1970

OFR Little Suamico Copy #3

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

BASE-FLOW STUDY OF LITTLE SUAMICO RIVER BASIN OCONTO, BROWN AND SHAWANO COUNTIES, WISCONSIN

by

Robert W. Devaul

U. S. Geological Survey

Prepared by
United States Geological Survey
in cooperation with the
Wisconsin Department of Natural Resources

Madison, Wisconsin

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
1815 University Avenue
Madison, Wisconsin - 53706
June 22, 1970

Mr. John O'Donnell
Wisconsin Department of Natural Resources
P. O. Box 450
Madison, Wisconsin - 53701

Dear Mr. O'Donnell:

Attached is the information collected as a result of the base-flow study of the Little Suamico River basin, Oconto, Brown, and Shawano Counties, Wisconsin, in August 1969. It includes one adjacent small basin, Tibbet Creek basin, tributary to Lake Michigan. This study was conducted by the U. S. Geological Survey in cooperation with the Wisconsin Department of Natural Resources.

Figure 2 is a map showing the locations of all stream measuring sites. Table 1 contains the streamflow information collected during the periods indicated; table 2 lists the dissolved oxygen measurements. The additional tables were compiled from information already available from the files of the U. S. Geological Survey.

The streamflow at four continuous-record gaging sites in and near the Green Bay area (figure 1) indicated the discharge in the area to be at about the 50 to 55 percent duration point (table 2) during the first set of August measurement and at about the 70 to 80 percent duration point during the second set of August measurements. That is, about 55 and 80 percent of the time respectively, the discharge of these streams would exceed that which occurred on these dates. A representative summer base flow is considered to be on the order of 80 percent duration.

Very truly yours,

C. L. R. Holt, Jr.
District Chief

CLH/paz

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The Little Suamico River is a gaining stream throughout its entire reach. No loss of water from the streams was noted between any measuring sites. The August 13 measurements were made during a base-flow period when flow duration was about 50 to 55 percent (table 2). The August 27, 28 measurements were made during a lower base-flow period when flow duration was about 70 to 80 percent. Flow duration at about 80 percent is more representative of low-flow conditions during the summer.

On August 13, most of the sub-basins contributed ground water ranging from .027 to .052 cfs per sq mi. Tibbett Creek at site 7 was nearly dry on August 13, and had no flow on August 28. Discharges in cfs per sq mi were about the same at sites 1, 2 and 3 on both August 13 and August 27, but were considerably less on August 27 at sites 4, 5 and 6. The sub-basins contributing very small discharges are in the upper reaches of the stream, which may become intermittent during dry periods.

Water temperatures during August 13, 27, and 28 ranged from 20°C (68°F) to 25.6°C (78°F). No temperature correlations were made because water temperatures were taken at different times during the day.

Specific conductance of water, measured in micromhos at 25°C, indicates the amount of dissolved minerals in the water. The specific conductance measured for the Little Suamico River ranged from 465 to 960 micromhos. The specific conductance at site 1, which measures the discharge from Pulaski area, was the highest for all sites.

Dissolved oxygen measurements were made at least once at each site during the study; however, it would be more useful to obtain a 24-hour dissolved oxygen profile at several points within the basin.

Table No. 1.--Low-flow and related water quality measurements in the Little Suamico River basin, Oconto, Brown and Shawano Counties, Wisconsin.

Stream	Site No.	Drainage area above site (sq mi)	August 13, 1969							August 27, 28, 1969						
			Discharge		Mean vel (ft/sec)	Spec. cond. (micromhos)	Temperature (°F)		Time CDT	Discharge		Mean vel. (ft/sec)	Spec. cond. (micromhos)	Temperature (°F)		Time CDT
			cfs	cfs/m^2			Air	Water		cfs	cfs/m^2			Air	Water	
Little Suamico River	1	9.75	0.40	.041	0.34	795	78	78	1230	0.40	.041	0.34	960	83	78	1445
Tributary	2	9.38	0.17	.018	0.55	-	76	-	1430	0.20	.021	0.43	630	85	72	1400
Tributary	3	5.78	0.18	.031	0.49	530	69	68	1330	0.19	.033	0.35	520	79	70	1330
Little Suamico River	4	34.8	1.67	.048	0.73	605	74	74	1545	1.27	.036	0.53	465	81	77	1645
Little Suamico River	5	41.1	2.14	.052	0.39	530	74	77	1715	1.35	.033	0.31	500	75	71	0915
Little Suamico River	6	54.8	1.46	.027	0.44	490	73	76	1930	0.66	.012	0.17	470	79	73	1030
Tibbet Creek	7	10.4	0.02	.002	0.33	560	68	72	2000	No flow	-	-	-	-	-	-

