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SURFACE-WATER RESOURCES OF THE YELLOW RIVER BASIN IN GWINNETT COUNTY, GEORGIA

by

R. F. Carter and W. B. Gannon
United States Geological Survey

Prepared cooperatively by the Geological Survey, United States Department of the Interior, Washington, D. C.

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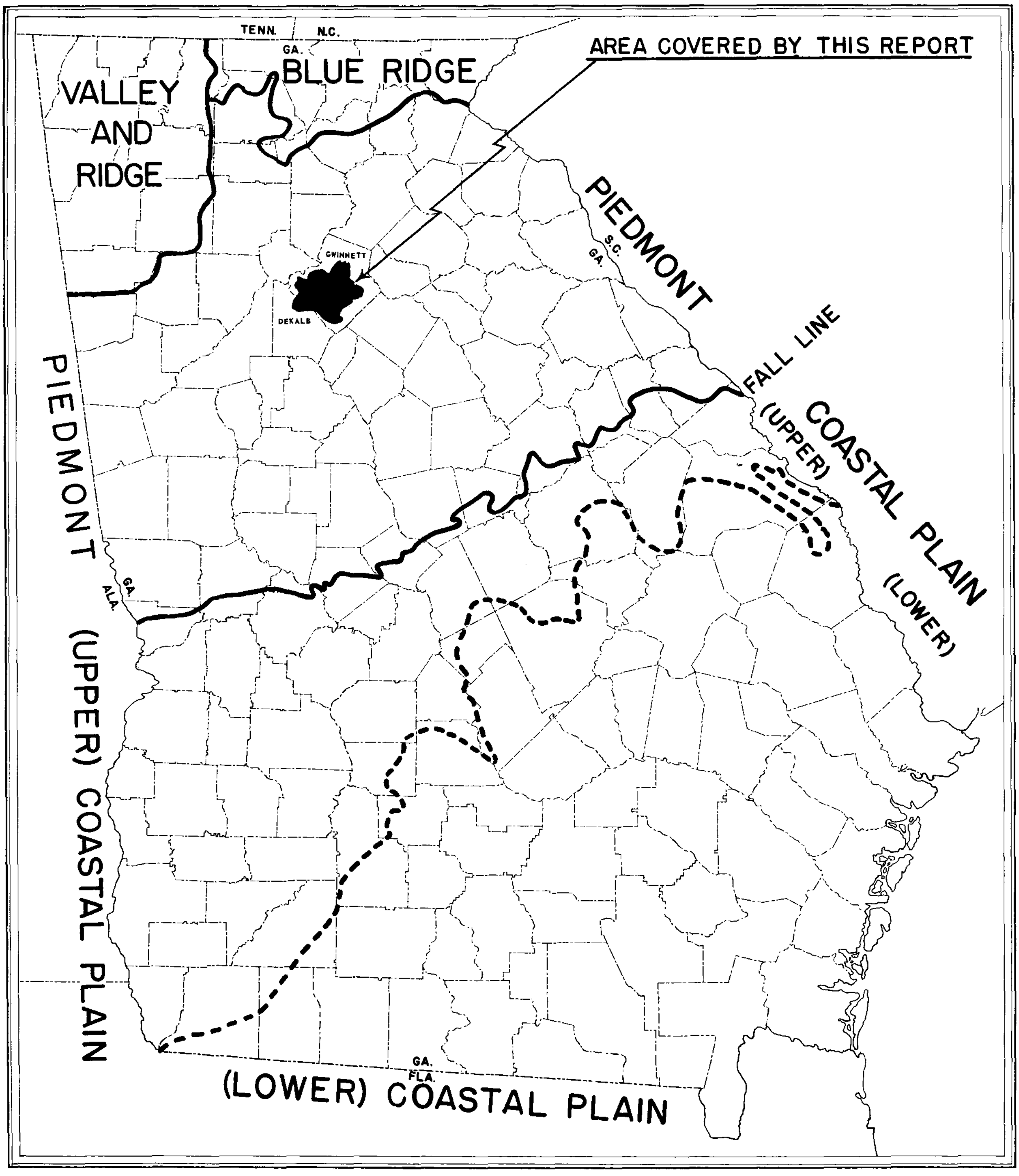

CONTENTS

ILLUSTRATIONS

TABLES

SURFACE-WATER RESOURCES OF THE YELLOW RIVER BASIN IN GWINNETT COUNTY

by R. F. Carter and W. B. Gannon

ABSTRACT

An inventory of surface-water resources of a small basin is presented, including information on water available for use at almost all points on perennial streams. The information is in the form of "flow maps" showing variations in flow along the streams as well as areal patterns. The flows shown on maps are minimum average flows for various periods of time and for various recurrence intervals. "Storage maps" are included to show the storage required to maintain minimum flows which are averages for time periods longer than 7 days.

In addition to the flow maps, flow data for selected points are tabulated. A method is presented by which the user can make reasonable estimates of the storage required to maintain any given rate of flow at 103 sites. These storage requirements may be estimated for each of three recurrence intervals.

INTRODUCTION

Purpose and Scope

The surface-water data in this report are assembled and presented as one unit of a water-resources inventory of Georgia which is being prepared by the U. S. Geological Survey. This report includes a comprehensive analysis of the water resources for a small basin in the Piedmont province of the State. Similar reports for other small river basins will be prepared; first, as a representative report for each hydrologic province, and eventually complete coverage for the State.

The primary value of the data presented in this report is its usefulness in estimating the amount of flow expected to be available during periods of scarcity or droughts. The data are also useful for estimating the storage capacity needed for supplementing natural flows sufficiently to meet various requirements.

The report area covers the Yellow River basin above the Upper Anniston Dam site. Most of the basin is in Gwinnett County, but a small part of it is in DeKalb County. The area, which is believed to be fairly representative of small river basins in the Piedmont province of Georgia, has considerable economic importance because of its growth potential. It is within easy commuting distance of Atlanta and is being made even more accessible by the construction of express highways through the area. Considerable population growth and industrial expansion may reasonably be expected in the near future.

A relatively large amount of streamflow information has been obtained in the Yellow River basin in Gwinnett County in recent years for use in studying the variation in streamflow characteristics and in determining the amount and types of observed data needed to define these characteristics on an areal basis. This streamflow information was used in the preparation of this report.

The report area is limited to the drainage basin tributary to the proposed multipurpose dam at the Upper Anniston Dam site. A preliminary investigation has been made by the Corps of Engineers, Department of the Army, of the feasibility of constructing a multipurpose dam at this site. The selection of the basin above this site for coverage in this report is not intended to imply that the dam will be constructed.

Much of the data in this report is presented in the form of "flow maps," which are intended to enable the user to find specific answers to many questions without further interpretation of the streamflow data. This type of presentation simplifies area comparisons of stream characteristics and is expected to supply all the information needed for reconnaissance-type studies.

Low flows are highly variable from stream to stream. They are greatly affected by local differences in soil type, land cover, topography, and geology. Areal generalizations are not feasible unless considerable flow data are available. This report utilizes streamflow measurements made during drought periods at a dense network of sites. These measured flows were correlated with continuous records of flow available at a few stream-gaging stations, located in the report area, thereby producing considerable flow information at the network of sites. Because these sites were close together with relatively little difference in flow between them, it was possible to interpolate from site to site along the stream pattern and construct flow maps which are areal generalizations.

Measurements of floodflows at a dense network of sites, such as used in this report, would be highly impracticable. Moreover, such an intensity of floodflow measurements is not necessary because these flows are less affected by variations in local land conditions than are drought flows. Areal analyses and generalizations of floodflows can be made on the basis of data collected at a less dense network of sites. Analysis of floodflows is not covered in this report.

Methods of estimating the frequency of floods of various magnitudes are described by Thomson and others[1]. Because of the difficulty of obtaining ample floodflow information on small streams,

[1]M. T. Thomson, S. M. Herrick, Eugene Brown and others, 1956, The availability and use of water in Georgia: Georgia Department of Mines, Mining and Geology Bulletin 65, p. 171-176.

sufficient data have not yet been collected for predicting flood magnitudes for streams draining less than 30 square miles in the area covered by this report.

At present, the flow of most streams in the area is predominantly natural flow with little man-made regulation. Economic growth of the area likely will alter this condition and streamflow records representing natural flow conditions may eventually be difficult to obtain.

Administration and acknowledgments

The streamflow data at the continuous-record gaging stations and the low-flow measurement at other sites were collected under a cooperative agreement between the Department of Mines, Mining and Geology of the Georgia State Division of Conservation, and the U.S. Geological Survey. The agreement also provides for the analysis of the data and the preparation of this report. The size of many of the drainage areas listed in this report were obtained under a cooperative agreement between the Georgia State Highway Department and the U.S. Geological Survey.

This report was prepared in the Georgia District of the Surface Water Branch under the general direction of A. N. Cameron, district engineer. R. F. Carter and W. B. Gannon, hydraulic engineers, directed the collection and compilation of the data. M. T. Thomson, former district engineer, did much of the preliminary planning of the report.

DESCRIPTION OF THE AREA

The Yellow River basin above the Upper Anniston Dam site is an area of 154 square miles. A map of the area is shown in plate 1. The topography consists generally of gently rolling hills with dendritic stream patterns. Most of the streams flow in well-defined channels with narrow or, in places, no flood plains and with densely wooded borders. Only a few streams flow through swampy areas. Towns, highways, railroads, and most of the farms are located on ridges.

The largest city in the area is Lawrenceville, which has a population of about 4,000 Other main towns lying all or partly in the area are Norcross, Duluth, Lilburn, and Snellville. The area is now part of suburban Atlanta and its development consists mainly of suburban homes and light industries. There are some light industries near the towns, but new industries and housing developments being established tend to prefer locations adjacent to the express highway under construction through the area.

The agricultural practices in the area have changed extensively in recent years. As in most parts of Georgia, the acreage under row-crop cultivation has decreased considerably. Row-crop farming has been replaced to a great extent by stock and poultry farming and by the production of timber and pulpwood. Very little irrigation is now practiced in the area, although there may be a trend toward an increase in this type of water use. Many farm ponds have been constructed to provide water for stock and for recreation; it is estimated that there are about 500 farm ponds in the entire area of Gwinnett County. Little or no information is available on the effects these ponds have on the flow of surface streams.

The Gwinnett County Water System supplements water supplies of most of the towns in the report area and serves a large percentage of the rural dwellings by means of an unusually long pipeline network. This system draws raw water from the Chattahoochee River outside the report area and may be expected to meet new domestic and light industry demands in the future. However, the streams in the study area may be used to supply major demands for water such as from industries that require large amounts of water or from increased irrigation. In addition, the streams of the study area will certainly be used more extensively for waste disposal.

FLOW RECORDS AVAILABLE

Five complete-record gaging stations with drainage areas ranging from 0.94 square mile to 134 square miles are operated in the report area. Measurements of base flow have been made at 99 additional sites with drainage areas ranging from 0.18 square mile to 126 square miles. The locations of these gaging stations and measuring sites are shown on plate 1, and descriptions of all the sites are included in table 1. The identification map numbers used in plate 1 and table 1 are based, in part, on a nationwide gaging-station numbering system. For this reason the map numbers do not begin with number 1, and the numbers are not consecutive.

Table 1.—Description of sites at which flow measurements have been made in the Yellow River basin

Map No.	Stream and location	Drainage area (sq. mi.)
491	Tributary to Yellow River (lat 34°00'25", long 83°59'10") at county road, 3½ miles north of Lawrenceville, 0.2 mile northeast of State Highway 20, and 0.3 mile upstream from junction with Yellow River.	0.53
492	Yellow River (lat 34°00'05", long 83°59'20") at State Highway 20, 3 miles north of Lawrenceville.	2.09
500	USGS complete-record gaging station 1953-; Wildcat Creek near Lawrenceville, Ga., (lat 34°00'05", long 84°00'20") at county road, 1.1 miles west of State Highway 20 and 3¼ miles north of Lawrenceville.	1.59
501	Yellow River (lat 33°59'15", long 84°00'40") at county road, 0.9 mile south of Collins Hill Church and 2½ miles northwest of Lawrenceville.	6.08
502	Little Suwanee Creek (lat 34°01'45", long 83°58'30") at county road, 0.8 mile west of Elbethel Church, 6 miles east of Suwanee, and 5 miles north of Lawrenceville.	.81
503	Tributary to Little Suwanee Creek (lat 34°02'35", long 83°59'30") at State Highway 20, 0.5 mile southeast of Rock Springs Church, 4½ miles east of Suwanee, and 0.5 mile above junction with Little Suwanee Creek.	.61
504	Little Suwanee Creek (lat 34°02'10", long 84°00'15") at county road, 0.8 mile east of Hopewell Church, 4 miles east of Suwanee, 1 mile west of State Highway 20, and 4 miles upstream from junction with Yellow River.	3.69
510	Little Suwanee Creek (lat 34°01'00", long 84°00'55") at county road, 1.2 miles north of Collins Hill Church and 4 miles southeast of Suwanee.	4.99
511	Webb Branch (lat 34°00'45", long 84°02'35") at county road, 1¼ miles south of Oldfield Church, 3¼ miles southeast of Suwanee, and 0.9 mile upstream from junction with Ager Creek.	.75
512	Ager Creek (lat 34°00'25", long 84°01'35") at county road, 4 miles southeast of Suwanee, and 0.2 mile upstream from junction with Little Suwanee Creek.	3.17
513	Little Suwanee Creek (lat 33°59'45", long 84°01'15") at county road, 0.5 mile northwest of McKendree Church, and 3¼ miles northwest of Lawrenceville.	9.62
520	Yellow River (lat 33°58'40", long 84°01'15") at county road, 0.9 mile north of State Highway 120, and 2¼ miles northwest of Lawrenceville.	17.7
521	Yellow River (lat 33°58'10", long 84°01'50") at State Highway 120, 2½ miles west of Lawrenceville.	19.1
522	West Fork of Wolf Creek (lat 33°59'35", long 84°03'00") about 4 miles northwest of Lawrenceville, 4 miles south of Suwanee, and 0.1 mile upstream from junction with East Fork of Wolf Creek.	.75
523	East Fork of Wolf Creek (lat 34°00'05", long 84°03'00") at county road, 0.1 mile east of Buggtown Church, 3¾ miles southeast of Suwanee, and 0.7 mile upstream from junction with West Fork of Wolf Creek.	.38
524	East Fork of Wolf Creek (lat 33°59'35", long 84°03'00") about 4 miles northwest of Lawrenceville, and 0.2 mile upstream from junction with West Fork of Wolf Creek.	.96
525	Wolf Creek (lat 33°59'30", long 84°03'00") at county road, 4¼ miles northwest of Lawrenceville.	1.83
530	Wolf Creek (lat 33°58'10", long 84°02'25") at State Highway 120, 3 miles west of Lawrenceville.	3.84
531	Tributary to Yellow River (lat 33°57'35", long 84°02'35") at county road, 1.2 miles southwest of Fairview Church, 0.5 mile south of State Highway 120, 3 miles west of Lawrenceville, and 0.2 mile upstream from junction with Yellow River.	.63
532	Yellow River (lat 33°57'15", long 84°02'25") at county road, 1.2 miles west of Mt. Vernon Church, and 3 miles west of Lawrenceville.	25.3
533	Yellow River (lat 33°56'40", long 84°02'30") at county road, 0.7 mile northwest of State Highway 8 and 3¼ miles west of Lawrenceville.	26.5
540	Yellow River (lat 33°55'50", long 84°02'45") at State Highway 8, 3¾ miles southwest of Lawrenceville.	28.0
541	Pew Creek (lat 33°56'15"), long 83°59'40") at State Highway 124, 1.3 miles south of Lawrenceville.	.55
550	USGS complete-record gaging station 1953-; Pew Creek near Lawrenceville, Ga., (lat 33°56'05", long 84°01'00") at county road, 0.2 mile southeast of State Highway 8, and 2¼ miles southwest of Lawrenceville.	2.23

