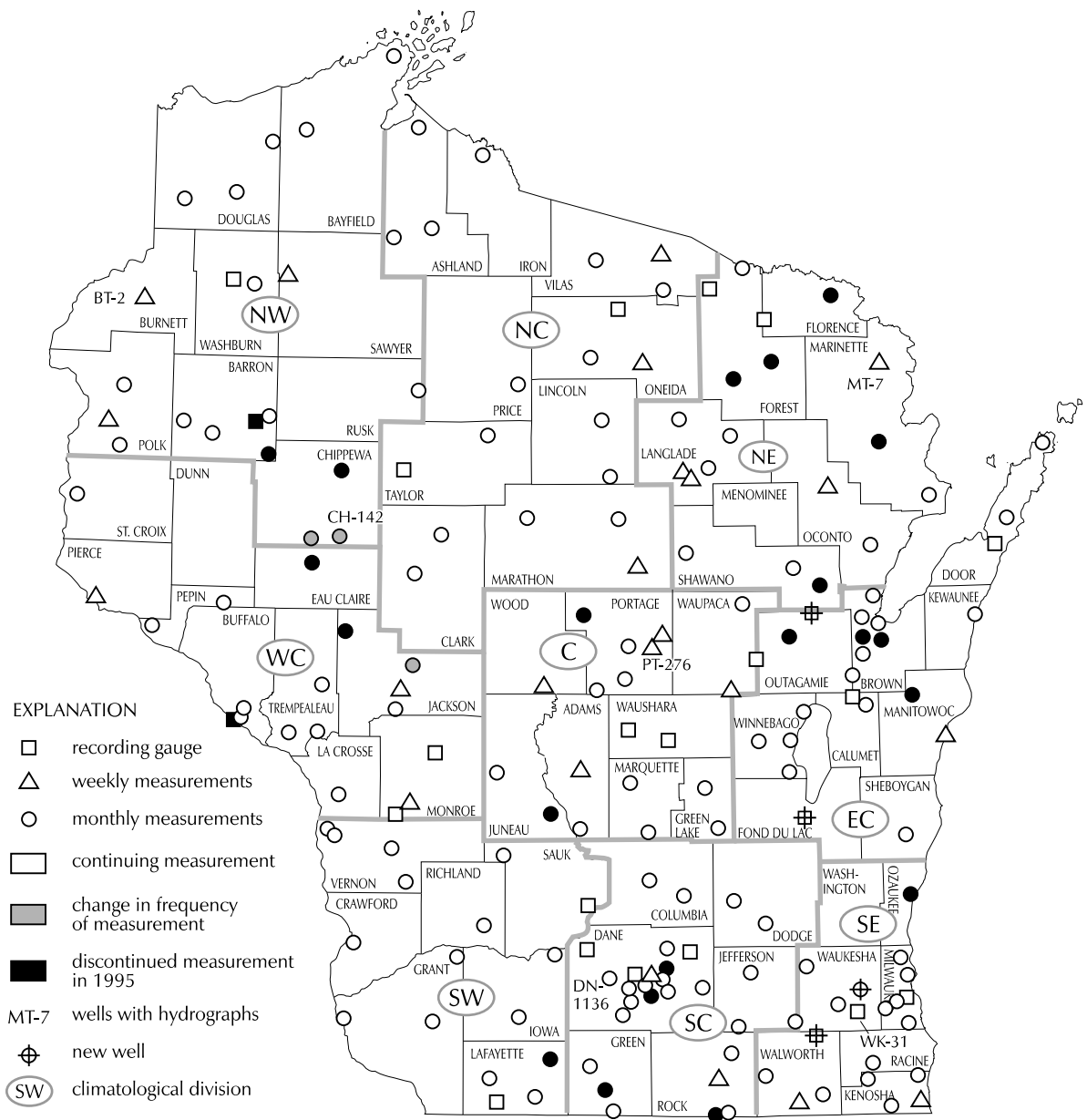


# GROUNDWATER LEVELS IN WISCONSIN, ANNUAL SUMMARY 1995

Alexander Zaporozec

(Compilation of data: Mark Dvorak)

