PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION
AND BERKSHIRE COUNTY

PHYSICAL SETTING, CLIMATE, WATER BUDGET, AND WATER USE

INTRODUCTION

This report describes the water resources and water problems of the upper Housatonic River basin, an area of about 530 square miles in Berkshire County, Massachusetts, and a small part of Columbia County, New York (figure 1).

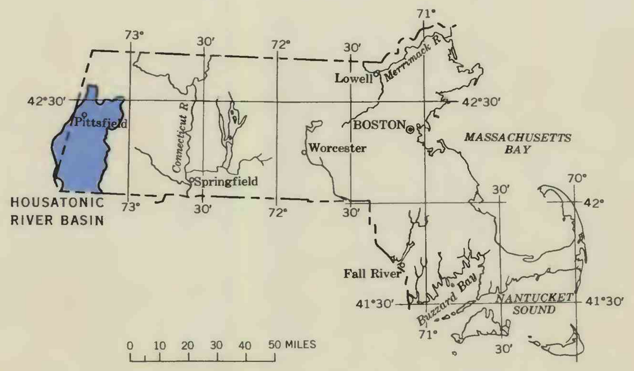

FIGURE 1.—*Index map of Massachusetts showing location of the Upper Housatonic River Basin*

The present population of about 95,000 is concentrated along the Housatonic River, principally in the industrial city of Pittsfield and in the larger trade centers bordering the river. The greater part of the water needs of population and industry are presently supplied from reservoirs on tributaries of the Housatonic River in hills bordering the main valley. Water for some industries and smaller settlements is obtained from wells in the glacial alluvium of the lowland and in the limestone, metamorphic, and igneous rocks beneath the valley and adjoining hills.

Present water systems are being taxed to capacity to meet industrial and population growth in the basin, and the drought of the past few years has pointed out the inadequacies of some of the systems. In 1964 the public and private water systems produced about 26 mgd (million gallons per day) of which about 9 mgd was from wells and springs.

Estimates based on regional plans forecast an increase in population of 40,000 by the year 2000. Based on this forecast and on probable increase in industrial and irrigational use of water, water needs for the year 2000 will increase at least 10 mgd, a 40 percent increase over present demands.

In this study, the major water problems were found to be:

1. Inadequate storage of surface water, particularly in dry years, and the lack of knowledge of the amount of surface water available.
2. Inadequate knowledge of sources of ground water in the glacial alluvium of the valley.
3. Chemical quality.
4. Pollution.

The results of the study show that (1) the quality and volume of streamflow in the many tributaries within the hills bordering the valley would be suitable for impounding large quantities of water, and additional billions of gallons of water could be made available from many of the lakes and ponds in the area; (2) large supplies of ground water are available at several places within the valley and this water is generally soft and of excellent quality for domestic and industrial use, though of greater hardness in limestone areas; and (3) the largest stream and source of surface water within the valley is highly polluted and not fit for human consumption without treatment.

ACKNOWLEDGMENTS

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PRECIPITATION

An average of about 46 inches of precipitation, amounting to an estimated 420 billion gallons of water, falls on the basin in a single year placing the basin in the humid class. Even so, the residents of the basin sometimes lack the 9.5 billion gallons that are needed yearly. Roughly 47 percent of the precipitation is lost to evapotranspiration. The remainder runs off in the Housatonic River or collects in reservoirs, lakes, and ponds.

