Water Resources of the Utica-Rome Area New York

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1499-C

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By H. N. HALBERG, O. P. HUNT, *and* F. H. PAUSZEK

WATER RESOURCES OF INDUSTRIAL AREAS

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WATER RESOURCES OF THE UTICA-ROME AREA, NEW YORK

By H. N. Halberg, O. P. Hunt, and F. H. Pauszek

ABSTRACT

The Utica-Rome area is along the Mohawk River and New York State Erie (Barge) Canal about midway between Lake Ontario and Albany. It encompasses about 390 square miles centered around the industrial cities of Utica and Rome.

The Mohawk River, its tributary West Canada Creek, and a system of reservoirs and diversions to maintain the flow in the barge-canal system, assure an ample water supply for the foreseeable needs of the area. The water from these sources is generally of good chemical quality requiring little treatment, although that from the Mohawk River is only fair and may require some treatment for sensitive industrial processes. Additional surface water is available from smaller streams in the area, particularly Oriskany and Sauquoit Creeks, but the water from these sources is hard, and has a dissolved-solids content of more than 250 ppm (parts per million). Ground water is available in moderate quantities from unconsolidated sand and gravel deposits in the river valleys and buried bedrock channels, and in small quantities from bedrock formations and less permeable unconsolidated deposits. The quality of water from sand and gravel, and bedrock ranges from good to poor. However, where necessary, the quality can be improved with treatment.

The Mohawk River is the source of the largest quantity of water in the area. The flow of the stream below Delta Dam equals or exceeds 108 mgd (million gallons per day) 90 percent of the time, and at Little Falls it equals or exceeds 560 mgd 90 percent of the time. The flow between these two points is increased by additions from Oriskany, Sauquoit, and West Canada Creeks and from many smaller tributary streams. The flow is also increased by diversions from outside the area, from the Black and Chenango Rivers and West Canada Creek for improvement of navigation in the Erie (Barge) Canal, and from West Canada and East Branch Fish Creeks for the public supplies of Utica and Rome. Much of the public-supply water eventually reaches the river by way of sewerage and industrial waste-disposal systems. The total diversion from these sources averages more than 92 mgd. An estimated 18.5 mgd is withdrawn from the Mohawk River by industry, mostly for nonconsumptive uses.

Floods in the Utica-Rome area are not a frequent problem owing to the use of regulatory measures. The major streams fluctuate through a narrow range in stage and generally only a narrow strip along the streams is subject to flooding.

Water-bearing sand and gravel deposits in the major river valleys are the principal sources of ground water, especially where they are recharged by infiltration from streams. The most important potential source is the deposit of sand and gravel underlying the extensive plain adjacent to the Mohawk River between Delta Reservoir and Rome. Maximum sustained yields from these deposits are not known; but moderate quantities of water, 300 gpm (gallons per minute) or less from a single well, can probably be obtained from some parts of the sand plain area, particularly in the vicinity of a buried bedrock channel that extends southwestward from Delta Reservoir. Similar quantities of ground water probably can be withdrawn from some parts of the flood plain of the Mohawk River between Rome and Frankfort and from the sand and gravel deposits filling the valley of Ninemile Creek below Holland Patent. The deposits underlying the flood plain of the Mohawk River generally are fine grained but in places contain interstratified beds of coarser sand and gravel. The most productive part of the flood plain is at the east end near Frankfort. The deposits in Ninemile Creek valley also are generally fine grained; but where they are sufficiently thick, as over a buried bedrock valley southwest of Floyd, moderate quantities of water may be obtained.

Small to moderate quantities of water (150 gpm or less from a single well) can be obtained from sand and gravel deposits in the bottoms of Oriskany and Sauquoit Creek valleys, especially where the materials are coarse grained and are connected hydraulically with the streams. Small quantities of water (20 gpm or less from a single well) can be obtained from smaller areas of sand and gravel filling minor channels carved in the bedrock of the uplands and from some of the bedrock formations.

The depth to water in most wells in the Utica-Rome area ranges from 5 to 50 feet below the land surface. In general the water table is closer to the surface in the valley bottoms than in the uplands or along the sloping valley sides, where not otherwise affected by differences in geologic or hydrologic conditions. The water table is nearly flat in the flood plain of the Mohawk River and stands generally only slightly higher than the adjacent river.

The amount of water used in the area is not large. The estimated average withdrawal was about 48.5 mgd in 1954. Of this, industry used the largest amount, requiring 60 percent or about 29 mgd. About one-third of the water used by industry was self supplied, the remainder was purchased from public water systems. Of the 48.5 mgd withdrawn, about 27.4 mgd was supplied by municipally owned systems, and 21.1 mgd was obtained from private sources. About 96 percent of the total was taken from surface sources, and 4 percent was drawn from ground-water sources. All the water for municipal supply and most of the water for industry was drawn from surface sources. The uses of water in this area are mostly nonconsumptive, and they cause little depletion of the supply. However, practically all withdrawal uses add dissolved solids or suspended matter to the water and decrease its usefulness for some purposes.

INTRODUCTION

The development of the water resources of the Utica–Rome area, to meet the increasing demands of municipal and industrial expansion, requires a knowledge of the occurrence and use of water. Information is required about sources of water, quantity available, chemical and physical quality, amount used, effect of use on the quantity and quality, and magnitude and frequency of floods.

The purpose of this report is to summarize the available data on the water resources of the area and to express them in general terms. The report should be useful for initial guidance in the planning of water-supply facilities by pointing out the sources of water, by describing their quantity and quality, and by giving ground-water and flood levels. It is not within the scope of this report to provide solutions for all possible water problems that may arise owing to the establishment of new industries within the area, use of new processes within individual industries, and shifts and trends in population. Each individual problem may require its own detailed investigation and design study. The information contained in this report will serve as a foundation for individual studies and appraisals of local water potential.

Most of the basic data summarized in this report were collected over a period of years by the U.S. Geological Survey as part of programs conducted cooperatively with the New York State Departments of Commerce, Conservation, Health, and Public Works, and the New York Water Power and Control Commission. Thanks are due many individuals, well drillers, public officials, and industries for furnishing information from their files and for granting permission to the Geological Survey for the collection of field data at their installations. The authors especially wish to acknowledge the courtesy and cooperation of Mr. L. J. Griswold, chief engineer, Board of Water Supply, City of Utica, and Mr. Ralph Hadlock, Associate County Agricultural Agent, New Hartford.

The report was prepared by H. N. Halberg, under the supervision of G. C. Taylor, Jr., district geologist; O. P. Hunt, under the direct supervision of A. W. Harrington, district engineer; and F. H. Pauszek, district chemist. R. V. Cushman was responsible for staff coordination, under the general supervision of C. C. McDonald, Chief, General Hydrology Branch.

LOCATION AND EXTENT OF AREA

The area covered by this report is along the Mohawk River and Erie (Barge) Canal, about midway between Lake Ontario and Albany. It encompasses about 390 square miles and includes the highly industrialized centers of Utica and Rome and the smaller industrial and rural communities south and north of these two cities (pl. 1). The area includes Floyd, Kirkland, Marcy, New Hartford, Utica, Westmoreland, and Whitestown, and parts of Deerfield, Rome, and Trenton in Oneida County, and Frankfort and Schuyler in Herkimer County.

PHYSICAL FEATURES

The Utica–Rome area is partly within the Mohawk valley lowland and partly in the north-central margin of the Allegheny plateau. The major topographic features are the valley of the Mohawk River trending northwest-southeast across the central part of the area, the prominent upland front of the Allegheny plateau south of the river, and the rolling upland plateau north of the river. These major features are largely the result of differential erosion of the underlying sedimentary rocks.

The Mohawk valley was carved out of the underlying soft Utica shale by preglacial and glacial streams. It is now partly filled with clay, sand, and gravel deposited during the earlier formative stages of the Great Lakes. These deposits underlie the modern flood plain of the river and form the conspicuous terraces that flank the flood plain, such as those in the part of the valley between Marcy and Oriskany. The plain is about 1 mile wide in the stretch between Rome and Frankfort. The plain also extends west of Rome where it is much wider. The flanking terraces are continuous with the valley fill in the lower reaches of Ninemile, Oriskany and Sauquoit Creeks and were formed during the outflow of higher stages of the glacial Great Lakes. The surface deposits throughout the valley consist of sand and gravel with some silt and clay.

The northern front of the plateau south of the Mohawk valley rises abruptly from the inner edges of the sand and gravel terraces at an altitude of about 600 feet to summit altitudes of 1,380 feet near the southern border of the area. The bedrock is exposed in the deeply cut tributary valleys and along the steeper upland slopes. The plateau is underlain by more resistant sedimentary rocks consisting predominantly of limestone, dolomite, shale, and sandstone with several intercalated beds of iron ore. The north-facing slope is deeply dissected by two large northward-flowing tributaries of the Mohawk River, Oriskany and Sauquoit Creeks.

The rolling plateau north of the river slopes gently from an altitude of 1,300 feet southward to an altitude of about 600 feet along the Mohawk River. It is underlain by the Utica and Frankfort shales, the latter being the more resistant and capping the higher hills. The plateau surface is scarred deeply by West Canada and Ninemile Creeks and several other smaller tributaries of the Mohawk River, exposing the underlying shale beds. Elsewhere in the upland area the bedrock is covered by a veneer of ground moraine (till).

The area is drained by the Mohawk River except the westernmost part, which is drained by the Oswego River, through Wood Creek and the drainage west of Rome (pl. 1). The Mohawk River enters the area north of Rome and flows in a meandering path through the central part of the Utica-Rome area to the eastern edge at Frankfort. Within this reach it has a fall of only about 40 feet and within its wide flat valley is most of the industry in the area. In places some of the river water is diverted by the Erie (Barge) Canal, which parallels its course from Rome to the eastern border of the area. The main tributaries of the Mohawk River within the area are Oriskany and Sauquoit Creeks, which enter from the south, and Ninemile Creek, which enters from the north. West Canada Creek forms the northeastern border of the area and enters the Mohawk River to the east. During the navigation season, Ninemile Creek carries water that is diverted from West Canada Creek basin to the Erie (Barge) Canal. Industrial development has occurred primarily along the Mohawk River and to the south along Oriskany and Sauquoit Creeks.

SOURCES OF SURFACE WATER

The water resources of the Utica-Rome area are its most important natural resource. The Mohawk River and its larger tributaries, Oriskany, Sauquoit, and West Canada Creeks, are the important sources of water in the area and assure an ample supply of good or improvable quality for all foreseeable needs. Additional surface water is obtained outside the area from East Branch Fish Creek in the Lake Ontario basin.

MOHAWK RIVER

The Mohawk River is formed by the confluence of its east and west branches just north of the Utica-Rome area. About 9 miles downstream from this point it enters and flows through Delta Reservoir, the lower or outflow end of which is just within the report area (pl. 1). Immediately south of Rome, the Mohawk River is intersected and crossed by the Erie (Barge) Canal, Division of the New York State Barge Canal System. The flow of the Mohawk River is divided between an integrated canal and river system from Rome until the river becomes the canal at Frankfort just east of the report area. The canal is north of the river and parallel to it, receiving the water from all tributaries to the north; the river receives the flow of tributaries to the south.

The Mohawk River is economically important to the thousands of people residing in the Utica-Rome area and to the State of New York. It supplies water for industrial use, recharges adjacent groundwater reservoirs, and provides a medium for sewage and waste disposal. An estimated 18.5 mgd is withdrawn from the river by industries in Rome and Utica for cooling and process purposes. Most of this water is returned to the river after use.

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The flow of the Mohawk River in the Utica-Rome area is regulated by the operation of Delta Reservoir and several diversions or feeders (Black River, Ninemile, and Oriskany Creek feeders) which bring water into the area in order to maintain a reasonably constant flow through the Erie (Barge) Canal during the canal operating season. Delta Reservoir was completed in 1912 and has a usable capacity of 21,000 million gallons. Water is diverted from the Black River at Forestport, about 11 miles northeast of the area, through Forestport feeder and Black River Canal (flowing south), into Delta Reservoir. Diversion for the 1953 water year averaged 16.6 mgd (25.7 cfs). (A water year begins on October 1 and ends on September 30, the dates selected to facilitate water studies.) Water also is diverted from the West Canada Creek basin at Trenton Falls through Ninemile feeder and reaches the Erie (Barge) Canal through Ninemile Creek about 7 miles northwest of Utica. Records of diversion through Ninemile feeder (navigation season only) have been collected by the Geological Survey since 1919 at a gaging station near Holland Patent. The amount of diversion depends upon requirements for navigation. For example, during the 1938 and 1948 canal seasons, there was no diversion; from June 15 to December 8 of the 1953 canal season, the diversion averaged 38 mgd (59.2 cfs). The maximum diversion occurred from April 28 to October 30 of the 1941 canal season when the flow averaged 101 mgd (156 cfs). The canal season usually begins about mid-April and ends about December 1. Oriskany Creek feeder diverts water from the upper Chenango River basin into Oriskany Creek near Solsville. No record is available of the amount of the diversion. Water occasionally may be received from the Oswego River basin through the summit level of the Erie (Barge) Canal near Rome.

The flow of the Mohawk River in the Utica-Rome area also is increased by diversions for the public water supplies of Utica and Rome which reach the river by way of public sewer and industrial waste-disposal systems. The amounts of these diversions are discussed under public water-supply systems. Figure 1 shows where water is diverted to the area and indicates the average amount of diversion in 1953 where records are available.