Map No.	Stream and location	Drainage area (sq. mi.)
551	Redland Creek (lat 33°57′35″, long 84°00′45″) at county road west of city limits of Lawrenceville, 0.5 mile west of State Highway 120, and 2 miles upstream from junction with Pew Creek.	0.18
552	Redland Creek (lat 33°56′20″, long 84°01′45″) at State Highway 8, 2¾ miles southwest of Lawrenceville.	3.11
553	Pughs Creek (lat 33°55′10″, long 83°58′55″) at county road, 2½ miles northwest of Grayson, 2½ miles south of Lawrenceville, and 0.7 mile west of State Highway 20.	.99
554	Tributary to Pughs Creek, (lat 33°55′00″, long 83°59′50″) at county road, 2½ miles south of Lawrenceville and 0.2 mile east of State Highway 124.	.89
555	Pughs Creek (lat 33°54′45″, long 84°00′30″) at county road (old Lawrenceville Road), 3½ miles south of Lawrenceville and 0.5 mile downstream from State Highway 124.	3.58
556	Tributary to Pughs Creek (lat 33°54′20″, long 84°00′50″) at county road (old Lawrenceville road), 3¾ miles south of Lawrenceville, and 0.6 mile upstream from junction with Pughs Creek.	.62
557	Tributary to Pughs Creek (lat 33°54′50″, long 84°01′40″) at county road, 0.2 mile northeast of Rocky Branch Church, 4 miles southwest of Lawrenceville, and 0.2 mile upstream from junction with Pughs Creek.	.42
558	Pughs Creek (lat 33°54′35″, long 84°02′05″) at county road, 0.3 mile west of Rocky Branch Church, and 4¼ miles southwest of Lawrenceville.	5.99
560	Yellow River (lat 33°54′50″, long 84°02′55″) at county road, 1 mile east of Gloster.	43.5
561	Yellow River (lat 33°54′10″, long 84°04′00″) at county road, 0.5 mile south of Gloster.	45.1
562	South Fork of Bankstan Creek (lat 33°53′30″, long 84°01′35″) about 2½ miles north of Snellville, and 0.1 mile upstream from junction with North Fork of Bankstan Creek.	1.45
563	North Fork of Bankstan Creek (lat 33°53′30″, long 84°01′30″) about 2½ miles north of Snellville, and 0.1 mile upstream from junction with South Fork of Bankstan Creek.	.46
564	Bankstan Creek (lat 33°53′35″, long 84°01′35″) at county road, 2½ miles north of Snellville, and 1.3 miles southwest of State Highway 124.	1.95
565	Tributary to Bankstan Creek (lat 33°53′10″, long 84°02′20″) at county road, 1.0 mile east of Friendship Church, 2¼ miles northwest of Snellville, and 1.2 miles east of Five Forks.	.20
566	Bankstan Creek (lat 33°53′45″, long 84°04′00″) at county road, 1 mile south of Gloster.	4.32
567	Fork Creek (lat 33°55′50″, long 84°04′05″) at county road, 1.4 miles north of Gloster, and 0.4 mile northeast of State Highway 8.	.66
570	Fork Creek (lat 33°54′45″, long 84°04′40″) at county road 0.7 mile west of Gloster.	2.34
571	Tributary to Sweetwater Creek (lat 33°59′20″, long 84°08′35″) at county road, 1.0 mile southwest of Duluth, and 0.4 mile upstream from junction with Sweetwater Creek.	.30
572	Tributary to Sweetwater Creek (lat 33°59′00″, long 84°08′35″) at county road 1.4 miles southwest of Duluth, and 0.3 mile upstream from junction with Sweetwater Creek.	.24
573	Knox Creek (lat 33°59′00″, long 84°07′40″) at State Highway 120, 1.5 miles southeast of Duluth.	1.48
574	Sweetwater Creek (lat 33°58′15″, long 84°07′30″) at county road, 2½ miles southeast of Duluth, 1 mile west of State Highway 120, and 1.2 miles upstream from junction with Singleton Creek.	4.47
575	Singleton Creek (lat 34°00′10″, long 84°05′55″) at county road, 2½ miles east of Duluth, 1 mile west of Trinity Church, and 2¾ miles upstream from junction with Sweetwater Creek.	.80
576	Singleton Creek (lat 33°58′45″, long 84°06′35″) at State Highway 120, 2½ miles southeast of Duluth.	3.54
577	Fork Creek (lat 33°59′25″, long 84°05′20″) at county road, 3¼ miles southeast of Duluth, and 1 mile west of Lebanon Church.	.86
580	Fork Creek (lat 33°58′40″, long 84°05′40″) at State Highway 120, 3¼ miles southeast of Duluth.	1.96
581	Tributary to Fork Creek (lat 33°58′30″, long 84°03′45″) at State Highway 120, 4½ miles northwest of Lawrenceville.	.82

Table 1.—Description of sites at which flow measurements have been made in the Yellow River basin—continued

Map No.	Stream and location	Drainage area (sq. mi.)
582	Tributary to Fork Creek (lat 33°58′30″, long 84°04′25″) at State Highway 120, 5 miles northwest of Lawrenceville, and 1.4 miles southeast of Meadow Church.	0.88
583	Tributary to Fork Creek (lat 33°57′35″, long 84°04′35″) at county road, 5 miles west of Lawrenceville, 5 miles southeast of Duluth, and 1.1 miles northwest of Mt. Vernon Church.	3.52
584	Sweetwater Creek (lat 33°57′00″, long 84°05′40″) at county road, 2 miles north of Mt. Vernon Church, and 4½ miles southeast of Duluth.	19.5
585	Tributary to Sweetwater Creek (lat 33°57′00″, long 84°06′50″) at county road 0.8 mile east of Pleasant Hill Church, 4 miles southeast of Duluth, and 0.6 mile upstream from junction with Sweetwater Creek.	1.08
586	Tributary to Sweetwater Creek (lat 33°57′05″, long 84°06′40″) at county road, 3 miles west of Mt. Vernon Church, and 0.7 mile upstream from junction with Sweetwater Creek.	.21
587	Tributary to Sweetwater Creek (lat 33°55′50″, long 84°06′05″) near mouth of tributary joining Sweetwater Creek about 2¾ miles southwest of Mt. Vernon Church.	.92
588	Sweetwater Creek (lat 33°55′45″, long 84°06′05″) at county road, 2¾ miles southwest of Mt. Vernon Church, and 1 mile north of junction with Beaver Ruin Creek.	23.2
590	Beaver Ruin Creek (lat 33°55′35″, long 84°11′35″) at county road, 1½ miles southeast of Norcross.	2.78
591	Tributary to Beaver Ruin Creek (lat 33°54′55″, long 84°11′15″) about 2¼ miles southeast of Norcross on Mitchell Road, 0.5 mile south of Atlanta Expressway, and 0.8 mile upstream from junction with Beaver Ruin Creek.	.79
592	Beaver Ruin Creek (lat 33°55′40″, long 84°10′00″) at county road, 2¾ miles southeast of Norcross.	6.11
594	Bromolow Creek (lat 33°57′35″, long 84°09′20″) at county road, 3 miles south of Duluth, 0.9 mile west of Adams Crossroads, and 1 mile upstream from junction with North Beaver Ruin Creek.	1.18
600	USGS complete-record gaging station 1953-; Shetley Creek near Norcross, Ga. (lat 33°57′20″, long 84°09′40″) at county road, 1 mile upstream from mouth, and 3 miles east of Norcross.	.94
601	North Beaver Ruin Creek (lat 33°57′10″, long 84°10′55″) at county road, 2 miles northeast of Norcross, and 0.5 mile southeast of State Highway 13.	1.61
602	North Beaver Ruin Creek (lat 33°56′30″, long 84°10′10″) at county road, 2½ miles east of Norcross, 0.6 mile northwest of Beaver Ruin Road, and 1 mile upstream from junction with Bromolow Creek.	4.16
603	Bromolow Creek (lat 33°56′35″, long 84°08′35″) at county road, 4 miles east of Norcross and just downstream from express highway.	9.23
604	Tributary to Bromolow Creek (lat 33°56′30″, long 84°08′00″) at Beaver Ruin Road, 0.1 mile east of Davis Road, 0.5 mile southeast of express highway.	.56
605	Bromolow Creek (lat 33°55′45″, long 84°07′35″) at county road, 0.7 mile west of Sweetwater Church, and 5 miles east of Norcross.	11.7
606	Beaver Ruin Creek (lat 33°55′20″, long 84°07′20″) at county road, 2½ miles northeast of Lilburn, and 1.2 miles downstream from Freeman Lake.	21.6
610	Sweetwater Creek (lat 33°54′50″, long 84°05′55″) at State Highway 8, 7 miles southwest of Lawrenceville.	48.1
611	Lucky Shoals Creek (lat 33°52′40″, long 84°12′10″) at county road, 4½ miles south of Norcross, and 0.3 mile downstream from DeKalb-Gwinnett county line.	1.32
613	Jackson Creek (lat 33°52′50″, long 84°11′20″) at county road, 1 mile east of DeKalb-Gwinnett county line, and 4½ miles south of Norcross.	3.79
614	Jackson Creek (lat 33°53′20″, long 84°10′20″) at county road, 2 miles west of Lilburn, and 4½ miles southeast of Norcross.	5.87
615	Pumpkin Vine Creek (lat 33°54′05″, long 84°11′30″) at county road, 0.7 mile east of Glover Church, 3 miles southeast of Norcross, and 1.5 miles upstream from junction with Jackson Creek.	.51
616	Pumpkin Vine Creek (lat 33°54′00″, long 84°10′20″) at county road, 2 miles northwest of Lilburn, and 3¾ miles southeast of Norcross.	1.62

Table 1.—Description of sites at which flow measurements have been made in the Yellow River basin—continued

Map No.	Stream and location	Drainage area (sq. mi.)
620	Jackson Creek (lat 33°53′50″, long 84°08′50″) at county road, 0.8 mile northwest of Lilburn, and 5 miles southeast of Norcross.	9.53
621	Camp Creek (lat 33°52′15″, long 84°09′45″) at county road, 3½ miles northheast of Tucker, 0.4 mile south of Harmony Grove Church, and 1.8 miles southwest of Lilburn (at Seaboard Air Line Railroad).	3.40
622	Tributary to Camp Creek (lat 33°51′55″, long 84°09′30″) at county road, 3½ miles northeast of Tucker, 0.9 mile south of Harmony Grove Church, and 2 miles southwest of Lilburn.	.47
623	Camp Creek (lat 33°53′05″, long 84°08′00″) at county road southeast of Lilburn and 6¼ miles southeast of Norcross.	6.47
624	Tributary to Jackson Creek (lat 33°54′05″, long 84°07′40″) at State Highway 8, 1 mile northeast of Lilburn.	.54
630	Jackson Creek (lat 33°53′40″, long 84°06′50″) at county road southeast of Luxomni and 6½ miles southeast of Norcross.	18.8
631	Tributary to Jackson Creek (lat 33°53′15″, long 84°06′15″) at county road, 1 mile southeast of Luxomni, and 0.5 mile upstream from junction with Jackson Creek.	.43
640	Yellow River (lat 33°53′25″, long 84°05′05″) at county road, 1.8 miles southwest of Gloster.	124.
642	Tributary to Yellow River (lat 33°52′25″, long 84°05′30″) at county road, 0.8 mile west of Yellow River Church, and 2½ miles north of Opossum Lake.	.49
643	Yellow River (lat 33°52′25″, long 84°05′00″) at county road, 0.3 miles west of Yellow River Church and 3¾ miles west of Snellville.	126.
644	Turkey Creek (lat 33°52′30″, long 84°02′20″) at county road, 1.7 miles northwest of Snellville, and 1.5 miles southeast of Five Forks.	.52
645	Turkey Creek (lat 33°52′00″, long 84°04′20″) at county road, 0.7 mile southeast of Yellow River Church, and 0.6 mile upstream from junction with Yellow River.	2.57
646	Watson Creek (lat 33°51′55″, long 84°01′25″) on Oak Road, in Snellville and 0.4 mile from intersection Oak Road and Northside Road (State Highway 124).	.27
647	Watson Creek (lat 33°51′50″, long 84°03′00″) at county road, 1.8 miles west of Snellville.	1.63
648	Tributary to Watson Creek (lat 33°51′25″, long 84°02′55″) at county road, 1.8 miles west of Snellville, and 0.5 mile north of U. S. Highway 78.	.47
649	Watson Creek (lat 33°51′50″, long 84°04′05″) at county road, 1.1 miles southeast of Yellow River Church, and 2¾ miles west of Snellville.	3.18
650	USGS complete-record gaging station 1942-; Yellow River near Snellville, Ga. (lat 33°51′10″, long 84°04′45″) at county road, 3¼ miles west of Snellville.	134.
651	Garner Creek (lat 33°51′00″, long 84°08′10″) at county road, 0.7 mile northwest of Trickum, and 3 miles south of Lilburn.	.74
652	Garner Creek (lat 33°51′25″, long 84°06′05″) at county road, 2¾ miles southeast of Lilburn, and 2 miles upstream from junction with Yellow River.	1.87
654	Hale Creek (lat 33°51′55″, long 84°07′05″) at county road, 2 miles southeast of Lilburn, 5 miles west of Snellville, and 0.6 mile upstream from junction with Garner Creek.	1.38
700	USGS complete-record gaging station 1953-; Garner Creek near Snellville, Ga. (lat 33°51′45″, long 89°05′45″) at county road, 0.9 mile upstream from mouth, and 4½ miles west of Snellville.	5.54
701	Pounds Creek (lat 33°50′10″, long 84°06′55″) at county road, 1.1 miles upstream from Opossum Lake, 1.5 miles upstream from junction with Yellow River, and 5¾ miles west of Snellville.	1.00
702	Tributary to Pounds Creek (lat 33°50′25″, long 84°06′10″) about 0.1 mile upstream from junction with Pounds Creek, 0.5 mile upstream from Opossum Lake, and 4 miles west of Snellville.	1.03
703	Pounds Creek (lat 33°49′55″, long 84°05′25″) at outflow of Opossum Lake near junction with Yellow River, just north of U. S. High 78, and 4¼ miles west of Snellville.	3.74
704	Tributary to Yellow River (lat 33°49′15″ long 84°05′15″), at private road. 0.7 mile southeast of U. S. Highway 78 and 0.2 mile upstream from mouth.	.93

Table 1.—Description of sites at which flow measurements have been made in the Yellow River basin—continued

Map No.	Stream and location	Drainage area (sq. mi.)
705	Jacks Creek (lat 33°49′35″, long 84°03′00″) at county road, 2¾ miles southwest of Snellville, and 1.2 miles southeast of U. S. Highway 78.	1.57
706	Jacks Creek (lat 33°49′15″, long 84°03′50″) at State Highway 264, 2¾ miles southwest of Snellville.	3.88
707	Jacks Creek (lat 33°48′50″, long 84°04′10″) at county road, 0.8 mile south of Shiloh Church and 1.6 miles northwest of Centerville.	4.89
708	Yellow River (lat 33°48′20″, long 84°04′35″) at county road, 2 miles west of Centerville, at proposed Upper Anniston Dam site.	154.

METHODS OF ANALYSIS

Correlation

The complete-record gaging station on Yellow River near Snellville, Georgia, (map number 650) which has been in operation since October 1942, has the longest record available in the report area. Records for this gaging station were extended back to September 1937 by correlation with records for the Middle Oconee River at Athens. The correlation methods used are based on Searcy's (1960) "Graphical Correlation of Gaging Station Records."[2].

Flow for Yellow River near Snellville, for the calendar years 1938 through 1958, forms the basis for computing data for the other sites. Records for four other complete-record gaging stations in the study area were extended by correlation with Yellow River near Snellville to cover the period 1938 through 1958. These four complete-record gaging stations are Wildcat Creek near Lawrenceville, Ga. (map number 500), Pew Creek near Lawrenceville, Ga. (map number 550), Shetley Creek near Norcross, Ga. (map number 600), and Garner Creek near Snellville, Ga. (map number 700). Base-flow measurements at the additional measurement sites were correlated with each of the complete-record gaging stations to obtain flow values for each of these sites. The computed flow values for these sites are subject to greater errors than those for complete-record gaging stations.

Frequency

The flow of a stream varies greatly during a year and the minimum flow reached during the dry season of a year varies greatly from year to year. Streamflow cannot be forecast a year ahead, but from past records the probability of a drought of any given severity can be predicted.

The recurrence interval, which is a term used in studies of the relative frequency of natural events, is the average of the intervals between successive events with a discharge equal to or less than a given amount. For example, if the annual low flow of a stream was less than 6 million gallons per day (mgd) on 10 occasions during 100 years, then the recurrence interval of an annual low flow less than 6 mgd would be 10 years. It is important to note that 10 years is not a fixed interval, but only the average of the intervals. The recurrence interval would still be 10 years even if, by chance, all the annual low flows of less than 6 mgd occurred in one 10-year period.

The recurrence interval is actually the reciprocal of probability. An event that has a 10-year recurrence interval has 1 chance in 10 (equivalent to a probability of 0.10) that the event will occur in a given year.

The data used in preparing this report have been processed by statistical methods commonly used by the Geological Survey to evaluate the magnitude and frequency of various rates of flow. The data presented are taken from low-flow frequency curves and are for recurrence intervals of 20, 10, and 2 years.