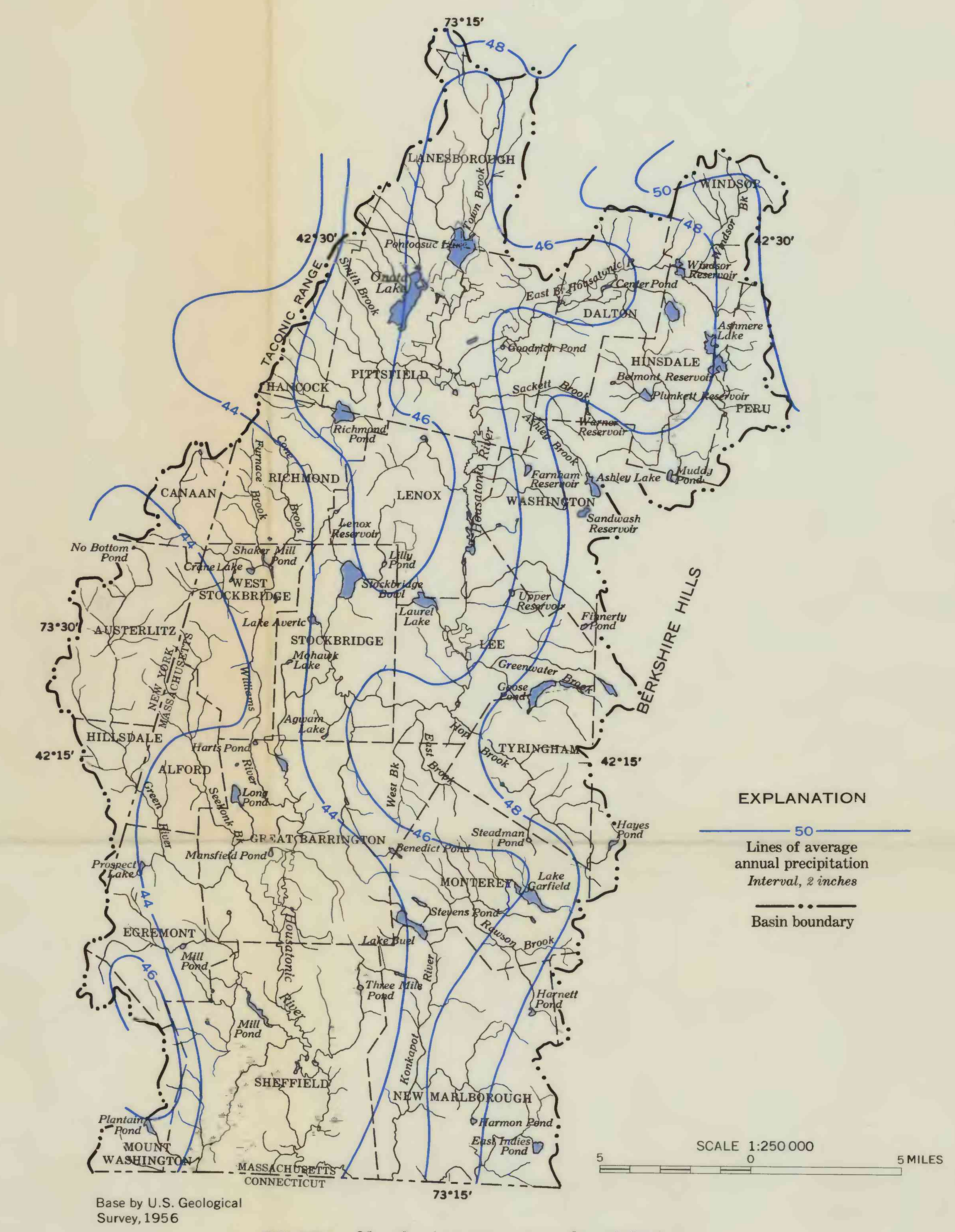


FIGURE 3.—*Map showing average annual precipitation*

The rugged topography of the basin (see figure 2) has a definite effect on the areal distribution of the precipitation; however, the relief is not great enough to create rain shadows in the area. The pattern of precipitation is shown on figure 3.

Normal monthly precipitation at Pittsfield is illustrated in figure 4 which shows a more or less even distribution throughout the year. This usually provides ample water for storage and for vegetation during the growing season.

