EFFECTS OF PRECIPITATION ENHANCEMENT ON THE HYDROLOGIC CYCLE FOR THREE KANSAS WATERSHEDS

by

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INTRODUCTION

Man's desires to control the weather have existed through the ages. In recent years there have been breakthroughs in the understanding of climatic processes and technological development designed to alter the naturally occurring weather events. Whether technology for weather modification at present produces significant or predictable alterations of the naturally occurring phenomenan remains a scientific uncertainty and controversy. The potential for weather control today is, however, within the realm of feasibility and thus the potential effects of weather modification on the economy and the environment gain importance. Possible outcomes of precipitation enhancement on the hydrology of Kansas are investigated in this report.

The term weather modification is rather vague. One definition for clarity is "the object of weather and climate modification is concerned with any artificially produced changes in the composition, behavior, or dynamics of the atmosphere. Such changes may be deliberate or inadvertent, they may be transient or permanent, and they may be manifested on any scale from the microclimate of plants to the macrodynamics of the worldwide atmospheric circulation" (31, p.1).

Deliberate weather modification efforts can increase or decrease precipitation, suppress hail, dissipate fog, mitigate hurricanes, prevent frost, and alter the radiation balance. The objective of weather and climatic control is "to produce deliberate beneficial changes in the environment and to bring under control, or avert, changes damaging to society" (31, p.2). The levelling of natural variations in climatic conditions could increase productivity and reduce the failure risk of the

affected area. To be free of the consequences of a regional crop failure in important production areas, such as the recent Soviet wheat crop failure, is a dream of all mankind. The potential benefits of controlling severe storms are incalculable. Man's ability to initiate these changes is still limited and uncertain, but the potentialities offer incentive for continued research.

HISTORY

The hydrologic cycle involves many complex variables whose interrelations may never be completely understood. The role of precipitation as we accept it today was first recognized by Marcus Vitruvius Pollio in 1000 B.C. However it was not until Leonardo de Vinci (1452-1519) that the modern view of the hydrologic cycle was developed (14). In the prescientific era of weather modification, it was thought that rain could be controlled by great noises, explosions, and great fires (4). The weather control was basically superstitious, involving ringing of church bells, ceremonial dances or rituals, or periodic cannon fire to ward off evil spirits, appease rain gods or drive away violent rain and hail storms. Gradually, scientific investigation has resulted in improved understanding of weather phenomena, although even today our understanding is limited.

In 1819, the United States Surgeon General of the Army started a program to measure precipitation. The records are currently being kept by the National Weather Service. It was not until 1888 that the U.S. Geological Survey began systematic streamflow measurements of the Mississippi River. The establishment of a record keeping division of government is a milestone, since long continuous environmental data collections are essential in

establishing accurate probabilities for design and in forecasting events.

James P. Espy, an advisor to Congress on meteorological problems from the War Department (later from the Navy), proposed in 1851 what could have been the first federally financed large scale modification program. Espy proposed the production of rain by fire. His plan was based on his view that "all precipitation and the other aspects of storms are explained as direct consequences of convection and the release of latent heat of condensation" (4, p.6). He proposed to simultaneously set fire to 40 acre parcels of timber spaced at twenty mile intervals along a north-south line in the western states at regular seven day intervals. He believed that this holocaust would initiate a "rain of great length" (4, p.6). The plan was not endorsed by Congress but not because of doubts about Espy's theories. His views on atmospheric static stability in vertical convection do contain important elements of storm mechanisms. Espy's fire proposal was discounted in 1871 after the Chicago fire, when a heavy rain fell under very adverse conditions according to Espy's theories (7).

In the period of time from 1875-1933 significant elements of the scientific framework for weather modification were established. In 1875 and 1879 accurate explanations of mechanism were advanced by Coulier and Aitken (7). In 1930 and 1938 Tor Bergeron and Walter Findeisen advanced the theory of rain based on coexistance of ice crystals and super-cooled droplets in clouds at the same temperature, and on the rapid transfer of vapor from droplets to crystals. This work formed the basis for artificial modification of clouds. Bergeron founded the basis for cloud seeding with silver iodide in the early 1930's (4).

During this time period weather modification demonstration tests were also being conducted. In 1880, General Daniel Ruggles was granted a

patent on his scheme of using balloon carried explosives to cause rain (4,7). In 1890 and 1891 at Washington, D.C., and later in Texas, General Robert Dyrenforth conducted tests using Ruggle's scheme. The tests were regarded as unsuccessful, but it was the first federally funded project supporting weather modification through the Department of Agriculture. In 1891, Louis Gathman conducted tests to produce rain by exploding shells containing liquified carbonic acid at cloud height. In 1961 Soviet scientists were using the same method to dissipate clouds rather than produce precipitation (7). There were a variety of field tests at many different locations with the results varying from inconclusive to successful. Tests were also directed in the areas of tornado dissipation and fog dispersion.

The modern era of weather modification began in 1946 when Schaefer, Langmiur, and Vonnegut completed the first laboratory verification of the atmospheric ice crystal formation process. Schaefer completed the first field demonstration of large scale modification of super-cooled clouds by seeding them with dry ice from an airplane. With this successful demonstration, weather modification claimed a foundation in scientific theory (4,7,19).

Langmuir, the director of the crystal formation study, influenced the Defense Department to support Project Cirrus. This project (1947-1951) demonstrated the possibilities in modifying, dissipating, and causing precipitation from super-cooled clouds. The project was instrumental in establishing the methods of investigation still being followed in present experiments.

Immediately following these studies a flurry of commercial seeding activities began and soon reached a maximum coverage of approximately

10% of the land area in the United States (13). The decline of these enterprises began in the mid-50's. The intense activity in cloud seeding resulted in the formation of the President's Advisory Committee on Weather Control in 1953. The committee's primary goal was to assess the effectiveness of cloud seeding efforts. The committee reported in 1958 that seeding was producing an increase of 10-15% in winter snowfall in the western United States mountains (21,23). Their major recommendation was to increase substantially the support for research into all aspects of the atmospheric sciences. The National Science Foundation (NSF) was given a lead role in directing this research. NSF was directed by Congress to initiate and support a program of study, research, and evaluation in the field of weather modification. In the years following, many research projects and field experiments were conducted at various locations throughout the world, and research is still continuing. These tests added greatly to the fundamental knowledge of cloud seeding. Although the effectiveness of seeding is still difficult to evaluate, understanding is improving due to increased knowledge of cloud physics, more stringent statistically designed control tests, and more and better radar and raingage network observation (14). In 1966, The National Academy of Sciences, (NAS) published a report presenting conclusions based on 41 projects involved in seasonal operation for winter orographic seeding and 14 operational projects in which cumulus clouds were seeded. The programs were designed as randomized experiments to test if ice-nuclui seeding increased precipitation. NAS concluded "...there is increasing but still somewhat ambiguous statistical evidence that precipitation from some type of clouds and storm systems can be modestly increased or redistributed by seeding techniques. The implications are manifold and of immediate national concern" (31, p.4). A report

published by NSF, complementary to the NAS conclusions, reassessed projects involved in weather modification and recommended continued financial support for research of weather modification in order to increase the scientific base from which decisions can be made (30).

Numerous agencies are now involved in work or provide funds for continued research (22). The Bureau of Reclamation funds approximately one-third of all activities. The Bureau is primarily concerned with precipitation enhancement in the water short western United States. NSF funds studies for all types of weather modification. Other governmental agencies fund studies within their concern. The Forest Service is interested in research of lightning suppression. The Department of Transportation through the Federal Aviation Administration funds fog clearance experiments. The Defense and Agricultural Departments, as well as other state and local governmental agencies, provide research funding.

This effort has resulted in significant progress since 1966. The progress, in summary by Kostecki (13, p.7) is "1) in understanding the weather and how it might be changed by man, 2) in ability to affect changes in clouds and weather, and 3) in capacity to measure both natural and modified conditions of the atmosphere." This progress prompted a further assessment of weather modification technology by NAS in 1973. This publication pointed to increasing water demands, extremely limited water resources at various locations, and increased vulnerability of urbanized and industrialized area to weather phenomena in emphasizing the need for economic justificiation of continued development of our weather modification capabilities. The report noted, "it is essential that there be expanded research programs to develop the knowledge base from which more reliable technological assessments can

be made" (33, p.16). The 1973 report summarizes findings of past and current studies.

OBJECTIVES

In response to operational weather modification programs which have been known to make overly optimistic claims of success without well-documented evidence, several studies and experiments have been undertaken to answer the question of social and economic impact. One of these is sponsored by the Kansas Water Resources Board. It is a multi-year, inter-disciplinary study to evaluate the potential impact of a full-scale operational precipitation enhancement program on the agriculturally-orientated economy of Kansas. Particular attention is being directed to the possible responses of agriculture as a result of assumed alterations in the precipitation pattern which might result from weather modification activities (1).

The objectives of the project are ambitious. They involve disciplines studying environmental factors including effects of modification on insects and disease in relation to crop production, and plant species distribution and production. The study also considers possible economic alterations, such as changes in farm resource inputs, farm outputs, organization, and other economic conditions. The project is obtaining data to aid future evolution of weather modification activities by gathering meteorological, ecological, and crop phenological data.

The objective of this particular report is to evaluate the effects of altered precipitation pattern upon the hydrology of the state.

PROCEDURE

The Model.--A modified version of the Kansas Watershed model (KWM) was used in this study to simulate the response of a watershed to enhanced

precipitation. The general concepts of KWM are described by Smith and Lumb (20). In addition the new evapotranspiration (ET) function description, included in the modified program, can be obtained in a report by Zovne and Nowaz (32). The model uses daily maximum and minimum temperatures and daily (or hourly) precipitation data read from magnetic tape containing the historical data record for the particular watershed. The ET is calculated using average monthly values of relative humidity, percent sunshine, wind speed, and solar radiation (6,24). The program also requires input watershed parameters that describe its physical characteristics. KWM can be generally described as follows: 1) it is a continuous model that generates daily flows, 2) it is a lumped-parameter model, which means average watershed properties are used without regard to spatial distribution, and 3) it is designed to model as completely as possible the land phase of the hydrologic cycle. A generalized flowchart of KWM is presented in Fig. 1.

Precipitation Enhancement.--In this study three Kansas watersheds were tested for streamflow pattern changes due to a precipitation enhancement program, assuming that cloud seeding can produce additional precipitation. Since the program monitors other information in addition to streamflow, comparisons of ET and general observations of soil moisture changes and recharge can be made.

Historical precipitation and stream flow records were used to match simulated and natural streamflows as closely as possible. The portions of the land phase of the hydrologic cycle were checked to make certain they were within reasonable limits for the conditions present at each watershed location. The historical precipitation record was then modified based on the enhancement expected from current available technology. The

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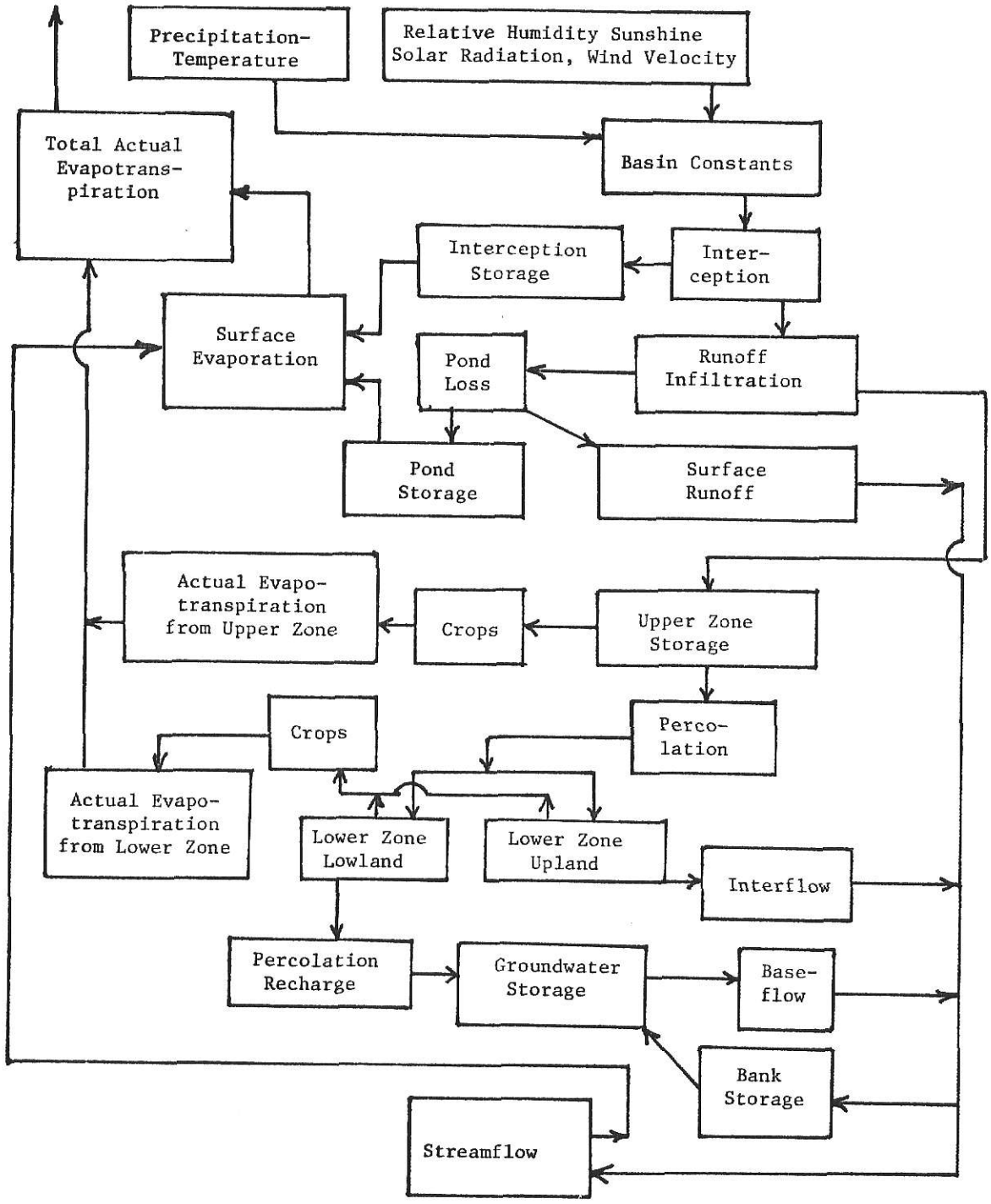


Fig. 1.--Flowchart of KSU Version of Kansas Watershed Model [from Zovne and Nawaz (32)].

possible enhancement programs for representing modification effects were discussed with many researchers and commercial operators (1). Eventually, Model B, as shown in Table 1, developed by Changnon and Huff (2), was selected as the best estimate of the possible effects of an operational seeding program for Kansas.

Smaller rainfall events are greatly enhanced by cloud seeding, assuming the seeding beneficially aids the efficiency of the clouds. Larger events are naturally more efficient and seeding is sometimes evidenced to interfere

TABLE 1.--Model B Precipitation Enhancement Program

Actual Amount of 24 hour		
Centimeters	Inches	% Increase
0.25 or less	0.10 or less	75
0.26 to 1.27	0.11 to 0.50	30
1.28 to 2.54	0.51 to 1.00	10
over 2.54	over 1.00	-10

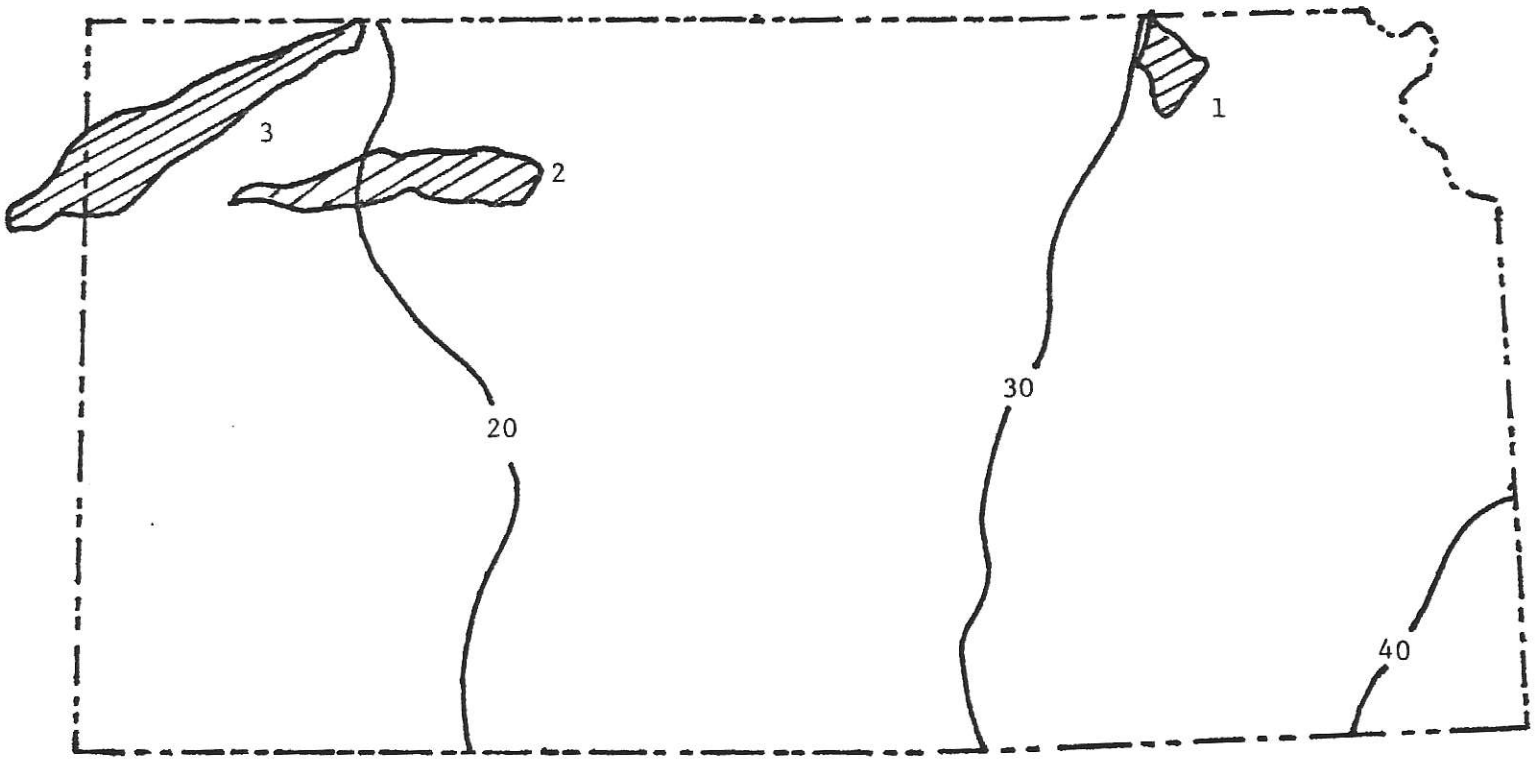
with this natural efficiency, thus reducing the magnitude of the event. Model B represents the average expected results in large-scale operation. Individual seeding events would experience large variations from Model B increases. Model B also accounts for inefficiencies arising from the technical inability to detect and seed every seedable cloud, especially at night.

Model B applies only to convective clouds that produce most of the precipitation in Kansas. Since winter clouds in Kansas are usually of non-convective origin, the Model B enhancement schedule was not applied to rainfalls occurring in winter months. Two schemes were actually used which were designated B-ZERO and B-TEN, respectively. Both schemes used Model B applied to rainfalls experienced during the seven-month growing season from March through September. The rainfall producing clouds during this

season are predominantly convective. In Model B-ZERO, the winter precipitation during the months of October through February are left unaltered, thus assuming a seeding operation confined to summer convective cloud season. In Model B-TEN it was assumed that seeding operations were continued in winter but that the basic Model B alteration scheme in Table 1 would not apply. Since there is little experience in seeding non-convective clouds on the Great Plains, a simple alteration scheme was applied in which all winter rainfalls were increased a uniform 10%, hence the term B-TEN.

The Watersheds.--The watersheds studied are the Black Vermillion, South Fork Solomon, and Beaver Creek drainage basins (Fig. 2).

The Black Vermillion basin (Fig. 3) is located in northeastern Kansas near the Nebraska border. It is the smallest of the three watersheds studied, draining 1067 km^2 (412 mi^2). The watershed lies in three counties, Marshall (74.75%), Nemaha (24.27%), and Pottawattomie (0.97%). The streamflow has been gaged continuously since 1954 at Frankfort. The area is located at the western edge of the Central Lowland physiographic province and is largely contained in the Dissected Till plains subdivision. This portion of the subdivision is further classified as the Kansas drift plains, due to the area being covered with deposits of till and loess. The till is a heterogenous, unstratified, and unsorted mixture of clay, silt, sand, and pebbles, and boulders deposited by glacial ice up to thirty feet thick. The loess is wind deposited silt. The area is a dissected plain with relatively broad gentle slopes, except where streams cut deeply into the thick glacial till deposits. The total relief is approximately 96.26 m (283 ft).



Legend:

1 - Black Vermillion 2 - South Fork Solomon 3 - Beaver Creek

—20— annual rainfall in inches

Fig. 2.--Location map of Kansas basins.

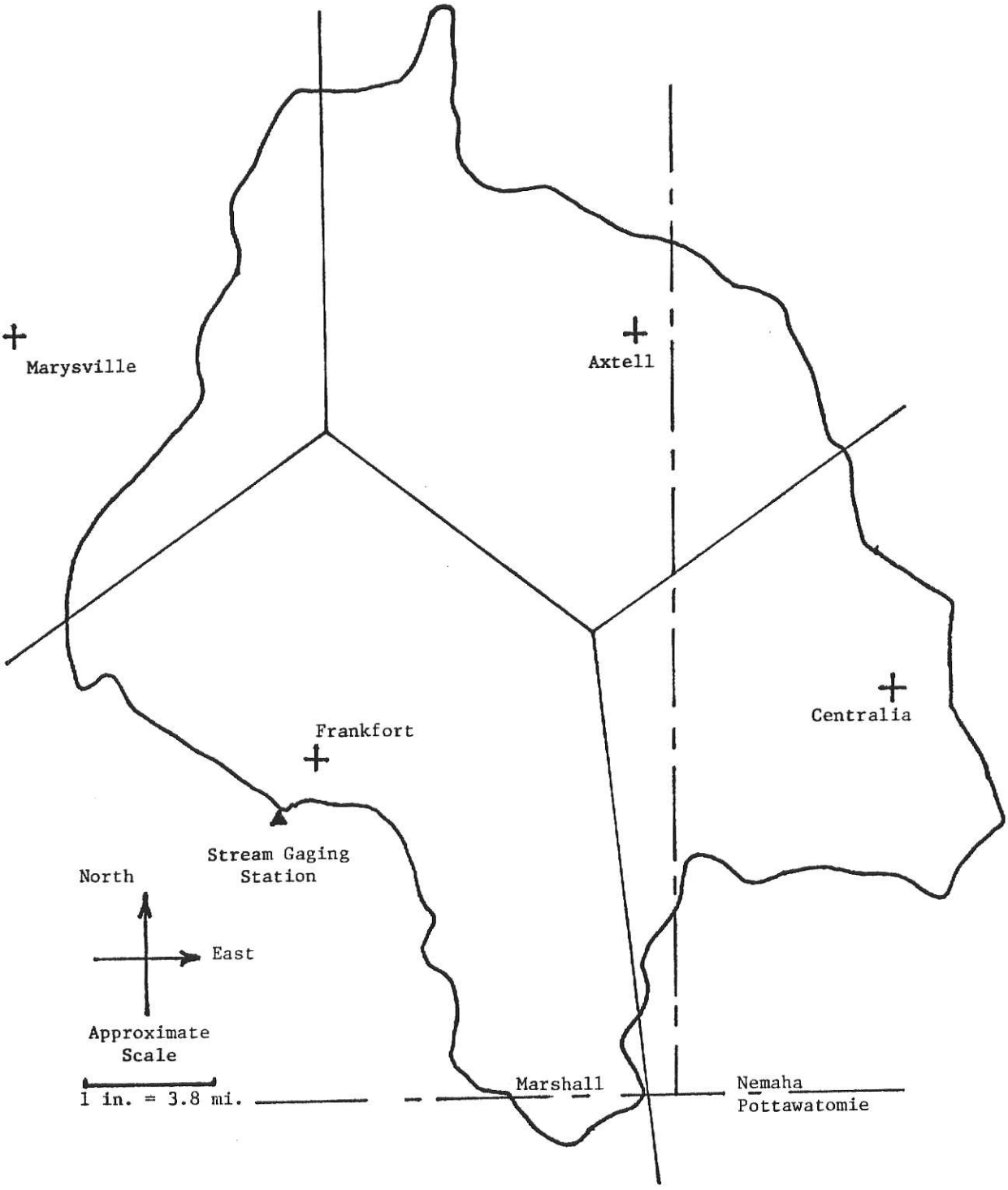


Fig. 3.--Black Vermillion Watershed.

The area is predominantly agriculturally oriented with the principle crops being wheat, sorghum, corn, soybeans, and alfalfa. The majority of the area is devoted to pasture land. The average annual precipitation is 79 cm (31 in.) and the majority of the precipitation falls within the growing season. The growing season averages 173 days in length. The mean annual temperature is 12°C (54°F) with summer temperatures rising to over 38°C (100°F) and winter temperatures falling below -18°C (0°F).

Most wells in the region are used for municipal and domestic supply. The watershed has characteristicly low well yields generally below 16 liters per sec (250 gallons per minute) (lps, gpm). The depth to groundwater in the major valleys is generally less than 6 m (20 ft) while in the upland areas selected locations may be 30.5 m (100 ft) to water. The saturated thickness of the principle water-bearing formation is from 12 to 24 m (40 to 80 ft) (12,15,18,29).

The Beaver Creek and South Fork Solomon basins, in contrast to the smaller rounded Black Vermillion watershed, are long, narrow watersheds.

The South Fork Solomon watershed (Fig. 4) is located in the second layer of counties from the northern Kansas border. The drainage area covers 2694 km^2 (1040 mi^2) with 46% in Graham county, 34.9% in Sheridan county, 18.9% in Thomas county, and the remaining 0.2% in Rooks county. Rooks county contains the gaging station which is located above Webster Reservoir.

This watershed is located within the area known as the High Plains section of the Great Plains physiographic province. The region generally slopes eastwardly at a rate of 0.28% (12 ft/mi). The western end of the basin, consists mainly of nearly flat to gently rolling upland broken by

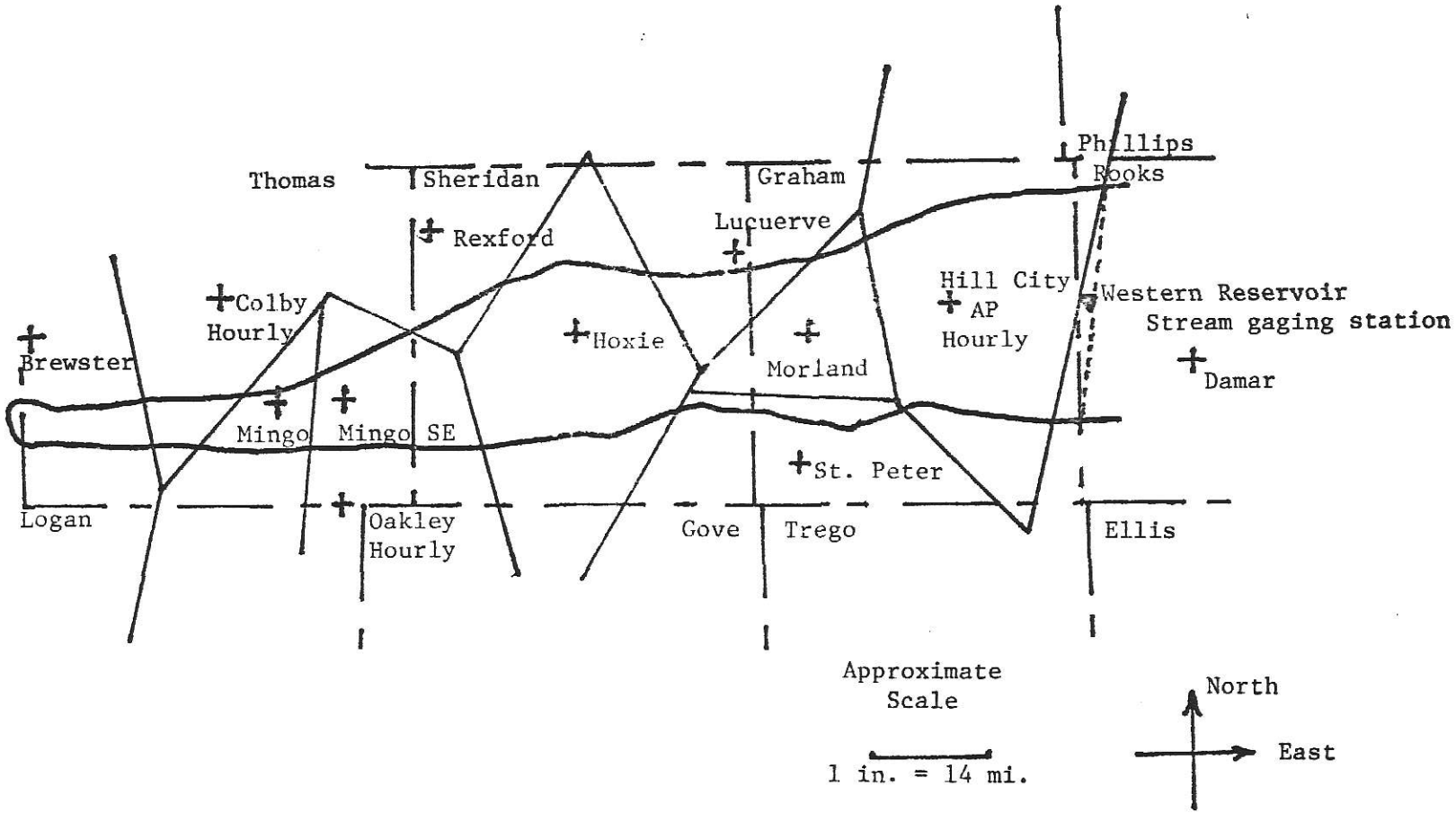


Fig. 4.--South Fork Solomon Watershed.

relatively shallow valleys. The upland areas of the basin are not always well drained because of the extreme flatness and the presence of shallow depression areas. In contrast, the eastern end of the watershed is well drained, sloping ground that is moderately to well dissected.

The basin is underlain by Pierre shale which is impervious to water from the water-bearing formation above it. The Ogallala formation rests on the Pierre shale. It averages 50 m (165 ft) thickness in the west but thins to almost nothing in the east. The Ogallala is the primary groundwater source. The well yields range from over 63 lps (1000 gpm) in the west to a few liters per second on the east. The Ogallala is overlain by unconsolidated deposits of silt or loess. This deposit is usually around 12 m (40 ft) thick and is above the water table.

The area is primarily agricultural with wheat being the main crop. The wheat-fallow rotation accounts for 50% of the cropland use. Pastures cover 40% of the area and the remaining land is largely devoted to sorghum, although other small grains and corn are present. The climate can be described as subhumid to semiarid. The average annual temperature is 12°C (53°F) with extremes recorded from -31°C (-24°F) to 47°C (117°F). The average precipitation is approximately 48 cm (19 in.) with extreme variations of 17 to 100 cm (7 to 39 in.). The average growing season is about 162 days (5,8,9,11,12).

Beaver Creek basin (Fig. 5) is located mainly in extreme northwestern Kansas. It drains 4190 km^2 (1168 mi^2) but 761 km^2 (294 mi^2) of which are probably non-contributing. The gaging station is located at Cedar Bluffs in Decatur county. The watershed lies in Kit Carson county, Colorado (20%), Sherman County (including a portion of Thomas, 31%), Cheyenne county (16%), and Decatur county (including Red Willows County, Nebraska, 6%).

The area is also located in the High Plains section of the Great Plains physiographic province. The upland areas are flat to gently rolling terrain and characterized by having numerous shallow undrained depressions. The watershed slopes eastwardly at a rate of 0.23 to 0.27% (12 to 14 ft/mi). The uplands are moderately dissected by small drainage ways. The areas bordering streams tend to be gentle until the stream becomes major in size when the slope then becomes more rugged and steeper, especially along the south side of Beaver Creek. The area of dissection extends 3 to 5 km (2 to 3 mi) either side of the streams and the flat valley floor may be 61 m (200 ft) below the upland plateau.

The basin is underlain by Pierre shale. It outcrops in only a few areas where the younger formations have eroded away. The Ogallala formation overlies the Pierre shale and is nearly 91 m (300 ft) thick in places. In other areas it is very thin or completely removed by erosion. The Ogallala outcrops along many stream valleys but it is generally covered by a 15 m (50 ft) thick deposit of wind-blown loess. The soils of the region are deep, well-drained, nearly level or gently sloping silt loams of the upland. The valley terraces are covered by deep, well-drained, strongly sloping loams.

The area is predominantly agricultural with wheat, sorghum, barley, corn, and pastures being the main crops. Summer fallowed areas are also present. Irrigation was increasing during the final years of the test period. The region is semiarid with a mean annual temperature of 12°C (53°F) with extremes of over 38°C (100°F) to less than 18°C (0°F). The rainfall also varies extremely from the average annual amount of 43 cm (17 in.). Test well yields range from 9 to 58 lps (150 to 900 gpm). The depth

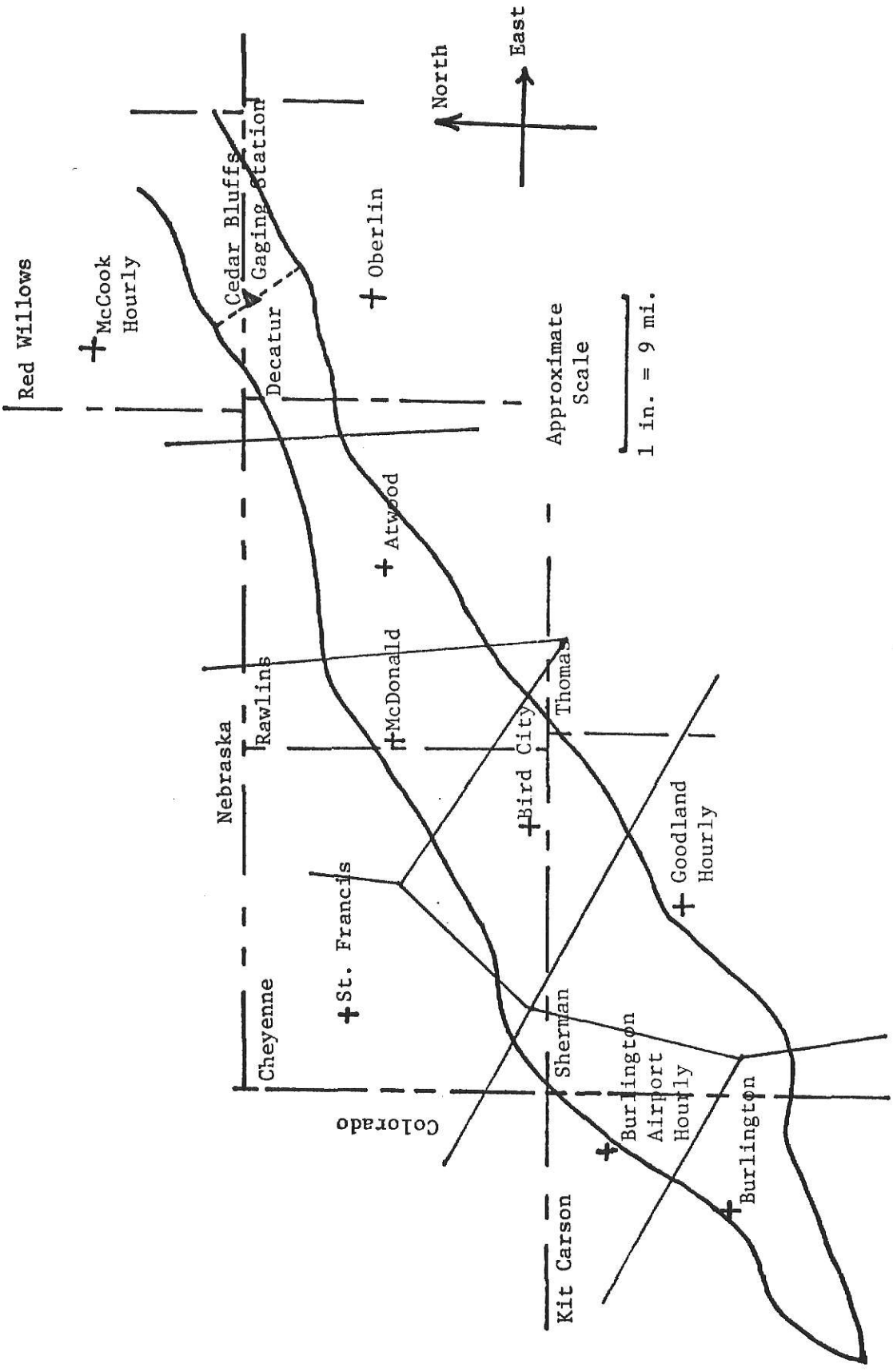


Fig. 5.--Beaver Creek Watershed.

to water for the upland wells is generally more than 30 m (100 ft) while in the valleys the depth can be as little as 3 m (10 ft). The saturated thickness of the water-bearing deposit range from less than 6 m (20 ft) in eastern Rawlins county to almost 60 m (200 ft) in Sherman county. Generally the thickness is over 30 m (100 ft) (10,13,16,17).

Model Calibration.--The Kansas Watershed Model is calibrated by comparing the calculated streamflows to observed stream flows. Coefficients are adjusted until long term observed and calculated sreamflows agree, as shown in Table 2. In the calibration process, elements of the budget such as interception, evapotranspiration, and soil moisture variations are similarly adjusted to yield reasonable values for the particular location. The correlations listed in Table 2 are the average of the monthly coefficients (r^2) computed from daily values of observed and calculated streamflows.

TABLE 2.--Observed and Modeled Accumulated Streamflows

Watershed	Simulation Period	Observed* Flow	Modeled Flow	Average Correlation (r^2)
Black Vermillion	1954-1967	142.65 (56.16)	144.04 (56.71)	.731
South Fork Solomon	1948-1961	47.78 (18.81)	46.40 (18.23)	.677
Beaver Creek+	1947-1965	11.68 (4.60)	12.34 (4.86)	.711

*Flows are in centimeters (inches)
+Flows for Beaver Creek exclude 1957 and 1960.

Two problem years, 1957 and 1960, were encountered in calibrating the Beaver Creek model. The program substantially underpredicted the flow for these two years. The observed flow was gaged at 15.82 cm (6.227 in.) for the 1947-1965 record period but KWM predicted only 13.27 cm (5.233 in.).

This is under-estimation of almost 16%. A check of the climatological data records and streamflow records (28,26,27) did not reveal any inconsistencies in the information recorded on the magnetic tape used as input for KWM. The model simply did not predict the extremely high May, 1957 flows. KWM tends to underpredict the peaks of extreme runoff events. For this particular event, however, the recorded precipitation could not have produced a runoff event of the observed magnitude, although there are damage accounts for the flood that occurred in May of 1957. This region typically experiences spotty high intensity storms. It is possible for a storm of sufficient magnitude to have occurred in the gaps of the rain gage network. Of the nine stations used in the program, four experienced a relatively large storm, two light to moderate, and three recorded no precipitation, which may explain the difficulty.

The 1960 streamflow difficulty was due to a very cold winter in which snow accumulation occurred from mid-January to mid-March. Several north western stations reported 68 consecutive days of snow cover. The low temperatures prevented most snowmelt until mid-March when above normal temperatures caused rapid melt and high runoff. KWM contains a simple snow acculmulation and snowmelt subroutine, which is uncalibrated due to the infrequency of substantial snow accumulations in Kansas. The extreme conditions of this winter were not modeled accurately by this subroutine.

Since the two years accounted for most of the underprediction of the total flow measurement, they were not used in comparing the effects of weather modification. The years are included in figures only to provide a continuous record. Computed averages, percentages, or deviations exclude these years.

RESULTS

The assumed modification schemes, B-ZERO and B-TEN, result in increased precipitation, streamflow, and runoff. There are some interesting effects resulting from applying B-ZERO and B-TEN assumptions to these watersheds.

Precipitation.--The Black Vermillion Watershed experienced an average of 5.36 cm (2.11 in.) per year of additional rainfall for the fourteen year test period due to B-ZERO modification. B-TEN caused an average increase of 6.81 cm (2.66 in.) per year. South Fork Solomon average increases were 5.54 cm (2.18 in.) and 6.27 cm (2.47 in.) per year. Beaver Creek experienced increased precipitation averaging 5.52 cm (2.18 in.) and 6.10 cm (2.40 in.) per year.

In the summaries presented in Tables 3, 4, and 5, the climatic difference between the subhumid Black Vermillion and the semiarid South Fork and Beaver Creek region are apparent. Although all these watersheds had similar absolute increases in precipitation under B-ZERO, the Beaver Creek, percentage increase over natural ormal precipitation was twice that of the Black Vermillian. South Fork experienced a similar result.

The effects of B-TEN modification were similar to B-ZERO, except that B-TEN is always somewhat higher. The Black Vermillian watershed showed the most significant increase in winter precipitation as a result of the B-TEN program. Since winter modification assumes a uniform percentage increase, a larger absolute increase in precipitation would be expected in the wetter region.

Runoff.--B-ZERO modification resulted in reduced streamflows for five years for the Black Vermillion, two years for the South Fork Solomon, and one year for Beaver Creek. There is quite a difference in streamflows for

TABLE 3.--Black Vermillion Watershed Summary

Year	Precipitation			Runoff			Eta & Interception			Storage Change		
	Normal	Mod B-ZERO	Mod B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN
1954	73.15 (28.80)	78.69 (30.98)	79.65 (31.36)	7.529 (2.965)	7.686 (3.046)	7.844 (3.088)	73.552 (28.957)	75.883 (29.875)	76.253 (30.021)	- 7.948 (-3.129)	- 4.938 (-1.944)	- 4.564 (-1.797)
1955	58.47 (23.02)	65.35 (25.73)	66.85 (26.32)	3.754 (1.478)	4.214 (1.658)	4.420 (1.740)	65.395 (25.746)	68.214 (26.856)	68.608 (27.011)	-10.678 (-4.204)	- 7.069 (-2.783)	- 6.185 (-2.435)
1956	51.69 (20.33)	57.79 (22.75)	59.03 (23.24)	2.052 (0.808)	3.454 (1.360)	3.729 (1.468)	60.333 (23.753)	62.949 (24,783)	62.669 (24.673)	-10.744) (-4.230)	- 8.621 (-3.394)	- 7.369 (-2.901)
1957	87.48 (34.44)	94.08 (37.04)	96.09 (37.83)	8.950 (3.327)	9.365 (3.687)	10.163 (4.001)	69.540 (27.378)	69.868 (27.507)	69.872 (27.609)	9.467 (3.727)	14.826 (5.837)	16.048 (6.318)
1958	96.57 (37.98)	99.67 (39.24)	100.79 (39.68)	19.207 (7.562)	16.683 (6.568)	16.746 (6.593)	66.372 (26.131)	73.609 (28.980)	74.475 (29.321)	10.861 (4.276)	9.347 (3.680)	9.568 (3.767)
1959	104.57 (41.17)	107.80 (42.44)	109.60 (43.15)	20.246 (7.971)	18.872 (7.430)	21.021 (8.276)	74.285 (29.246)	77.249 (30.413)	77.602 (30.552)	9.996 (3.935)	11.643 (4.584)	10.980 (4.323)
1960	74.42 (24.30)	80.19 (31.67)	81.69 (32.16)	5.921 (2.331)	11.254 (4.431)	14.846 (5.845)	6.953 (24.391)	75.671 (29.792)	75.761 (29.827)	- 6.152 (-2.422)	- 6.764 (-2.663)	- 8.910 (-3.508)
1961	99.39 (29.13)	104.90 (41.30)	107.01 (42.13)	12.421 (4.890)	15.969 (6.287)	18.075 (7.116)	75.827 (29.853)	76.736 (30.211)	76.799 (30.236)	11.128 (4.381)	12.159 (4.787)	12.144 (4.781)
1962	87.22 (34.34)	91.47 (36.01)	93.32 (36.74)	13.424 (5.285)	19.759 (7.779)	21.608 (8.507)	78.161 (30.772)	78.628 (30.960)	78.674 (30.974)	- 4.399 (-1.732)	- 6.975 (-2.746)	- 6.960 (-2.740)
1963	56.16 (22.11)	62.84 (24.74)	63.60 (25.04)	2.802 (1.103)	4.427 (1.793)	5.141 (2.024)	77.008 (30.318)	79.964 (31.982)	80.185 (31.569)	-23.645 (-9.309)	-21.557 (-8.487)	-21.717 (-8.550)
1964	82.55 (32.50)	86.16 (33.92)	87.27 (34.36)	12.098 (4.763)	10.902 (4.292)	10.496 (4.329)	68.405 (26.931)	74.673 (29.399)	75.499 (29.724)	2.029 (0.799)	0.549 (0.216)	0.772 (0.304)
1965	96.67 (38.06)	104.60 (41.18)	106.22 (41.82)	14.742 (5.804)	15.193 (5.962)	15.740 (6.197)	73.345 (28.876)	76.4921 (30.115)	76.723 (30.206)	8.547 (3.365)	12.931 (5.091)	13.757 (5.416)
1966	58.52 (23.04)	62.74 (24.70)	63.53 (25.01)	6.327 (2.491)	5.872 (2.312)	5.918 (2.330)	61.913 (24.375)	68.356 (26.912)	68.849 (27.106)	- 9.728 (-3.830)	-11.501 (-9.528)	-11.245 (-4.427)
1967	91.90 (36.18)	97.51 (38.39)	99.09 (39.01)	14.801 (5.827)	13.759 (5.917)	14.186 (5.585)	71.128 (28.003)	76.985 (30.309)	77.460 (30.496)	5.941 (2.339)	6.734 (2.651)	7.452 (2.934)
Total	1118.62 (440.40)	1193.75 (469.98)	1213.76 (477.86)	144.043 (56.710)	157.709 (62.090)	170.454 (67.108)	989.909 (389.728)	1035.258 (407.582)	1039.424 (409.222)	-15.326 (-6.034)	0.762 (0.300)	3.894 (1.533)
Average	79.91 (31.46)	85.27 (33.57)	86.69 (34.13)	10.290 (4.051)	11.265 (4.435)	12.174 (4.793)	70.709 (27.838)	73.947 (29.113)	74.244 (29.230)	- 1.095 (-0.431)	0.053 (.021)	0.279 (0.110)
% Increase	---	6.72	8.51	---	9.70	10.35	---	4.58	5.00			
% Water Budget	100	100	100	12.88	13.21	14.04	88.49	86.73	85.63	- 1.37	0.06	0.33

NOTE: All numbers in centimeters (inches)

TABLE 4.--South Fork Solomon Summary

Year	Precipitation			Runoff			Eta & Interception			Storage Change		
	Normal	Mod B-ZERO	Mod B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN
1948	48.77 (19.20)	54.28 (21.37)	54.97 (21.64)	1.788 (0.704)	2.090 (0.823)	2.101 (0.827)	49.456 (19.471)	54.475 (21.447)	54.607 (21.499)	- 2.477 (-0.975)	- 2.296 (-0.909)	- 1.742 (-0.686)
1949	62.59 (24.64)	70.74 (27.84)	71.63 (28.20)	2.230 (0.878)	2.677 (1.054)	2.797 (1.101)	60.053 (23.643)	61.351 (24.154)	61.448 (24.192)	0.290 (.114)	6.701 (2.635)	7.404 (2.915)
1950	53.62 (21.11)	59.49 (23.42)	59.89 (23.58)	6.279 (2.472)	6.050 (2.382)	6.068 (2.389)	47.427 (18.672)	55.789 (21.964)	56.312 (22.170)	- 0.099 (-0.039)	2.362 (-0.930)	- 2.489 (-0.980)
1951	84.02 (33.08)	88.37 (34.79)	88.87 (34.99)	13.678 (6.386)	19.632 (7.729)	20.800 (8.189)	60.154 (23.683)	62.011 (24.414)	62.062 (24.434)	10.201 (4.016)	6.715 (2.250)	6.015 (2.368)
1952	32.69 (12.87)	39.29 (15.47)	39.62 (15.60)	1.699 (0.699)	3.381 (1.331)	3.589 (1.413)	42.520 (16.740)	46.667 (18.373)	46.675 (18.376)	-11.529 (-4.539)	-10.744 (-4.230)	-10.653 (-4.194)
1953	48.21 (18.98)	53.11 (20.91)	54.78 (21.37)	1.321 (0.520)	1.588 (0.625)	0.635 (1.613)	41.740 (16.433)	46.909 (18.468)	47.582 (18.733)	6.149 (2.027)	4.618 (1.818)	5.085 (2.002)
1954	37.36 (14.71)	41.63 (16.39)	42.29 (16.65)	1.316 (0.518)	1.577 (0.621)	1.595 (0.628)	41.686 (16.412)	47.036 (18.510)	48.148 (18.956)	- 5.723 (-2.253)	- 6.734 (-2.651)	- 7.445 (-2.431)
1955	38.63 (15.21)	41.86 (16.48)	42.24 (16.63)	0.960 (0.378)	1.008 (0.397)	1.057 (0.416)	35.817 (14.101)	39.091 (15.390)	39.792 (15.666)	1.869 (0.736)	1.758 (0.692)	1.400 (0.551)
1956	24.79 (9.76)	29.21 (11.50)	29.74 (11.71)	0.490 (0.193)	0.660 (0.260)	0.665 (0.262)	27.181 (10.701)	31.237 (12.248)	31.669 (12.476)	- 2.883 (-1.136)	- 2.695 (-1.061)	- 2.609 (-1.027)
1957	69.63 (27.42)	75.90 (29.88)	76.58 (30.15)	5.230 (2.059)	4.940 (1.945)	4.958 (1.952)	59.149 (23.287)	61.571 (24.240)	61.816 (24.337)	5.271 (2.075)	9.388 (3.696)	9.807 (3.861)
1958	57.51 (22.64)	64.39 (26.35)	65.25 (25.69)	3.518 (1.385)	6.619 (2.606)	7.369 (2.901)	52.281 (20.583)	54.346 (21.396)	54.526 (21.467)	1.717 (0.676)	3.426 (1.349)	3.366 (1.325)
1959	55.19 (21.73)	61.29 (24.13)	62.41 (24.57)	1.514 (0.596)	1.974 (0.777)	2.090 (0.823)	51.951 (20.453)	57.503 (22.639)	59.426 (23.396)	1.722 (0.678)	0.061 (0.025)	0.876 (0.345)
1960	52.83 (20.80)	58.29 (22.95)	59.79 (23.54)	2.611 (1.028)	5.845 (2.301)	7.988 (3.145)	51.608 (20.318)	54.188 (21.334)	53.868 (21.208)	- 1.379 (- .543)	- 1.735 (-0.683)	- 2.057 (-0.810)
1961	66.45 (26.16)	72.01 (28.35)	72.67 (28.61)	3.594 (1.415)	5.456 (2.148)	6.753 (2.265)	57.498 (22.637)	59.644 (23.482)	60.256 (23.723)	5.347 (2.105)	6.914 (2.722)	6.668 (2.625)
Total	732.31 (288.31)	809.85 (318.84)	820.24 (322.93)	46.309 (18.232)	63.497 (24.999)	68.412 (26.934)	678.520 (267.134)	731.817 (288.117)	736.866 (289.711)	7.475 (2.943)	12.017 (4.731)	13.625 (6.364)
Average	52.309 (20.594)	57.846 (22.774)	58.588 (23.066)	3.307 (1.302)	4.536 (1.786)	4.887 (1.924)	48.466 (19.081)	52.273 (20.580)	52.562 (20.644)	0.533 (0.210)	0.864 (0.340)	0.973 (0.383)
% Increase	---	10.59	12.00	---	37.12	47.73	---	7.85	8.45	---	---	---
% Budget	100	100	100	4.52	7.74	8.45	92.66	90.36	89.71	1.02	1.48	1.66

NOTE: All numbers in centimeters (inches).

TABLE 5.--Beaver Creek Watershed Summary

Year	Precipitation			Runoff			Eta & Interception			Storage Change		
	Normal	Mod B-ZERO	Mod B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN	Normal	B-ZERO	B-TEN
1947	37.87 (14.91)	43.74 (17.22)	44.42 (17.49)	0.869 (0.342)	0.902 (0.355)	0.902 (0.355)	42.174 (16.604)	44.613 (17.564)	44.780 (17.630)	- 5.171 (-2.036)	- 1.775 (-0.699)	- 1.230 (-0.496)
1948	49.17 (19.36)	54.53 (21.53)	55.22 (21.74)	1.036 (0.408)	0.960 (0.378)	0.963 (0.379)	44.516 (17.526)	47.821 (18.827)	47.897 (18.857)	3.586 (1.412)	5.895 (2.321)	6.353 (2.501)
1949	58.34 (22.97)	66.24 (26.08)	66.78 (26.29)	0.574 (0.226)	3.513 (1.383)	4.445 (1.750)	53.769 (21.169)	55.578 (21.881)	55.799 (21.698)	4.003 (1.576)	7.163 (2.830)	6.525 (2.569)
1950	36.04 (14.19)	42.27 (16.64)	42.75 (16.83)	0.432 (0.170)	0.904 (0.356)	0.980 (0.386)	43.602 (17.166)	48.146 (18.955)	48.494 (19.092)	- 7.910 (-3.114)	- 6/895 (-2.675)	- 6.731 (-2.650)
1951	60.07 (23.65)	64.36 (25.39)	57.15 (22.50)	1.654 (0.651)	3.172 (1.249)	3.627 (1.428)	49.685 (19.561)	52.601 (20.709)	52.601 (20.709)	8.738 (3.440)	8.603 (3.387)	8.545 (3.364)
1952	32.89 (12.95)	39.57 (15.58)	39.80 (15.67)	0.401 (0.158)	4.166 (1.640)	4.440 (1.748)	40.427 (15.916)	44.912 (17.682)	45.204 (17.797)	- 7.930 (-3.122)	- 9.512 (-3.745)	- 9.845 (-3.876)
1953	38.91 (15.32	4.09 (17.36)	84.73 (17.69)	0.236 (0.093)	0.612 (0.241)	0.615 (0.242)	38.011 (14.965)	43.868 (17.271)	43.812 (17.249)	0.660 (0.260)	0.904 (0.356)	0.498 (0.196)
1954	24.28 (9.56)	28.65 (11.28)	29.08 (11.45)	0.249 (0.089)	0.274 (0.108)	0.279 (0.110)	27.826 (10.955)	38.052 (14.981)	38.270 (15.067)	- 3.774 (-1.486)	- 9.865 (-3.884)	- 9.462 (-3.725)
1955	27.56 (10.85)	32.44 (12.77)	32.87 (12.94)	0.155 (0.061)	0.191 (0.075)	0.196 (0.077)	27.541 (10.843)	33.754 (13.289)	34.963 (13.765)	- 0.140 (-0.055)	- 1.501 (-0.591)	- 2.436 (-0.959)
1956	28.55 (11.24)	33.93 (13.36)	34.54 (13.60)	0.213 (0.084)	0.274 (0.108)	0.274 (0.108)	27.450 (10.807)	31.011 (12.209)	31.415 (12.360)	0.884 (0.345)	2.652 (1.044)	2.860 (1.126)
1957	55.98 (22.04)	63.80 (25.12)	64.29 (25.31)	0.612 (0.241)	0.714 (0.281)	0.716 (0.282)	50.808 (20.003)	51.996 (20.274)	42.276 (20.581)	4.552 (1.792)	10.831 (4.264)	11.295 (4.447)
1958	53.16 (20.93)	61.09 (24.05)	61.77 (24.32)	0.648 (0.255)	2.078 (0.818)	3.155 (1.242)	48.466 (19.081)	51.436 (20.279)	51.450 (20.256)	4.041 (1.591)	7.521 (2.961)	7.176 (2.825)
1959	40.82 (16.07)	47.73 (18.79)	48.62 (19.14)	0.323 (0.127)	1.046 (0.412)	1.374 (0.541)	44.950 (17.697)	49.647 (19.546)	50.058 (19.708)	- 0.404 (-0.158)	- 2.962 (-1.166)	- 2.827 (-1.113)
1960	43.82 (17.25)	48.72 (19.18)	50.34 (19.82)	0.348 (0.137)	5.829 (2.295)	7.371 (2.902)	43.325 (17.057)	46.505 (18.309)	46.373 (18.257)	0.142 (0.056)	- 3.612 (-1.422)	- 3.409 (-1.342)
1961	51.00 (20.08)	56.90 (22.40)	57.48 (22.63)	0.701 (0.276)	1.300 (0.512)	1.882 (0.741)	47.612 (18.745)	50.409 (19.846)	50.630 (19.933)	2.685 (1.057)	5.199 (2.047)	9.971 (1.957)
1962	57.33 (22.57)	61.32 (24.14)	61.80 (24.33)	2.111 (0.831)	6.988 (2.755)	7.374 (2.903)	50.460 (19.866)	53.040 (20.882)	53.274 (20.974)	4.750 (1.870)	1.273 (0.501)	1.158 (0.456)
1963	44.75 (17.62)	50.22 (19.77)	50.72 (19.97)	0.617 (0.243)	2.563 (1.009)	3.081 (1.213)	47.567 (18.727)	50.937 (20.054)	51.227 (20.168)	- 3.434 (-1.352)	- 3.294 (-1.297)	- 3.592 (-1.414)
1964	31.65 (12.46)	35.36 (13.92)	35.61 (14.02)	0.671 (0.264)	0.749 (0.295)	0.782 (0.308)	38.852 (15.246)	41.171 (16.209)	41.389 (16.295)	- 7.869 (- 3.098)	- 6.508 (-2.506)	- 6.566 (-2.585)
1965	69.14 (27.22)	72.92 (28.71)	73.81 (29.06)	1.463 (0.576)	4.978 (1.960)	5.497 (2.164)	49.108 (19.334)	52.207 (20.554)	52.306 (20.563)	18.166 (7.152)	15.728 (6.192)	16.012 (6.304)
Total	741.53 (291.99)	835.46 (328.92)	844.91 (332.64)	12.332 (4.885)	34.676 (13.652)	39.865 (15.695)	722.015 (284.358)	789.262 (310.733)	793.570 (312.429)	10.801 (4.284)	11.059 (4.354)	10.996 (4.329)
Average	43.51 (17.17)	49.15 (19.35)	49.71 (19.57)	0.726 (0.286)	2.040 (0.803)	2.344 (0.923)	42.471 (16.721)	46.426 (18.278)	46.680 (18.378)	0.640 (0.252)	0.650 (0.256)	0.645 (0.254)
% Increase	---	12.67	13.94	---	181.19	223.27	---	9.31	9.91	---	---	---
% Budget	100	100	100	1.66	4.15	4.72	97.37	94.45	93.92	1.47	1.32	1.30

NOTE: All numbers in centimeters (inches)

the two regions. The Black Vermillion experienced a 10% runoff increase due to modification, which represents only a slight change in the percent of the watershed budget represented by runoff. In the unmodified model, runoff was 12.88% of the entire water budget. B-ZERO and B-TEN modifications increased the runoff budget percentage to 13.21 and 14.04%, respectively. The other two watersheds show more variation. The South Fork experienced 37.12 and 47.73% increases in runoff, representing increases from 4.52% of the water budget to 7.74 and 8.95%, respectively. Beaver Creek, which has a very low average runoff per year, experienced increases of 181.19% and 223.27%, respectively. These represent an increase in the percentage of the total budget from 1.66% for normal conditions to 4.15 and 4.72% for the two modified conditions. The natural average runoff in centimeters (inches) for the three watersheds from east to west is 10.29 (4.05), 3.31 (1.30), and 0.73 (0.29), respectively while for B-ZERO the runoffs are 11.26 (4.44), 4.54 (1.79), and 2.04 (0.80) centimeters (inches).