The low-flow frequency curves for the gaging stations in the report area were compared with data for other gaging stations in the State with much longer periods of record. The comparisions were used to help define the shape of the low-flow frequency curves for gaging stations in the report area, thereby minimizing the effect of unusual drought events during the relatively short period of record at these gaging stations. Recurrence intervals computed on the basis of data thus modified are believed to be more nearly representative of events likely to occur in the future than results based only on records of gaging stations in the report area.

[2]Searcy, J. K., 1960, Graphical correlation of gaging station records pt. 1 of manual of hydrology, general surface-water techniques: U.S. Geological Survey Water-Supply Paper 1541-C, p. 67-100.

Storage

As computed for this report, storage is a volume of water that would be required to supplement streamflows to maintain a constant rate of flow. For specific periods of record, storage may be computed by summation of the difference between daily flow rates and the desired constant rate. This is equivalent to the mass curve technique explained in most text books on hydrology.

Frequency of storage requirements for this report was computed by using data from low-flow frequency curves to construct mass curves. For example, the average flows for various periods of consecutive days with a given recurrence interval, taken from the low-flow frequency curves, were used to construct mass curves of flow with that recurrence interval. The storage required to maintain various rates of constant flow was computed from these mass curves, and has the same recurrence interval as the flow data on which the mass curves are based.

PRESENTATION OF RESULTS

Complete-record gaging stations

Statistics on the low flow at complete-record gaging stations are tabulated in table 2. The annual low flows for various periods of time, ranging from 1 day to 274 days, are average flows for the given number of days. These average flows are listed for 20-year, 10-year, and 2-year recurrence intervals.

Table 2.—Magnitude and frequency of annual low flow at complete-record gaging stations

*Map number	Drainage area (sq. mi.)	Recurrence interval (yrs.)	Discharge, in million gallons per day, for indicated number of consecutive days and indicated recurrence interval — Number of consecutive days: 1	3	7	14	30	60	90	120	150	183	274
500	1.59	2	0.081	0.094	0.11	0.12	0.15	0.21	0.27	0.30	0.37	0.45	0.75
		10	.022	.023	.025	.030	.043	.056	.073	.099	.13	.17	.35
		20	.012	.013	.014	.017	.028	.038	.051	.072	.094	.13	.27
550	2.23	2	.29	.32	.34	.36	.41	.51	.58	.65	.76	.87	1.3
		10	.16	.16	.17	.18	.21	.23	.27	.32	.38	.44	.74
		20	.12	.13	.13	.14	.18	.20	.22	.27	.31	.37	.61
600	.94	2	.091	.10	.11	.12	.15	.19	.24	.26	.30	.37	.57
		10	.024	.026	.028	.035	.049	.062	.083	.11	.13	.16	.29
		20	.015	.016	.017	.020	.033	.044	.059	.082	.10	.13	.24
650	134	2	11	12	13	15	18	24	28	32	36	43	67
		10	2.3	2.5	2.8	3.5	5.2	7.0	9.5	13	16	20	35
		20	1.3	1.4	1.5	1.8	3.2	4.5	6.5	9.3	12	16	29
700	5.54	2	1.0	1.1	1.2	1.2	1.3	1.6	1.7	1.8	2.0	2.2	2.7
		10	.54	.54	.57	.62	.73	.83	.96	1.1	1.3	1.4	1.9
		20	.42	.44	.45	.48	.61	.70	.81	.94	1.1	1.3	1.8

*Gaging stations are shown on the map, plate 1, and the locations are described in table 1.

Flow maps

The main results of the study are presented in the flow maps of figures 1-17, which show data for nearly all the well-defined streams in the study area. Flow rates, in million gallons per day, were interpolated between the sites where flows were computed on basis of discharge measurements. These rates of flow, which are depicted graphically in terms of ranges of probable flow, can be read from the maps for any site.

Figure 1 shows only the generalized stream pattern and the map numbers of measurement sites. It serves as an index map to facilitate the identification of specific sites on the flow maps.

The probable range of flows to be expected at most points on streams in the basin may be read from the flow maps of figures 2, 3, 5 and 7 for the 20-year recurrence interval, from figures 9, 10, 12 and 14 for the 10-year recurrence interval, and from figure 16 for the 2-year recurrence interval. These flow maps show the average flows for selected periods of consecutive days. The annual low flows for periods of 7, 30, 90 and 274 days are shown by the maps for the 20-year and 10-year recurrence intervals. Only the 7-day annual low flow is shown for the 2-year recurrence interval.

Storage required to develop average flow

If the prospective user of streamflow wishes to be sure of a water supply available without interruption, he needs somewhat more information than just the average flow to be expected during a certain number of days. Because streamflow is variable with time the flow during part of a period will be less than the average and the flow during the remainder of the period will be greater than the average. Therefore, some means of storage must be provided if the average rate of flow is to be available continuously during the period.

During low-flow periods on streams not affected by artificial regulation, the average flow for 1 day does not usually differ significantly from the absolute minimum flow during the day. Also, the average flow for 7 days does not usually differ significantly from the average for 1 day. A small temporary dam can usually provide enough pondage in a stream to equalize such minor fluctuations. The storage required to maintain flows as high as the averages for periods of time longer than 7 days will usually be great enough to necessitate advance planning and preparation.

Storage maps

The storage required to develop a flow rate equal to the annual low flows for 30, 90, and 274-day periods at selected recurrence intervals have been computed and are shown on maps. The storage required to develop the annual low flows that have a 20-year recurrence interval is shown in figures 4, 6, and 8. The storage required to develop the annual low flows that have a 10-year recurrence interval is shown in figures 11, 13, and 15. Each storage map immediately follows the flow map to which it is related.

Long-term average flow

Figure 17 is a map showing the average flow for streams in the report area for the period 1938 through 1958. At complete-record gaging stations and other measurement sites the average flows are based on correlations. At intermediate points the average flows are based on interpolation. This flow statistic averages floods with droughts and tends to conceal the effect of minor differences in land characteristics. Average flow characteristically tends to be proportional to drainage area in relatively small areas, such as this, that have fairly uniform topography, land cover, and average precipitation.

Tabulation of flow

Flow data for the numbered sites in the report area, including data on which the flow maps are based, are tabulated in table 3. The flows listed are in units of million gallons per day per square mile to show the variation of low-flow characteristics of the streams and to make apparent the uncertainities of low-flow estimates based on average yield per unit area rather than on flow measurements and correlations.

Probable accuracy

The accuracy of the data presented in this report is probably highest at complete-record gaging stations, which are listed in table 2. Data for other sites, which are based on flow correlations and on interpolations, are probably much less accurate.

The flows listed in table 3 are shown to two significant figures in order to reflect the differences in flow characteristics of the sites. Although these data, based on correlations, are likely much more accurate than data computed by other methods, they are nevertheless subject to error. A study of the data used in making the correlations indicate the accuracy is such that most of the figures shown in table 3 are within twofold of what would have been obtained had the relationship with the gaging station been perfect.

The use of records of past events as an index to the future is always subject to what is known as "sampling" error. This means that the sample of past events which have been analyzed may not accurately reflect the future events for which a forecast is made.

APPLICATION OF RESULTS

Use of flow maps

The streamflow maps of this report are useful in comparing one area or one reach of a stream with another area or reach. A site can be selected from the map, by inspection, that will have streamflow characteristics which will fit a given set of specifications. Similarly, the comparative flow characteristics of alternative sites can readily be appraised. The flow maps satisfy the data requirements of most reconnaissance studies.

Use of low-flow table

Flow information, in addition to that presented by the flow maps and in table 2, may be obtained for any of the numbered sites shown on plate 1 by use of the low-flow data shown in table 3. The average flow for a specified length of time and recurrence interval at a selected site may be read from table 3, but because these flow figures are in units of million gallons per day per square mile (mgdsm) they must be multiplied by the drainage area of the selected site to obtain a result in million gallons per day (mgd).

Storage

The storage required to maintain a given rate of flow for a site selected from plate 1 can be estimated from figure 18 by use of the "storage index" listed in table 3. First obtain the storage index for the desired recurrence interval from table 3. Second, using figure 18, enter the graph at the selected storage index on the horizontal axis, and then, opposite the desired flow on the vertical axis, read the storage requirement indicated by the family of storage curves. Some interpolation between storage curves will probably be necessary. It is important to note that both flow and storage are in "per square mile" units in the graphs of figure 18. Thus, the results must be multiplied by the size of the drainage area to convert to absolute values.

The curves in figure 18 are based on the low-flow frequency curves at the five complete-record gaging stations listed in table 2. The storage index is the 30-day annual low flow, in million gallons per day per square mile, at the indicated recurrence interval. This flow characteristic works well as an indicator of storage requirements. The storage required and allowable draft are based on data having the same recurrence intervals as the storage index. For example, with a storage index having a 20-year recurrence interval, the storage and allowable draft are such that at average intervals of 20 years the amount of storage required is as great or greater than that shown.

The use of the storage curves in figure 18 is not confined to the specific flow rates listed in table 3. The curves may be used to estimate the storage required to maintain any rate of flow within the range of definition of the curves. It is necessary only to know the storage index for a given recurrence interval for a given site in order to estimate the storage required at that recurrence interval to maintain given rates of flow.

If the use of the curves of figure 18 indicates that no storage would be required to maintain a given rate of flow, then it is likely that the natural flow of the streams would provide that rate of flow. If alternate sites were being considered for location of a facility requiring a certain rate of flow, the storage curves could be used to select the site most likely to provide the flow without the use of supplemental storage or else to select the site likely to require the least supplemental storage. This appraisal of the compartive characteristics of alternate sites could be made without using any flow figures other than those used as the storage index in table 3.

Minimum flow during the 1954 drought

The drought of 1954 was the most severe for which adequate records are available in the study areas. Observed minimum daily flows at the complete-record gaging stations and computed minimum daily flows for the remainder of the numbered sites in the report area are listed in table 3 in terms of million gallons per day. When divided by the drainage area these flows are somewhat less than the annual low flows shown for the 20-year recurrence interval.

DISCUSSION AND REVIEW

This inventory of surface-water resources in a part of the Yellow River basin describes the flow available for use and development. The inventory has been prepared in considerable detail because the use of streams in the area is expected to be extensive and because this was a pilot type of study to see how useful the flow maps and other material will be. For areas where the use of streams would be less, similar reports could be prepared with a less exhaustive treatment.

The flow data included in the report represent, for the most part, natural conditions, although some changes in flow characteristics likely have occurred as a result of changes in land use by man. The present trend toward urbanization, industrialization, and possible increased irrigation likely will cause more pronounced and more rapid changes in flow characteristics in the future.

The streamflow characteristics were investigated and analyzed by a sampling and correlation process. This process delineated the extreme variability of streamflow in the area and provided sufficient data to compute flows on most perennial streams. These computed flows are believed to me much more accurate than flows that could be computed without the use of base-flow measurements.

Studies under way may eventually result in development of methods of making areal predictions of streamflow characteristics on the basis of land features (geology, topography, vegetal cover, culture, etc.) but these methods, when developed, are likely to supplement rather than supplant the methods used in preparing this report.

The "overall picture" of streamflow during times of drought as presented in this report makes it possible to coordinate the use and development of this resource. The flow maps may be used to study the effect the use of a given stream will have at downstream sites. For example, if a quantity of waste material is added to a stream at a given site, the amount of dilution this waste will receive in traveling downstream may be estimated from the flow maps.

The form of presentation of storage requirement data in figure 18 is a new development. Recent hydrologic reports have included similar families of curves showing storage requirements data but only for one frequency or for one historical event. The use of a single set of curves to show storage requirement data over a range of frequencies as well as over a range of demand flows is a new technique.

This new form of presentation makes it simple to compare the relative benefits possible from providing supplemental storage at several sites. The presentation also provides a convenient basis for computing the reserve storage capacity needed at several recurrence intervals and therefore provides a means of weighing the relative cost of reducing the risk of water shortage.

Certain generalized patterns of low-flow characteristics may be seen by examining the data in this report. In certain parts of the basin, most streams tend to have very low flows per unit of area, in other parts, the streams tend to have fairly high flows per unit of area, while in still other parts, the streams tend to have moderate flows per unit of area. Within these generalized areas of the basin, however, there is still a large range of flow variability. Estimates of flow based only on areal averages or coefficients would be subject to much larger errors than would estimates, such as in this inventory, based on interpolations between points where actual flow measurements and correlations have been made.

