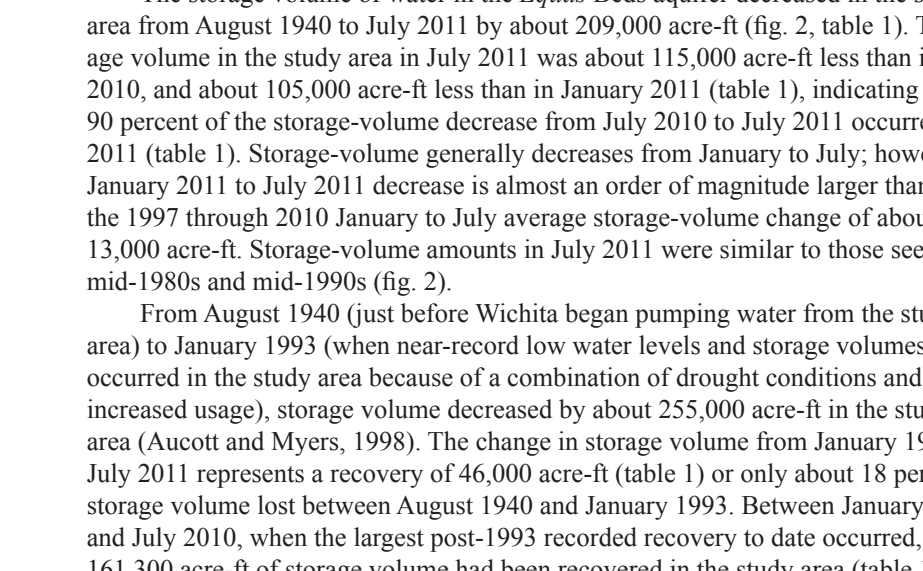


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Storage-Volume Change, July 2011

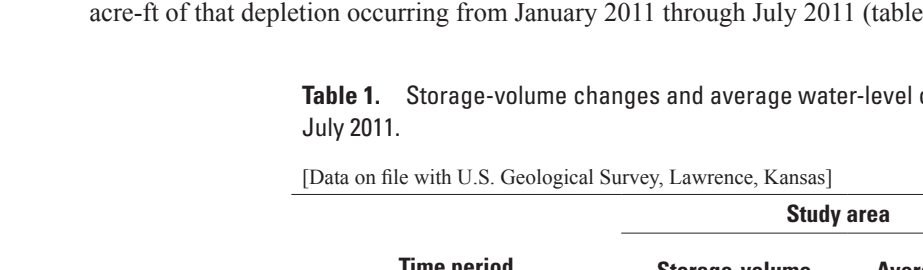


Figure 4. Storage-volume change in the Equus Beds aquifer near Wichita, south-central Kansas, August 1940 to July 2011.

The approximately 100 acre-ft of water artificially recharged to the aquifer at the Phase 1 sites (fig. 3) by the city of Wichita from July 2010 to July 2011, none of which occurred in January through July 2011, was not so counteracted these large storage-volume changes.

References Cited

Annett, W.R., and Myers, N.C., 1998. Changes in groundwater levels and storage in the Wichita well field, south-central Kansas, 1940-88. U.S. Geological Survey Water-Resources Investigations Report 98-414, 20 p.

Central Part of Study Area

The change in storage volume in the Equus Beds aquifer in the central part of the study area (where Wichita city wells are located) from August 1940 to July 2011 was a decrease of about 85,000 acre-ft (fig. 2, table 1).