The flow of the Mohawk River is measured at gaging stations below Delta Dam, where the river enters the area, and below Rocky Rift Dam near Little Falls, about 19 miles east of the area. (See pl. 1; fig. 2, and table 1.) The New York State Department of Public Works also obtains records of stage at each lock in the Erie (Barge) Canal system.

The flow of the Mohawk River at the gage below Delta Dam is completely regulated by Delta Reservoir except during periods of

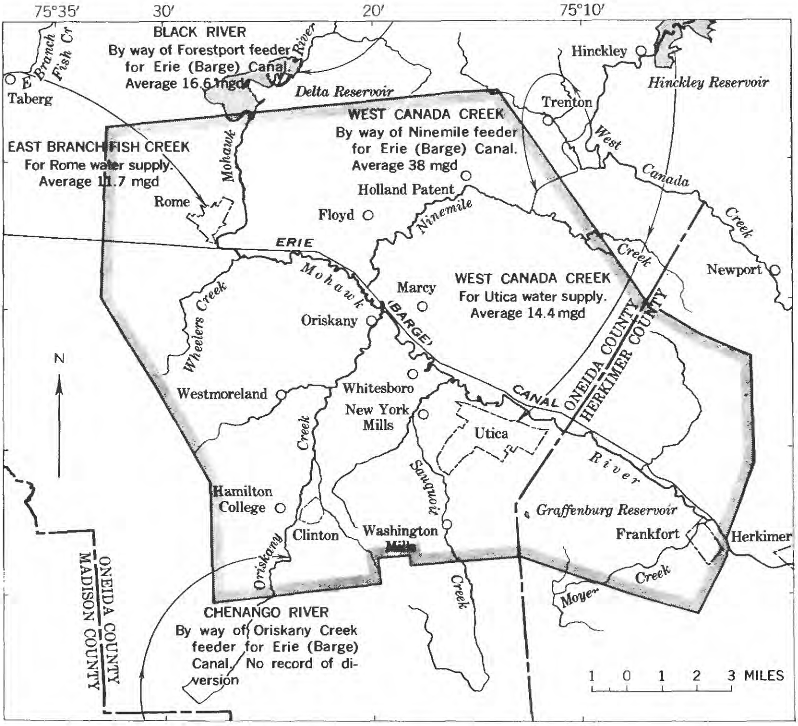

FIGURE 1.—Outline map showing location and amount of major diversions of water into the Utica-Rome area, 1953.

spilling. The pattern of regulation remained practically unchanged during the time records were collected, so that all records at this station represent conditions under the present pattern of diversion and storage. Average observed discharge for the 32-year period 1921–53 was 259 mgd (401 cfs). Observed monthly discharge (fig. 3) during this period ranged from a maximum of 1,034 mgd (1,600 cfs) to a minimum of 49.1 mgd (76 cfs).

The flow-duration curve, figure 4, shows the percentage of time the daily flow of Mohawk River below Delta Dam equaled or exceeded different quantities. For example, the curve indicates that the flow would be equal to or exceed 66 mgd (102 cfs) 99 percent of the time, and would be at least 108 mgd (167 cfs) 90 percent of the time. The flow would equal or exceed 259 mgd (401 cfs, average flow below Delta Dam) about 30 percent of the time. The flow during the summer and fall is maintained well above natural low-flow conditions in accordance with requirements for navigation.

No gaging stations are maintained on that part of the Mohawk River between Delta Dam and Little Falls and therefore no records of flow are available in the vicinity of Utica where the river leaves

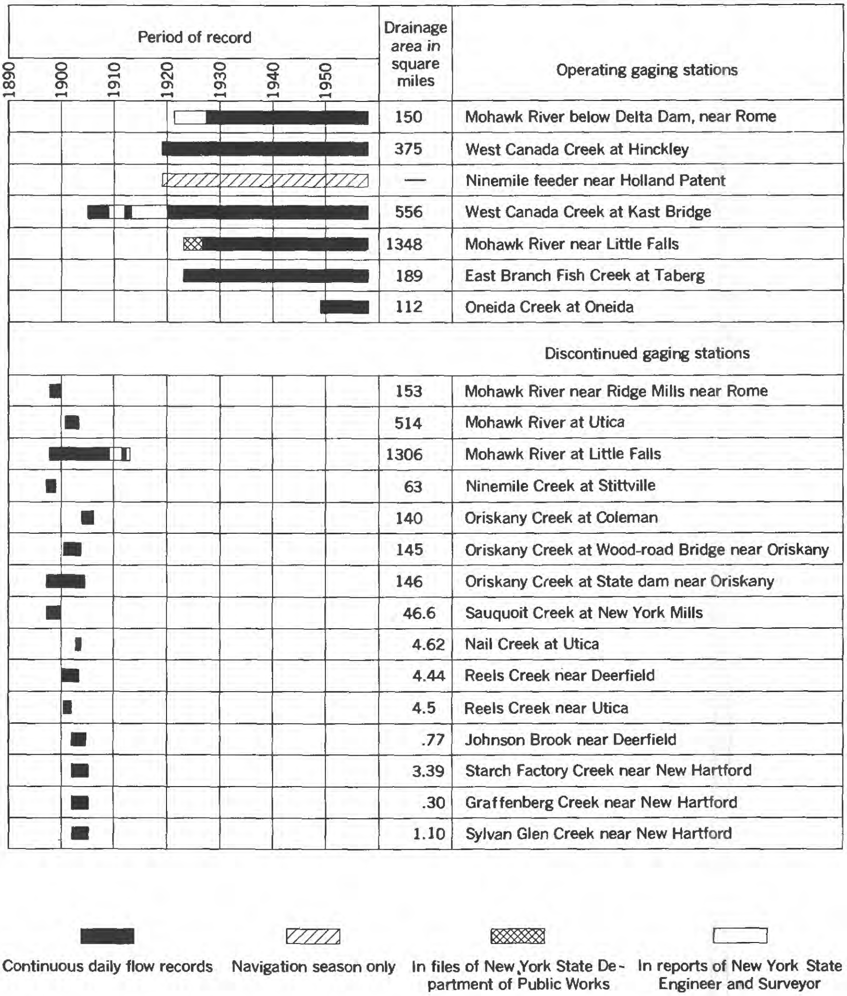

FIGURE 2.—Duration of streamflow records in the Utica-Rome area and vicinity.

the report area. However, records for the Mohawk River below Delta Dam and below Little Falls, together with records for West Canada Creek at Kast Bridge and Ninemile feeder near Holland Patent, have been used to synthesize a flow record for the Mohawk River above the mouth of West Canada Creek, a few miles east of the area. The record, as summarized in table 2, shows that monthly discharges ranged from 4,074 mgd (6,304 cfs) to 202 mgd (312 cfs). The flow-duration curve (fig. 4) represents probable flow conditions above the mouth of West Canada Creek and shows that the discharge would be equal to or greater than 170 mgd (263 cfs) 99 percent of the time and at least 248 mgd (384 cfs) 90 percent of the time.

TABLE 1.—*Summary of streamflow data*

Gaging station	Drainage area (sq mi)	Elevation of gage (feet above mean sea level)	Period of record	Average flow		Maximum flow			Minimum daily flow		Remarks
				Quantity (mgd)	Years	Quantity (mgd)	Gage height (feet)	Date	Quantity (mgd)	Date	
Mohawk River below Delta Dam.	150	474.00	Dec. 1, 1919, to Sept. 30, 1953.[1]	[2] 259	32	5,530	11.18	Oct. 2, 1945	29	Jan. 17, 1931	Regulated.
Mohawk River near Little Falls.	1,348	310.00	Oct. 1, 1927, to Sept. 30, 1953.	1,815	26	[3] 16,400	17.80	Oct. 3, 1945	299	Sept. 2, 1934	Includes flow in Erie (Barge) Canal.
West Canada Creek at Hinckley.	375	1,134.00	June 14, 1919, to Sept. 30, 1953.	[2] 648	34	11,100	11.45	Oct. 2, 1945	48	Aug. 31, 1919	
West Canada Creek at Kast Bridge.	556	438.99	Oct. 1, 1920, to Sept. 30, 1953.[4]	868	33	13,200	8.08	Oct. 2, 1945	38	Sept. 2, 1929	
East Branch Fish Creek at Taberg.	189	490.12	Apr. 1, 1923, to Sept. 30, 1953.	[2] 354	30	8,790	10.90	Oct. 2, 1945	[2] 3.4	Aug. 15–17, 1949	Diversion above gage by cities of Oneida and Rome for water supply.

[1] December 1919 to September 1926 from reports of State engineer and surveyor. Gage-height readings only prior to July 1921.
[2] Unadjusted.
[3] Flow in river channel only.
[4] Additional records available May 1905 to December 1909 (1905–06, gage heights and discharge measurements only), January 1912 to December 1913.

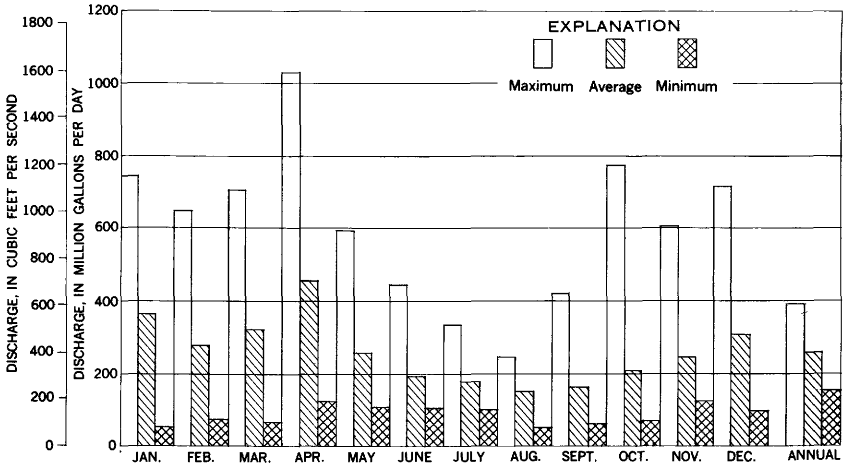

FIGURE 3.—Maximum, average, and minimum monthly and annual observed discharge of the Mohawk River below Delta Dam, near Rome, 1921–53.

Records of daily flow of the Mohawk River near Little Falls include diversion at Rocky Rift Dam into the Erie (Barge) Canal for power and lockage at lock 16, near St. Johnsville. The average flow for the 26-year period 1927–53 was 1,815 mgd (2,808 cfs).

Monthly flows during this period, as shown in table 2, ranged from 7,749 mgd (11,990 cfs) to 415 mgd (642 cfs). The minimum daily flow during 1927–53 was 299 mgd (463 cfs) on September 2, 1934.

The flow-duration curve, figure 4, defines the flow characteristics of the Mohawk River at the Little Falls gaging station. The curve indicates that there will be a flow of at least 400 mgd (619 cfs) available 99 percent of the time, and at least 560 mgd (866 cfs) 90 percent of the time. Discharges during summer and fall are maintained well above natural low flows by regulation of Delta Reservoir and of Hinckley Reservoir on West Canada Creek.

Floods on the Mohawk River have not caused much damage in the Utica-Rome area in recent years because of regulation by storage in Delta Reservoir and closing of head gates in feeder canals. They are discussed briefly, however, because the records are useful in design of intake structures and docks and in locating building sites in areas of potential flooding. The floods in this area are most likely to occur during March, April, and May, although the greatest flood of record in the upper Mohawk River basin since the completion of the Erie (Barge) Canal and storage reservoirs about 1918 was the flood of October 2, 1945. Other large floods during this period occurred in March 1936 and April 1950. Fragmentary records indicate that

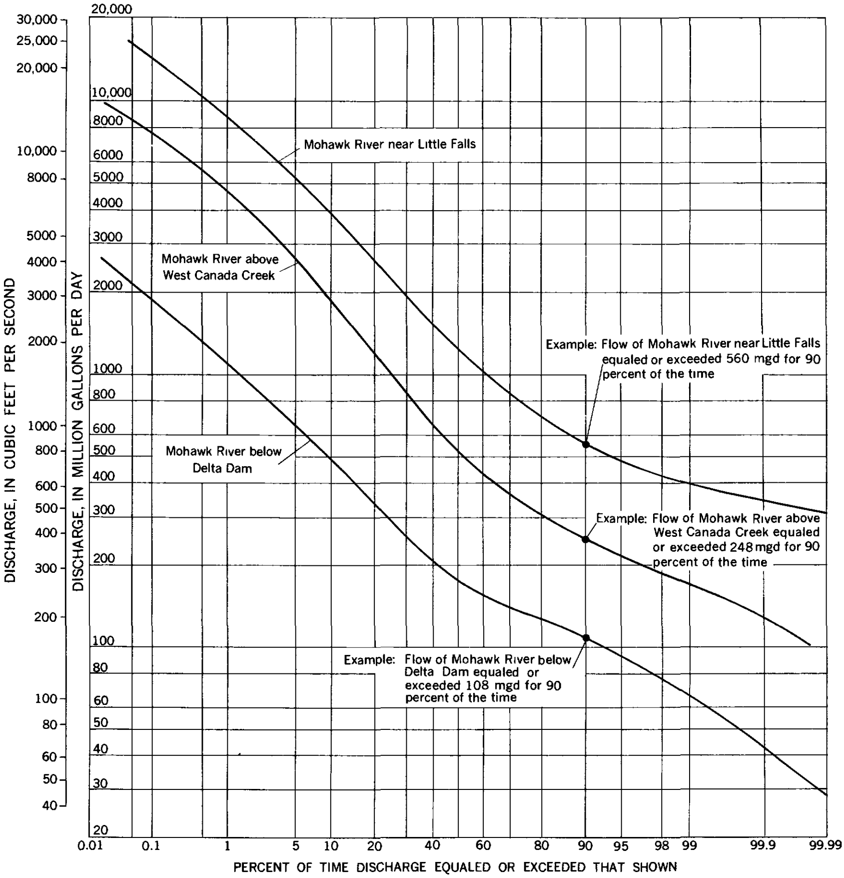

Figure 4.—Duration curve of daily flow, Mohawk River below Delta Dam, above West Canada Creek, and near Little Falls, 1928–53.

greater floods than the 1945 flood occurred in 1901, 1902, 1904, and 1913, and that the greatest flood known occurred in the 1860's.