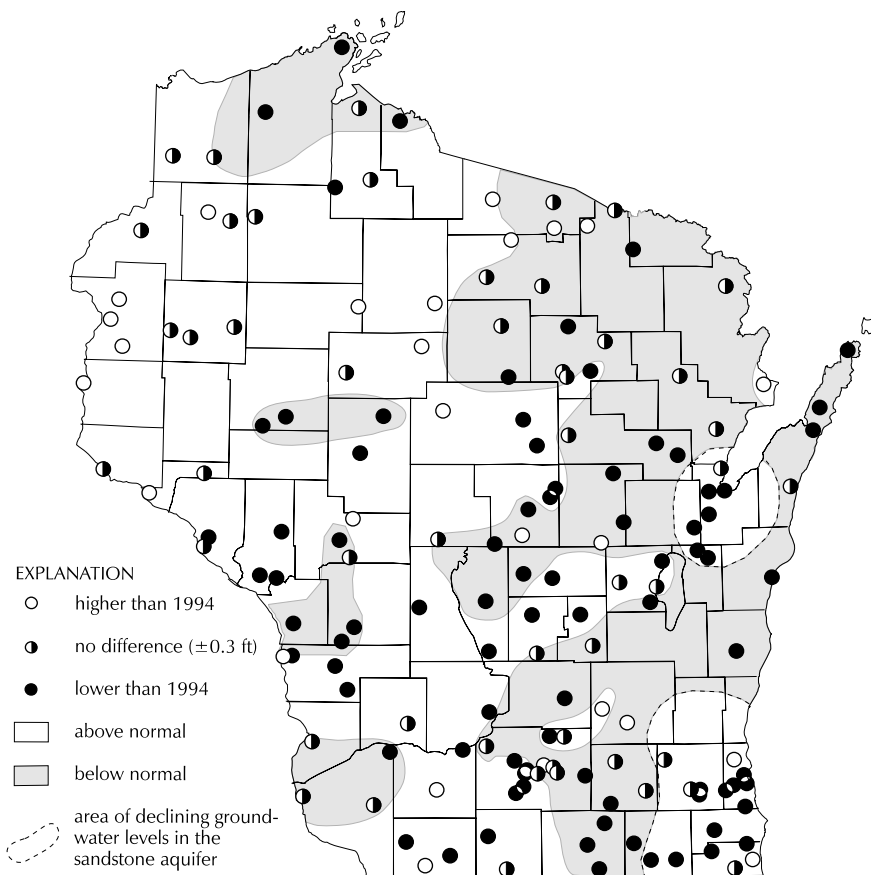
1996



**Figure 1.** Location of observation wells in Wisconsin, 1995.

In cooperation with

U.S. Department of the Interior, U.S. Geological Survey  
 Water Resources Division, Madison District Office  
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**Figure 2.** Average water level changes from 1994 to 1995.

The Wisconsin Geological and Natural History Survey (WGNHS) and the U.S. Geological Survey (USGS) have jointly operated a network of observation wells in Wisconsin since 1946. During 1994–95 a joint USGS/WGNHS committee evaluated all observation wells to determine whether they met network goals and objectives, especially the completeness of geologic data, well construction conditions, and hydraulic connection with the corresponding aquifers (Zaporozec, 1996). The evaluation resulted in discontinuing 22 wells and adding 4 wells. At the end of 1995, measurements were made on 167 wells in 67 counties. Locations of wells are shown in figure 1. The counties of Dunn, Eau Claire, Menominee, Ozaukee, and Washington at present do not have any observation

wells. Information about wells and water-level measurements can be obtained from the USGS (Bernie Ellefson, 608/276.3849) or the WGNHS (Alex Zaporozec, 608/262.3385).

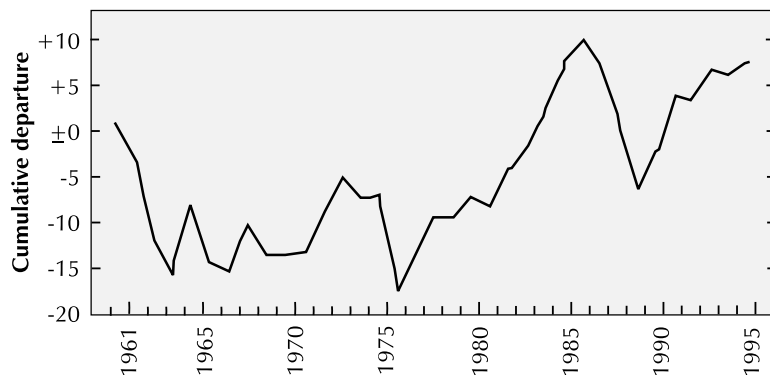
The year 1995 was uneventful as far as the fluctuations of water levels are concerned, primarily because precipitation amounts in 1994 were close to normal levels (98%). Individual water-level measurements were averaged monthly to calculate average annual water levels in individual wells. Average water levels were approximately the same as in 1994 in about one-third of the observation wells, spread evenly around the state (fig. 2). Average water levels