Evapotranspiration.--The Black Vermillion was calibrated to produce an average of 70.71 cm (27.84 in.) of evapotranspiration (ET) per year, which is 22.25 cm (8.76 in.) per year more than South Fork and 28.24 cm (11.12 in.) per year more than Beaver Creek ET. The Black Vermillion ET is, however, less responsive to increased precipitation, as 4.58 and 5.00% increases were experienced in comparison to 9.31 and 9.91% increases for Beaver Creek. Unfortunately the 9.31% only translates into a 3.96 cm (1.56 in.) per year average increase in ET for Beaver Creek while the 4.58% increase for the Black Vermillion yields 3.25 cm (1.28 in.) per year. The South Fork B-ZERO average increase was 3.81 cm (1.50 in.) per year. Increase of any magnitude in ET would usually be termed beneficial.

Table 6 represents an attempt to show that weather modifications may result in a change of the variability of runoff and ET. The standard deviation ($\hat{\sigma}$) is used to characterize the degree to which B-ZERO and B-TEN either increases or decreases the dispersion (variability) about the mean. The rainfalls experience almost no change in variability, which may or may not be a surprising result. The runoff dispersion is decreased by modification for the Black Vermillion, but increased for the other two watersheds. In all cases, the modified ET's were less variable than the unmodified ET's.

Figures 6 through 14 illustrate the carry over effects of wet to dry years and the differing effects of weather modification in wet and dry years. Figures 15, 16 and 17 present the general trend of B-ZERO and B-TEN in relation to the normal precipitation. All figures illustrate the usual trend is for the greatest percent increase to occur during the years of below natural rainfall. This does not mean dry years receive larger absolute amounts of precipitation, but that these increases are a function of the number and magnitude of the rainfalls experienced in each year.

Water Storage.--In the fourth column of the summary tables, the changes in storage from the beginning of the test period at initial conditions to the final ending conditions are listed. The storage change consists of the sum of soil moisture changes and groundwater level changes. The long term average of this account should be near zero since there are cyclic trends in water consumption and the total water available for consumption is limited.

The Black Vermillion simulation ends with 15.33 cm (6.03 in.) of deficit or an average loss from storage of 1.09 cm (0.43 in.) per year. The B-ZERO modification provides enough moisture that this deficit is overcome and provides enough extra rainfall for a 0.05 cm (.02 in.) per year gain. B-TEN modification raises the net average gain to 0.28 cm (0.11 in.) per year.

TABLE 6.--Comparison of Statistics for Precipitation, Runoff, and Evapotranspiration.

Watershed	Precipitation		Runoff		Evapotranspiration	
	$\hat{\mu}$	$\hat{\sigma}$	$\hat{\mu}$	$\hat{\sigma}$	$\hat{\mu}$	$\hat{\sigma}$
Black Vermillion						
Natural	79.91 (31.46)	17.75 (6.99)	10.240 (0.051)	8.405 (3.309)	70.709 (27.838)	5.977 (2.353)
B-ZERO	85.27 (33.57)	17.58 (6.92)	11.265 (4.435)	5.585 (2.199)	73.962 (29.118)	4.989 (1.964)
B-TEN	86.69 (39.13)	17.78 (7.00)	12.174 (4.793)	5.791 (2.280)	74.244 (29.230)	4.892 (1.926)
South Fork						
Natural	52.31 (20.59)	15.77 (6.21)	3.307 (1.302)	3.411 (1.343)	48.466 (19.081)	9.787 (3.853)
B-ZERO	57.85 (22.77)	16.20 (6.38)	4.536 (1.786)	4.912 (1.934)	42.273 (20.580)	9.091 (3.579)
B-TEN	58.59 (23.07)	16.24 (6.40)	4.887 (1.924)	5.164 (2.033)	52.563 (20.694)	8.865 (3.498)
Beaver Creek						
Natural	43.61 (17.17)	13.09 (5.15)	0.726 (0.246)	0.554 (0.218)	42.721 (16.721)	8.245 (3.246)
B-ZERO	49.15 (19.35)	12.312 (5.202)	2.040 (0.803)	1.938 (0.763)	46.426 (18.278)	7.00 (2.756)
B-TEN	49.71 (19.57)	13.274 (5.226)	2.344 (0.423)	2.129 (0.838)	46.680 (18.378)	6.853 (2.698)

NOTE: All numbers in centimeters (inches).

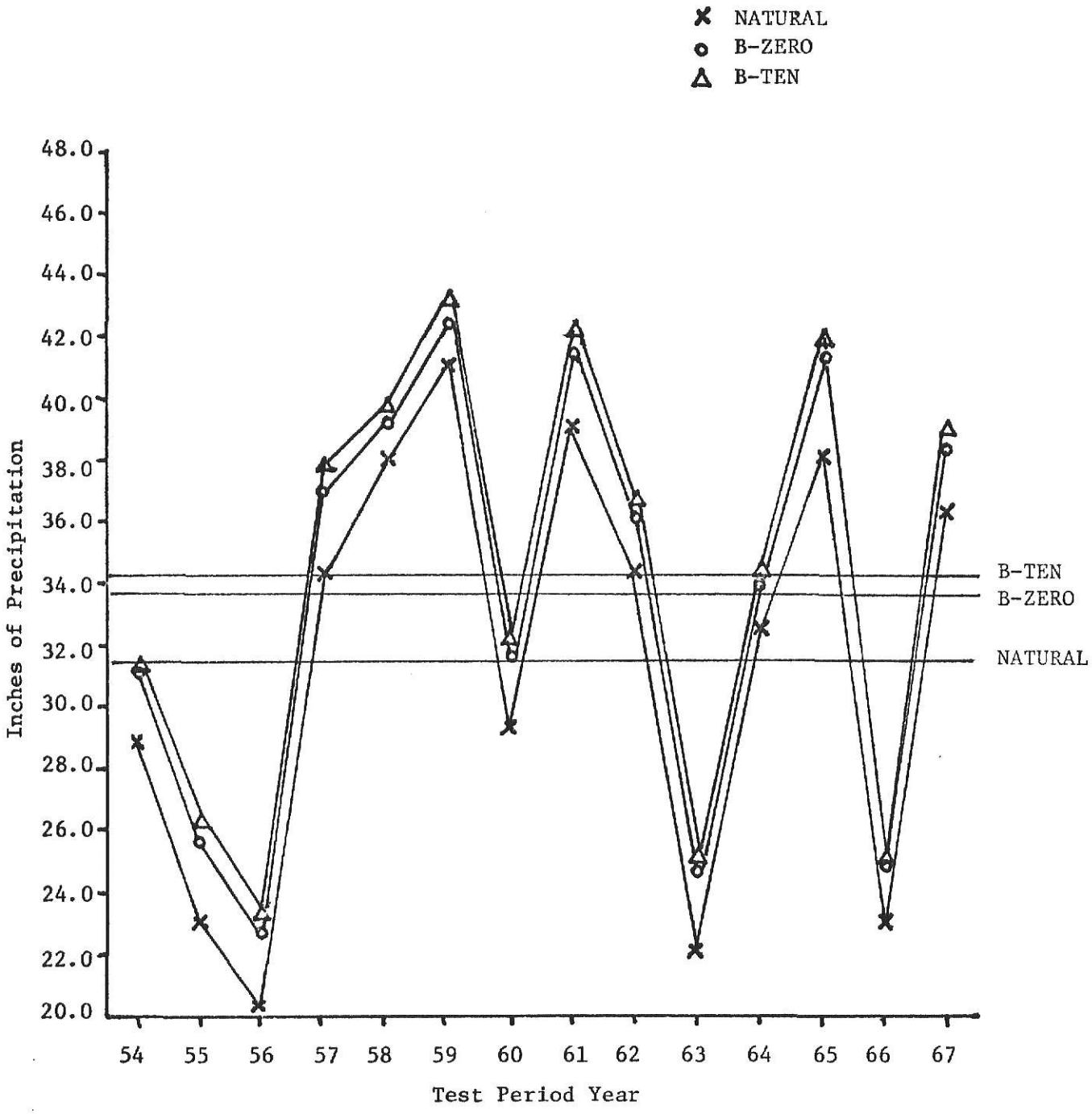


Fig. 6.--Precipitation for the Black Vermillion.

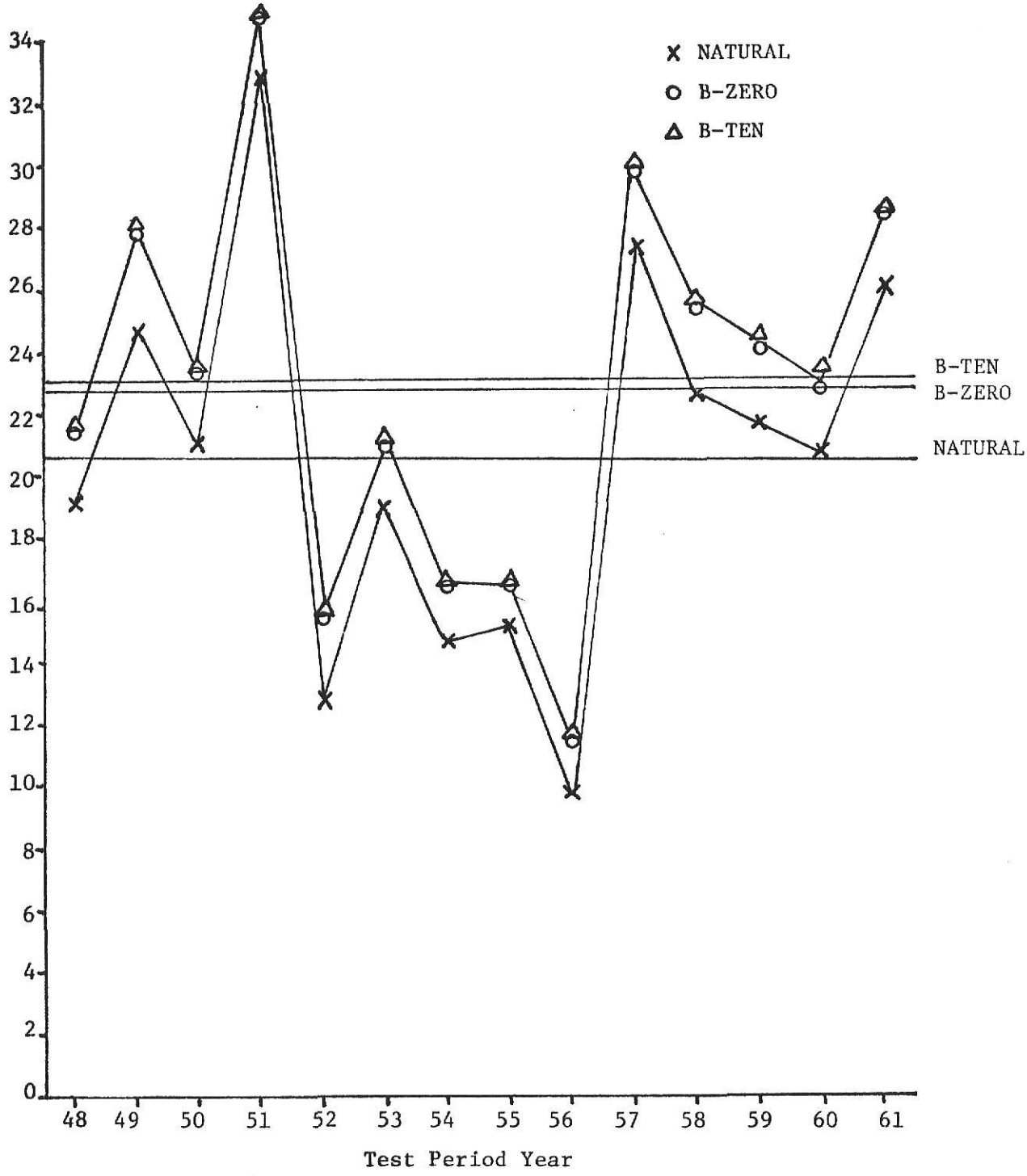


FIG. 7.--Precipitation for the South Fork Solomon

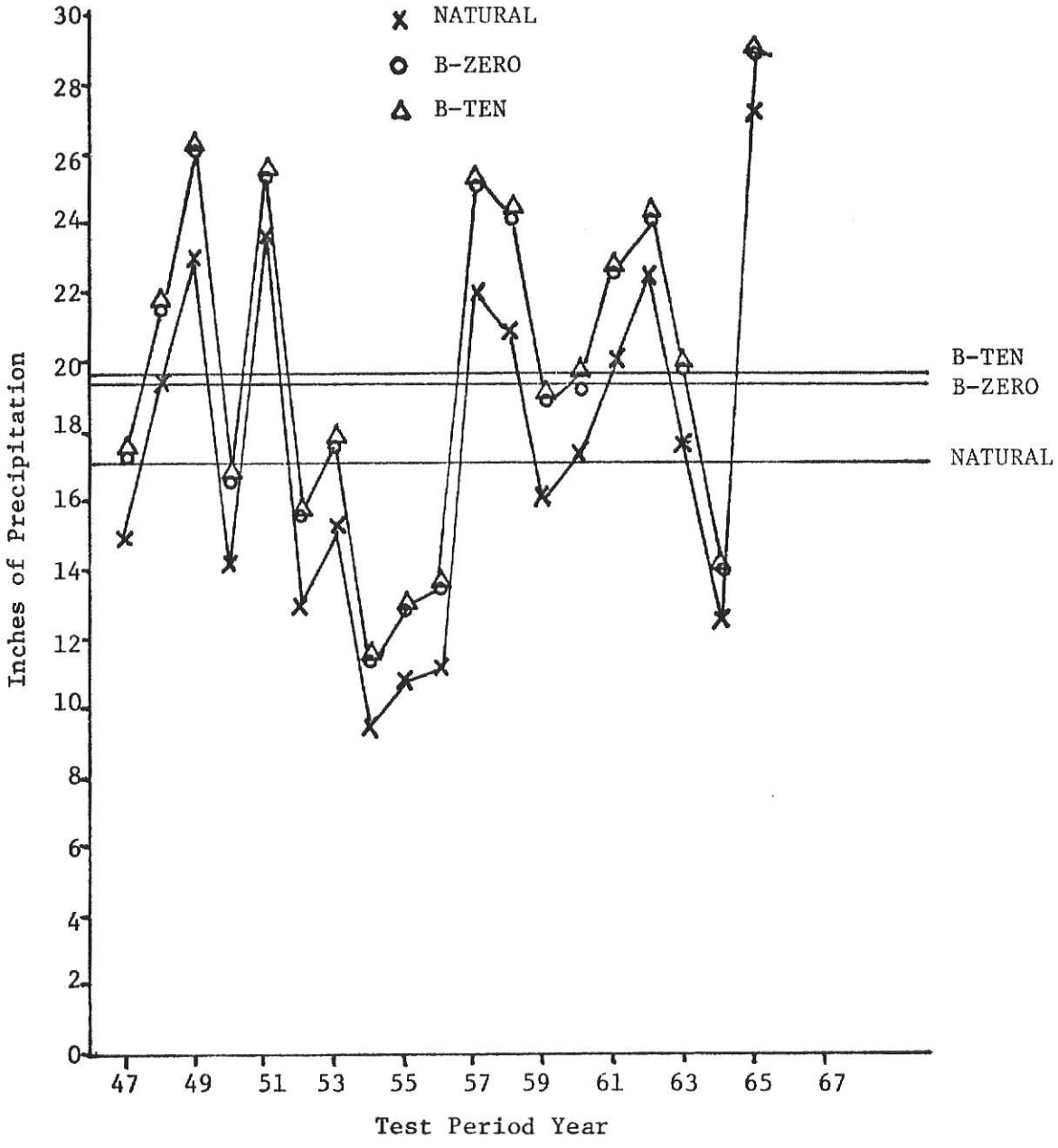


Fig. 8.--Precipitation for the Beaver Creek

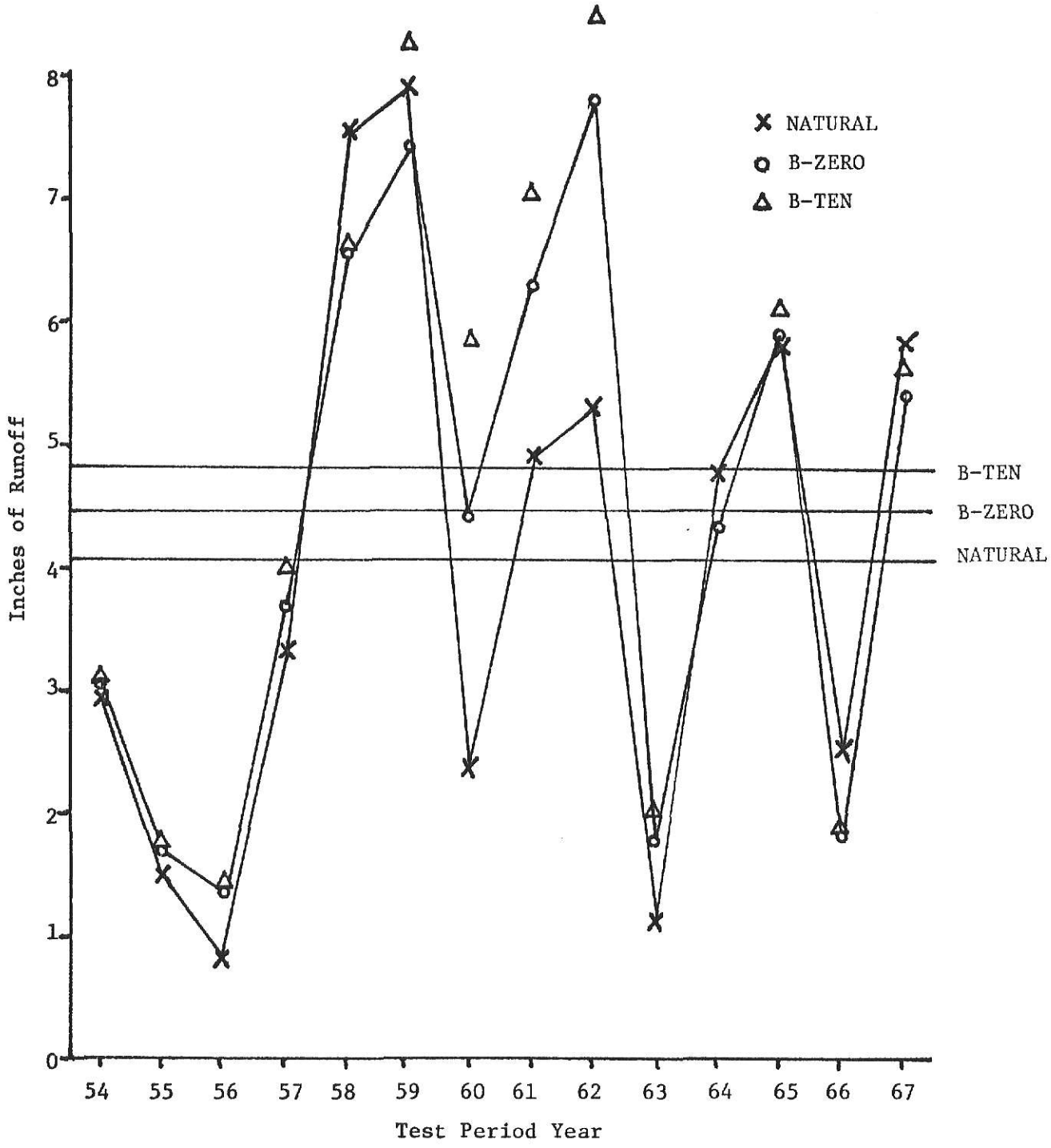


Fig. 9.--Runoff for the Black Vermillion.

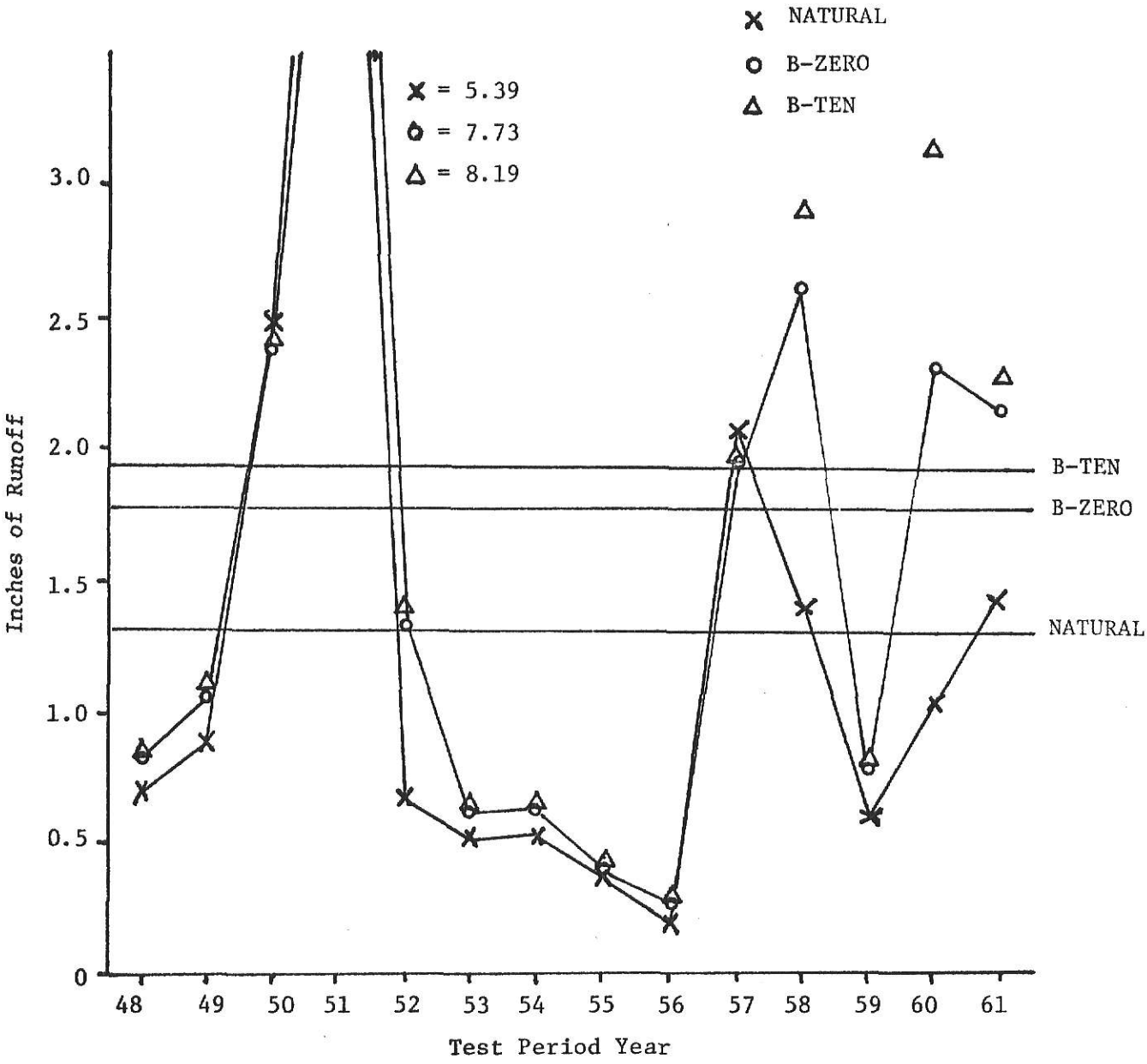


Fig. 10.--Runoff for the South Fork Solomon

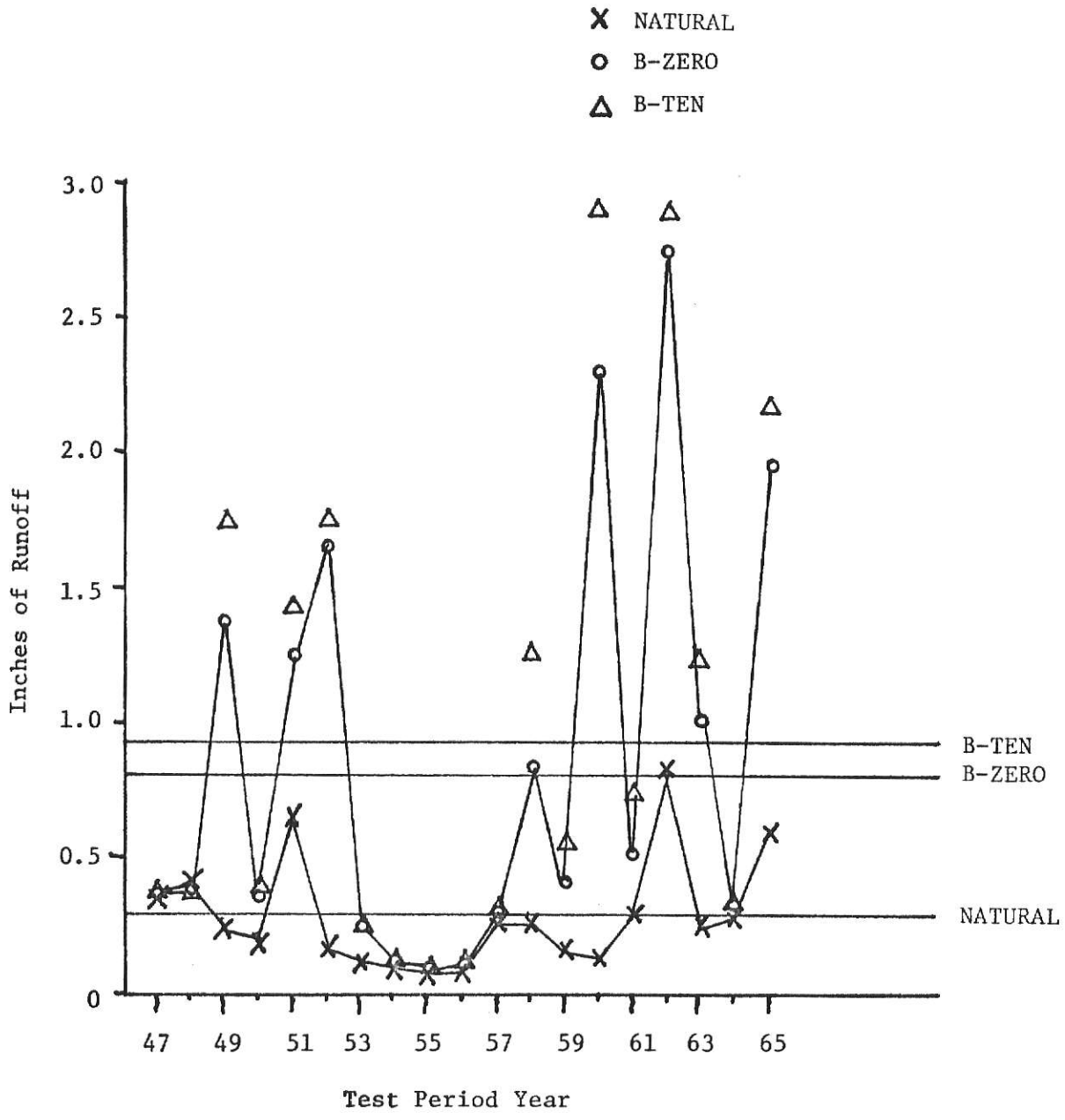


Fig. 11.--Runoff for the Beaver Creek

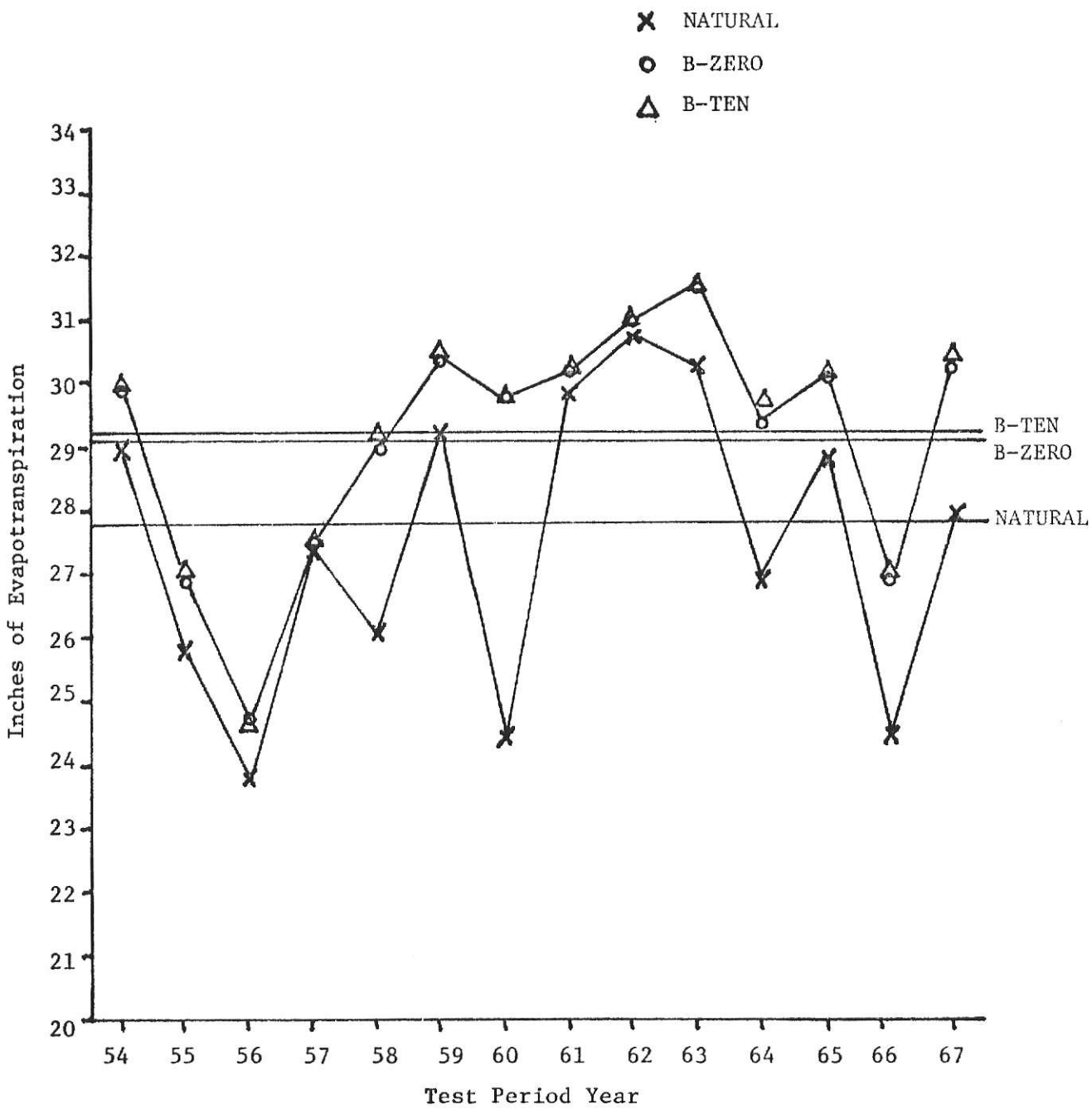


Fig. 12.--Evapotranspiration for the Black Vermillion.

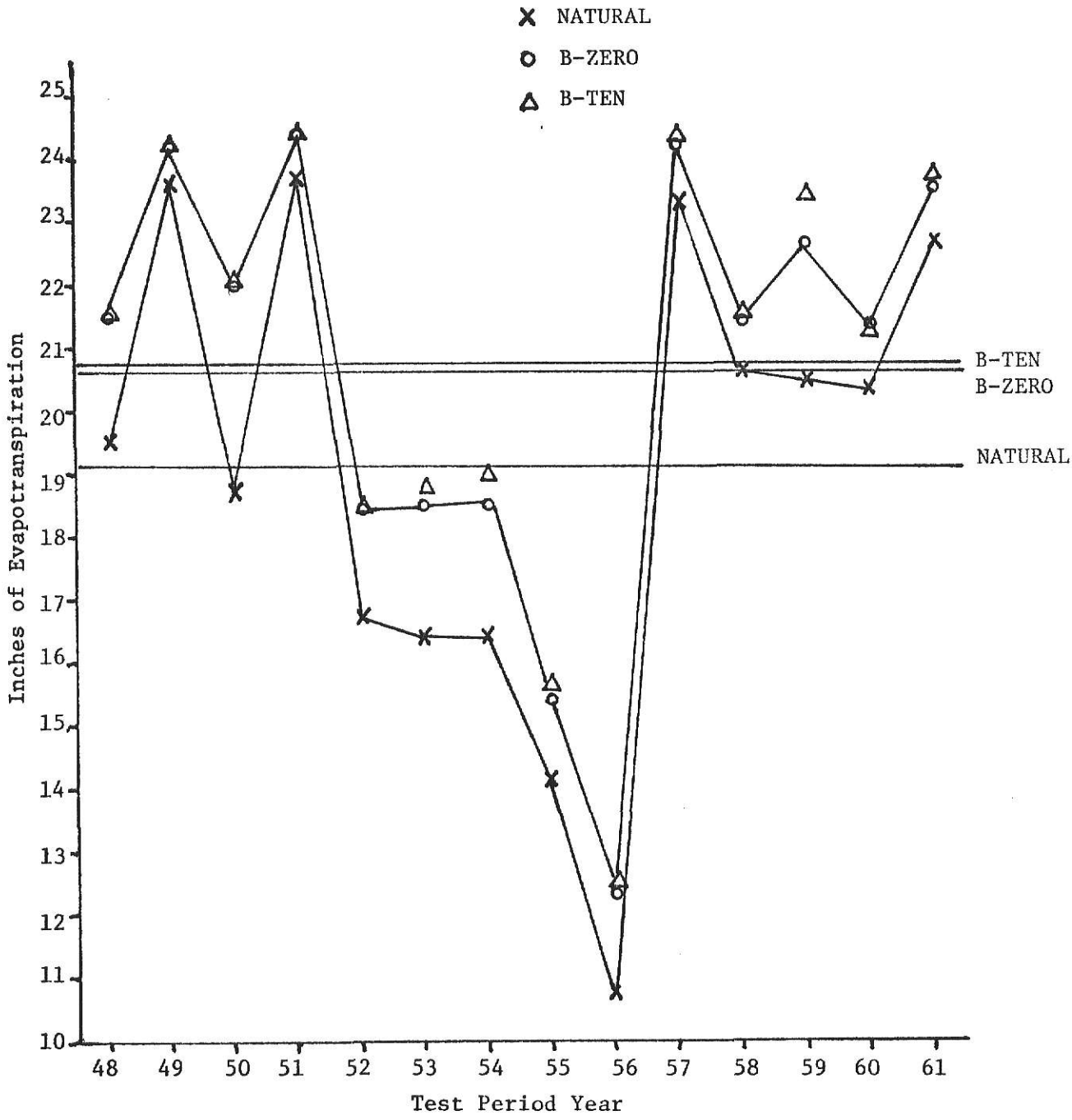


Fig. 13.--Evapotranspiration for the South Fork.

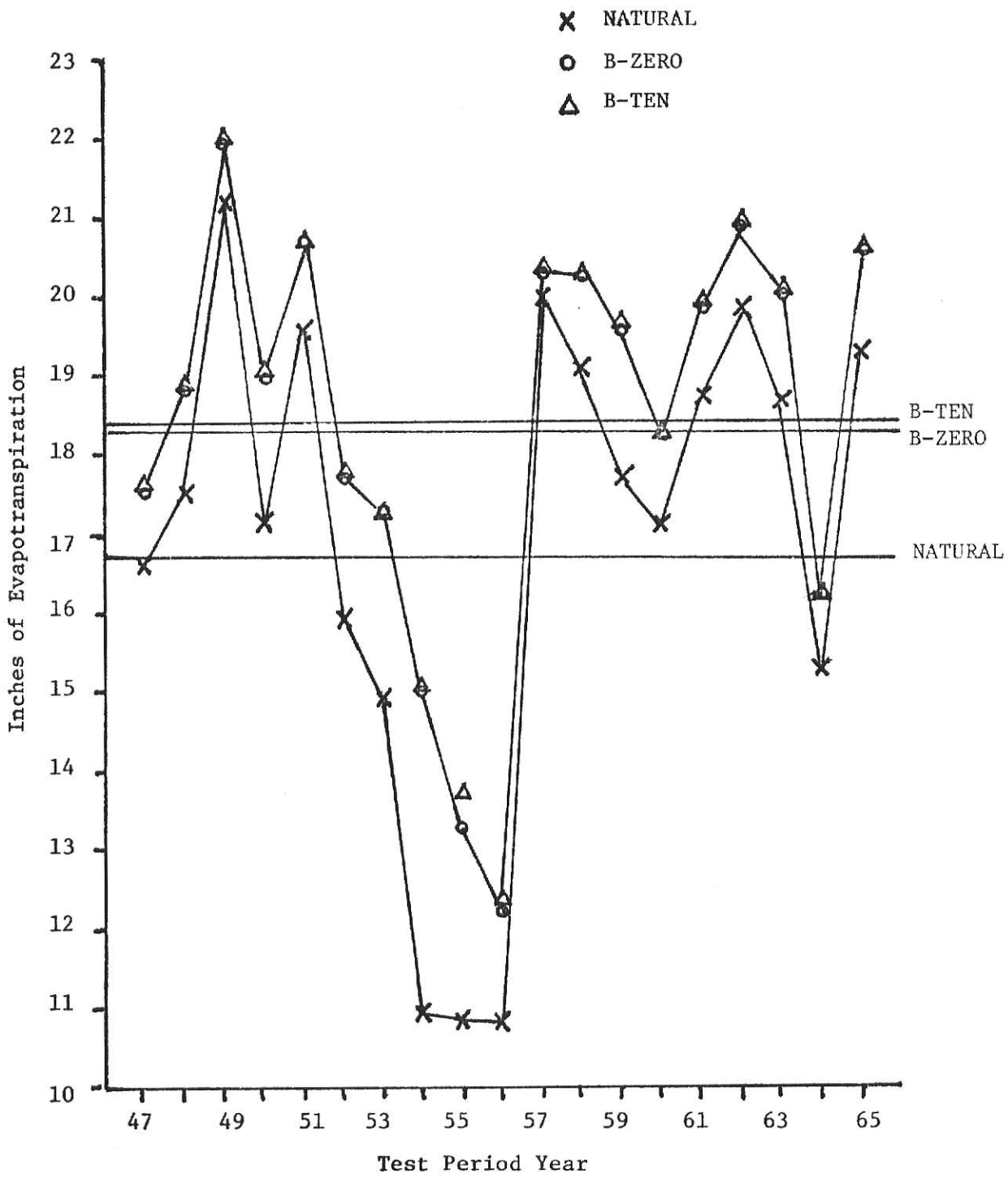


Fig. 14.--Evapotranspiration for the Beaver Creek.

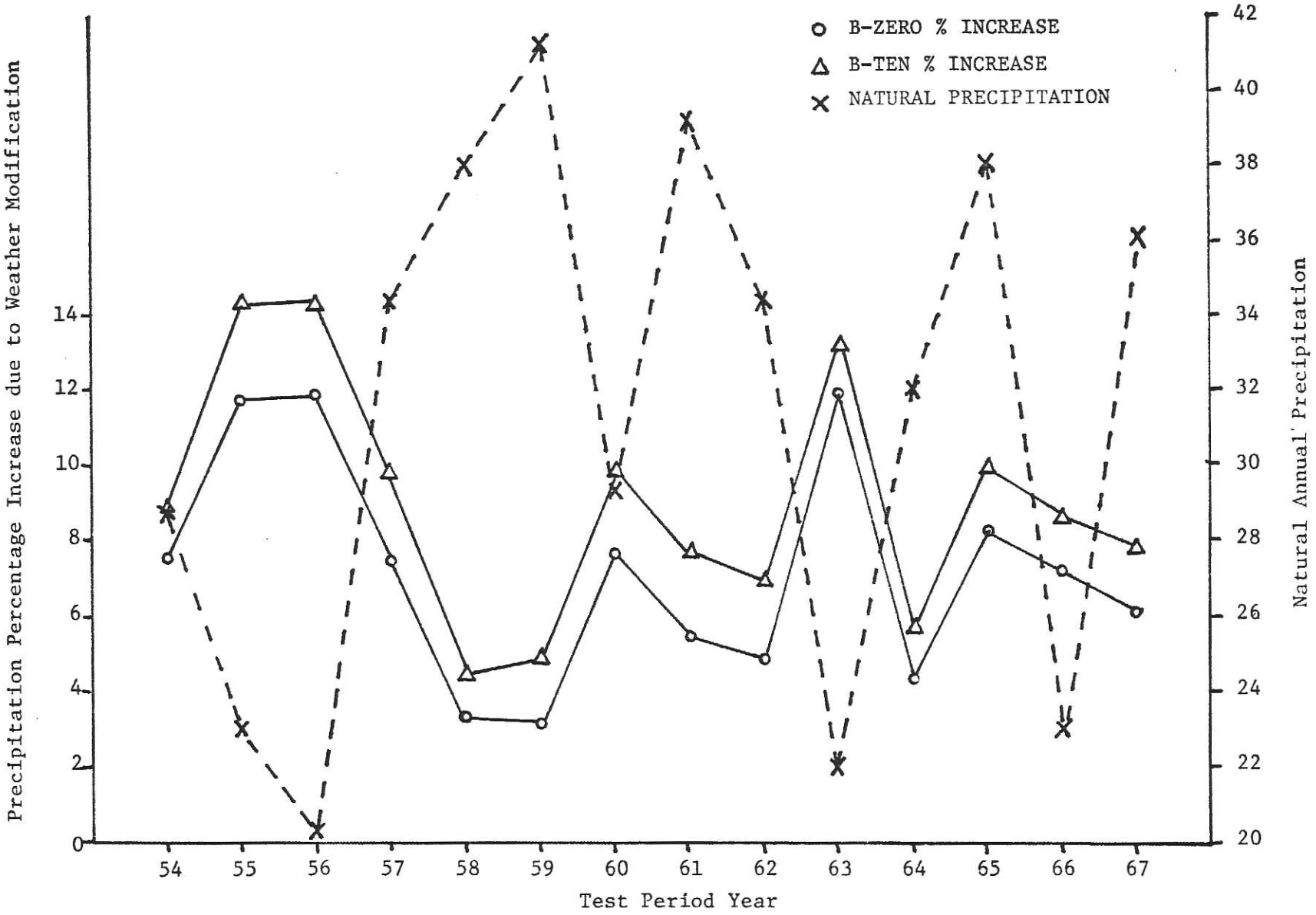


Fig. 15.--Percent Increase of Precipitation for Black Vermillion

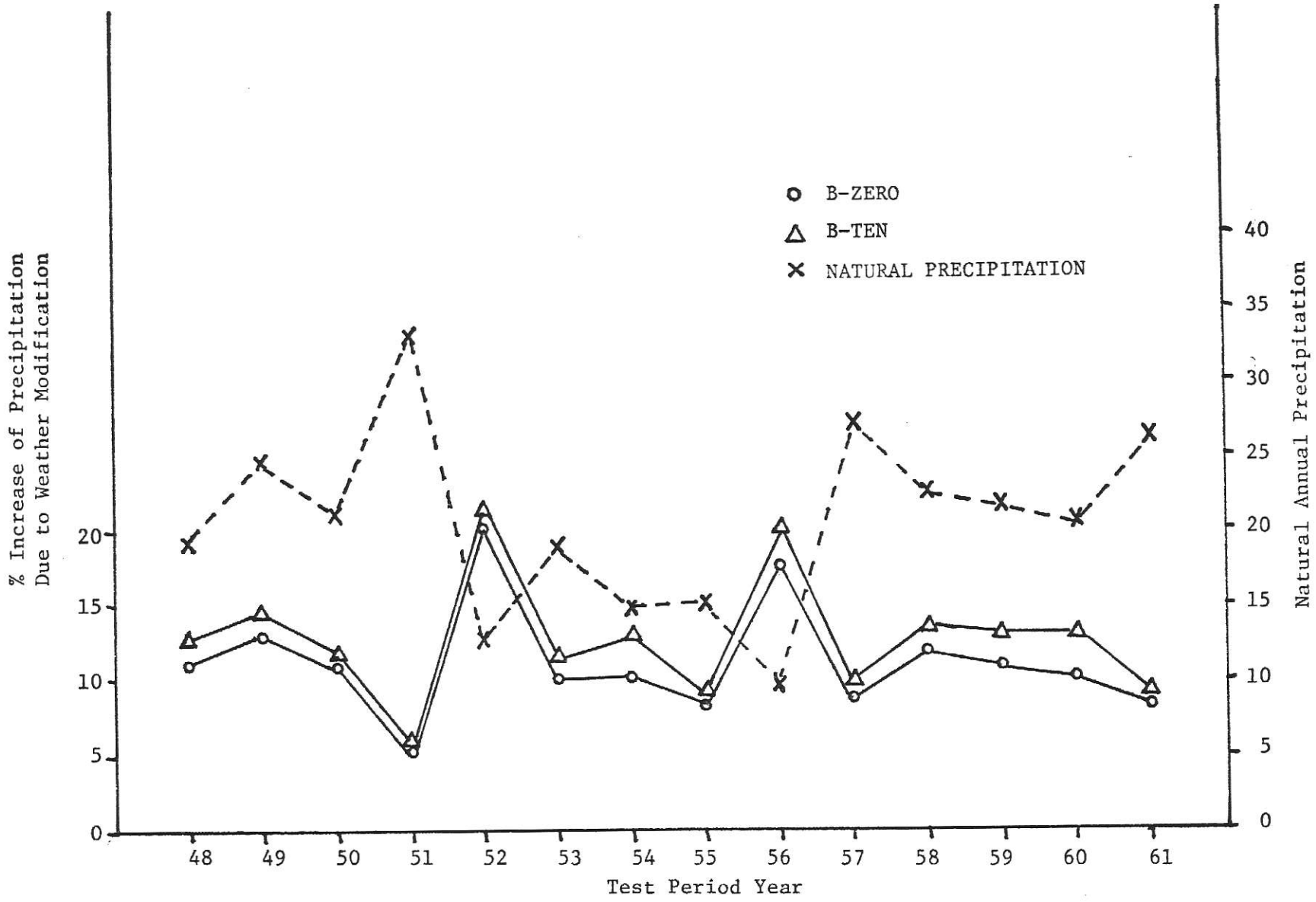


Fig. 16.--Percentage Increase of Precipitation for South Fork

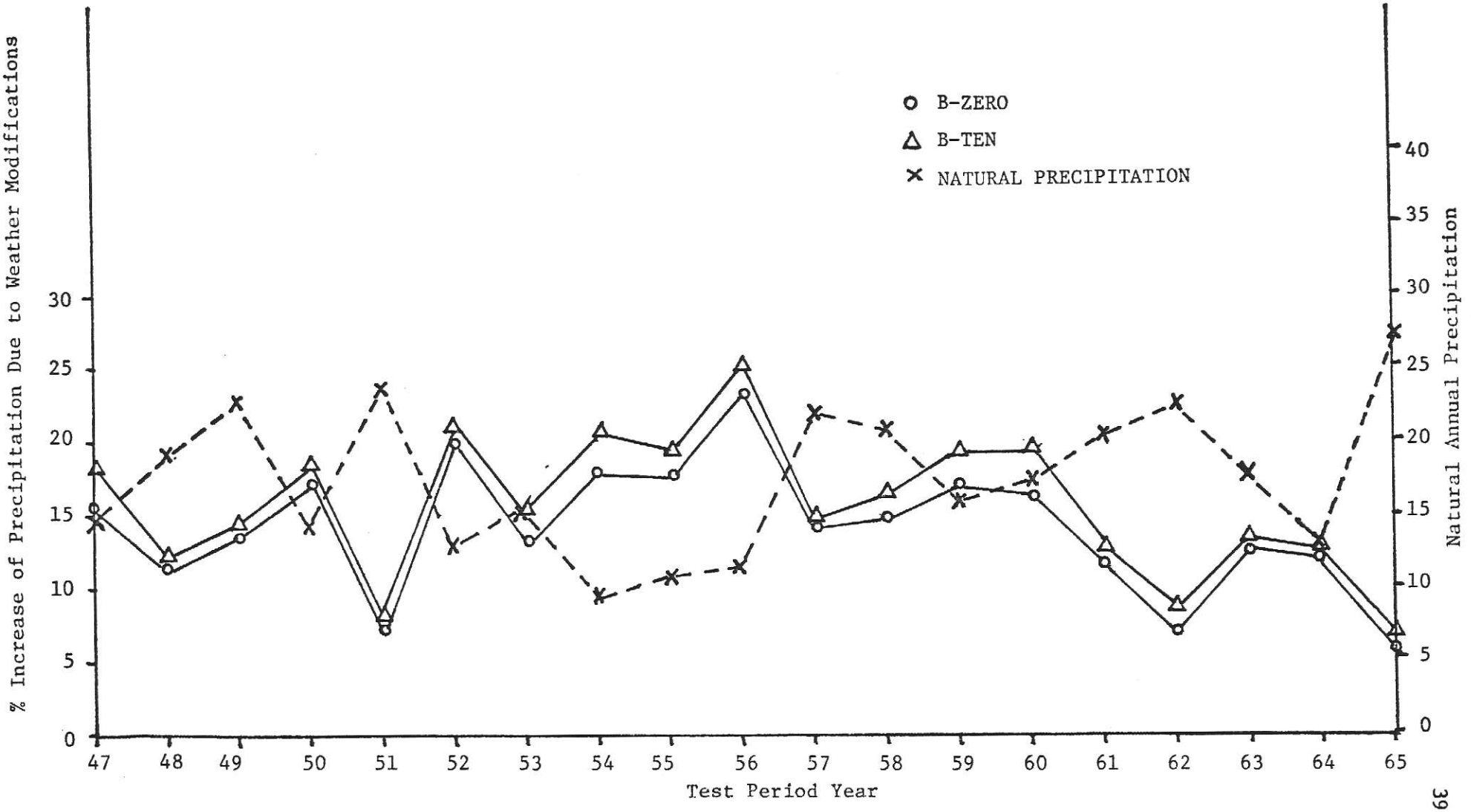


Fig. 17.--Percentage Increase of Precipitation for Beaver Creek

The South Fork Solomon has 7.48 cm (2.94 in.) net gain for its test period. The gain may seem large for this semiarid region, however, the test period ended on the relatively wet year of 1961. In 1961, 5.35 cm (2.11 in.) were added to storage accounting for most of the gain. This watershed also experienced a positive addition to storage due to the weather modification programs.

The Beaver Creek Basin also ended on an extremely wet year in 1965. This year added 18.17 cm (7.15 in.) to storage, which brought the storage budget from a deficit to a 10.88 cm (4.28 in.) gain. Beaver Creek experiences slight storage gains due to the precipitation enhancement.

Recharge.--The South Fork Solomon and the Beaver Creek Watersheds have one additional printout not included on the earlier completed Black Vermillion. This additional printout was the quantity of recharge from the lower zone to groundwater. Table 7 is a summary of the information generated. The results of weather modification on the amount of water passing through the lower zone is quite significant. Beaver Creek experienced no recharge under unmodified conditions but under modification averages of 1.54 cm (0.61 in.) and 1.86 cm (0.731 in.) per year were obtained for B-ZERO and B-TEN, respectively. The South Fork experienced only one year in which recharge occurred under unmodified conditions resulting in 0.41 cm (0.16 in.) average over the record period. B-ZERO and B-TEN modifications recharged an average of 1.74 cm (0.68 in.) and 2.06 cm (0.81 in.) per year.

TABLE 7.--Recharges for South Fork and Beaver Creek

Watershed	No. Years of Record	No. Years of Recharge	Total Recharge Centimeters (inches)	Average Recharge cm per yr (in per yr)
South Fork				
Natural	14	1	5.766 (2.270)	0.412 (0.162)
B-ZERO	14	4	23.305 (9.569)	1.736 (0.684)
B-TEN	14	5	28.867 (11.365)	2.062 (0.812)
Beaver Creek				
Natural	17	0	0 (0)	0 (0)
B-ZERO	17	9	26.208 (10.318)	1.542 (0.607)
B-TEN	17	9	31.824 (12.434)	1.872 (0.731)

CONCLUSIONS

The weather modification program B-ZERO resulted in average precipitation increases for the three watersheds of 6.72, 10.59, and 12.67 percent from the eastern Black Vermillion to the western Beaver Creek. This variability is significant since cloud seeding success is dependent on the number of events and the magnitude of the storm experienced in the area, as reflected in the Model B formulation. The wet-year, dry-year variation is also important. The dry years, due to the magnitude of increase for light rainfalls have increases comparable to those for wet years. Although it did not occur during any of the test years, B-ZERO could have reduced the total rainfall if enough of the storms were of high magnitude greater than one inch. It could also be possible to reduce the total rainfall for a given year and still experience better growing conditions, particularly if the

smaller magnitude storms were distributed properly throughout the growing season to provide the crop the necessary water requirements. The use of B-ZERO did result in reduced streamflows in some years, especially on the Black Vermillion, where higher runoff percentage naturally occur. The reductions are again the result of B-ZERO reducing the high magnitude storms. The soils at any location have only a certain capacity for surface storage and infiltration. When these are exceeded the remainder of the rainfall is essentially wasted in terms of crop utilization or benefit since it flows away through the drainage network. Any reduction of the storm size for a storm that exceeds the moisture retaining properties of the basin is reflected in reduced surface runoff. The reduction of runoff could have possible economic benefits in erosion control and flood damage suppression. The B-ZERO storms that are greatly enhanced are small enough that any additional rainfall from them could be fully utilized. It is the middle to high magnitude storm that is either enhanced or reduced that determines whether runoff is increased or decreased.

The increased runoff in the drier western watersheds may have a more important economic benefit. The additional runoff would add storage to ponds and reservoirs. In addition, a more reliable streamflow would benefit industries and municipalities that use the water.

The amount of evapotranspiration experienced and the reduction of the variability of this quantity is an important occurence. In all cases the average ET is increased for the test periods by weather modification. The reduction of the variability of ET is largely due to the decreased percentage of the total budget it represents in modified conditions. This means more water is available for either runoff or storage. If the additional moisture is stored within the soil profile it allows the crop

to pull from this reserve in no rainfall situations. This carryover soil moisture effect is illustrated in Fig. 12 for the Black Vermillion. In 1960 the modified ET remains above average while the normal ET dropped to more than three inches below the average. The 1960 ET level remained high since 1959 was a wet year that replenished soil moistures. Other illustrations are less pronounced than this event.

A change in ET may be associated with a change in crop yield. The average ET increases, as presented earlier, are larger in the western regions where the water supply is more limited. Of the extra rainfall received on the Black Vermillion 60% of it was utilized as ET. The South Fork used 69% of the B-ZERO precipitation gain as ET and the Beaver Creek utilized 71% of extra precipitation as gain. Preliminary results from a different discipline on crop yields (1) support this trend. In the northwestern district of Kansas the average effect of B-ZERO on wheat yields was an annual increase of 2.18 hectoliters per hectare (2.50 bushels per acre), while the Black Vermillion in the northeast district had only a predicted yield increase of 0.02 hectoliters per hectare (0.03 bushels per acre).

Groundwater recharge under natural conditions for northwest Kansas is near zero. Only in 1951, with heavy rainfalls for two months, did recharge occur in the South Fork Solomon. The enhanced rainfalls always increased the recharge, both in absolute quantity and in frequency of occurrence. Increased recharge due to weather modification would have a very limited effect on extending diminishing groundwater supplies because of the small increases involved.

The effects of the winter uniform percentage increase, B-TEN, are difficult to evaluate in terms of benefits gained for the expenditure

required. B-TEN resulted in only small increases above the B-ZERO amounts. The Black Vermillion received an extra 1.42 cm (0.56 in) per year from B-TEN above B-ZERO. Of that amount, 0.86 cm (0.34 in.) per year were added to runoff. The remaining 0.56 cm (0.22 in.) per year resulted in additional ET. The drier basins in the west, where winter precipitation enhancement is less than the Black Vermillion, received 0.74 and 0.56 cm (0.29 and 0.22 in.) per year increases by modification for the South Fork and the Beaver Creek, respectively. This extra amount was split almost in half in allocation to runoff and to ET. The smaller increases afforded by B-TEN seem insignificant and hardly justifiable to extend weather modification the additional five months.

In summary, these conclusions of this report are enumerated as follows:

1) The precipitation enhancement program, Model B, provides a realistic approach to modeling weather modification activities by allowing variable percentage increases based on the number and magnitude of precipitation events. This results in more uniform absolute increases in precipitation for wet and dry years and for wet and dry regions.

2) The precipitation enhancement program, Model B, effected streamflows in a varying manner. The streamflows were increased or decreased as a function of the number and magnitude of events falling into the different levels of precipitation enhancement.

3) Both enhancement schemes resulted in an average ET increase and a decrease in the variability of ET. Carryover effects of increased soil moisture possibly accounts for the reduced variability.

4) Both enhancement schemes increased the recharge for the two western watersheds. The increases are not large enough to be of significance in augmenting groundwater supplies.

5) There is a relatively insignificant difference between the precipitation enhancement programs B-ZERO and B-TEN. The additional five months of winter operation does not produce significant additional rainfall, runoff, ET, carryover effects or recharge.