Storage-Volume Change, July 2011

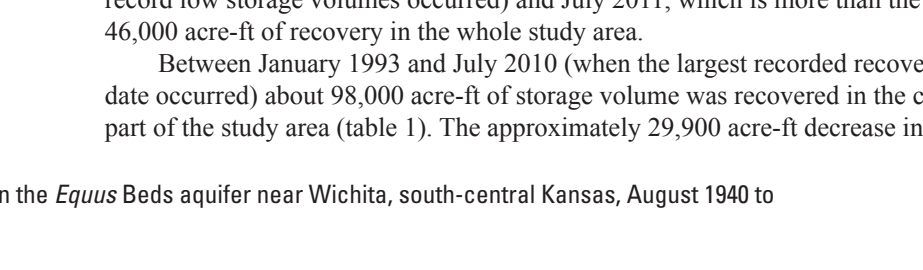


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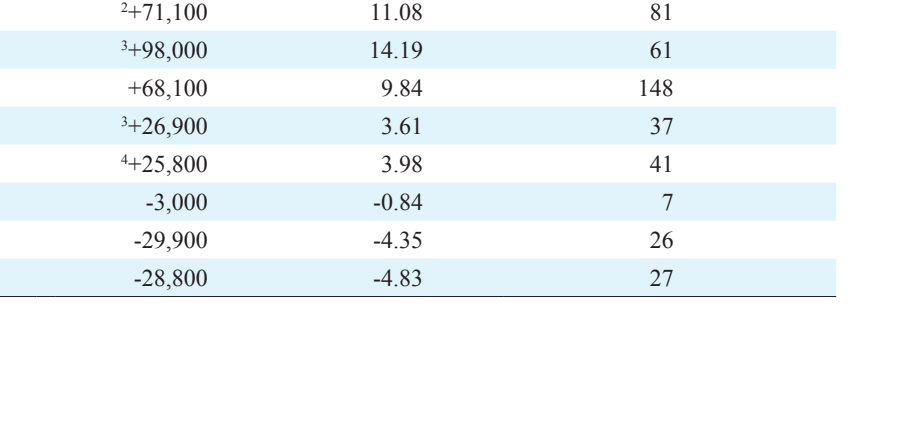


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Storage-Volume Change, July 2011

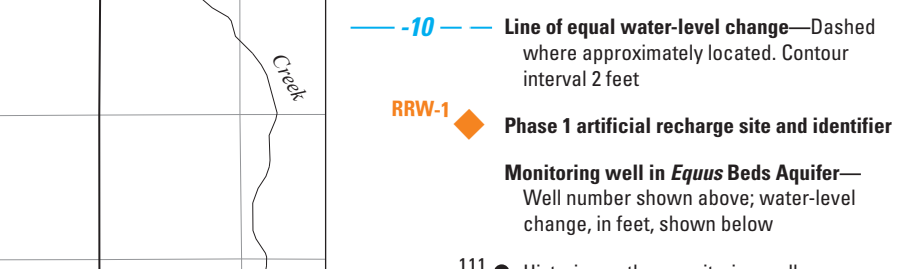


Figure 4. Storage-volume change in the Equus Beds aquifer near Wichita, south-central Kansas, August 1940 to July 2011.

Purpose and Scope

The purpose of this report is to describe the status of the groundwater levels and storage volume in a part of the Equus Beds aquifer near Wichita from July 2011 as compared with conditions before large-scale withdrawals began in September

Figure 1. Location of study area near Wichita, south-central Kansas (modified from Annett and Myers, 1998).

Figure 2. Potentiometric surface of the shallow layer of the Equus Beds aquifer, July 2011.

Figure 3. Potentiometric surface of the deep layer of the Equus Beds aquifer, July 2011.

Figure 4. Storage-volume change in the Equus Beds aquifer near Wichita, south-central Kansas, August 1940 to July 2011.

Figure 5. Water-level changes in the Equus Beds aquifer in the study area, August 1940 to July 2011.