Table 3.—Low-flow data and storage indexes for sites in the Yellow River basin

Map number	Drainage area (sq. mi.)	Annual low flow, in million gallons per day per square mile, for indicated number of consecutive days and indicated recurrence interval, in years: 7-days			30-days			90-days			274-days			Storage index			1954 Min. daily (mgd)
		2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	
491	0.53	0.058	0.012	0.007	0.082	0.022	0.014	0.150	0.039	.026	0.47	0.20	0.16	0.082	0.022	0.014	*
492	2.09	.036	.004	.002	.055	.010	.006	.12	.023	.014	.45	.16	.12	.055	.010	.0055	*
500	1.59	.067	.016	.009	.097	.027	.018	.17	.046	.032	.47	.22	.17	.097	.027	.018	.006
501	6.08	.053	.012	.006	.074	.020	.013	.15	.036	.024	.46	.19	.14	.074	.020	.013	.02
502	.81	.069	.016	.010	.096	.029	.019	.17	.048	.034	.48	.22	.17	.096	.029	.019	*
503	.61	.054	.011	.006	.078	.021	.013	.15	.037	.025	.46	.20	.15	.078	.021	.013	*
504	3.69	.087	.023	.014	.12	.039	.027	.19	.062	.045	.49	.25	.20	.12	.039	.027	.03
510	4.99	.061	.009	.004	.090	.019	.011	.17	.040	.025	.47	.21	.16	.090	.019	.011	.01
511	.75	.11	.032	.021	.14	.051	.036	.21	.078	.058	.50	.27	.22	.14	.051	.036	*
512	3.17	.11	.028	.016	.14	.048	.036	.22	.083	.058	.50	.28	.23	.14	.048	.036	.03
513	9.62	.086	.023	.014	.12	.039	.027	.20	.062	.045	.49	.24	.19	.12	.039	.027	.07
520	17.7	.040	.006	.003	.075	.010	.006	.12	.021	.012	.47	.18	.14	.075	.010	.0058	.03
521	19.1	.042	.006	.003	.077	.012	.008	.14	.025	.015	.46	.19	.14	.077	.012	.0078	.03
522	.75	.094	.027	.017	.12	.044	.031	.20	.069	.051	.49	.26	.21	.12	.044	.031	.01
523	.38	.059	.013	.007	.084	.023	.015	.16	.040	.028	.47	.21	.16	.084	.023	.015	*
524	.96	.089	.025	.016	.12	.041	.028	.19	.065	.047	.49	.25	.20	.12	.041	.028	*
525	1.83	.13	.048	.032	.17	.067	.052	.25	.10	.077	.52	.31	.25	.17	.067	.052	.03
530	3.84	.14	.046	.030	.18	.068	.052	.25	.11	.081	.52	.29	.26	.18	.068	.052	.07
531	.63	.18	.081	.059	.22	.11	.085	.31	.15	.12	.54	.35	.31	.22	.11	.085	.02
532	25.3	.038	.005	.003	.058	.011	.007	.12	.023	.014	.47	.18	.14	.058	.011	.0072	.06
533	26.5	.037	.005	.003	.056	.011	.007	.12	.022	.014	.46	.16	.13	.056	.011	.0068	.04
540	28.0	.037	.005	.003	.054	.010	.007	.12	.024	.014	.43	.15	.13	.054	.010	.0068	.03
541	.55	.039	.006	.004	.060	.013	.007	.12	.025	.016	.45	.17	.12	.060	.013	.0074	*
550	2.23	.15	.074	.059	.18	.092	.079	.26	.12	.098	.59	.33	.27	.18	.092	.079	.10
551	.18	.14	.051	.035	.17	.074	.056	.25	.11	.083	.52	.31	.26	.17	.074	.056	*
552	3.11	.18	.074	.052	.20	.11	.081	.29	.14	.12	.55	.35	.30	.20	.11	.081	.12
553	.99	.097	.028	.018	.13	.046	.032	.21	.071	.053	.50	.26	.21	.13	.046	.032	.01
554	.89	.14	.054	.037	.18	.077	.058	.26	.11	.087	.51	.32	.26	.18	.077	.058	.02
555	3.58	.11	.032	.021	.14	.051	.037	.21	.078	.058	.50	.27	.22	.14	.051	.037	.04
556	.62	.12	.038	.025	.15	.058	.043	.23	.088	.066	.51	.28	.23	.15	.058	.043	*
557	.42	.074	.018	.011	.10	.032	.021	.18	.052	.037	.48	.23	.18	.10	.032	.021	*
558	5.99	.14	.052	.037	.16	.072	.057	.24	.10	.081	.54	.30	.25	.16	.072	.057	.17
560	43.5	.075	.014	.008	.10	.026	.016	.18	.050	.034	.50	.22	.18	.10	.026	.016	.24
561	45.1	.075	.014	.008	.10	.026	.016	.18	.050	.034	.49	.22	.18	.10	.026	.016	.24
562	1.45	.15	.060	.045	.19	.090	.070	.27	.12	.10	.53	.32	.28	.19	.090	.070	.06
563	.46	.11	.034	.022	.14	.053	.038	.22	.079	.061	.50	.27	.22	.14	.053	.038	*
564	1.95	.12	.041	.027	.15	.061	.045	.23	.092	.070	.51	.29	.24	.15	.061	.045	.03
565	.20	.20	.097	.071	.24	.13	.100	.32	.17	.14	.55	.37	.32	.24	.13	.10	.01
566	4.32	.12	.038	.026	.15	.062	.043	.24	.093	.070	.52	.29	.24	.15	.062	.043	.08
567	.66	.081	.021	.013	.11	.036	.024	.19	.058	.042	.49	.24	.19	.11	.036	.024	*
570	2.34	.11	.035	.023	.14	.057	.039	.22	.084	.065	.51	.28	.23	.14	.057	.039	.03
571	.30	.076	.019	.012	.10	.032	.022	.18	.054	.038	.48	.23	.18	.10	.032	.022	*
572	.24	.074	.018	.011	.10	.032	.021	.17	.052	.037	.48	.23	.18	.10	.032	.021	*
573	1.48	.070	.018	.010	.090	.030	.021	.16	.051	.036	.49	.20	.16	.090	.030	.021	.01
574	4.47	.060	.013	.008	.085	.024	.015	.16	.041	.028	.48	.21	.16	.085	.024	.015	.01
575	.80	.091	.026	.016	.12	.042	.029	.20	.066	.048	.49	.25	.21	.12	.042	.029	*
576	3.54	.074	.018	.011	.10	.032	.021	.17	.052	.037	.48	.24	.18	.10	.032	.021	.02
577	.86	.054	.011	.006	.078	.021	.013	.15	.037	.025	.46	.20	.15	.078	.021	.013	*
580	1.96	.098	.025	.014	.12	.045	.029	.19	.074	.055	.50	.25	.20	.12	.045	.029	.02
581	.82	.10	.032	.020	.13	.050	.035	.21	.076	.054	.50	.27	.24	.13	.050	.035	*
582	.88	.15	.059	.041	.18	.083	.064	.27	.12	.094	.52	.32	.27	.18	.083	.064	.02
583	3.52	.14	.051	.035	.17	.074	.056	.25	.11	.084	.52	.31	.27	.17	.074	.056	.07
584	19.5	.056	.012	.007	.074	.022	.014	.13	.039	.026	.48	.18	.14	.074	.022	.014	.09
585	1.08	.27	.16	.12	.30	.21	.16	.38	.25	.20	.58	.43	.39	.30	.21	.16	.10
586	.21	.19	.089	.065	.23	.12	.094	.32	.16	.13	.55	.36	.32	.23	.12	.094	.01
587	.92	.045	.008	.004	.067	.016	.009	.13	.029	.019	.46	.18	.13	.067	.016	.009	*
588	23.2	.083	.022	.014	.11	.037	.025	.19	.059	.043	.49	.24	.19	.11	.037	.025	.15
590	2.78	.11	.035	.023	.13	.054	.039	.21	.080	.062	.52	.28	.23	.13	.054	.039	.05
591	.79	.28	.16	.13	.31	.21	.16	.39	.24	.21	.59	.44	.40	.31	.21	.16	.08
592	6.11	.10	.036	.023	.13	.048	.039	.21	.075	.056	.52	.26	.21	.13	.048	.039	.09
594	1.18	.16	.067	.047	.20	.092	.070	.28	.13	.10	.54	.33	.28	.20	.092	.010	.04
600	.94	.12	.030	.018	.16	.052	.035	.25	.088	.063	.54	.31	.25	.16	.052	.035	.008
601	1.61	.15	.058	.040	.18	.081	.062	.26	.12	.091	.52	.32	.27	.18	.081	.062	.04
602	4.16	.10	.031	.020	.14	.048	.035	.21	.075	.057	.50	.27	.21	.14	.048	.035	.04
603	9.23	.10	.034	.020	.13	.050	.023	.19	.076	.057	.52	.26	.21	.13	.050	.023	.13
604	.56	.23	.12	.087	.26	.16	.12	.34	.19	.16	.56	.39	.35	.26	.16	.12	.03
605	11.7	.10	.031	.020	.13	.050	.030	.19	.075	.055	.52	.25	.20	.13	.050	.023	.11
606	21.6	.093	.026	.016	.12	.042	.029	.20	.066	.048	.50	.26	.20	.12	.042	.029	.17
610	48.1	.085	.024	.015	.11	.040	.023	.19	.056	.040	.50	.25	.19	.11	.040	.023	.40
611	1.32	.19	.088	.063	.23	.12	.090	.29	.16	.13	.55	.36	.32	.23	.12	.090	.06
613	3.79	.19	.090	.066	.22	.12	.098	.29	.16	.13	.56	.36	.31	.22	.12	.098	.19

Table 3.—Low-flow data and storage indexes for sites in the Yellow River basin—continued

Map number	Drainage area (sq. mi.)	Annual low flow, in million gallons per day per square mile, for indicated number of consecutive days and indicated recurrence interval, in years												Storage index			1954 Min. daily (mgd)
		7-days			30-days			90-days			274-days						
		2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	2-yr.	10-yr.	20-yr.	
614	5.87	0.17	0.075	0.050	0.20	0.10	0.080	0.26	0.14	0.11	0.55	0.34	0.28	0.20	0.10	0.080	0.15
615	.51	.26	.15	.11	.29	.19	.15	.37	.21	.19	.58	.42	.38	.29	.19	.15	.04
616	1.62	.22	.11	.087	.25	.15	.088	.33	.19	.16	.57	.39	.34	.25	.15	.088	.11
620	9.53	.19	.090	.065	.20	.12	.080	.29	.16	.13	.56	.38	.32	.20	.12	.080	.14
621	3.40	.19	.084	.061	.22	.11	.087	.31	.16	.13	.54	.35	.31	.22	.11	.087	.14
622	.47	.19	.087	.062	.23	.19	.090	.31	.16	.13	.54	.36	.31	.23	.19	.090	.02
623	6.47	.20	.077	.056	.24	.11	.085	.32	.16	.125	.55	.37	.32	.24	.11	.085	.28
624	.54	.094	.027	.017	.12	.035	.031	.20	.069	.051	.50	.26	.32	.12	.035	.031	*
630	18.8	.18	.070	.055	.19	.11	.080	.28	.15	.12	.52	.38	.32	.19	.11	.080	.38
631	.43	.080	.021	.013	.11	.035	.024	.18	.058	.041	.49	.24	.19	.11	.035	.024	*
640	124	.095	.020	.010	.13	.036	.022	.20	.065	.045	.50	.25	.21	.13	.036	.022	.65
642	.49	.054	.011	.006	.077	.020	.012	.14	.034	.024	.46	.20	.15	.077	.020	.012	*
643	126	.095	.020	.010	.13	.036	.022	.20	.065	.045	.50	.25	.21	.11	.028	.019	.71
644	.52	.33	.21	.17	.36	.26	.21	.43	.28	.25	.61	.49	.45	.36	.26	.21	.07
645	2.57	.19	.085	.061	.23	.12	.087	.31	.16	.13	.54	.36	.31	.23	.12	.087	.11
646	.27	.037	.006	.003	.057	.012	.007	.11	.023	.014	.44	.16	.12	.057	.012	.0067	*
647	1.63	.13	.038	.024	.17	.063	.043	.25	.10	.072	.52	.30	.18	.17	.063	.043	.03
648	.47	.15	.059	.041	.18	.083	.063	.27	.12	.094	.52	.32	.27	.18	.083	.063	.01
649	3.18	.17	.074	.054	.21	.10	.079	.29	.14	.10	.54	.34	.31	.21	.10	.079	.11
650	134	.10	.021	.011	.14	.039	.024	.21	.071	.048	.50	.26	.22	.14	.039	.024	1.0
651	.74	.32	.20	.161	.35	.26	.20	.43	.27	.24	.61	.48	.44	.35	.26	.20	.09
652	1.87	.24	.13	.10	.27	.17	.13	.36	.20	.17	.57	.40	.36	.27	.17	.13	.12
654	1.38	.25	.14	.10	.28	.18	.14	.36	.21	.18	.57	.41	.36	.28	.18	.14	.10
700	5.54	.21	.103	.081	.24	.13	.110	.31	.17	.15	.49	.35	.32	.24	.13	.11	.37
701	1.00	.10	.032	.020	.13	.050	.035	.21	.077	.057	.50	.27	.24	.13	.050	.035	.01
702	1.03	.10	.030	.019	.13	.048	.034	.21	.074	.055	.50	.26	.21	.13	.048	.034	.01
703	3.74	.089	.025	.016	.12	.041	.028	.20	.065	.048	.49	.25	.20	.12	.041	.028	.03
704	.93	.15	.060	.042	.19	.084	.065	.27	.12	.095	.53	.32	.27	.19	.084	.065	.04
705	1.57	.17	.074	.054	.21	.10	.079	.29	.14	.10	.54	.34	.30	.21	.10	.079	.06
706	3.88	.11	.035	.024	.14	.055	.040	.22	.085	.060	.50	.28	.22	.11	.036	.025	.06
707	4.89	.11	.036	.024	.14	.056	.041	.22	.085	.064	.51	.28	.23	.14	.056	.041	.06

*Flow less than 0.005 mgd.

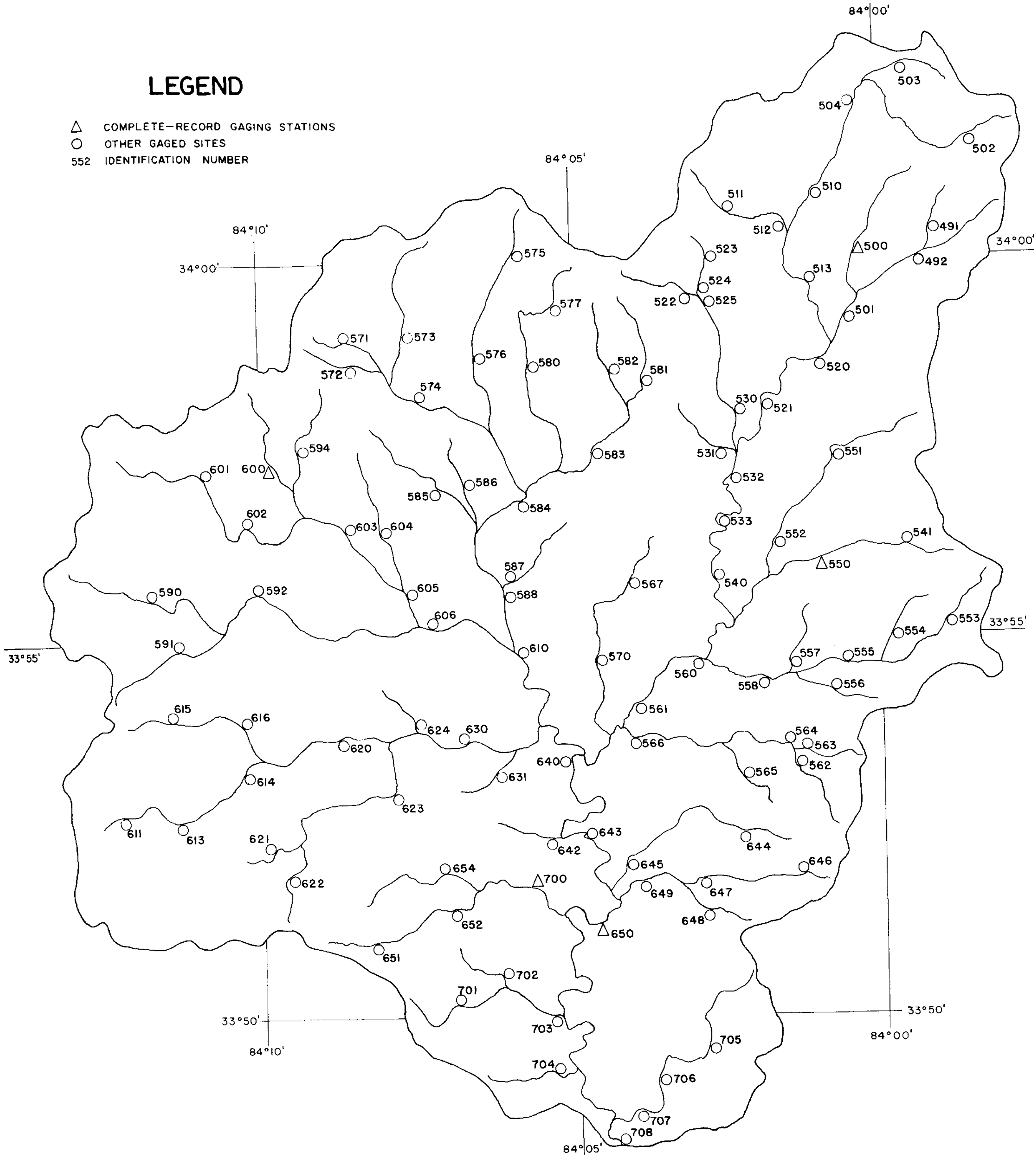

Figure 1. Stream patterns and location of numbered flow measurement sites, Yellow River Basin, Gwinnett County, Ga.

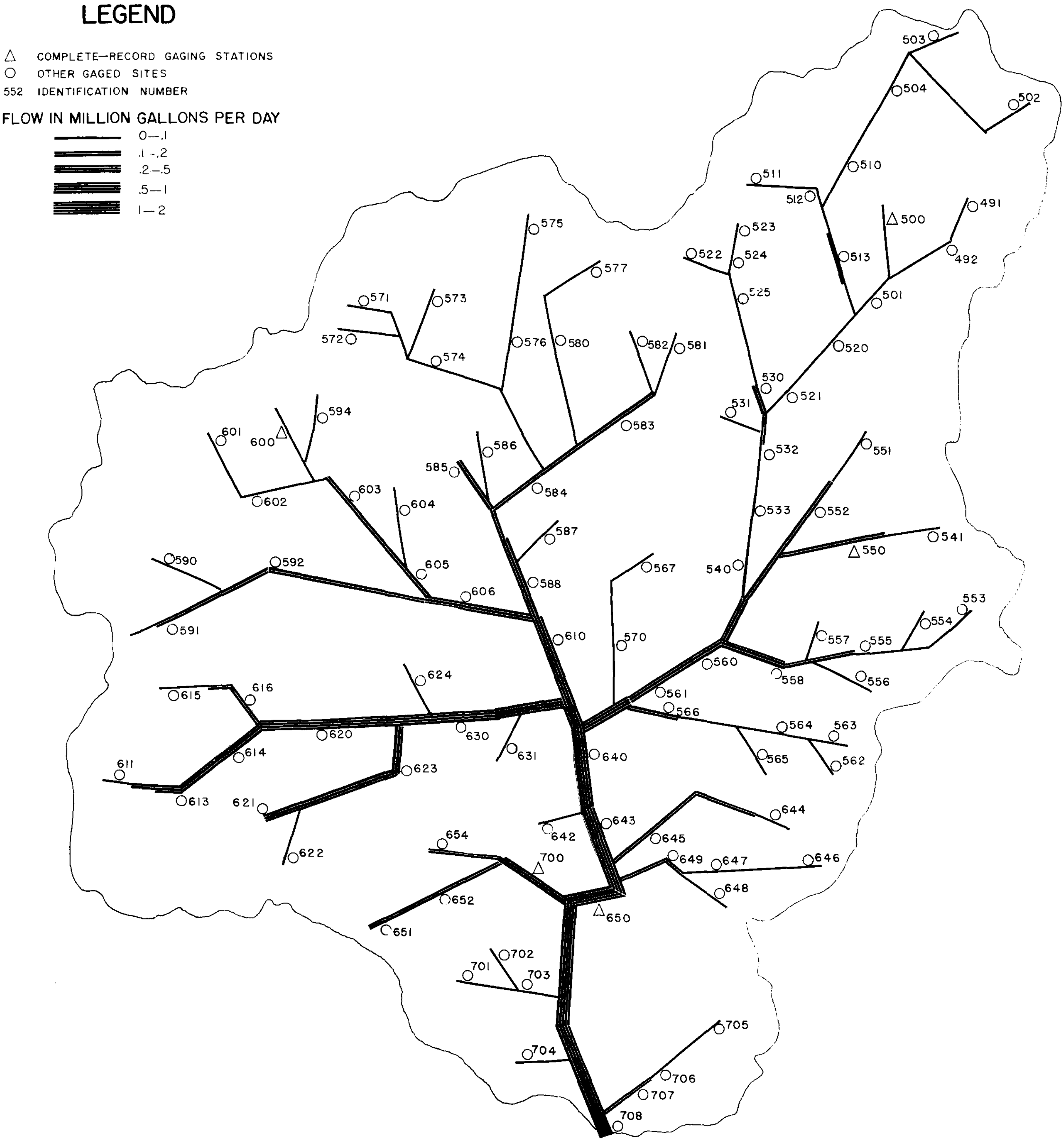

Figure 2. Flow map showing minimum 7-day average flow having a recurrence interval of 20 years.