A drought condition existed in the basin from 1961 to 1966. At Pittsfield Weather Bureau station precipitation was about 75, 66, 71, and 64 percent of normal during the years of 1961-64, respectively. To evaluate this drought according to the seasonal distribution, monthly precipitation values have been averaged for the period 1961-64 for the Pittsfield station; they are:

Storage period				
Dec.	Jan.	Feb.	Mar.	Apr.
3.02	2.56	2.16	2.24	3.02

Growing period			
May	June	July	Aug.
2.10	2.82	2.90	3.04

Replenishment period		
Sept.	Oct.	Nov.
2.12	1.52	3.23

The sum of these average figures is 10.86 inches for the growing period, 6.87 inches for the replenishment period, and 13.0 inches for the storage period. In contrast, the normal precipitation for the same periods is 16.94 inches for the growing period, 11.66 inches for the replenishment period, and 15.82 inches for the storage period.

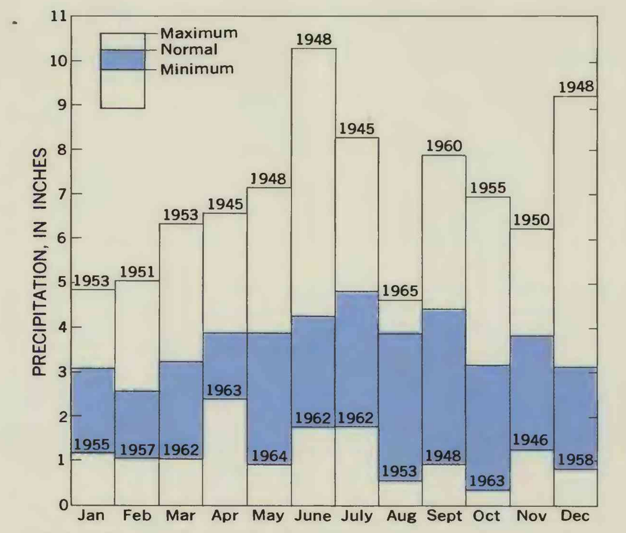


FIGURE 4.—*Graph showing minimum, normal, and maximum precipitation at Pittsfield for the years 1944-65 (normal based on period 1931-60)*