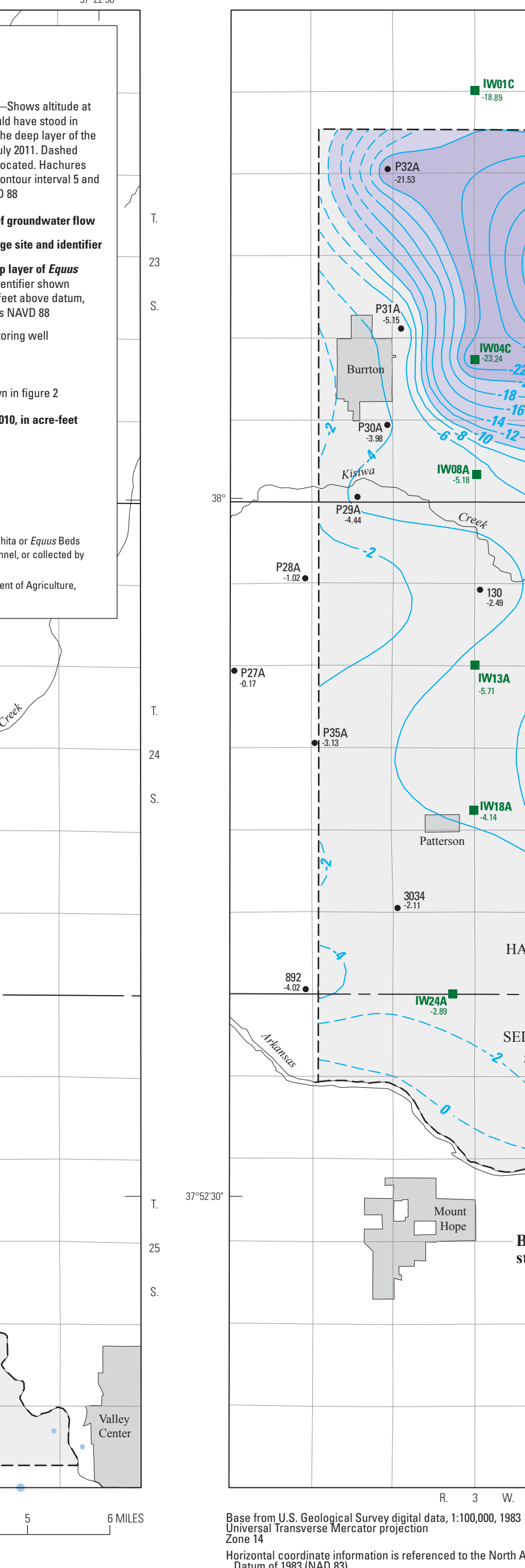