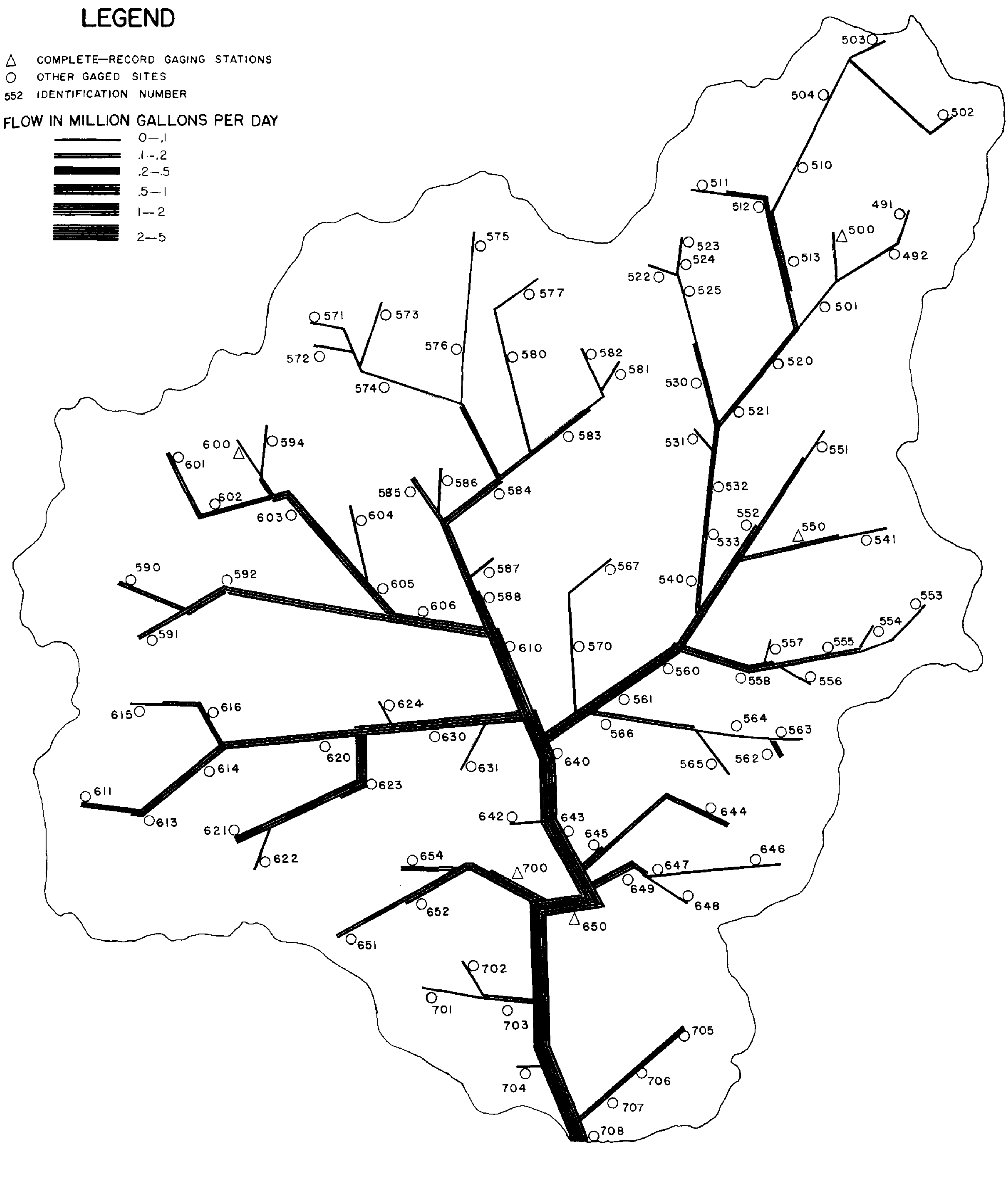

Figure 3. Flow map showing minimum 30-day average flow having a recurrence interval of 20 years.

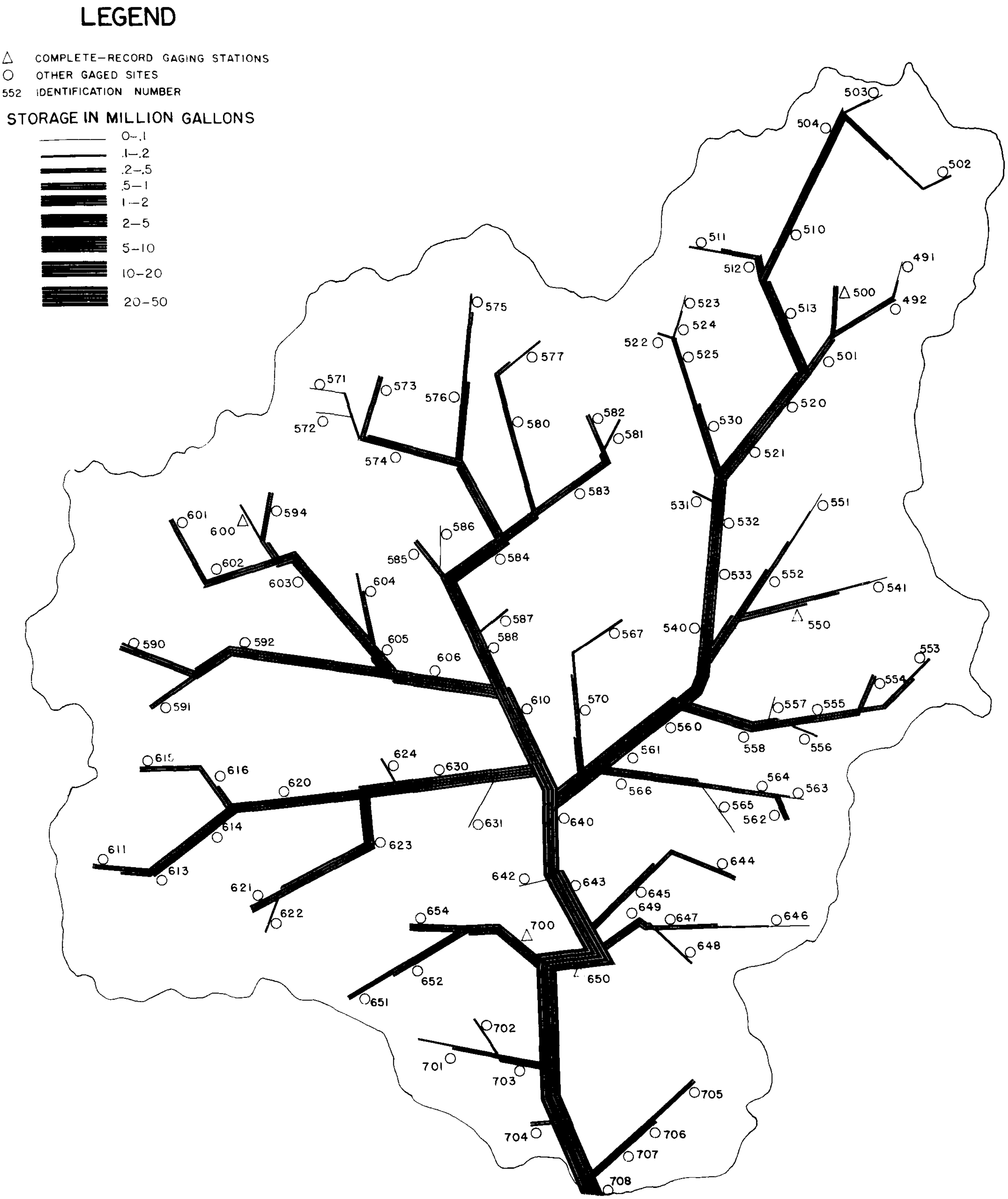

Figure 4. Map showing the storage required to develop the 30-day average flow having a recurrence interval of 20 years.

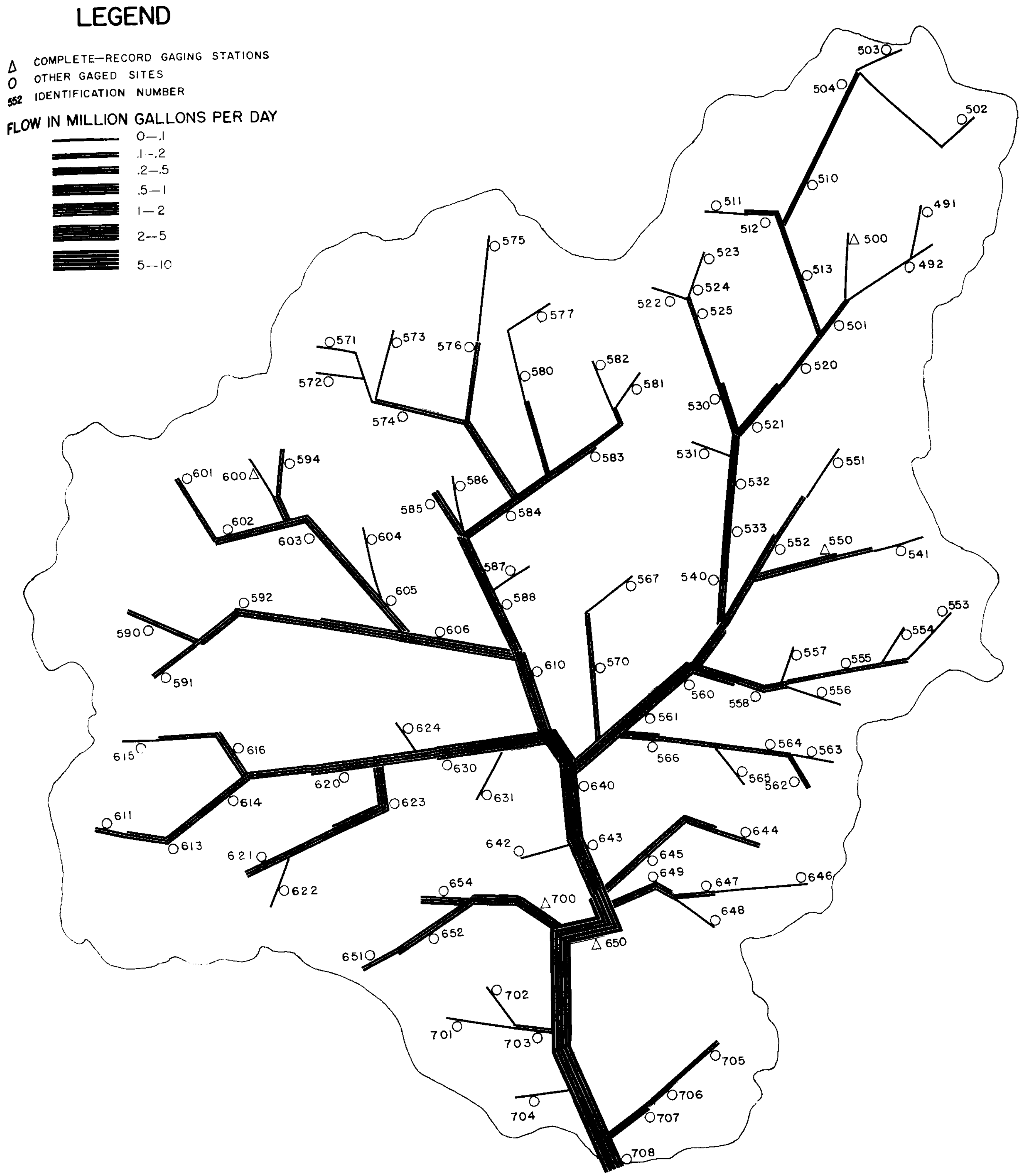

Figure 5. Flow map showing 90-day average flow having a recurrence interval of 20 years.

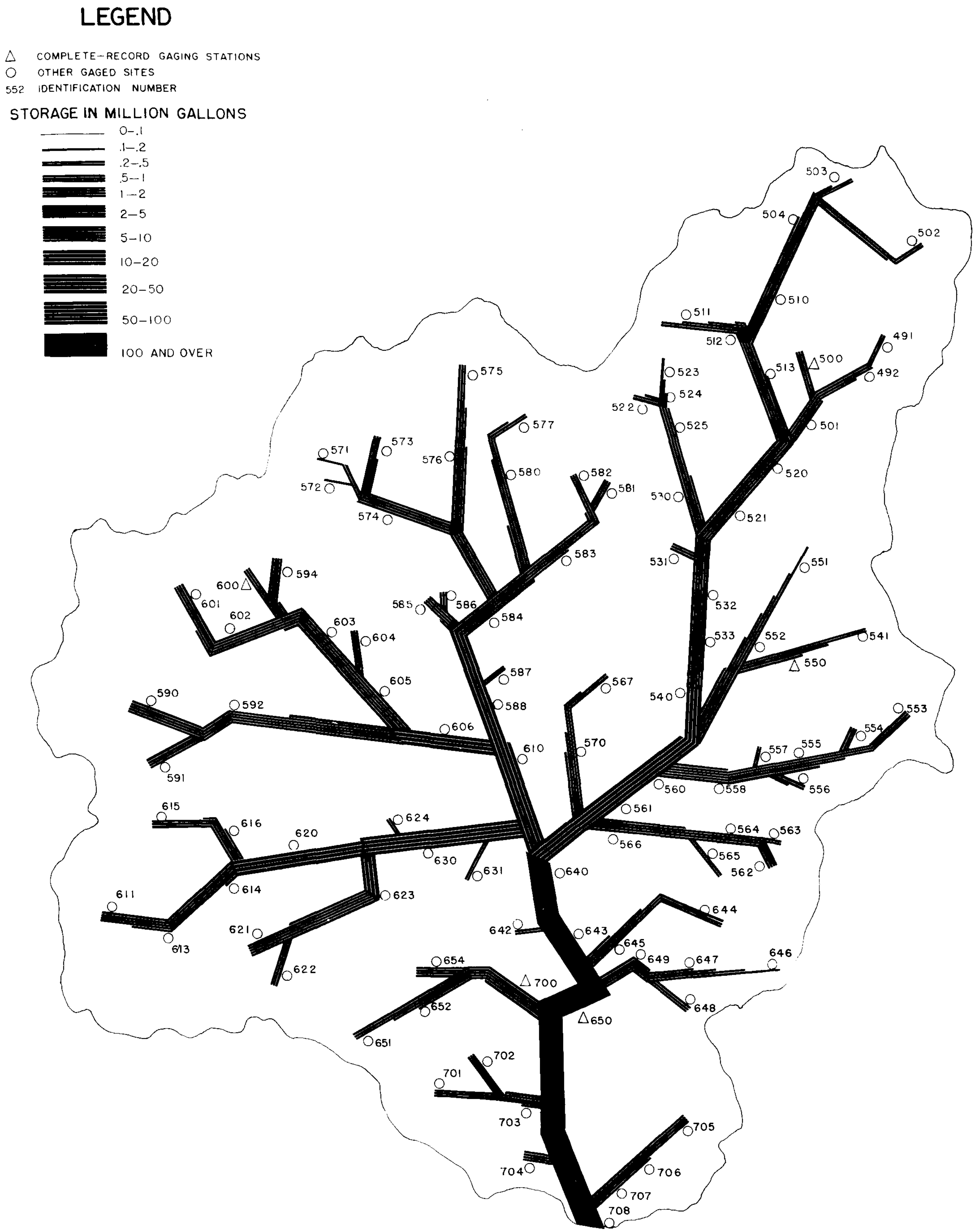

Figure 6. Map showing the storage required to develop the 90-day average flow having a recurrence interval of 20 years.