in 1995 were lower than in 1994 in almost half of observation wells, primarily in the southern two-thirds of the state (fig. 2). The greatest declines (greater than 2 ft) were recorded for wells in west-central, central, and south-central Wisconsin. The maximum recorded decline (besides on deep wells in areas of heavy pumping) was 4.25 ft in Waupaca County. In other areas, average water levels in observation wells declined only slightly (less than 1 ft). Average water levels rose slightly (from 0.3 to 0.6 ft) from 1994 to 1995 in only 19 percent of observation wells, primarily in the northern third of Wisconsin (fig. 2). Water levels only occasionally rose by more than 1 ft, and no more than 2 ft. The maximum recorded rise was 1.9 ft for a well in Rusk County.

Average water levels in the deep sandstone aquifer in areas of heavy pumping in eastern Wisconsin, around Green Bay and Milwaukee/Waukesha metropolitan centers (fig. 2), continued to gradually decline. The extent of affected areas has expanded slightly into Calumet, Outagamie, and Walworth Counties. On the average, water levels in observations wells have been declining at the rate of 3 ft/yr in Brown County, 4 ft/yr in the Milwaukee–Racine–Kenosha area, and 5 ft/yr around the city of Waukesha since the beginning of record in the late 1940s.

In comparison with long-term means for the years 1961–90 (so-called normal water levels), the 1995 levels generally were below normal in the eastern half and above normal in the western half of Wisconsin (fig. 2). However, the variations from normal levels mostly were within three percent. Not considering wells in areas of heavy pumping, water levels were significantly (more than 15%) below normal only in single wells in Lincoln, Monroe, Portage, Sheboygan, and Waupaca Counties and in the Door County peninsula. Water levels significantly higher (more than 15%) than normal were recorded in Vernon County and in single wells in Barron, Lafayette, Marinette, Price, Richland, Rusk, Trempeleau, and Winnebago Counties.