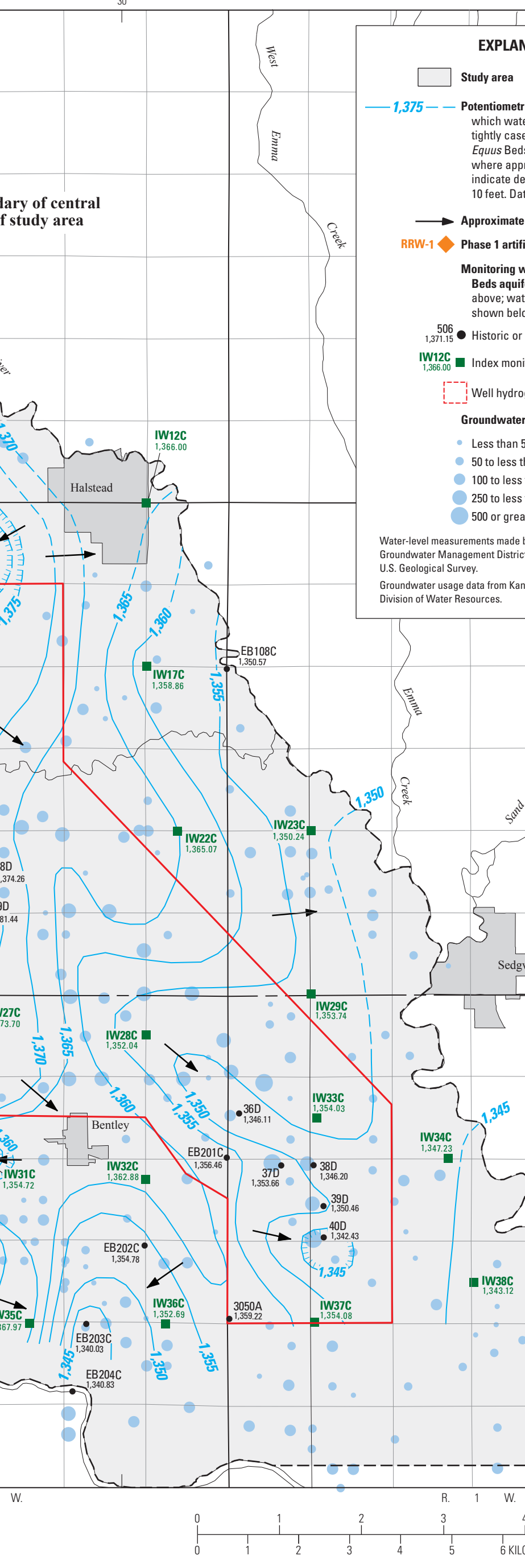
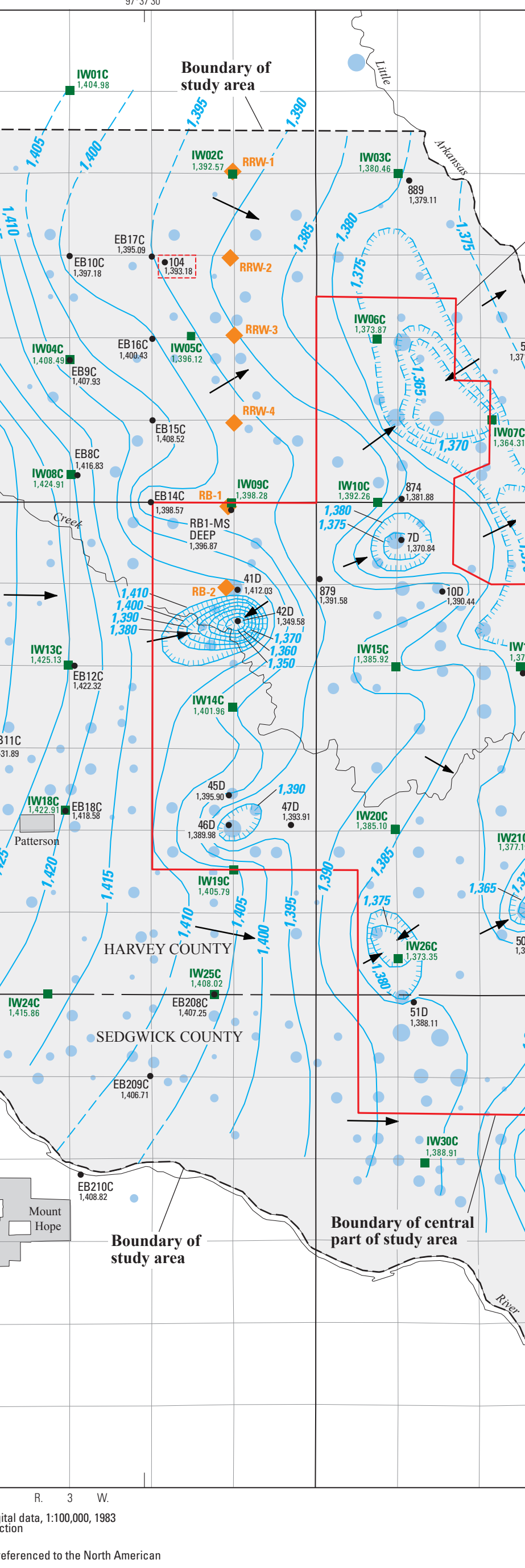