The profile of the water surface of the flood of October 1945 for the stretch of river between Delta Dam and Hanson Avenue Bridge at Little Falls (outside the area) is shown in figure 5. Also shown are the profiles of the floods of March 1936 and April 1950 for the stretch of river between Oriskany Bridge and Hanson Avenue Bridge in Little Falls. The peaks of the 1945 flood were reduced materially by storage in the reservoirs in the upper Mohawk River basin even though the latter were nearly full on October 1, 1945, as the result of heavy rainfall in September. For example, the peak flow of the Mohawk River above Delta Reservoir was computed as 10,300 cfs at the town of North Western (from a drainage area of 77.7 sq mi) and

TABLE 2.—*Maximum, minimum, and average monthly and annual discharges, in million gallons per day, in the Mohawk River basin, 1928–53*

Gaging station	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Mohawk River above West Canada Creek (697 sq mi):													
Maximum	2,303	1,819	3,272	2,682	1,932	1,361	979	781	4,074	1,935	1,651	1,932	1,283
Minimum	202	225	259	527	379	253	214	223	219	219	213	202	492
Average	1,103	931	1,614	1,755	838	495	446	348	538	505	752	883	855
Mohawk River near Little Falls (1,348 sq mi):													
Maximum	4,595	3,420	6,177	7,749	5,092	3,283	2,437	1,552	1,947	4,220	3,316	4,007	2,581
Minimum	530	439	1,094	1,563	948	584	443	415	442	482	485	685	1,086
Average	2,274	1,870	3,262	3,859	2,192	1,116	964	750	833	1,132	1,628	1,932	1,815
West Canada Creek at Hinckley (375 sq mi):													
Maximum	1,428	1,113	1,506	2,191	2,457	1,357	975	659	611	1,459	1,267	1,234	860
Minimum	216	144	233	690	505	251	243	221	256	269	275	300	439
Average	649	584	806	1,364	1,032	476	416	367	365	492	606	620	648

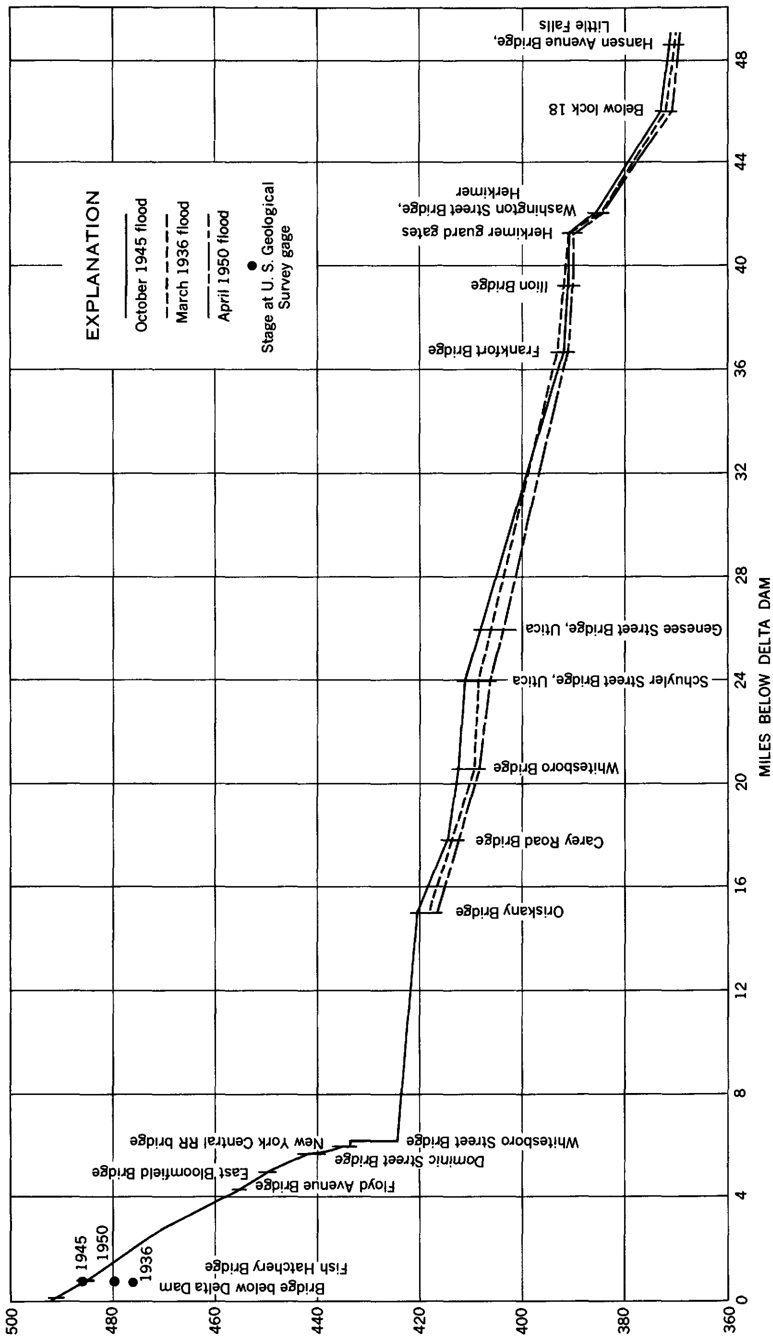

FIGURE 5.—Water-surface profile of selected floods on the Mohawk River from Delta Dam to Little Falls.

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the peak outflow from Delta Reservoir (from a drainage area of 145 sq mi) was only 8,560 cfs.

The chemical quality of the water of the Mohawk River in the Utica-Rome area is fair. Analyses of two water samples from the Mohawk River taken in January 1955 just below Delta Reservoir and at Utica 20 miles downstream showed an increase of dissolved solids from 84 to 195 ppm in the 20-mile stretch. The higher concentrations of dissolved solids reflect increases in concentrations of individual chemical constituents including calcium, magnesium, bicarbonate, and sulfate. As a result, hardness increased from 56 to 128 ppm. (Analyses are given in table 3.) The increases may be due in part to natural conditions, as the more mineralized water in Oriskany and Sauquoit Creeks joins the Mohawk River between the points sampled, and in part to an increase of industrial and municipal pollution which alter the chemical character of the water. Both domestic and industrial pollution in this area are reported by the New York State Water Pollution Control Board (1952).

Downstream from the Utica-Rome area, a station for daily sampling of the Mohawk River water was established near Little Falls in October 1956 and operated through September 1957. During this period, concentrations of dissolved solids and hardness fluctuated within a narrower range than at the locations in the Utica-Rome area (table 4).

The dissolved-solids content of water from the Mohawk River probably is low enough for many industrial uses. But for sensitive industrial processes requiring soft water that is low in dissolved solids, suitable treatment would have to be applied. The temperature of the Mohawk River water generally follows the same trend as the air temperature in the region. At the sampling station near Little Falls the water temperature fluctuated between 32° and 78° F from October 1, 1956, to September 30, 1957 (fig. 6). The daily water temperature generally changed less than 3° F between successive days. In some sections the temperature of the river water may be affected by the inflow of industrial wastes.

ORISKANY CREEK

Oriskany Creek is the first major tributary stream on the south side of the Mohawk River below Rome (pl. 1). It drains the north slope of the Allegheny plateau, rising in Oneida County at an altitude of 1,500 feet and entering the Mohawk River about 6 miles northwest of Utica at an altitude of 410 feet. The two-thirds of Oriskany Creek drains an area of relatively steep slopes underlain by bedrock covered with thin till deposits. The lower one-third, below Clinton,

TABLE 3.—*Chemical analyses of surface water in parts per million, at points in the Utica–Rome area*

Stream and location	Date of collection	Discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate HCO_3	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25° C)	pH	Color
East Branch Fish Creek at Taberg	Jan. 18, 1955	186	4.8	0.06	0.00	8.7	1.8	3.5		29	10	1.2	0.1	0.7	55	29	5	69.9	7.7	2
Do	Apr. 7, 1955	3,170	3.0	.09	------	5.2	1.2	.8		12	7.3	.2	.1	2.1	33	18	8	41.0	6.8	4
Mohawk River near Rome	Jan. 19, 1955	423	7.5	.09	.00	19	2.2	3.9		55	15	2.0	.1	1.5	84	56	11	127	8.0	5
Oriskany Creek near Oriskany	Jan. 17, 1955	143	9.0	.06	.00	79	20	6.2		239	82	3.5	.0	8.2	351	279	84	557	8.1	5
Do	Apr. 7, 1955	641	3.9	.06	.01	59	9.3	14		[1] 187	48	6.0	.1	5.2	287	185	32	402	8.4	5
Sauquoit Creek at New Hartford	Jan. 17, 1955	54.6	7.5	.15	.00	87	20	4.9		209	122	3.5	.0	8.3	380	299	128	579	8.2	3
Do	Apr. 7, 1955	366	5.4	.11	.00	60	9.1	11		[2] 172	56	4.0	.1	6.8	273	187	46	396	8.4	3
Mohawk River near Utica	Jan. 17, 1955	905	6.0	.23	.00	40	6.8	12		115	43	7.0	.0	5.9	195	128	34	309	8.2	4
West Canada Creek at Hinckley	Apr. 7, 1955	842	5.4	.10	.00	4.8	.3	4.4		9	12	.5	.1	2.1	38	13	6	40.7	7.0	5
West Canada Creek at Kast Bridge	Sept. 11, 1956	486	4.0	.18	.00	15	1.3	[3] 1.6		44	7.4	.8	.1	.7	61	43	7	93.9	6.8	22
Do	May 27, 1957	1,280	4.3	.07	.00	17	2.5	[4] 1.5		54	6.5	.6	.1	1.0	65	53	9	107	7.5	12

[1] Includes equivalent of 5 ppm CO_3.
[2] Includes equivalent of 3 ppm CO_3.
[3] Na, 1.1 ppm; K, 0.5 ppm.
[4] Na, 1.1 ppm; K, 0.4 ppm.

TABLE 4.—*Summary of chemical analyses, in parts per million, Mohawk River at Little Falls, October 1956 to September 1957*

Constituents	Minimum	Time weighted-average	Maximum
Silica (SiO_2)	4.2	6.4	11
Iron (Fe)	.05	.14	.38
Calcium (Ca)	27	31	38
Magnesium (Mg)	4.0	5.3	7.0
Sodium (Na)	4.1	5.7	7.6
Potassium (K)	1.1	1.3	1.7
Bicarbonate (HCO_3)	79	92	104
Sulfate (SO_4)	23	28	37
Chloride (Cl)	4.2	5.9	7.8
Fluoride (F)	.0	.1	.2
Nitrate (NO_3)	1.4	3.3	4.6
Dissolved solids	122	138	170
Hardness as calcium, magnesium ($CaCO_3$)	84	101	124
Oxygen consumed:			
Unfiltered	4	7	16
Filtered	2	4	5
Specific conductance (micromhos at 25°C)	163	231	314
pH	7.0	------	7.6
Color	3	9	17

drains a nearly flat valley in which thick deposits of sand and gravel overlie the bedrock. Below Clinton the creek furnishes water to several industries.

Water has been diverted into Oriskany Creek from the Chenango River basin through Oriskany Creek feeder at Solsville, about 8 miles outside the report area for more than 100 years. Incomplete records during 1954–58 indicate that the amount of water diverted averages about 6.5 mgd (10 cfs) during the summer months.

Although no gaging station is operated on Oriskany Creek, seven discharge measurements were made in 1954 and 1955 near Oriskany, where the drainage area is 145 square miles. These measured discharges were correlated with discharges of gaged streams in the vicinity and on this basis, with the pattern of feeder operation during 1954–55, approximately low-flow duration data were computed. Tabulated below are the results of these correlations:

Percentage of time discharge was equaled or exceeded	Mgd per square mile	Percentage of time discharge was equaled or exceeded	Mgd per square mile
50	0.50	80	0.25
60	.40	90	.19
70	.32	95	.16

Under the pattern of feeder operations during 1954–55, magnitude and frequency of annual low flows has been computed for this stream. These data, listed below, are also based on correlation methods using the regional low-flow frequency data for gaged streams in the vicinity.