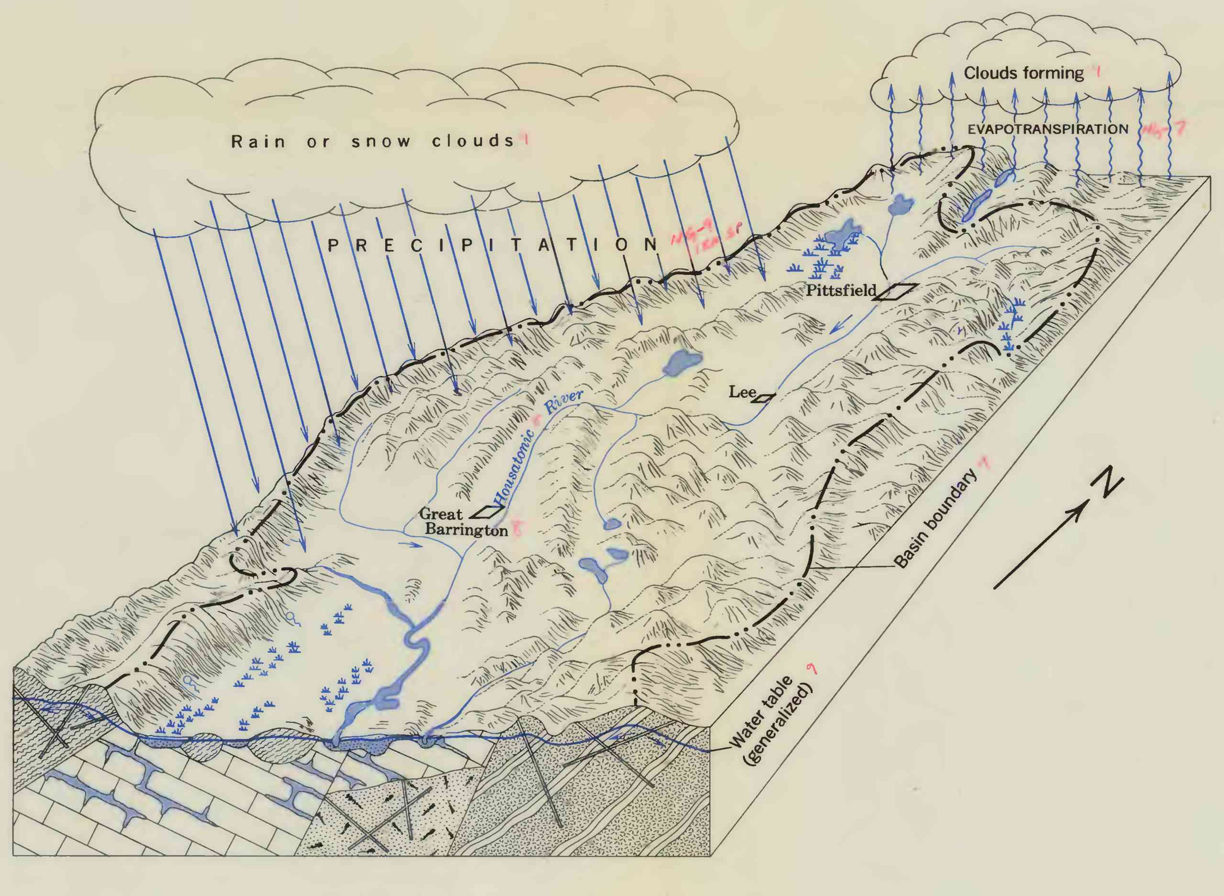


FIGURE 2.—*Block diagram showing the hydrologic cycle and a generalized section of ground-water occurrence*

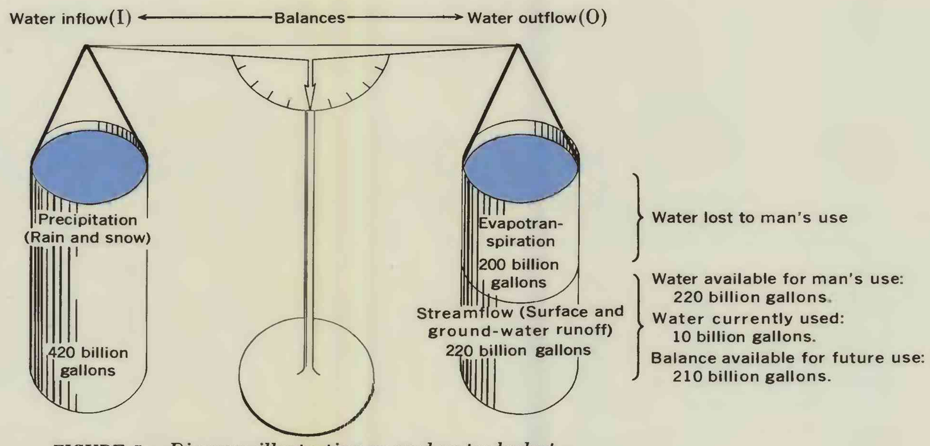


FIGURE 5.—*Diagram illustrating annual water budget*

PRESENT WATER DEVELOPMENT

The water budget (figure 5) balances inflow and outflow in the basin, with allowances for changes in storage. Stated as an equation, it is simply:

$$\text{Inflow (I)} = \text{Outflow (O)}.$$

The surface-water divides largely coincide with the ground-water divides depicted on the block diagram in figure 2, hence all inflow is measured as precipitation. Outflow from the basin includes streamflow, evaporation, transpiration, and subsurface flow (see figure 2). Changing items in the budget, either plus or minus, include ground-water storage, surface-water storage, soil moisture, and human consumption. In an average annual budget the changing items excepting human consumption probably average out each year and, thus, need not be considered. Water use by man, exclusive of papermill use, amounts to about 2 percent of the total precipitation. Papermills use a large but undetermined amount of surface water. Most of this combined usage returns to the streams and the ground, so it is not a significant part of the budget. Most of the subsurface flow occurs in a relatively narrow strip of valley-fill sediments at the State line. These sediments generally are fine grained and the hydraulic gradient at the State line is slight; therefore, underflow out of the basin is negligible in relation to the total volume of outflow. Therefore, the simplified average annual budget, stated as an equation is:

$$\text{Precipitation(P)} = \text{Streamflow(SF)} + \text{Evapotranspiration(ET)}.$$

The first two elements of the above equation are measured; the third element can be computed. The average annual budget for the basin is thus:

$$420 \text{ billion gallons (P)} = 220 \text{ billion gallons (SF)} + \text{evapotranspiration (ET), therefore ET} = 200 \text{ billion gallons.}$$

The budget shows that there is a tremendous volume of water moving through the basin annually; much more than probably ever will be needed in this area.

AVERAGE ANNUAL WATER BUDGET

An average of about 26 million gallons of water was used daily in the basin in 1964. This includes water from municipal supplies and industrial ground-water sources. It does not include the large amount of water taken directly from streams and lakes for papermill use. Ground water from wells and springs makes up about 36 percent of the total use.

The areal distribution of the major water usage in the basin is shown on the water use map. Table 1 lists the volumes of selected reservoirs, lakes, and ponds in the basin. The combined usable capacity of these reservoirs is about 6.9 billion gallons. From this seemingly large reservoir storage about 6 billion gallons is pumped yearly for municipal use.

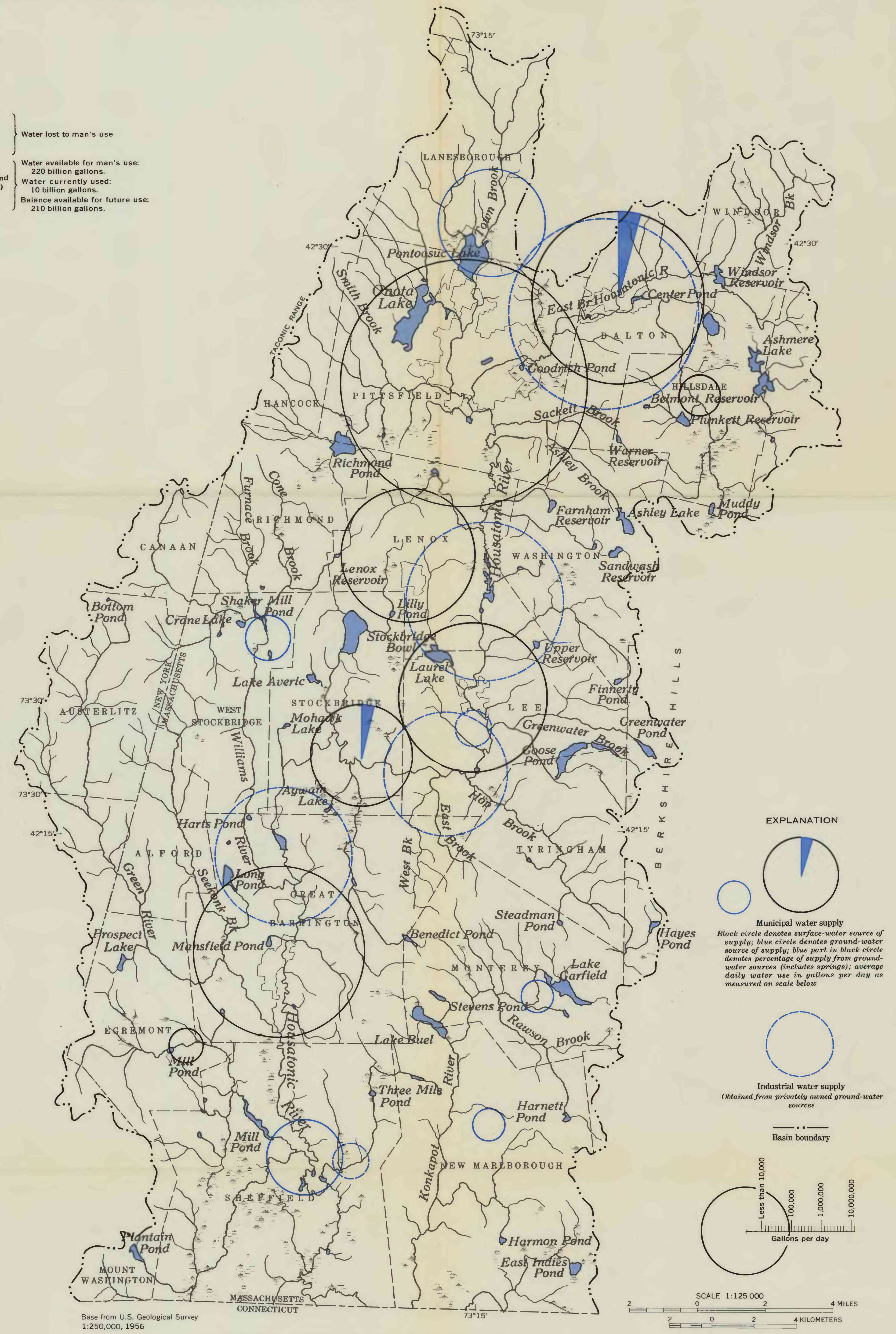
Fortunately the basin has at least 13 billion additional gallons of water in its larger lakes and ponds. This water might be used in extremely critical times but not without some problems involving prior rights, public health considerations, and distribution problems. In dry years, these additional sources also may be low.