APPENDIX I - REFERENCES

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APPENDIX II - SELECTED WATERSHED PRINTOUT

KANSAS WATERSHED MODEL PROGRAM

ILLEGIBLE DOCUMENT

THE FOLLOWING DOCUMENT(S) IS OF POOR LEGIBILITY IN THE ORIGINAL

THIS IS THE BEST COPY AVAILABLE

```
0001              DIMENSION IBUF(11000)
0002              DIMENSION  FLOW(368),SIMQ(368),AET(368),PET(368)
0003              DIMENSION TEMP(368),OWP(368),DAY(368),CCW(12),CCSG(12),CCC(12)
0004              DIMENSION SUSU(10),PX(9,24),CCSB(12),CCP(12),CCA(12),CCF(12)      00100
0005              DIMENSION PSUNS(12),RHD(12),RA(12),WIND(12)
0006              COMMON TOTALM(13,27),MONH(15),CKN(20),MMTH(12,6),CK(20),UZS(20),
                 1       PLTP(4,31),P24(20),CSE(24),SERR(24),SERA(24),S(24),
                 2       CAS(24),SQER(24),AVAR(24),AVER(24),P1(24),P2(24),
                 3       DEPTH(20),RRR(9),SRX(9),ICHAR(121),LZST(10),IFL(10)
0007              INTEGER ACT,LY
0008              REAL IFW,IIA,LZSA,LZST,LZSU,LZZTN,IA,IB1,IM1,LZSTN                00600
0009              REAL LZSAN, LZSO, LZMX, LZMN, IKR, IFL, LZSTZ                    00601
0010              REAL ETP,ETA,T,ABST                                               00602
0011              REAL TAU,R,ES,ESA,CENT,ETPH,CCREL,TMAX,TMIN,ETPS
0012              REAL LETA,KSU,KCW,KCSG,KCC,KCP,KCA,KCSB,KS
0013              REAL KWW,KWSG,KWC,KWSB,KWP,KWA
0014              DATA CCW/0.30,0.40,0.60,0.85,1.10,1.06,0.0,0.0,0.0,0.0,0.45,0.40,0.30/
0015              DATA CCSG/0.0,0.0,0.0,0.0,0.0,0.0,0.25,0.85,1.10,0.75,0.30,0.0,0.0/
0016              DATA CCC/0.0,0.0,0.0,0.0,0.0,0.15,0.45,1.0,1.0,0.85,0.60,0.0,0.0/
0017              DATA CCSB/0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.35,0.95,0.75,0.0,0.0,0.0,0.0/
0018              DATA CCP/0.0,0.0,0.0,0.50,0.65,0.90,0.85,0.85,0.90,0.55,0.0,0.0/
0019              DATA CCA/0.0,0.0,0.0,0.55,0.70,0.90,1.0,1.0,0.85,0.60,0.0,0.0/
0020              DATA CCF/0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0/
0021              NAMELIST/DATA/SB1,SM1,IB1,IM1,UZSN,UBP,UMP,UZMX,UZMN,LZMX,LZMN,
                 *ETBOM,CX,YSTRT,IKR,PCL,RGWB,RGWM,GWSN,BK,AGW,PDY,TLL,LZSAN,LZSTN,
                 *AREA,UZSO,LZSO,GWSO,YREND,GWRF,PORF,IIA,GWMN,PTPOND,ETR,FM,POWER,
                 *PWRE,QUANTY,B,C,PONDDP,PONDAR,ZZT,MODEL,WPCNT
0022              CALL PLOTS (IBUF,11000)
0023              CALL ORIGIN (2.5,1.5,11.0)
0024              READ(5,1010)(MONH(K),K=1,13)                                      00700
0025           1010 FORMAT(13A6)                                                    00800
0026              READ(5,1015)((MMTH(J,K),K=1,6),J=1,12)                            00900
0027           1015 FORMAT(72A1)                                                    01000
0028              WRITE(6,1012)                                                     01100
0029           1012 FORMAT(2H1  )                                                   01200
              C THE CKN(J) ARRAY IS FOR THE 6-HOUR INCREMENTAL VALUES OF THE UNITGRAPH01300
0030              READ(5,1009) (CKN(J),J=1,20)                                      01400
0031              WRITE(6,919)
0032            919 FORMAT(15X,'THE 6-HOUR INCREMENTAL VALUES OF THE UNIT HYDROGRAPH')
0033              WRITE(6,1009)(CKN(J),J=1,20)                                      01500
0034           1009 FORMAT(10F8.4)                                                  01600
0035              READ(5,DATA)
0036              WRITE(6,DATA)
              C CALCULATION OF CONSTANTS AND SETTING INITIAL VALUES                 03300
0037              PACK=0.0
0038              NSTRT=YSTRT                                                       03500
0039              NEND=YREND                                                        03600
0040              LL=TLL+5                                                          03700
0041              TAREA=AREA
0042              AREA=AREA-PONDAR/640.                                             03800
0043              AREAX=AREA*26.9                                                   03900
0044              UUZS=0.0
0045              STORGE=1500.                                                      04100
0046              PONDVL=PONDDP*PONDAR                                              04200
0047              UDELT=UZMX-UZSN                                                   04300
0048              DELTL=LZMX-LZSAN                                                  04400
0049              PCU=1.0-PCL                                                       04500
0050              WFI=AREAX*(-ALOG(IKR))                                            05400
```

```
0051            PER=(1.0-ACH)                                                   05500
0052            LZZTN=LZSTN                                                     05600
0053            FCT=PER/(LZMX**POWER-LZZTN**POWER)                              05700
0054            UPR=PER-FCT*(LZMX**POWER)                                       05800
0055            DIF=(LZMX-LZZTN)/10.                                            05900
0056            FR=AREAX*AGW*(-ALOG(BK))                                        06000
0057            AF=1.0/(AREAX*AGW)                                              06100
0058            FCTR=0.97/(132.**PWRE)                                          06200
0059            FCTR2=(.03)/(10000.-132.)                                       06300
0060            DO 3 L=6,LL                                                     06400
0061          3 UZS(L)=UZSO                                                     06500
0062            DO 111 K=1,10
0063        111 LZST(K)=LZSO
0064            LZSA=LZSO
0065            GWS=GWSC                                                        06900
0066            DO 20 L=6,LL                                                    07000
0067            CK(L)=0.0
0068         20 DEPTH(L)=0.0                                                    07100
0069            DO 909 K=1,7                                                    07200
0070        909 SRP(K)=0.0                                                      07300
0071            DO 903 J=1,24                                                   07400
0072            CSE(J)=0.0                                                      07500
0073            CAS(J)=0.0                                                      07600
0074            SERR(J)=0.0                                                     07700
0075            SERA(J)=0.0                                                     07800
0076            S(J)=0.0                                                        07801
0077        903 SOER(J)=0.0                                                     07900
0078            DO 9191 JIG=1,8
0079       9191 SUSU(JIG)=0.0                                                   08100
0080            BAL=0.0                                                         08200
0081            AIA=0.0                                                         08300
0082            SFW=0.0                                                         08400
0083            SSETOF=0.0                                                      08500
0084            NV=0                                                            08600
0085            CUZS=0.0
0086            CLZS=0.0
0087            TIME=0.0
0088            R=0.23
0089            READ(5,50) (PSUNS(I),RHD(I),RA(I),WIND(I),I=1,12)
0090         50 FORMAT(2X,F2.2,F2.0,F4.2,F3.1)
              C BEGIN YEARLY LOOP                                               08700
0091            DO 999 NNN=NSTRT,NEND                                           08800
0092            ACT=1
0093            DO 901 KK=1,13                                                  08900
0094            DO 901 K=1,27
0095        901 TOTALM(KK,K)=0.0                                                09100
0096            AAIA=0.0                                                        09200
0097            EPY=0.0                                                         09300
0098            YSOTO=0.0                                                       09500
0099            YSOACO=0.0                                                      09600
0100            YSOSYO=0.0                                                      09700
0101            READ(1,4444) (TOTALM(LK,8),LK=1,12)
0102            WRITE(6,4443)
0103       4443 FORMAT('0',1X,'AVERAGE MONTHLY BASE FLOW')
0104            WRITE(6,4444) (TOTALM(LK,8),LK=1,12)                            09900
0105       4444 FORMAT(12F6.1)                                                  10000
              C CK(J)=THIESSEN COEFICIENTS                                      10100
0106            READ(1,220) (CK(J),J=8,14),LY
```

```
0107          220 FORMAT(7F10.4,8X,I2)
0108              CK(8)=0.2302
0109              CK(11)=0.0
0110              CK(12)=0.3691
                C PERCENTAGE OF THE WATERSHED COVERED BY WHEAT SORGHUM CORN SOYBEAN
                C PASTURES ALFALFA CROPS.
0111              CKW=0.0882
0112              CKSG=0.2346
0113              CKC=0.0449
0114              CKSB=0.0281
0115              CKP=0.5571
0116              CKA=0.0471
0117              WRITE(6,505) LY
0118          505 FORMAT('0',5X,'LEAP YEAR INDICATOR=',I2,5X,'YES=1 & NO=0')
0119              READ(1,123) ITHAW,IFREZ,IYEAR
0120              WRITE(6,122)
0121          122 FORMAT('0',2X,'ITHAW',3X,'IFREEZ',59X,'YEAR')
0122              WRITE(6,123) ITHAW,IFREZ,IYEAR
0123          123 FORMAT(2I8,60X,I4)
0124              K9=24                                                    10800
0125              NTD1=1                                                   10900
                C BEGIN MONTHLY LOOP                                     11600
0126              DO 888 NN=1,12                                           11700
0127              IDY=31                                                   11800
0128              IF(NN.EQ.4.OR.NN.EQ.6.OR.NN.EQ.9.OR.NN.EQ.11)IDY=30      11900
0129              IF(NN.EQ.2) IDY=28+LY                                    12000
                C CROP COEFFICIENTS FOR WHEAT
0130              KCW=CCW(NN)
                C CROP COEFFICIENTS FOR SORHGHUM
0131              KCSG=CCSG(NN)
                C CROP COEFFICIENTS FOR CORN
0132              KCC=CCC(NN)
                C CROP COEFFICIENTS FOR SOYBEANS
0133              KCSB=CCSB(NN)
                C CROP COEFFICIENTS FOR PASTURES
0134              KCP=CCP(NN)
                C CROP COEFFICIENTS FOR ALFALFA
0135              KCA=CCA(NN)
0136              TOTALM(NN,8)=TOTALM(NN,8)                                12100
0137              NTD2=NTD1+IDY-1                                          12200
0138              XIDY=IDY
0139              XIDY=1.0/XIDY                                            12400
0140              SDTD=0.0                                                 12500
0141              SDACO=0.0                                                12600
0142              SDSYO=0.0                                                12700
0143              NCZ=0.0                                                  12800
                C BEGIN DAILY LOOP                                       12900
0144              DO 777 N=NTD1,NTD2
0145              READ(1,221)(P24(J),J=1,LL)                               13100
0146          221 FORMAT(2X,F7.0,3X,F7.1,3X,F2.0,2X,F4.0,1X,F4.0,9(1X,F4.2))  13200
0147              DO 1111 J=6,LL                                           13300
0148              IF(P24(J).GT.PDY) GO TO 1112
0149         1111 CONTINUE
0150              GO TO 4269                                               13500
0151         1112 READ(1,607) PDATE,(P1(J),J=1,24)                         13600
0152          607 FORMAT(1X,F7.0,24F3.2)
0153              TIME=-1
0154         4269 NCZ=NCZ+1
```

```
0155              TIME=TIME+1
0156              NV=NV+1
0157              DO 622 K=1,6                                                    14200
0158              RRR(K)=RRR(K+1)                                                 14300
0159            622 SRX(K)=0.0                                                    14400
0160            613 TPERC=0.0                                                     14500
0161              AUZS=0.0                                                        14700
0162              TPA=0.0                                                         14800
                C CALULATION OF POTENTIAL ET USING PENMAN COMBINATION EQUATION
0163              T=(P24(4)+P24(5))/2
0164              TMEL=T
0165              IF(T.LT.0.0) T=0.0
0166              CENT=100*((T-32)/180)
0167              ABST=CENT+273.16
0168              ES=33.9*((0.00738*CENT+0.8072)**8-0.000019*ABS(1.8*CENT+48)
                 1  +0.00136)
0169              ESA=ES*RHD(NN)/100
0170              RN=(1-R)*RA(NN)*(0.22+0.54*PSUNS(NN))-2.010E-09*ABST**4*(0.98-0.68
                 1 -0.036*SQRT(ESA))*(0.1+0.9*PSUNS(NN))
0171              WVD=(WIND(NN)*24)*(ALOG10(6.6)/ALOG10(30.))
0172              EA=0.26*(0.75+0.01*WVD)*(ES-ESA)
0173              DELTA=0.039*T**0.673
0174              GUM=1-DELTA
0175              EE=(DELTA*RN)+(GUM*EA)
                C     EE IN MM,  RA IN MM,  ABST IN DEG. K,  ES & ESA IN MB,
                C        WVD IN MILES,  (LANGLEYS OR CAL/CM2)*0.0171=MM
0176              IF(EE.LT.0.0) EE=0.0
0177              ETP=EE/25.39998
0178              ETPH=ETP/24
0179              ETPS=ETP*(PONDAR/(640*AREA))
0180              DO 623 L=6,LL                                                   15500
0181              M=L-5
0182              RX(M,12)=0.0                                                    15700
0183              CALL WTSMOD(P24(L),NN,MODEL,WPCNT)
0184              IF(P24(L).GT.PDY) GO TO 615                                     15800
0185              TPA=TPA+P24(L)*CK(L)                                            15900
0186              RAN=P24(L)                                                      16000
0187              IF(P24(L).LE.0.0) GO TO 22                                      16100
0188              IA=IB1-IM1*UZS(L)                                               16200
0189              IF(UZS(L).LT.UUZS) IA=B-C*UZS(L)                                16300
0190              IF(IA.LT.IIA) IA=IIA                                            16400
0191              DIFF=IA-DEPTH(L)                                                16500
0192              IF(DEPTH(L).GE.IA) DIFF=0.0                                     16600
0193              IF(DIFF.GE.P24(L)) GO TO 23                                     16700
0194              DEPTH(L)=DEPTH(L)+DIFF                                          16800
0195              P24(L)=P24(L)-DIFF                                              16900
0196              GO TO 22                                                        17000
0197            23 DEPTH(L)=DEPTH(L)+P24(L)                                       17100
0198              P24(L)=0.0                                                      17200
0199            22 DEPTH(L)=DEPTH(L)-ETP                                          17300
0200              IF(DEPTH(L).LE.0.0) DEPTH(L)=0.0                                17400
0201            71 IF(P24(L).LE.FM) GO TO 726                                     17500
0202              SNN=SB1-SM1*UZS(L)                                              17600
0203              IF(SNN.LT.0.0) SNN=0.0                                          17700
0204              RX(M,12)=(P24(L)*P24(L))/(P24(L)+SNN)                           17800
0205              IF((P24(L)-RX(M,12)).LT.FM) RX(M,12)=P24(L)-FM                  17900
0206              SRX(2)=SRX(2)+RX(M,12)*CK(L)                                    18000
0207            726 PERC=0.0                                                      18100
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0208              AAIA=AAIA+(RAN-P24(L))*CK(L)                                  18200
0209              EXCESS=UZS(L)-UZSN                                            18300
0210              DO 873 K=1,10                                                 18400
0211              IF(EXCESS-PERC)876,876,873                                    18500
0212            873 PERC=PERC+UBP*((EXCESS-PERC)/(UZMX-UZSN))**UMP/10.          18600
0213            876 UZS(L)=UZS(L)+P24(L)-RX(M,12)-PERC                          18700
0214              TPERC=TPERC+PERC*CK(L)                                        18800
0215              GO TO 729                                                     18900
0216            615 K99=0                                                       19000
0217              IF(M.LE.7) K99=0
0218              DO 728 J=1,24                                                 19200
0219              K9=J+K99                                                      19300
0220              PI2=PI(K9)*P24(L)                                             19400
0221              TPA=TPA+PI2*CK(L)                                             19500
0222              RAN=PI2                                                       19600
0223              IF(PI2.LE.0.0) GO TO 5                                        19700
0224              IA=IB1-IM1*UZS(L)                                             19800
0225              IF(UZS(L).LT.UUZS)IA=B-C*UZS(L)                               19900
0226              IF(IA.LT.IIA)IA=IIA                                           20000
0227              DIFF=IA-DEPTH(L)                                              20100
0228              IF(DEPTH(L).GE.IA) DIFF=0.0                                   20200
0229              IF(DIFF.GT.PI2) GO TO 6                                       20300
0230              DEPTH(L)=DEPTH(L)+DIFF                                        20400
0231              PI2=PI2-DIFF                                                  20500
0232              GO TO 5                                                       20600
0233            6 DEPTH(L)=DEPTH(L)+PI2                                         20700
0234              PI2=0.0                                                       20800
0235            5 DEPTH(L)=DEPTH(L)-ETPH
0236              IF(DEPTH(L).LE.0.0) DEPTH(L)=0.0                              21000
0237              RX(M,J)=0.0                                                   21100
0238              IF(PI2.LE.FM) GO TO 17                                        21200
0239              SNN=SB1-SM1*UZS(L)                                            21300
0240              IF(SNN.LT.0.0) SNN=0.0                                        21400
0241              RX(M,J)=(PI2*PI2)/(PI2+SNN)                                   21500
0242              IF((PI2-RX(M,J)).LT.FM) RX(M,J)=PI2-FM                        21600
0243              IF(RX(M,J).LE.0.0) RX(M,J)=0.0                                21700
0244              I=(J+5)/6                                                     21800
0245              SRX(I)=SRX(I)+RX(M,J)*CK(L)                                   21900
0246            17 PERC=0.0                                                     22000
0247              AAIA=AAIA+(RAN-PI2)*CK(L)                                     22100
0248              EXCESS=UZS(L)-UZSN                                            22200
0249              IF(EXCESS.GT.0.001)PERC=UBP*(EXCESS/UDELT)**UMP/24.           22300
0250              UZS(L)=UZS(L)+PI2-RX(M,J)-PERC                                22400
0251              IF(UZS(L)-UZMX) 30,30,40                                      22500
0252            40 RX(M,J)=RX(M,J)+UZS(L)-UZMX                                  22600
0253              I=(J+5)/6
0254              SRX(I)=SRX(I)+(UZS(L)-UZMX)*CK(L)                             22700
0255              UZS(L)=UZMX                                                   22800
0256            30 TPERC=TPERC+PERC*CK(L)                                       22900
0257           728 CONTINUE                                                     23000
0258           729 UZS(L)=UZS(L)-CUZS
0259              IF(UZS(L).LT.0.0) UZS(L)=0.0
0260              AUZS=AUZS+UZS(L)*CK(L)                                        23500
0261           623 CONTINUE                                                     23600
0262              IF(AUZS.LE.UZMN) AUZS=0.0
0263              A7=SRX(1)+SRX(2)+SRX(3)+SRX(4)                                23700
                C ROUTING                                                       23800
0264              IF(A7)83,83,84                                                23900
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0265            84 DO 85 K=1,4                                                  24000
0266               IF(SPX(K)) 85,85,87                                          24100
0267            87 DO 89 L= 1,20                                                24200
0268               J=(K+L+2)/4                                                  24300
0269            89 RRR(J)=RRR(J)+SPX(K)*CKN(L)                                  24400
0270            85 CONTINUE                                                     24500
              C DETERMINATION OF ET POTENTIAL REALIZED
0271            83 IF(N.GT.ITHAW.AND.N.LT.(ITHAW+25)) GO TO 207                 24700
0272               IF(N.GE.(ITHAW+25).AND.N.LT.IFREZ) FRAC=1.0                  24800
0273               IF(N.LE.ITHAW.OR.N.GE.IFREZ) FRAC=0.0                        24900
0274               GO TO 206                                                    25000
0275           207 X=N-ITHAW                                                    25100
0276               FRAC= X/25.0                                                 25200
0277           206 CONTINUE                                                     25300
              C INTERFLOW CALCULATIONS
0278               LZSTZ=LZZTN
0279               IFW=0.0
0280               PRT1=0.0
0281               DO 100 K=1,10
0282               IFL(K)=0.0
0283               LZSTZ=LZSTZ+DIF
0284               PRT2=UPR+FCT*(LZSTZ**POWER)
0285               PRT=PRT2-PRT1
0286               EXCESS=LZST(K)-LZZTN
0287               EXCESS=LZST(K)-LZSTZ+DIF
0288               IF(EXCESS.GT.0.0.AND.LZST(K).GT.LZSTZ-DIF) IFL(K)=EXCESS*WFI
0289               IFW=IFW+IFL(K)*PRT
0290               IFL(K)=IFL(K)/AREAX
0291               LZST(K)=LZST(K)+TPERC-IFL(K)-CLZS
0292               IF(LZST(K).LT.0.0) LZST(K)=0.0
0293               ALZST=LZST(K)
0294           100 PRT1=PRT2
0295               IF(ALZST.LE.LZMN) ALZST=0.0
              C RECHARGE CALCULATIONS(NEXT 3 CARDS)                             28200
0296               RECGW=0.0                                                    28300
0297               EXCESS=LZSA-LZSAN                                            28400
0298               IF(EXCESS.LE.0.0) EXCESS=0.0
0299               IF(EXCESS.GT.0.0) RECGW=RGWB*(EXCESS/DELTL)**RGWM            28500
0300               LZSA=LZSA+TPERC-RECGW-CLZS
0301               IF(LZSA.LT.0.0) LZSA=0.0
0302               ALZSA=LZSA
0303               IF(ALZSA.LE.LZMN) ALZSA=0.0
0304               AVBSM=AUZS+ALZST+ALZSA
0305               FCSM=UZMX+LZMX+LZMX
0306               PSM=AVBSM/FCSM
0307               PSM=PSM*100.0
              C COEFFICIENT RELATED TO AVAILABLE SOIL MOISTURE
0308               KS=(ALOG(PSM+1.0))/ALOG(101.)
0309               IF(KS.GT.1.0) KS=1.0
0310               IF(KS.LT.0.0) KS=0.0
              C COEFFICIENT WHEN SOIL SURFACE IS WETTED BY RAINFALL
0311               KWW=(1-(KCW*KS))*(2.72**(-(0.3*TIME)))
0312               KWSG=(1-(KCSG*KS))*(2.72**(-(0.3*TIME)))
0313               KWC=(1-(KCC*KS))*(2.72**(-(0.3*TIME)))
0314               KWSB=(1-(KCSB*KS))*(2.72**(-(0.3*TIME)))
0315               KWP=(1-(KCP*KS))*(2.72**(-(0.3*TIME)))
0316               KWA=(1-(KCA*KS))*(2.72**(-(0.3*TIME)))
              C TO FIND RATIO OF ACTUAL TO POTENTIAL ET
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0317              RTW=((KCW*KS)+KWW)
0318              RTSG=((KCSG*KS)+KWSG)
0319              RTC=((KCC*KS)+KWC)
0320              RTSB=((KCSB*KS)+KWSB)
0321              RTP=((KCP*KS)+KWP)
0322              RTA=((KCA*KS)+KWA)
                C DETERMINATION OF ACTUAL EVAPOTRANSPIRATION
0323              ETAW=RTW*ETP
0324              ETASG=RTSG*ETP
0325              ETAC=RTC*ETP
0326              ETASB=RTSB*ETP
0327              ETAP=RTP*ETP
0328              ETAA=RTA*ETP
                C DETERMINATION OF ACTUAL EVAPOTRANSPIRATION FOR WHOLE OF WATERSHED
0329              ETA=(ETAW*CKW+ETASG*CKSG+ETAC*CKC+ETASB*CKSB+ETAP*CKP+ETAA*CKA)*
                  10.846*AREA/TAREA
0330              UETA=PCU*ETA
0331              LETA=PCL*ETA*FRAC
0332              CUZS=UETA
0333              CLZS=LETA
0334              TETA=ETPS+UETA+LETA
                C POND ROUTINE
0335              RR=RRR(1)*AREAX                                          28600
0336              ETTT=(ETP*PONDAR)/12
0337              CFSIN=0.0                                                28700
0338              CFSOUT=0.0                                               28800
0339              CFSD=RR+IFW+TPA*PONDAR*26.9/640.0                        28900
0340              IF(CFSD.LE.0.0) GO TO 333                                29000
0341              CFSIN=CFSD*PTPOND                                        29100
0342              CFSOUT=CFSD-CFSIN                                        29200
0343              ACFT=CFSIN/0.5042                                        29300
0344              FREEVL=PONDVL-STORGE                                     29400
0345              IF(FREEVL.GT.ACFT) GO TO 222                             29500
0346              IF(FREEVL.LE.0.0) FREEVL=0.0                             29600
0347              STORGE=STORGE+FREEVL                                     29700
0348              CFSIN=ACFT-FREEVL                                        29800
0349              GO TO 333                                                29900
0350            222 STORGE=STORGE+CFSIN                                    30000
0351              CFSIN=0.0                                                30100
0352            333 STORGE=STORGE-ETTT                                     30200
0353              IF(STORGE.LT.0.0) STORGE=0.0                             30300
0354              OUTFLO=0.5042*CFSIN+CFSOUT                               30400
0355              EPY=EPY+(CFSD-OUTFLO)/AREAX                              30500
0356              IF(OUTFLO) 79,79,81                                      30600
0357             79 RR=0.0                                                 30700
0358              IFW=0.0                                                  30800
0359              GO TO 82                                                 30900
0360             81 IFW=IFW*(OUTFLO/CFSD)                                  31000
0361              RR=RR*(OUTFLO/CFSD)                                      31100
                C STREAMFLOW-GROUNDWATER INTERACTION                       31200
                C THE STATEMENTS THROUGH 784 REPRESENT A LINEAR APPROXIMATION OF   31300
                C THE STAGE DISCHARGE RELATIONSHIP. THEY MUST BE CHANGED FOR EACH NEW   31400
                C BASIN TO WHICH THE MODEL IS APPLIED.                     31500
0362             82 Q=RR+IFW                                               31600
0363              STG=0.0                                                  31700
0364              IF(Q.LT.3400) STG=0.251*Q**0.539
0365              IF(Q.GE.3400) STG=3.72*Q**0.207
0366            784 EXCESS=GWS-GWSN                                        32100
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0367              IF(EXCESS.LT.0.0) EXCESS=0.0                                  32200
0368              GIGI=STG-PORF*EXCESS-1.500                                    32300
0369              IF(GIGI.LT.0.0) GO TO 785                                     32400
0370              GWREC=GWRF*STG*GIGI                                           32500
0371              BF=EXCESS*FB
0372              IF(EXCESS.LE.0.5) BF=10.0
0373              GO TO 786                                                     32700
0374            785 BF=EXCESS*FB                                                32800
0375              GWREC=0.0                                                     32900
0376            786 BFIN=BF*AF                                                  33000
0377              GWFIN=GWREC*AF                                                33100
                C BUDGET EQUATIONS                                            33200
0378              IF(PP.LT.GWREC) GO TO 751                                     33300
0379              RR=RR-GWREC                                                   33400
0380              ROBF=RR+IFW+BF                                                33500
0381              GO TO 753                                                     33600
0382            751 IF(RR+IFW.LT.GWREC) GO TO 752                               33700
0383              IFW=RR+IFW-GWREC                                              33800
0384              RR=0.0                                                        33900
0385              ROBF=IFW+BF                                                   34000
0386              GO TO 753                                                     34100
0387            752 GWFIN=(RR+IFW)*AF                                           34200
0388              RR=0.0                                                        34300
0389              IFW=0.0                                                       34400
0390              ROBF=0.0                                                      34500
0391            753 CONTINUE                                                    34600
0392              IF(ROBF.LE.0.0) GO TO 41                                      34900
0393              ROBF1=ROBF                                                    35100
0394              IF(ROBF) 29,29,31                                             36900
0395             29 BF=0.0                                                      37000
0396              RR=0.0                                                        37100
0397              IFW=0.0                                                       37200
0398              GO TO 41                                                      37300
0399             31 RR=RR*(ROBF/ROBF1)                                          37400
0400              IFW=IFW*(ROBF/ROBF1)                                          37500
0401              BF=BF*(ROBF/ROBF1)                                            37600
0402             41 CONTINUE                                                    37700
0403              GWS=GWS+RECGW+GWRIN-BFIN                                      37900
0404              PLTR(1,NCZ)=BF                                                38100
0405              PLTR(2,NCZ)=IFW+BF                                            38200
0406              IF(PLTR(2,NCZ).GT.ROBF) PLTR(2,NCZ)=ROBF                      38300
0407              PLTR(3,NCZ)=P24(2)                                            38400
0408              PLTR(4,NCZ)=ROBF                                              38500
0409              DWP(ACT)=TPA
0410              IF(P24(2).LT.1.0) FLOW(ACT)=1.0
0411              IF(P24(2).GE.1.0) FLOW(ACT)=P24(2)
0412              IF(ROBF.LT.1.0) SIMQ(ACT)=1.0
0413              IF(ROBF.GE.1.0) SIMQ(ACT)=ROBF
0414              PET(ACT)=ETP
0415              AET(ACT)=ETA
0416              TEMP(ACT)=T
0417              DAY(ACT)=ACT
                C MONTHLY TOTALS                                              38600
0418              TOTALM(NN,1)=TOTALM(NN,1)+TPA
0419              TOTALM(NN,2)=TOTALM(NN,2)+ROBF                                38800
0420              TOTALM(NN,3)=TOTALM(NN,3)+P24(2)                              38900
0421              TOTALM(NN,4)=TOTALM(NN,4)+RR                                  39000
0422              TOTALM(NN,5)=TOTALM(NN,5)+P24(2)                              39100
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0423              TOTALM(NN,6)=TOTALM(NN,6)+IFW                                    39200
0424              TOTALM(NN,7)=TOTALM(NN,7)+BF                                     39300
0425              TOTALM(NN,9)=TOTALM(NN,9)+ETP
0426              TOTALM(NN,10)=TOTALM(NN,10)+UETA
0427              TOTALM(NN,11)=TOTALM(NN,11)+LETA
0428              TOTALM(NN,12)=TOTALM(NN,12)+TETA
0429              TOTALM(NN,13)=TOTALM(NN,13)+TPERC
0430              TOTALM(NN,14)=TOTALM(NN,14)+AUZS*XIDY
0431              TOTALM(NN,15)=TOTALM(NN,15)+LZSA*XIDY
0432              TOTALM(NN,16)=TOTALM(NN,16)+LZST(10)*XIDY
0433              TOTALM(NN,17)=TOTALM(NN,17)+GWS*XIDY
0434              TOTALM(NN,18)=TOTALM(NN,18)+T*XIDY
                C CORRELATION COEFFICIENT CALCULATIONS                             43800
0435              ACM=TOTALM(NN,3)*XIDY
0436              SYM=TOTALM(NN,2)*XIDY
0437              DAC=PLTR(3,NCZ)-ACM
0438              DSY=PLTR(4,NCZ)-SYM
0439              SDTD=SDTD+DAC*DSY                                                44400
0440              SDACQ=SDACQ+DAC*DAC                                              44500
0441              SDSYQ=SDSYQ+DSY*DSY                                              44600
0442              IF(SDACQ.LE.0.0.OR.SDSYQ.LE.0.0) GO TO 112
0443              CCOREL=SDTD/SQRT(SDACQ*SDSYQ)
0444              GO TO 113
0445            112 IF(SDTD.EQ.0.0) GO TO 1121
0446              CCOREL=0.0
0447              GO TO 113
0448           1121 CCOREL=1.0
0449            113 CCOREL=CCOREL**2
0450              TOTALM(NN,19)=TOTALM(NN,19)+CCOREL*XIDY
                C FLOW DURATION CALCULATIONS                                       40300
0451              IF(NV-183) 777,777,108                                           40400
0452            108 ERR=ROBF-P24(2)                                                40500
0453              IF(P24(2).LT.1.0) IND=1.0                                        40600
0454              IF(P24(2).GE.1.0) IND=4.0*ALOG10(P24(2))+2.0                     40700
0455              CAS(IND)=CAS(IND)+1.0                                            40800
0456              IF(ROBF.LT.1.0) IDN=1.0                                          40900
0457              IF(ROBF.GE.1.0)IDN=4.0*ALOG10(ROBF)+2.0                          41000
0458              CSE(IDN)=CSE(IDN)+1.0                                            41100
0459              SERR(IND)=SERR(IND)+EPR                                          41200
0460              SERA(IND)=SERA(IND)+ABS(ERR)                                     41300
0461              SQER(IND)=SQER(IND)+ERR*EPR                                      41400
0462              AVER(IND)=SERR(IND)/CAS(IND)                                     41500
0463              AVAR(IND)=SERA(IND)/CAS(IND)                                     41600
0464              S(IND)=0.0                                                       41700
0465              IF(CAS(IND).GT.1.0) S(IND)=SQRT((SQER(IND)-SERR(IND)**2/CAS(IND))/41800
                 1(CAS(IND)-1.0))                                                41900
0466            777 ACT=ACT+1
0467              TOTALM(NN,5)=TOTALM(NN,5)-TOTALM(NN,8)
                C YEARLY TOTALS                                                    42600
0468              DY=IDY
0469              YL=LY+365                                                        42800
0470              DO 806 K=1,8                                                     42900
0471            806 TOTALM(13,K)=TOTALM(13,K)+TOTALM(NN,K)                         43000
0472              DO 104 K=9,13
0473            104 TOTALM(13,K)=TOTALM(13,K)+TOTALM(NN,K)
0474              DO 105 K=14,18
0475            105 TOTALM(13,K)=TOTALM(13,K)+TOTALM(NN,K)*DY/YL
0476              TOTALM(13,19)=TOTALM(13,19)+TOTALM(NN,19)*DY/YL
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0477          888 NTD1=NTD2+1
             C YEARLY OUTPUT
0478              CALL PLOTT(DAY,FLOW,SIMQ,DWP,ACT,IYEAR,PET,AET,TEMP)
0479            1 WRITE(6,1013) NNN                                          45600
0480           1013 FORMAT('1',34X,51HSUMMARY TABLE -- BLACK VERMILLION RIVER BASIN --45700
                1 19,12,/36X,50H----------)45800
0481              WRITE(6,1002)
0482           1002 FORMAT(//13X,'JAN.     FEB.     MAR.     APR.     MAY.     JUN.
                1  JUL.     AUG.     SEP.     OCT.     NOV.     DEC.    TOTAL')
0483              WRITE(6,1003) ((TOTALM(J,K),J=1,13),K=1,19)
0484           1003 FORMAT(9H  PRECIP ,13F9.2//17H CALCULATED TOTAL/9H  RUNOFF ,13F9.046200
                1//15H OBSERVED TOTAL/9H  RUNOFF ,13F9.0//19H CALCULATED SURFACE/9H46300
                2  RUNOFF ,13F9.0//17H OBSERVED SURFACE/9H  RUNOFF ,13F9.0//18H CAL46400
                3CULATED INTER-/9H    FLOW  ,13F9.0//11H CALCULATED/9H BASEFLOW,13F946500
                4.0//9H OBSERVED/9H BASEFLOW,13F9.0///9H     ETP  ,13F9.3///9H    UE46600
                5TA ,13F9.3///9H     LETA ,13F9.3///9H     ETA  ,13F9.3//6H  PER-/9H
                6COLATION,13F9.3///9H     UZS  ,13F9.3///9H     LZSA ,13F9.3///9H
                7LZST ,13F9.3///9H     GWS  ,13F9.3///9H    TEMP. ,13F9.1//18H CORREL
                8ATION COEF-/9H FICIENTS,13F9.3)
0485              BALNCE=TOTALM(13,1)-TOTALM(13,2)/AREAX-TOTALM(13,12)
0486              V=BALNCE-AAIA-EPY
0487              WRITE(6,1006) BALNCE,AAIA,EPY,V
0488           1006 FORMAT(////18H  DELTA STORAGE  =,F10.3,8H  INCHES/18H  AAIA  =    47400
                1     ,F10.3/18H  POND STORAGE  = ,F10.3/28H----------
                2-----/18H  TOTAL CHANGE  = ,F10.3//)
0489              SEW=SEW+EPY                                                47800
0490              BAL=BAL + BALNCE                                           47900
0491              AIA=AIA+AAIA                                               48000
0492              LDY=365+LY
0493              SUSU(1)=SUSU(1)+TOTALM(13,2)                               48200
0494              SUSU(2)=SUSU(2)+TOTALM(13,3)                               48300
0495              SUSU(3)=SUSU(3)+TOTALM(13,4)+TOTALM(13,6)                  48400
0496              SUSU(4)=SUSU(4)+TOTALM(13,5)                               48500
0497              SUSU(5)=SUSU(5)+TOTALM(13,7)                               48600
0498              SUSU(6)=SUSU(6)+TOTALM(13,8)                               48700
0499              SUSU(7)=SUSU(7)+TOTALM(13,1)
0500              SUSU(8)=SUSU(8)+TOTALM(13,12)
0501              WRITE(6,15) SUSU(1),SUSU(2),SUSU(3),SUSU(4),SUSU(5),SUSU(6)  48800
0502            15 FORMAT(//4X,17HSUM CAL TOTAL =  ,F15.0/4X,17HSUM OBS TOTAL =  ,F1548900
                1.0/4X,17HSUM CAL SRINT =  ,F15.0/4X,14HSUM OBS SR =  ,F18.0/4X,14H49000
                2SUM CAL BF =  ,F18.0/4X,14HSUM OBS BF =  ,F18.0//)
0503            999 CONTINUE                                                 49200
0504              WRITE(6,1012)                                              49300
             C CALCULATIONS AND OUTPUT OF FLOW DURATION                      49400
0505              WRITE(6,1019)                                              49500
0506           1019 FORMAT(1H1///41X,35HDAILY FLOW DURATION AND ERROR TABLE //11X,93HF49600
                1LOW INTERVAL  ACT.CASES  PCT.    CALC.CASES   PCT.     AVE.ERROR  49700
                2 AV.ABS.ERROR   STD.ERROR  /)                               49800
0507              SSTER=0.0
0508              SSERA=0.0
0509              SSERF=0.0
0510              SCASE=0.0
0511              SCSC=0.0
0512              DO 911 J=1,24
0513              SCASE=SCASE+CAS(J)                                         50500
0514              SCSC=SCSC+CSE(J)                                           50600
0515              SSERR=SSERR+SERR(J)                                        50700
0516              SSERA=SSERA+SERA(J)                                        50800
```

```
0517          911 SSTER=SSTER+S(J)                                              50900
0518              SCLS=SCASE                                                    51000
0519              SCSE=SCSC                                                     51100
0520              DO 981 J=1,24                                                 51200
0521              IF(J.GT.2) GO TO 912                                          51300
0522              IF(J.EQ.1) FLOO=0.0                                           51400
0523              IF(J.EQ.2) FLOO=1.0                                           51500
0524              GO TO 913
0525          912 FJ=J                                                          51700
0526              POWR=FJ/4.0-0.5
0527              FLOO=10.0**POWR
0528          913 IF(SCASE.LE.0.0) GO TO 1447
0529              PSCLS=100.0*SCLS/SCASE
0530              GO TO 1448
0531         1447 PSCLS=0.0
0532         1448 CLS=CAS(J)
0533              SCLS=SCLS-CLS
0534              IF(SCSC.LE.0.0) GO TO 1449
0535              PSCSE=100.0*SCSE/SCSC
0536              GO TO 1450
0537         1449 PSCSE=0.0
0538         1450 SCL=CSE(J)
0539              SCSE=SCSE-SCL                                                 52500
0540              IF(CLS.EQ.0.0) GO TO 980
0541              SERACS=SERA(J)/CLS
0542              SERRCS=SERR(J)/CLS
0543              IF(CLS.EQ.1.0) WRITE(6,1018)FLOO,CLS,PSCLS,SCL,PSCSE,SERRCS   52900
0544              IF(CLS.GT.1.0) WRITE(6,1018)FLOO,CLS,PSCLS,SCL,PSCSE,SERRCS,SERACS
                 1,S(J)
0545         1018 FORMAT(12X,F10.1,1H-,F9.1,F11.3,F10.1,F11.3,F12.1,2F13.2)     53200
0546              GO TO 981                                                     53300
0547          980 WRITE(6,1018) FLOO,CLS,PSCLS,SCL,PSCSE
0548          981 CONTINUE
0549              WRITE(6,1020) SCASE,SCSC,SSERR,SSERA,SSTER
0550         1020 FORMAT(/23X,F9.1,11X,F10.1,11X,F12.1,F13.2,F13.2)
               C END OF CALCULATIONS                                            53800
0551              V=BAL-AIA-SEW
0552              WRITE(6,1006) BAL,AIA,SEW,V
0553              WRITE(6,1273) SUSU(7)
0554         1273 FORMAT(/22H TOTAL PRECIPITATION =,F10.3/)
0555              TRO=SUSU(1)/AREAX
0556              CKBAL=TRO+SUSU(8)+AIA+V
0557              WRITE(6,1274) TRO,SUSU(8),AIA,V,CKBAL
0558         1274 FORMAT(//16H TOTAL RUN OFF =,F10.3,8H  INCHES/16H TOTAL ETA     =,
                 1F10.3/16H TOTAL AAIA    =,F10.3/16H TOTAL CHANGE  =,F10.3/26H-----
                 2----------/16H CHECK BALANCE =,F10.3/)
0559              CALL PLOT (0.0,0.0,999)
0560              STOP
0561              END
```

```
0001              SUBROUTINE PLOTT(X,YH,YHC,YP,I,IYEAR,PET,AET,TEMP)
0002              DIMENSION X(368),YH(368),YP(368),PET(368),AET(368)
0003              DIMENSION TEMP(368),YHC(368)
0004              INTEGER FSTV,DLTV
0005              INTEGER  YEARS(14)
0006              DATA YEARS/'1954','1955','1956','1957','1958','1959','1960',
                 *  '1961','1962','1963','1964','1965','1966','1967'/
0007              I=I-1
0008              FSTV=I+1
0009              DLTV=I+2
0010              X(FSTV)=0.0
0011              X(DLTV)=30.5
0012              YH(FSTV)=1.0
0013              YH(DLTV)=1.0
0014              YHC(FSTV)=1.0
0015              YHC(DLTV)=1.0
0016              TEMP(FSTV)=0.0
0017              TEMP(DLTV)=25.0
0018              PET(FSTV)=0.0
0019              PET(DLTV)=0.125
0020              AET(FSTV)=0.0
0021              AET(DLTV)=0.125
0022              CALL PLOT (0.0,0.0,3)
0023              CALL SCALE (YP,3.0,I,1)
0024              CALL AXISC (0.0,0.0,YEARS(IYEAR-1953),-4,12.0,0.0,1.0,1.0)
0025              DO 450 L=1,4
0026            450 CALL DAXIS (0.0,L/YH(DLTV),12.0,0.0,12.0,1)
0027              CALL LGAXIS (0.0,0.0,'CALC.-* & OBS.-+ DISCHARGE (CFS)',32,8.0,
                 *  90.0,YH(FSTV),YH(DLTV))
0028              CALL AXIS (0.0,8.0,'THIESSEN WEIGHTED DAILY PRECIPITATION',37,
                 *12.0,0.0,X(FSTV),X(DLTV))
0029              CALL AXIS (12.0,8.0,'INCHES',6,3.0,-90.0,YP(FSTV),YP(DLTV))
0030              CALL LGLINE (X,YH,I,1,4,3,1)
0031              CALL LGLINE (X,YHC,I,1,4,11,1)
0032              DO 500 L=1,I
0033              XO=(X(L)/X(DLTV))-(1/(2*X(DLTV)))-(X(FSTV)/X(DLTV))
0034              YO=8.0-(YP(L)/YP(DLTV))
0035              H=YP(L)/YP(DLTV)
0036              W=1/X(DLTV)
0037            500 CALL BAR (XO,YO,0.0,H,W,0.0,1,0)
0038              IF(IYEAR.LT.1970) GO TO 650
0039              CALL ORIGIN (16.0,1.5,11.0)
0040              CALL PLOT (0.0,0.0,3)
0041              CALL AXISC (0.0,0.0,YEARS(IYEAR-1953),-4,12.0,0.0,1.0,1.0)
0042              CALL AXIS (0.0,0.0,'PET-+ & AET-* (INCHES)',22,8.0,90.0,0.0,0.125)
0043              IF(IYEAR.LT.1970) GO TO 510
0044              CALL AXIS (0.0,8.0,'AVERAGE DAILY TEMPERATURE',25,12.0,0.0,
                 *  X(FSTV),X(DLTV))
0045              CALL AXIS (12.0,8.0,'DEGREES FAHRENHEIT',18,4.0,-90.0,
                 *  TEMP(FSTV),TEMP(DLTV))
0046            510 CALL LINE (X,PET,I,1,4,3)
0047              CALL LINE (X,AET,I,1,4,11)
0048              DO 600 L=1,I
0049              XO=(X(L)/X(DLTV))-(1/(2*X(DLTV)))-(X(FSTV)/X(DLTV))
0050              YO=8.0-(TEMP(L)/TEMP(DLTV))
0051              H=TEMP(L)/TEMP(DLTV)
0052              W=1/X(DLTV)
0053            600 CALL BAR (XO,YO,0.0,H,W,0.0,1,0)
```

```
0054          650 CALL ORIGIN (16.0,1.5,11.0)
0055              CALL PLOT (0.0,0.0,3)
0056              RETURN
0057              END
```

```
FORTRAN IV G LEVEL  21                  WTRMOD              DATE = 76307        20/16/08              PAGE 0001

0001                SUBROUTINE WTRMOD(PRECIP,MONTH,MODEL,WPCNT)
0002                IF(MODEL.EQ.1) GO TO 30
0003                IF(MONTH.LT.3.OR.MONTH.GT.9) GO TO 10
0004                ADJ=1.75
0005                IF(PRECIP.GT.0.10) ADJ=1.30
0006                IF(PRECIP.GT.0.50) ADJ=1.10
0007                IF(PRECIP.GT.1.00) ADJ = 0.90
0008                GO TO 20
0009             10 ADJ = 1.0
0010                IF (MODEL.EQ.3) ADJ=WPCNT
0011             20 PRECIP=PRECIP*ADJ
0012             30 RETURN
0013                END
```

THE FOLLOWING PAGE WAS BOUND WITHOUT A PAGE NUMBER.

THIS IS AS RECEIVED FROM CUSTOMER.

RESULTS - UNMODIFIED MODEL

```
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 996.........31 MAR 77..RCL06484..ROGERS.........................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 996.........31 MAR 77..RCL06484..ROGERS.........................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 996.........31 MAR 77..RCL06484..ROGERS.........................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 996.........31 MAR 77..RCL06484..ROGERS.........................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 996.........31 MAR 77..RCL06484..ROGERS.........................START........

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COMPUTING MADE FUN
COMPUTER-GAME DAY
APRIL 2

THE GENERAL PUBLIC IS INVITED TO PLAY A VARIETY OF GAMES (STAR TREK, KINGDOM, ETC.) APRIL 2, 9:00 A.M. TO 3:00 P.M., IN FAIRCHILD 117 (MINI-LAB). THIS EVENT IS SPONSORED BY THE STUDENT CHAPTER OF ACM IN CONJUNCTION WITH THE COMPUTER SCIENCE DEPARTMENT AS A PART OF THE UNIVERSITY OPEN HOUSE.

THE 6-HOUR INCREMENTAL VALUES OF THE UNIT HYDROGRAPH

0.0100 0.0250 0.0650 0.0800 0.0850 0.0900 0.1000 0.0750 0.0650 0.0600
0.0550 0.0500 0.0450 0.0400 0.0350 0.0300 0.0250 0.0230 0.0210 0.0210