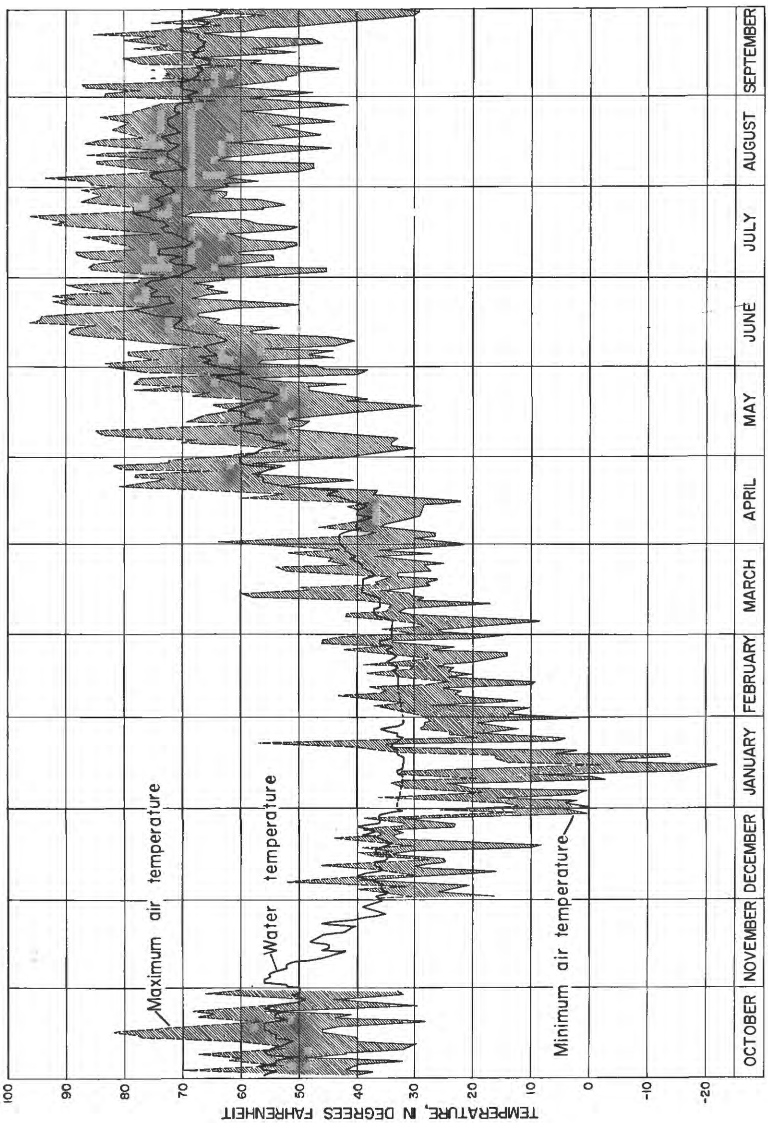

FIGURE 6.—Temperature of Mohawk River water and air at Little Falls, October 1, 1956, to September 30, 1957.

Recurrence interval (years)	*Annual minimum discharge (mgd)*	
	7-day	*30-day*
2	24.0	29.7
5	17.9	22.1
10	15.5	18.8
20	14.7	16.3

The chemical quality of the raw water from Oriskany Creek is poor. Two samples taken from the creek near Oriskany indicate a high concentration of dissolved solids, which originated probably from the solution of the several limestone formations underlying the area drained by Oriskany Creek and possibly from industrial wastes entering the stream above Oriskany. The water contains principally calcium, magnesium, bicarbonate, sulfate, and lesser amounts of other cations and anions. (See table 3.) As a result, the water is hard, with both temporary (carbonate) and permanent (noncarbonate) hardness being present. The latter is especially objectionable because it forms a hard scale in boilers. In industrial processes in which the water might be used for cleansing purposes, an objectionable scum would be formed by the reaction of calcium and magnesium with soaps. However, the quality can be substantially improved by treatment. The samples of January and April 1955 were taken at relatively low and high flows, 143 and 641 cfs, respectively, and the dilution effects of the higher flow can be noted in the generally lower content of included chemical constituents. Data on the water temperature of Oriskany Creek are not available; however, the temperature probably follows the characteristic cyclic seasonal trend of other streams in the area and averages about the mean air temperature of the region (48°F). The water temperature may be affected near the inflow of industrial and municipal wastes.

SAUQUOIT CREEK

Sauquoit Creek rises in Oneida County about 10 miles south of Utica at an altitude of 1,450 feet and flows nortwestward to enter the Mohawk River 2 miles northwest of Utica (pl. 1). It drains 61 square miles on the slope of the Allegheny plateau. The drainage basin is chiefly rolling farmland and contains many small villages. The largest village in the basin, New York Mills, near the mouth of the stream, had a population of 3,366 in 1950. Above New Hartford the valley is narrow and has relatively steep-sided bedrock walls. Below New Hartford it is flat and is underlain by deposits of sand and gravel.

Continuous discharge records have not been collected for this stream; however, from November 1954 to September 1955, seven discharge measurements were made of the base flow at New Hartford, where the drainage area is 43 square miles. The minimum discharge measured was 9.6 mgd (14.9 cfs) on September 20, 1955.

These discharge measurements were correlated with discharges of gaged streams in the vicinity and on this basis approximate low-flow characteristics were obtained for Sauquoit Creek. The following tabulation shows the probable flow in million gallons per day per square mile that would be equaled or exceeded for the selected percentages of time shown:

Percentage of time discharge was equaled or exceeded	*Mgd per square mile*	*Percentage of time discharge was equaled or exceeded*	*Mgd per square mile*
50	0.68	80	0.40
60	.57	85	.37
70	.49	90	.33
		95	.29

The magnitude and frequency of annual low flows at New Hartford were also determined by correlation with nearby gaged streams. The listing below shows for given average recurrence intervals what mean discharge for 1, 7, and 30 days can be expected to occur as the lowest of the year.

Recurrence interval (years)	*Annual minimum discharge (mgd)*		
	1-day	*7-day*	*30-day*
2	10.9	12.8	14.7
5	9.2	10.5	12.0
10	8.5	9.6	10.9
20	8.1	8.8	9.8

The chemical composition of water from Sauquoit Creek (table 3) is about the same as that from Oriskany Creek, as both creeks drain areas underlain by similar rock formations. Solution of limestone beds gives the water a relatively high mineral content. Analyses of two samples collected from Sauquoit Creek at New Hartford indicate that the water was slightly higher in dissolved mineral matter than water from Oriskany Creek and had a higher noncarbonate hardness.

WEST CANADA CREEK

West Canada Creek rises in the central Adirondack region, flows southwest through Hinckley Reservoir to a point about 6 miles below the reservoir (pl. 1) where it turns to flow southeast and south to join the Mohawk River at Herkimer. Above Hinckley Reservoir the creek drains an area of rugged topography underlain by crystalline bedrock. Below the reservoir the area drained is a gently sloping plateau underlain chiefly by sedimentary rocks. The main course of the stream in the latter area is confined to a narrow valley that is incised deeply into the underlying bedrock. Most of the drainage basin is outside the area considered in this report but the following discussion is included because of the diversions into the Utica-Rome area for public water supply and Erie (Barge) Canal operations and because the flow record was used in the computation of the previously mentioned synthetic record for the Mohawk River above the mouth of West Canada Creek.

Water is diverted from Hinckley Reservoir into the Utica-Rome area for the public supply of the city of Utica. The reservoir, which has a usable capacity of 25,000 million gallons, was completed in 1915 by the State of New York as a feeder reservoir for the Erie (Barge) Canal; but through acquisition of riparian rights on West Canada Creek prior to construction of the reservoir, the city of Utica has the right to divert about 50 mgd from Hinckley Reservoir. The present diversion for this purpose is about 14.4 mgd.

The flow of West Canada Creek has been gaged since June 1919 at Hinckley, 1 mile downstream from Hinckley Dam (pl. 1 and fig. 2). Discharge is completely regulated by Hinckley Reservoir, except for periods of spilling. Average discharge observed for the 34-year period 1919–53 was 648 mgd (1,002 cfs). Monthly discharges during this period ranged from 2,457 mgd (3,801 cfs) to 144 mgd (223 cfs); see tables 1 and 2. The minimum daily discharge during this period was 48 mgd (75 cfs) on August 31, 1919. Discharges during the summer and fall are maintained well above natural low flows in accordance with requirements for navigation.

The chemical quality of the water is excellent. The concentration of dissolved solids is low, generally less than 50 ppm. Calcium and magnesium comprise about one-tenth of the concentration of dissolved solids and the water is very soft. The concentrations of other cations and anions are low and have no significance insofar as the utility of the water is concerned. (See analysis in table 3.)

Moderate increases in the overall mineral content and the hardness from the quality at Hinckley have been noted at Kast Bridge about 20 miles downstream from the reservoir and 4 miles upstream from the confluence with the Mohawk River (table 3). Such increases probably have resulted from the solution of the underlying dolomitic limestone formations that form the creekbed below the reservoir. The chemical character of the water, however, remains excellent and the water is suitable for most purposes.

EAST BRANCH FISH CREEK

East Branch Fish Creek drains a large area of the Tug Hill plateau in Lewis and Oneida Counties and flows southward into Oneida Lake by way of Fish and Wood Creeks. The area drained is outside the Utica-Rome area as considered in this report (pl. 1), but the stream is discussed here because it is the source of the public water supply for the city of Rome. Above Taberg the creek drains an area underlain by exposed shale bedrock and generally poorly sorted fine-grained surficial deposits. Below Taberg the surficial deposits are stratified and coarse grained.

Water diverted from East Branch Fish Creek above Taberg into the Utica-Rome area by the city of Rome for public supply, reaches the Mohawk River as sewage effluent. Figure 7 shows the annual diversion by water years during 1924–58 and indicates a large increase in water use during the war-emergency years. The minimum average diversion of 8.2 mgd (12.7 cfs) occurred in the 1931 and 1932 water years; the maximum, 15.1 mgd (23.3 cfs), occurred during the 1948 water year.

Discharge records for East Branch Fish Creek at Taberg (drainage area, 189 square miles) have been collected since 1923 (fig. 2). Average observed discharge for the 35-year period 1923–58 was 351 mgd (543 cfs). The minimum observed daily discharge during the same period was 3.4 mgd (5.2 cfs) on August 14–17, 1949. Average diversion for water supply by the cities of Oneida and Rome for the 35-year period was about 13.6 mgd (21 cfs).

The flow characteristics, after diversion for water supply by the cities of Oneida and Rome, are shown by a flow-duration curve (fig. 8). This curve is based on observed discharges for the period October 1, 1923, to September 30, 1958. The curve shows the approximate quantity of water available for further development and can be useful in the solution of many design problems. For example, if a flow of 13 mgd (20 cfs) is required for industrial use, this quantity of water would be available about 99 percent of the time with present diversions (fig. 8).

The 7-day low-flow frequency curve for East Branch Fish Creek at Taberg (fig. 9) gives the average intervals at which a specified average consecutive 7-day discharge may be expected to recur as the lowest in the climatic year, April 1 to March 31. For example, under the pattern of diversion and climatic conditions that existed during 1923–58, an average consecutive 7-day flow of 13 mgd (20 cfs) has occurred on an average of every 5.8 years.

This curve of low-flow frequency and the flow-duration curve in figure 8 represent the observed flow at Taberg that occurred 1923–58, which was affected by variation in the amount and pattern of diversion. In view of the changing pattern of diversion, these curves can be used only to determine approximate future flow.

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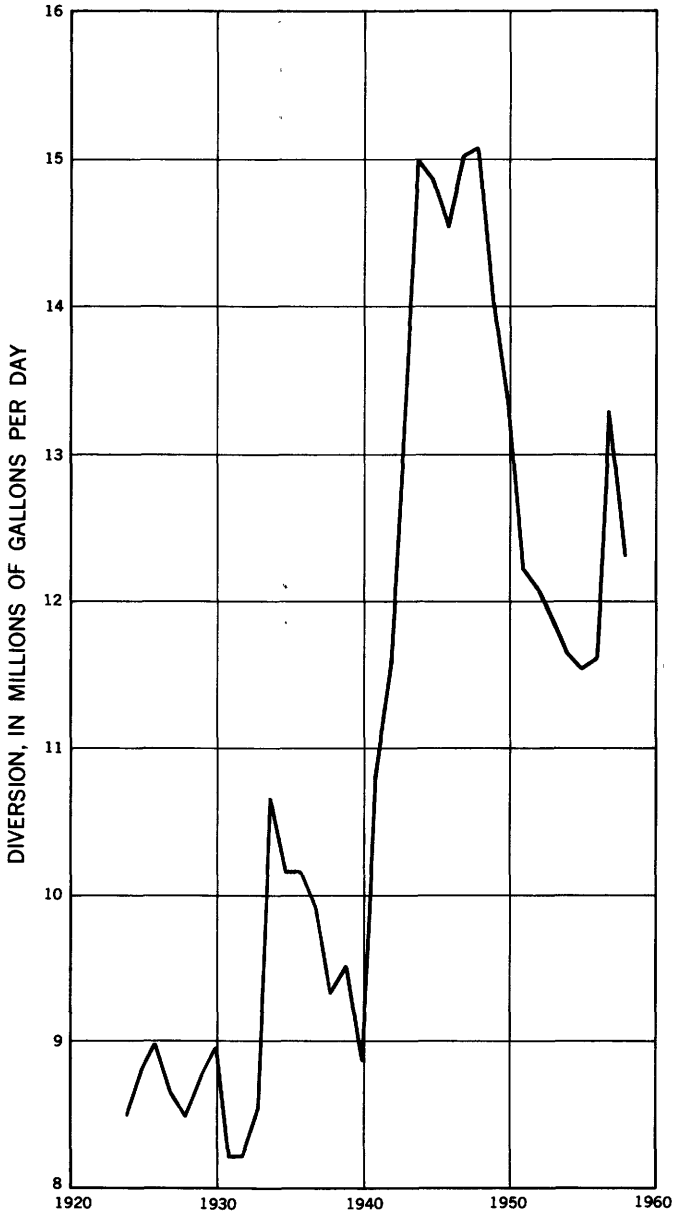

Figure 7.—Annual diversion by the city of Rome from East Branch Fish Creek, 1924–58.