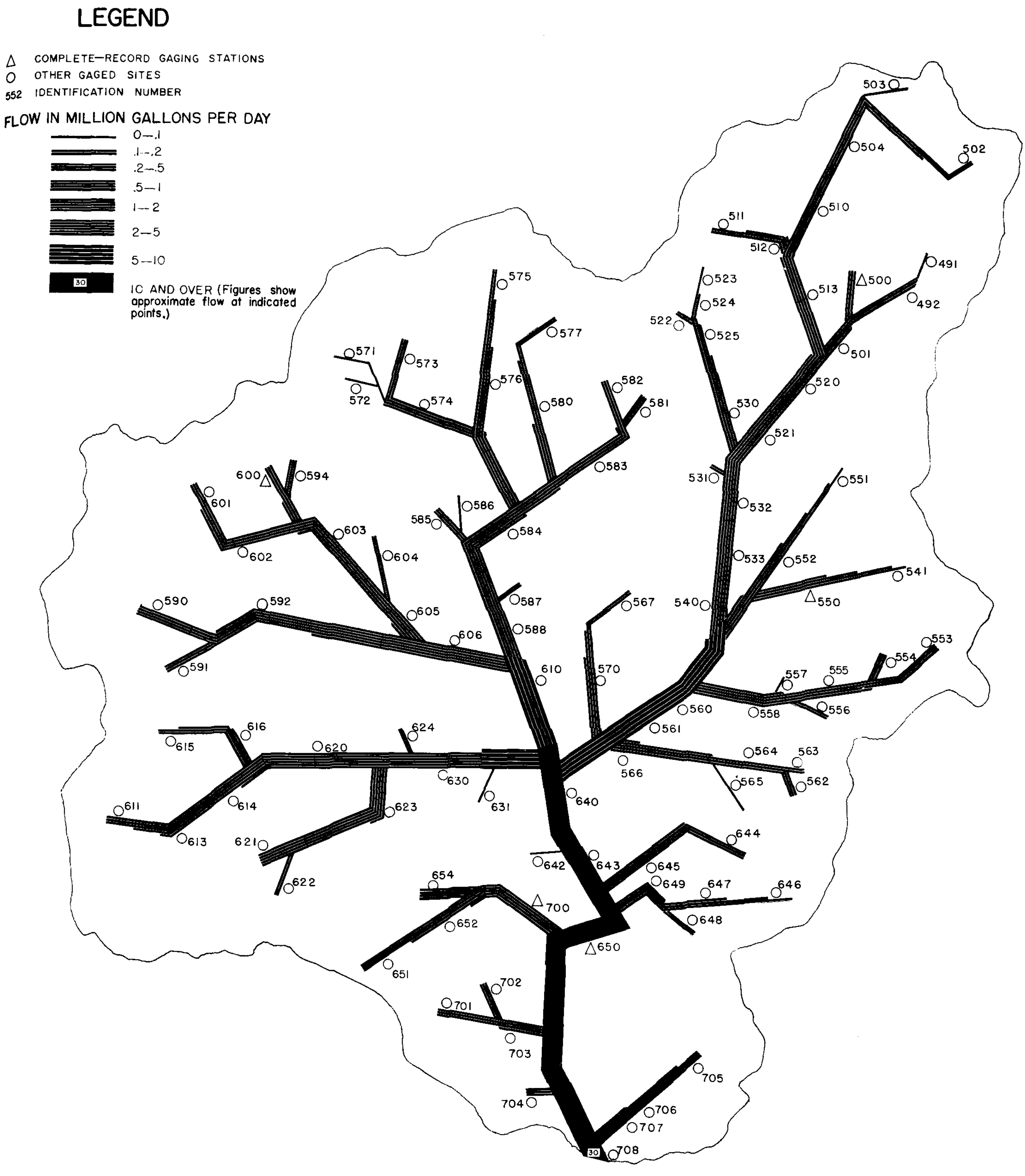

Figure 7. Flow map showing minimum 274-day average flow having a recurrence interval of 20 years.

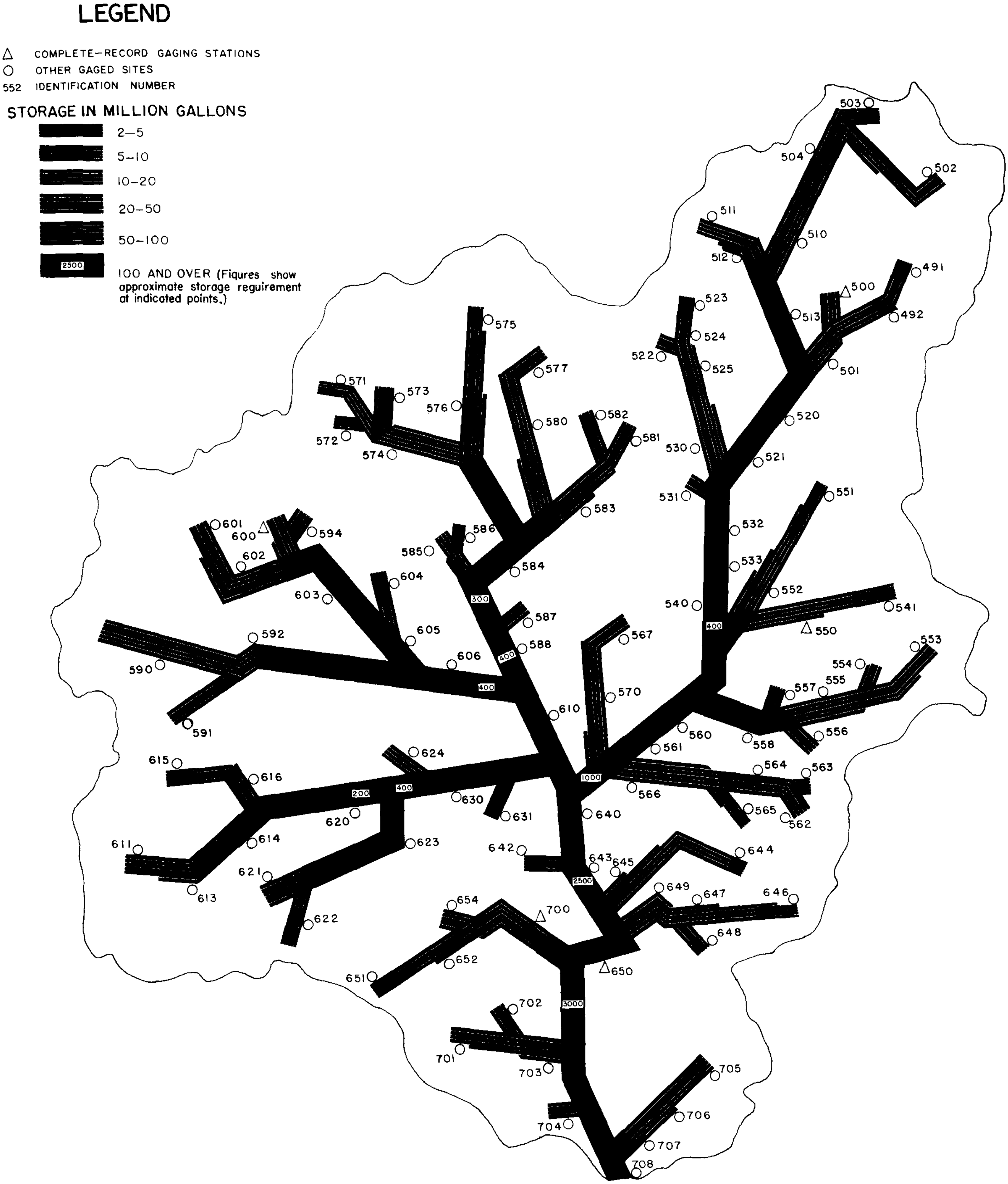

Figure 8. Map showing the storage required to develop the 274-day average flow having a recurrence intervals of 20 years.

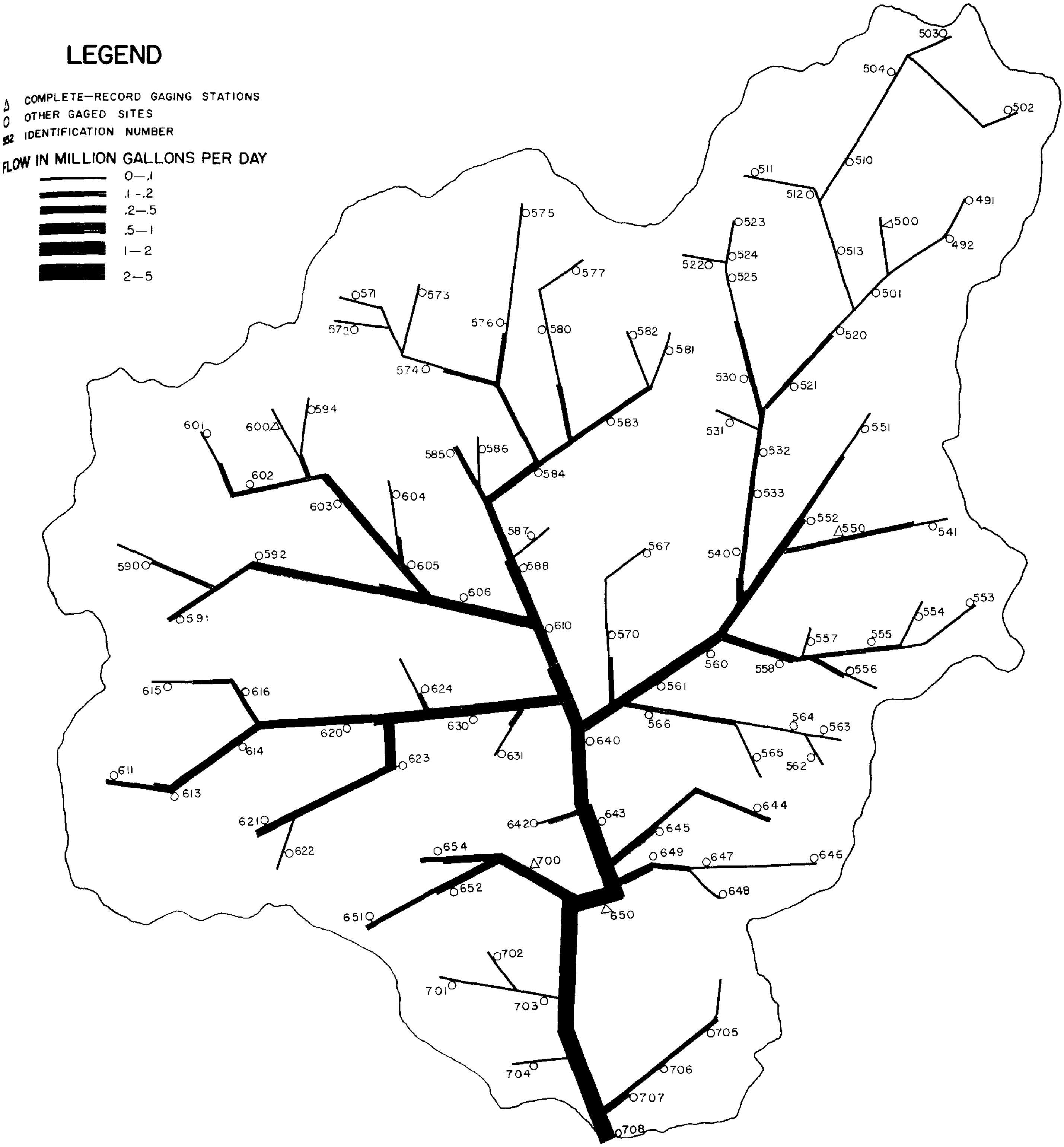

Figure 9. Flow map showing minimum 7-day average flow having a recurrence interval of 10 years.

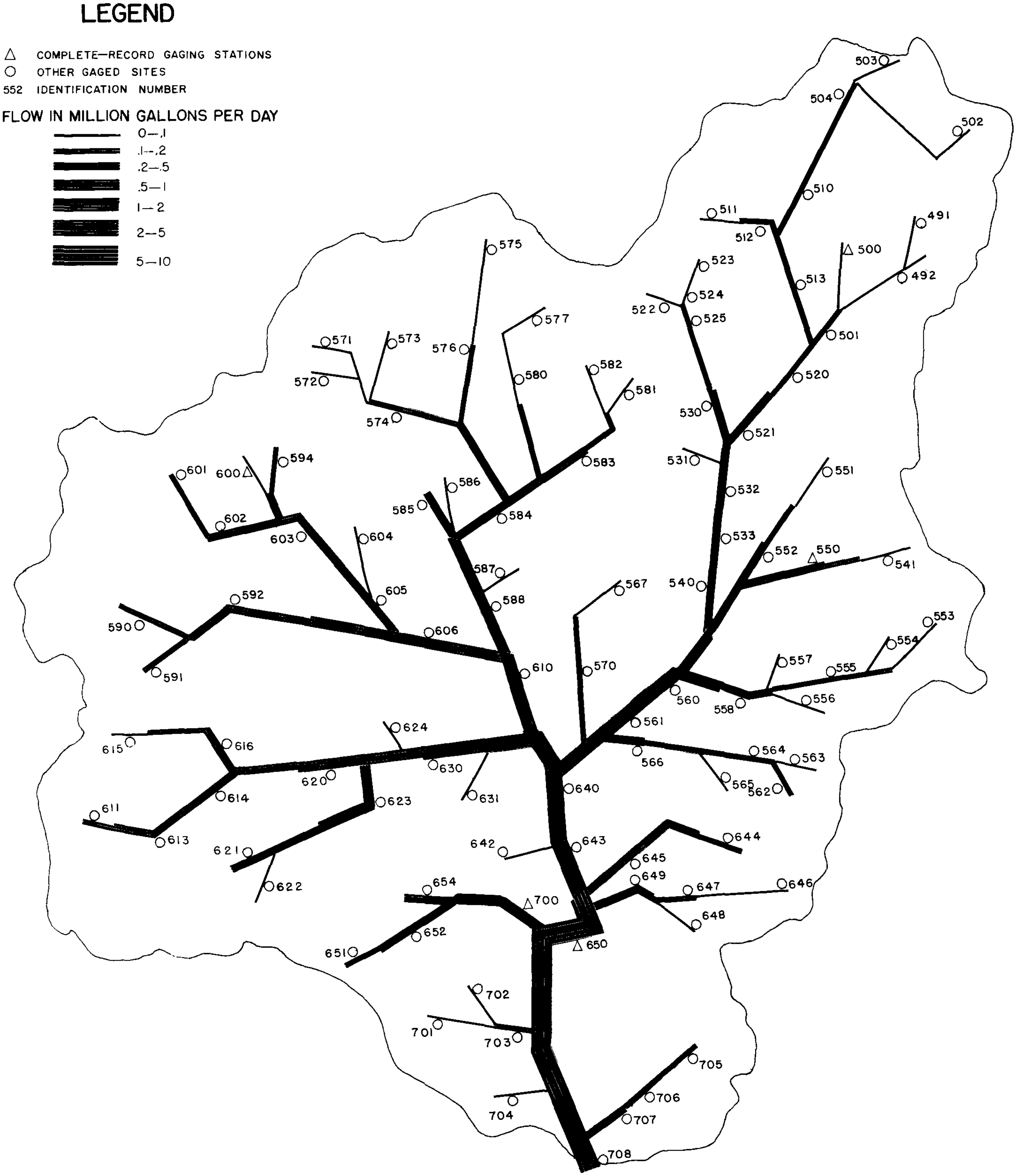

Figure 10. Flow map showing minimum 30-day average flow having a recurrence interval of 10 years.