```
&DATA
SB1= 30.500000    ,SM1= 5.5999994    ,IB1= 0.37399995    ,IM1= 0.10399997    ,UZSN= 4.5000000    ,UBP= 9.0000000    ,UMP=
 2.0000000    ,UZ4X= 5.6999998    ,UZMN= 2.0000000    ,LZMX= 16.000000    ,LZMN= 7.7999992    ,ET80M= 0.22999996    ,CX=
0.89999998    ,YSTRT= 48.000000    ,IKR= 0.98999995    ,PCL= 0.34999996    ,RGWB= 6.0000000    ,RGWM= 2.0000000    ,GWSN=
 2.0000000    ,3K= 0.98999995    ,AGW= 0.79999995    ,PDY= 0.09999964E-01,TLL= 11.000000    ,LZSAN= 14.000000    ,LZSTN=
 14.000000    ,AREA= 1040.0000    ,UZSO= 3.0000000    ,LZSC= 9.3999996    ,GWSO= 2.0000000    ,YREND= 61.000000    ,GWRF=
 3.0000000    ,PDF= 0.89999964E-01,IIA= 0.20000000E-01,GWMN= 1.0000000    ,PTPOND= 0.0    ,ETR= 0.11000000E-01,FM=
0.39999999E-01,PDMF= 1.0000000    ,PWRE= 0.59999964E-01,QUANTY= 0.59999996    ,B= 1.2599993    ,C= 0.69999999    ,PONDDP=
0.0    ,PCNCAR= 0.0    ,ZZT= 1.0000000    ,MODEL= 1,WPCNT= 1.0999994    ,USOIL= 0.38999999    ,CSOIL=
0.17699999    ,PCTIRR= 0.79999995
&END
```

AVERAGE MONTHLY BASE FLOW

18.6 72.5 527.0 300.0 58.9 870.0 1240.0 402.0 12.0 4.7 120.0 310.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
123	285	48

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1948

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.04	0.53	1.54	0.34	3.54	4.91	1.69	3.76	0.76	0.58	1.04	0.46	19.20
CALCULATED TOTAL RUNOFF	0.	6.	219.	20.	2335.	6182.	1781.	6108.	1045.	731.	862.	401.	19692.
OBSERVED TOTAL RUNOFF	21.	423.	1409.	390.	2101.	13288.	2454.	3513.	40.	5.	131.	338.	24114.
CALCULATED SURFACE RUNOFF	0.	6.	189.	20.	2265.	5880.	1311.	5586.	327.	122.	425.	43.	16174.
OBSERVED SURFACE RUNOFF	2.	351.	882.	90.	2042.	12418.	1214.	3110.	28.	1.	11.	28.	20177.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	0.	0.	30.	0.	70.	302.	471.	523.	718.	610.	437.	358.	3519.
OBSERVED BASEFLOW	19.	73.	527.	300.	59.	870.	1240.	403.	12.	5.	120.	310.	3937.
ETP	0.887	0.845	1.444	4.549	5.315	6.210	6.537	5.709	5.012	3.045	1.100	0.708	41.361
UETA	0.168	0.119	0.344	1.209	1.706	2.579	2.126	2.203	1.226	0.695	0.233	0.105	12.711
LETA	0.0	0.0	0.0	0.0	0.500	1.389	1.146	0.897	0.035	0.0	0.0	0.0	3.967
ETA	0.179	0.273	0.646	1.209	2.206	3.968	3.272	3.100	1.261	0.695	0.431	0.217	17.456
PER-COLATION	0.0	0.0	0.001	0.0	0.477	1.104	0.051	0.699	0.035	0.0	0.0	0.0	2.367
UZS	2.880	2.939	3.569	3.605	3.295	3.980	3.769	4.079	3.506	2.882	2.949	3.595	3.422
LZSA	9.400	9.400	9.400	9.401	9.277	9.099	8.483	7.901	7.800	7.800	7.800	7.800	8.627
LZST	9.400	9.400	9.400	9.401	9.277	9.099	8.483	7.901	7.800	7.800	7.800	7.800	8.627
GWS	2.000	2.000	2.000	1.999	2.001	2.063	2.086	2.126	2.119	2.089	2.067	2.051	2.050
TEMP.	28.5	30.0	33.8	58.8	63.2	70.9	76.5	76.8	71.2	55.0	37.7	30.5	52.8
CORRELATION COEF-FICIENTS	1.000	0.634	0.570	0.424	0.809	0.586	0.463	0.571	0.810	0.588	0.286	0.905	0.639

DELTA STORAGE = 1.040 INCHES
AAIA = 2.793
POND STORAGE = 0.0

TOTAL CHANGE = -1.753

SUM CAL TOTAL = 19692.
SUM OBS TOTAL = 24114.
SUM CAL SRINT = 16174.
SUM OBS SR = 20177.
SUM CAL BF = 3519.
SUM OBS BF = 3937.

PACK ON DECEMBER 31 = 0.26 CHANGE IN SNOW STORAGE = 0.26

AVERAGE MONTHLY BASE FLOW
34.11092.02015.01260.01108.03000.0 651.0 173.6 39.0 235.6 570.0 456.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
106	295	49

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1949

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.33	1.16	1.24	2.88	4.34	6.41	2.66	3.15	0.30	1.98	0.07	0.11	24.64
CALCULATED TOTAL RUNOFF	320.	484.	443.	928.	4586.	8633.	3024.	2018.	948.	2242.	540.	407.	24572.
OBSERVED TOTAL RUNOFF	37.	6127.	2325.	1554.	3496.	12838.	1929.	809.	97.	504.	569.	521.	30807.
CALCULATED SURFACE RUNOFF	58.	301.	271.	751.	4284.	8181.	2428.	1336.	229.	1679.	13.	6.	19538.
OBSERVED SURFACE RUNOFF	3.	5035.	310.	294.	1388.	9838.	1278.	635.	58.	269.	-1.	25.	19132.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	261.	183.	172.	177.	302.	451.	596.	682.	719.	562.	528.	401.	5034.
OBSERVED BASEFLOW	34.	1092.	2015.	1260.	2108.	3000.	651.	174.	39.	236.	570.	496.	11674.
ETP	0.0	0.509	2.677	3.584	5.333	6.288	6.642	5.547	4.588	3.011	1.903	1.017	41.100
UETA	0.0	0.110	0.796	1.457	2.452	2.817	2.248	1.960	1.276	0.800	0.213	0.098	14.227
LETA	0.0	0.0	0.0	0.122	1.207	1.517	1.210	1.055	0.687	0.359	0.0	0.0	6.157
ETA	0.159	0.393	0.828	1.810	3.659	4.333	3.458	3.015	1.963	1.159	0.213	0.098	21.068
PER-COLATION	0.0	0.434	0.220	0.929	1.557	2.965	0.234	0.165	0.0	0.165	0.0	0.0	6.570
UZS	3.831	4.217	4.267	4.306	4.307	4.158	3.537	3.445	3.291	3.499	3.408	3.313	3.795
LZSA	7.800	7.892	8.280	9.103	9.664	10.978	10.494	9.467	8.700	8.263	8.213	8.213	8.927
LZST	7.800	7.892	8.280	9.103	9.664	10.978	10.494	9.467	8.700	8.263	8.213	8.213	8.927
GWS	2.037	2.027	2.020	2.014	2.033	2.120	2.151	2.133	2.111	2.097	2.077	2.057	2.073
TEMP.	18.3	29.9	36.5	51.9	63.5	71.9	78.0	74.3	64.3	54.2	47.3	32.4	52.2
CORRELATION COEFFICIENTS	0.590	0.677	0.680	0.476	0.617	0.492	0.699	0.633	0.603	0.648	0.968	0.983	0.672

DELTA STORAGE = 2.689 INCHES
AAIA = 3.259
PCND STORAGE = 0.0

TOTAL CHANGE = -0.570

SUM CAL TOTAL = 44264.
SUM OBS TOTAL = 54920.
SUM CAL SPINT = 35712.
SUM OBS SR = 39309.
SUM CAL BF = 8553.
SUM OBS BF = 15611.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.26

AVERAGE MONTHLY BASE FLOW
372.01038.01023.0 600.0 469.0 105.01395.03410.01530.0 744.0 650.0 713.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
123	306	50

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1950

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.12	1.20	0.39	0.93	2.45	1.50	7.29	6.28	0.30	0.55	0.07	0.02	21.11
CALCULATED TOTAL RUNOFF	298.	380.	283.	282.	960.	1023.	34125.	22206.	3612.	2576.	1943.	1474.	69162.
OBSERVED TOTAL RUNOFF	371.	1027.	1041.	721.	599.	449.	21805.	31911.	2063.	952.	710.	725.	62374.
CALCULATED SURFACE RUNOFF	6.	175.	120.	158.	770.	868.	33824.	18941.	152.	208.	2.	0.	55221.
OBSERVED SURFACE RUNOFF	-1.	19.	18.	121.	134.	344.	20410.	28501.	533.	208.	20.	12.	50319.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	293.	206.	163.	125.	190.	155.	301.	3266.	3460.	2368.	1940.	1474.	13940.
OBSERVED BASEFLOW	372.	1008.	1023.	600.	465.	105.	1395.	3410.	1530.	744.	690.	713.	12055.
ETP	0.795	1.558	2.302	3.878	5.046	6.390	6.258	5.308	4.622	3.284	1.589	1.099	42.130
UETA	0.019	0.206	0.473	1.009	1.751	1.968	2.304	2.273	1.356	0.693	0.196	0.061	12.310
LETA	0.0	0.0	0.0	0.0	0.535	0.0	0.826	1.230	0.741	0.389	0.014	0.0	3.735
ETA	0.036	0.206	0.599	1.009	2.286	1.968	3.131	3.503	2.097	1.082	0.210	0.061	16.187
PER-COLATION	0.0	0.077	0.023	0.022	0.0	0.0	1.805	2.380	0.0	0.0	0.0	0.0	4.307
UZS	3.232	3.695	3.911	3.741	3.550	3.201	3.804	4.209	3.560	3.090	2.689	2.602	3.444
LZSA	8.213	8.231	8.307	8.325	8.139	7.800	8.080	9.683	9.517	8.961	8.785	8.785	8.571
LZST	8.213	8.231	8.307	8.325	8.139	7.800	8.080	9.683	9.517	8.961	8.785	8.785	8.571
GWS	2.042	2.031	2.023	2.016	2.011	2.007	2.084	2.555	2.508	2.386	2.285	2.209	2.181
TEMP.	27.3	36.8	38.2	48.4	56.3	73.3	72.7	70.6	64.9	59.8	38.9	34.5	52.1
CORRELATION COEFFICIENTS	0.992	0.627	0.538	0.636	0.539	0.3[illegible]	0.527	0.639	0.865	0.694	0.936	0.717	0.667

DELTA STORAGE = 2.446 INCHES
AAIA = 2.627
POND STORAGE = 0.0

TOTAL CHANGE = -0.181

SLM CAL TOTAL = 113426.
SLM OBS TOTAL = 117295.
SLM CAL SRINT = 90533.
SLM OBS SR = 89629.
SLM CAL BF = 22493.
SLM OBS BF = 27666.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.00

AVERAGE MONTHLY BASE FLOW
868.0 992.01240.01170.01612.04800.06820.03410.02760.02294.02250.01085.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
122	283	51

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	2.270	0.0	0.0	0.0	0.0	0.0	2.270

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1951

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.29	0.93	0.62	2.29	5.75	9.28	7.49	2.35	3.10	0.70	0.18	0.10	33.08
CALCULATED TOTAL RUNOFF	1035.	766.	746.	1465.	20102.	26612.	43234.	20034.	15442.	9482.	6648.	5049.	150664.
OBSERVED TOTAL RUNOFF	892.	976.	1249.	1503.	17401.	53000.	79382.	9426.	11537.	2494.	2386.	1452.	181698.
CALCULATED SURFACE RUNOFF	7.	57.	165.	1072.	15420.	24519.	28877.	2966.	3134.	133.	1.	0.	80351.
OBSERVED SURFACE RUNOFF	24.	24.	9.	333.	15789.	48200.	72562.	6016.	8777.	200.	136.	367.	152437.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	402.	220.	53.	0.	0.	0.	675.
CALCULATED BASEFLOW	1077.	709.	581.	393.	683.	2093.	13955.	16847.	12255.	9349.	6647.	5049.	69638.
OBSERVED BASEFLOW	868.	952.	1240.	1170.	1612.	4800.	6820.	3410.	2760.	2294.	2250.	1085.	29261.
ETP	0.458	1.240	2.572	3.869	5.235	5.774	6.353	5.626	4.494	2.938	1.491	0.666	40.716
USTA	0.025	0.183	0.429	0.957	1.883	2.947	2.634	2.139	1.756	0.814	0.244	0.054	13.966
LSTA	0.0	0.0	0.0	0.0	0.619	1.533	1.418	1.152	0.946	0.194	0.0	0.0	5.861
ETA	0.206	0.262	0.429	0.957	2.502	4.380	4.052	3.291	2.702	1.008	0.266	0.112	20.168
PER-COLATION	0.0	0.0	0.0	0.259	1.919	4.217	3.503	0.369	0.861	0.0	0.0	0.0	11.128
UZS	2.657	2.787	2.963	3.491	3.895	4.413	4.272	3.887	3.879	3.079	2.925	2.793	3.422
LZSA	8.785	8.785	8.785	8.878	9.578	11.701	13.049	12.454	12.257	11.807	11.782	11.782	10.820
LZST	8.785	8.785	8.785	8.878	9.578	11.701	14.440	14.764	14.527	14.077	14.052	14.052	11.889
GWS	2.153	2.113	2.086	2.066	2.142	2.500	4.069	4.393	3.799	3.327	2.975	2.717	2.868
TEMP.	27.3	35.4	36.1	48.3	62.1	64.9	74.0	75.6	62.8	52.6	37.5	27.5	50.4
CORRELATION COEFFICIENTS	0.801	0.637	0.836	0.721	0.6[illegible]	0.689	0.515	0.597	0.647	0.[illegible]	0.954	0.836	0.740

DELTA STORAGE = 7.531 INCHES
AATA = 3.856
POND STORAGE = 0.0

TOTAL CHANGE = 3.675

SLM CAL TOTAL = 264089.
SLM OBS TOTAL = 298993.
SLM CAL SPRNT = 171559.
SLM OBS SP = 242066.
SLM CAL BF = 92131.
SLM OBS BF = 56927.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.0

AVERAGE MONTHLY BASE FLOW

550.01595.01550.02400.02325.0 330.0 55.8 34.1 0.0 1.6 45.0 155.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
132	280	52

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1952

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.10	0.20	1.27	2.34	2.25	0.26	2.33	2.54	0.61	0.03	0.07	0.86	12.87
CALCULATED TOTAL RUNOFF	3691.	2549.	2138.	1575.	3032.	1137.	1566.	1283.	751.	400.	284.	297.	18703.
OBSERVED TOTAL RUNOFF	1360.	1885.	3100.	4200.	4656.	488.	110.	117.	28.	2.	50.	255.	16751.
CALCULATED SURFACE RUNOFF	0.	0.	125.	304.	2315.	161.	854.	729.	255.	0.	0.	81.	4825.
OBSERVED SURFACE RUNOFF	310.	290.	1550.	1800.	2331.	158.	54.	83.	28.	0.	5.	100.	6710.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	3691.	2549.	2013.	1271.	716.	977.	712.	553.	496.	400.	284.	216.	13878.
OBSERVED BASEFLOW	1550.	1595.	1550.	2400.	2325.	330.	56.	34.	0.	2.	45.	155.	10041.
ETP	0.955	1.537	0.945	3.736	5.155	6.844	6.458	5.754	4.887	2.943	1.402	0.268	40.888
UETA	0.033	0.110	0.179	1.016	1.807	1.810	1.218	1.319	0.807	0.199	0.020	0.031	8.549
LETA	0.0	0.0	0.0	0.0	0.259	1.265	1.127	1.056	0.674	0.065	0.0	0.0	4.447
ETA	0.067	0.132	0.783	1.101	2.065	3.075	2.345	2.375	1.481	0.265	0.035	0.296	14.020
PER-COLATION	0.0	0.0	0.077	0.177	0.203	0.0	0.0	0.0	0.014	0.0	0.0	0.0	0.470
UZS	2.751	2.699	3.079	3.496	3.739	2.787	2.396	2.362	2.539	2.150	2.051	2.521	2.714
LZSA	11.782	11.782	11.790	11.909	12.065	11.349	10.095	9.045	8.164	7.810	7.805	7.805	10.111
LZST	14.052	14.052	14.060	14.179	14.335	13.619	12.365	11.315	10.434	10.080	10.075	10.075	12.381
GWS	2.524	2.387	2.286	2.212	2.183	2.157	2.121	2.097	2.077	2.057	2.042	2.031	2.180
TEMP.	32.4	36.1	34.1	49.2	60.9	72.5	87.6	77.5	69.1	52.9	36.9	29.6	53.9
CORRELATION COEF-FICIENTS	0.993	0.994	0.991	0.988	0.609	0.75	[illegible]	0.434	0.799	0.322	0.470	0.766	0.724

DELTA STORAGE = -1.819 INCHES
AREA = 3.744
POND STORAGE = 0.0

TOTAL CHANGE = -5.563

SUM CAL TOTAL = 282793.
SUM OBS TOTAL = 315744.
SUM CAL SRINT = 176784.
SUM OBS SF = 248776.
SUM CAL BF = 106009.
SUM OBS BF = 66968.

PACK ON DECEMBER 31 = 0.47 CHANGE IN SNOW STORAGE = 0.47

AVERAGE MONTHLY BASE FLOW
372.0 588.0 930.0 810.0 527.0 6.0 99.2 89.9 3.0 4.7 156.0 310.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
134	303	53

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1953

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.33	0.19	1.39	1.89	2.07	2.40	3.19	3.14	0.35	1.21	1.77	1.05	18.98
CALCULATED TOTAL RUNOFF	192.	116.	447.	514.	1051.	1528.	3814.	4624.	670.	734.	371.	492.	14553.
OBSERVED TOTAL RUNOFF	771.	673.	1125.	995.	635.	317.	2267.	1315.	7.	5.	162.	351.	8627.
CALCULATED SURFACE RUNOFF	35.	11.	325.	425.	901.	1402.	3530.	4193.	235.	380.	105.	275.	11816.
OBSERVED SURFACE RUNOFF	399.	85.	155.	189.	108.	311.	2167.	1225.	4.	0.	6.	41.	4731.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	158.	106.	122.	89.	150.	126.	284.	430.	436.	354.	266.	217.	2737.
OBSERVED BASEFLOW	372.	588.	930.	810.	527.	6.	99.	90.	3.	5.	156.	310.	3896.
ETP	0.931	1.589	2.535	3.822	5.092	6.667	6.584	5.590	4.906	3.239	1.267	0.118	42.259
UETA	0.016	0.125	0.389	1.107	1.554	2.160	1.808	2.011	1.115	0.618	0.262	0.044	11.210
LETA	0.0	0.0	0.0	0.0	0.177	0.367	0.756	0.702	0.091	0.0	0.0	0.0	2.092
ETA	0.146	0.125	0.590	1.107	1.731	2.527	2.563	2.713	1.206	0.618	0.450	0.386	14.161
PER-COLATION	0.0	0.0	0.111	0.043	0.070	0.105	0.672	0.611	0.031	0.0	0.051	0.569	2.253
UZS	2.892	2.925	3.104	3.459	3.581	3.145	3.625	3.857	3.016	2.628	3.745	4.428	3.371
LZSA	7.805	7.805	7.877	7.919	7.961	7.803	7.842	7.876	7.800	7.800	7.828	8.131	7.872
LZST	10.075	10.075	10.147	10.189	10.231	9.609	8.838	8.487	7.862	7.800	7.828	8.131	9.101
GWS	2.022	2.017	2.012	2.008	2.005	2.004	2.028	2.076	2.068	2.051	2.039	2.029	2.030
TEMP.	37.9	36.1	44.0	47.5	60.0	77.1	77.2	75.0	69.4	58.8	41.6	29.8	54.6
CORRELATION COEF-FICIENTS	0.763	0.801	0.387	0.397	0.670	0.624	0.477	0.439	0.634	0.467	0.519	0.419	0.548

DELTA STORAGE = 4.299 INCHES
AAIA = 3.131
POND STORAGE = 0.0

TOTAL CHANGE = 1.168

SUM CAL TOTAL = 257346.
SUM OBS TOTAL = 324371.
SUM CAL SPINT = 188599.
SUM OBS SP = 253507.
SUM CAL BF = 108747.
SUM OBS BF = 70864.

PACK ON DECEMBER 31 = 0.08 CHANGE IN SNOW STORAGE =-0.39

AVERAGE MONTHLY BASE FLOW
248.0 812.0 744.0 516.0 1085.0 870.0 24.8 1.6 0.0 6.2 16.5 15.5

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
123	294	54

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1954

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.14	0.48	0.57	0.55	5.23	2.08	1.19	2.39	0.48	1.52	0.02	0.06	14.71
CALCULATED TOTAL RUNOFF	197.	173.	129.	246.	5576.	4700.	572.	1696.	536.	678.	236.	183.	15327.
OBSERVED TOTAL RUNOFF	380.	1021.	789.	744.	5110.	5516.	48.	134.	0.	6.	18.	23.	13790.
CALCULATED SURFACE RUNOFF	52.	80.	49.	165.	5350.	4223.	367.	1240.	114.	356.	0.	4.	11999.
OBSERVED SURFACE RUNOFF	132.	209.	45.	234.	4025.	4646.	23.	133.	0.	0.	1.	7.	9457.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	146.	98.	80.	80.	226.	477.	605.	456.	422.	323.	236.	179.	3328.
OBSERVED BASEFLOW	248.	812.	744.	510.	1085.	870.	25.	2.	0.	6.	17.	16.	4334.
ETP	0.901	1.865	2.535	4.397	4.904	6.560	6.582	5.807	5.109	2.991	1.819	1.048	44.920
UETA	0.031	0.364	0.591	1.096	2.063	2.410	1.433	1.499	0.531	0.591	0.077	0.086	10.772
LETA	0.0	0.0	0.0	0.0	0.604	1.362	0.775	0.031	0.0	0.027	0.0	0.0	2.800
ETA	0.031	0.364	0.591	1.096	2.667	3.772	2.209	1.530	0.531	0.618	0.077	0.109	13.594
PER-COLATION	0.141	0.041	0.0	0.006	1.537	0.396	0.0	0.031	0.0	0.027	0.0	0.0	2.179
UZS	4.130	4.093	3.971	3.564	4.099	3.642	2.366	2.672	2.360	2.715	2.672	2.601	3.236
LZSA	8.546	8.575	8.602	8.604	8.986	9.109	8.050	7.800	7.800	7.800	7.800	7.800	8.287
LZST	8.546	8.575	8.602	8.604	8.986	9.109	8.050	7.800	7.800	7.800	7.800	7.800	8.287
GWS	2.021	2.015	2.011	2.008	2.026	2.092	2.094	2.078	2.062	2.046	2.035	2.025	2.043
TEMP.	28.2	44.9	37.5	56.4	57.3	75.6	82.7	78.3	72.7	53.7	44.8	34.7	55.6
CORRELATION COEF-FICIENTS	0.751	0.717	0.781	0.878	0.754	0.469	.392	0.302	0.281	0.282	0.910	0.676	0.615

DELTA STORAGE = 0.564 INCHES
AREA = 2.840
POND STORAGE = 0.0

TOTAL CHANGE = -2.275

SUM.CAL TOTAL = 312673.
SUM OBS TOTAL = 338162.
SUM CAL SPRNT = 200598.
SUM OBS SR = 262964.
SUM CAL BF = 112075.
SUM OBS BF = 75198.

PACK ON DECEMBER 31 = 0.20 CHANGE IN SNOW STORAGE = 0.12

AVERAGE MONTHLY BASE FLOW
18.6 148.4 291.4 294.0 9.3 9.0 0.0 0.0 0.0 6.2 9.0 77.5

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
110	298	55

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1955

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.49	0.59	0.34	1.04	2.39	3.41	1.24	1.43	3.85	0.19	0.05	0.18	15.21
CALCULATED TOTAL RUNOFF	136.	126.	100.	299.	936.	3124.	1433.	1312.	2359.	338.	211.	200.	10573.
OBSERVED TOTAL RUNOFF	32.	325.	512.	427.	74.	686.	1.	6.	2176.	147.	10.	86.	4481.
CALCULATED SURFACE RUNOFF	5.	39.	28.	233.	820.	2899.	1178.	1062.	2131.	43.	2.	41.	8478.
OBSERVED SURFACE RUNOFF	13.	176.	221.	133.	65.	677.	1.	6.	2176.	140.	1.	7.	3617.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	131.	88.	72.	66.	116.	225.	255.	250.	228.	295.	210.	159.	2095.
OBSERVED BASEFLOW	19.	148.	291.	294.	9.	9.	0.	0.	0.	6.	9.	78.	863.
ETP	0.199	0.635	2.434	4.375	5.391	6.028	6.949	5.878	4.870	3.142	1.466	0.490	41.856
UETA	0.013	0.109	0.240	0.923	1.235	2.031	1.558	1.261	0.857	0.810	0.191	0.040	9.269
LETA	0.0	0.0	0.0	0.040	0.258	0.452	0.086	0.0	0.215	0.382	0.0	0.0	1.434
ETA	0.317	0.255	0.303	0.963	1.493	2.483	1.644	1.261	1.073	1.192	0.191	0.188	11.364
PER-COLATION	0.017	0.106	0.031	0.059	0.085	0.452	0.086	0.0	0.619	0.0	0.0	0.0	1.455
UZS	2.651	2.929	2.887	2.764	2.657	3.213	2.836	2.643	2.634	3.653	3.240	3.221	2.944
LZSA	7.801	7.879	7.936	7.986	7.828	7.844	7.801	7.800	7.891	7.941	7.821	7.821	7.862
LZST	7.801	7.879	7.936	7.986	7.828	7.844	7.801	7.800	7.891	7.941	7.821	7.821	7.862
GWS	2.019	2.014	2.010	2.007	2.005	2.022	2.034	2.034	2.030	2.042	2.031	2.023	2.023
TEMP.	27.7	26.8	39.0	56.1	64.3	68.4	82.2	79.4	68.8	56.9	36.8	28.8	53.1
CORRELATION COEF-FICIENTS	0.836	0.505	0.940	0.651	0.711	0.803	0.071	0.229	0.949	0.623	0.128	0.782	0.604

DELTA STORAGE = 3.472 INCHES
AAIA = 3.398
POND STORAGE = 0.)

TOTAL CHANGE = 0.075

SUM CAL TOTAL = 323246.
SUM OBS TOTAL = 342642.
SUM CAL SRINT = 209076.
SUM OBS SR = 266581.
SUM CAL BF = 114169.
SUM OBS BF = 76061.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.21

AVERAGE MONTHLY BASE FLOW
217.0 234.9 589.0 330.0 148.8 3.0 4.7 1.6 0.) 0.0 0.0 0.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
118	306	56

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1956

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.16	0.53	0.19	0.77	1.35	1.20	2.71	1.66	0.36	0.96	0.11	0.06	9.76
CALCULATED TOTAL RUNOFF	121.	117.	78.	407.	636.	267.	2719.	587.	110.	214.	100.	44.	5399.
OBSERVED TOTAL RUNOFF	226.	368.	627.	450.	371.	363.	2306.	155.	0.	0.	0.	0.	4868.
CALCULATED SURFACE RUNOFF	4.	36.	15.	321.	557.	222.	2490.	414.	0.	123.	42.	0.	4224.
OBSERVED SURFACE RUNOFF	9.	133.	38.	120.	222.	360.	2301.	154.	0.	0.	0.	0.	3339.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	116.	80.	63.	86.	79.	45.	229.	173.	110.	92.	58.	44.	1175.
OBSERVED BASEFLOW	217.	235.	589.	330.	149.	3.	5.	2.	0.	0.	0.	0.	1529.
ETP	0.634	0.401	2.604	3.833	5.498	6.768	6.619	5.752	4.945	3.293	1.645	1.111	43.103
UETA	0.031	0.006	0.340	0.934	1.233	1.339	1.601	1.164	0.249	0.220	0.150	0.075	7.392
LETA	0.0	0.0	0.0	0.002	0.128	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.130
ETA	0.124	0.342	0.420	0.936	1.360	1.339	1.601	1.164	0.249	0.220	0.150	0.075	8.031
PER-COLATION	0.0	0.009	0.000	0.099	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.109
UZS	3.291	3.400	3.727	3.501	2.784	2.299	2.774	2.492	2.113	2.083	2.299	2.225	2.763
LZSA	7.821	7.823	7.831	7.923	7.833	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.819
LZST	7.821	7.823	7.831	7.923	7.833	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.819
GWS	2.017	2.012	2.009	2.007	2.005	2.005	2.024	2.022	2.016	2.012	2.008	2.006	2.012
TEMP.	28.1	29.2	41.9	47.7	65.8	78.5	77.7	77.5	70.1	60.0	39.7	35.7	54.4
CORRELATION COEF-FICIENTS	0.759	0.599	0.787	0.427	0.506	0.141	.667	0.441	1.000	1.000	1.000	0.871	0.684

DELTA STORAGE = 1.535 INCHES
AATA = 3.179
POND STORAGE = 0.0

TOTAL CHANGE = -1.644

SUM CAL TOTAL = 328644.
SUM OBS TOTAL = 347510.
SUM CAL SPINT = 213300.
SUM OBS SR = 209920.
SUM CAL BF = 115344.
SUM OBS BF = 77590.

PACK ON DECEMBER 31 =-0.01 CHANGE IN SNOW STORAGE =-0.01

AVERAGE MONTHLY BASE FLOW
1.6 5.6 9.3 450.01023.01890.01736.0 133.2 138.0 558.0 810.0 651.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
104	298	57

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1957

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.32	0.42	2.44	2.78	6.18	7.81	1.03	3.03	1.61	1.43	0.67	0.01	27.42
CALCULATED TOTAL RUNOFF	32.	31.	119.	1999.	9217.	26774.	6402.	4186.	4096.	2112.	1521.	1112.	57601.
OBSERVED TOTAL RUNOFF	2.	13.	105.	2253.	13469.	31743.	6602.	3589.	4873.	657.	833.	665.	64804.
CALCULATED SURFACE RUNOFF	0.	10.	92.	1848.	8814.	26320.	3824.	2184.	2593.	249.	58.	1.	45993.
OBSERVED SURFACE RUNOFF	1.	8.	95.	1803.	12446.	29853.	4866.	3456.	4735.	99.	23.	14.	57398.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	32.	21.	27.	150.	403.	455.	2578.	2002.	1502.	1863.	1463.	1111.	11608.
OBSERVED BASEFLOW	2.	6.	9.	450.	1023.	1890.	1736.	133.	138.	558.	810.	651.	7406.
ETP	0.293	1.375	1.883	3.759	5.002	6.050	6.782	5.756	4.560	2.957	1.304	1.228	40.989
UETA	0.031	0.034	0.300	1.322	2.280	2.890	2.402	1.476	1.348	0.814	0.229	0.070	13.195
LETA	0.0	0.0	0.0	0.130	1.156	1.556	1.293	1.010	0.738	0.394	0.0	0.0	6.278
ETA	0.135	0.099	0.648	1.504	3.435	4.446	3.696	2.486	2.086	1.209	0.342	0.070	20.156
PER-COLATION	0.0	0.0	0.0	0.944	2.150	2.796	0.373	0.055	0.278	0.001	0.011	0.000	6.502
UZS	2.161	2.187	2.293	4.230	4.290	4.342	3.612	2.726	3.671	3.623	3.782	3.963	3.410
LZSA	7.800	7.800	7.800	8.426	8.586	10.064	10.385	9.297	8.627	8.175	8.015	8.024	8.621
LZST	7.800	7.800	7.800	8.426	8.586	10.064	10.385	9.297	8.627	8.175	8.015	8.024	8.621
GWS	2.005	2.003	2.002	2.006	2.076	2.310	2.480	2.383	2.361	2.288	2.215	2.158	2.192
TEMP.	21.2	37.0	38.2	48.3	58.7	69.7	79.9	77.6	63.9	53.8	37.7	37.8	52.0
CORRELATION COEF-FICIENTS	0.318	0.673	0.768	0.769	0.705	0.875	0.911	0.637	0.863	0.952	0.985	0.976	0.760

DELTA STORAGE = 5.206 INCHES
AAIA = 3.814
POND STORAGE = 0.0

TOTAL CHANGE = 1.392

SLM CAL TOTAL = 386245.
SLM OBS TOTAL = 412314.
SLM CAL SPRNT = 259293.
SLM OBS SR = 327319.
SLM CAL BF = 126952.
SLM OBS BF = 84996.

PACK ON DECEMBER 31 = 0.04 CHANGE IN SNOW STORAGE = 0.05

AVERAGE MONTHLY BASE FLOW
806.0 816.01519.02700.02046.0 720.01240.01054.0 660.0 496.0 780.0 868.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
119	274	58

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1958

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.37	0.38	1.51	3.20	4.11	2.09	6.37	2.26	0.99	0.12	0.80	0.47	22.64
CALCULATED TOTAL RUNOFF	879.	634.	588.	3519.	4408.	1529.	9439.	11157.	2478.	1623.	1170.	920.	38742.
OBSERVED TOTAL RUNOFF	825.	644.	1860.	3473.	4184.	2408.	8396.	7233.	2369.	608.	825.	920.	33745.
CALCULATED SURFACE RUNOFF	67.	96.	546.	3062.	3947.	993.	9000.	9601.	831.	0.	16.	44.	28203.
OBSERVED SURFACE RUNOFF	19.	28.	341.	773.	2138.	1688.	7156.	6179.	1709.	112.	45.	52.	20240.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	813.	537.	442.	456.	461.	536.	438.	1555.	1647.	1623.	1154.	876.	10539.
OBSERVED BASEFLOW	806.	616.	1519.	2700.	2046.	720.	1240.	1054.	660.	496.	780.	868.	13505.
ETP	0.296	0.710	0.0	3.344	5.369	6.213	6.334	5.647	4.882	3.099	1.281	0.848	38.523
UETA	0.032	0.172	0.0	1.155	2.302	2.239	2.435	2.042	1.352	0.456	0.095	0.113	12.483
LETA	0.0	0.0	0.0	0.012	0.938	1.232	1.338	1.099	0.845	0.015	0.0	0.0	5.479
ETA	0.166	0.282	0.742	1.435	3.240	3.521	3.773	3.141	2.197	0.471	0.238	0.157	19.363
PER-COLATION	0.095	0.175	1.082	2.090	1.291	0.076	1.393	0.735	0.088	0.0	0.0	0.0	7.023
UZS	3.977	4.072	4.147	4.269	4.093	3.384	3.748	3.816	3.290	2.579	2.502	3.090	3.579
LZSA	8.032	8.148	8.404	11.283	11.837	11.194	10.566	10.528	9.955	9.568	9.563	9.568	9.895
LZST	8.032	8.148	8.404	11.283	11.837	11.194	10.566	10.528	9.955	9.568	9.568	9.568	9.895
GWS	2.115	2.086	2.064	2.083	2.094	2.058	2.151	2.302	2.308	2.230	2.169	2.124	2.153
TEMP.	31.9	28.9	25.7	48.0	64.0	70.0	73.7	75.9	69.1	56.0	40.8	31.1	51.4
CORRELATION COEF-FICIENTS	0.870	0.809	0.634	0.591	0.872	0.833	0.575	0.407	0.571	0.586	0.968	0.902	0.701

DELTA STORAGE = 1.896 INCHES
AAIA = 2.621
PERC STORAGE = 0.0

TOTAL CHANGE = -0.725

SUM CAL TOTAL = 424987.
SUM OBS TOTAL = 446055.
SUM CAL SRINT = 287496.
SUM OBS SR = 347558.
SUM CAL BF = 137491.
SUM OBS BF = 98501.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.04

AVERAGE MONTHLY BASE FLOW
558.0 1260.0 1209.0 1350.0 930.0 450.0 62.0 12.4 6.0 589.0 720.0 868.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHRU	IPREZ	YEAR
112	284	59

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1959

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.39	0.65	2.16	0.86	1.89	2.65	2.99	3.59	3.10	3.19	0.05	0.21	21.73
CALCULATED TOTAL RUNOFF	692.	560.	800.	465.	935.	3277.	1959.	2905.	1825.	2525.	484.	301.	16687.
OBSERVED TOTAL RUNOFF	569.	1354.	1509.	1387.	1184.	1619.	263.	325.	202.	2175.	771.	876.	12233.
CALCULATED SURFACE RUNOFF	11.	144.	445.	198.	695.	2936.	1642.	2580.	1496.	2110.	125.	23.	12405.
OBSERVED SURFACE RUNOFF	11.	94.	300.	37.	254.	1169.	201.	313.	196.	1586.	51.	8.	4218.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	641.	416.	355.	266.	240.	341.	317.	325.	329.	416.	359.	279.	4283.
OBSERVED BASEFLOW	558.	1260.	1209.	1350.	930.	450.	62.	12.	6.	589.	720.	868.	8014.
ETP	0.470	0.827	2.738	3.999	5.231	6.517	6.426	5.875	4.551	2.820	1.406	1.157	42.037
UETA	0.076	0.135	0.686	1.267	1.653	2.147	2.022	1.920	1.505	1.023	0.265	0.255	13.958
LETA	0.0	0.0	0.0	0.028	0.778	1.327	0.855	0.357	0.217	0.254	0.0	0.0	3.826
ETA	0.210	0.252	0.689	1.295	2.431	3.473	2.887	2.277	1.722	1.276	0.265	0.255	17.035
PER-COLATION	0.0	0.000	0.543	0.006	0.138	0.473	0.071	0.357	0.426	1.589	0.003	0.0	3.607
UZS	3.154	3.472	3.750	3.716	3.468	3.283	2.806	3.424	3.471	4.119	4.198	4.044	3.575
LZSA	9.568	9.566	9.706	10.114	9.870	9.185	8.060	7.819	7.844	9.102	9.348	9.348	9.124
LZST	9.568	9.568	9.706	10.114	9.870	9.185	8.060	7.819	7.844	9.102	9.348	9.348	9.124
GWS	2.091	2.068	2.051	2.039	2.029	2.051	2.046	2.055	2.051	2.066	2.054	2.040	2.053
TEMP.	25.8	29.1	39.7	50.3	62.0	75.0	75.0	79.4	63.7	50.3	36.0	35.0	51.9
CORRELATION COEFFICIENTS	0.789	0.853	0.840	0.789	0.748	[illegible]	0.635	0.423	0.725	0.677	0.660	0.965	0.729

DELTA STORAGE = 4.096 INCHES
AATA = 3.669
PEAK STORAGE = 0.0

TOTAL CHANGE = 0.427

SUM CAL TOTAL = 441675.
SUM OBS TOTAL = 458252.
SUM CAL SPRNT = 299900.
SUM OBS SP = 351776.
SUM CAL BF = 141774.
SUM OBS BF = 106515.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.00

AVERAGE MONTHLY BASE FLOW
589.01508.02170.03300.02697.01710.0 558.0 68.2 63.0 161.2 480.0 713.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
113	297	60

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1960

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.57	1.66	1.97	1.60	3.90	3.55	0.82	2.97	1.11	1.86	0.16	0.62	20.80
CALCULATED TOTAL RUNOFF	298.	856.	822.	3922.	9817.	4759.	1642.	3310.	1190.	1050.	571.	473.	28750.
OBSERVED TOTAL RUNOFF	615.	1843.	5734.	3728.	10007.	4943.	622.	1741.	294.	245.	503.	719.	34993.
CALCULATED SURFACE RUNOFF	91.	668.	657.	3550.	9224.	3963.	495.	2529.	327.	360.	29.	61.	21954.
OBSERVED SURFACE RUNOFF	26.	335.	7564.	428.	7310.	3233.	64.	1672.	231.	84.	23.	6.	20976.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	207.	188.	165.	372.	593.	836.	1148.	781.	863.	690.	542.	412.	6798.
OBSERVED BASEFLOW	589.	1508.	7170.	3300.	2697.	1710.	558.	68.	63.	161.	480.	713.	14017.
ETP	0.415	0.171	0.694	4.244	5.105	6.148	6.457	5.690	4.833	3.128	1.685	0.545	39.114
UETA	0.102	0.041	0.120	1.479	2.186	2.567	1.780	1.445	0.941	0.635	0.302	0.123	11.722
LETA	0.0	0.0	0.0	0.032	0.959	1.382	1.150	1.072	0.740	0.364	0.0	0.0	5.700
ETA	0.209	0.302	0.753	1.511	3.145	3.949	2.931	2.518	1.681	0.999	0.302	0.288	18.588
PER-COLATION	0.057	1.434	1.412	0.342	1.296	0.591	0.021	0.114	0.011	0.057	0.000	0.028	5.412
UZS	4.032	4.505	4.520	3.946	4.204	3.892	2.865	2.764	2.797	3.107	3.479	3.537	3.639
LZSA	9.376	10.569	11.282	12.621	13.083	12.579	11.574	10.474	9.705	9.122	9.032	9.038	10.702
LZST	9.376	10.569	11.282	12.621	13.083	12.579	11.574	10.474	9.705	9.122	9.032	9.038	10.702
GWS	2.029	2.022	2.017	2.059	2.130	2.204	2.189	2.134	2.137	2.105	2.079	2.058	2.099
TEMP.	24.4	21.4	31.0	54.1	60.2	70.0	75.4	76.5	68.3	56.6	40.9	30.0	50.8
CORRELATION COEF-FICIENTS	0.542	0.580	0.715	0.601	0.585	0.57[illegible]	0.776	0.523	0.589	0.801	0.847	0.866	0.667

DELTA STORAGE = 1.187 INCHES
AAIA = 2.896
PERC STORAGE = 0.0

TOTAL CHANGE = -1.709

SLM CAL TOTAL = 470424.
SLM OBS TOTAL = 463285.
SLM CAL SRINT = 321354.
SLM OBS SR = 372752.
SLM CAL BF = 148570.
SLM OBS BF = 120533.

PACK ON DECEMBER 31 = 0.10 CHANGE IN SNOW STORAGE = 0.10

AVERAGE MONTHLY BASE FLOW
775.0 530.01054.01110.01674.02130.0 713.0 496.0 450.0 744.01140.01023.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITRAN	IPREZ	YEAR
111	292	61

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1961

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.12	0.13	1.72	1.22	6.42	4.87	2.78	4.14	1.80	0.76	1.94	0.26	26.16
CALCULATED TOTAL RUNOFF	302.	206.	886.	944.	8054.	11583.	3309.	6640.	2708.	1618.	2413.	978.	39642.
OBSERVED TOTAL RUNOFF	792.	1001.	1145.	1385.	5954.	11571.	2110.	5168.	863.	795.	1207.	1047.	33038.
CALCULATED SURFACE RUNOFF	1.	5.	682.	766.	7724.	10606.	2121.	5631.	1435.	178.	1425.	18.	30591.
OBSERVED SURFACE RUNOFF	17.	21.	91.	275.	4280.	5441.	1397.	4672.	413.	51.	67.	24.	20749.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	301.	201.	204.	178.	331.	977.	1188.	1009.	1273.	1440.	989.	960.	9051.
OBSERVED BASEFLOW	775.	980.	1054.	1110.	1674.	2130.	713.	496.	450.	744.	1140.	1023.	12289.
ETP	1.018	1.367	2.820	3.126	4.979	6.208	6.560	5.584	4.435	2.988	1.305	0.355	40.745
UETA	0.029	0.069	0.785	0.925	2.137	2.717	2.124	1.920	1.286	0.752	0.314	0.037	13.145
LETA	0.0	0.0	0.0	0.032	0.988	1.463	1.236	1.094	0.705	0.295	0.0	0.0	5.813
ETA	0.029	0.101	0.785	1.230	3.175	4.179	3.360	3.015	1.991	1.047	0.407	0.196	19.516
PER-COLATION	0.000	0.009	0.396	0.225	2.554	2.368	0.360	0.594	0.221	0.028	0.776	0.054	7.584
UZS	3.775	3.761	3.834	3.852	4.191	4.106	2.963	3.476	3.623	3.432	3.659	3.911	3.714
LZSA	9.060	9.064	9.317	9.588	10.482	12.420	11.608	10.937	10.517	10.067	10.398	10.786	10.360
LZST	9.060	9.064	9.317	9.588	10.482	12.420	11.608	10.937	10.517	10.067	10.398	10.786	10.360
GWS	2.043	2.032	2.025	2.022	2.061	2.268	2.258	2.263	2.268	2.216	2.173	2.136	2.147
TEMP.	30.2	35.7	40.5	46.3	58.+	70.8	76.8	74.9	61.8	53.8	36.2	24.9	51.0
CORRELATION COEFFICIENTS	0.899	0.907	0.525	0.447	0.757	0.734	.801	0.520	0.712	0.917	0.541	0.891	0.721

DELTA STORAGE = 5.226 INCHES
AAIE = 3.679
POND STORAGE = 0.0

TOTAL CHANGE = 1.547

SUM CAL TOTAL = 510066.
SUM OBS TOTAL = 526323.
SUM CAL SRINT = 352445.
SUM OBS SR = 393501.
SUM CAL BF = 157621.
SUM OBS BF = 132822.

PACK ON DECEMBER 31 = 0.30 CHANGE IN SNOW STORAGE = 0.20

DAILY FLOW DURATION AND ERROR TABLE

FLOW INTERVAL	ACT.CASES	PCT.	CALC.CASES	PCT.	AVE.ERROR	AV.ABS.ERROR	STD.ERROR
0.0-	910.0	100.000	65.0	100.000	18.4	18.35	31.22
1.0-	164.0	81.545	148.0	98.482	22.5	22.55	38.51
1.8-	146.0	78.219	206.0	95.688	26.0	26.12	37.22
3.2-	163.0	75.259	420.0	91.503	30.0	30.58	57.23
5.6-	303.0	71.953	598.0	82.485	16.3	19.50	31.87
10.0-	416.0	65.707	671.0	70.858	12.3	19.48	31.25
17.8-	944.0	57.230	655.0	57.250	11.7	25.76	48.63
31.6-	777.0	38.096	741.0	43.967	6.9	37.64	59.57
56.2-	487.0	22.328	603.0	28.939	48.5	83.74	113.21
100.0-	302.0	12.452	306.0	16.711	40.4	123.14	179.02
177.8-	112.0	6.327	201.0	10.505	102.7	232.03	320.64
316.2-	77.0	4.056	156.0	6.429	160.5	352.35	516.02
562.3-	47.0	2.494	88.0	3.265	226.9	630.23	834.49
1000.0-	33.0	1.541	35.0	1.480	107.6	1071.89	1574.94
1778.3-	20.0	0.872	25.0	0.771	-873.2	1835.33	2377.70
3162.3-	11.0	0.466	7.0	0.264	-2518.6	2518.58	756.16
5623.4-	5.0	0.243	5.0	0.122	-3829.8	3829.83	799.83
10000.0-	4.0	0.142	1.0	0.020	-7037.3	7037.26	4748.14
17782.7-	0.0	0.020	0.0	0.0			
31622.7-	1.0	0.020	0.0	0.0	-30162.2		
56234.0-	0.0	0.0	0.0	0.0			
99999.8-	0.0	0.0	0.0	0.0			
177827.4-	0.0	0.0	0.0	0.0			
316226.9-	0.0	0.0	0.0	0.0			
	4931.0		4931.0		-7124.3	448933.31	12557.65

DELTA STORAGE = 39.368 INCHES
AAIA = 45.507
POND STORAGE = 0.0

TOTAL CHANGE = -6.139

TOTAL PRECIPITATION = 288.308

TOTAL IA	45.507
TOTAL SURFACE RUNOFF	16.487
TOTAL BETA	163.903
TOTAL PERC	60.961
CHANGE IN UZSM	1.048
CHECK BALANCE	287.911

RESULTS - MODEL B-ZERO

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..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 232..........1 APR 77..RCL06587..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 232..........1 APR 77..RCL06587..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 232..........1 APR 77..RCL06587..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 232..........1 APR 77..RCL06587..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON..........JOB 232..........1 APR 77..RCL06587..ROGERS.......................START........

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MOD 80

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                THE 6-FOUR INCREMENTAL VALUES OF THE UNIT HYDROGRAPH
 0.0100  0.0250  0.0650  0.0800  0.0850  0.0900  0.1000  0.0750  0.0650  0.0600
 0.0550  0.0500  0.0450  0.0400  0.0350  0.0300  0.0250  0.0230  0.0210  0.0210
&DATA
SB1=  30.500000     ,SM1=  5.5999994     ,IB1= 0.37399995     ,IM1= 0.10399997     ,UZSN=  4.5000000     ,UBP=  9.0000000     ,UMP=
  2.0000000     ,UZMX=  5.6999998     ,UZMN=  2.0000000     ,LZMX=  16.000000     ,LZMN=  7.7999992     ,ETBOM= 0.22999996     ,CX=
 0.89999998     ,YSTRT=  48.000000     ,IKR= 0.98999995     ,PCL= 0.34999996     ,RGWP=  6.0000000     ,RGWM=  2.0000000     ,GWSN=
  2.0000000     ,BK= 0.98999995     ,AGW= 0.79999995     ,PDY= 0.99999964E-01,TLL=  11.000000     ,LZSAN=  14.000000     ,LZSTN=
  14.000000     ,AREA=  1040.0000     ,UZSO=  3.0000000     ,LZSO=  9.3999996     ,GWSO=  2.0000000     ,YREND=  61.000000     ,GWRF=
  3.0000000     ,PORF= 0.83299994E-01,IIA= 0.20000000E-01,GWMN=  1.0000000     ,PTPOND= 0.0           ,ETR= 0.11000000E-01,FM=
 0.39999999E-01,POWER=  1.0000000     ,PWRE= 0.99999964E-01,QUANTY= 0.59999996     ,B=  1.2599993     ,C= 0.69999999     ,PONDDP=
 0.0           ,PCNDAR= 0.0           ,ZZT=  1.0000000     ,MODEL=           2,WPCNT=  1.0999994     ,USOIL= 0.38999999     ,CSOIL=
 0.17699999     ,PCTIRR= 0.79999995
&END

 AVERAGE MONTHLY BASE FLOW
 18.6  72.5 527.0 300.0  58.9 870.01240.0 403.0  12.0   4.7 120.0 310.0

     LEAP YEAR INDICATOR= 1     YES=1 & NO=0

  ITHAW   IFREZ                                                    YEAR
    123     285                                                      48

                              RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

          JAN.     FEB.     MAR.     APR.     MAY.     JUN.     JUL.     AUG.     SEP.     OCT.     NOV.     DEC.     TOTAL
          0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
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SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1948

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.04	0.53	1.92	0.48	3.60	5.60	2.00	4.14	0.98	0.58	1.04	0.45	21.37
CALCULATED TOTAL RUNOFF	0.	6.	315.	55.	2457.	7245.	2267.	6984.	1350.	878.	973.	492.	23025.
OBSERVED TOTAL RUNOFF	21.	423.	1409.	390.	2101.	13288.	2454.	3513.	40.	5.	131.	338.	24114.
CALCULATED SURFACE RUNOFF	0.	6.	275.	55.	2361.	6946.	1743.	6439.	464.	119.	434.	44.	18887.
OBSERVED SURFACE RUNOFF	2.	351.	882.	90.	2042.	12418.	1214.	3110.	28.	1.	11.	28.	20177.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	0.	0.	40.	0.	96.	298.	524.	545.	886.	760.	539.	449.	4137.
OBSERVED BASEFLOW	19.	73.	527.	300.	59.	870.	1240.	403.	12.	5.	120.	310.	3937.
ETP	0.887	0.845	1.337	4.549	5.315	6.210	6.537	5.709	5.012	3.045	1.100	0.708	41.253
UETA	0.168	0.119	0.380	1.239	1.834	2.765	2.277	2.320	1.408	0.737	0.245	0.107	13.598
LETA	0.0	0.0	0.0	0.0	0.521	1.489	1.226	1.249	0.700	0.0	0.0	0.0	5.185
ETA	0.179	0.273	0.731	1.239	2.355	4.254	3.504	3.569	2.107	0.737	0.442	0.220	19.609
PER-COLATION	0.0	0.0	0.183	0.0	0.549	1.678	0.091	1.017	0.066	0.0	0.0	0.0	3.585
UZS	2.880	2.939	3.646	3.801	3.619	4.161	3.909	4.195	3.636	2.967	3.024	3.660	3.538
LZSA	9.400	9.400	9.468	9.583	9.487	9.437	9.173	8.645	8.047	7.800	7.800	7.800	8.835
LZST	9.400	9.400	9.468	9.583	9.487	9.437	9.173	8.645	8.047	7.800	7.800	7.800	8.835
GWS	2.000	2.000	2.000	1.999	2.003	2.064	2.104	2.152	2.149	2.111	2.084	2.064	2.061
TEMP.	28.5	30.0	33.8	58.8	63.2	70.9	76.5	76.8	71.2	55.0	37.7	30.5	52.8
CORRELATION COEF-FICIENTS	1.000	0.636	0.552	0.419	0.808	0.603	0.470	0.807	0.817	0.590	0.307	0.302	0.644

DELTA STORAGE = 0.934 INCHES
AAIA = 2.664
POND STORAGE = 0.0

TOTAL CHANGE = -1.730

SUM CAL TOTAL = 23025.
SUM OBS TOTAL = 24114.
SUM CAL SRINT = 18887.
SUM OBS SR = 20177.
SUM CAL BF = 4137.
SUM OBS BF = 3937.

PACK ON DECEMBER 31 = 0.26 CHANGE IN SNOW STORAGE = 0.26

AVERAGE MONTHLY BASE FLOW
34.11092.02015.01260.02108.03000.0 651.0 173.6 39.0 235.6 570.0 496.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
106	295	49

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1949

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.33	1.16	1.69	3.45	5.16	6.90	2.95	3.62	0.42	1.98	0.07	0.11	27.85
CALCULATED TOTAL RUNOFF	392.	543.	695.	1379.	5937.	8601.	3391.	2893.	1268.	3077.	748.	567.	29491.
OBSERVED TOTAL RUNOFF	37.	6127.	2325.	1554.	3496.	12838.	1929.	809.	97.	504.	569.	521.	30807.
CALCULATED SURFACE RUNOFF	64.	316.	486.	1165.	5614.	8123.	2846.	2177.	398.	2336.	12.	8.	23544.
OBSERVED SURFACE RUNOFF	3.	5035.	310.	294.	1388.	9838.	1278.	635.	58.	269.	-1.	25.	19132.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	328.	227.	209.	214.	323.	478.	545.	717.	870.	741.	737.	560.	5948.
OBSERVED BASEFLOW	34.	1092.	2015.	1260.	2108.	3000.	651.	174.	39.	236.	570.	496.	11674.
ETP	0.0	0.509	2.677	3.584	5.333	6.288	6.642	5.547	4.588	3.011	1.903	1.017	41.100
UETA	0.0	0.110	0.757	1.452	2.479	2.853	2.269	2.102	1.344	0.921	0.240	0.109	14.636
LETA	0.0	0.0	0.0	0.121	1.217	1.536	1.222	1.132	0.724	0.408	0.0	0.0	6.360
ETA	0.139	0.393	0.788	1.805	3.696	4.390	3.490	3.233	2.068	1.329	0.240	0.109	21.680
PER-COLATION	0.0	0.497	0.576	1.394	2.285	3.285	0.314	0.691	0.000	0.190	0.0	0.0	9.231
UZS	3.896	4.258	4.331	4.402	4.370	4.205	3.781	3.837	3.546	3.702	3.535	3.435	3.939
LZSA	7.800	7.915	8.407	9.789	10.962	12.882	12.547	11.684	11.198	10.735	10.671	10.671	10.452
LZST	7.800	7.915	8.407	9.789	10.962	12.882	12.547	11.684	11.198	10.735	10.671	10.671	10.452
GWS	2.047	2.034	2.026	2.020	2.051	2.144	2.176	2.162	2.148	2.134	2.108	2.079	2.094
TEMP.	18.3	29.9	39.5	51.9	63.5	71.9	78.0	74.3	64.3	54.2	47.3	32.4	52.2
CORRELATION COEF-FICIENTS	0.620	0.659	0.692	0.537	0.670	0.494	0.744	0.690	0.521	0.657	0.970	0.983	0.688

DELTA STORAGE = 5.112 INCHES
AAIA = 3.158
POND STORAGE = 0.0

TOTAL CHANGE = 1.954

SUM CAL TOTAL = 52516.
SUM OBS TOTAL = 54920.
SUM CAL SRINT = 42431.
SUM OBS SR = 39309.
SUM CAL BF = 10085.
SUM OBS BF = 15611.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE =-0.26

AVERAGE MONTHLY BASE FLOW
372.01008.01023.0 600.0 465.0 105.01395.03410.01530.0 744.0 690.0 713.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
120	306	50

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1950

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.12	1.20	0.63	1.25	3.12	1.83	7.43	6.76	0.44	0.55	0.07	0.02	23.42
CALCULATED TOTAL RUNOFF	414.	452.	378.	467.	1720.	1647.	30767.	21070.	3702.	2596.	1947.	1476.	66635.
OBSERVED TOTAL RUNOFF	371.	1027.	1041.	721.	599.	449.	21805.	31911.	2063.	952.	710.	725.	62374.
CALCULATED SURFACE RUNOFF	5.	176.	150.	288.	1491.	1440.	30452.	17864.	238.	225.	3.	0.	52333.
OBSERVED SURFACE RUNOFF	-1.	19.	18.	121.	134.	344.	20410.	28501.	533.	208.	20.	12.	50319.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	409.	276.	227.	180.	229.	207.	315.	3206.	3463.	2371.	1943.	1476.	14303.
OBSERVED BASEFLOW	372.	1008.	1023.	600.	465.	105.	1395.	3410.	1530.	744.	690.	713.	12055.
ETP	0.795	1.558	2.302	3.878	5.046	6.390	6.258	5.308	4.622	3.284	1.589	1.099	42.130
UETA	0.024	0.282	0.666	1.205	1.840	2.326	2.473	2.410	1.393	0.711	0.199	0.063	13.593
LETA	0.0	0.0	0.0	0.0	0.602	1.289	1.361	1.298	0.750	0.399	0.014	0.0	5.713
ETA	0.041	0.282	0.793	1.205	2.442	3.615	3.834	3.708	2.143	1.109	0.213	0.063	19.448
PER-COLATION	0.0	0.027	0.016	0.057	0.283	0.011	2.231	2.768	0.0	0.0	0.0	0.0	5.392
UZS	3.403	3.820	4.028	3.898	3.913	3.587	3.974	4.273	3.679	3.237	2.830	2.742	3.615
LZSA	10.671	10.675	10.705	10.743	10.622	9.808	9.264	11.080	11.099	10.532	10.350	10.350	10.490
LZST	10.671	10.675	10.705	10.743	10.622	9.808	9.264	11.080	11.099	10.532	10.350	10.350	10.490
GWS	2.058	2.043	2.032	2.024	2.019	2.019	2.113	2.558	2.508	2.387	2.285	2.209	2.189
TEMP.	27.3	36.8	38.2	48.4	59.3	73.3	72.7	70.6	64.9	59.8	38.9	34.5	52.1
CORRELATION COEF-FICIENTS	0.903	0.668	0.638	0.599	0.510	0.[illegible]	0.582	0.659	0.887	0.715	0.936	0.717	0.687

```
 DELTA STORAGE  =      1.586  INCHES
 AAIA  =               2.658
 POND STORAGE  =       0.0


 TOTAL CHANGE  =      -1.072


    SUM CAL TOTAL =          119151.
    SUM OBS TOTAL =          117295.
    SUM CAL SRINT =           94764.
    SUM OBS SR =              89629.
    SUM CAL BF =              24388.
    SUM OBS BF =              27666.


    PACK ON DECEMBER 31 = 0.0          CHANGE IN SNOW STORAGE = 0.0

 AVERAGE MONTHLY BASE FLOW
868.0 952.01240.0117C.01612.04800.06820.03410.02760.02294.02250.01085.0

    LEAP YEAR INDICATOR= 0     YES=1 & NO=0

    ITHAW   IFREZ                                                YEAR
     122     283                                                  51

                              RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

          JAN.    FEB.    MAR.    APR.    MAY.    JUN.    JUL.    AUG.    SEP.    OCT.    NOV.    DEC.    TOTAL
          0.0     0.0     0.0     0.0     0.0     1.915   3.935   0.0     0.0     0.0     0.0     0.0     5.850
```

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1951

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.29	0.93	0.78	2.58	6.00	9.56	7.51	2.75	3.42	0.70	0.18	0.10	34.79
CALCULATED TOTAL RUNOFF	1087.	774.	795.	1756.	18678.	26098.	56869.	38848.	28786.	19007.	13379.	10160.	216237.
OBSERVED TOTAL RUNOFF	892.	976.	1249.	1503.	17401.	53000.	79382.	9426.	11537.	2494.	2386.	1452.	181698.
CALCULATED SURFACE RUNOFF	8.	64.	220.	1370.	17992.	20883.	23583.	3381.	3202.	139.	4.	1.	70848.
OBSERVED SURFACE RUNOFF	24.	24.	9.	333.	15789.	48200.	72562.	6016.	8777.	200.	136.	367.	152437.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	228.	2887.	2822.	1960.	849.	562.	427.	9734.
CALCULATED BASEFLOW	1079.	710.	575.	386.	686.	4987.	30398.	32645.	23625.	18019.	12813.	9732.	135655.
OBSERVED BASEFLOW	868.	952.	1240.	1170.	1612.	4800.	6820.	3410.	2760.	2294.	2250.	1085.	29261.
ETP	0.458	1.240	2.453	3.869	5.235	5.774	6.353	5.626	4.494	2.938	1.491	0.666	40.598
UETA	0.025	0.185	0.440	1.139	2.038	2.886	2.728	2.154	1.800	0.847	0.255	0.058	14.554
LETA	0.0	0.0	0.0	0.0	0.652	1.554	1.469	1.160	0.969	0.196	0.0	0.0	6.000
ETA	0.206	0.264	0.491	1.139	2.690	4.440	4.197	3.313	2.769	1.043	0.277	0.116	20.945
PER-COLATION	0.0	0.0	0.0	0.542	2.161	4.591	3.669	0.604	0.978	0.0	0.0	0.0	12.546
UZS	2.804	2.960	3.240	3.837	4.027	4.449	4.297	3.966	4.044	3.287	3.154	3.021	3.593
LZSA	10.350	10.350	10.350	10.558	11.507	13.447	12.585	11.583	11.512	11.072	11.046	11.046	11.288
LZST	10.350	10.350	10.350	10.558	11.507	13.975	16.809	16.901	16.553	15.975	15.909	15.880	13.782
GWS	2.153	2.114	2.086	2.068	2.145	2.979	6.456	6.637	5.468	4.558	3.880	3.382	3.674
TEMP.	27.3	35.4	36.1	48.3	62.1	64.9	74.0	75.6	62.8	52.6	37.5	27.5	50.4
CORRELATION COEF-FICIENTS	0.803	0.687	0.828	0.711	0.634	0.627	0.502	0.535	0.546	0.974	0.954	0.836	0.724

```
DELTA STORAGE  =      6.117  INCHES
AAIA  =               3.860
POND STORAGE  =       0.0


TOTAL CHANGE  =       2.258


  SUM CAL TOTAL =          335388.
  SUM OBS TOTAL =          298993.
  SUM CAL SRINT =          175346.
  SUM OBS SR =             242066.
  SUM CAL BF =             160042.
  SUM OBS BF =              56927.