The chemical quality of water samples from the East Branch Fish Creek taken at periods of low flow and high flow is available. (See table 3.) The chemical quality is excellent. Only moderate amounts

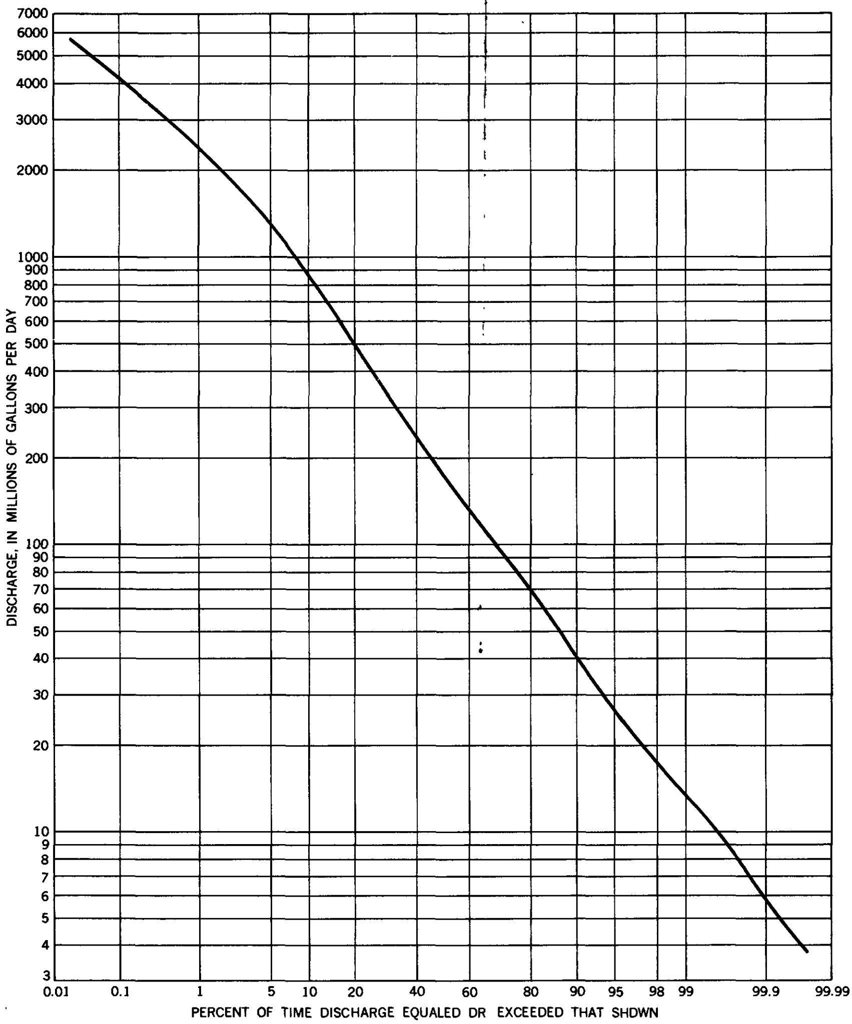

FIGURE 8.—Duration curve of observed daily flow, East Branch Fish Creek at Taberg, 1924–58.

of mineral matter are present and the water is soft. Generally, the water is suitable for most purposes.

SOURCES OF GROUND WATER

SAND AND GRAVEL DEPOSITS

Ground water, of good or improvable quality is available in moderate supply from sand and gravel deposits in the Mohawk River lowland and from similar deposits in the lower valleys of Oriskany

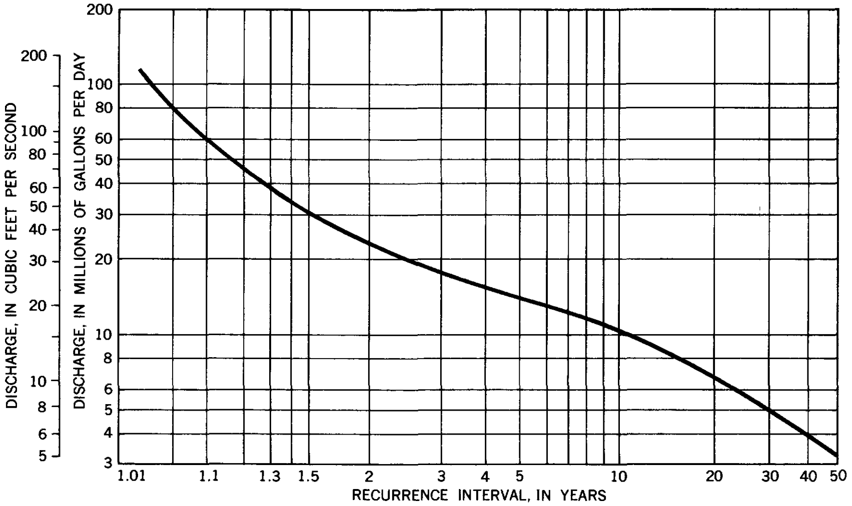

FIGURE 9.—Magnitude and frequency of observed annual consecutive 7-day low flows, East Branch Fish Creek at Taberg, 1923–58.

and Sauquoit Creeks. It is available in small supply from the bedrock formations and from the veneer of ground moraine overlying the bedrock in the upland areas, although it may be hard. Ground water also serves to maintain the low-water flow of the streams and conversely may be recharged by adjacent streams during floods or periods of heavy ground-water pumpage.

MOHAWK RIVER LOWLAND

The Mohawk River lowland as described in this report is the area within the Mohawk River valley that is underlain by glaciofluvial deposits and by lacustrine and alluvial deposits (pl. 1). The land surface is mainly valley bottom or flood plain and adjacent terraces. It is nearly level and has a maximum relief of about 200 feet, the outer limit of the lowland being at an altitude of about 600 feet. Within the lowland, moderate to large quantities of ground water can be obtained from sand and gravel deposits (table 5). These deposits make up the greater part of the unconsolidated material underlying the extensive sand plain north of Rome, the valley of Ninemile Creek below Holland Patent, and the terraces bordering the Mohawk River plain from west of Rome to Frankfort. They also are interspersed with extensive beds of clay and silt in the fill of the Mohawk River plain.

Data upon which to base reliable appraisals of yield of ground water are lacking for this area because many wells for which records are available were drilled for domestic users requiring only small supplies and the wells were not constructed or developed for maximum yield.

TABLE 5.—*Geologic formations in the Utica-Rome area and their water-bearing properties (modified from Dale, 1953 and Kay, 1953)*

Age: System	Age: Series	Geologic unit	Thickness (feet)	Average depth of wells (feet)	Range in yield of wells (gpm)	Average yield of wells (gpm)	Character of material and water-bearing properties
Quaternary	Recent and Pleistocene	Fine-grained glaciofluvial, lacustrine and alluvial deposits	70–150	68	2–40	11	Clay, silt, and sand formed in temporary lakes or by recent streams. Poor aquifer generally, but sand beds may yield moderate supplies, especially where recharged by nearby streams.
	Pleistocene	Medium to coarse-grained glaciofluvial and deltaic deposits	10–140	67	10–290	80	Interbedded and interlensing sand and gravel formed by sorting action of glacial melt water. Most productive aquifer in area, especially where recharged by nearby streams. Furnishes good-quality water, suitable for most purposes.
		Ground moraine (till)	1–40	10	1/2–10	3	Heterogeneous mixture ranging in grain size from clay to boulders. Found mostly in the uplands. Poor aquifer but furnishes enough water from dug wells for domestic use.
Silurian	Cayuga	Manlius limestone	150+	----------	----------	----------	Dark blue fossiliferous limestone having dark shale partings. Furnishes small to moderate quantities of moderately hard water.
		Salina group: Bertie limestone	30	100	0–40	7	Drab-colored, thin-bedded, clayey limestone. Furnishes small to moderate quantities of moderately hard water.
		Salina group: Camillus shale	200–300				Mottled red and green, drab-colored shale and thin-bedded limestone zones. Yields sufficient water for domestic use but quality is very poor.
		Salina group: Vernon shale	300				Purplish-red shale spotted with green, and thin beds of green shale and limestone. Yields sufficient water for domestic use but quality is very poor.
	Niagara	Lockport dolomite	80	86	0–8	2⅔	Dark-colored nearly black dolomite and shale. Furnishes small quantities of poor-quality water.
		Clinton group	270	67	½–35	9½	Green and gray shale and sandstone, a few dolomite and conglomerate beds, and several thin beds of fossiliferous red oolitic hematite (iron ore). Yields sufficient water for domestic purposes. Water may be hard in some places.
		Oneida conglomerate	29	----------	----------	----------	Quartz-pebble conglomerate and crossbedded sandstone, pyritiferous. Relatively unimportant aquifer owing to thinness.
Ordovician	Upper Ordovician	Frankfort shale (includes Pulaski shale)	400–500	114	½–20	5	Gray sandy shale, thin beds of dolomite and calcareous sandstone. Furnishes small to moderate quantities of good-quality water.
		Utica shale	300–400	127	½–48	7½	Black and gray carbonaceous shale containing calcareous argillites. Reliable source of small to moderate quantities of water. Water obtained from openings along joints and bedding planes. Water is of good quality but contains hydrogen sulfide in some places.

From the available data it would seem that the most important potential sources of ground water in the area are the deposits of sand and gravel underlying the extensive plain between Rome and Delta Reservoir. These sediments were carried southward into the area by glacial melt water and were probably deposited in several stages, partly as glaciofluvial terraces and partly as a delta of the glacial Mohawk River. The deposits are coarse grained to the north near Delta Reservoir and become finer grained southward. They are generally less than 40 feet thick except in the vicinity of a buried bedrock channel that extends southwestward from the southwestern part of Delta Reservoir, in which they reach a maximum known thickness of 90 feet. They are a potentially productive source of ground water because they are highly permeable and are saturated for most of their thickness. Water levels in wells tapping sand and gravel deposits in the plain north of Rome are commonly 10 to 30 feet below the land surface. Maximum sustained yields from the glaciofluvial deposits in this area are not known as they are tapped only by domestic wells, except for an 8-inch-diameter screened well at the State Fish Hatchery north of Rome that is reported to have yielded 290 gpm with a drawdown in water level of 13 feet. Yields of about the same magnitude or even greater can probably be obtained from properly constructed wells elsewhere in the plain north of Rome.

The fill underlying the Mohawk River plain between Rome and Frankfort is the second most important source of ground water in the lowland. It occupies an older channel that was eroded deeply into the soft shales of the region. The maximum thickness of the valley fill ranges from about 70 feet at Rome to 150 feet at Frankfort. The deposits are thickest over the axis of the older eroded bedrock channel which seems to be south of the present river in the reach between Rome and Whitesboro and north of the Erie (Barge) Canal in the reach between Whitesboro and Frankfort. The sediments making up most of the valley fill were carried in by glacial melt water and deposited in the standing water bodies that were earlier glacial stages of the development of the Great Lakes. These are overlain generally by a veneer of flood-plain deposits of the present Mohawk River. Consequently the sediments are predominantly fine sand, silt, and clay, but they are interstratified in places with beds and lenses of coarser sand and gravel that were washed in by stronger currents (pl. 3). These water-bearing sand and gravel deposits yield moderate supplies to a few industrial and domestic wells and are potential sources of additional supplies. The yields of 9 wells between Rome and Frankfort penetrating sand and gravel ranged from 7 to 80 gpm.

Most of the higher yielding wells are at the east end of the channel, between Utica and Frankfort. Most wells in the channel obtain water from beds or lenses of sand and gravel that underlie fine-grained materials and hence have little direct hydraulic connection with the Mohawk River or the Erie (Barge) Canal. However, in this area long-sustained, moderate to large quantities of ground water can probably be obtained from properly constructed wells that penetrate coarse-grained deposits of appreciable thickness. These coarse-grained deposits lie close to and are hydraulically connected with the river or canal, from which recharge can be effectively induced. For example, 1 well in the Mohawk River channel at Frankfort yields 500 gpm and 2 wells at Ilion, about 2 miles east of Frankfort, have a combined yield of 400 gpm. Their sustained high production is due partly to induced infiltration from the Mohawk River. In the broad, featureless plain west of Rome drained by Wood Creek, which is the western continuation of the channel discussed above, the underlying deposits are of lacustrine origin and comprise primarily clay and silt. They commonly are not very permeable and, hence, do not yield water readily. However, a few wells yield small supplies from discontinuous beds of sand and gravel at the base of the fill in the deepest part of the channel near Coonrod.