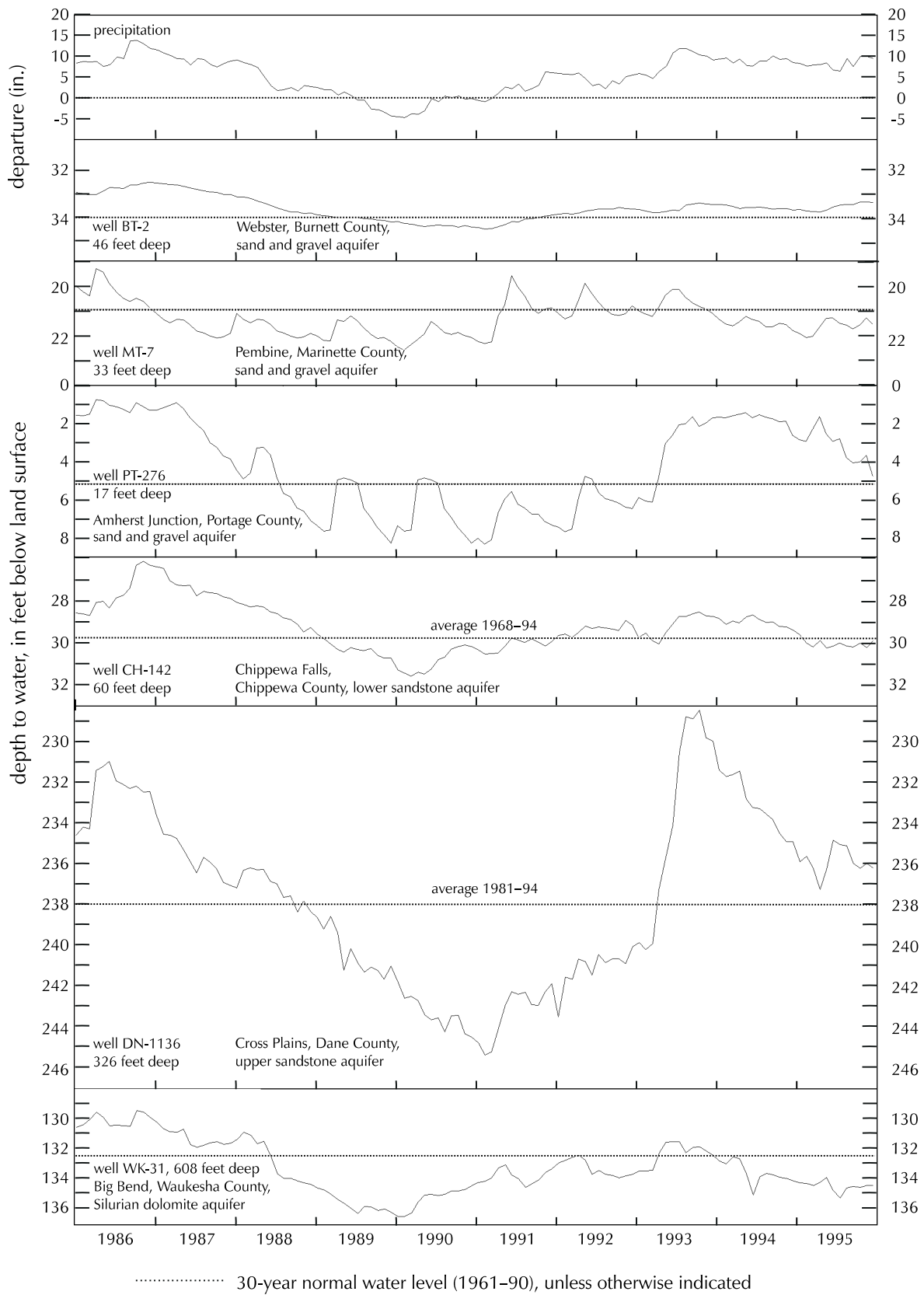
The long-term trends in water levels are influenced by precipitation, the main source of recharge to groundwater. The alternating periods of wet and dry years result in increasing and declining groundwater levels, respectively. Although the precipitation amounts in Wisconsin vary from year to year, they have been generally



**Figure 3.** Cumulative departure from normal annual precipitation in Wisconsin, 1961–95. (data from P. Naber Knox, State Climatologist, 1995).

increasing since the mid-1960s (fig. 3). During 20 of the past 35 years, Wisconsin experienced above-normal precipitation. Groundwater levels were especially influenced by a 10-year period of high precipitation between 1977 and 1986. As a result, many observation wells reached record high levels in 1985–86.

The correlation of precipitation cycles and groundwater cycles is best seen by plotting the average annual water levels along with the cumulative departure from normal precipitation, as seen in figure 4. Seasonal variations that tend to obscure the long-term trends are eliminated by plotting the average values. The hydrographs of key wells in figure 4 demonstrate the influence of precipitation on long-term trends of groundwater levels. Water levels in observation wells peaked in 1986 in response to the preceding 10-year period of wet years. After that, water levels declined and reached their minima in 1990–91 in response to drought years 1988–89. However, water levels again recovered rather swiftly as a result of plentiful precipitation in 1990, 1991, and 1993 and reached another peak in the late 1993 and early 1994 (fig. 4).



**Figure 4.** Cumulative departure from normal monthly precipitation in Wisconsin and fluctuations of water levels in selected key wells, 1986-95.

Since 1994, water levels have been slowly declining and will continue to do so until another period of wet years comes along, which would cause water levels to rise again. Generally, precipitation cycles result in corresponding cycles in groundwater levels, and we could use the historical precipitation record to predict future trends in groundwater levels. In a historical study of the precipitation and groundwater level cycles, Zaporozec (1980) examined the existing precipitation record in Wisconsin from 1880 to 1979 and concluded that since the mid-1960s Wisconsin precipitation had been generally increasing in a trend that could be expected to last well into the next century. That, in turn,

means that we could expect that the water levels would be also generally increasing during this period. ■

## References

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