  PACK ON DECEMBER 31 = 0.0          CHANGE IN SNOW STORAGE = 0.0

AVERAGE MONTHLY BASE FLOW
```

550.01595.01550.024CC.02325.0 330.0 55.8 34.1 0.0 1.6 45.0 155.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
132	280	52

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1952

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.10	0.20	1.75	3.10	2.76	0.37	2.59	2.92	0.75	0.03	0.07	0.85	15.47
CALCULATED TOTAL RUNOFF	7428.	5131.	4042.	3237.	5285.	2870.	2766.	2109.	1675.	1158.	823.	709.	37232.
OBSERVED TOTAL RUNOFF	1860.	1885.	3100.	4200.	4656.	488.	110.	117.	28.	2.	50.	255.	16751.
CALCULATED SURFACE RUNOFF	0.	2.	323.	722.	3012.	238.	849.	858.	341.	0.	0.	84.	6430.
OBSERVED SURFACE RUNOFF	310.	290.	1550.	1800.	2331.	158.	54.	83.	28.	0.	5.	100.	6710.
CALCULATED INTER-FLOW	312.	216.	232.	997.	1963.	521.	0.	0.	0.	0.	0.	0.	4241.
CALCULATED BASEFLOW	7115.	4914.	3486.	1518.	310.	2111.	1917.	1250.	1334.	1158.	823.	625.	26561.
OBSERVED BASEFLOW	1550.	1595.	1550.	2400.	2325.	330.	56.	34.	0.	2.	45.	155.	10041.
ETP	0.955	1.537	0.804	3.630	5.155	6.844	6.458	5.754	4.887	2.948	1.402	0.268	40.641
UETA	0.036	0.119	0.170	1.247	2.163	2.199	1.391	1.458	1.110	0.250	0.044	0.031	10.218
LETA	0.0	0.0	0.0	0.0	0.307	1.330	1.151	1.072	0.693	0.059	0.0	0.0	4.622
ETA	0.069	0.141	0.835	1.378	2.470	3.529	2.542	2.530	1.803	0.318	0.059	0.297	15.972
PER-COLATION	0.0	0.0	0.362	0.855	0.482	0.0	0.0	0.006	0.022	0.0	0.0	0.0	1.727
UZS	2.978	2.934	3.580	4.051	4.003	2.922	2.446	2.431	2.760	2.229	2.087	2.541	2.913
LZSA	11.046	11.046	11.094	11.665	12.477	11.765	10.476	9.407	8.523	8.157	8.152	8.152	10.163
LZST	15.858	15.843	15.879	16.368	16.899	15.955	14.649	13.580	12.696	12.329	12.324	12.324	14.554
GWS	3.010	2.746	2.553	2.444	2.455	2.439	2.338	2.271	2.223	2.164	2.121	2.089	2.403
TEMP.	32.4	36.1	34.1	49.2	60.9	79.5	87.6	77.5	69.1	52.9	36.9	29.6	53.9
CORRELATION COEF-FICIENTS	0.993	0.994	0.983	0.835	0.666	0.600	0.454	0.286	0.568	0.322	0.470	0.662	0.652

DELTA STORAGE = -1.829 INCHES
AAIA = 3.533
POND STORAGE = 0.0

TOTAL CHANGE = -5.362

SUM CAL TOTAL = 372620.
SUM OBS TOTAL = 315744.
SUM CAL SRINT = 186017.
SUM OBS SR = 248776.
SUM CAL BF = 185603.
SUM OBS BF = 66968.

PACK ON DECEMBER 31 = 0.47 CHANGE IN SNOW STORAGE = 0.47

AVERAGE MONTHLY BASE FLOW
372.0 588.0 930.0 810.0 527.0 6.0 99.2 89.9 3.0 4.7 156.0 310.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
134	303	53

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1953

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.33	0.19	1.63	2.29	2.50	2.61	3.43	3.43	0.44	1.21	1.79	1.05	20.91
CALCULATED TOTAL RUNOFF	492.	317.	780.	830.	1621.	2030.	4019.	4731.	824.	824.	451.	575.	17493.
OBSERVED TOTAL RUNOFF	771.	673.	1125.	999.	635.	317.	2267.	1315.	7.	5.	162.	351.	8627.
CALCULATED SURFACE RUNOFF	35.	11.	513.	610.	1381.	1806.	3695.	4268.	304.	404.	127.	319.	13471.
OBSERVED SURFACE RUNOFF	399.	85.	195.	189.	108.	311.	2167.	1225.	4.	0.	6.	41.	4731.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	457.	306.	268.	220.	240.	224.	324.	463.	520.	420.	324.	256.	4022.
OBSERVED BASEFLOW	372.	588.	930.	810.	527.	6.	99.	90.	3.	5.	156.	310.	3896.
ETP	0.931	1.509	2.535	3.822	5.092	6.667	6.584	5.590	4.906	3.239	1.267	0.118	42.259
UETA	0.021	0.134	0.451	1.148	1.719	2.469	2.046	2.143	1.188	0.663	0.276	0.051	12.309
LETA	0.0	0.0	0.0	0.0	0.194	1.082	0.814	0.779	0.165	0.074	0.0	0.0	3.107
ETA	0.151	0.134	0.652	1.148	1.913	3.551	2.859	2.922	1.353	0.737	0.464	0.393.	16.276
PER-COLATION	0.0	0.0	0.195	0.156	0.301	0.220	0.725	0.685	0.340	0.0	0.086	0.707	3.115
UZS	2.908	2.934	3.141	3.652	3.920	3.429	3.704	3.984	3.212	2.782	3.919	4.431	3.506
LZSA	8.152	8.152	8.264	8.397	8.606	8.190	7.848	7.900	7.800	7.800	7.833	8.297	8.103
LZST	12.324	12.324	12.437	12.570	12.778	12.323	11.510	11.195	10.481	9.991	9.839	10.304	11.502
GWS	2.065	2.048	2.037	2.028	2.023	2.023	2.045	2.092	2.083	2.062	2.048	2.035	2.049
TEMP.	37.9	36.1	44.0	47.5	60.0	77.1	77.2	75.0	69.4	58.8	41.6	29.8	54.6
CORRELATION COEF-FICIENTS	0.652	0.847	0.451	0.497	0.729	0.5[illegible]	0.498	0.494	0.628	0.470	0.522	0.431	0.565

DELTA STORAGE = 4.010 INCHES
AAIA = 3.052
POND STORAGE = 0.0

TOTAL CHANGE = 0.958

SUM CAL TOTAL = 390113.
SUM OBS TOTAL = 324371.
SUM CAL SRINT = 199488.
SUM OBS SR = 253507.
SUM CAL BF = 190625.
SUM OBS BF = 70864.

PACK ON DECEMBER 31 = 0.08 CHANGE IN SNOW STORAGE =-0.39

AVERAGE MONTHLY BASE FLOW
248.0 812.0 744.0 510.01085.0 870.0 24.8 1.6 0.0 6.2 16.5 15.5

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
123	294	54

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1954

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.14	0.48	0.76	0.78	5.60	2.36	1.39	2.67	0.62	1.52	0.02	0.06	16.39
CALCULATED TOTAL RUNOFF	233.	201.	203.	392.	6506.	4885.	1116.	1898.	675.	762.	284.	219.	17374.
OBSERVED TOTAL RUNOFF	380.	1021.	789.	744.	5110.	5516.	48.	134.	0.	6.	18.	23.	13790.
CALCULATED SURFACE RUNOFF	51.	80.	103.	290.	6275.	4386.	425.	1406.	187.	385.	0.	4.	13591.
OBSERVED SURFACE RUNOFF	132.	209.	45.	234.	4025.	4646.	23.	133.	0.	0.	1.	7.	9457.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	181.	121.	100.	102.	231.	499.	690.	492.	489.	378.	284.	216.	3783.
OBSERVED BASEFLOW	248.	812.	744.	510.	1085.	870.	25.	2.	0.	6.	17.	16.	4334.
ETP	0.901	1.865	2.535	4.397	4.904	6.560	6.982	5.807	5.109	2.991	1.819	1.048	44.920
UETA	0.028	0.361	0.594	1.127	2.139	2.567	1.682	1.696	0.659	0.598	0.078	0.085	11.613
LETA	0.0	0.0	0.0	0.0	0.616	1.392	1.218	0.468	0.156	0.111	0.0	0.0	3.962
ETA	0.028	0.361	0.594	1.127	2.755	3.959	2.900	2.164	0.815	0.709	0.078	0.109	15.599
PER-COLATION	0.144	0.042	0.047	0.012	1.952	0.481	0.0	0.078	0.0	0.062	0.0	0.0	2.820
UZS	4.129	4.092	4.020	3.719	4.231	3.772	2.478	2.772	2.432	2.747	2.693	2.622	3.304
LZSA	8.721	8.751	8.791	8.830	9.394	9.808	8.647	7.824	7.800	7.802	7.800	7.800	8.495
LZST	10.728	10.757	10.797	10.836	11.400	11.814	10.653	9.531	8.633	8.130	8.057	8.057	9.944
GWS	2.026	2.019	2.014	2.010	2.032	2.110	2.109	2.092	2.074	2.056	2.042	2.031	2.051
TEMP.	28.2	44.9	37.5	56.4	57.3	75.6	82.7	78.3	72.7	53.7	44.8	34.7	55.6
CORRELATION COEF-FICIENTS	0.779	0.742	0.711	0.874	0.761	0.47[illegible]	0.616	0.308	0.293	0.282	0.910	0.677	0.618

DELTA STORAGE = 0.169 INCHES
AAIA = 2.943
POND STORAGE = 0.0

TOTAL CHANGE = -2.775

SUM CAL TOTAL = 407488.
SUM OBS TOTAL = 338162.
SUM CAL SRINF = 213079.
SUM OBS SR = 262964.
SUM CAL BF = 194408.
SUM OBS BF = 75198.

PACK ON DECEMBER 31 = 0.20 CHANGE IN SNOW STORAGE = 0.12

AVERAGE MONTHLY BASE FLOW
18.6 148.4 291.4 294.0 9.3 9.0 0.0 0.0 0.0 6.2 9.0 77.5

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
110	298	55

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1955

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.49	0.59	0.48	1.27	2.75	3.75	1.43	1.47	3.83	0.19	0.05	0.18	16.48
CALCULATED TOTAL RUNOFF	162.	145.	117.	438.	1122.	3750.	1409.	1229.	2039.	315.	191.	186.	11103.
OBSERVED TOTAL RUNOFF	32.	325.	512.	427.	74.	686.	1.	6.	2176.	147.	10.	85.	4481.
CALCULATED SURFACE RUNOFF	5.	39.	31.	348.	999.	3498.	1116.	957.	1795.	48.	2.	42.	8877.
OBSERVED SURFACE RUNOFF	13.	176.	221.	133.	65.	677.	1.	6.	2176.	140.	1.	7.	3617.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	158.	106.	87.	91.	123.	252.	293.	273.	244.	267.	190.	144.	2227.
OBSERVED BASEFLOW	19.	148.	291.	294.	9.	9.	0.	0.	0.	6.	9.	78.	863.
ETP	0.199	0.635	2.353	4.375	5.391	6.028	6.949	5.878	4.870	3.142	1.466	0.490	41.775
UETA	0.013	0.109	0.225	1.080	1.381	2.241	2.021	1.334	0.867	0.802	0.189	0.042	10.306
LETA	0.0	0.0	0.0	0.040	0.457	0.757	0.053	0.000	0.217	0.310	0.0	0.0	1.836
ETA	0.317	0.255	0.324	1.120	1.839	2.998	2.074	1.335	1.085	1.112	0.189	0.190	12.838
PER-COLATION	0.017	0.106	0.057	0.114	0.152	0.758	0.053	0.000	0.527	0.0	0.0	0.0	1.784
UZS	2.671	2.953	2.925	2.895	2.826	3.605	3.100	2.652	2.663	3.685	3.294	3.276	3.045
LZSA	7.801	7.880	7.940	8.054	7.862	7.916	7.800	7.800	7.872	7.866	7.800	7.800	7.869
LZST	8.058	8.137	8.197	8.311	8.011	7.916	7.800	7.800	7.872	7.866	7.800	7.800	7.962
GWS	2.022	2.017	2.012	2.009	2.007	2.028	2.042	2.038	2.032	2.038	2.028	2.020	2.024
TEMP.	27.7	26.8	39.0	56.1	64.3	68.4	82.2	79.4	68.8	56.9	36.8	28.8	53.1
CORRELATION COEF-FICIENTS	0.829	0.494	0.948	0.643	0.716	0.814	.073	0.224	0.940	0.655	0.128	0.787	0.605

DELTA STORAGE = 3.244 INCHES
AAIA = 3.248
POND STORAGE = 0.0

TOTAL CHANGE = -0.004

SUM CAL TOTAL = 418591.
SUM OBS TOTAL = 342642.
SUM CAL SRINT = 221956.
SUM OBS SR = 266581.
SUM CAL BF = 196635.
SUM OBS BF = 76061.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.21

AVERAGE MONTHLY BASE FLOW
217.0 234.9 589.0 330.0 148.8 3.0 4.7 1.6 0.0 0.0 0.0 0.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
118	306	56

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1956

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.16	0.53	0.34	1.00	1.55	1.61	3.00	2.07	0.10	0.96	0.11	0.06	11.50
CALCULATED TOTAL RUNOFF	111.	110.	86.	644.	786.	592.	3327.	1025.	159.	258.	123.	56.	7278.
OBSERVED TOTAL RUNOFF	226.	368.	627.	450.	371.	363.	2306.	155.	0.	0.	0.	0.	4868.
CALCULATED SURFACE RUNOFF	5.	37.	29.	550.	700.	475.	3065.	795.	12.	133.	47.	0.	5849.
OBSERVED SURFACE RUNOFF	9.	133.	38.	120.	222.	360.	2301.	154.	0.	0.	0.	0.	3339.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	105.	73.	57.	94.	86.	117.	262.	230.	147.	125.	76.	58.	1429.
OBSERVED BASEFLOW	217.	235.	589.	330.	149.	3.	5.	2.	0.	0.	0.	0.	1529.
ETP	0.634	0.401	2.604	3.833	5.498	6.768	6.619	5.752	4.945	3.293	1.645	1.111	43.103
UETA	0.034	0.007	0.367	0.957	1.360	1.880	1.880	1.416	0.564	0.434	0.150	0.075	9.123
LETA	0.0	0.0	0.0	0.002	0.179	0.0	0.086	0.020	0.0	0.0	0.0	0.0	0.287
ETA	0.127	0.342	0.446	0.959	1.539	1.880	1.966	1.436	0.564	0.434	0.150	0.075	9.919
PER-COLATION	0.0	0.012	0.001	0.168	0.0	0.0	0.086	0.020	0.0	0.0	0.0	0.0	0.287
UZS	3.345	3.655	3.840	3.763	3.055	2.667	3.195	2.964	2.547	2.257	2.403	2.330	3.000
LZSA	7.800	7.803	7.813	7.967	7.857	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.820
LZST	7.800	7.803	7.813	7.967	7.857	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.820
GWS	2.015	2.011	2.008	2.008	2.006	2.007	2.028	2.028	2.022	2.016	2.011	2.008	2.014
TEMP.	28.1	29.2	41.9	47.7	65.8	78.5	77.7	77.5	70.1	60.0	39.7	35.7	54.4
CORRELATION COEF-FICIENTS	0.757	0.592	0.662	0.437	0.468	0.148	0.560	0.411	1.000	1.000	1.000	0.871	0.668

DELTA STORAGE = 1.318 INCHES
AATA = 2.888
POND STORAGE = 0.0

TOTAL CHANGE = -1.570

SUM CAL TOTAL = 425869.
SUM OBS TOTAL = 347510.
SUM CAL SRINT = 227805.
SUM OBS SR = 269920.
SUM CAL BF = 198064.
SUM OBS BF = 77590.

PACK ON DECEMBER 31 =-0.01 CHANGE IN SNOW STORAGE =-0.01

AVERAGE MONTHLY BASE FLOW
1.6 5.6 9.3 450.01023.01890.01736.0 133.3 138.0 558.0 810.0 651.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
104	298	57

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1957

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.02	0.40	3.00	3.27	6.69	8.06	1.33	3.21	1.77	1.43	0.68	0.01	29.89
CALCULATED TOTAL RUNOFF	42.	37.	189.	2452.	8604.	24412.	5801.	4180.	4051.	2068.	1490.	1084.	54410.
OBSERVED TOTAL RUNOFF	2.	13.	105.	2253.	13469.	31743.	6602.	3589.	4873.	657.	833.	665.	64804.
CALCULATED SURFACE RUNOFF	0.	9.	157.	2276.	8208.	23971.	3699.	2224.	2584.	251.	63.	1.	43444.
OBSERVED SURFACE RUNOFF	1.	8.	95.	1803.	12446.	29853.	4866.	3456.	4735.	99.	23.	14.	57398.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	42.	28.	32.	176.	396.	441.	2101.	1956.	1468.	1817.	1426.	1083.	10967.
OBSERVED BASEFLOW	2.	6.	9.	450.	1023.	1890.	1736.	133.	138.	558.	810.	651.	7406.
ETP	0.293	1.324	1.883	3.759	5.002	6.050	6.782	5.756	4.560	2.997	1.304	1.228	40.938
UETA	0.031	0.033	0.392	1.316	2.286	2.894	2.452	1.778	1.476	0.880	0.254	0.062	13.874
LETA	0.0	0.0	0.0	0.132	1.156	1.658	1.320	1.021	0.797	0.414	0.0	0.0	6.399
ETA	0.135	0.117	0.740	1.501	3.442	4.453	3.772	2.799	2.273	1.294	0.368	0.082	20.975
PER-COLATION	0.0	0.0	0.059	1.542	2.783	3.144	0.375	0.113	0.299	0.007	0.024	0.000	8.347
UZS	2.265	2.290	2.463	4.343	4.352	4.396	3.744	2.950	3.806	3.674	3.807	3.974	3.509
LZSA	7.800	7.800	7.802	9.122	10.178	11.614	12.108	11.027	10.380	9.889	9.728	9.748	9.778
LZST	7.800	7.800	7.802	9.122	10.178	11.614	12.108	11.027	10.380	9.889	9.728	9.748	9.778
GWS	2.006	2.004	2.003	2.012	2.074	2.289	2.463	2.374	2.352	2.281	2.209	2.154	2.186
TEMP.	21.2	37.0	38.2	48.3	58.7	68.7	79.9	77.6	63.9	53.8	37.7	37.8	52.0
CORRELATION COEF-FICIENTS	0.318	0.583	0.685	0.780	0.710	0.879	0.[illegible]	0.647	0.848	0.954	0.985	0.976	0.748

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DELTA STORAGE  =      6.962  INCHES
AAIA           =      3.367
POND STORAGE   =      0.0

TOTAL CHANGE   =      2.994


SUM CAL TOTAL =          480279.
SUM OBS TOTAL =          412314.
SUM CAL SRINT =          271245.
SUM OBS SR    =          327313.
SUM CAL BF    =          209031.
SUM OBS BF    =           84996.

PACK ON DECEMBER 31 = 0.04          CHANGE IN SNOW STORAGE = 0.05

AVERAGE MONTHLY BASE FLOW
806.0 616.01519.027CC.02046.0 72C.01240.01054.0 660.0 496.0 780.0 868.0

LEAP YEAR INDICATOR= 0     YES=1 & NO=0

ITHAW   IFREZ                                                    YEAR
 115     274                                                      58

                    RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

        JAN.   FEB.   MAR.   APR.   MAY.   JUN.   JUL.   AUG.   SEP.   OCT.   NOV.   DEC.   TOTAL
        0.0    0.0    0.0    0.300  1.163  0.0    0.0    0.0    0.0    0.0    0.0    0.0    1.463
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SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1958

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.38	0.38	1.69	4.23	4.39	2.61	6.79	2.33	1.18	0.12	0.79	0.47	25.35
CALCULATED TOTAL RUNOFF	856.	621.	1164.	6209.	10123.	9455.	17292.	13784.	5534.	3465.	2474.	1915.	72892.
OBSERVED TOTAL RUNOFF	825.	644.	1860.	3473.	4184.	2408.	8396.	7232.	2369.	508.	825.	920.	33745.
CALCULATED SURFACE RUNOFF	64.	97.	735.	4769.	4107.	1562.	10775.	7943.	992.	6.	15.	47.	31113.
OBSERVED SURFACE RUNOFF	19.	28.	341.	773.	2138.	1688.	7156.	6179.	1709.	112.	45.	52.	20240.
CALCULATED INTER-FLOW	0.	0.	0.	48.	361.	49.	1.	0.	0.	0.	0.	0.	459.
CALCULATED BASEFLOW	792.	524.	429.	1392.	5655.	7843.	6516.	5841.	4542.	3459.	2459.	1868.	41320.
OBSERVED BASEFLOW	806.	616.	1519.	2700.	2046.	720.	1240.	1054.	660.	496.	780.	868.	13505.
ETP	0.736	0.710	0.0	3.228	5.369	6.213	6.334	5.647	4.882	3.099	1.281	0.848	38.407
UETA	0.040	0.111	0.0	1.143	2.292	2.435	2.694	2.177	1.580	0.497	0.100	0.115	13.183
LETA	0.0	0.0	0.0	0.011	0.921	1.311	1.450	1.172	0.861	0.016	0.0	0.0	5.743
ETA	0.174	0.221	0.742	1.434	3.213	3.746	4.144	3.350	2.440	0.513	0.243	0.158	20.378
PER-COLATION	0.056	0.181	1.258	3.091	1.472	0.145	1.953	0.746	0.106	0.0	0.0	0.0	9.008
UZS	3.986	4.158	4.249	4.297	4.165	3.671	4.138	4.004	3.445	2.663	2.559	3.138	3.705
LZSA	9.752	9.832	10.114	13.837	13.891	12.783	12.417	12.534	11.940	11.550	11.550	11.550	11.821
LZST	9.752	9.832	10.114	14.022	14.819	14.246	13.881	13.998	13.404	13.013	13.013	13.013	12.773
GWS	2.112	2.083	2.063	2.281	2.941	3.151	2.931	2.834	2.667	2.491	2.361	2.265	2.517
TEMP.	31.9	28.9	25.7	48.0	64.0	70.9	73.7	75.9	69.1	56.0	40.8	31.1	51.4
CORRELATION COEF-FICIENTS	0.870	0.810	0.628	0.582	0.783	0.645	0.568	0.390	0.573	0.584	0.966	0.918	0.693

DELTA STORAGE = 2.367 INCHES
AAIA = 2.470
ROND STORAGE = 0.0

TOTAL CHANGE = -0.103

SUM CAL TOTAL = 553171.
SUM OBS TOTAL = 446059.
SUM CAL SRINT = 302820.
SUM OBS SR = 347558.
SUM CAL BF = 250351.
SUM OBS BF = 98501.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.05

AVERAGE MONTHLY BASE FLOW
558.01260.01209.01350.0 930.0 450.0 62.0 12.4 6.0 589.0 720.0 868.0

LEAP YEAR INDICATOR= 0 YES=1 NO=0

ITHAW	IFREZ	YEAR
112	284	59

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1952

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.39	0.65	2.62	1.19	2.35	2.82	3.20	3.71	3.75	3.19	0.05	0.21	24.13
CALCULATED TOTAL RUNOFF	1377.	1010.	1292.	923.	1463.	3638.	2353.	3013.	2736.	2600.	668.	456.	21728.
OBSERVED TOTAL RUNOFF	569.	1354.	1509.	1387.	1184.	1619.	263.	325.	202.	2175.	771.	876.	12233.
CALCULATED SURFACE RUNOFF	11.	155.	619.	364.	1047.	3163.	1946.	2654.	2303.	2225.	123.	24.	14632.
OBSERVED SURFACE RUNOFF	11.	94.	300.	37.	254.	1169.	201.	313.	196.	1585.	51.	8.	4213.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	1366.	856.	673.	559.	415.	475.	407.	360.	433.	576.	545.	432.	7096.
OBSERVED BASEFLOW	558.	1260.	1209.	1350.	930.	450.	62.	12.	6.	589.	720.	868.	8014.
ETP	0.470	0.827	2.758	3.999	5.231	6.517	6.426	5.875	4.551	2.820	1.406	1.157	42.037
UETA	0.076	0.135	0.723	1.399	1.814	2.365	2.107	2.082	1.595	1.076	0.283	0.220	13.874
LETA	0.0	0.0	0.0	0.030	0.829	1.367	1.198	1.152	0.866	0.266	0.0	0.0	5.708
ETA	0.210	0.252	0.723	1.429	2.643	3.732	3.304	3.234	2.461	1.342	0.283	0.220	19.833
PER-COLATION	0.0	0.043	0.747	0.052	0.303	0.688	0.108	0.391	0.810	1.754	0.002	0.0	4.899
UZS	3.199	3.502	3.847	3.951	3.734	3.393	3.015	3.534	3.654	4.147	4.236	4.092	3.692
LZSA	11.550	11.563	11.791	12.367	12.234	11.744	10.554	9.688	8.999	10.526	10.740	10.740	11.033
LZST	13.013	13.026	13.255	13.830	13.698	13.208	12.018	11.152	10.463	11.989	12.204	12.204	12.501
GWS	2.194	2.145	2.111	2.087	2.071	2.090	2.080	2.088	2.082	2.104	2.083	2.061	2.099
TEMP.	25.8	29.1	39.7	50.3	62.0	75.0	75.0	79.4	63.7	50.3	36.0	35.0	51.9
CORRELATION COEF-FICIENTS	0.780	0.763	0.422	0.843	0.824	0.666	.615	0.374	0.761	0.[illegible]	0.794	0.971	0.748

DELTA STORAGE = 3.522 INCHES
AAIA = 3.748
POND STORAGE = 0.0

TOTAL CHANGE = -0.226

SUM CAL TOTAL = 574899.
SUM OBS TOTAL = 458292.
SUM CAL SRINT = 317452.
SUM OBS SR = 351776.
SUM CAL BF = 257447.
SUM OBS BF = 106515.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.00

AVERAGE MONTHLY BASE FLOW
589.01508.02170.03300.02697.01710.0 558.0 68.2 63.0 161.2 480.0 713.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
113	297	60

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.325	1.205	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.530

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1960

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.57	1.66	2.20	2.01	4.23	3.99	1.04	3.15	1.46	1.86	0.15	0.63	22.95
CALCULATED TOTAL RUNOFF	410.	920.	1147.	4605.	18085.	13985.	7338.	7313.	3640.	3027.	2190.	1707.	64369.
OBSERVED TOTAL RUNOFF	615.	1843.	9734.	3728.	10007.	4943.	622.	1741.	294.	245.	503.	719.	34993.
CALCULATED SURFACE RUNOFF	95.	676.	767.	3176.	7967.	4468.	642.	2403.	614.	402.	34.	69.	21312.
OBSERVED SURFACE RUNOFF	26.	335.	7564.	428.	7310.	3233.	64.	1672.	231.	84.	23.	6.	20976.
CALCULATED INTER-FLOW	0.	0.	144.	1129.	2204.	1073.	53.	0.	0.	0.	0.	0.	4604.
CALCULATED BASEFLOW	315.	244.	236.	300.	7914.	8444.	6643.	4911.	3026.	2625.	2157.	1638.	38453.
OBSERVED BASEFLOW	589.	1508.	2170.	3300.	2697.	1710.	558.	68.	63.	161.	480.	713.	14017.
ETP	0.415	0.171	0.582	4.244	5.105	6.148	6.457	5.690	4.833	3.128	1.685	0.545	39.002
UETA	0.129	0.041	0.105	1.498	2.276	2.719	1.961	1.590	1.159	0.654	0.305	0.124	12.560
LETA	0.0	0.0	0.0	0.032	1.000	1.464	1.165	1.081	0.755	0.370	0.0	0.0	5.867
ETA	0.236	0.302	0.791	1.530	3.276	4.182	3.126	2.670	1.914	1.024	0.305	0.288	19.644
PER-COLATION	0.054	1.516	1.672	0.478	1.722	0.837	0.035	0.111	0.054	0.103	0.000	0.057	6.639
UZS	4.138	4.525	4.537	4.020	4.265	3.984	2.992	2.934	2.921	3.291	3.641	3.703	3.743
LZSA	10.767	11.985	12.764	14.062	14.012	13.349	12.413	11.304	10.529	9.986	9.925	9.937	11.749
LZST	12.230	13.448	14.228	15.805	16.594	16.045	15.080	13.970	13.195	12.652	12.591	12.603	14.036
GWS	2.045	2.035	2.027	2.345	3.240	3.241	2.943	2.698	2.534	2.419	2.316	2.233	2.508
TEMP.	24.4	21.4	31.0	54.1	60.2	70.0	75.4	76.5	68.3	56.6	40.9	30.0	50.8
CORRELATION COEF-FICIENTS	0.599	0.597	0.690	0.642	0.525	0.531	0.915	0.419	0.564	0.658	0.903	0.886	0.661

DELTA STORAGE = 1.007 INCHES
AAIA = 2.907
POND STORAGE = 0.0

TOTAL CHANGE = -1.900

SUM CAL TOTAL = 639268.
SUM OBS TOTAL = 493285.
SUM CAL SRINT = 343368.
SUM OBS SR = 372752.
SUM CAL BF = 295899.
SUM OBS BF = 120533.

PACK ON DECEMBER 31 = 0.10 CHANGE IN SNOW STORAGE = 0.10

AVERAGE MONTHLY BASE FLOW
775.0 980.01054.01110.01674.02130.0 713.0 496.0 450.0 744.01140.01023.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
111	292	61

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.726	0.0	0.0	0.0	0.0	0.0	0.0	0.726

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1961

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.11	0.13	2.17	1.48	6.70	5.18	3.06	4.42	2.14	0.76	1.94	0.26	28.35
CALCULATED TOTAL RUNOFF	1199.	809.	1501.	1647.	8265.	16537.	7918.	10359.	4000.	2873.	3253.	1734.	60095.
OBSERVED TOTAL RUNOFF	792.	1001.	1145.	1385.	5954.	11571.	2110.	5168.	863.	795.	1207.	1047.	33038.
CALCULATED SURFACE RUNOFF	1.	7.	928.	1133.	7675.	9364.	2035.	6147.	1366.	224.	1498.	20.	30398.
OBSERVED SURFACE RUNOFF	17.	21.	91.	275.	4280.	9441.	1397.	4672.	413.	51.	67.	24.	20749.
CALCULATED INTER-FLOW	0.	0.	0.	0.	109.	2141.	578.	1.	0.	0.	0.	0.	2828.
CALCULATED BASEFLOW	1197.	802.	573.	514.	481.	5033.	5305.	4211.	2635.	2649.	1756.	1714.	26870.
OBSERVED BASEFLOW	775.	980.	1054.	1110.	1674.	2130.	713.	496.	450.	744.	1140.	1023.	12289.
ETP	1.018	1.367	2.820	2.996	4.979	6.208	6.560	5.584	4.435	2.988	1.359	0.355	40.669
UETA	0.029	0.069	0.799	1.018	2.298	2.759	2.268	2.078	1.331	0.771	0.377	0.063	13.860
LETA	0.0	0.0	0.0	0.037	1.039	1.485	1.248	1.132	0.722	0.301	0.0	0.0	5.965
ETA	0.029	0.101	0.799	1.388	3.337	4.244	3.516	3.210	2.053	1.072	0.447	0.222	20.419
PER-COLATION	0.001	0.009	0.707	0.454	2.850	2.687	0.376	0.757	0.317	0.046	0.857	0.018	9.079
UZS	3.928	3.914	3.984	4.038	4.290	4.132	3.978	3.603	3.777	3.670	3.874	4.038	3.859
LZSA	9.982	9.988	10.423	10.951	12.140	13.792	12.883	12.283	11.943	11.559	11.933	12.355	11.695
LZST	12.649	12.654	13.089	13.617	14.807	16.880	15.908	15.298	14.959	14.575	14.948	15.371	14.573
GWS	2.170	2.126	2.100	2.084	2.116	2.813	2.754	2.601	2.504	2.400	2.311	2.243	2.353
TEMP.	30.2	35.7	40.9	46.3	58.4	70.8	76.8	74.9	61.8	53.8	36.2	24.9	51.0
CORRELATION COEF-FICIENTS	0.897	0.894	0.717	0.498	0.805	0.654	0.686	0.549	0.708	0.869	0.598	0.891	0.730

DELTA STORAGE = 5.785 INCHES
AAIA = 3.657
POND STORAGE = 0.0

TOTAL CHANGE = 2.128

SUM CAL TOTAL = 699363.
SUM OBS TOTAL = 526323.
SUM CAL SRINT = 376594.
SUM OBS SR = 393501.
SUM CAL BF = 322769.
SUM OBS BF = 132822.

PACK ON DECEMBER 31 = 0.30 CHANGE IN SNOW STORAGE = 0.20

DAILY FLOW DURATION AND ERROR TABLE

FLOW INTERVAL	ACT.CASES	PCT.	CALC.CASES	PCT.	AVE.ERROR	AV.ABS.ERROR	STD.ERROR
0.0-	910.0	100.000	21.0	100.000	25.5	25.50	33.57
1.0-	164.0	81.545	120.0	99.574	34.1	34.11	48.61
1.8-	146.0	78.219	162.0	97.141	44.3	44.40	52.58
3.2-	163.0	75.259	280.0	93.855	58.5	59.00	67.92
5.6-	308.0	71.953	429.0	88.177	32.0	34.12	51.16
10.0-	418.0	65.707	486.0	79.477	31.9	37.05	51.98
17.8-	944.0	57.230	732.0	69.621	33.0	42.35	69.30
31.6-	777.0	38.086	687.0	54.776	40.6	60.45	96.11
56.2-	487.0	22.328	648.0	40.844	165.3	184.99	220.83
100.0-	302.0	12.452	517.0	27.702	138.6	186.15	275.88
177.8-	112.0	6.327	349.0	17.218	236.7	327.70	411.33
316.2-	77.0	4.056	245.0	10.140	332.6	468.15	573.83
562.3-	47.0	2.494	135.0	5.171	324.1	684.93	829.85
1000.0-	33.0	1.541	82.0	2.434	118.0	941.08	1358.99
1778.3-	20.0	0.872	25.0	0.771	-873.4	1578.16	1977.46
3162.3-	11.0	0.466	9.0	0.264	-2552.8	2552.82	705.84
5623.4-	5.0	0.243	4.0	0.081	-4276.1	4276.09	580.90
10000.0-	6.0	0.142	0.0	0.0	-7642.9	7642.91	4218.50
17782.7-	0.0	0.020	0.0	0.0			
31622.7-	1.0	0.020	0.0	0.0	-30667.4		
56234.0-	0.0	0.0	0.0	0.0			
99999.8-	0.0	0.0	0.0	0.0			
177827.4-	0.0	0.0	0.0	0.0			
316226.5-	0.0	0.0	0.0	0.0			
	4931.0		4931.0		160808.9	597691.94	11624.63

DELTA STORAGE = 40.303 INCHES
AAIA = 44.753
POND STORAGE = 0.0

TOTAL CHANGE = -4.449

TOTAL PRECIPITATION = 318.839

TOTAL IA 44.753
TOTAL SURFACE RUNOFF 16.715
TOTAL UETA 177.301
TOTAL PERC 78.450
CHANGE IN UZSM 1.205

CHECK BALANCE 318.425

RESULTS - MODEL B-TEN

```
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON.........JOB 398.........1 APR 77..RCL06598..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON.........JOB 398.........1 APR 77..RCL06598..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON.........JOB 398.........1 APR 77..RCL06598..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON.........JOB 398.........1 APR 77..RCL06598..ROGERS.......................START........
..KSU..REMOTE..COMPUTING..LABORATORY...SEATON.........JOB 398.........1 APR 77..RCL06598..ROGERS.......................START........

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COMPUTING MADE FUN
COMPUTER-GAME DAY
APRIL 2

THE GENERAL PUBLIC IS INVITED TO PLAY A VARIETY OF GAMES (STAR TREK, KINGDOM, ETC.) APRIL 2, 9:00 A.M. TO 3:00 P.M., IN FAIRCHILD 117 (MINI-LAB). THIS EVENT IS SPONSORED BY THE STUDENT CHAPTER OF ACM IN CONJUNCTION WITH THE COMPUTER SCIENCE DEPARTMENT AS A PART OF THE UNIVERSITY OPEN HOUSE.

```
          THE 6-HOUR INCREMENTAL VALUES OF THE UNIT HYDROGRAPH
 0.0100  0.0250  0.0650  0.0800  0.0850  0.0900  0.1000  0.0730  0.0650  0.0600
 0.0550  0.0500  0.0450  0.0400  0.0350  0.0300  0.0250  0.0230  0.0210  0.0210
&DATA
$B1=  30.500000     ,SM1=  5.5999994     ,IB1= 0.37399995     ,IM1= 0.10399997     ,UZSN=  4.5000000     ,UBP=  9.0000000     ,UMP=
  2.0000000     ,UZMX=  5.6999998     ,UZMN=  2.0000000     ,LZMX=  16.000000     ,LZMN=  7.7999992     ,ETBOM= 0.22999996     ,CX=
 0.85999998     ,YSTRT=  48.000000     ,IKR= 0.98999995     ,PCL= 0.34999996     ,RGWB=  6.0000000     ,RGWM=  2.0000000     ,GWSN=
  2.0000000     ,BK= 0.58999995     ,AGW= 0.79999995     ,PDY= 0.99999964E-01,TLL=  11.000000     ,LZSAN=  14.000000     ,LZSTN=
  14.000000     ,AREA=  1040.0000     ,UZSO=  3.0000000     ,LZSO=  9.3999996     ,GWSO=  2.0000000     ,YREND=  61.000000     ,GWRF=
  3.0000000     ,PORF= 0.83299994E-01,IIA= 0.20000000E-01,GWMN=  1.0000000     ,PTPOND= 0.0     ,ETR= 0.11000000E-01,FM=
 0.35999999E-01,POWER=  1.0000000     ,PWRE= 0.99999964E-01,QUANTY= 0.59999996     ,B=  1.2599993     ,C= 0.69999995     ,PONDOP=
 0.0     ,PONDAR= 0.0     ,ZZT=  1.0000000     ,MODEL=     3,WPCNT=  1.0999994     ,USOIL= 0.38999999     ,CSOIL=
 0.17659999     ,PCTIRR= 0.79999995
&END

 AVERAGE MONTHLY BASE FLOW
 18.6  72.5 527.0 300.0  58.9 870.01240.0 403.0  12.0   4.7 120.0 310.0

    LEAP YEAR INDICATOR= 1      YES=1 & NO=0

  ITHAW   IFREZ                                                 YEAR
   123     285                                                   43

                         RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

          JAN.     FEB.     MAR.     APR.     MAY.     JUN.     JUL.     AUG.     SEP.     OCT.     NOV.     DEC.     TOTAL
          0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
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SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1948

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.04	0.58	1.92	0.48	3.60	5.60	2.00	4.14	0.98	0.64	1.13	0.53	21.64
CALCULATED TOTAL RUNOFF	0.	8.	332.	56.	2434.	7244.	2265.	6982.	1349.	895.	1082.	506.	23151.
OBSERVED TOTAL RUNOFF	21.	423.	1409.	390.	2101.	13288.	2454.	3513.	40.	5.	131.	338.	24114.
CALCULATED SURFACE RUNOFF	0.	8.	292.	56.	2337.	6945.	1742.	6438.	464.	148.	546.	46.	19023.
OBSERVED SURFACE RUNOFF	2.	351.	882.	90.	2042.	12413.	1214.	3110.	28.	1.	11.	28.	20177.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	0.	0.	40.	0.	97.	298.	523.	544.	885.	746.	535.	460.	4129.
OBSERVED BASEFLOW	19.	73.	527.	300.	59.	870.	1240.	403.	12.	5.	120.	310.	3937.
ETP	0.887	0.776	1.337	4.549	5.315	6.210	6.537	5.709	5.012	3.045	1.100	0.708	41.184
UETA	0.168	0.111	0.380	1.267	1.834	2.800	2.278	2.320	1.415	0.737	0.245	0.108	13.662
LETA	0.0	0.0	0.0	0.0	0.520	1.508	1.227	1.249	0.720	0.0	0.0	0.0	5.224
ETA	0.179	0.292	0.731	1.267	2.354	4.308	3.505	3.569	2.135	0.737	0.442	0.220	19.741
PER-COLATION	0.0	0.0	0.254	0.0	0.532	1.666	0.091	1.016	0.066	0.0	0.0	0.002	3.627
UZS	2.880	2.970	3.709	3.801	3.618	4.166	3.908	4.195	3.635	2.974	3.137	3.871	3.574
LZSA	9.400	9.400	9.496	9.654	9.557	9.471	9.195	8.666	8.065	7.800	7.800	7.802	8.857
LZST	9.400	9.400	9.496	9.654	9.557	9.471	9.195	8.666	8.065	7.800	7.800	7.802	8.857
GWS	2.000	2.000	2.000	1.999	2.003	2.063	2.104	2.152	2.149	2.111	2.085	2.065	2.061
TEMP.	29.5	30.0	33.8	58.8	63.2	70.9	76.5	76.8	71.2	55.0	37.7	30.5	52.8
CORRELATION COEF-FICIENTS	1.000	0.640	0.552	0.418	0.807	0.605	0.470	0.607	0.818	0.591	0.294	0.917	0.645

DELTA STORAGE = 1.072 INCHES
AAIA = 2.613
POND STORAGE = 0.0

TOTAL CHANGE = -1.541

SUM CAL TOTAL = 23151.
SUM OBS TOTAL = 24114.
SUM CAL SRINT = 19023.
SUM OBS SR = 20177.
SUM CAL BF = 4129.
SUM OBS BF = 3937.

PACK ON DECEMBER 31 = 0.30 CHANGE IN SNOW STORAGE = 0.30

AVERAGE MONTHLY BASE FLOW
34.11092.02015.01260.02108.03000.0 651.0 173.6 39.0 235.6 570.0 496.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
106	295	49

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.005	0.0	0.0	0.0	0.0	0.0	0.0	0.005

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1949

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.34	1.32	1.65	3.45	5.16	6.90	2.95	3.62	0.42	2.18	0.08	0.13	28.20
CALCULATED TOTAL RUNOFF	412.	738.	700.	1376.	5920.	8606.	3395.	2900.	1285.	3709.	825.	624.	30489.
OBSERVED TOTAL RUNOFF	37.	6127.	2325.	1554.	3496.	12838.	1929.	809.	97.	504.	569.	521.	30807.
CALCULATED SURFACE RUNOFF	76.	485.	489.	1161.	5597.	8121.	2842.	2170.	398.	2932.	16.	10.	24298.
OBSERVED SURFACE RUNOFF	3.	5035.	310.	294.	1388.	9838.	1278.	635.	58.	269.	-1.	25.	19132.
CALCULATED INTERFLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	336.	252.	211.	215.	323.	485.	553.	730.	887.	777.	809.	614.	6191.
OBSERVED BASEFLOW	34.	1092.	2015.	1260.	2108.	3000.	651.	174.	39.	236.	570.	496.	11674.
ETP	0.0	0.342	2.677	3.584	5.333	6.288	6.642	5.547	4.588	3.011	1.903	1.017	40.933
UETA	0.0	0.089	0.804	1.476	2.481	2.856	2.271	2.105	1.348	0.940	0.244	0.110	14.724
LETA	0.0	0.0	0.0	0.126	1.218	1.538	1.223	1.133	0.726	0.416	0.0	0.0	6.380
ETA	0.139	0.437	0.835	1.833	3.700	4.394	3.495	3.239	2.073	1.356	0.244	0.110	21.853
PERCOLATION	0.004	0.903	0.545	1.370	2.280	3.283	0.313	0.685	0.000	0.240	0.0	0.0	9.622
UZS	4.117	4.380	4.317	4.405	4.370	4.205	3.779	3.834	3.543	3.788	3.634	3.550	3.991
LZSA	7.805	8.085	8.807	10.157	11.310	13.224	12.884	12.017	11.526	11.094	11.039	11.039	10.763
LZST	7.805	8.085	8.807	10.157	11.310	13.227	12.889	12.022	11.531	11.099	11.044	11.044	10.766
GWS	2.048	2.035	2.026	2.020	2.051	2.147	2.180	2.166	2.151	2.144	2.119	2.087	2.098
TEMP.	18.3	29.9	39.5	51.9	63.5	71.9	78.0	74.3	64.3	54.2	47.3	32.4	52.2
CORRELATION COEFFICIENTS	0.538	0.702	0.649	0.536	0.672	0.495	0.745	0.691	0.525	0.659	0.969	0.982	0.685

DELTA STORAGE = 5.255 INCHES
AAIA = 3.088
POND STORAGE = 0.0

TOTAL CHANGE = 2.166

SUM CAL TOTAL = 53640.
SUM OBS TOTAL = 54920.
SUM CAL SRINT = 43321.
SUM OBS SR = 39309.
SUM CAL BF = 10320.
SUM OBS BF = 15611.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE =-0.30

AVERAGE MONTHLY BASE FLOW
372.01008.01023.0 600.0 465.0 105.01395.03410.01530.0 744.0 690.0 713.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
120	306	50

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1950

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.13	1.29	0.63	1.25	3.12	1.83	7.43	6.76	0.44	0.61	0.08	0.03	23.58
CALCULATED TOTAL RUNOFF	456.	539.	448.	503.	1766.	1637.	30649.	21060.	3700.	2645.	1949.	1477.	66828.
OBSERVED TOTAL RUNOFF	371.	1027.	1041.	721.	599.	449.	21805.	31911.	2063.	952.	710.	725.	62374.
CALCULATED SURFACE RUNOFF	7.	239.	195.	306.	1529.	1421.	30333.	17855.	238.	272.	5.	0.	52400.
OBSERVED SURFACE RUNOFF	-1.	19.	18.	121.	134.	344.	20410.	28501.	533.	208.	20.	12.	50319.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	449.	300.	253.	197.	237.	216.	315.	3205.	3462.	2372.	1944.	1477.	14429.
OBSERVED BASEFLOW	372.	1008.	1023.	600.	465.	105.	1395.	3410.	1530.	744.	690.	713.	12055.
ETP	0.795	1.558	2.302	3.878	5.046	6.390	6.258	5.308	4.622	3.284	1.589	1.099	42.130
UETA	0.025	0.275	0.652	1.282	1.929	2.317	2.492	2.413	1.397	0.714	0.200	0.063	13.758
LETA	0.0	0.0	0.0	0.0	0.632	1.301	1.364	1.299	0.753	0.401	0.014	0.0	5.765
ETA	0.041	0.275	0.778	1.282	2.561	3.619	3.856	3.713	2.150	1.115	0.214	0.063	19.666
PER-COLATION	0.0	0.082	0.057	0.085	0.289	0.003	2.183	2.764	0.0	0.0	0.0	0.0	5.468
UZS	3.525	3.984	4.207	3.991	3.936	3.539	3.965	4.272	3.675	3.282	2.879	2.792	3.670
LZSA	11.039	11.066	11.144	11.225	11.098	10.266	9.678	11.479	11.495	10.925	10.743	10.742	10.907
LZST	11.044	11.071	11.149	11.230	11.103	10.271	9.683	11.484	11.500	10.930	10.748	10.748	10.912
GWS	2.064	2.048	2.036	2.026	2.021	2.021	2.114	2.558	2.508	2.387	2.285	2.210	2.191
TEMP.	27.3	36.8	38.2	48.4	59.3	73.3	72.7	70.6	64.9	59.8	38.9	34.5	52.1
CORRELATION COEFFICIENTS	0.932	0.653	0.611	0.606	0.518	0.442	0.587	0.659	0.887	0.774	0.935	0.716	0.691

DELTA STORAGE = 1.523 INCHES
AAIA = 2.647
POND STORAGE = 0.0

TOTAL CHANGE = -1.123

SUM CAL TOTAL = 120469.
SUM OBS TOTAL = 117295.
SUM CAL SRINT = 95720.
SUM OBS SR = 89629.
SLM CAL BF = 24748.
SLM OBS BF = 27666.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.0

AVERAGE MONTHLY BASE FLOW
868.0 952.01240.01170.01612.04800.06820.03410.02760.02294.02250.01085.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
122	283	51

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	2.456	3.933	0.0	0.0	0.0	0.0	0.0	6.389

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1951

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.32	1.01	0.77	2.58	6.00	9.56	7.51	2.75	3.42	0.77	0.20	0.10	34.99
CALCULATED TOTAL RUNOFF	1090.	795.	849.	1829.	18418.	28391.	60144.	41292.	30551.	20434.	14386.	10926.	229105.
OBSERVED TOTAL RUNOFF	892.	976.	1249.	1503.	17401.	53000.	79382.	9426.	11537.	2404.	2386.	1452.	181698.
CALCULATED SURFACE RUNOFF	11.	85.	280.	1438.	17734.	20820.	23464.	3325.	3144.	155.	4.	2.	70460.
OBSERVED SURFACE RUNOFF	24.	24.	9.	333.	15789.	49200.	72562.	6016.	8777.	200.	136.	367.	152437.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	490.	3570.	3307.	2324.	1140.	770.	585.	12185.
CALCULATED BASEFLOW	1080.	711.	569.	391.	684.	7081.	33110.	34661.	25083.	19139.	13613.	10339.	146459.
OBSERVED BASEFLOW	868.	952.	1240.	1170.	1612.	4800.	6820.	3410.	2760.	2294.	2250.	1085.	29261.
ETP	0.408	1.182	2.453	3.869	5.235	5.774	6.353	5.626	4.494	2.938	1.491	0.638	40.462
UETA	0.025	0.176	0.441	1.237	2.056	2.888	2.729	2.155	1.801	0.848	0.254	0.057	14.667
LETA	0.0	0.0	0.0	0.0	0.654	1.555	1.470	1.160	0.970	0.196	0.0	0.0	6.005
ETA	0.227	0.278	0.492	1.237	2.710	4.443	4.199	3.315	2.771	1.044	0.276	0.125	21.117
PER-COLATION	0.0	0.0	0.0	0.693	2.162	4.588	3.669	0.602	0.977	0.0	0.0	0.0	12.692
UZS	2.673	3.075	3.458	3.928	4.025	4.449	4.297	3.966	4.043	3.313	3.232	3.107	3.649
LZSA	10.742	10.742	10.742	11.059	12.046	13.671	12.582	11.579	11.506	11.066	11.040	11.040	11.487
LZST	10.748	10.748	10.748	11.064	12.051	14.513	17.291	17.255	16.809	16.165	16.048	15.982	14.141
GWS	2.153	2.114	2.087	2.069	2.146	3.261	6.841	6.923	5.662	4.717	3.997	3.468	3.802
TEMP.	27.3	35.4	36.1	48.3	62.1	64.9	74.0	75.6	62.8	52.6	37.5	27.5	50.4
CORRELATION COEF-FICIENTS	0.805	0.684	0.779	0.703	0.635	0.681	0.501	0.529	0.538	0.974	0.954	0.836	0.719

```
DELTA STORAGE  =      5.685  INCHES
AAIA  =               3.762
PCND STORAGE  =       0.0

TOTAL CHANGE  =       1.923


  SUM CAL TOTAL =          346573.
  SUM OBS TOTAL =          298993.
  SUM CAL SRINT =          178366.
  SUM OBS SR =             242066.
  SUM CAL BF =             171207.
  SUM OBS BF =              56927.

  PACK CN DECEMBER 31 = 0.0          CHANGE IN SNOW STORAGE = 0.0

AVERAGE MONTHLY BASE FLOW
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550.01595.01550.02400.02325.0 330.0 55.8 34.1 0.0 1.6 45.0 155.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
132	280	52

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1952

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.09	0.22	1.76	3.10	2.76	0.37	2.59	2.92	0.75	0.04	0.08	0.92	15.60
CALCULATED TOTAL RUNOFF	7987.	5517.	4800.	2774.	5801.	2955.	2877.	2176.	1753.	1228.	873.	775.	39518.
OBSERVED TOTAL RUNOFF	1860.	1885.	3100.	4200.	4656.	488.	110.	117.	28.	2.	50.	255.	16751.
CALCULATED SURFACE RUNOFF	0.	2.	343.	721.	2981.	235.	849.	858.	341.	0.	0.	112.	6441.
OBSERVED SURFACE RUNOFF	310.	290.	1550.	1800.	2331.	158.	54.	83.	28.	0.	5.	100.	6710.
CALCULATED INTER-FLOW	428.	295.	333.	1155.	2100.	589.	0.	0.	0.	0.	0.	0.	4900.
CALCULATED BASEFLOW	7559.	5220.	4124.	898.	721.	2131.	2029.	1318.	1412.	1228.	873.	663.	28177.
OBSERVED BASEFLOW	1550.	1595.	1550.	2400.	2325.	330.	56.	34.	0.	2.	45.	155.	10041.
ETP	0.916	1.537	0.804	3.630	5.155	6.844	6.458	5.754	4.887	2.948	1.402	0.134	40.468
UETA	0.032	0.120	0.177	1.271	2.164	2.198	1.391	1.458	1.110	0.250	0.044	0.027	10.242
LETA	0.0	0.0	0.0	0.0	0.308	1.331	1.151	1.072	0.694	0.069	0.0	0.0	4.624
ETA	0.081	0.142	0.842	1.402	2.472	3.529	2.542	2.530	1.804	0.319	0.059	0.344	16.065
PER-COLATION	0.0	0.0	0.442	0.874	0.482	0.0	0.0	0.006	0.022	0.0	0.0	0.0	1.826
UZS	3.069	3.032	3.677	4.074	4.002	2.920	2.446	2.431	2.760	2.229	2.087	2.603	2.943
LZSA	11.040	11.040	11.113	11.744	12.570	11.857	10.567	9.498	8.613	8.246	8.242	8.242	10.228
LZST	15.533	15.898	15.944	16.467	16.582	16.016	14.706	13.636	12.752	12.385	12.380	12.390	14.619
GWS	3.073	2.792	2.586	2.477	2.492	2.464	2.358	2.288	2.237	2.174	2.128	2.094	2.429
TEMP.	32.4	36.1	34.1	49.2	60.9	79.5	87.6	77.5	69.1	52.9	36.9	29.6	53.9
CORRELATION COEF-FICIENTS	0.993	0.994	0.992	0.609	0.657	0.596	0.448	0.275	0.543	0.322	0.470	0.653	0.628

DELTA STORAGE = -1.882 INCHES
AAIA = 3.510
POND STORAGE = 0.0

TOTAL CHANGE = -5.393

SUM CAL TOTAL = 389091.
SUM OBS TOTAL = 315744.
SUM CAL SRINT = 189707.
SUM OBS SR = 248776.
SUM CAL BF = 199384.
SUM OBS BF = 66968.

PACK ON DECEMBER 31 = 0.50 CHANGE IN SNOW STORAGE = 0.50

AVERAGE MONTHLY BASE FLOW
372.0 588.0 930.0 810.0 527.0 6.0 99.2 89.9 3.0 4.7 156.0 310.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
134	303	53

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1953

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.37	0.21	1.63	2.29	2.50	2.61	3.43	3.43	0.44	1.33	1.99	1.13	21.37
CALCULATED TOTAL RUNOFF	520.	349.	803.	864.	1615.	2021.	3974.	4740.	825.	920.	515.	630.	17775.
OBSERVED TOTAL RUNOFF	771.	673.	1125.	969.	635.	317.	2267.	1315.	7.	5.	162.	351.	8627.
CALCULATED SURFACE RUNOFF	35.	24.	523.	634.	1370.	1793.	3649.	4275.	304.	497.	183.	366.	13655.
OBSERVED SURFACE RUNOFF	399.	85.	195.	189.	108.	311.	2167.	1225.	4.	0.	6.	41.	4731.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	485.	325.	281.	229.	245.	228.	325.	464.	521.	422.	332.	264.	4121.
OBSERVED BASEFLOW	372.	583.	930.	810.	527.	6.	99.	90.	3.	5.	156.	310.	3896.
ETP	0.931	1.509	2.535	3.822	5.092	6.667	6.564	5.590	4.906	3.239	1.267	0.118	42.259
UETA	0.020	0.136	0.453	1.150	1.818	2.478	2.047	2.143	1.189	0.664	0.321	0.051	12.470
LETA	0.0	0.0	0.0	0.0	0.199	1.220	0.791	0.781	0.165	0.076	0.0	0.0	3.231
ETA	0.150	0.136	0.653	1.150	2.017	3.699	2.837	2.925	1.354	0.739	0.509	0.393	16.562
PER-COLATION	0.008	0.035	0.260	0.182	0.256	0.218	0.696	0.688	0.040	0.002	0.304	0.775	3.463
UZS	3.033	3.058	3.193	3.693	3.912	3.413	3.696	3.984	3.211	2.822	4.068	4.478	3.550
LZSA	8.245	8.259	8.452	8.608	8.805	8.326	7.844	7.901	7.800	7.800	7.906	8.571	8.210
LZST	12.383	12.397	12.591	12.746	12.943	12.459	11.623	11.299	10.585	10.096	10.018	10.682	11.648
GWS	2.069	2.051	2.039	2.030	2.024	2.025	2.045	2.093	2.083	2.063	2.049	2.036	2.051
TEMP.	37.9	36.1	44.0	47.5	60.0	77.1	77.2	75.0	69.4	58.8	41.6	29.8	54.6
CORRELATION COEF-FICIENTS	0.643	0.833	0.456	0.501	0.747	0.590	0.500	0.494	0.628	0.465	0.542	0.416	0.566

```
 DELTA STORAGE  =      4.173  INCHES
 AAIA  =               3.032
 POND STORAGE  =       0.0

 ------------------------
 TOTAL CHANGE  =       1.141


   SUM CAL TOTAL =              406866.
   SUM OBS TOTAL =              324371.
   SUM CAL SRINT =              203361.
   SUM OBS SR =                 253507.
   SUM CAL BF =                 203505.
   SUM OBS BF =                  70864.

   PACK ON DECEMBER 31 = 0.15          CHANGE IN SNOW STORAGE =-0.35

 AVERAGE MONTHLY BASE FLOW
248.0 812.0 744.0 510.01085.0 870.0  24.8   1.6   0.0   6.2  16.5  15.5

    LEAP YEAR INDICATOR= 0     YES=1 & NO=0

  ITHAW   IFREZ                                                  YEAR
   123     294                                                    54

                          RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

          JAN.    FEB.    MAR.    APR.    MAY.    JUN.    JUL.    AUG.    SEP.    OCT.    NOV.    DEC.   TOTAL
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1954

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.19	0.53	0.76	0.78	5.60	2.36	1.39	2.67	0.62	1.67	0.02	0.06	16.65
CALCULATED TOTAL RUNOFF	233.	235.	208.	392.	6565.	4867.	1119.	1895.	677.	868.	291.	223.	17574.
OBSERVED TOTAL RUNOFF	380.	1021.	789.	744.	5110.	5516.	48.	134.	0.	6.	18.	23.	13790.
CALCULATED SURFACE RUNOFF	45.	104.	106.	289.	6334.	4365.	425.	1401.	186.	488.	0.	2.	13747.
OBSERVED SURFACE RUNOFF	132.	209.	45.	234.	4025.	4646.	23.	133.	0.	0.	1.	7.	9457.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	187.	131.	102.	103.	231.	502.	694.	494.	491.	380.	291.	221.	3827.
OBSERVED BASEFLOW	248.	812.	744.	510.	1085.	870.	25.	2.	0.	6.	17.	16.	4334.
ETP	0.859	1.865	2.535	4.397	4.904	6.560	6.982	5.807	5.109	2.991	1.819	1.048	44.878
UETA	0.048	0.348	0.616	1.158	2.159	2.598	1.702	1.701	0.656	0.618	0.085	0.092	11.782
LETA	0.0	0.0	0.0	0.0	0.618	1.399	1.220	0.731	0.157	0.129	0.0	0.0	4.254
ETA	0.065	0.348	0.616	1.158	2.777	3.998	2.922	2.432	0.812	0.747	0.085	0.116	16.076
PER-COLATION	0.196	0.070	0.041	0.011	1.532	0.484	0.0	0.077	0.0	0.084	0.0	0.0	2.894
UZS	4.175	4.178	4.083	3.748	4.273	3.803	2.474	2.766	2.427	2.840	2.795	2.727	3.353
LZSA	9.060	9.098	9.155	9.188	9.732	10.142	8.976	7.945	7.800	7.803	7.800	7.800	8.705
LZST	11.172	11.209	11.267	11.300	11.843	12.253	11.088	9.960	9.058	8.568	8.501	8.501	10.388
GWS	2.027	2.020	2.014	2.011	2.033	2.111	2.109	2.092	2.074	2.057	2.043	2.031	2.052
TEMP.	28.2	44.9	37.5	56.4	57.3	75.6	82.7	78.3	72.7	53.7	44.8	34.7	55.6
CORRELATION COEF-FICIENTS	0.815	0.712	0.709	0.874	0.761	0.479	0.616	0.308	0.293	0.288	0.910	0.678	0.619

DELTA STORAGE = -0.050 INCHES
AAIA = 2.920
POND STORAGE = 0.0

TOTAL CHANGE = -2.971

SUM CAL TOTAL = 424440.
SUM OBS TOTAL = 338162.
SUM CAL SRINT = 217108.
SUM OBS SR = 262964.
SUM CAL BF = 207332.
SUM OBS BF = 75198.

PACK ON DECEMBER 31 = 0.23 CHANGE IN SNOW STORAGE = 0.08

AVERAGE MONTHLY BASE FLOW
18.6 148.4 291.4 294.0 9.3 9.0 0.0 0.0 0.0 6.2 9.0 77.5

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
110	298	55

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1955

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.55	0.64	0.48	1.27	2.75	3.75	1.43	1.47	3.83	0.21	0.05	0.22	16.63
CALCULATED TOTAL RUNOFF	169.	152.	127.	528.	1162.	4045.	1426.	1247.	2049.	339.	202.	198.	11645.
OBSERVED TOTAL RUNOFF	32.	325.	512.	427.	74.	686.	1.	6.	2176.	147.	10.	85.	4481.
CALCULATED SURFACE RUNOFF	8.	44.	38.	415.	1040.	3784.	1112.	956.	1794.	58.	2.	47.	9298.
OBSERVED SURFACE RUNOFF	13.	176.	221.	133.	65.	677.	1.	6.	2176.	140.	1.	7.	3617.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	162.	108.	89.	112.	122.	261.	314.	291.	255.	281.	200.	152.	2346.
OBSERVED BASEFLOW	19.	148.	291.	294.	9.	9.	0.	0.	0.	6.	9.	78.	863.
ETP	0.157	0.531	2.353	4.375	5.391	6.028	6.949	5.878	4.870	3.142	1.466	0.490	41.628
UETA	0.016	0.095	0.241	1.151	1.478	2.249	2.028	1.333	0.867	0.802	0.189	0.042	10.492
LETA	0.0	0.0	0.0	0.041	0.540	0.901	0.100	0.000	0.217	0.309	0.0	0.0	2.109
ETA	0.337	0.281	0.340	1.191	2.018	3.150	2.128	1.334	1.084	1.111	0.189	0.190	13.355
PER-COLATION	0.027	0.131	0.057	0.156	0.151	0.867	0.053	0.000	0.527	0.0	0.0	0.0	1.969
UZS	2.790	3.163	3.166	3.093	2.560	3.668	3.097	2.451	2.662	3.700	3.314	3.305	3.130
LZSA	7.801	7.905	7.975	8.129	7.899	7.946	7.800	7.800	7.872	7.866	7.800	7.800	7.882
LZST	8.502	8.606	8.676	8.830	8.515	8.060	7.801	7.800	7.872	7.866	7.800	7.800	8.174
GWS	2.023	2.017	2.013	2.008	2.007	2.031	2.046	2.041	2.035	2.040	2.029	2.022	2.026
TEMP.	27.7	26.8	39.0	56.1	64.3	68.4	82.2	79.4	68.8	56.9	36.8	28.8	53.1
CORRELATION COEF-FICIENTS	0.829	0.477	0.932	0.698	0.713	0.826	0.074	0.223	0.940	0.635	0.128	0.784	0.606

DELTA STORAGE = 2.862 INCHES
AAIA = 3.065
PCND STORAGE = 0.0

TOTAL CHANGE = -0.203

SUM CAL TOTAL = 436085.
SUM OBS TOTAL = 342642.
SUM CAL SRINT = 226406.
SUM OBS SR = 266581.
SUM CAL BF = 209678.
SUM OBS BF = 76061.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.23

AVERAGE MONTHLY BASE FLOW
217.0 234.5 589.0 330.0 148.8 3.0 4.7 1.6 0.0 0.0 0.0 0.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
118	306	55

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1956

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.16	0.63	0.34	1.00	1.55	1.61	3.00	2.37	0.10	1.06	0.12	0.07	11.71
CALCULATED TOTAL RUNOFF	117.	117.	94.	717.	783.	587.	3240.	1017.	155.	293.	142.	55.	7317.
OBSERVED TOTAL RUNOFF	226.	368.	627.	450.	371.	363.	2306.	155.	0.	0.	0.	0.	4868.
CALCULATED SURFACE RUNOFF	6.	41.	34.	617.	692.	467.	2581.	791.	12.	171.	62.	0.	5874.
OBSERVED SURFACE RUNOFF	9.	133.	38.	120.	222.	360.	2301.	154.	0.	0.	0.	0.	3339.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	111.	76.	60.	100.	91.	120.	260.	226.	143.	122.	80.	55.	1443.
OBSERVED BASEFLOW	217.	235.	589.	330.	149.	3.	5.	2.	0.	0.	0.	0.	1529.
ETP	0.604	0.401	2.604	3.833	5.498	6.768	6.619	5.752	4.945	3.293	1.645	1.111	43.073
UETA	0.022	0.004	0.369	0.972	1.438	1.878	1.880	1.416	0.564	0.438	0.153	0.075	9.210
LETA	0.0	0.0	0.0	0.002	0.282	0.0	0.059	0.020	0.0	0.0	0.0	0.0	0.363
ETA	0.127	0.340	0.448	0.974	1.720	1.878	1.939	1.436	0.564	0.438	0.153	0.075	10.093
PER-COLATION	0.0	0.066	0.009	0.209	0.0	0.0	0.059	0.020	0.0	0.0	0.0	0.0	0.363
UZS	3.394	3.740	3.952	3.834	3.088	2.644	3.180	2.958	2.541	2.267	2.486	2.412	3.039
LZSA	7.800	7.816	7.872	8.063	7.920	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.839
LZST	7.800	7.816	7.872	8.063	7.920	7.800	7.800	7.800	7.800	7.800	7.800	7.800	7.839
GWS	2.016	2.012	2.009	2.009	2.007	2.008	2.028	2.028	2.021	2.015	2.011	2.008	2.014
TEMP.	28.1	29.2	41.9	47.7	65.8	78.5	77.7	77.5	70.1	60.0	39.7	35.7	54.4
CORRELATION COEF-FICIENTS	0.756	0.566	0.641	0.435	0.478	0.148	0.660	0.411	1.000	1.000	1.000	0.871	0.665

```
 DELTA STORAGE  =      1.356  INCHES
 AAIA  =               2.903
 PCND STORAGE  =       0.0

 ---------------------------
 TOTAL CHANGE  =      -1.547


   SUM CAL TOTAL =          443402.
   SUM OBS TOTAL =          347510.
   SUM CAL SPINT =          232280.
   SUM OBS SR =             269920.
   SUM CAL BF =             211122.
   SUM OBS BF =              77590.

   PACK ON DECEMBER 31 =-0.01          CHANGE IN SNOW STORAGE =-0.01

 AVERAGE MONTHLY BASE FLOW
  1.6   5.6   9.3 450.01023.01890.01736.0 133.3 138.0 558.0 810.0 651.0

    LEAP YEAR INDICATOR= 0     YES=1 & NO=0

  ITHAW   IFREZ                                                    YEAR
   104     298                                                      57

                          RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

          JAN.    FEB.    MAR.    APR.    MAY.    JUN.    JUL.    AUG.    SEP.    OCT.    NOV.    DEC.   TOTAL
          0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1957

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.02	0.44	3.00	3.27	6.69	8.06	1.33	3.21	1.77	1.58	0.76	0.02	30.15
CALCULATED TOTAL RUNOFF	40.	43.	206.	2504.	8604.	24409.	5802.	4180.	4051.	2141.	1531.	1086.	54598.
OBSERVED TOTAL RUNOFF	2.	13.	105.	2253.	13469.	31743.	6602.	3589.	4873.	657.	833.	665.	64804.
CALCULATED SURFACE RUNOFF	0.	16.	175.	2325.	8207.	23968.	3699.	2222.	2582.	322.	102.	1.	43619.
OBSERVED SURFACE RUNOFF	1.	8.	95.	1803.	12446.	29853.	4866.	3456.	4735.	99.	23.	14.	57398.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	40.	27.	31.	178.	397.	442.	2103.	1958.	1469.	1819.	1429.	1085.	10979.
OBSERVED BASEFLOW	2.	6.	9.	450.	1023.	1890.	1736.	133.	138.	558.	810.	651.	7406.
ETP	0.293	1.275	1.883	3.759	5.002	6.050	6.782	5.756	4.560	2.997	1.304	1.228	40.889
UETA	0.033	0.034	0.405	1.218	2.287	2.395	2.453	1.778	1.478	0.881	0.269	0.162	13.994
LETA	0.0	0.0	0.0	0.133	1.157	1.559	1.321	1.022	0.797	0.415	0.0	0.0	6.403
ETA	0.138	0.137	0.753	1.503	3.444	4.454	3.774	2.800	2.275	1.295	0.383	0.162	21.118
PER-COLATION	0.0	0.0	0.131	1.608	2.781	3.143	0.375	0.112	0.298	0.012	0.080	0.0	8.539
UZS	2.346	2.383	2.600	4.344	4.352	4.396	3.743	2.949	3.804	3.744	3.949	4.080	3.561
LZSA	7.800	7.800	7.804	9.259	10.314	11.748	12.240	11.159	10.510	10.020	9.879	9.936	9.884
LZST	7.800	7.800	7.804	9.259	10.314	11.748	12.240	11.159	10.510	10.020	9.879	9.936	9.884
GWS	2.006	2.004	2.003	2.013	2.074	2.290	2.463	2.374	2.352	2.282	2.210	2.154	2.187
TEMP.	21.2	37.0	38.2	48.3	58.7	68.7	79.9	77.6	63.9	53.8	37.7	37.8	52.0
CORRELATION COEF-FICIENTS	0.318	0.676	0.650	0.719	0.710	0.879	0.664	0.647	0.848	0.963	0.989	0.975	0.753

DELTA STORAGE = 7.080 INCHES
AAIA = 3.940
PCNC STORAGE = 0.0

TOTAL CHANGE = 3.140

SUM CAL TOTAL = 498000.
SUM OBS TOTAL = 412314.
SUM CAL SRINT = 275900.
SUM OBS SR = 327318.
SUM CAL BF = 222100.
SUM OBS BF = 84996.