The unconsolidated materials filling the valley of Ninemile Creek also are a potential source of moderate quantities of ground water. The deposits originated as a delta of an earlier glacial stream and extend in typical fan-shaped form from Holland Patent nearly to the Mohawk River. They are coarse grained and poorly sorted near the head of the delta and grade southwestward into silt and medium- to fine-grained sand. The finer grained deposits underlie the broad sand plain south and west of Floyd as well as the irregular sand hills near Griffiss Air Force Base and the extensive flat-topped terrace or bench between Marcy and the Mohawk River. The unconsolidated deposits in Ninemile Creek valley range in thickness from 30 feet near the head of the delta at Holland Patent, and along its south edge, to 140 feet near the center of the delta front east of the airbase. The thickest deposits overlie a buried preglacial bedrock channel of an earlier Ninemile Creek whose axis lies north of the present creek and extends southwestward from a point just east of Floyd. The present Ninemile Creek has trenched the delta along its south side and cut through the sediments to bedrock in many places. As a result the upper beds are well drained, particularly in the reach of the delta between Holland Patent and Floyd, and conditions for storage of large quantities of water are poor. Moreover, because the streambed rests on bedrock, opportunities for induced recharge of stream water are poor.

The most favorable area for development of moderate ground-water supplies in the valley of Ninemile Creek seems to be in the area of the buried bedrock channel from a point just east of Floyd to Griffiss Air Force Base. The sand and gravel filling of the channel in this area is a potentially productive source of water because the stratified deposits are thick, are saturated for much of their thickness, and in at least one area are crossed by Ninemile Creek, which is a potential source of induced recharge. Only a few wells tap the sand and gravel in Ninemile Creek valley. They supply sufficient water for domestic and agricultural needs, but their yields give no indication of the maximum available. Larger yields probably could be obtained if the wells were designed for higher productivity.

The depths to water in most wells in the sand and gravel deposits of the Mohawk River lowland range from 5 to 40 feet below the land surface. In general the water table is closer to the land surface in the valley bottoms than in the terraces or along the sloping valley sides. In the flat valley bottoms, such as the low plain west of Rome and the Mohawk River channel, the water table is nearly level and stands generally only slightly higher than the level of the adjacent stream. Under natural conditions it slopes toward the streams or open bodies of water such as swamps, ponds, and reservoirs. The maximum depth to the water table (about 50 feet) is in the riverward faces of the sand and gravel terraces, where the slopes are steep and well drained.

No record of the fluctuations of water levels has been collected in the Utica-Rome area. The water levels in wells in the area close to the Mohawk River and its larger tributaries are probably affected by changes in river level. Water levels in some wells may be affected by the pumping of nearby wells. Elsewhere in the Mohawk River lowland, the fluctuations probably follow the general seasonal patterns of precipitation and evapotranspiration; the range of fluctuations is probably between 3 and 15 feet per year.

Observations of the water level during 1926-55 in a well tapping sand and gravel near Woodgate, about 17 miles north of the area, and observations at other wells in the State show that water levels commonly rise in early spring in response to infiltration from rain and melting snow. They decline in late spring, summer, and early fall in response to transpiration and evaporation during the growing season. Although water levels have fluctuated from year to year, the long-term levels have been stable, and there has been no regional lowering of ground-water levels. In the well at Woodgate, the water level declined to the lowest stage of record during the period of deficient precipitation and low temperatures in 1930–31.

Only a few data are available on the chemical quality of ground water from sand and gravel aquifers in the Mohawk River lowland. In general, water from these deposits is less mineralized than water from the bedrock formations (fig. 10). The analyses given in table 6 show that the quality of the water from sand and gravel formations varies widely. The water contains moderate concentrations of dissolved solids, primarily calcium bicarbonate, and is soft to moderately hard. Water from sand and gravel forming the Ninemile Creek delta (wells Oe 146 and 652 on pl. 1) may be somewhat softer and less mineralized than water from sand and gravel in the Mohawk River channel. Iron concentrations are somewhat high and in wells Oe 42 and 269 were sufficiently high (more than 0.3 ppm) to cause discoloration of laundry and deposition in boilers and cooking utensils. However, with the exception of that containing high concentrations of iron, the water is suitable for most uses. The iron content and hardness can be reduced with suitable treatment.

The water from well Oe 47, which penetrates sand in the Mohawk River channel, is abnormally high in dissolved mineral matter (627 ppm) and is hard; sodium and chloride are the predominant ions. The concentration of chloride exceeds the generally recommended maximum limit of 250 ppm for domestic use of water. The abnormal concentration of these constituents may have resulted from the upward movement of water into the sand from the underlying bedrock formations, which contain scattered accumulations of salt water associated with natural gas.

No data are available on the temperature of ground water in the area. It is presumed to be fairly constant throughout the year, except in wells that receive water by infiltration from adjacent streams. The temperature of water in most wells probably varies seasonally between 45° and 52° F; the average is about the same as the average air temperature of 47° F. Water from wells that receive infiltration from adjacent streams probably has a slightly greater range in temperature.

ORISKANY AND SAUQUOIT CREEK VALLEYS

The unconsolidated deposits of glaciofluvial origin in the valleys of Oriskany and Sauquoit Creeks consist chiefly of sand and gravel which in some places are intercalated with lenses of silt and clay. The water-bearing beds of sand and gravel supply water to a few fairly large industrial wells and are potential sources of additional supplies.

Little is known of the character and water-yielding capacity of the valley-fill deposits in the valleys of Oriskany and Sauquoit Creeks, because records of only a few wells that obtain water from them are

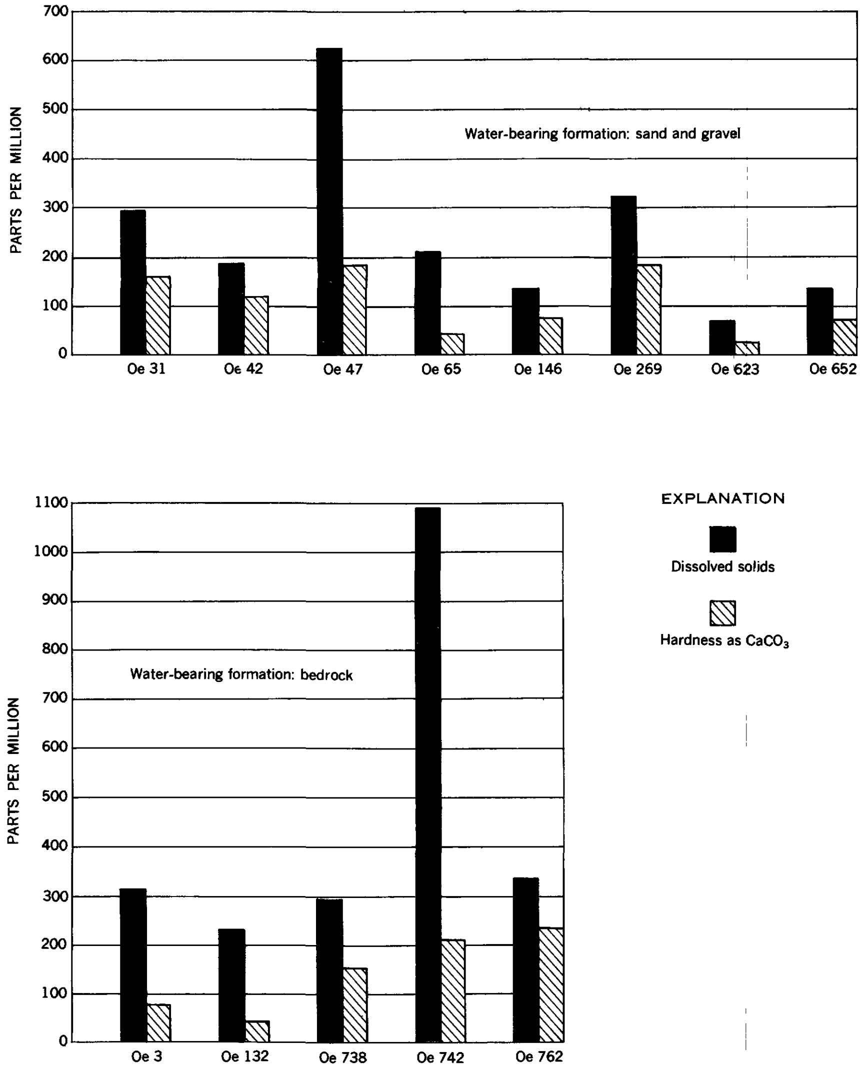

FIGURE 10.—Concentrations of dissolved solids in and hardness of ground water.

available. Most of the deposits are below an altitude ranging from about 700 feet on the south, near the border of the Utica-Rome area, to 600 feet at the north ends where the creeks enter the Mohawk River lowland. The present valley bottoms of the creeks and the flat-topped terraces flanking the creek bottoms are underlain by these deposits. The deposits also overlie and fill a buried segment of a former Oriskany Creek valley that lies between Oriskany and Whitesboro east of the present mouth of Oriskany Creek, and two eastward-

TABLE 6.—*Chemical analyses, in parts per million, of water from selected wells in the Utica–Rome area*

Well (pl.1)	Date of collection	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$		Specific conductance (micromhos at 25 °C)	pH	Color
																Calcium, magnesium	Noncarbonate			
Bedrock																				
Oe 3	Mar. 16, 1955	10	0.08	0.00	22	6.2	95		-------	277	14	30	0.6	2.9	314	80	0	533	8.2	2
132	1955	11	.24	.00	14	2.7	69		-------	190	21	9.5	.2	6.7	232	46	0	331	7.6	2
738	Mar. 16, 1955	15	.40	.00	26	22	66		8	300	33	1.5	.2	2.6	297	155	0	551	8.4	1
742	do	9.7	.19	.00	48	22	317		20	318	220	262	1.0	5.2	1,090	210	0	1,920	8.6	2
762	1955	11	.24	.00	56	23	46		16	289	57	5.0	1.7	.2	336	234	0	586	8.5	2
Sand and gravel																				
Oe 31	Mar. 18, 1955	8.7	------	0.01	33	19	60		12	240	54	12	0.1	0.7	292	160	0	491	8.5	1
42	1955	9.8	.63	.01	39	5.4	26		4	163	27	4.5	.1	.1	189	120	0	321	8.4	2
47	Mar. 17, 1955	11	.74	.00	54	12	138		-------	92	3.1	288	.1	.2	627	154	109	1,080	8.1	3
65	Mar. 18, 1955	6.5	1.96	.01	13	2.5	64		6	188	3.1	6.5	.5	4.2	212	43	0	327	8.7	2
146	Mar. 17, 1955	8.3	.10	.00	17	8.4	17		2	119	6.1	4.5	.1	.2	134	77	0	211	8.4	2
269	Mar. 23, 1955	11	.54	.00	42	19	[1] 46.9		-------	216	11	74	.1	.2	322	[2] 184	7	565	7.3	6
623	Mar. 17, 1955	7.4	.36	.01	10	.3	6.4		-------	34	10	1.0	.1	.3	69	26	0	74.7	7.6	1
652	do	13	.34	.00	20	5.2	15		-------	117	6.0	1.0	.1	.3	136	71	0	197	8.2	2

[1] Na, 46 ppm; K, 0.9 ppm.
[2] Includes hardness of all polyvalent cations reported.

trending buried valleys that seem to have connected Oriskany and Sauquoit Creeks before the last glaciation. The eastward-trending valleys underlie the present Mud Creek valley between Clinton and Utica and the depression occupied by the tracks of the New York Central Railroad between Clark Mills and Utica, respectively. The coarsest deposits are those forming the terraces, but because they are poorly sorted and well drained, they probably would yield only small quantities of water to wells.

The most productive water-bearing beds are associated with the bottom deposits of the present creek valleys. In Sauquoit Creek valley between Willowvale and Whitesboro, the deposits consist of sand and gravel interfingered with silt and clay. They have accumulated in the valley to a maximum known depth of more than 100 feet; of this thickness the coarser materials occur mostly in the upper and lower parts of the section; the finer grained materials are in the middle. An industrial plant 1 mile north of Willowvale has 3 wells about 500 to 600 feet from Sauquoit Creek. The wells range in depth from 112 to 132 feet and penetrate sand and gravel. Their yields range from 64 to 171 gpm, and they have a combined yield of 290 gpm. The percentage of fine-grained material (silt and clay) in the bottom deposits increases downstream from Willowvale, and several wells in the creek valley between New Hartford and Whitesboro obtain moderate supplies from shallow sand and gravel deposits overlying silt and clay.

Little information is available on the water-yielding capacity of the deposits in Oriskany Creek valley and in the buried channels tributary to the creek. The valley fill consists chiefly of fine sand, silt, and clay which in some places is interstratified with beds or lenses of sand and gravel. The deposits have accumulated to depths of at least 100 feet in many places. More than 100 feet of material has accumulated in the buried channel of Oriskany Creek near its mouth and more than 90 feet in the depression between Utica and Clark Mills. The water-bearing sand and gravel deposits yield moderate supplies to wells and should yield large sustained supplies to wells so situated as to induce infiltration from Oriskany Creek.

Ground water in sand and gravel deposits in the valleys of Oriskany and Sauquoit Creeks has about the same chemical quality as that in the Mohawk River lowland. It is moderately high in dissolved mineral matter, as shown by the analyses of water from wells Oe 31 and Oe 65 (table 6) and may be moderately hard. The hardness is due to the calcium and magnesium dissolved from limestone in the area and possibly from fragments of this rock which are included in the gravel beds. Water from well Oe 65 contains 1.96 ppm of iron, an especially high concentration of iron. The hardness of water from wells receiving water by infiltration from Oriskany and Sauquoit Creeks may be similar to that of water from the creeks. In addition, water from these wells may be adversely contaminated by industrial wastes in the stream water, particularly wells in the lower reaches of the creeks where contamination of the water is greatest.

OTHER SOURCES

The ground moraine and isolated bodies of sand and gravel that are the surficial deposits outside the areas discussed previously and the consolidated bedrock which underlies the entire Utica-Rome area are also sources of ground water.