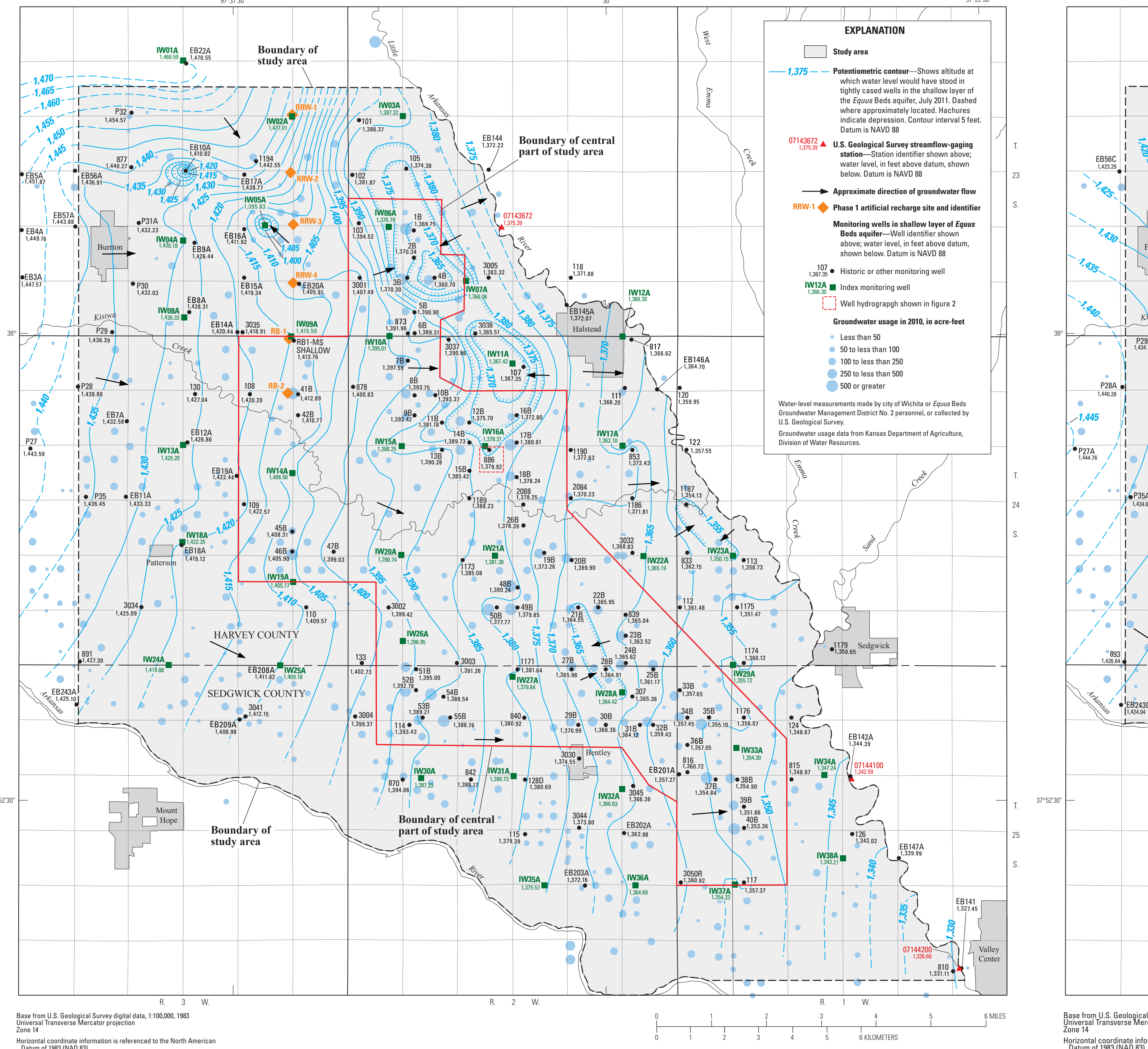