PACK ON DECEMBER 31 = 0.05 CHANGE IN SNOW STORAGE = 0.06

AVERAGE MONTHLY BASE FLOW
836.0 616.01519.02700.02046.0 720.01240.01054.0 660.0 496.0 780.0 868.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
115	274	58

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.659	1.161	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.820

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1958

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.43	0.43	1.69	4.33	4.39	2.61	6.79	2.33	1.18	0.13	0.87	0.51	25.69
CALCULATED TOTAL RUNOFF	854.	641.	1187.	8313.	12586.	10560.	18090.	14366.	5952.	3782.	2706.	2104.	81160.
OBSERVED TOTAL RUNOFF	825.	644.	1860.	3473.	4184.	2408.	8396.	7233.	2369.	608.	825.	920.	33745.
CALCULATED SURFACE RUNOFF	60.	123.	755.	4955.	4065.	1557.	10754.	7933.	992.	6.	21.	65.	31286.
OBSERVED SURFACE RUNOFF	19.	28.	341.	773.	2138.	1688.	7156.	6179.	1709.	112.	45.	52.	20240.
CALCULATED INTER-FLOW	0.	0.	0.	168.	625.	113.	12.	3.	0.	0.	0.	0.	921.
CALCULATED BASEFLOW	794.	518.	432.	3190.	7895.	8509.	7324.	6430.	4960.	3776.	2685.	2039.	48952.
OBSERVED BASEFLOW	806.	616.	1519.	2700.	2046.	720.	1240.	1054.	660.	496.	780.	868.	13505.
ETP	0.796	0.710	0.0	3.228	5.369	6.213	6.334	5.647	4.882	3.099	1.226	0.848	38.351
UETA	0.057	0.159	0.0	1.145	2.294	2.439	2.687	2.180	1.580	0.500	0.095	0.115	13.261
LETA	0.0	0.0	0.0	0.011	0.922	1.313	1.452	1.174	0.861	0.016	0.0	0.0	5.749
ETA	0.191	0.270	0.742	1.435	3.215	3.752	4.149	3.354	2.441	0.517	0.262	0.159	20.485
PER-COLATION	0.080	0.210	1.233	3.178	1.471	0.145	1.947	0.745	0.105	0.0	0.0	0.0	9.169
UZS	4.040	4.203	4.278	4.297	4.163	3.669	4.135	4.032	3.443	2.662	2.582	3.292	3.729
LZSA	9.943	10.052	10.364	13.920	13.891	12.781	12.410	12.523	11.927	11.536	11.536	11.536	11.876
LZST	9.943	10.052	10.364	14.368	15.176	14.601	14.230	14.343	13.747	13.356	13.356	13.356	13.089
GWS	2.113	2.084	2.063	2.520	3.163	3.307	3.048	2.917	2.728	2.536	2.394	2.289	2.599
TEMP.	31.9	28.9	25.7	48.0	64.0	70.9	73.7	75.9	69.1	56.0	40.8	31.1	51.4
CORRELATION COEF-FICIENTS	0.870	0.822	0.586	0.627	0.802	0.633	0.562	0.387	0.568	0.584	0.966	0.917	0.693

DELTA STORAGE = 2.308 INCHES
AAIA = 2.457
POND STORAGE = 0.0

TOTAL CHANGE = -0.150

SUM CAL TOTAL = 579160.
SUM OBS TOTAL = 446059.
SUM CAL SRINT = 308107.
SUM OBS SR = 347558.
SUM CAL BF = 271053.
SUM OBS BF = 98501.

PACK ON DECEMBER 31 =-0.00 CHANGE IN SNOW STORAGE =-0.05

AVERAGE MONTHLY BASE FLOW
558.01260.01209.01350.0 930.0 450.0 62.0 12.4 6.0 589.0 720.0 868.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
112	284	59

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1969

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.42	0.71	2.62	1.19	2.35	2.82	3.20	3.71	3.75	3.51	0.06	0.23	24.57
CALCULATED TOTAL RUNOFF	1508.	1139.	1389.	976.	1485.	3628.	2357.	3009.	2736.	3496.	764.	524.	23011.
OBSERVED TOTAL RUNOFF	569.	1354.	1509.	1387.	1184.	1619.	263.	325.	202.	2175.	771.	876.	12233.
CALCULATED SURFACE RUNOFF	17.	207.	660.	366.	1041.	3134.	1938.	2645.	2290.	2864.	161.	33.	15355.
OBSERVED SURFACE RUNOFF	11.	94.	300.	37.	254.	1169.	201.	313.	196.	1586.	51.	8.	4218.
CALCULATED INTER-FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCULATED BASEFLOW	1491.	932.	729.	610.	444.	494.	420.	364.	446.	632.	603.	491.	7656.
OBSERVED BASEFLOW	558.	1260.	1209.	1350.	930.	450.	62.	12.	6.	589.	720.	868.	8014.
ETP	0.425	0.765	2.758	3.999	5.231	6.517	6.426	5.875	4.551	2.820	1.406	1.157	41.931
UETA	0.079	0.128	0.777	1.416	1.851	2.374	2.106	2.085	1.597	1.070	0.299	0.229	14.011
LETA	0.0	0.0	0.0	0.030	0.838	1.369	1.199	1.154	0.868	0.266	0.0	0.0	5.725
ETA	0.230	0.269	0.777	1.446	2.689	3.744	3.306	3.239	2.465	1.336	0.299	0.229	20.028
PER-COLATION	0.0	0.164	0.886	0.051	0.295	0.676	0.107	0.387	0.800	2.011	0.004	0.0	5.382
UZS	3.394	3.705	4.009	3.970	3.735	3.391	3.010	3.528	3.646	4.170	4.265	4.110	3.744
LZSA	11.536	11.611	11.532	12.613	12.469	11.962	10.768	9.837	9.202	10.880	11.193	11.193	11.269
LZST	13.356	13.431	13.752	14.432	14.289	13.782	12.588	11.717	11.022	12.700	13.013	13.013	13.089
GWS	2.212	2.159	2.121	2.096	2.078	2.095	2.084	2.092	2.085	2.116	2.095	2.070	2.108
TEMP.	25.8	29.1	39.7	50.3	62.0	75.0	75.0	79.4	63.7	50.3	36.0	35.0	51.9
CORRELATION COEF-FICIENTS	0.784	0.793	0.926	0.861	0.836	0.666	0.620	0.375	0.759	0.671	0.764	0.969	0.752

DELTA STORAGE = 3.715 INCHES
AAIA = 3.662
POND STORAGE = 0.0

TOTAL CHANGE = 0.053

SUM CAL TOTAL = 602171.
SUM OBS TOTAL = 458292.
SUM CAL SRINT = 323462.
SUM OBS SR = 351776.
SUM CAL BF = 278709.
SUM OBS BF = 106515.

PACK ON DECEMBER 31 = 0.0 CHANGE IN SNOW STORAGE = 0.00

AVERAGE MONTHLY BASE FLOW
589.01508.02170.03300.02697.01710.0 558.0 68.2 63.0 161.2 480.0 713.0

LEAP YEAR INDICATOR= 1 YES=1 & NO=0

ITHAW	IFREZ	YEAR
113	297	60

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.620	0.581	1.201	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.403

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1960

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.62	1.76	2.34	2.01	4.23	3.99	1.04	3.15	1.46	2.05	0.18	0.71	23.54
CALCULATED TOTAL RUNOFF	486.	1126.	2181.	12594.	22838.	17067.	9408.	8684.	5191.	3653.	2646.	2101.	87975.
OBSERVED TOTAL RUNOFF	615.	1843.	9734.	3728.	10007.	4943.	622.	1741.	294.	245.	503.	719.	34993.
CALCULATED SURFACE RUNOFF	130.	784.	774.	3020.	7741.	4330.	622.	2403.	613.	508.	53.	131.	21110.
OBSERVED SURFACE RUNOFF	26.	335.	7564.	428.	7310.	3233.	64.	1672.	231.	84.	23.	6.	20976.
CALCULATED INTER-FLOW	0.	71.	667.	2499.	3307.	1858.	270.	0.	0.	0.	0.	0.	8672.
CALCULATED BASEFLOW	357.	271.	740.	7075.	11790.	10879.	8515.	6280.	4578.	3145.	2593.	1970.	58193.
OBSERVED BASEFLOW	589.	1508.	2170.	3300.	2657.	1710.	558.	68.	63.	161.	480.	713.	14017.
ETP	0.415	0.0	0.582	4.244	5.105	6.148	6.457	5.690	4.833	3.128	1.685	0.513	38.800
UETA	0.078	0.0	0.106	1.501	2.279	2.721	1.960	1.591	1.160	0.658	0.305	0.126	12.484
LETA	0.0	0.0	0.0	0.032	1.001	1.465	1.166	1.082	0.756	0.370	0.0	0.0	5.874
ETA	0.185	0.326	0.791	1.533	3.280	4.186	3.126	2.672	1.916	1.029	0.305	0.303	19.652
PER-COLATION	0.388	1.740	1.835	0.479	1.720	0.835	0.035	0.111	0.053	0.155	0.001	0.112	7.163
UZS	4.220	4.546	4.545	4.021	4.265	3.983	2.990	2.933	2.920	3.341	3.796	3.906	3.786
LZSA	11.231	12.652	13.413	14.063	14.012	13.347	12.408	11.298	10.522	9.995	9.969	9.992	11.904
LZST	13.051	14.472	15.330	16.829	17.345	16.594	15.536	14.424	13.648	13.121	13.094	13.119	14.711
GWS	2.051	2.041	2.133	3.060	3.718	3.599	3.209	2.892	2.672	2.503	2.380	2.280	2.713
TEMP.	24.4	21.4	31.0	54.1	60.2	70.0	75.4	76.5	68.3	56.6	40.9	30.0	50.8
CORRELATION COEFFICIENTS	0.579	0.616	0.649	0.814	0.548	0.516	0.930	0.398	0.579	0.661	0.901	0.890	0.673

DELTA STORAGE = 0.746 INCHES
AAIA = 2.850
POND STORAGE = 0.0

TOTAL CHANGE = -2.104

SUM CAL TOTAL = 690146.
SUM OBS TOTAL = 493285.
SUM CAL SRINT = 353244.
SUM OBS SR = 372752.
SUM CAL BF = 336901.
SUM OBS BF = 120533.

PACK ON DECEMBER 31 = 0.10 CHANGE IN SNOW STORAGE = 0.10

AVERAGE MONTHLY BASE FLOW
775.0 930.01054.01110.01674.02130.0 713.0 496.0 460.0 744.01140.01023.0

LEAP YEAR INDICATOR= 0 YES=1 & NO=0

ITHAW	IFREZ	YEAR
111	292	61

RECHARGE TO GROUND WATER FROM THE LOWER SOIL ZONE

JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
0.0	0.0	0.0	0.0	0.0	0.748	0.0	0.0	0.0	0.0	0.0	0.0	0.748

SUMMARY TABLE - SOUTH FORK SOLOMON RIVER BASIN - 1961

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
PRECIP	0.12	0.13	2.17	1.48	6.70	5.18	3.06	4.42	2.14	0.84	2.13	0.26	28.61
CALCULATED TOTAL RUNOFF	1444.	978.	1564.	1739.	8464.	17223.	8455.	10547.	4190.	2912.	3884.	1959.	63359.
OBSERVED TOTAL RUNOFF	792.	1001.	1145.	1385.	5954.	11571.	2110.	5168.	863.	795.	1207.	1047.	33038.
CALCULATED SURFACE RUNOFF	4.	13.	526.	1133.	7702.	9261.	1978.	6133.	1365.	264.	2003.	21.	30803.
OBSERVED SURFACE RUNOFF	17.	21.	91.	275.	4280.	5441.	1357.	4672.	413.	51.	67.	24.	20749.
CALCULATED INTER-FLOW	0.	0.	0.	0.	310.	2631.	953.	35.	0.	0.	46.	115.	4091.
CALCULATED BASEFLOW	1440.	965.	638.	606.	452.	5331.	5525.	4379.	2825.	2648.	1835.	1822.	28465.
OBSERVED BASEFLOW	775.	980.	1054.	1110.	1674.	2130.	713.	496.	450.	744.	1140.	1023.	12289.
ETP	1.018	1.313	2.820	2.996	4.979	6.208	6.560	5.584	4.435	2.988	1.305	0.355	40.561
UETA	0.054	0.161	1.030	1.039	2.325	2.761	2.268	2.079	1.331	0.773	0.357	0.043	14.223
LETA	0.0	0.0	0.0	0.039	1.044	1.487	1.249	1.132	0.723	0.301	0.0	0.0	5.975
ETA	0.054	0.214	1.030	1.411	3.370	4.248	3.517	3.211	2.054	1.074	0.450	0.203	20.836
PER-COLATION	0.001	0.005	0.588	0.451	2.909	2.687	0.575	0.755	0.316	0.072	0.986	0.038	9.182
UZS	4.143	4.099	4.118	4.127	4.307	4.131	3.075	3.601	3.775	3.689	3.949	4.159	3.929
LZSA	10.031	10.034	10.454	10.923	12.148	13.765	12.981	12.278	11.987	11.567	12.020	12.507	11.732
LZST	13.237	13.210	13.580	14.049	15.267	17.268	16.194	15.550	15.209	14.839	15.292	15.779	14.963
GWS	2.204	2.152	2.120	2.101	2.131	2.848	2.785	2.625	2.520	2.411	2.325	2.259	2.374
TEMP.	30.2	35.7	40.9	46.3	58.4	70.8	76.8	74.9	61.8	53.3	36.2	24.9	51.0
CORRELATION COEF-FICIENTS	0.898	0.899	0.758	0.510	0.813	0.[illegible]	0.679	0.550	0.701	0.879	0.568	0.891	0.733

DELTA STORAGE = 5.512 INCHES
AAIA = 3.525
PEND STORAGE = 0.0

TOTAL CHANGE = 1.987

SUM CAL TOTAL = 753504.
SUM OBS TOTAL = 526323.
SUM CAL SRINT = 380138.
SUM OBS SR = 393501.
SUM CAL BF = 365366.
SUM OBS BF = 132322.

PACK ON DECEMBER 31 = 0.37 CHANGE IN SNOW STORAGE = 0.27

DAILY FLOW DURATION AND ERROR TABLE

FLOW INTERVAL	ACT.CASES	PCT.	CALC.CASES	PCT.	AVE.ERROR	AV.ABS.ERROR	STD.ERROR
0.0-	910.0	100.000	23.0	100.000	26.3	26.31	34.30
1.0-	164.0	81.545	108.0	99.534	36.8	36.82	53.76
1.8-	146.0	78.219	161.0	97.343	46.8	46.88	60.27
3.2-	163.0	75.259	267.0	94.078	66.5	66.95	77.06
5.6-	303.0	71.953	374.0	88.664	36.6	38.50	59.55
10.0-	418.0	65.707	502.0	81.079	38.2	40.88	58.29
17.8-	944.0	57.230	716.0	70.898	37.7	46.49	78.42
31.6-	777.0	38.086	678.0	56.378	47.3	65.26	106.65
56.2-	487.0	22.328	644.0	42.628	196.0	213.68	236.68
100.0-	302.0	12.452	517.0	29.568	176.0	215.33	293.61
177.8-	112.0	6.327	369.0	19.383	273.1	352.02	431.75
316.2-	77.0	4.056	291.0	11.600	374.8	504.38	593.71
562.3-	47.0	2.494	152.0	5.699	355.8	704.91	846.59
1000.0-	33.0	1.541	87.0	2.616	161.7	928.30	1359.51
1778.3-	20.0	0.872	29.0	0.852	-831.6	1557.55	1974.71
3162.3-	11.0	0.466	9.0	0.264	-2529.2	2529.18	704.01
5623.4-	5.0	0.243	4.0	0.081	-4250.6	4250.60	586.95
10000.0-	6.0	0.142	0.0	0.0	-7601.5	7601.45	4174.19
17782.7-	0.0	0.020	0.0	0.0			
31622.7-	1.0	0.020	0.0	0.0	-30552.1		
56234.0-	0.0	0.0	0.0	0.0			
99999.8-	0.0	0.0	0.0	0.0			
177827.4-	0.0	0.0	0.0	0.0			
316226.9-	0.0	0.0	0.0	0.0			
	4931.0		4931.0		234952.9	639077.44	11730.00

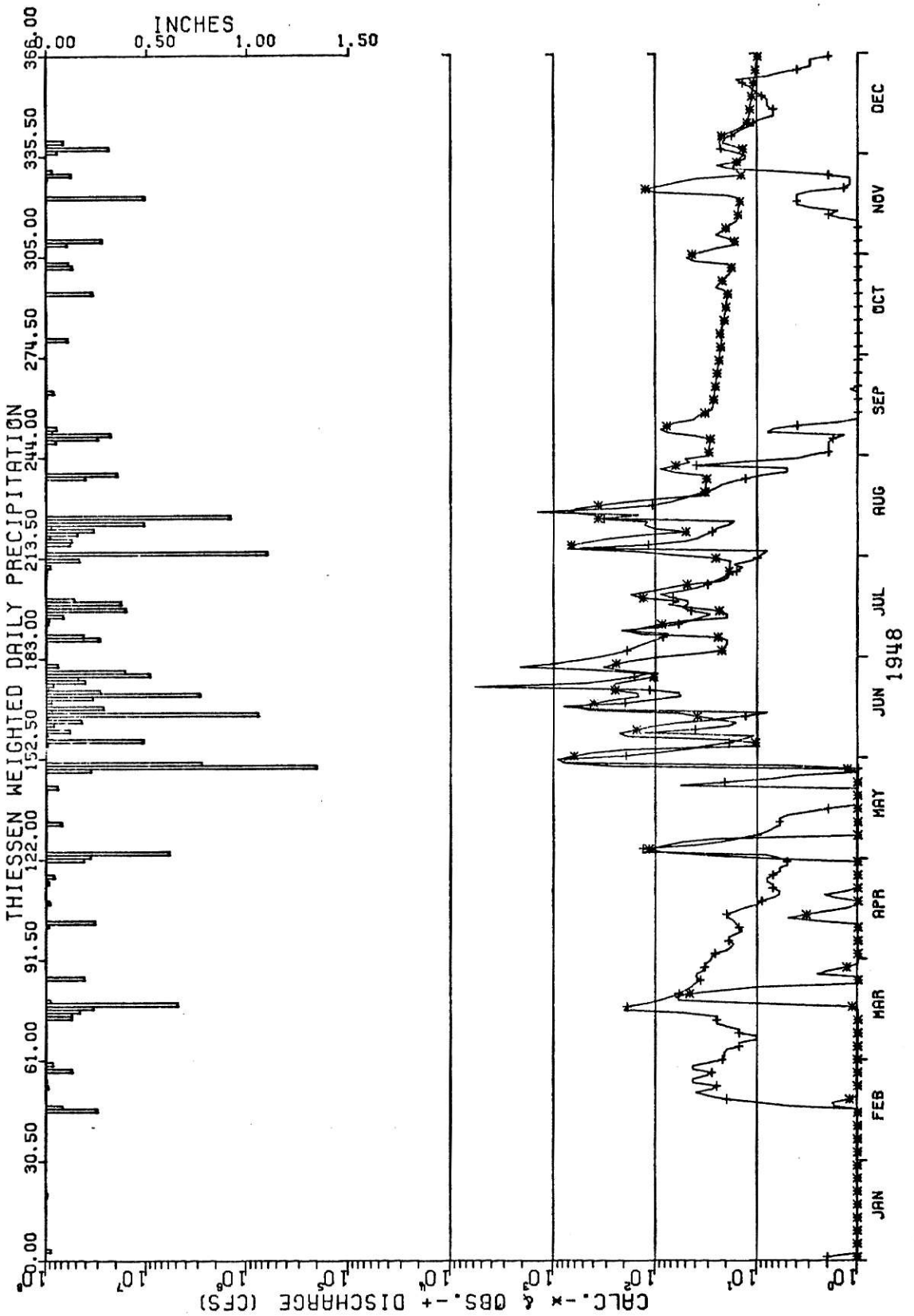
DELTA STORAGE = 39.354 INCHES
AAIA = 43.974
POND STORAGE = 0.0

TOTAL CHANGE = -4.620

TOTAL PRECIPITATION = 322.934

TOTAL IA	43.974
TOTAL SURFACE RUNOFF	16.891
TOTAL USTA	178.980
TOTAL PERC	81.350
CHANGE IN UZSM	1.314
CHECK BALANCE	322.508

HYDROGRAPHS - UNMODIFIED MODEL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1.00
1.50
THIESSEN WEIGHTED DAILY PRECIPITATION
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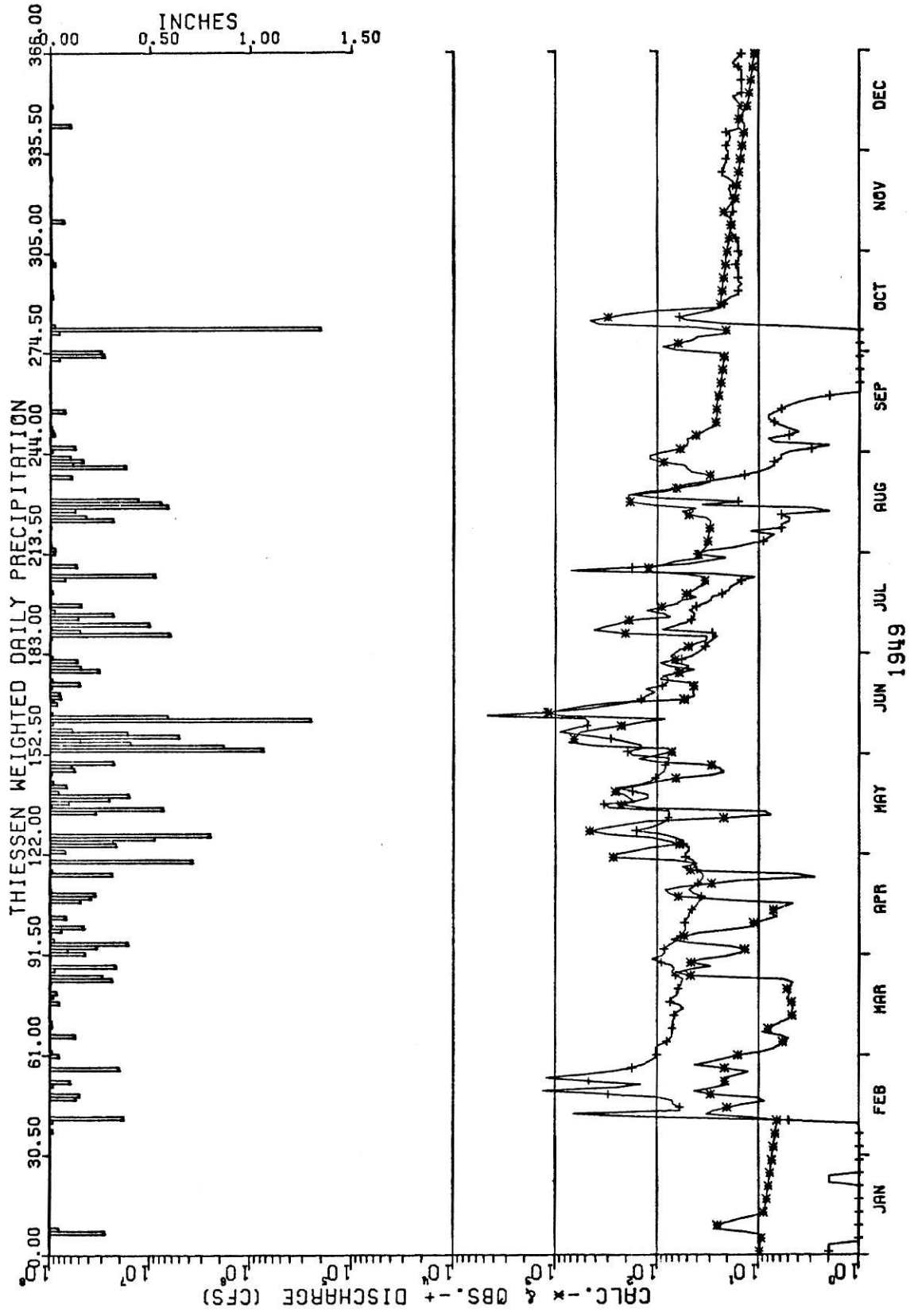
30.50
61.00
91.50
122.00
152.50
183.00
213.50
244.00
274.50
305.00
335.50
366.00
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1948
CALC.-* & OBS.-+ DISCHARGE (CFS)