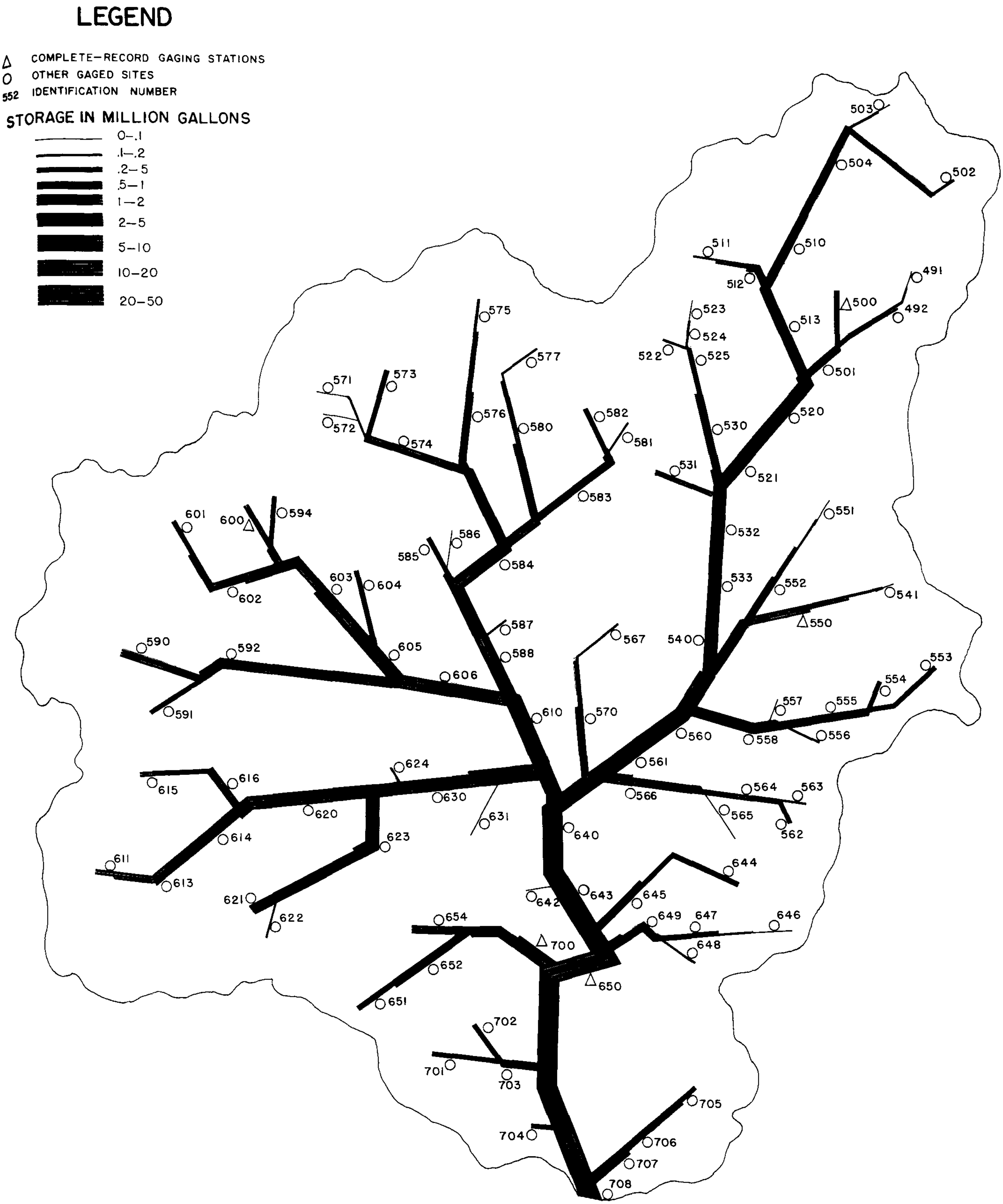

Figure 11. Map showing the storage required to develop the 30-day average flow having a recurrence interval of 10 years.

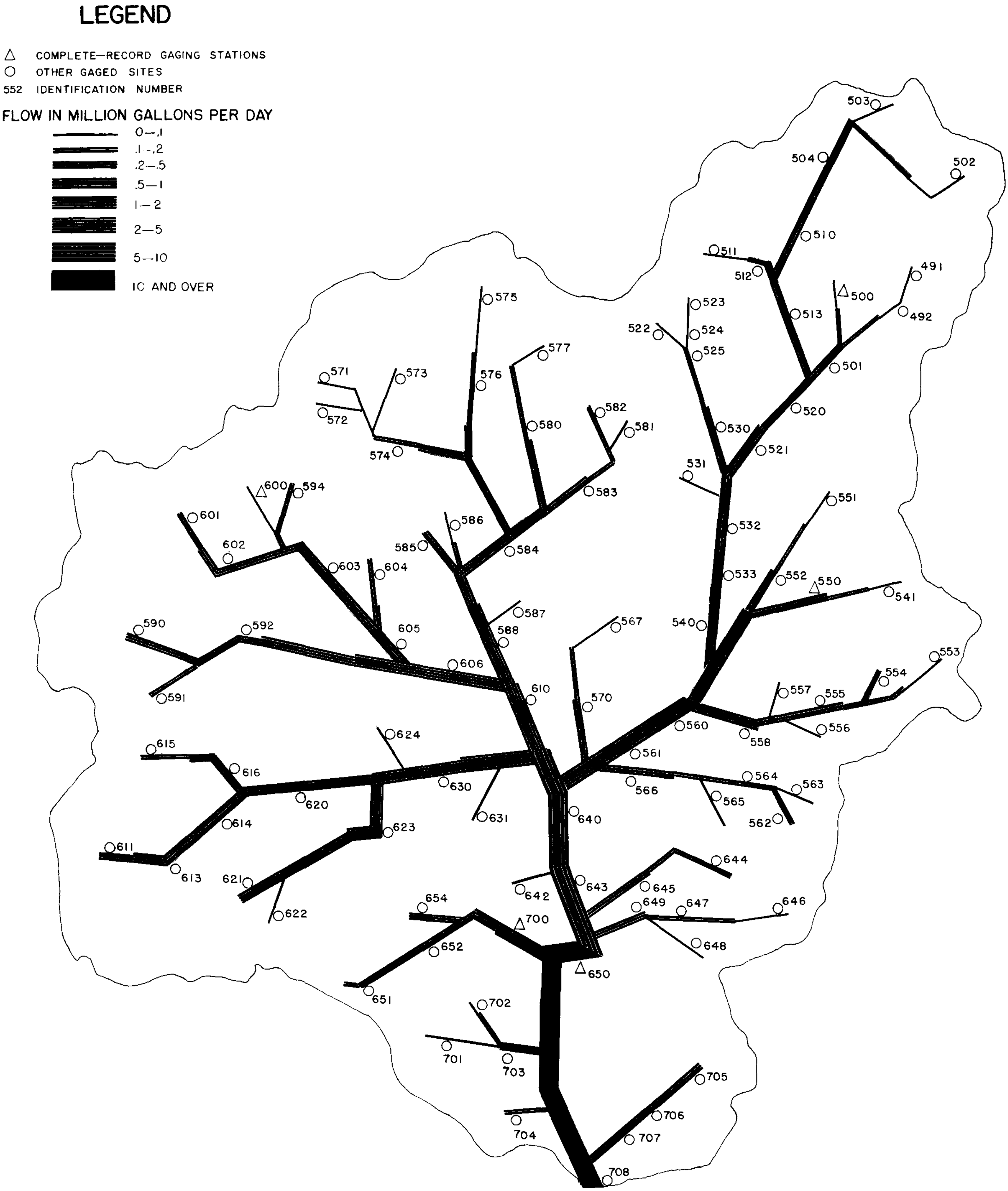

Figure 12. Map showing the storage required to develop the 90-day average flow having a recurrence interval of 10 years.

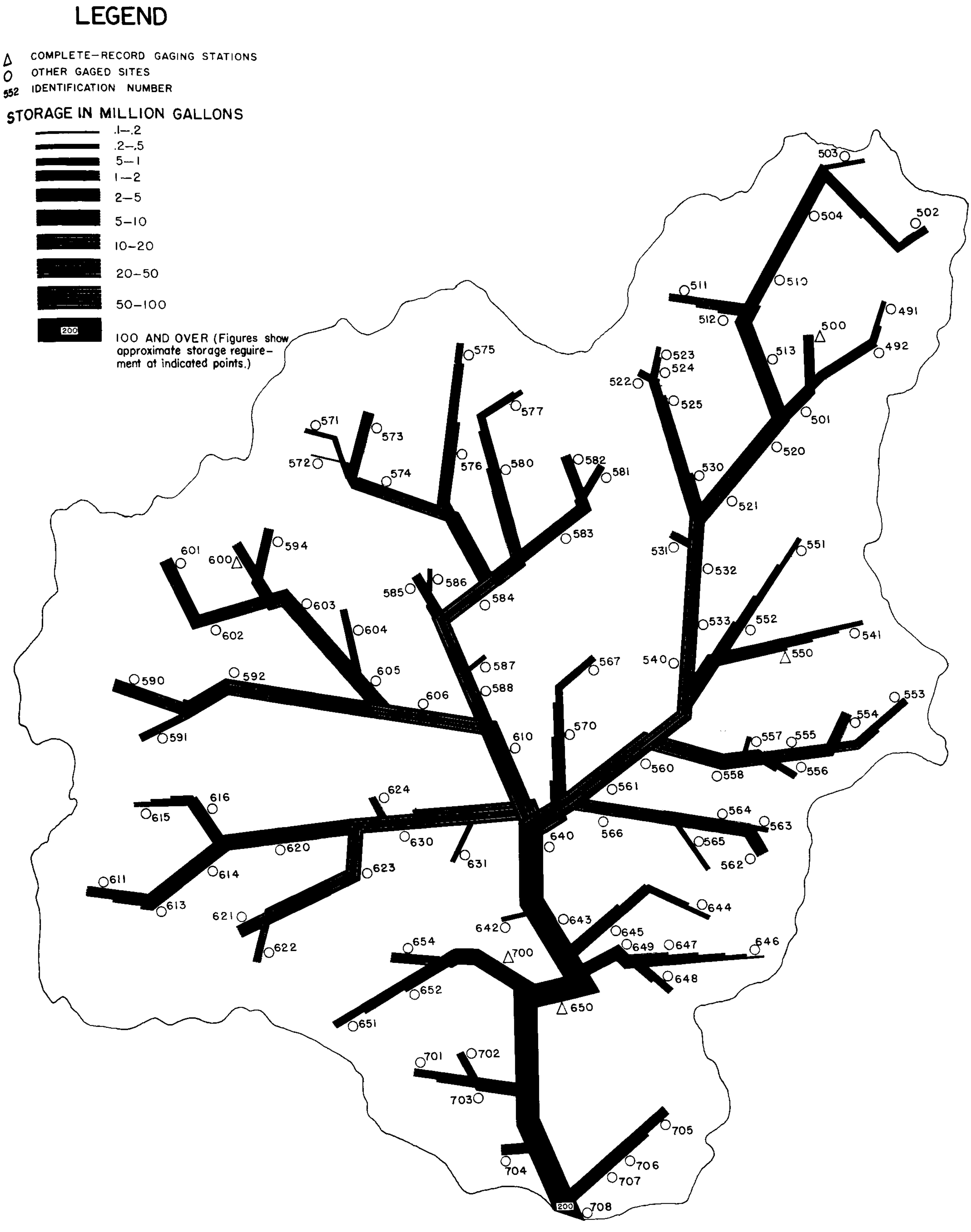

Figure 13. Flow map showing minimum 90-day average flow having a recurrence interval of 10 years.

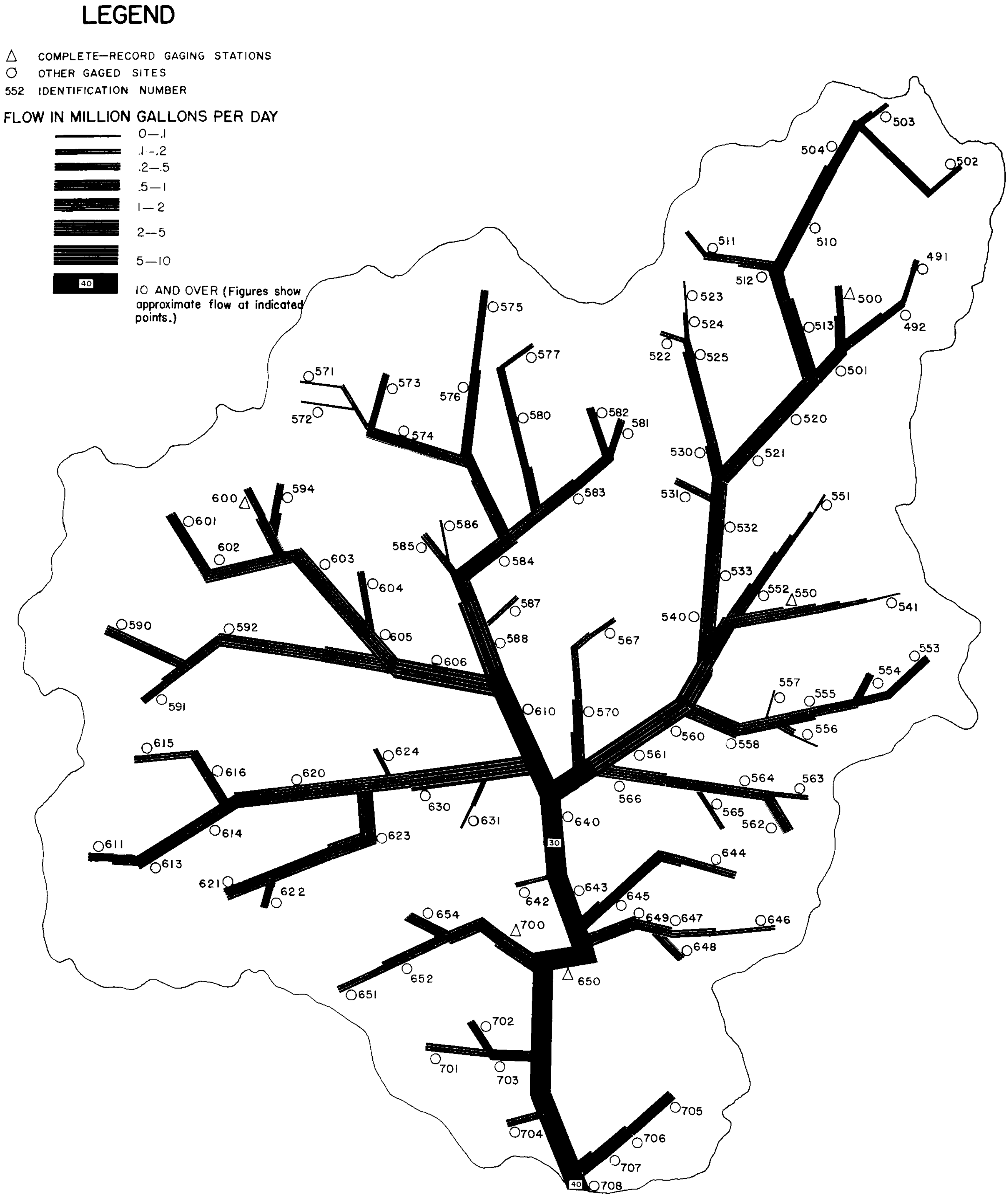

Figure 14. Flow map showing the minimum 274-day average flow having a recurrence interval of 10 years

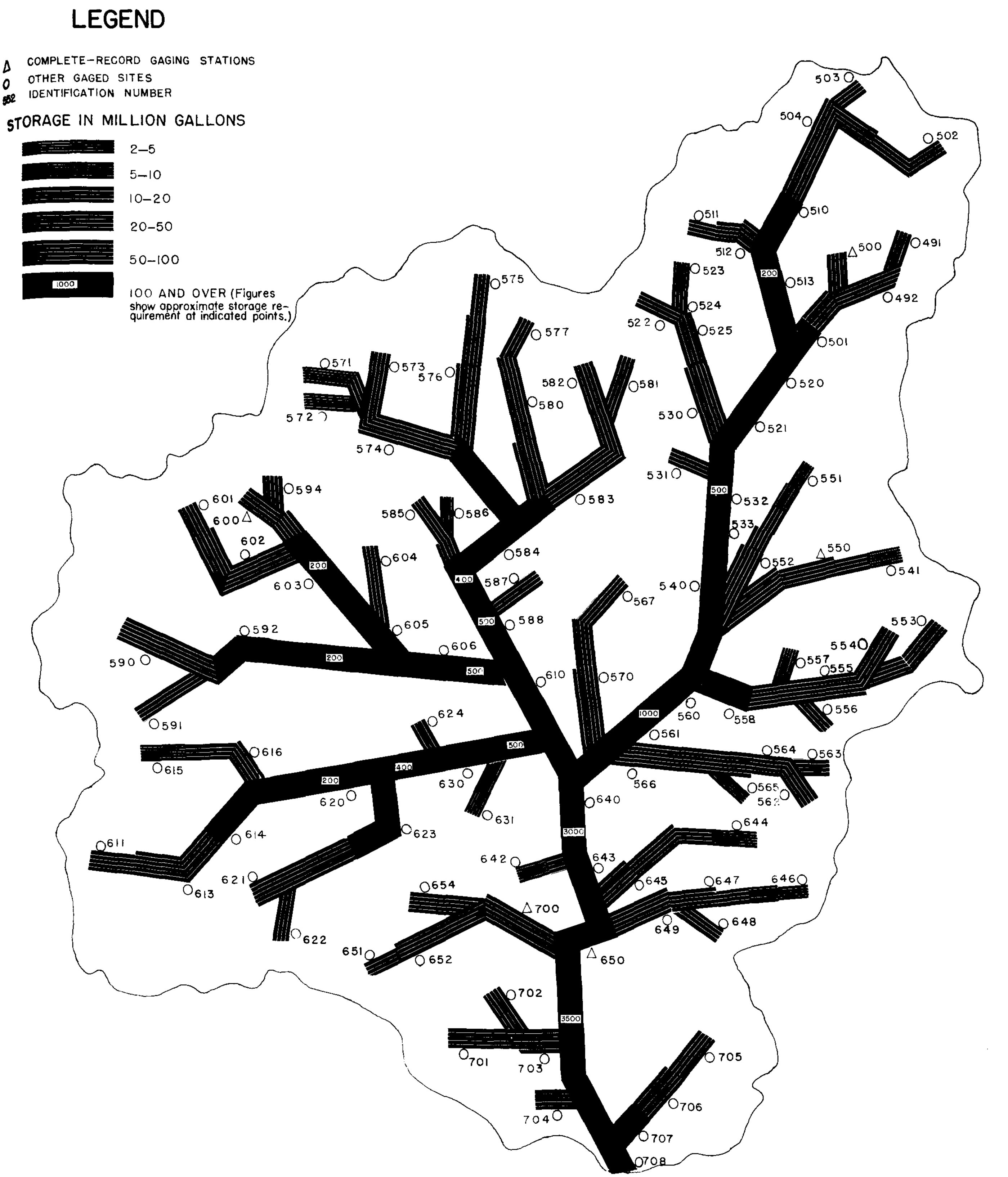

Figure 15. Map showing the storage required to develop the 274-day average flow having a recurrence interval of 10 years.