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Status of Groundwater Levels and Storage Volume in the Equus Beds Aquifer near Wichita, Kansas, July 2011

By Cristi V. Hansen, 2012

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The change in storage volume in the Equus Beds aquifer in the central part of the study area (where Wichita city wells are located) from August 1940 to July 2011 was a decrease of about 85,000 acre-ft (fig. 2, table 1).

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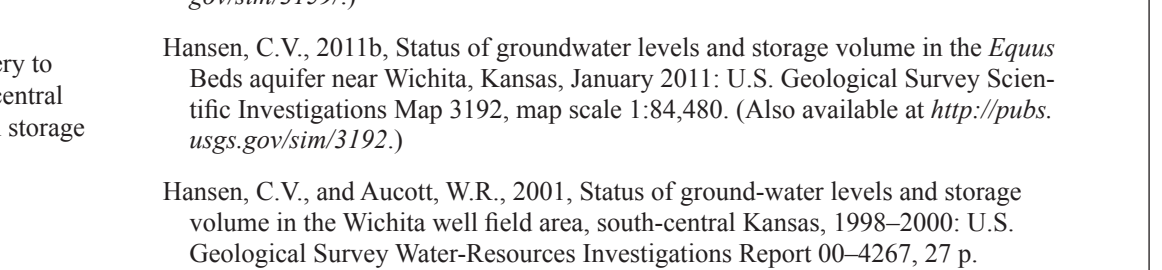


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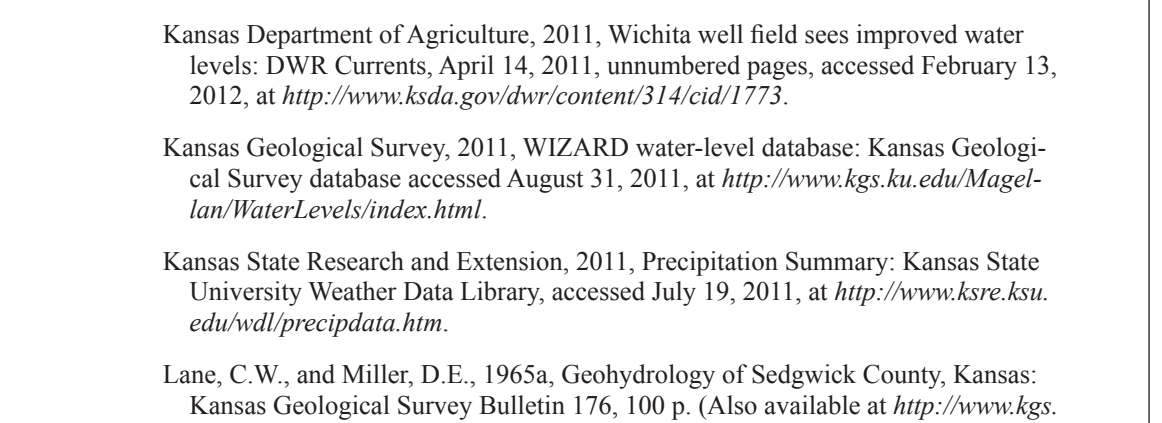


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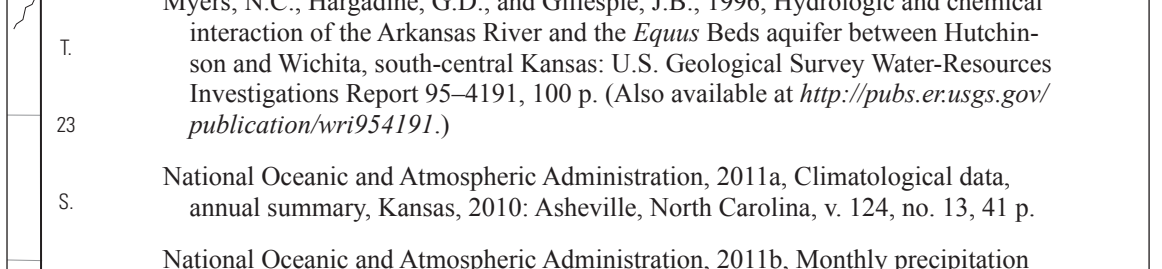