Table 2.--Discharge and flow duration of four long-term continuous record gaging stations and two long-term partial record sites in the Green Bay area on indicated dates. Includes 7-day Q_2 and 7-day Q_{10} values*.

Stream	Drainage area (sq mi)	Date	Discharge		Flow duration % of time flow equaled or exceeded	7-day	7-day
			cfs (ave. daily)	cfs/sq mi		Q_2 (cfs)[a]	Q_{10} (cfs)[b]
Wolf River at Keshena Falls	812	8/11/69	584	.72	57.0	380	300
		8/12/69	597	.74	54.9		
		8/13/69	595	.73	55.2		
		8/26/69	472	.58	78.3		
		8/27/69	472	.58	78.3		
		8/24/69	473	.58	78.1		
Embarrass River near Embarrass	395	8/11/69	194	.49	44.8	75	45
		8/12/69	180	.46	48.7		
		8/13/69	168	.43	53.6		
		8/26/69	126	.32	70.8		
		8/27/69	126	.32	70.8		
		8/28/69	125	.32	71.4		
Wolf River at new London	2,240	8/11/69	1,180	.53	51.8	655	450
		8/12/69	1,140	.51	54.3		
		8/13/69	1,140	.51	54.3		
		8/26/69	824	.37	78.0		
		8/27/69	824	.37	78.0		
		8/28/69	824	.37	78.0		
Oconto River near Gillette	678	8/11/69	406	.60	54.0	230	175
		8/12/69	411	.61	53.1		
		8/13/69	397	.59	55.8		
		8/26/69	300[e]	.44	78.2		
		8/27/69	290[e]	.43	80.7		
		8/28/69	285[e]	.42	82.4		
North Branch Embarrass River near Bowler	37.1	8/11/69	25.3m	.68	-	9.2[c]	5.6[c]
		8/27/69	23.1m	.62	-		
Apple Creek near Kaukauna	14.6	8/12/69	0m	0	-	0	0
		8/26/69	0m	0	-		

* [a] 7-day Q_2 - The lowest mean discharge for 7 consecutive days that occurs on the average of once in 2 years or has a 50 percent chance of occurring in any year.

[b] 7-day Q_{10} - The lowest mean discharge for 7 consecutive days that occurs on the average of once in 10 years or has a 10 percent chance of occurring in any year.

c - Values obtained by correlation with nearby long-term gaging stations.

m - Measured discharge. e - Estimated.

Table No. 3.--Dissolved oxygen measurements made during period of low-flow investigations in the Little Suamico River basin, Wisconsin

Stream	Site No.	Date	Dissolved Oxygen			
			Time CDT	Temp °C	mg/l	Percent Sat.
Little Suamico River	1	Aug. 15, 1969	0810	19.0	3.9[a]	41
		Aug. 27, 1969	1500	25.6	16.5[b]	201
Tributary	2	Aug. 15, 1969	0830	16.2	4.3[a]	43
		Aug. 27, 1969	-	-	-	-
Tributary	3	Aug. 15, 1969	0800	17.0	5.6[a]	57
		Aug. 27, 1969	-	-	-	-
Little Suamico River	4	Aug. 15, 1969	0855	19.4	6.5[a]	70
		Aug. 27, 1969	-	-	-	-
Little Suamico River	5	Aug. 15, 1969	0955	22.2	9.2[a]	104
		Aug. 28, 1969	0915	21.7	-	-
Little Suamico River	6	Aug. 15, 1969	1020	23.8	5.4[a]	64
		Aug. 28, 1969	1000	22.8	6.5[b]	75
Tibbet Creek	7	Aug. 13, 1969	No Flow		-	-
		Aug. 27, 1969	No Flow		-	-

[a] D. O. determinations by D. O. meter.
[b] D. O. determinations by field kit.