INCHES
0.00
0.50
1.00
1.50
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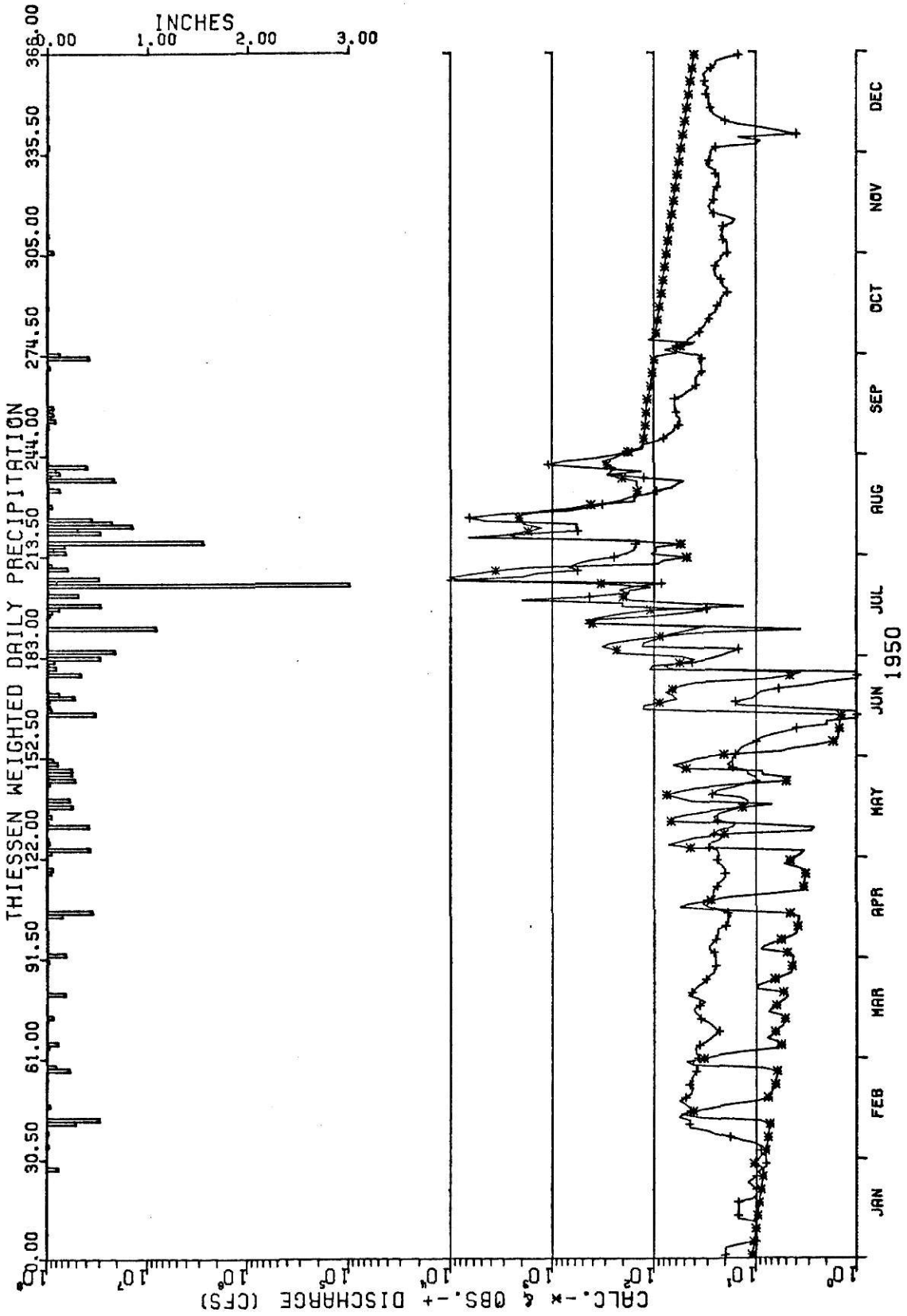
1949
CALC.-× & OBS.-+ DISCHARGE (CFS)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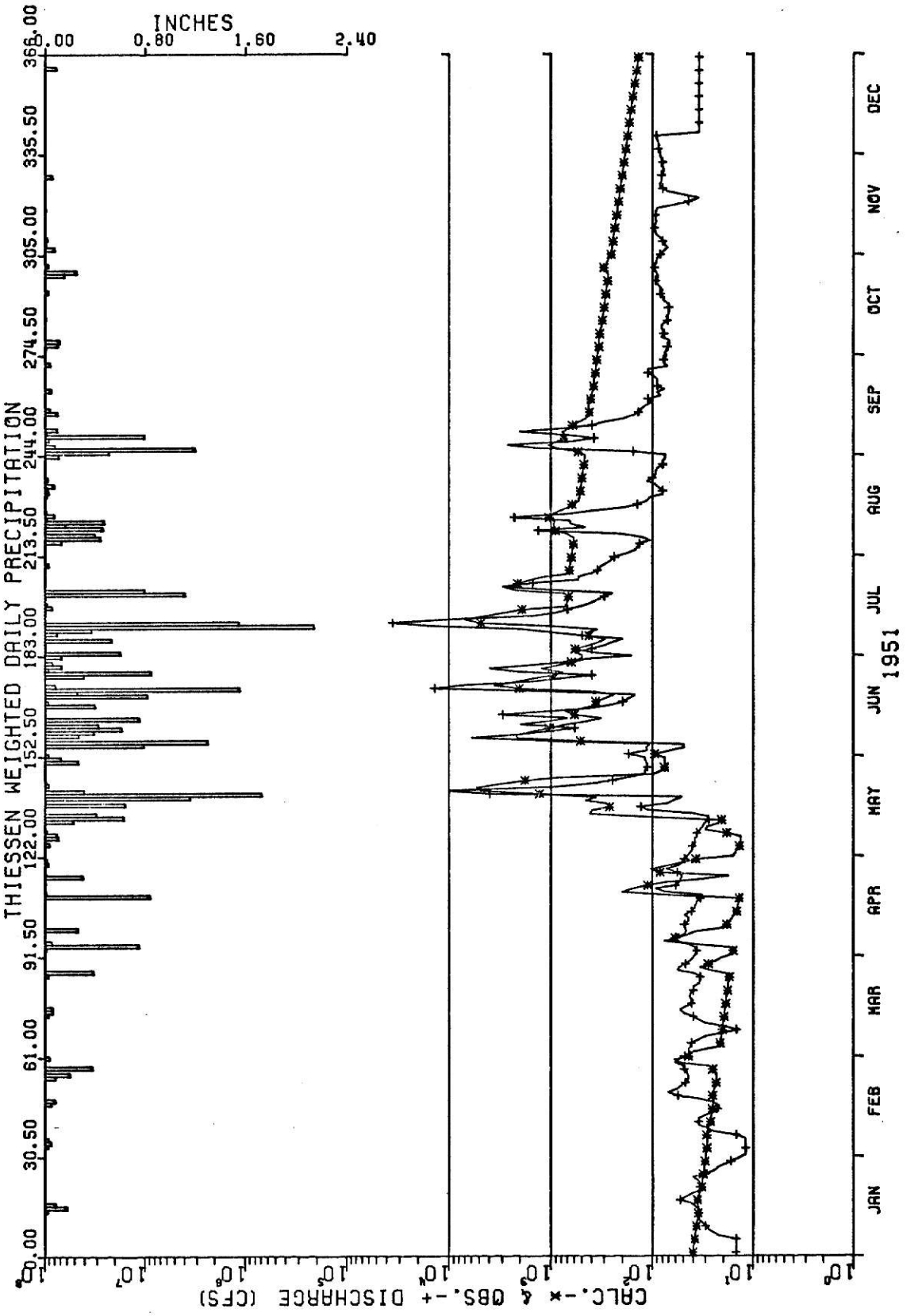
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1951
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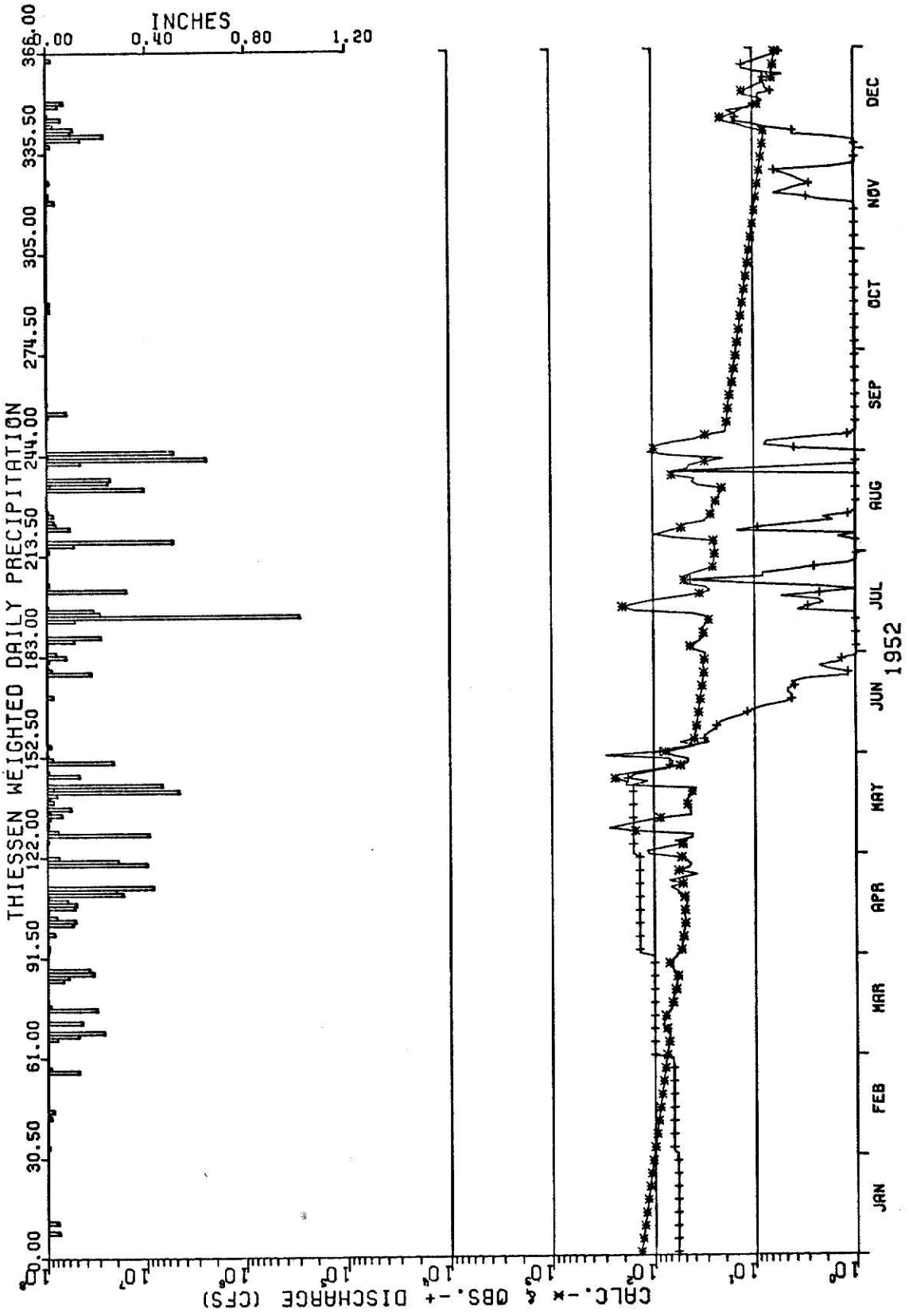
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CALC. -* & OBS. -+ DISCHARGE (CFS)
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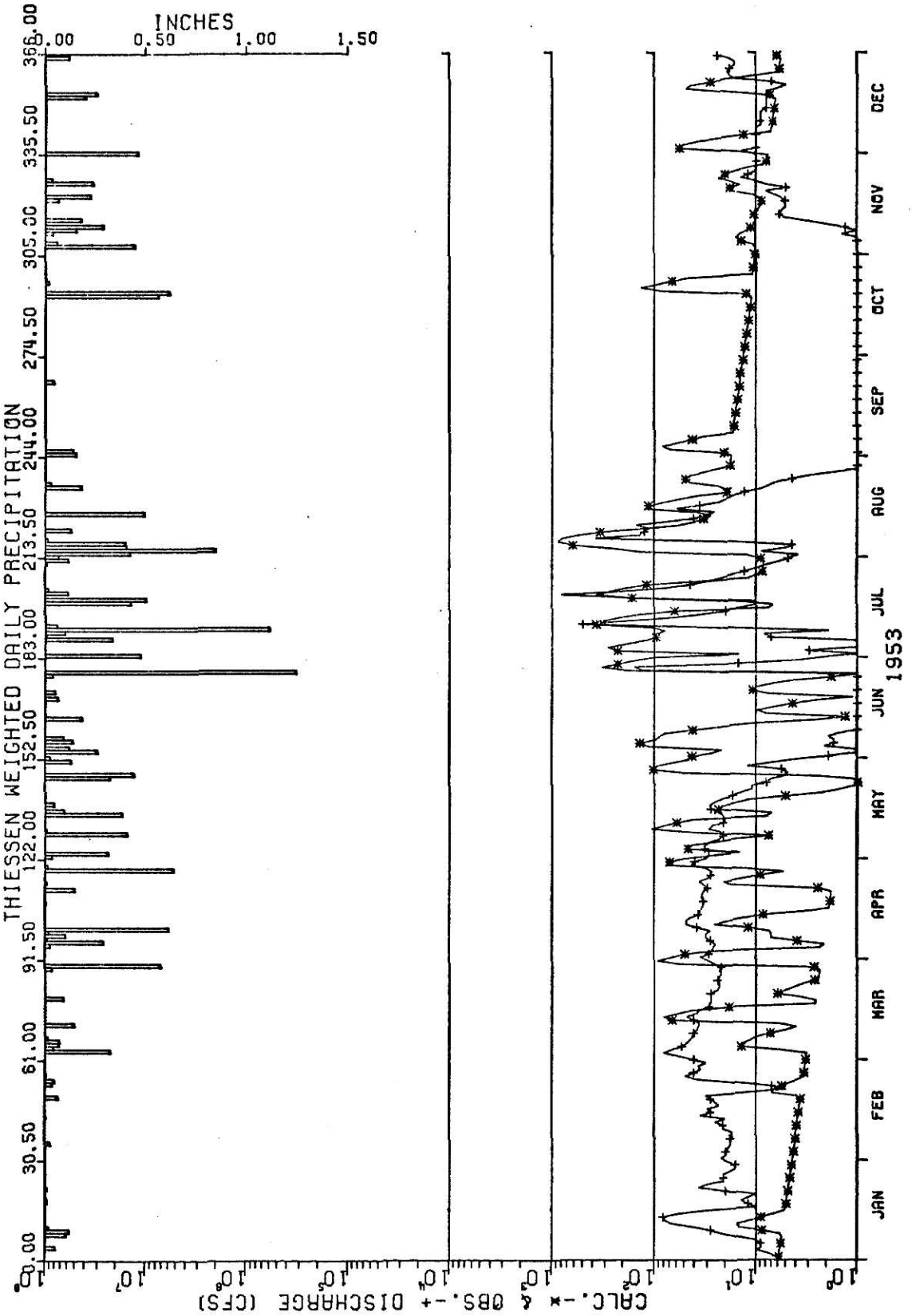
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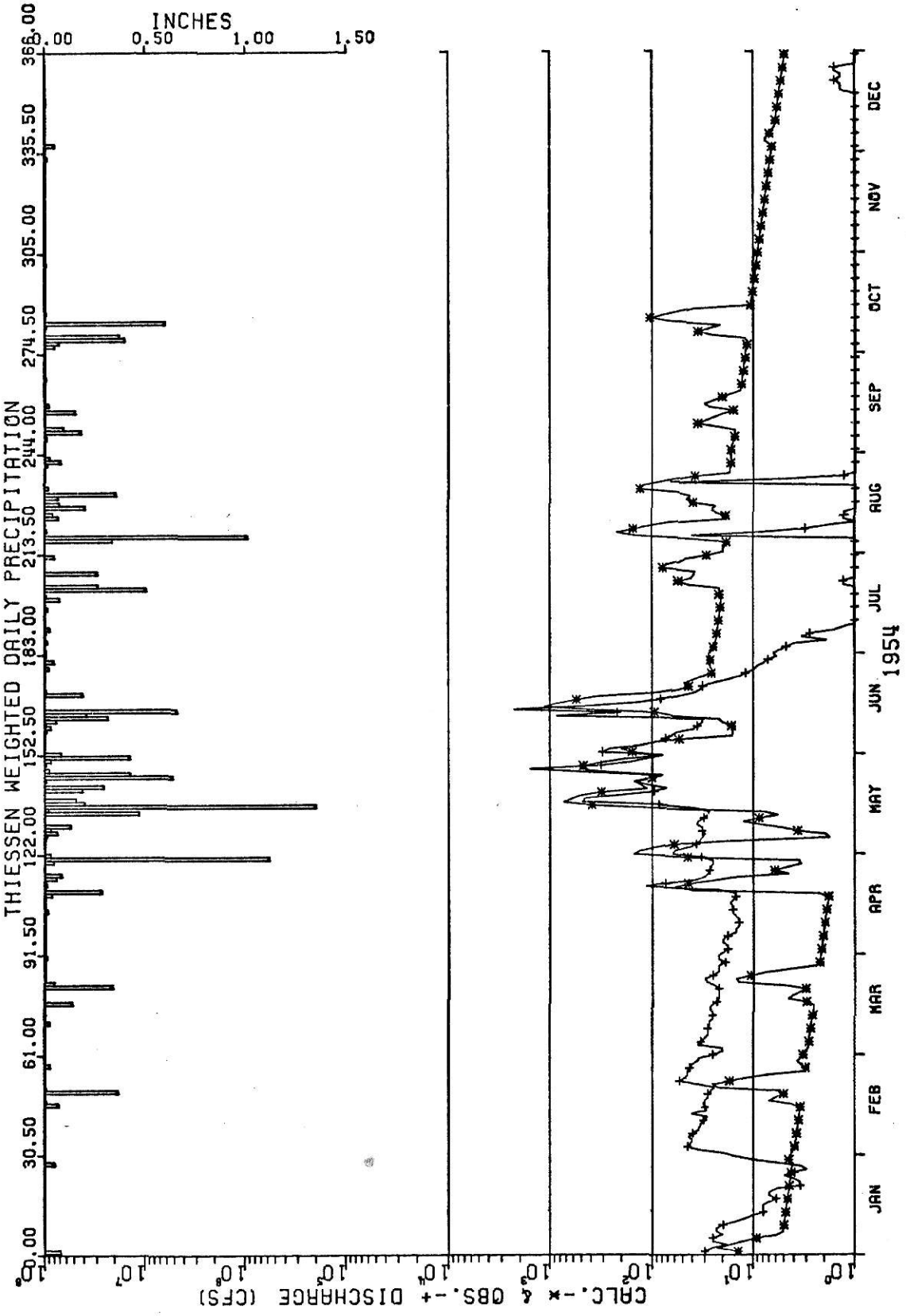
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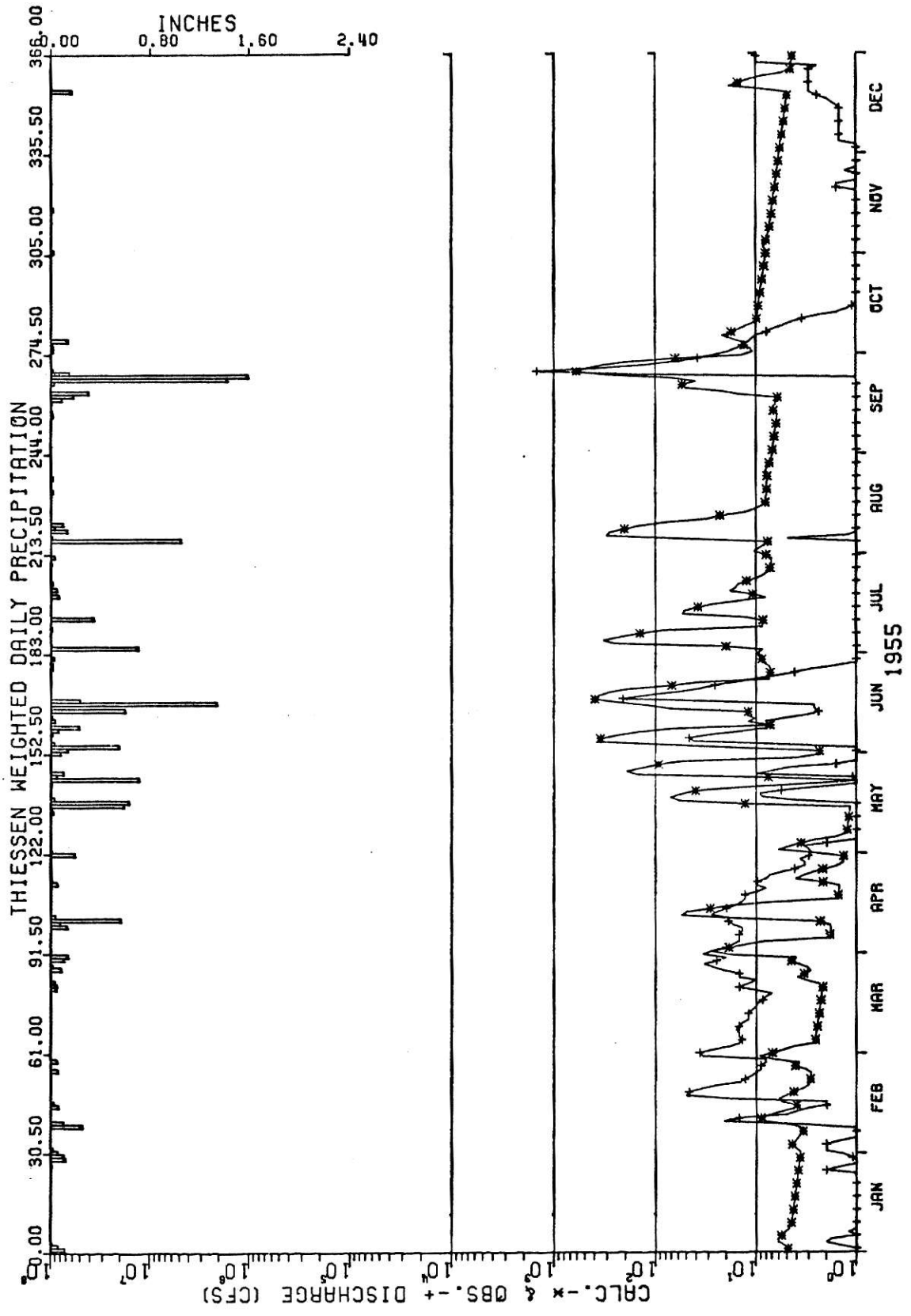
1954
CALC. -* & OBS. -+ DISCHARGE (CFS)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CALC.-* & OBS.-+ DISCHARGE (CFS)
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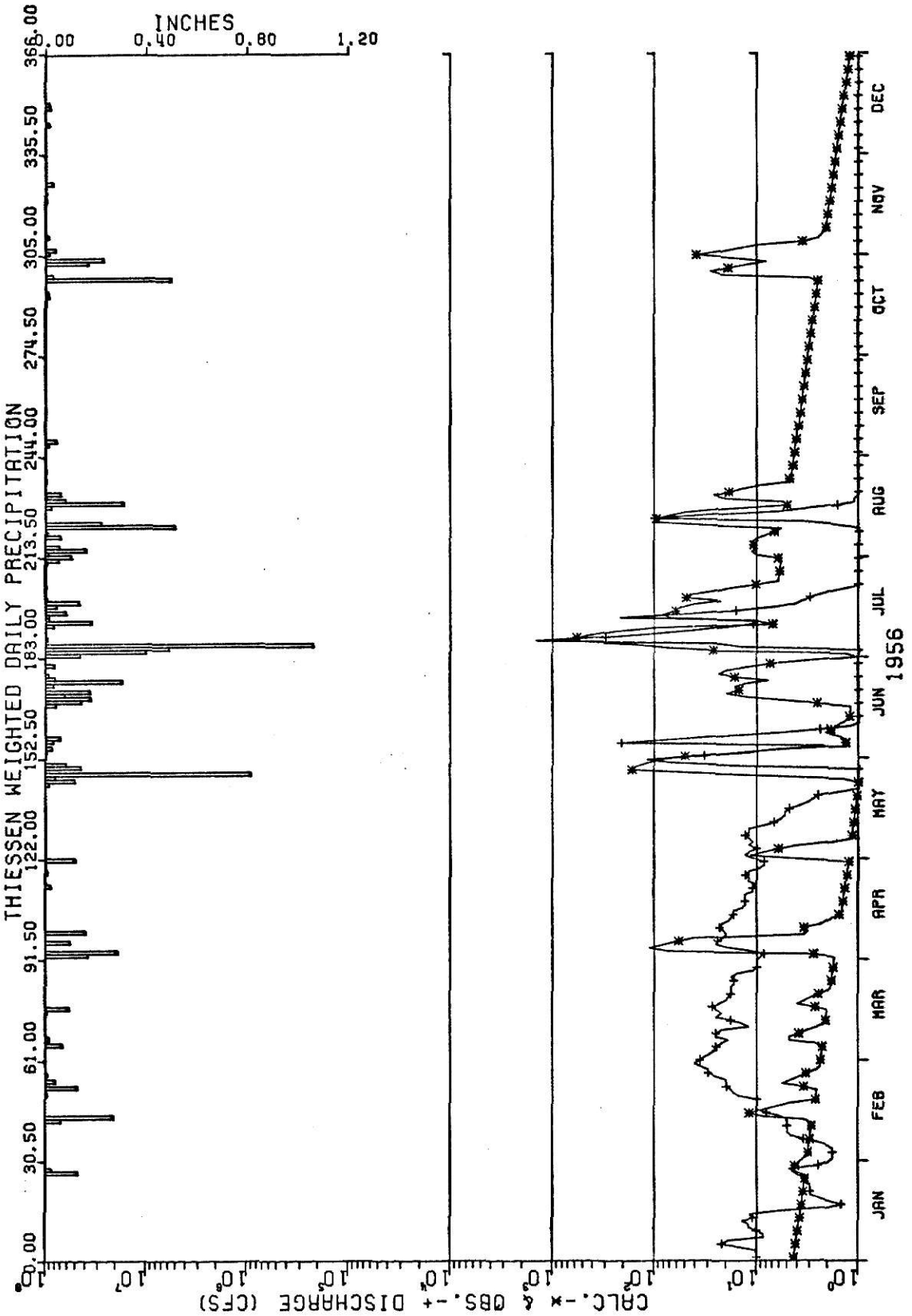
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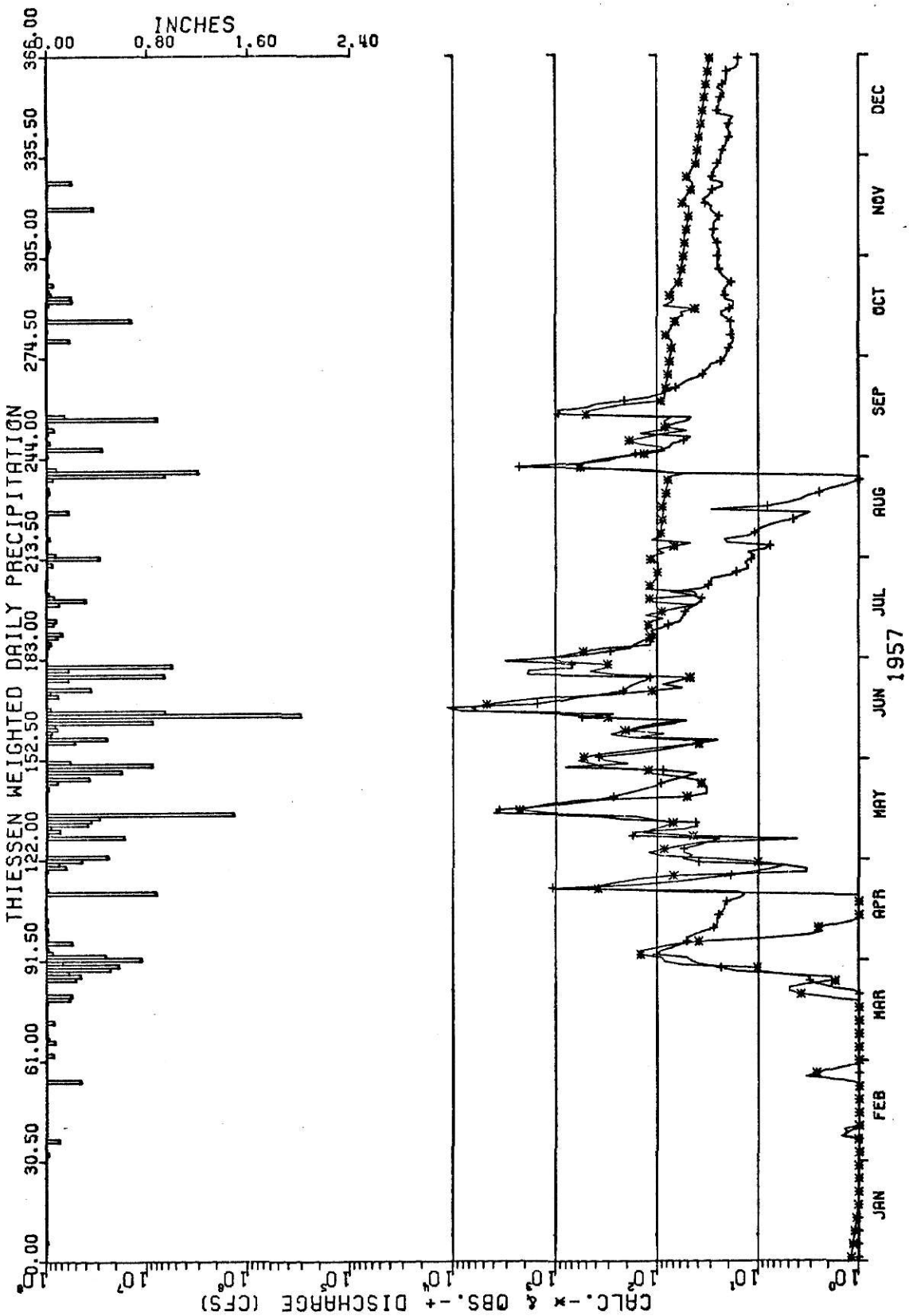
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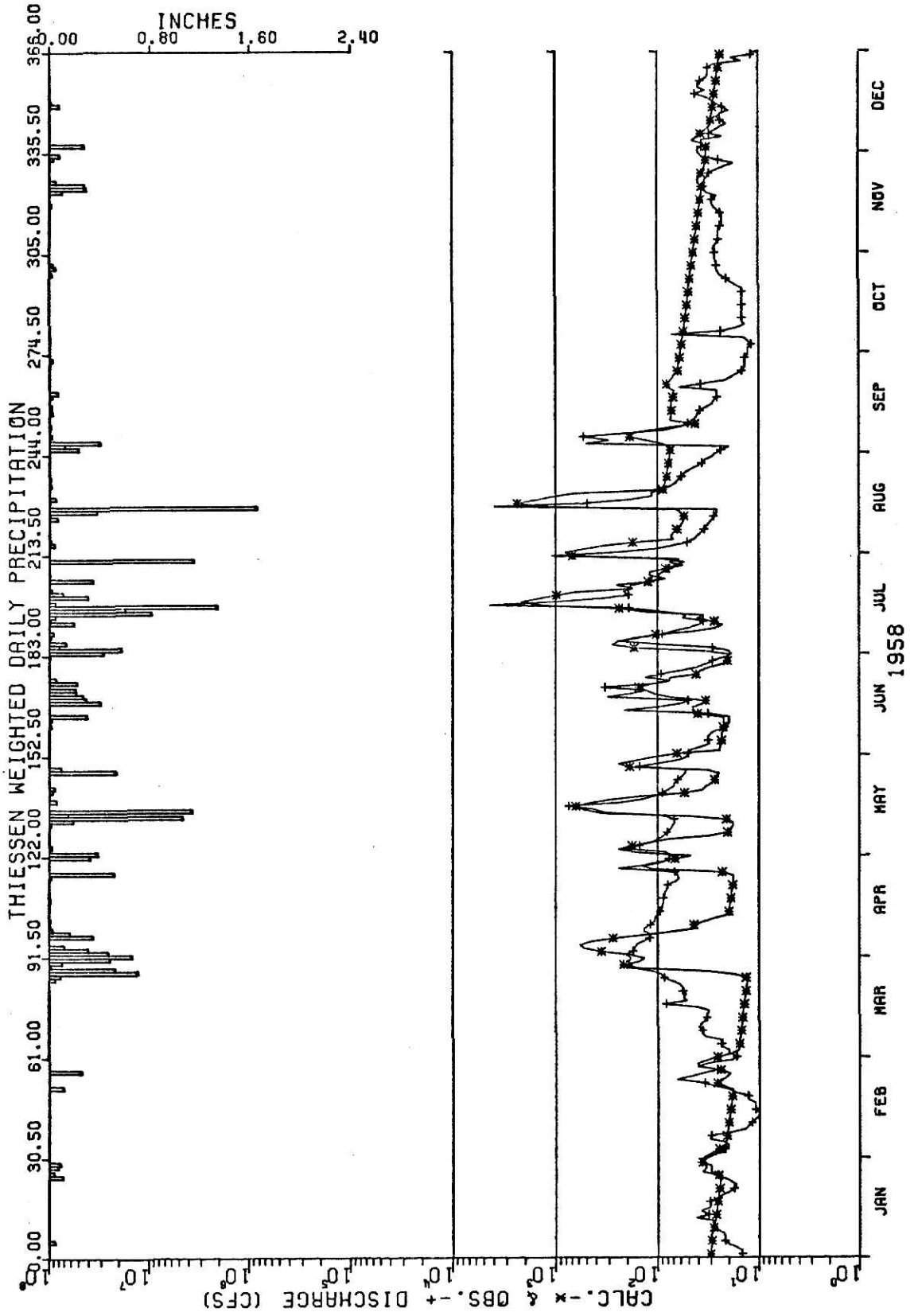
1957
CALC.-* & OBS.-+ DISCHARGE (CFS)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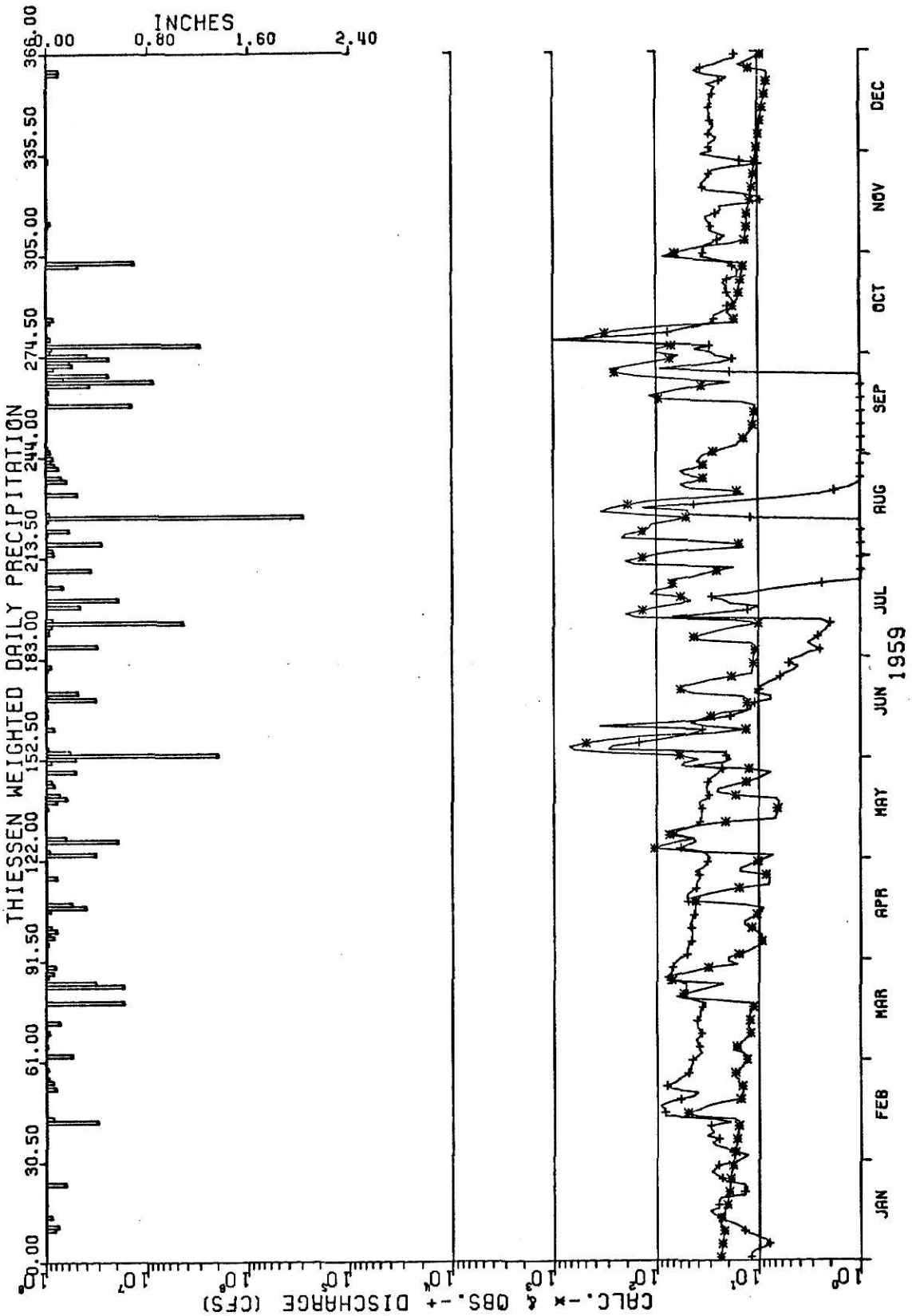
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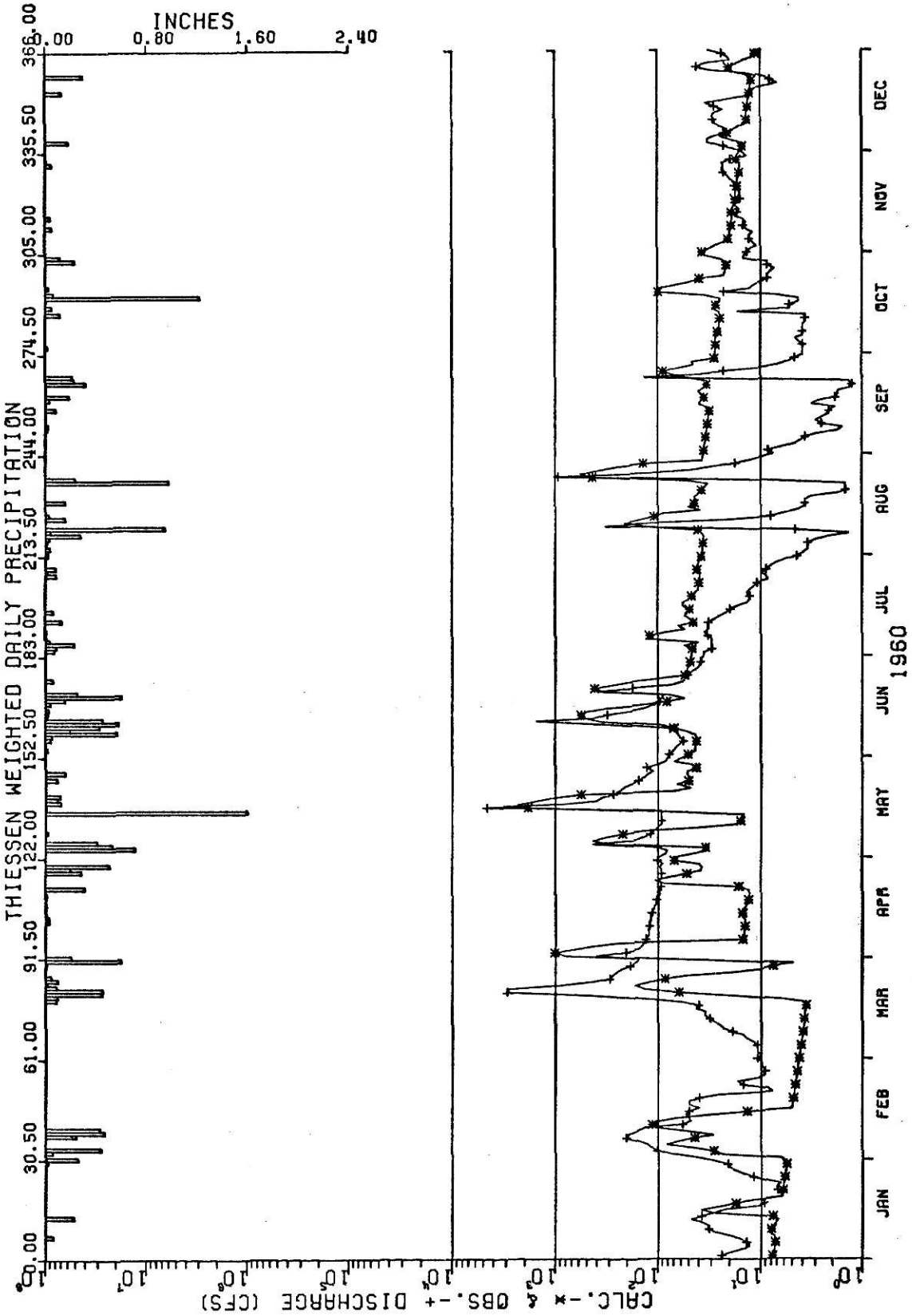
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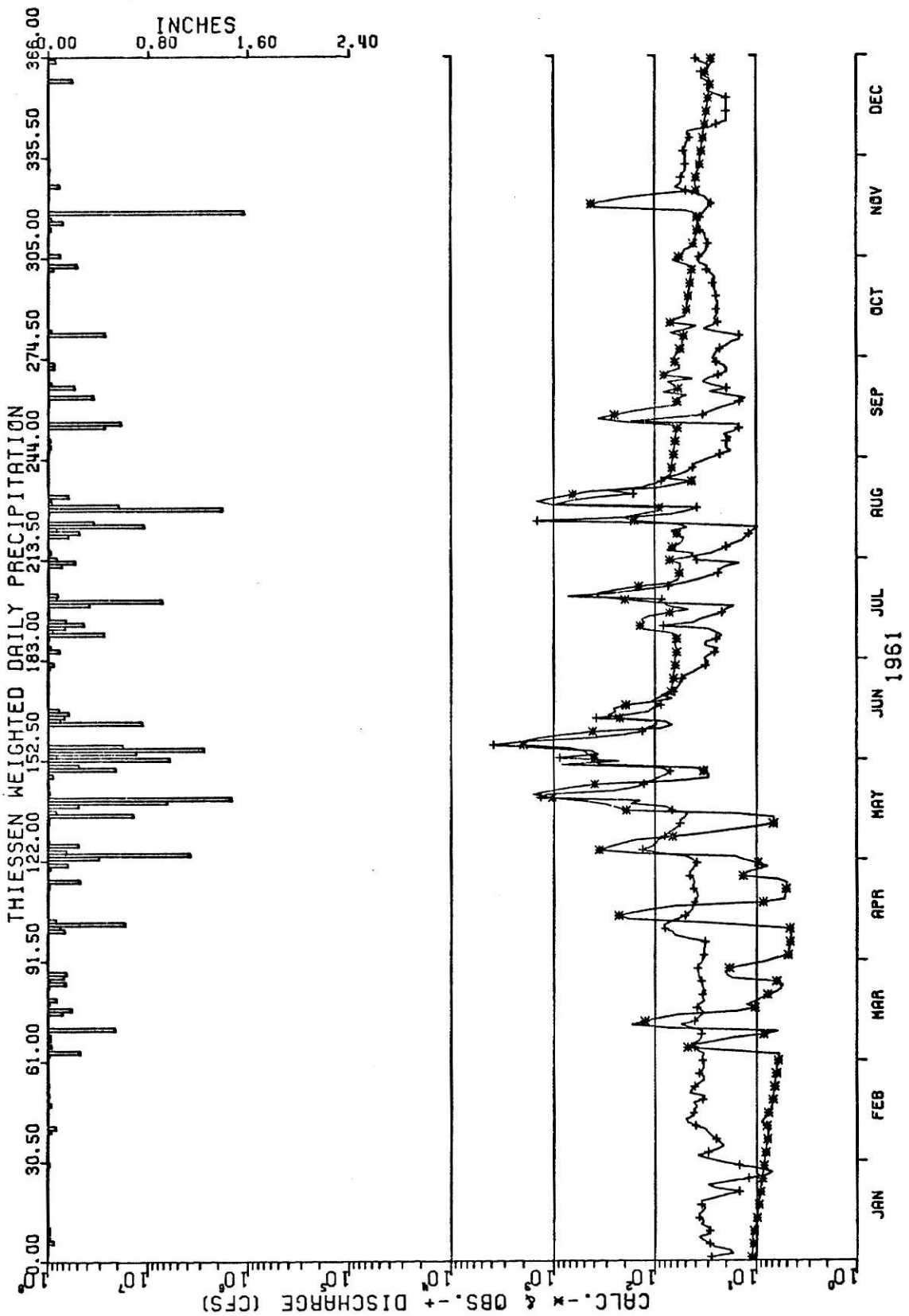
1960
CALC. -* & OBS. -+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
CALC. -* & OBS. -+ DISCHARGE (CFS)
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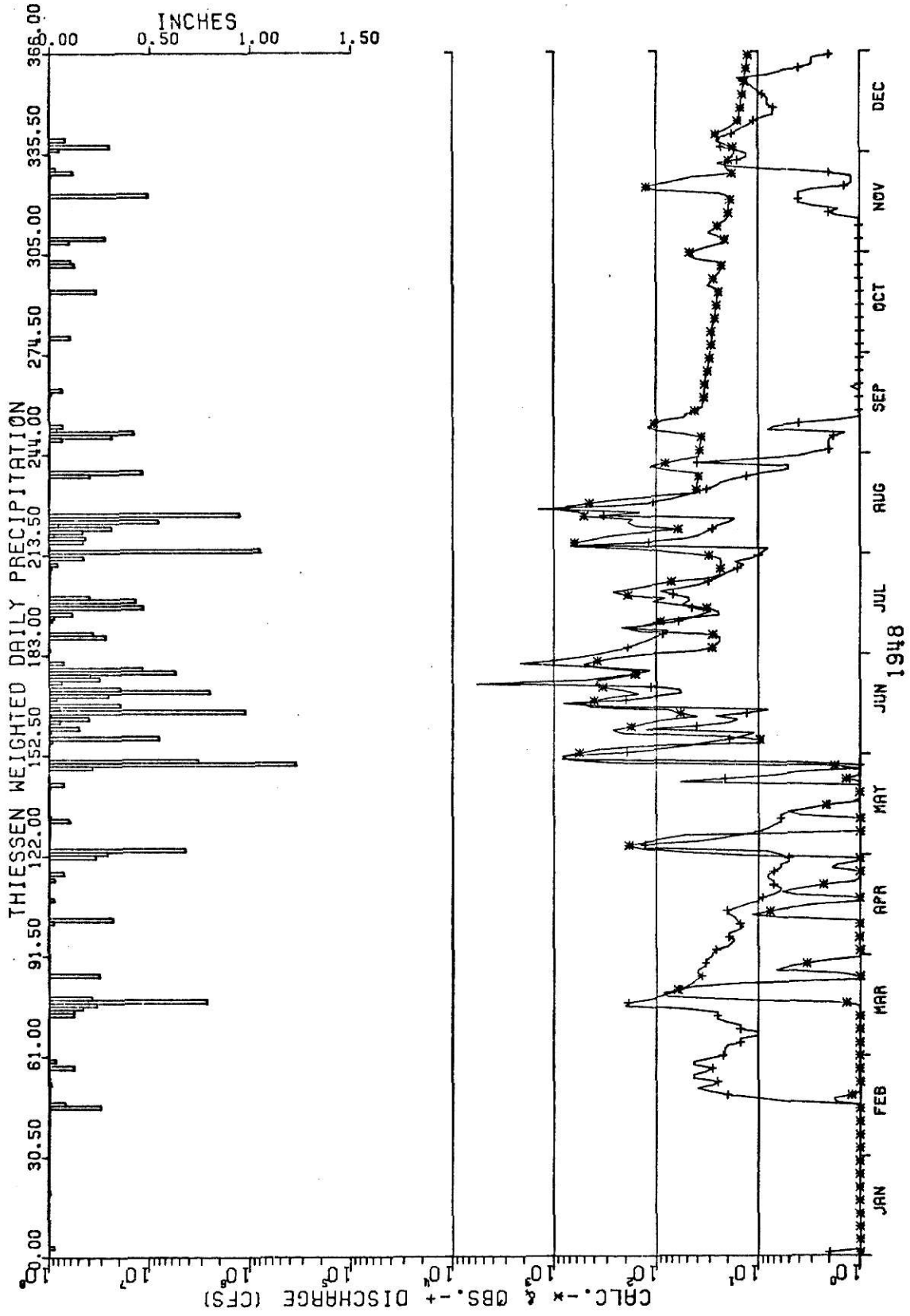
HYDROGRAPHS - MODEL B-ZERO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THIESSEN WEIGHTED DAILY PRECIPITATION
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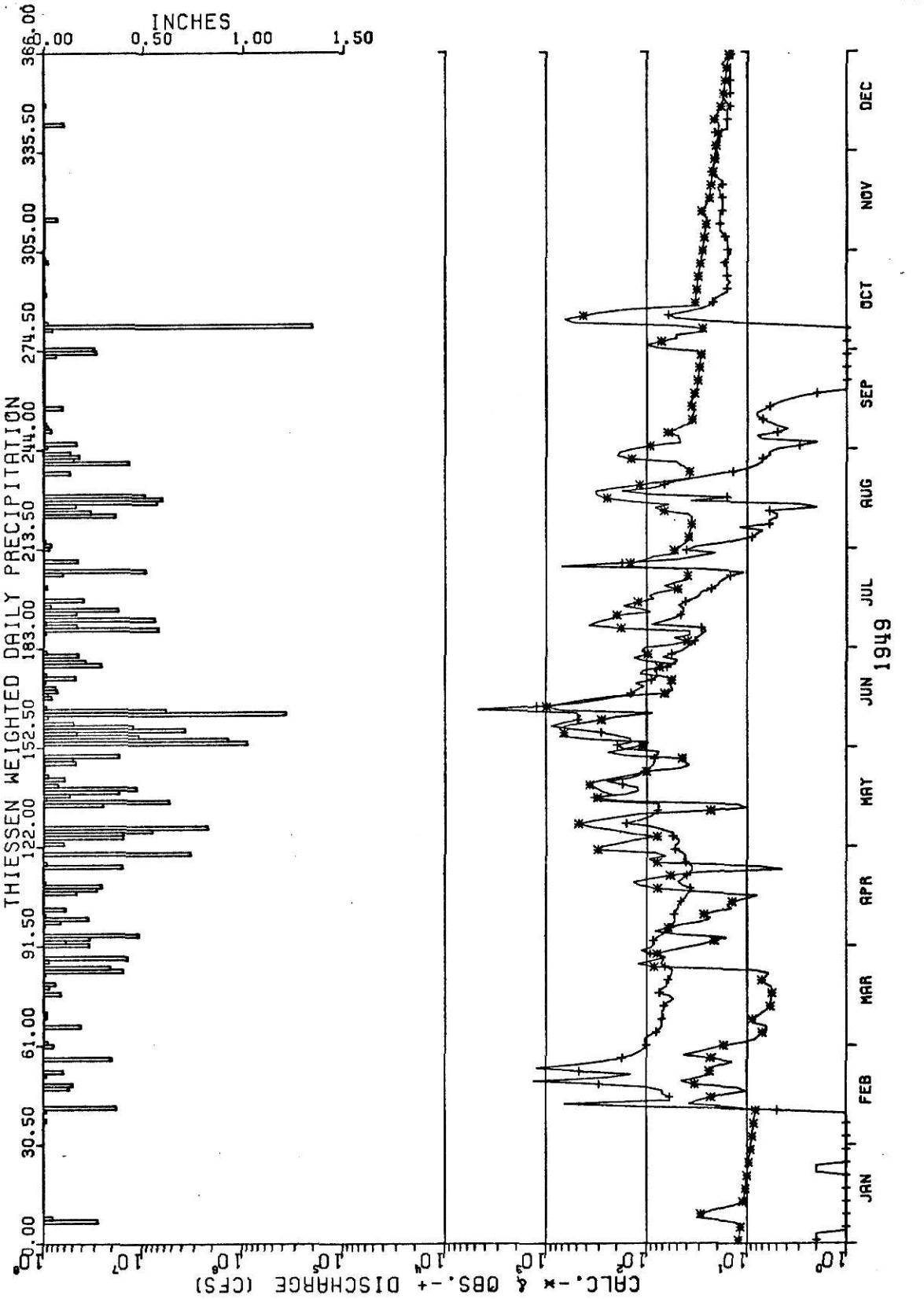
CALC.-* & OBS.-+ DISCHARGE (CFS)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CALC. -* & OBS. -+ DISCHARGE (CFS)
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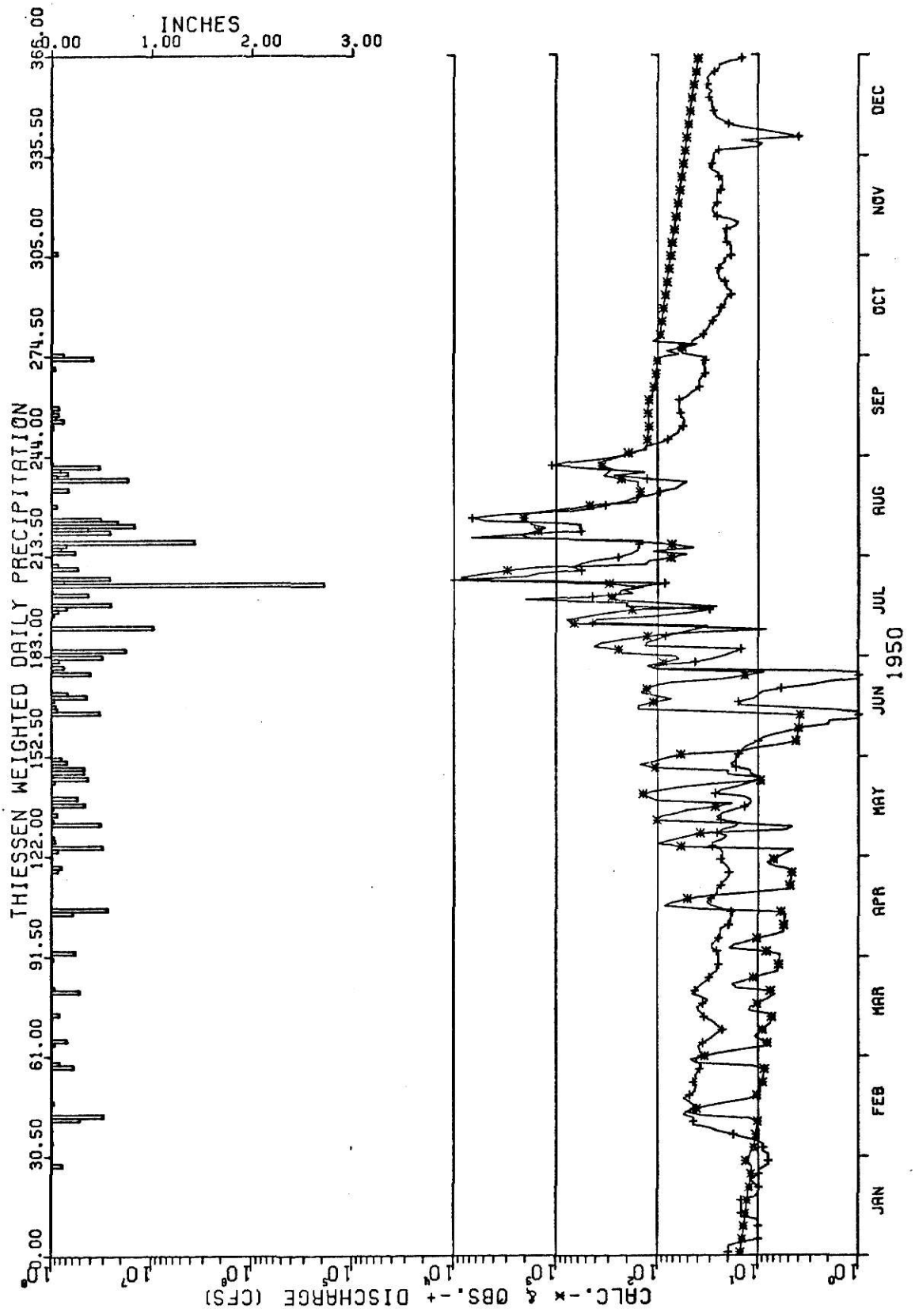
1949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THIESSEN WEIGHTED DAILY PRECIPITATION
CALC.-* & OBS.-+ DISCHARGE (CFS)
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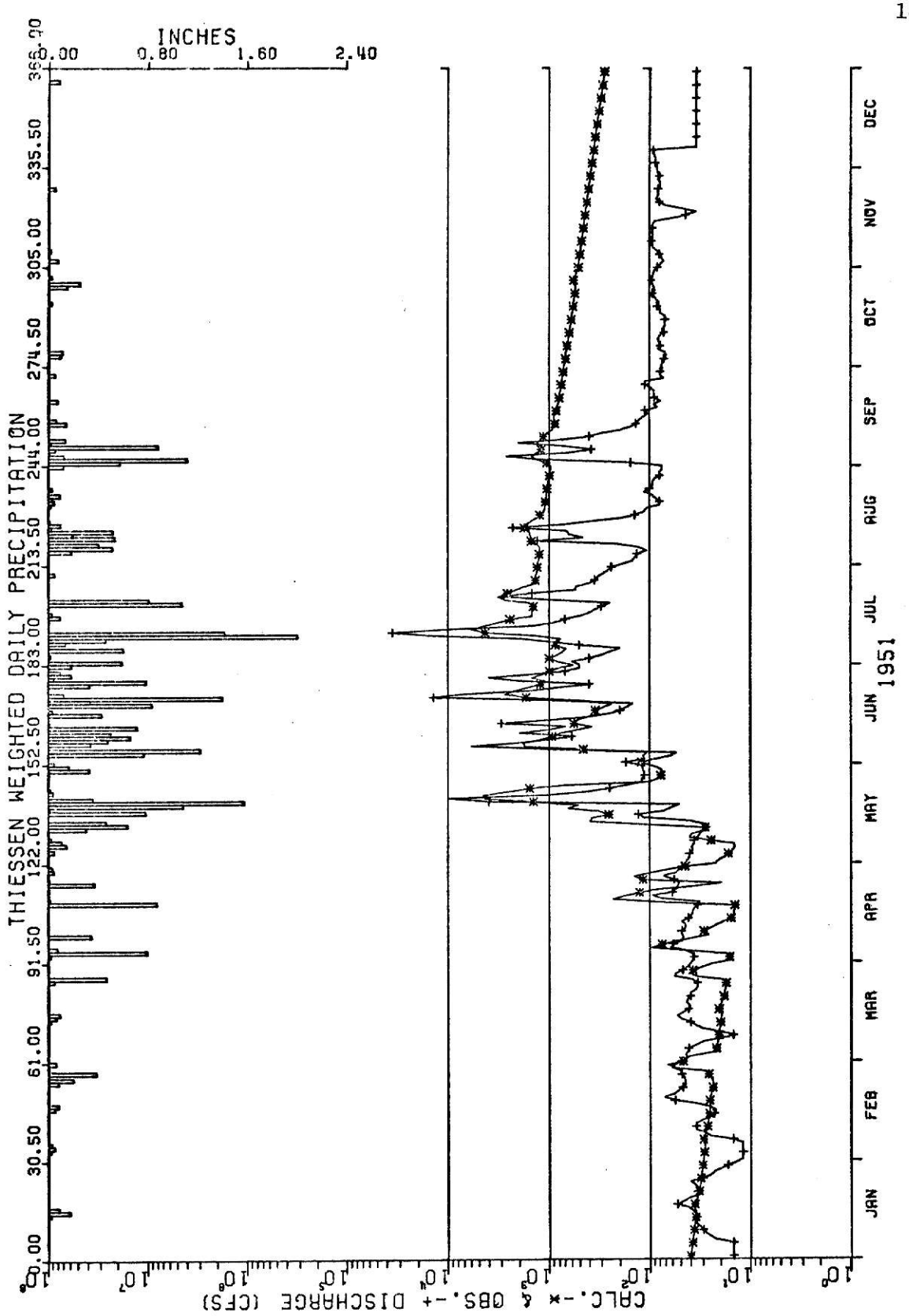
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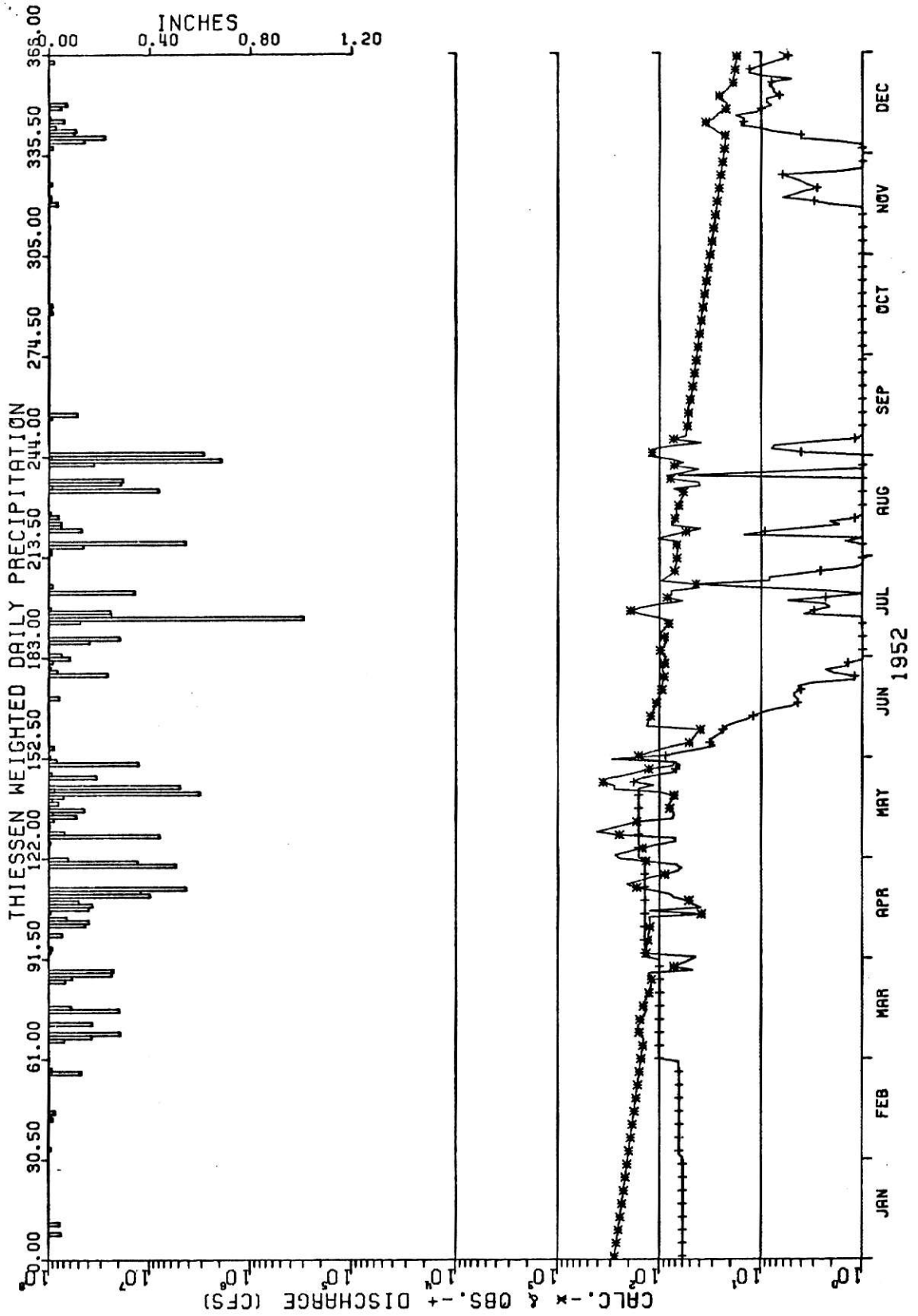
1951
CALC.-* & OBS.-+ DISCHARGE (CFS)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CALC.-* & OBS.-+ DISCHARGE (CFS)
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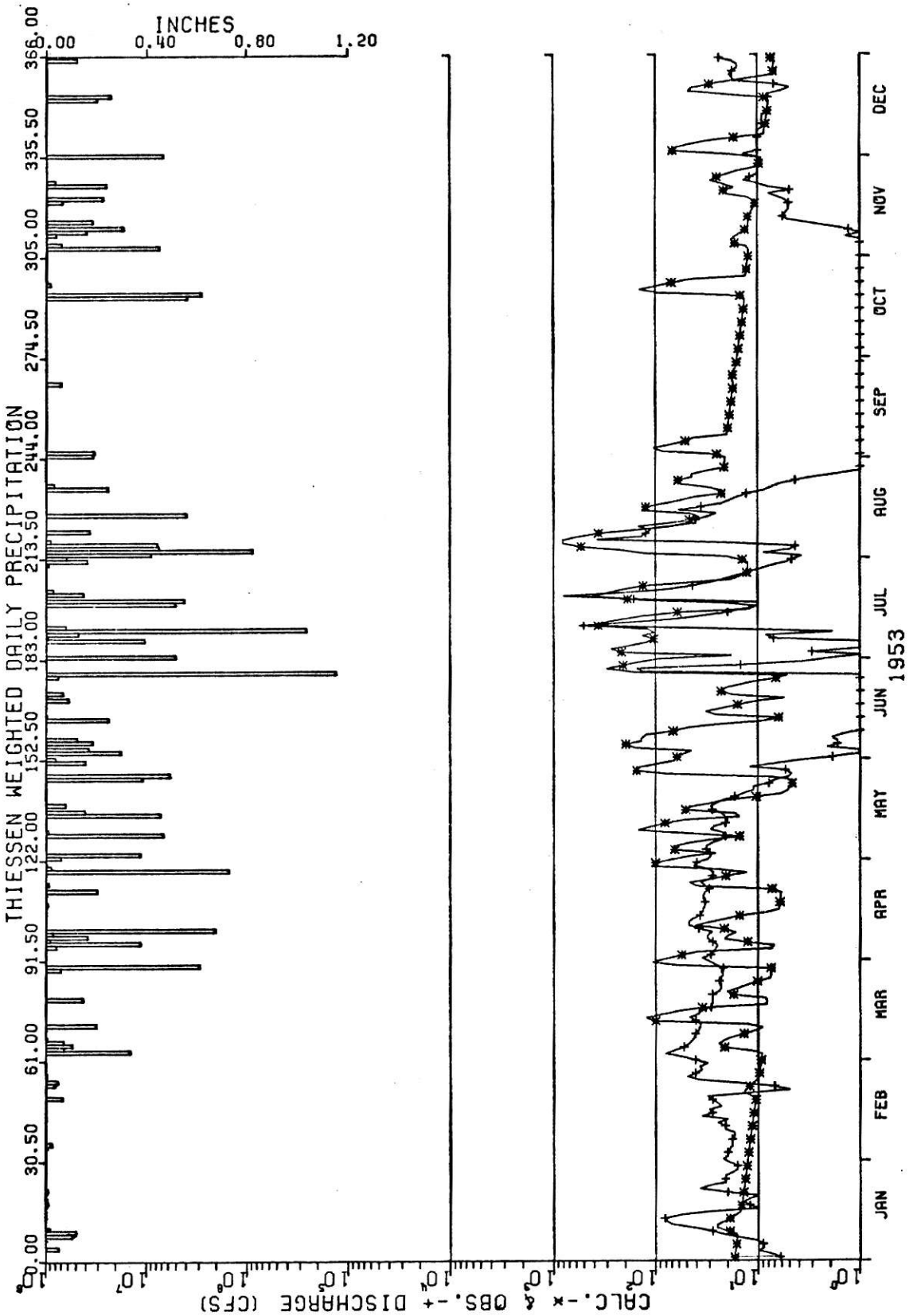
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CALC.-× & OBS.-+ DISCHARGE (CFS)
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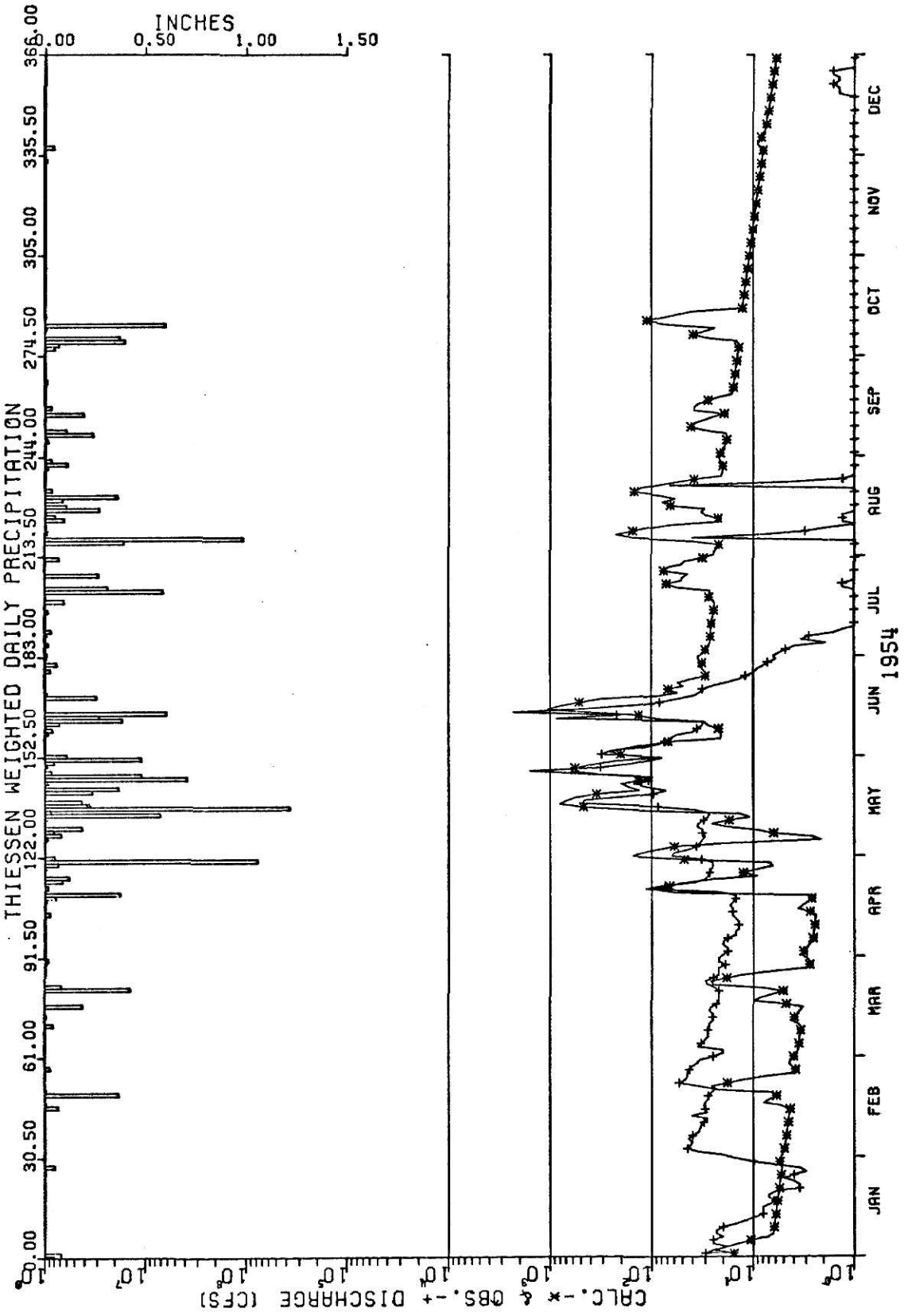
1953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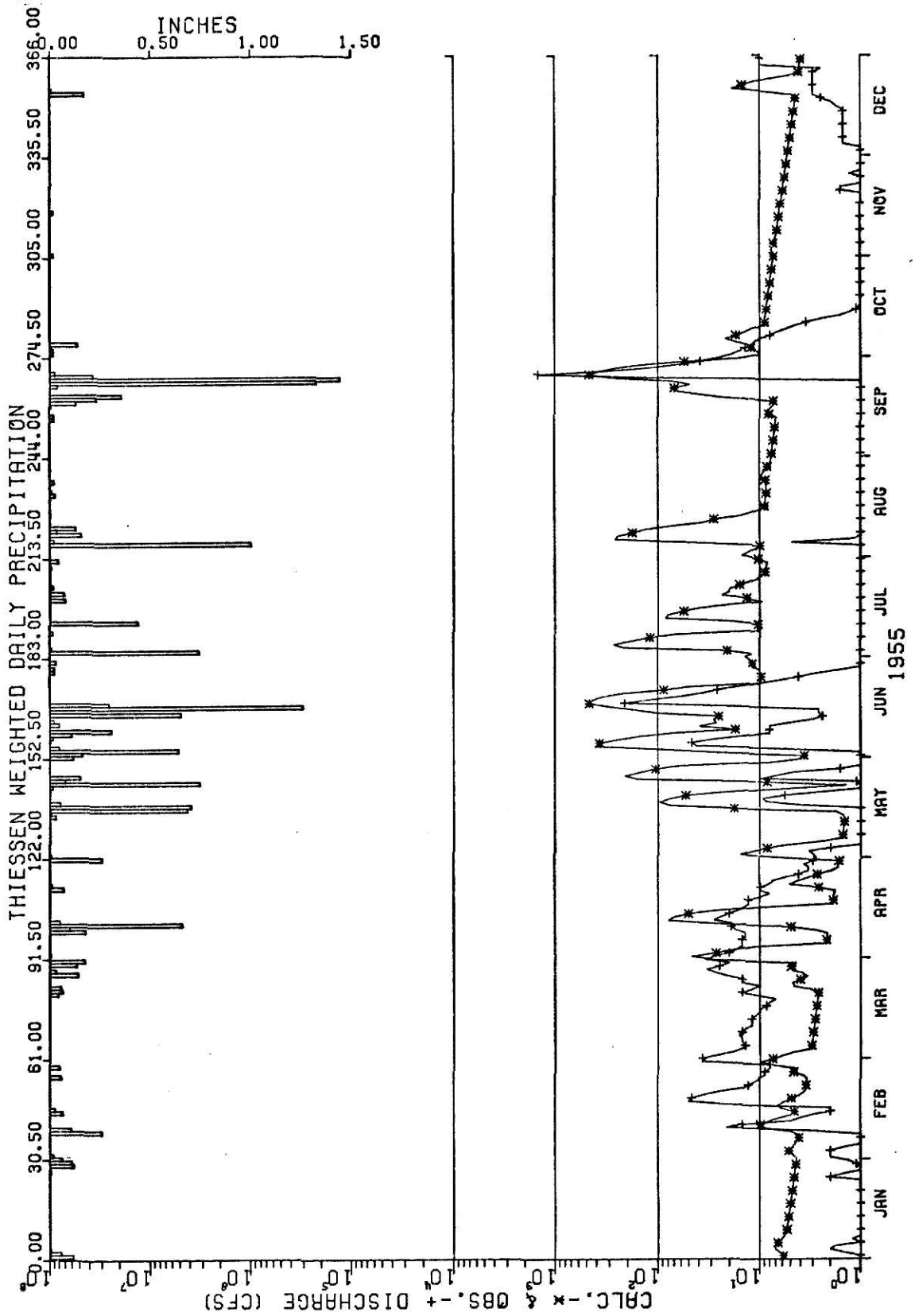
1954
CALC.-* & OBS.-+ DISCHARGE (CFS)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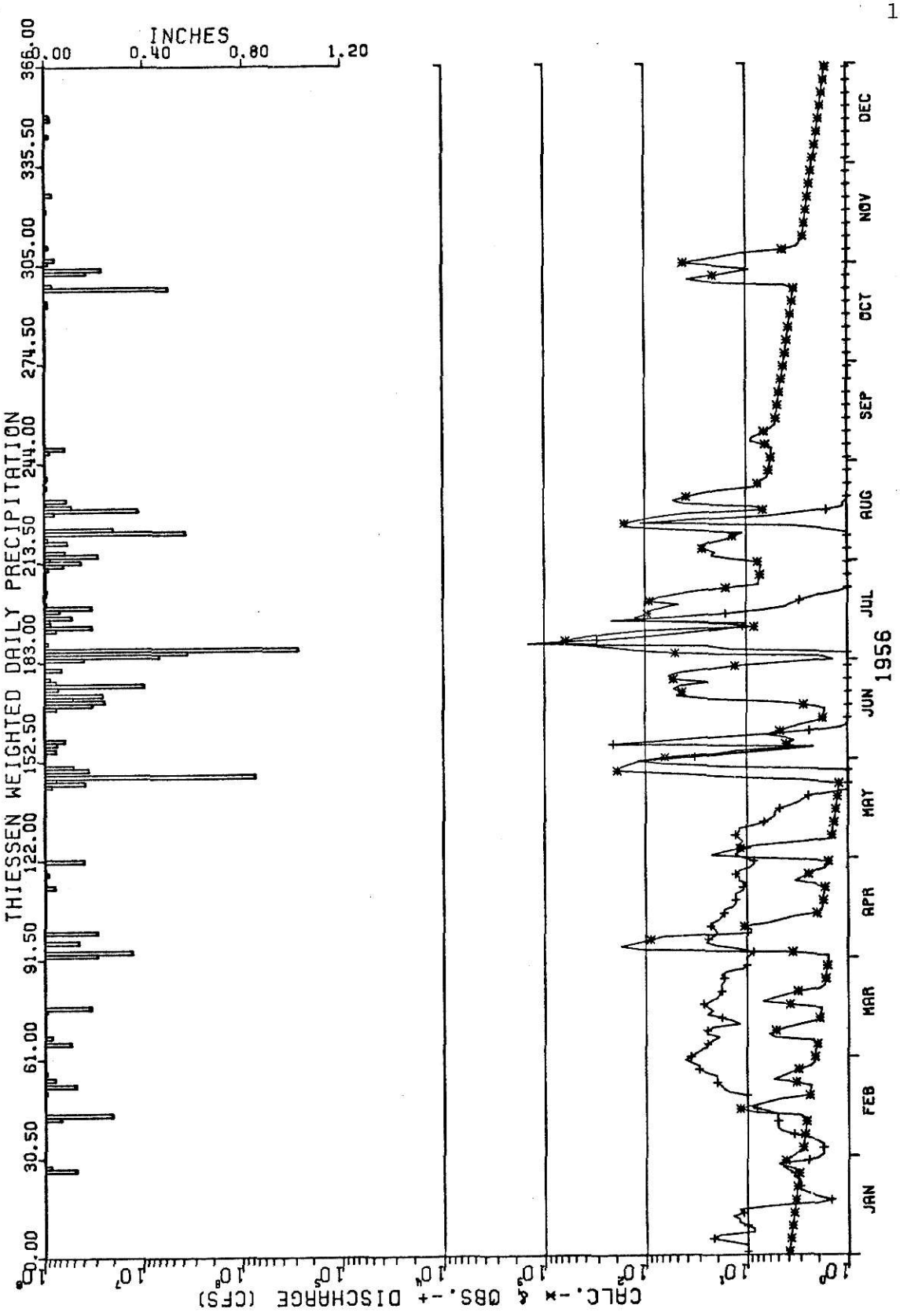
1955
CALC.-× & OBS.-+ DISCHARGE (CFS)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CALC. -* & OBS. -+ DISCHARGE (CFS)
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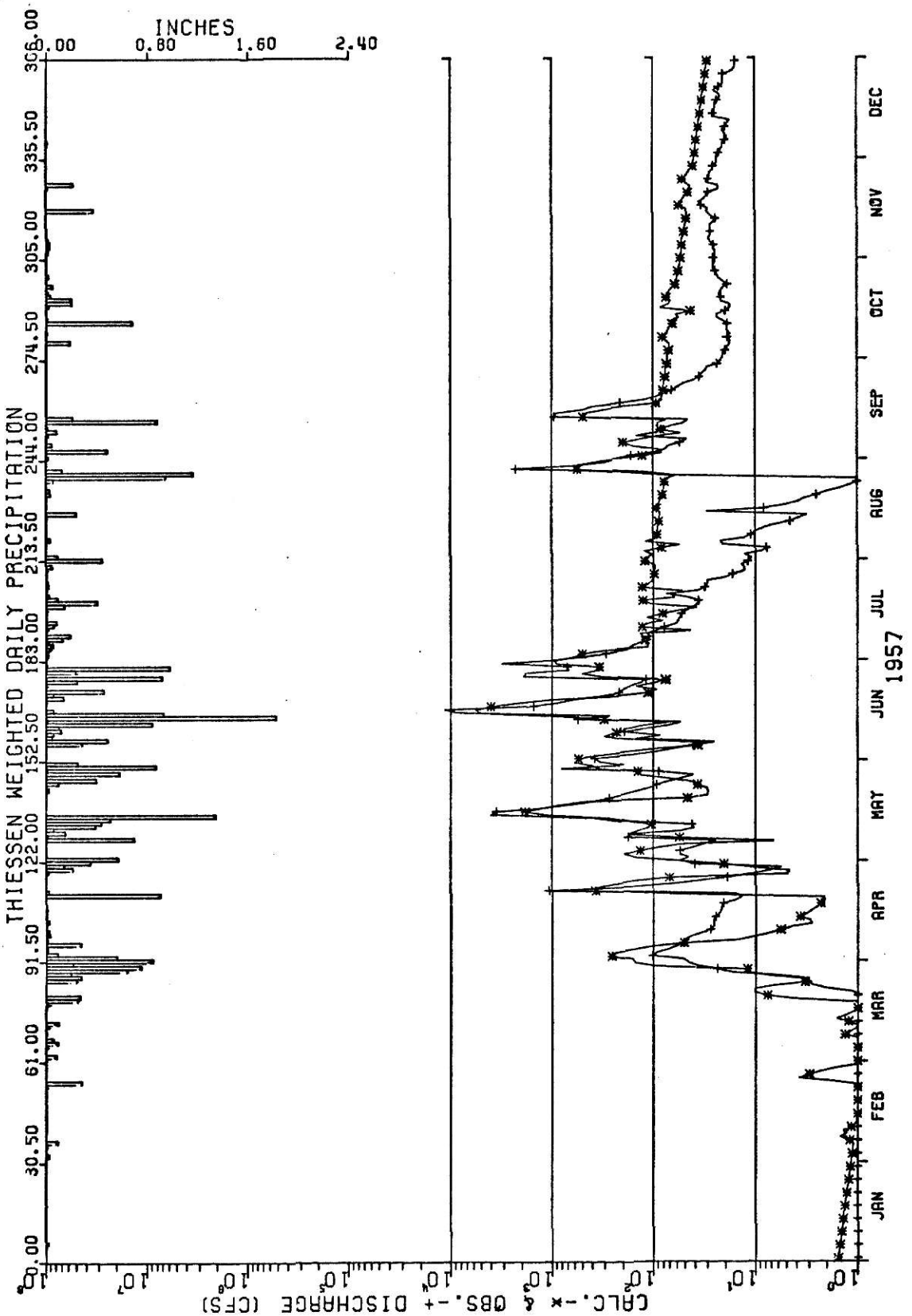
1956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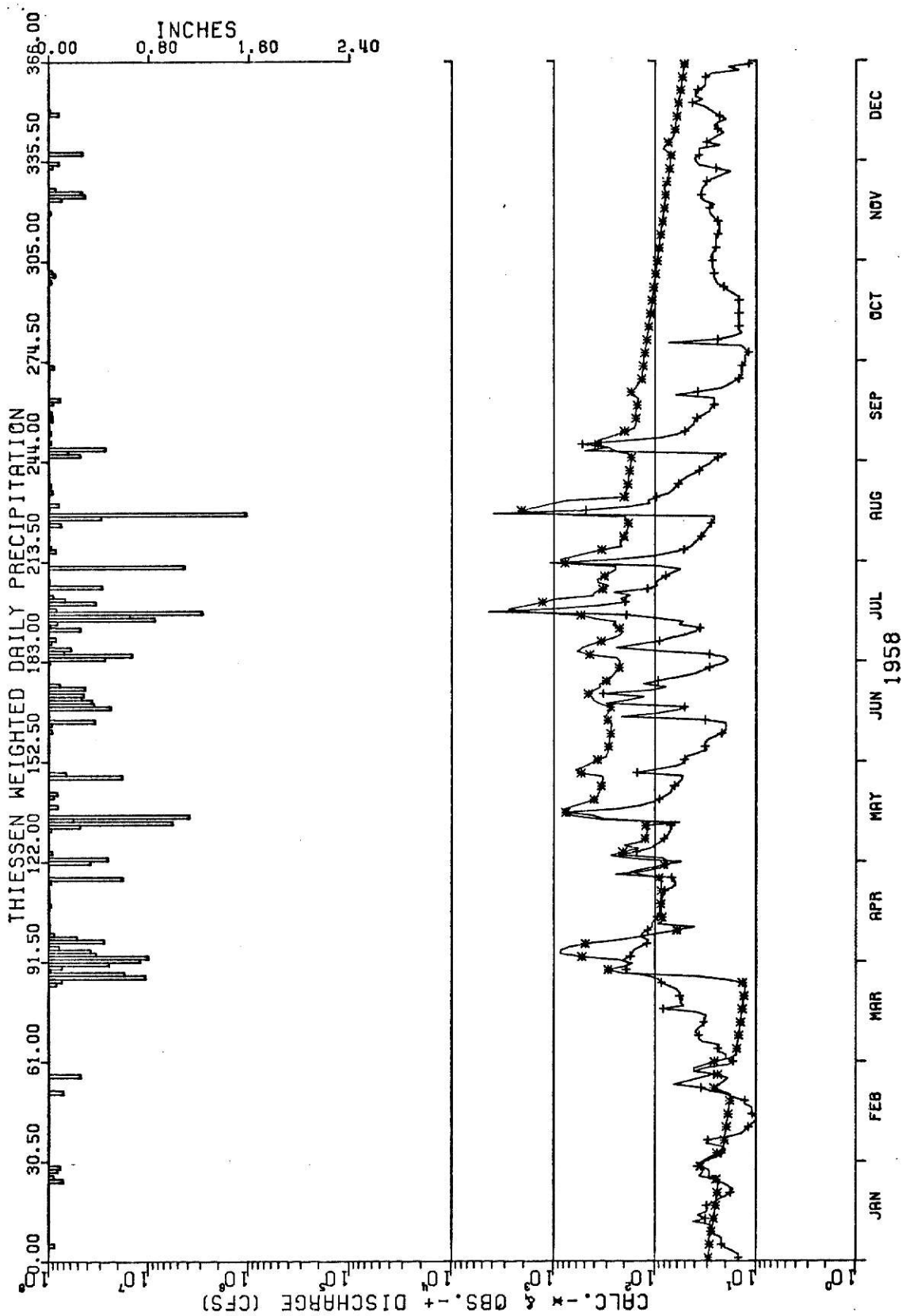
1957
CALC.-× & OBS.-+ DISCHARGE (CFS)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CALC.-* & OBS.-+ DISCHARGE (CFS)
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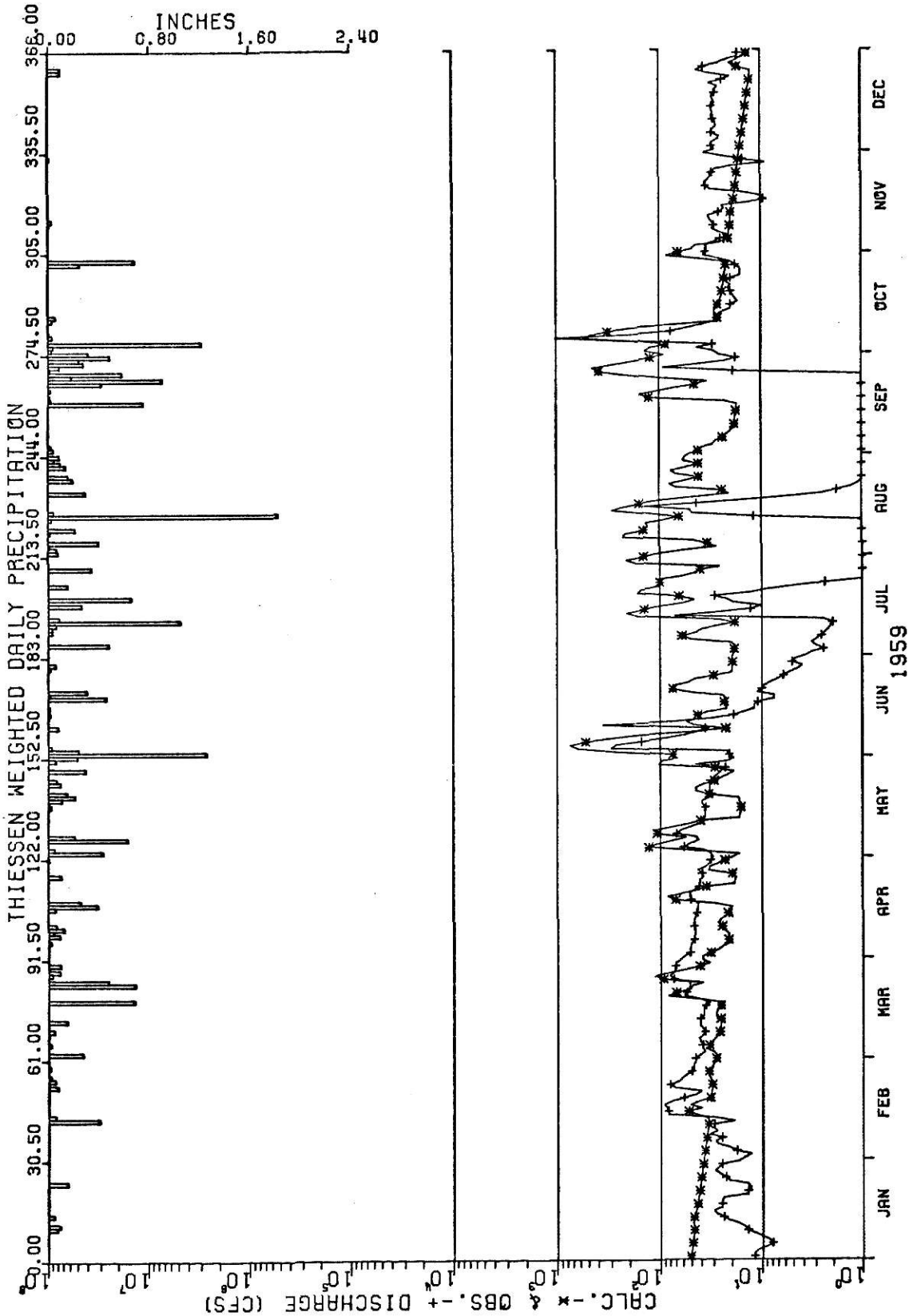
1958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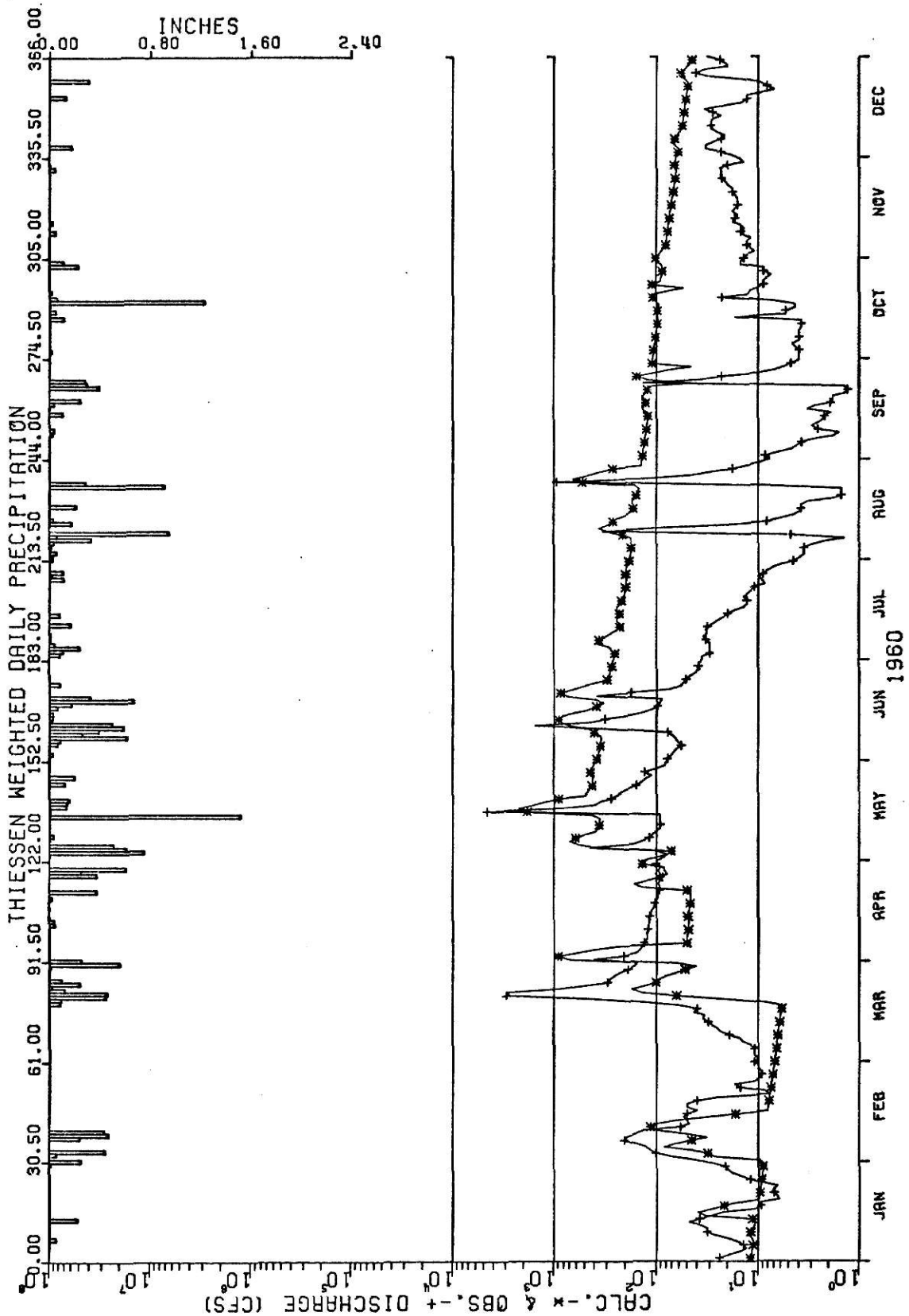
1959
CALC.-* & OBS.-+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
CALC.-× & OBS.-+ DISCHARGE (CFS)
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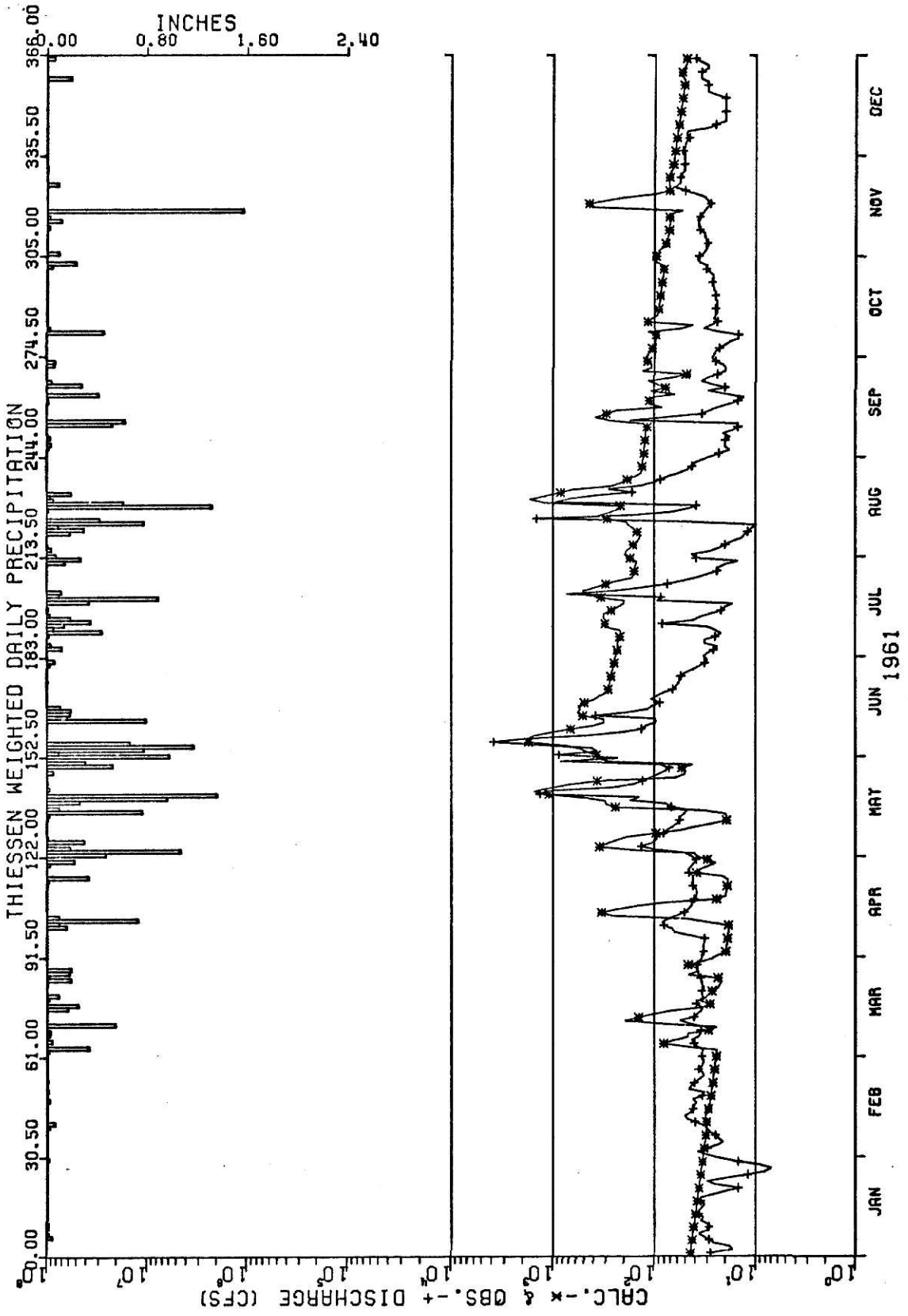
1960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CALC.-× & OBS.-+ DISCHARGE (CFS)
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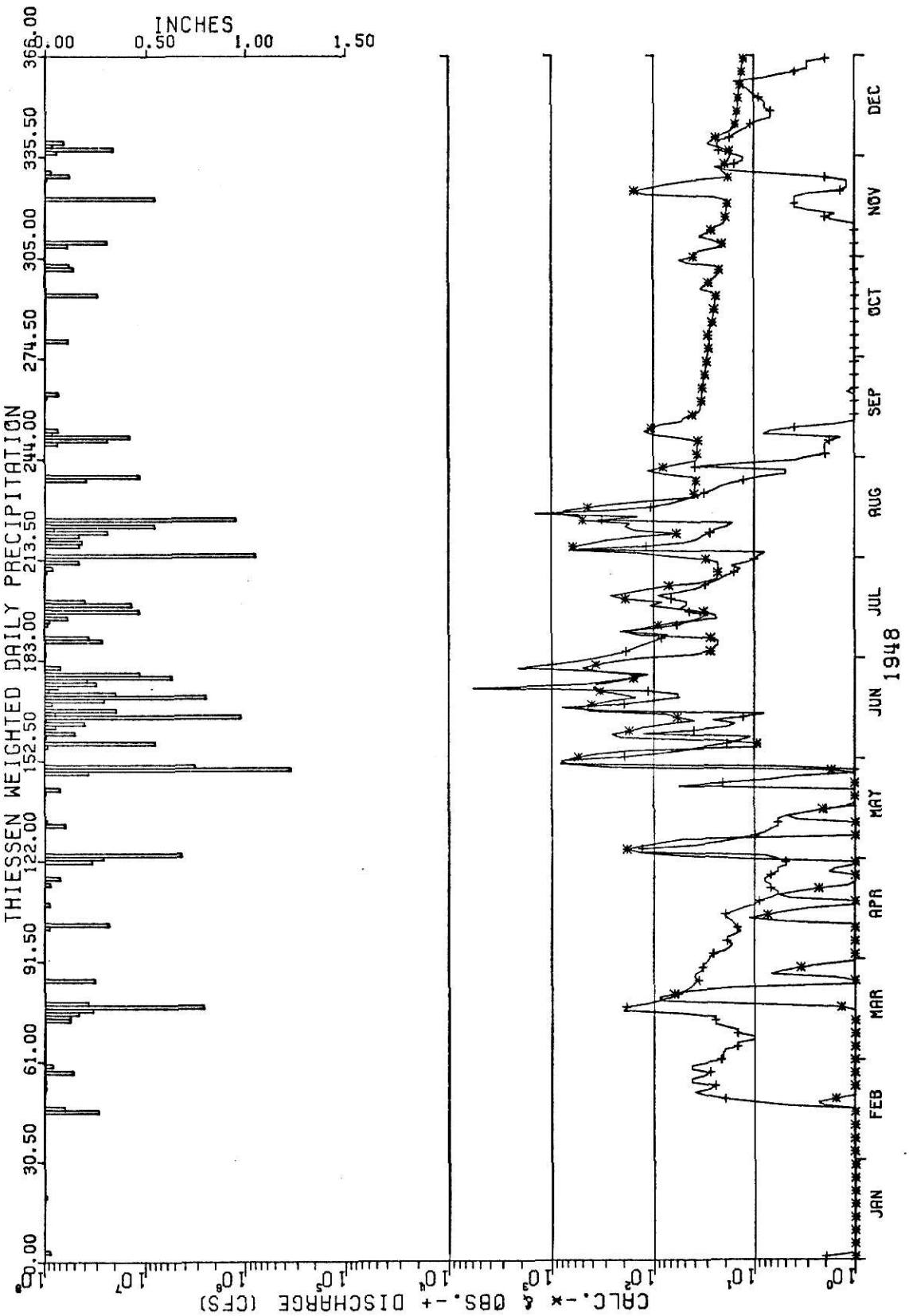
HYDROGRAPHS - MODEL B-TEN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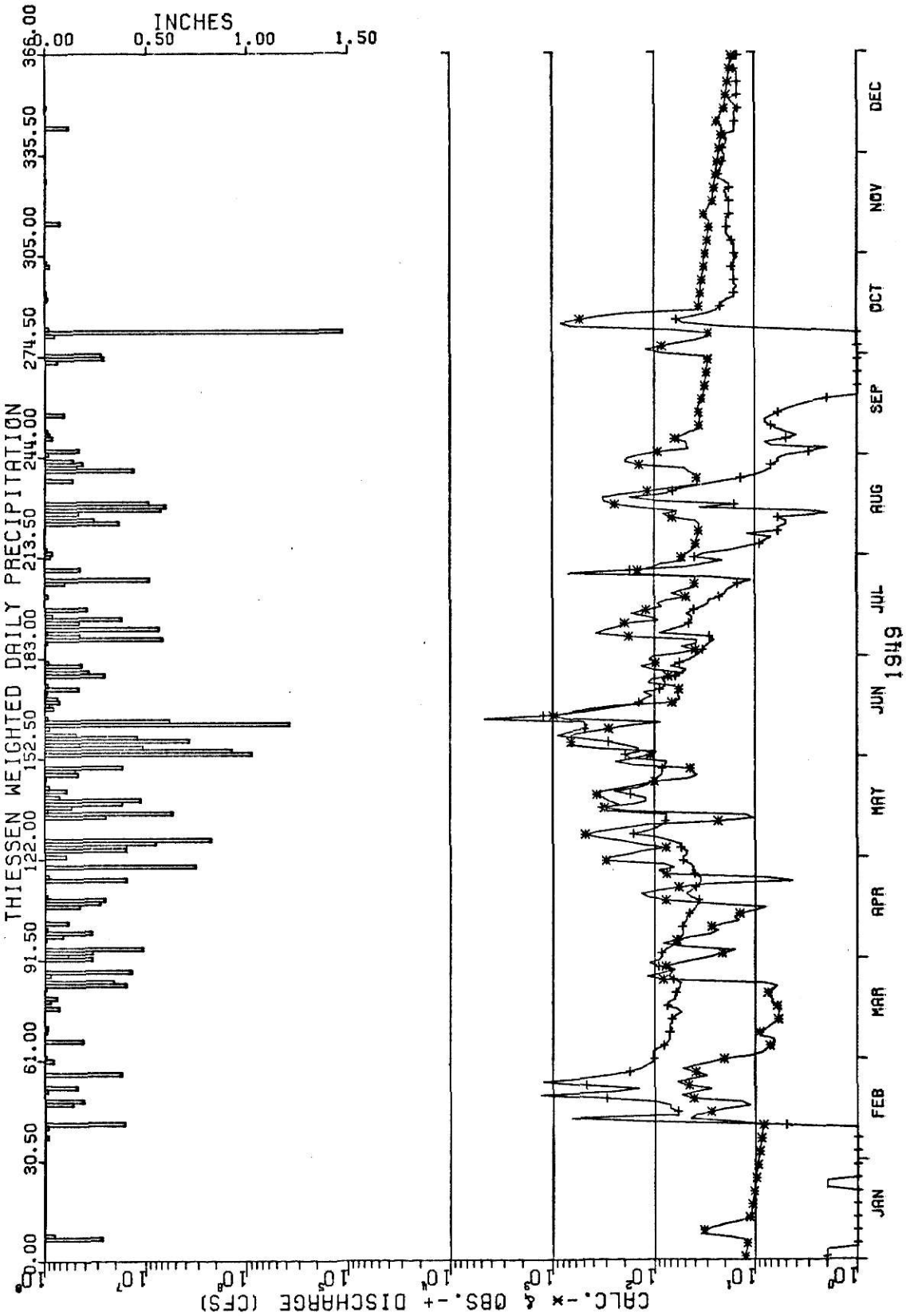
THIESSEN WEIGHTED DAILY PRECIPITATION
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1948
CALC.-* & OBS.-+ DISCHARGE (CFS)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CALC.-* & OBS.-+ DISCHARGE (CFS)
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DEC
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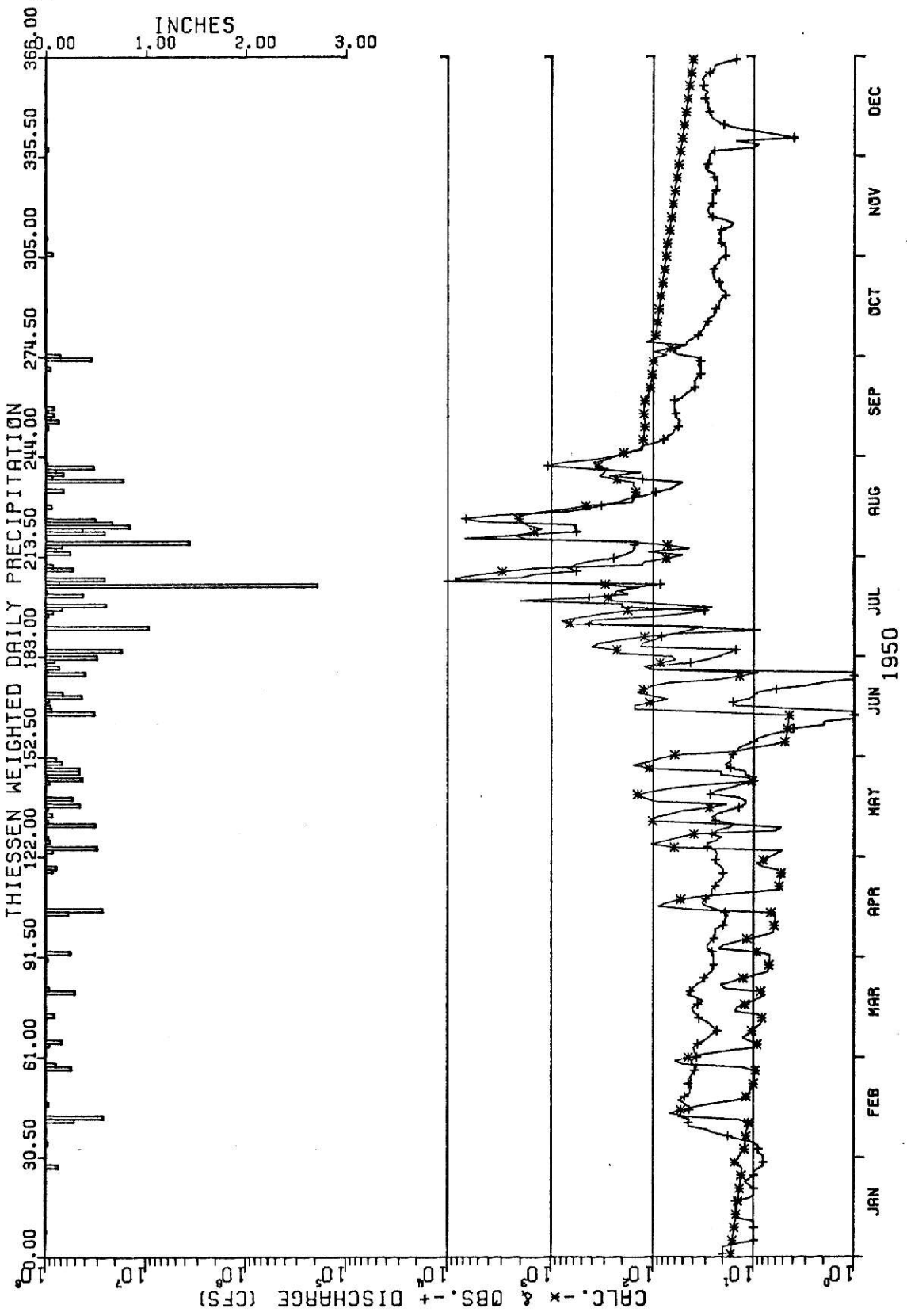
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THIESSEN WEIGHTED DAILY PRECIPITATION
JAN
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OCT
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DEC
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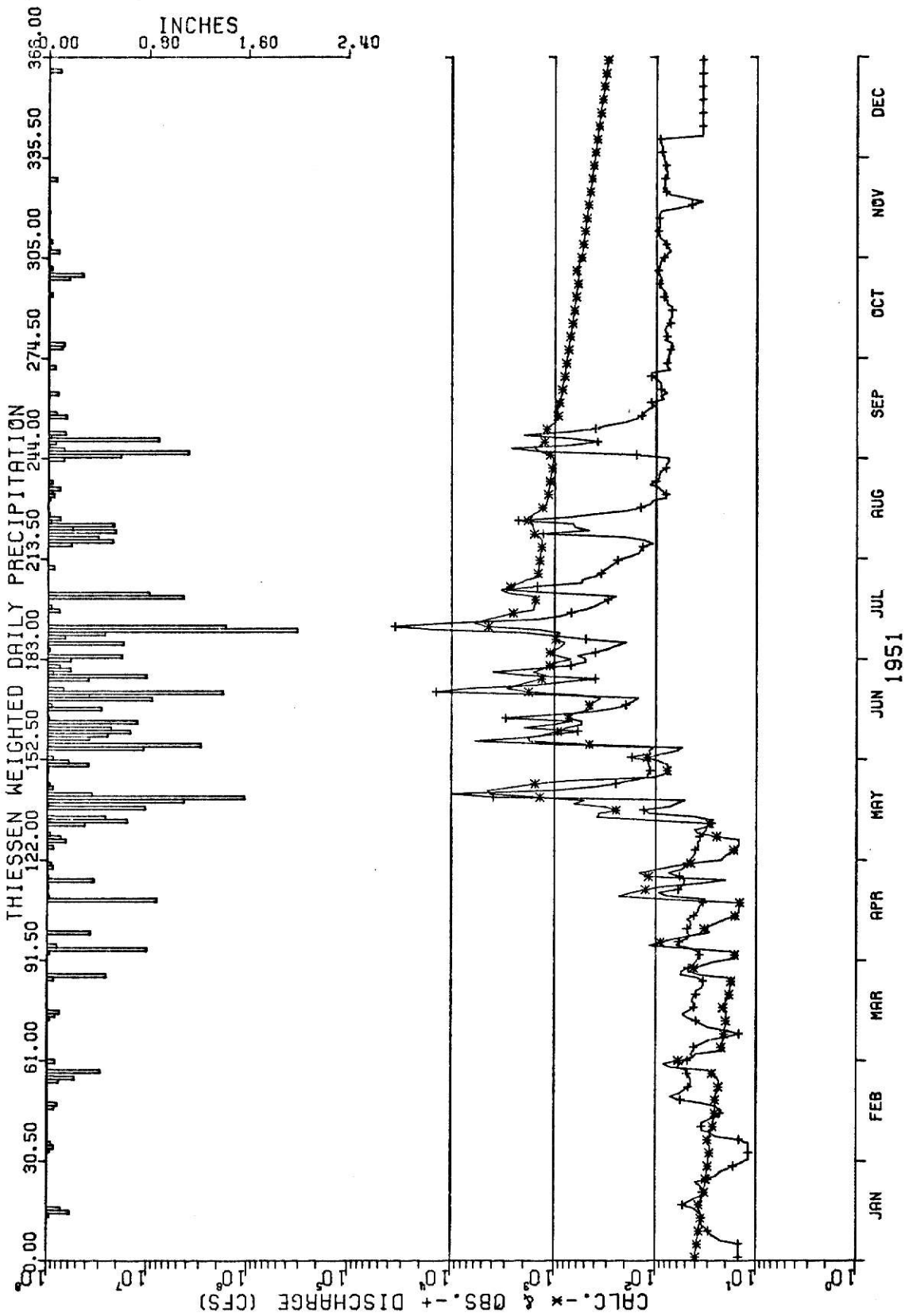
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CALC.-* & OBS.-+ DISCHARGE (CFS)
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FEB
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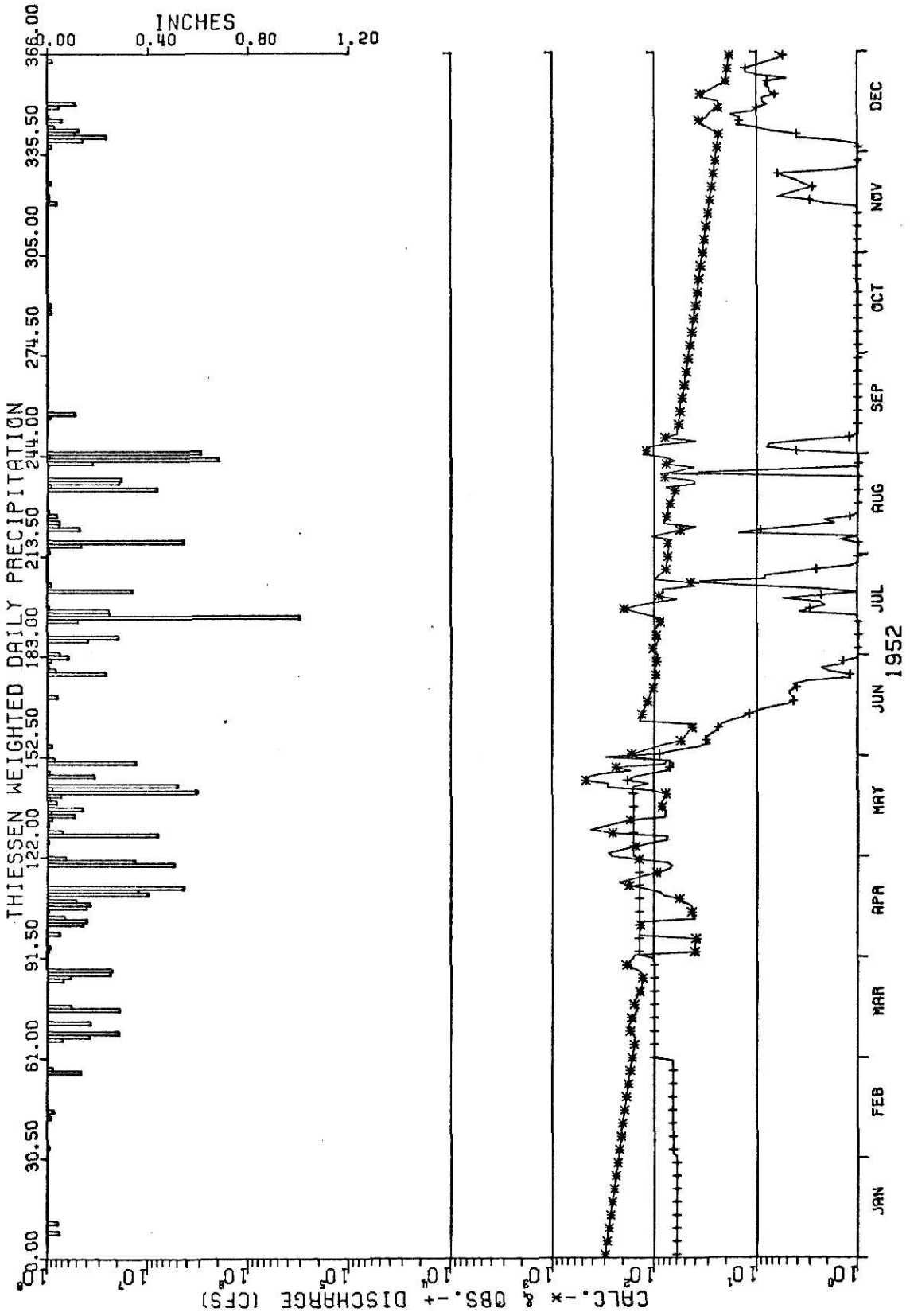
SEP
OCT
NOV
DEC
1951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JAN
FEB
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APR
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JUN
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AUG
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OCT
NOV
DEC
1952
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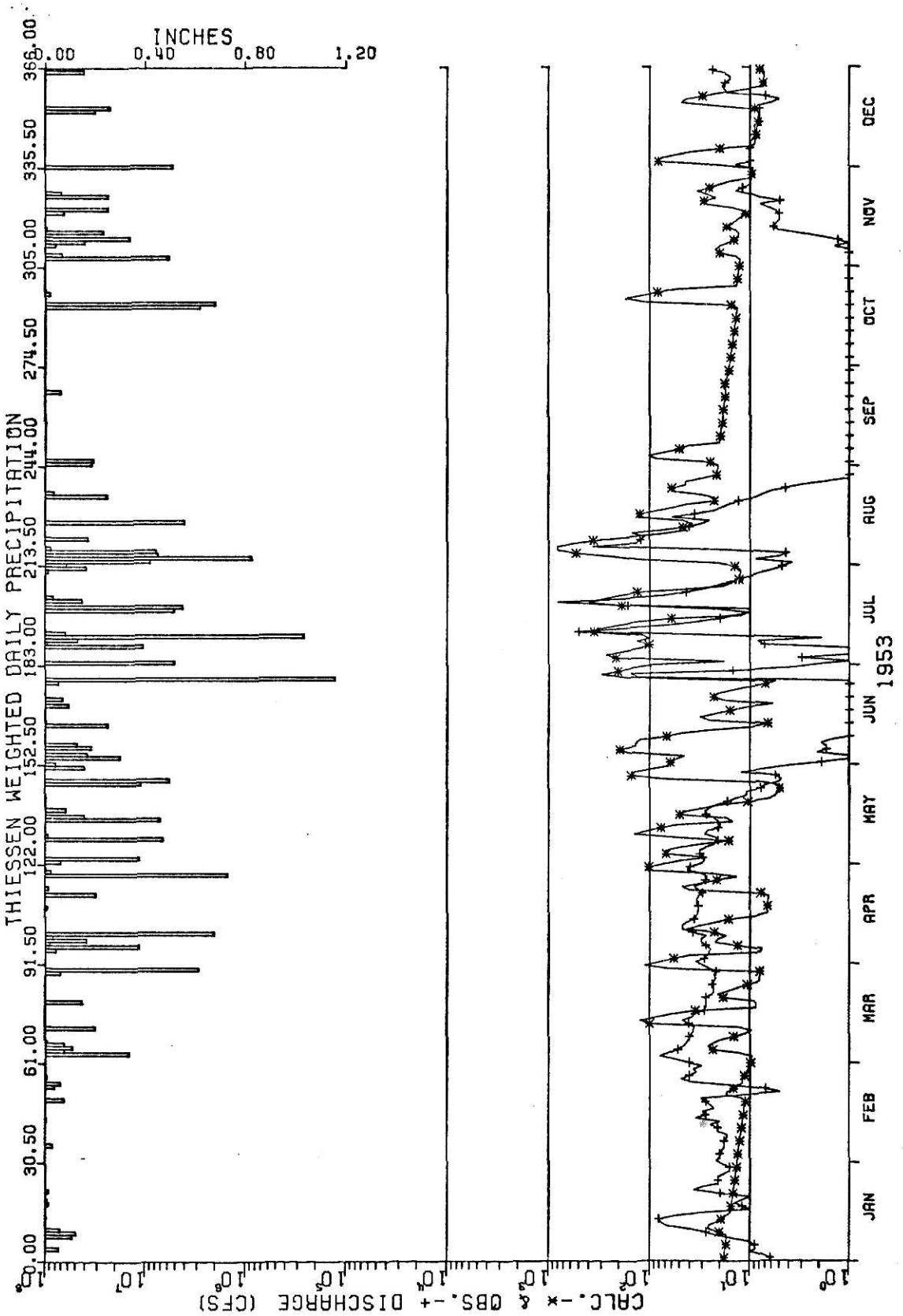
10^2
10^3
10^4
10^5
10^6
10^7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JAN
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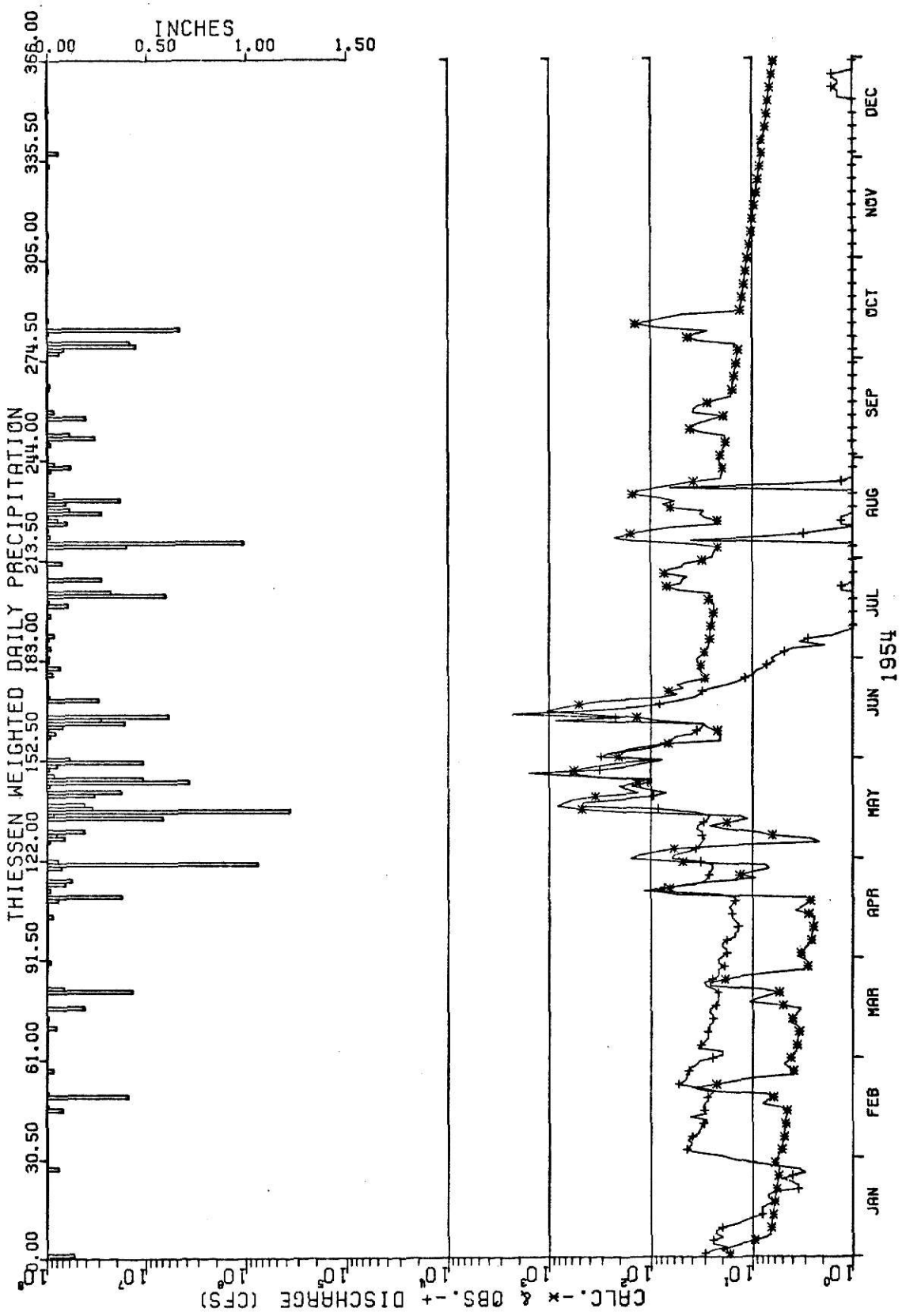
DEC
1953
CALC.-* & OBS.-+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
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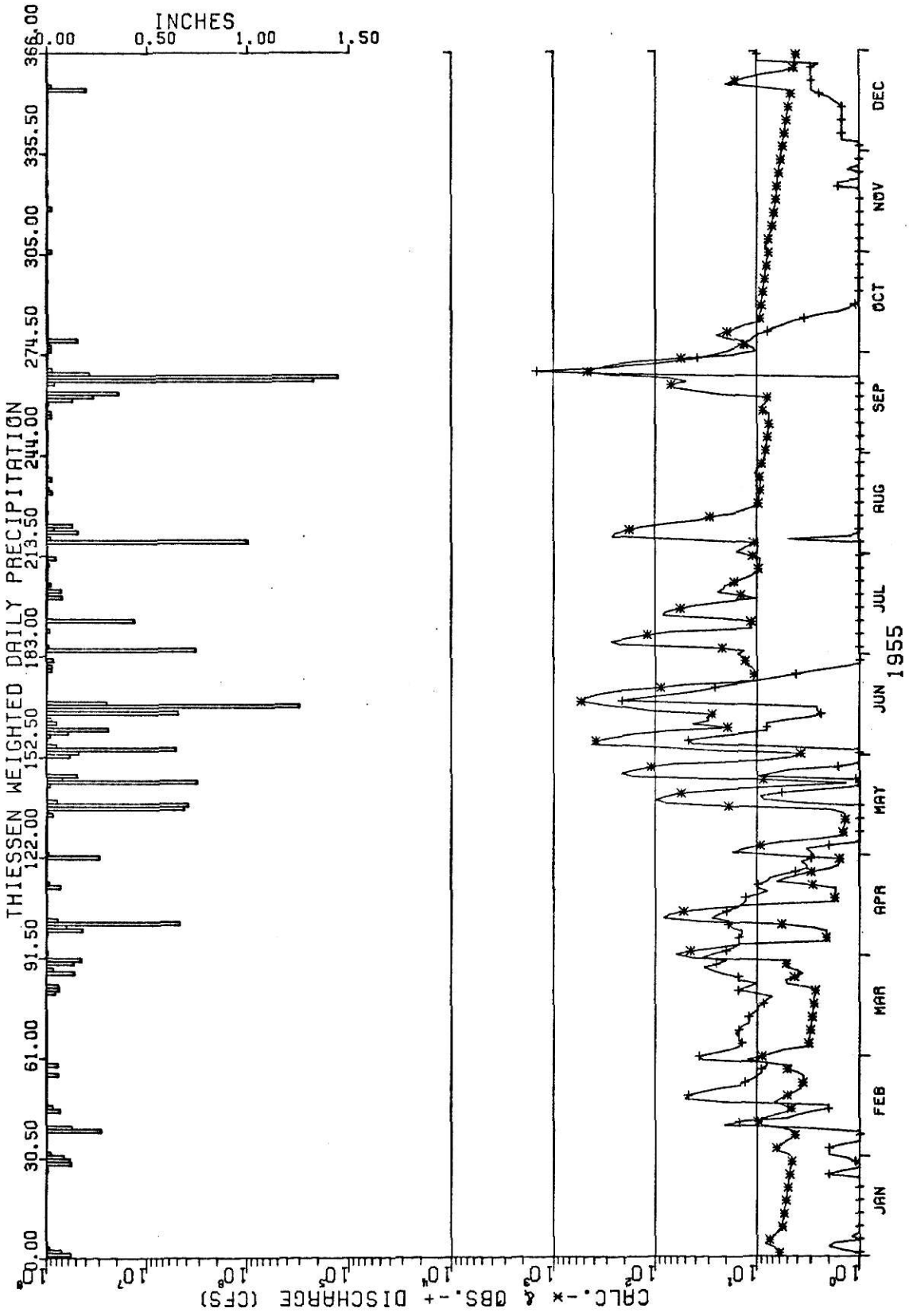
OCT
NOV
DEC
1954
CALC.-* & OBS.-+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
CALC.-* & OBS.-+ DISCHARGE (CFS)
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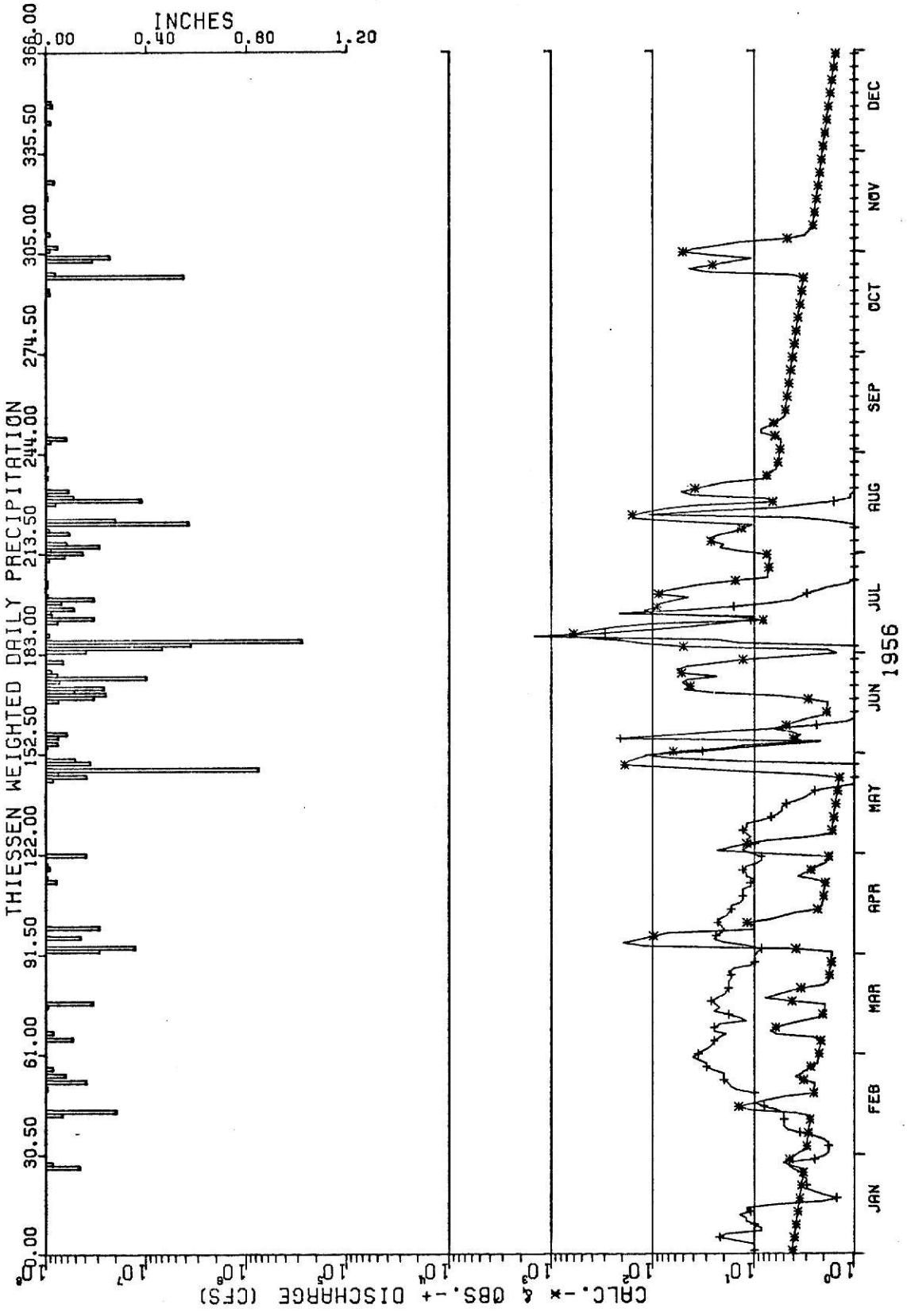
1955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1956
CALC. -* & OBS. -+ DISCHARGE (CFS)
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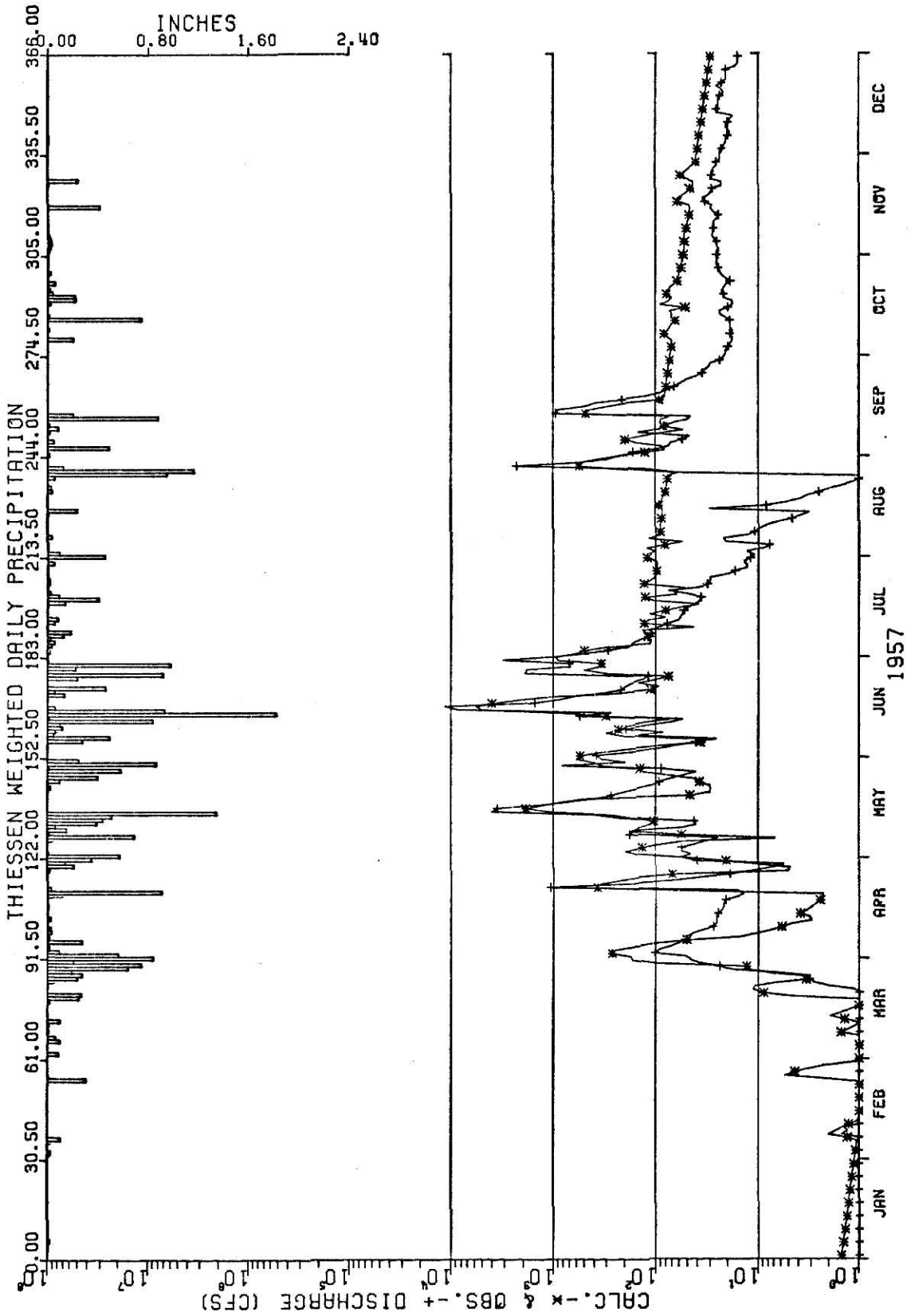
10^4
10^5
10^6
10^7
10^8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THIESSEN WEIGHTED DAILY PRECIPITATION
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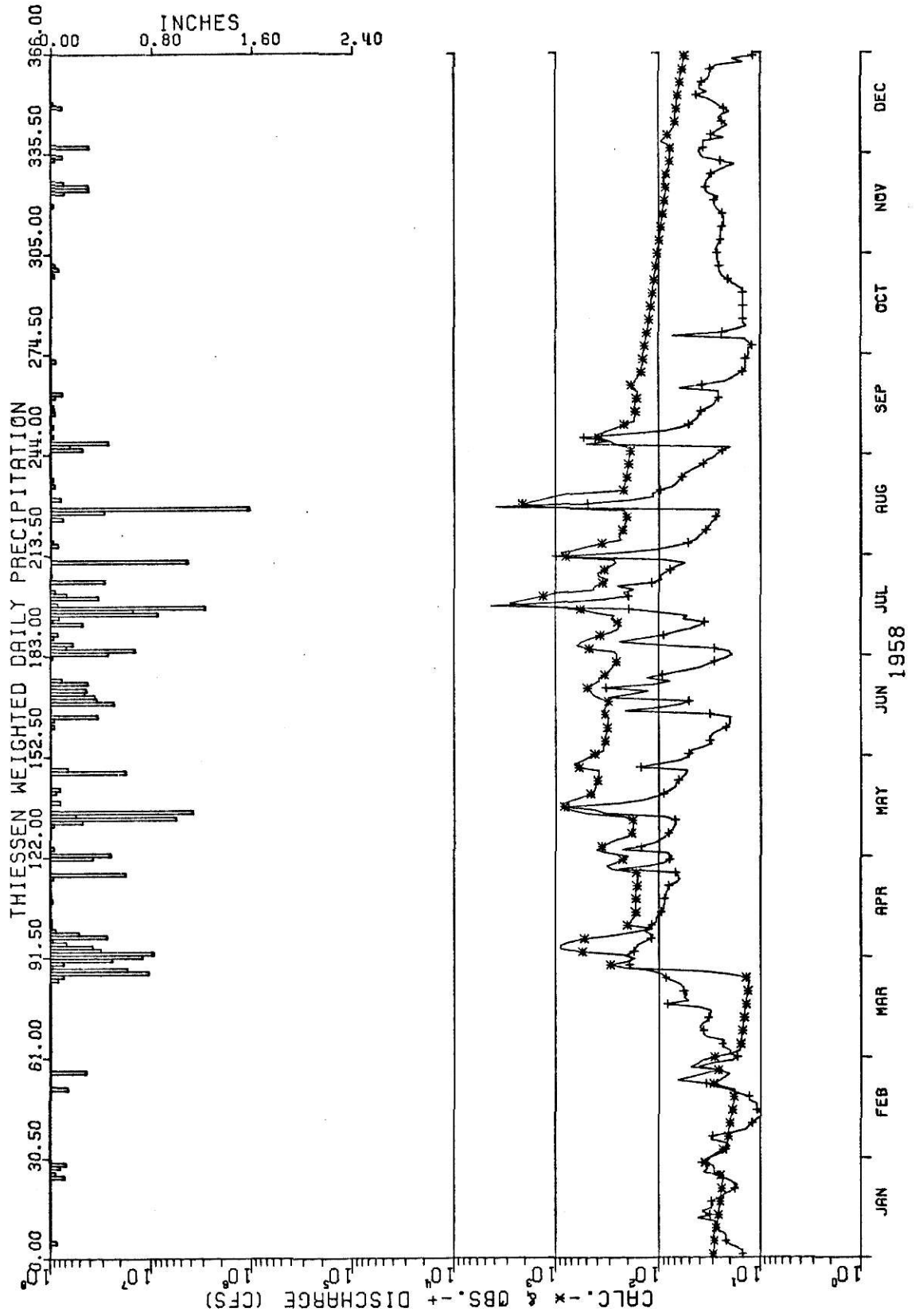
1957
CALC.-× & OBS.-+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
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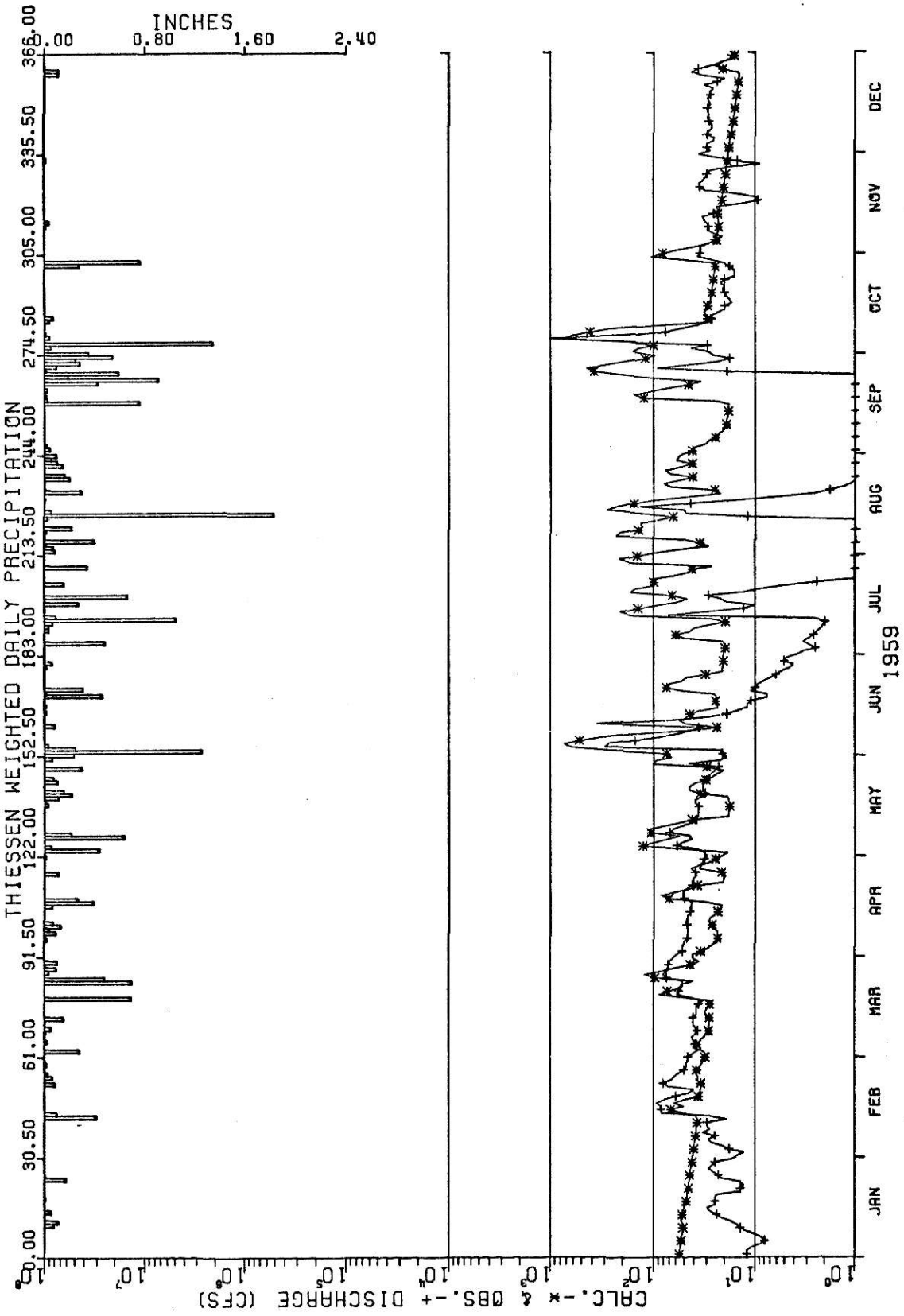
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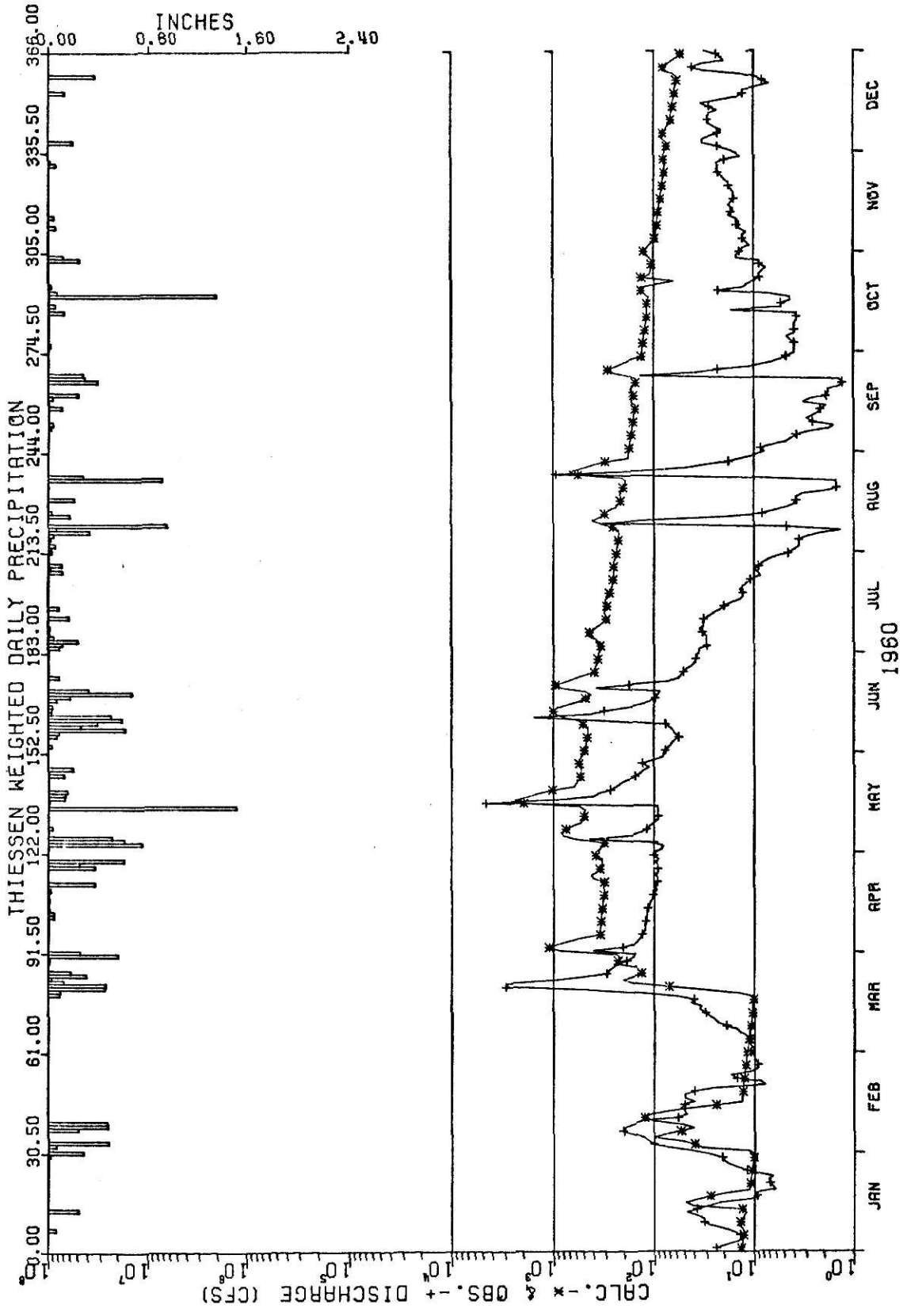
1959
CALC.-× & OBS.-+ DISCHARGE (CFS)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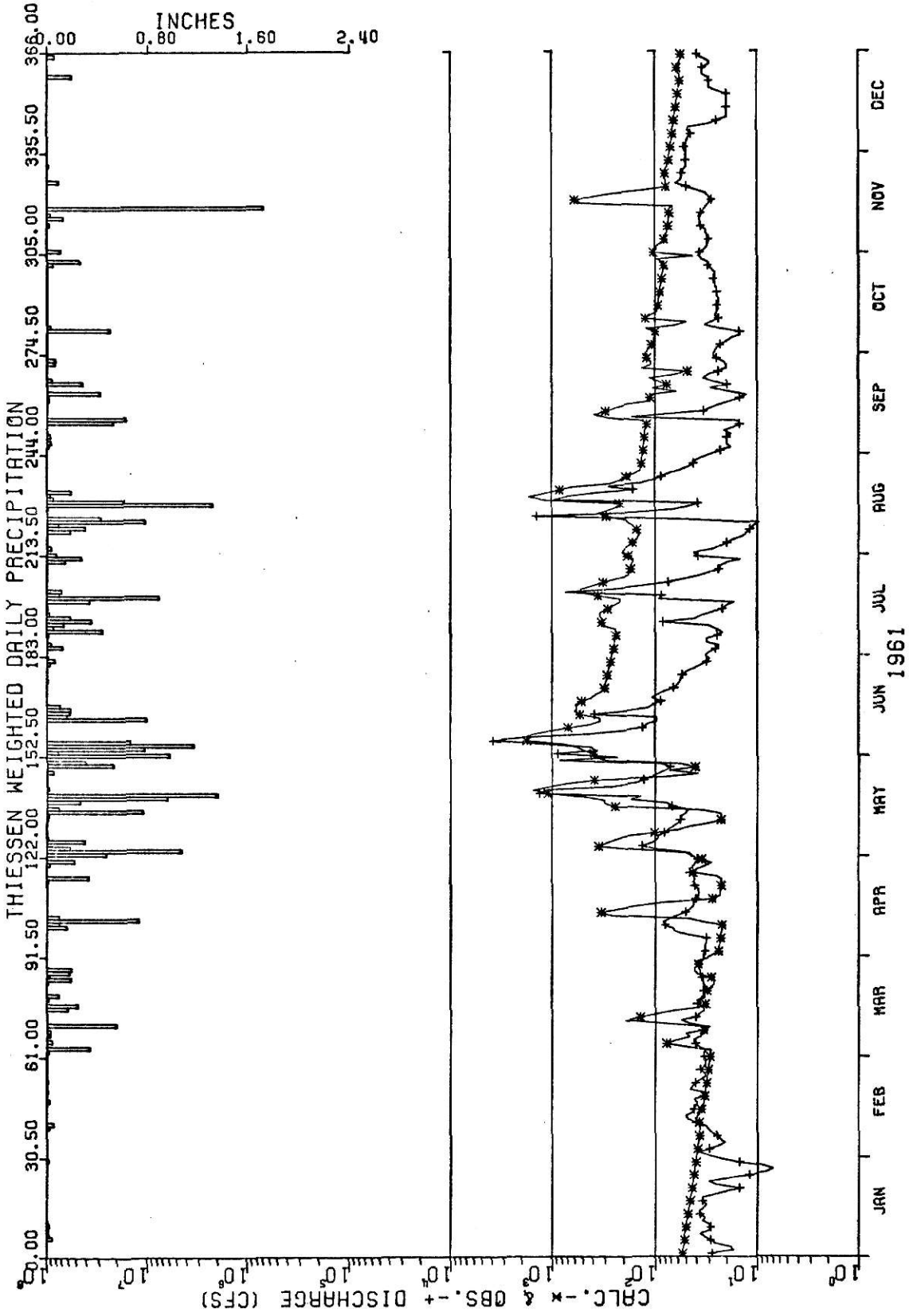
1960
CALC.-* & OBS.-+ DISCHARGE (CFS)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THIESSEN WEIGHTED DAILY PRECIPITATION
CALC.-× & OBS.-+ DISCHARGE (CFS)
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DEC
1961