Most of the uplands above an altitude of about 600 feet in the Utica-Rome area are covered by a mantle of ground moraine and small isolated bodies of sand and gravel. In the lowlands ground moraine occurs beneath the stratified deposits. The ground moraine is mostly till, a direct deposit of the glacial ice consisting generally of a clay matrix containing sand and boulders. The till in this area is tough and compact and is often called hardpan by well drillers and farmers. It commonly has a very low permeability. Owing to its low permeability, till generally yields less than 1 gpm to wells but is an important source of water in quantities adequate for homes and small farms. Probably the maximum yield that can be obtained from a well tapping till is between 200 and 2,000 gpd. The water is commonly obtained by means of large-diameter dug wells which provide large infiltration area and storage capacity.

Supplies adequate for the needs of rural homes, small municipalities, and industries requiring only small quantities of water may be obtained from some of the small bodies of sand and gravel that overlie the till in the gently sloping parts of the upland areas. Ordinarily this sand and gravel mantle is a recent deposit of streams draining the upland. Although thin and of small areal extent, the sand and gravel bodies may yield small to moderate amounts of water to shallow wells of proper construction, especially where they are adjacent to streams. One of two wells of the Westmoreland Water District finished in these sand and gravel bodies was pumped at the rate of 380 gpm, the other at 194 gpm. The specific capacities of the wells were 69 and 16 gpm per foot, respectively.

Where exposed, the bedrock consists of sedimentary rock formations composed principally of shale, sandstone, limestone, and dolomite. As described in table 5, they include the Utica and Frankfort shales, the Clinton group containing the red iron ores, the Lockport dolomite, the Vernon and Camillus shales, and the Bertie and Manlius limestones. The well-known Utica and Frankfort shales underlie the bottom and sides of the Mohawk River lowland and the upland north of the Mohawk River. The Vernon and Camillus shales are the distinctive red and green shales that form the steep northern slope of the Allegheny plateau; the limestone formations are the distinctive capping of the plateau and underlie the highest areas in the southern part of the Utica-Rome area. The physical characteristics and water-yielding capacity of the bedrock formations are shown in table 5 and their distribution is shown on plate 2. Limestone and dolomite beds of the Trenton group underlie the Utica shale in this area but are not exposed, although rocks of this group have been found in many deep wells.

Most ground water in the bedrock is transmitted through secondary openings along joints, bedding planes, and faults. As a result the yields of wells penetrating these formations range widely. The yields generally are small but are adequate for the needs of farms or households, and the wells are an important source of water in areas in which more productive aquifers are not available. The yields of 77 wells tapping the bedrock formations in the area average about 8 gpm and range from less than 1 to 75 gpm. Wells tapping the Clinton group yield, on the average, a little more water than the other formations; 18 wells tapping the Clinton have an average yield of 9½ gpm, as compared with an average yield of 7½ gpm for 26 wells tapping the Utica shale. Wells tapping the other consolidated rock formations in the area generally yield less water than wells in the Utica shale. Few wells draw fresh water from depths greater than 250 feet. In fact, deeper drilling in the outcrop area of the Utica shale has tapped salt water and occasionally natural gas (Dale, 1953, p. 176–182).

The chemical quality of water from the bedrock differs greatly from place to place, partly because of differences in geology. (See table 6.) The concentration of dissolved solids in water samples collected at scattered locations ranged from 232 to 1,090 ppm. The mineral matter consists principally of calcium, sodium, and bicarbonate and lesser amounts of magnesium. However, water from well Oe 742 (dissolved-solids content, 1,090 ppm) contained 220 ppm of sulfate and 262 ppm of chloride. Water from well Oe 762 contained 1.7 ppm of fluoride, which is slightly greater than the content recommended for drinking water (U.S. Public Health Service, 1946). Moderately large amounts of mineral matter were present in water samples from three other wells (wells Oe 3, Oe 132, and Oe 738 in table 6), and water in these was soft and moderately hard. Because of the difference in chemical composition, a general evaluation of the chemical quality of water from bedrock cannot be made. However, if water is present in sufficient quantity to be an important source of supply, the chemical quality can be improved by treatment to reduce hardness.

The water from the Utica and Frankfort shales commonly is moderately hard (wells Oe 3 and Oe 132 in table 6) and in some wells has a slightly sulfurous taste and odor. Salt water and natural gas from the limestone beds underlying the Utica shale occur in several wells in the Rome area (Dale, 1953, p. 176–182). Ground water from the Clinton group is generally suitable for most uses (well Oe 738, table 6), although water from the limy beds of the Clinton is hard.

Probably the water of poorest quality obtained from bedrock in Utica-Rome area is drawn from the Lockport dolomite and the overlying Vernon and Camillus shales. The Lockport dolomite yields water that is hard and has a noticeable hydrogen sulfide taste and odor. Also, high sulfate and chloride concentrations in the water from the Lockport dolomite are reported by many well owners. (See also well Oe 742, table 6.) No analyses of water from wells tapping the Vernon and Camillus shales are available, but a high mineral content and undesirable concentrations of sulfate and chloride have been reported in water from wells in the outcrop areas of these formations. The sulfate and chloride are probably derived from beds of gypsum and salt, which occur in the Vernon and Camillus shales in the Utica-Rome area. The calcareous mud or tufa, known locally as horse bone, that is deposited near the head of the village of Clinton and Hamilton College reservoirs is derived from minerals dissolved from the Vernon and Camillus shales by circulating ground water. The water from many small brooks and tributary streams that originate in springs draining the slopes underlain by the Vernon and Camillus shales is moderately to very hard as shown by analyses reported by Dale (1953, p. 19–20). Water from the younger limestones in the area (Bertie and Manlius limestones) may also be very hard. (See well Oe 762, table 6.)

PUBLIC WATER-SUPPLY SYSTEMS

Seven public water-supply systems in the Utica-Rome area serve about 92 percent of the population and some industries. All the systems are supplied by surface water. The two largest public water-supply systems are those of the cities of Utica and Rome (fig. 11).

These cities obtain most of their water from sources outside the Utica-Rome area. Descriptive data for public water-supply systems are summarized in table 7, and analyses of finished water are given in table 8.

Utica obtains its supply from Hinckley Reservoir on West Canada Creek and Graffenburg Reservoir southeast of the city. Hinckley

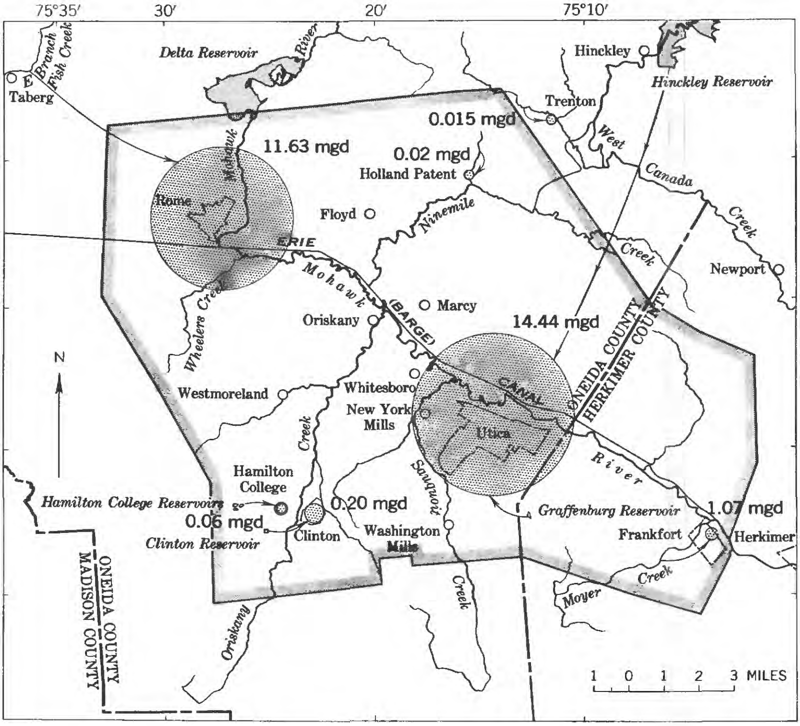

FIGURE 11.—Source of and demand on the public water supplies.

Reservoir, constructed by the State in 1915 as a feeder reservoir for the Erie (Barge) Canal, has a capacity of 25,000 million gallons; and Graffenburg Reservoir, built in 1854, has a capacity of 654 million gallons. About 98 percent of the demand is obtained from Hinckley Reservoir, the city of Utica having the right to divert about 50 mgd. In addition to supplying the city, the water-supply system furnishes water to the villages of New Hartford, New York Mills, Oriskany, Whitesboro, and Yorkville and to suburban customers in the towns of Deerfield, Frankfort, Marcy, New Hartford, Schuyler, Trenton, and Whitestown.

The water from Hinckley and Graffenburg Reservoirs has the lowest mineral content and is the softest water (19 ppm, hardness as $CaCO_3$) of any of the public supplies in the area (fig. 12 and table 8).

Rome takes its entire supply from East Branch Fish Creek in the Oneida River basin. The maximum daily use in 1954 was 17.8 million gallons of which slightly less than half was used by industry. The present rated capacity of the system is 21 mgd, and it is being

TABLE 7.—*Public water-supply systems*

[Treatment: Dc, chlorine gas disinfection; Dh, hypochlorite disinfection; N, ammoniation; Ng, NH_3 gas; S, sedimentation; Z, zeolite softening]

Public water-supply system	Estimated population served (1954)	Source of water	Raw water storage (million gallons)	Treated water storage (million gallons)	Treatment	Daily use in 1954: Maximum (mgd)	Daily use in 1954: Average (mgd)	Daily use in 1954: Average per capita (gallons)
Clinton	1,600	Stream	19	0	Dc		0.20	125
Frankfort	4,564	Streams, wells (auxiliary).	10	0	Dh	1.35	1.07	235
Hamilton College.	750	Springs	27	0			.06	80
Holland Patent	370	Stream	.24	0	Dc		.02	55
Rome	44,000	do	0	66	Dc, N, S	17.80	11.63	265
Trenton	250	Spring	.15	0	None		.015	60
Utica	133,170	Streams, springs.	26,455	2.47	Dc, Ng, Z	19.62	14.44	108

TABLE 8.—*Chemical analyses, in parts per million, of finished water from major public water-supply systems in the Utica-Rome area*

[Samples collected Jan. 27, 1955]

Constituents	Frankfort	Rome	Utica [1]	Utica [2]
Silica (SiO_2)	7.2	4.7	6.3	6.5
Iron (Fe), dissolved [3]	.01	.01	.11	.01
Iron (Fe), total	.04	.06	.18	.09
Manganese (Mn), dissolved [3]	.01	.00	.00	.01
Manganese (Mn), total				
Calcium (Ca)	48	9.1	6.4	26
Magnesium (Mg)	12	1.9	.8	8.8
Sodium and Potassium (Na+K)	8.5	3.7	2.2	34
Bicarbonate (HCO_3)	161	28	14	161
Carbonate (CO_3)	6	0	0	0
Sulfate (SO_4)	35	10	8.3	35
Chloride (Cl)	4.5	2.5	2.0	3.5
Fluoride (F)	.0	.1	.1	.0
Nitrate (NO_3)	3.5	1.6	1.2	1.3
Dissolved solids	230	59	49	200
Hardness as $CaCO_3$, calcium, magnesium	169	30	19	101
Noncarbonate	27	8	8	0
Specific conductance (micromhos at 25° C)	349	75.6	50.2	332
pH	8.5	7.4	6.7	8.0
Color	2	6	12	3
Temperature (°F)	36	34	34	33

[1] Mixture of finished water from Hinckley Reservoir (West Canada Creek) and Graffenburg Reservoir (springs).
[2] Finished water from Graffenburg Reservoir.
[3] In solution at time of analysis.

enlarged. Additional descriptive information is given in table 7. An analysis of the finished water indicates that the water is soft and has a low mineral content (table 8).

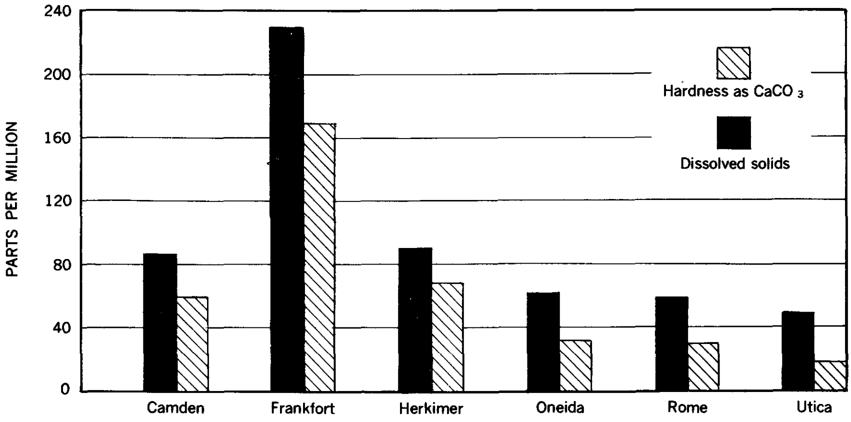

FIGURE 12.—Dissolved solids and hardness of finished water from public water supplies.