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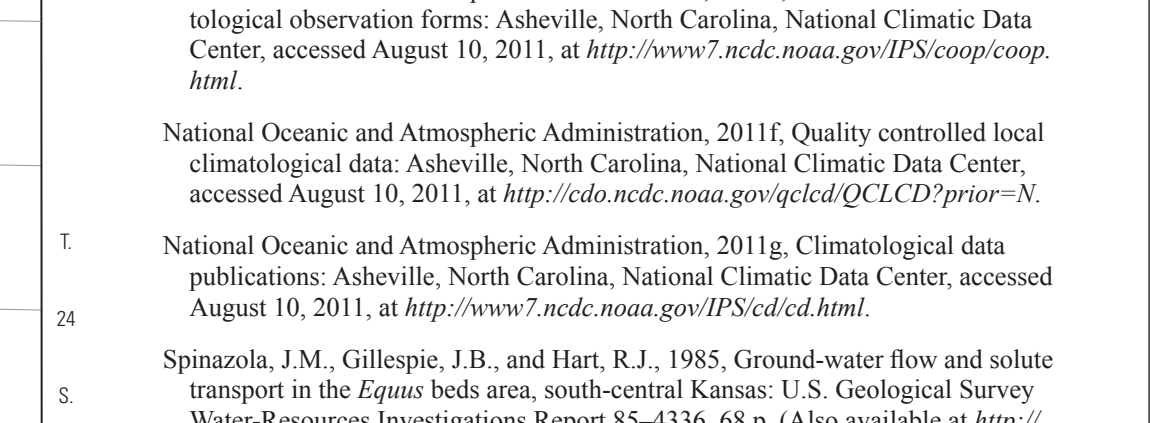


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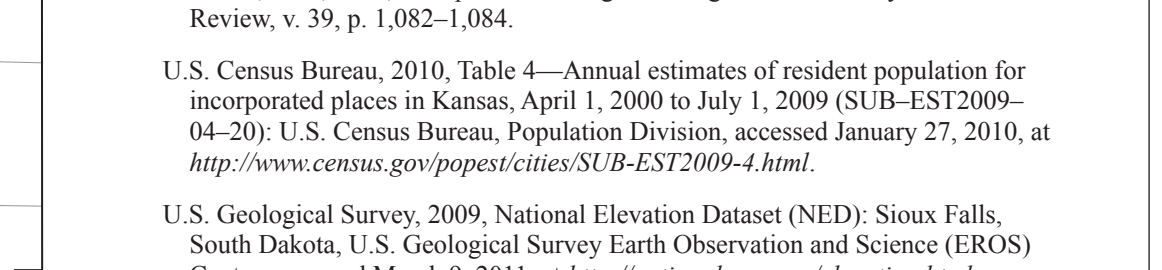


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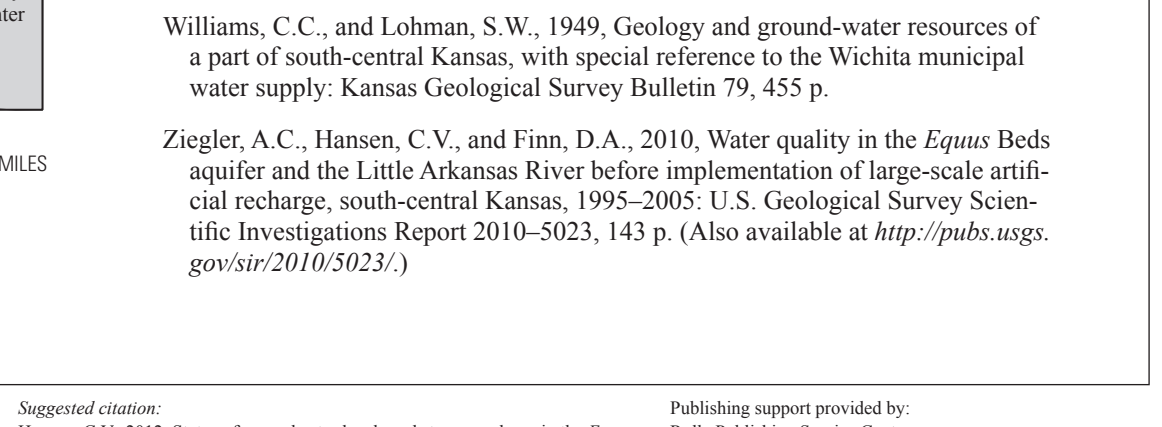


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Supplemental notes

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