EFFECTS OF PRECIPITATION ENHANCEMENT ON THE HYDROLOGIC CYCLE FOR THREE KANSAS WATERSHEDS

by

DANNY H. ROGERS

B.S., Kansas State University, 1976

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Civil Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1977

ABSTRACT

The effect of weather modification on the land phase of the hydrologic cycle, particularly the alteration of stream flow patterns, is the concern of this report. The question of weather modification effects has arisen in recent times, since the technological capability of weather modification is expanding.

The historical records for three Kansas watersheds were obtained. The watersheds in this study were the Black Vermillion, the South Fork Solomon, and the Beaver Creek. These watersheds were studied by calibrating the KSU version of the Kansas Watershed Model to match historical stream flow records. Once calibrated, the precipitation pattern was altered by two modification schemes, B-ZERO and B-TEN. B-ZERO and B-TEN both modify the seven month growing season by the expected average results of full scale modification for different magnitude storms. B-ZERO has no winter time modification, while B-TEN has a uniform percentage increase of winter time precipitation.

The results of the precipitation enhancement for B-ZERO are 6.72, 10.59, 12.67 percent increases for the Black Vermillion, South Fork, and Beaver Creek, respectively. The general result of the increased precipitation is increased runoff and increased evapotranspiration. However, since the modification schemes are representative of actual modification occurrences, large magnitude storms are actually reduced in magnitude and this reduction is sometimes reflected by reduced stream flows.