TABLE 1.—*Selected reservoirs, lakes, and ponds*

(One million gallons or more usable capacity)
Use: I, Industrial; M, municipal; R, recreation

Name of reservoir and selected lakes and ponds	Total volume (millions of gallons)	Usable storage capacity (millions of gallons)	Use
Becket			
Greenwater Pond	663	–	R
Dalton			
Egypt Brook	–	8	M
Windsor	–	100	M
Egremont			
Prospect Lake	108	–	R
Great Barrington			
East Mountain	–	5	M
Long Pond	–	325	M
Mansfield Pond	78	–	R
Hinsdale			
Belmont	–	35	M
Cleveland Brook[1]	–	1500	M
New Sackett[1]	–	147	M
Plunkett	215	–	R
Ashmere Lake	480	–	R
Lee			
Goose Pond	2130	–	I,R
Lahey	–	240	M
Laurel Lake	1239	–	I,R
Lenox			
Lower Root	–	65	M
Upper Root	–	65	M
Monterey			
Benedict Pond[2]	64	–	R
Lake Buel	667	–	R
Lake Garfield	1269	–	R
New Marlborough			
East Indies Pond	115	–	R
Harmon Pond	96	–	R
Otis			
Hayes Pond	136	–	R
Pittsfield			
Onota Lake[3]	4267	3215	M,R
Pontoosuc Lake	2090	–	R
Richmond			
Richmond Pond[4]	940	–	R
Stockbridge			
Lake Averic	–	119	M
Lake Mahkeenac	3094	–	R
Washington			
Ashley Lake[1]	–	360	M
Farnham[1]	–	420	M
Sandwash[1]	–	348	M
West Stockbridge			
Crane Lake	103	–	R

[1] In Pittsfield watershed area
[2] Half of pond in Great Barrington
[3] Used as emergency water supply
[4] Half of pond in Pittsfield



MAP SHOWING AVERAGE DAILY WATER USE

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HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS

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