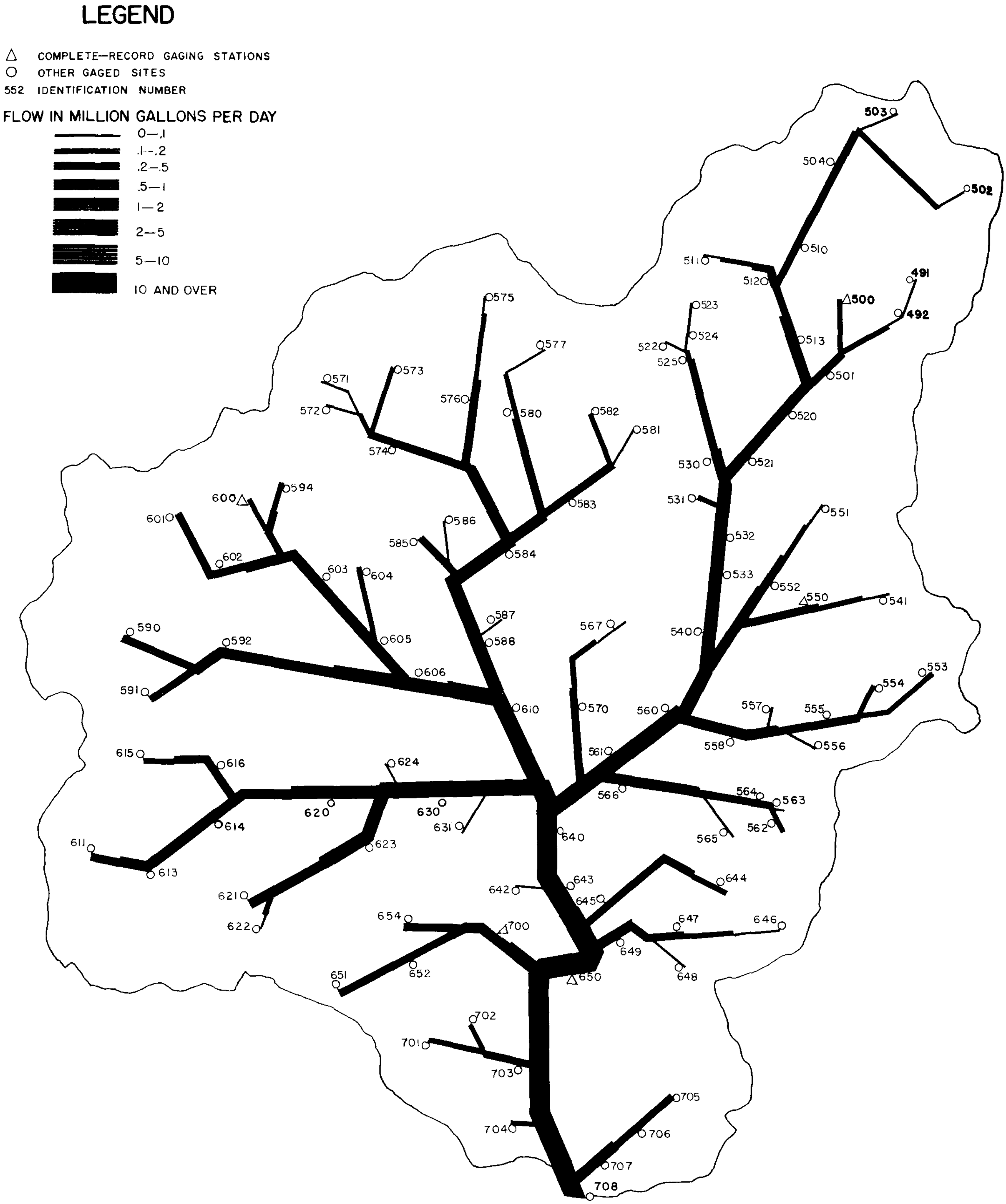

Figure 16. Flow map showing the minimum 7-day average flow having a recurrence interval of 2 years.

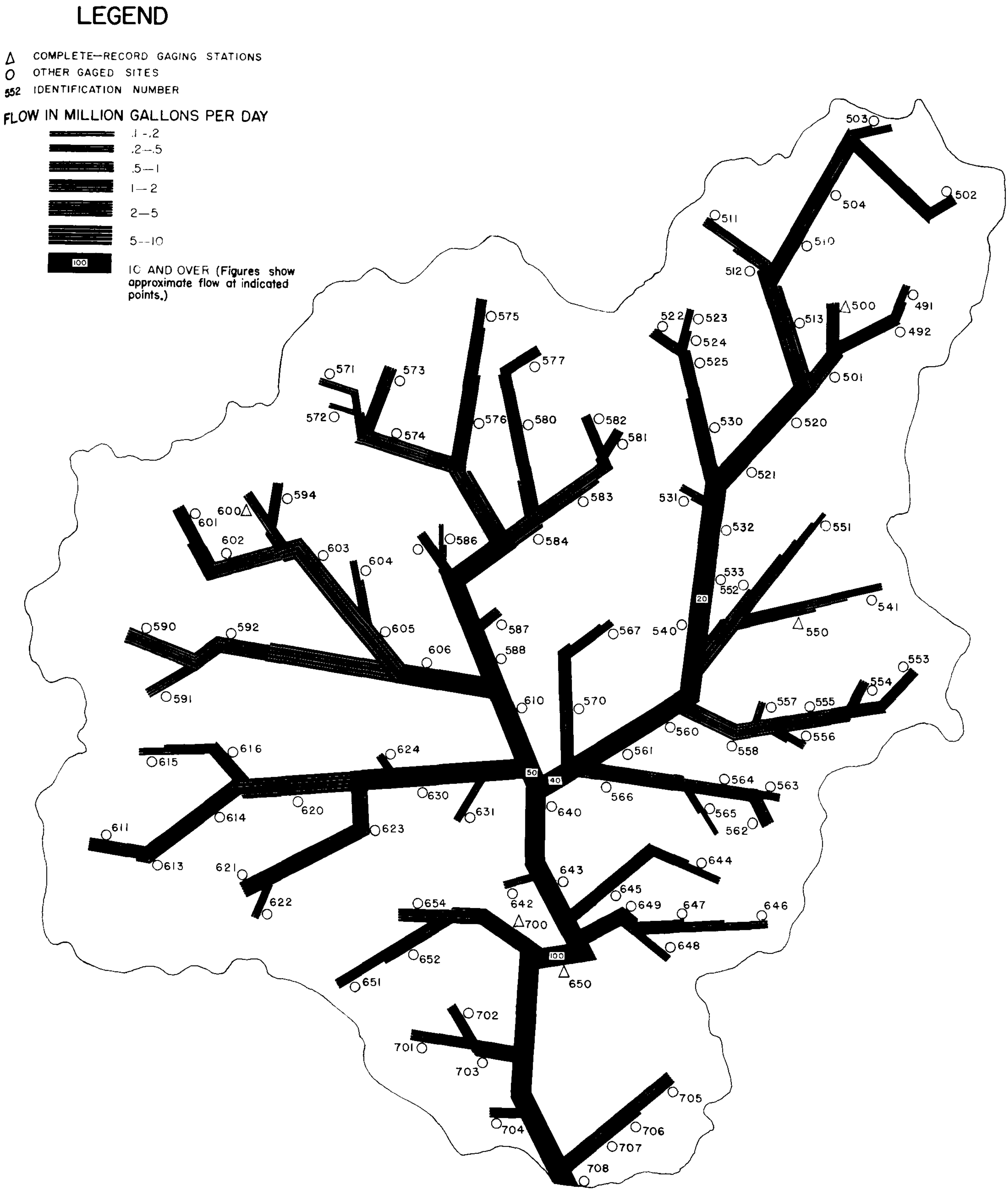

Figure 17. Flow map showing long term average flow for the period of 1938-58.

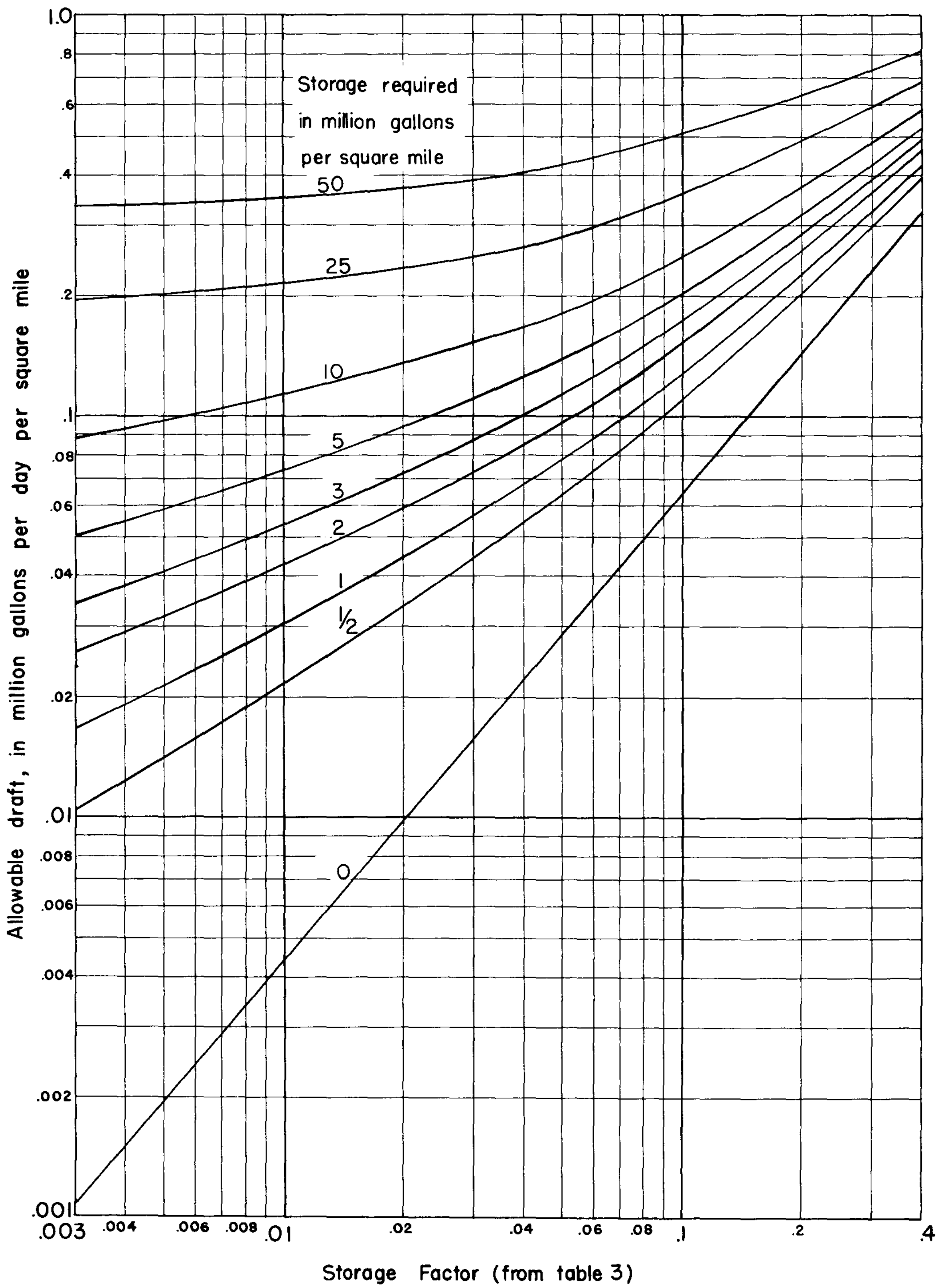

Figure 18. Storage requirement curves for recurrence intervals of from 2 to 20 years.

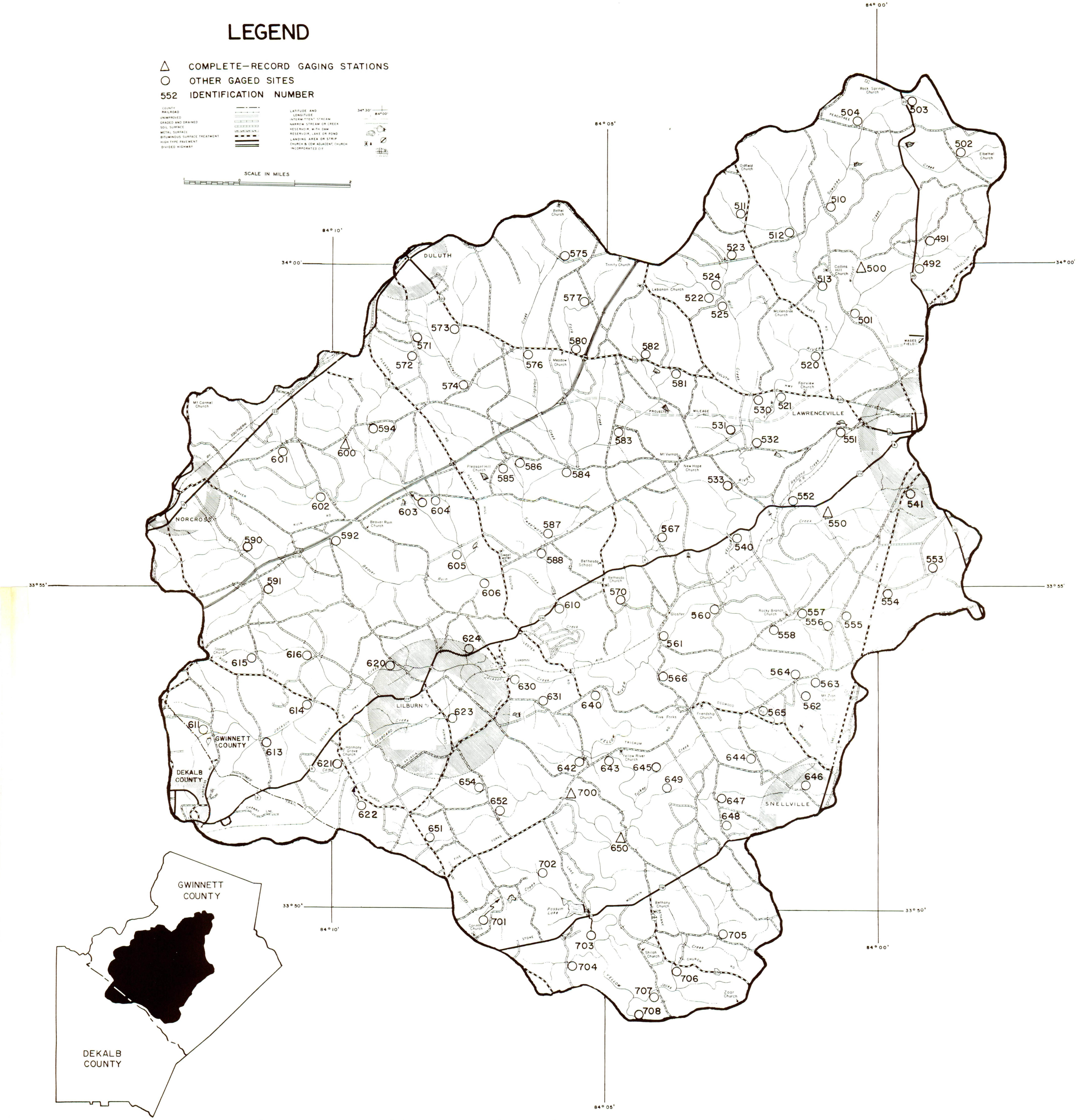

Plate No. 1—Map of the portion of the Yellow River Basin covered by this report.