The village of Frankfort obtains its principal supply from Moyer Creek and has two wells as an auxiliary supply. The impounding reservoir on Moyer Creek has a capacity of 10 million gallons and the maximum demand by the village was 1.3 mgd in 1954. The finished water from the system is hard and contains more dissolved solids than most other public supply water in the area (fig. 12 and table 8). The village supplies water to 3 water districts serving about 400 people outside the village in the town of Frankfort. An additional 320 people in the town are supplied by the village of Ilion.

SUMMARY OF WATER USED

The estimated use of water in the Utica-Rome area averaged about 48.5 mgd in 1954 (table 9). About 57 percent, or 27.4 mgd, was supplied by municipally owned systems and 43 percent, or 21.1 mgd, was obtained from private sources. All the water for municipal supply and most of the water for industry was drawn from surface sources; only about 4 percent of the total was drawn from groundwater sources. Industry used the most water, requiring 60 percent or 29.1 mgd.

Of the 27.4 mgd furnished by public water supplies in 1954, about 35 percent was supplied to industry, about 43 percent was for domestic use, and the remaining 22 percent was for all other uses. About 40 percent of the water delivered by the city of Utica was used by industry. In the city of Rome, 57 percent of the water was used for domestic purposes and 34 percent for industrial purposes.

About two-thirds of the 29.1 mgd used by industry in 1954 was self supplied; the other one-third was purchased from public-water systems. Of the two-thirds that was self supplied, more than 99 percent of the water was drawn from surface sources, the largest withdrawals being from the Mohawk River and the Erie (Barge) Canal. The ready availability of these large sources in contrast to the low yield of most aquifers accounts for the greater use of surface water. The small amount of well water used (0.2 mgd) was mostly for light industries such as dairies and bottling plants. The largest single ground-water development for industrial purposes used an average of about 44,000 gpd in 1954.

TABLE 9.—*Average use of water in the Utica–Rome area in 1954, in million gallons per day*

Use	Public supply	Self-supplied			All systems
	All surface water	Ground water	Surface water	All sources	
Domestic	11. 7	1. 0		1. 0	12. 7
Public, commercial, and leakage	5. 9				5. 9
Industrial	9. 8	. 2	19. 1	19. 3	29. 1
Agricultural (excluding domestic use on farms).		. 8		. 8	. 8
All uses	27. 4	2. 0	19. 1	21. 1	48. 5

Industry in the Utica-Rome area uses water for cooling and processing, for boiler feed, and for sanitary and service needs. The largest amount is used as process water for production of heavy metals, paper products, and textiles. The Rome Division of Revere Copper and Brass, Inc., uses more water than any other industry in the area. Table 10 shows the quantities of water used by the various types of industries in the area.

An estimated 15,700 persons live outside areas served by the public water-supply systems and obtain most of their water from privately owned wells and springs. About 10,000 of these people live in suburban residences; the remaining 5,700 live on farms. The quantity of water used by this group of people is estimated to be 1 mgd, based on a per capita consumption of 65 gpd. This figure includes water for domestic use on farms but not for livestock or irrigation.

In the Utica-Rome area, water is used for agricultural purposes such as watering dairy cattle and poultry, irrigation, and domestic use on farms at an average rate of about 0.8 mgd, according to Ralph Hadlock, associate county agricultural agent; the principal use is by dairy cattle. During the growing season of 1954 about 6.2 million gallons was used for irrigation or about 17,000 gpd on a year-round basis. Water is applied entirely by sprinklers and is used principally to irrigate potatoes, beans, and other vegetables, forage crops, and pastures.

TABLE 10.—*Industrial use of water, 1954*

Community and type of industry	Number of installations	Average use, (gpd)		
		All sources	Public supply	Private supply
City of Utica:				
Heavy-metal production	9	1, 583, 000	1, 514, 000	69, 000
Light-metal production	8	643, 000	643, 000	----------
Food processing	35	805, 000	762, 000	43, 000
Beverages and breweries	5	725, 000	725, 000	----------
Laundry and dry cleaning	13	262, 000	262, 000	----------
Paper products	2	1, 982, 000	192, 000	1, 790, 000
Textiles	5	7, 379, 000	372, 000	7, 007, 000
Electrical equipment	3	636, 000	636, 000	----------
Construction materials	3	26, 000	26, 000	----------
Transportation	1	204, 000	204, 000	----------
Public utilities	1	61, 000	61, 000	----------
Miscellaneous	10	172, 000	172, 000	----------
Total	95	14, 478, 000	5, 569, 000	8, 904, 000
Suburban Utica (supplied by city of Utica):				
Heavy-metal production	2	427, 000	422, 000	5, 000
Light-metal production	6	268, 000	266, 000	2, 000
Food processing	9	53, 000	40, 000	13, 000
Beverages and breweries	3	51, 000	51, 000	----------
Paper products	1	7, 000	7, 000	----------
Textiles	2	3, 328, 000	251, 000	3, 077, 000
Construction materials	1	3, 000	3, 000	----------
Miscellaneous	2	13, 000	6, 000	7, 000
Total	26	4, 150, 000	1, 046, 000	3, 104, 000
City of Rome:				
Heavy-metal production	8	8, 538, 000	1, 665, 000	6, 873, 000
Light-metal production	4	1, 156, 000	1, 156, 000	----------
Food processing	10	105, 000	102, 000	3, 000
Laundry and dry cleaning	3	36, 000	36, 000	----------
Beverages and breweries	1	5, 000	5, 000	----------
Textiles	1	19, 000	19, 000	----------
Miscellaneous	10	81, 000	81, 000	----------
Total	37	9, 940, 000	3, 064, 000	6, 876, 000
Other communities:				
Heavy-metal production	4	84, 000	80, 000	4, 000
Light-metal production	1	20, 000	----------	20, 000
Food processing	6	97, 000	34, 000	63, 000
Beverages and breweries	2	46, 000	----------	46, 000
Paper products	2	255, 000	----------	255, 000
Miscellaneous	5	8, 000	1, 000	7, 000
Total	20	510, 000	115, 000	395, 000
Total, all communities	178	29, 078, 000	9, 794, 000	19, 284, 000

More than half the water for livestock and domestic use on farms is drawn from springs; the remainder is obtained from wells. Farm ponds supply a small part of the water used for watering stock.

POSSIBILITY OF FURTHER DEVELOPMENT

Ample supplies of water are available in most of the Utica-Rome area for all uses. The Utica municipal supply is capable of furnishing much more water to current or potential users than is presently demanded, by virtue of its right to divert 50 mgd from Hinckley Reservoir. The present demand upon the public supply of the city of Rome is near the rated capacity of the present system, which is being enlarged.

The area can be supplied with much more surface water. The Mohawk River and the Erie (Barge) Canal and its two feeders near the area, Delta and Hinckley Reservoirs, are the major sources. The larger tributaries of the Mohawk River within the area, Oriskany and Sauquoit Creeks, can supply moderate quantities of water.

Ground water is available in moderate quantities from extensive deposits of sand and gravel along the main river channels or in a few buried valleys. This is true especially if the bodies of coarse-grained materials are in a position to be recharged with surface water.

The quality of the surface water is generally fair. Ground water from the unconsolidated deposits is generally of good quality and can be used for most purposes with little treatment.

MOHAWK RIVER LOWLAND

The Mohawk River is a source of water for large potential development. The present withdrawal from the Mohawk River and Erie (Barge) Canal is only a small part of the flow, and much of the water withdrawn is not consumed. The flow below Delta Dam, where the river enters the area, equals or exceeds 108 mgd 90 percent of the time; and the flow at Little Falls, about 10 miles east of the point where the river leaves the Utica-Rome area, equals or exceeds 560 mgd 90 percent of the time. The quality of the water is fair and is probably satisfactory for most uses or can be made satisfactory by suitable treatment. The Mohawk River is an important potential source of water for industrial, agricultural, and fire-fighting uses in its present condition. The impounded water in Delta Reservoir and the water in the Mohawk River are potential sources for municipal supply if treated.

The valley fill of the Mohawk River lowland includes many bodies of coarse-grained sand and gravel that are potential sources of ground water. The water generally is of good quality and is suitable for most uses without treatment. The most favorable areas of potential development are the extensive plains between Rome and Delta Reservoir, the flood plain of the Mohawk River between Rome and Frankfort, and the valley lowland of Ninemile Creek below Holland Patent. Deposits of sand and gravel underlying the northern part of the plain between Rome and Delta Reservoir are a potentially productive source of moderate supplies of ground water because they are highly permeable and are saturated for most of their thickness. Available test data indicate that yields of about 300 gpm or larger can be obtained. The valley fill underlying the flood plain of the Mohawk River is mostly fine sand, clay, and silt; however in some places these fine-grained materials are interstratified with sand and gravel. Drill data and information from a few industrial wells indicate that wells yielding as much as 500 gpm can be developed at sites where the sand and gravel aquifers are hydraulically connected with the river. Where the aquifers are not connected with the river, wells are likely to yield 80 gpm or less. The sand and gravel deposits in Ninemile Creek valley are a potentially productive source because they are thick and saturated throughout much of their thickness. Maximum sustained yields are not indicated from existing data. The most favorable area of potential development in Ninemile Creek valley is along the axis of a buried bedrock channel southwest of Floyd and north of the present creek.

OTHER POTENTIAL SOURCES

Several creeks and smaller streams tributary to the Mohawk River and draining the upland areas of the valley in the Utica-Rome area have well-sustained low flows and are important sources for potential development. Oriskany and Sauquoit Creeks are examples of such streams. Miscellaneous flow measurements on Sauquoit Creek, for example, show that the creek has a probable flow that equals or exceeds 0.33 mgd per square mile 90 percent of the time. The mineral content of water in streams draining the south slopes of the Mohawk valley is high and may require treatment before it can be used by industries and municipalities.

Coarse-grained sand and gravel deposits adjacent to the smaller streams may yield small to moderate quantities of water. These deposits are much smaller than those in the Mohawk River lowland, but where they are hydraulically connected with adjacent streams, they may yield dependable supplies. Industrial wells tapping sand and gravel deposits in the Oriskany and Sauquoit Creek valleys have yielded from 64 to 170 gpm. The water from these wells probably has a high content of dissolved solids.

The public water-supply may be the most satisfactory source of water for industrial use in the Utica-Rome area. The cities of Utica and Rome now serve a large percentage of the industries. The capacities of the systems will exceed present peak demands for many years and the sources of water are adequate for expansion. The maximum daily use of water by the city of Utica in 1954 was less than half the 50 mgd that the city may divert from Hinckley Reservoir. The finished water from the public supply systems is of good quality and meets all U.S. Public Health Service standards for drinking water.

SELECTED REFERENCES

Dale, N. C., 1953, Geology and mineral resources of the Oriskany quadrangle: New York State Mus. Bull. 345, 197 p.

Gillette, Tracy, 1947, The Clinton of western and central New York: New York State Mus. Bull. 341, 191 p.

Kay, Marshall, 1953, Geology of the Utica quadrangle, New York: New York State Mus. Bull. 347, 126 p.

Lewis, H. G., Brookins, E. F., Howe, F. B., and Kinsman, D. F., 1929, Soil survey, Herkimer County area, New York: U.S. Dept. Agr., Bur. Chemistry and Soils, ser. 1923, p. 1601–1648.

Lohr, E. W., and Love, S. K., 1954, The industrial utility of public water supplies in the United States, part 1, States east of the Mississippi River: U.S. Geol. Survey Water-Supply Paper 1299, 639 p.

Maxon, E. T., Carr, M. E., and Stevens, E. H., 1915, Soil survey of Oneida County, New York: U.S. Dept. Agr. Bur. Chemistry and Soils, Field Operations for 1913, 59 p.

New York State Department of Commerce, 1950, New York State business facts, Mohawk valley area: New York State Dept. Commerce, 11 p.

New York State Department of Health, Water Pollution Control Board, 1950, Rules and classifications and standards of quality and purity for waters of New York State: New York State Dept. of Health, 15 p.

——— 1951, Recommended classifications and assignments of standards of quality and purity for designated waters of New York State: Mohawk River drainage basin survey series, rept. 1, Sauquoit Creek drainage basin, 23 p.

——— 1952, Recommended classifications and assignments of standards of quality and purity for designated waters of New York State: Mohawk River drainage basin survey series, rept. 2, Mohawk River drainage basin, 245 p.

Thomas, N. O., and Harbeck, G. E., Jr., 1956, Reservoirs in the United States: U.S. Geol. Survey Water-Supply Paper 1360–A, p. 1–99.

U.S. Geological Survey, issued annually, Quality of surface waters of the United States, parts 1–4, North Atlantic slope basins to St. Lawrence River basin: U.S. Geol. Survey Water-Supply Papers 1250, 1290.

——— issued annually, Surface-water supply of the United States, part 1, North Atlantic slope basins: U.S. Geol. Survey Water-Supply Papers 1001, 1031, 1051, 1081, 1111, 1141, 1171, 1201, 1202, 1231, 1232, 1271, 1272, 1331, 1332, 1381.

——— issued annually, Water levels and artesian pressures in observation wells in the United States, part 1, Northeastern States: U.S. Geol. Survey Water-Supply Papers 777, 817, 840, 845, 886, 906, 936, 944, 986, 1016, 1023, 1071, 1096, 1126, 1156, 1165, 1191, 1221, 1265, 1321, 1404.

——— 1951, Index of surface-water records, part 1, North Atlantic slope basins, to September 30, 1955: U.S. Geol. Survey Circ. 381, 30 p.

U.S. Public Health Service, 1946, Drinking water standards: reprint 2697, from Public Health Service Repts., vol. 61, No. 11, p. 12.

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