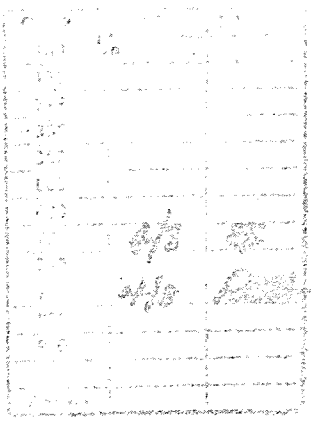
McDonald 267

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
OFFICE OF ASSISTANT COMMISSIONER AND CHIEF ENGINEER
BUILDING 53, DENVER FEDERAL CENTER
DENVER 25, COLORADO

IN REPLY REFER TO: D-735

APR - 4 1963



To: District Manager, Juneau, Alaska

From: Chief Development Engineer

Subject: Inflow design flood study for Vee Damsite--Vee Project, Alaska
(your letter dated December 21, 1962)

An inflow design flood for Vee Damsite which was requested in reference letter has been prepared by this office. Since the possibility existed that the Vee Dam might be constructed before Denali Dam upstream, we felt it advisable to prepare inflow design floods with and without Denali operating. The floods prepared in this study have the following characteristics:

Condition	Inflow design flood: Peak discharge (cfs)	Inflow design flood: 15-day volume (acre-feet)	Plate No.
Denali Dam not constructed	140,000	1,575,000	1
Denali Dam constructed	105,000	1,575,000	2

Diversion during construction hydrographs that were prepared in this study have the following characteristics:

Frequency in years	Peak discharge (cfs)	15-day volume (acre-feet)
5	42,700	634,000
10	49,200	903,000
25	58,000	1,141,000

In routing the inflow design flood through the reservoir the water surface elevation should be assumed at the top of conservation storage at the beginning of flood inflow.

Because of the serious lack of streamflow and precipitation data we believe this study is only of reconnaissance level. However, we are willing to accept the study for feasibility designs and estimates because of the long delay that would be involved in collecting additional data. To counteract this deficiency, conservative data should be

analyzed as they become available and appropriate revisions made in the inflow design flood prior to definite plan report or final design. This is especially true in regard to the streamflow for the Susitna River near Cantwell, where records currently exist subsequent to May 1961.

We understand that the Armed Forces operate a recreational area around Lake Louise throughout the summer. It is suggested that you contact either the Commanding Officer of Elmendorf Field or Fort Richardson to determine if the man in charge of this recreational area could be prevailed upon to operate a precipitation station at Lake Louise throughout the summer season.

Three copies of the Vee inflow design flood study are being transmitted to you under separate cover.

Under separate cover (103483)
1 copy retained in 7D

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Office of Chief Engineer
Denver Federal Center
Denver 25, Colorado

March 26, 1963

Memorandum

To: Head, Flood Hydrology Section

From: Donald L. Miller

Subject: Inflow design flood study, Vee Damsite--Vee Project, Alaska

Authority

This study was requested by the District Manager by his letter of December 21, 1962.

Recommendations

Two inflow design floods having values as listed below are recommended for use for feasibility designs and estimates for Vee Dam. One flood represents conditions assuming Vee Dam is constructed before Denali Dam, upstream, is constructed. The other flood represents conditions should Vee Dam be built after Denali Dam is constructed and operating.

Condition	Inflow design flood		Plate No.
	Peak discharge (cfs)	15-day volume (acre-feet)	
Denali Dam not constructed	140,000	1,575,000	1
Denali Dam constructed	105,000	1,575,000	2

Probable 5-, 10-, and 25-year flood hydrographs having characteristics as listed below and shown graphically on Plate 3 are recommended for use for estimating diversion during construction requirements.

Frequency in years	Peak discharge (cfs)	15-day volume (acre-feet)
5	42,700	884,000
10	49,200	993,000
25	58,000	1,141,000

Routing recommendation. Reservoir be assumed full to top of conservation storage space at the beginning of the inflow design flood.

Description of Study

Vee Damsite is on the Susitna River approximately at the location of the stream gaging station identified as near Cantwell; latitude 62° 42' 00" N, longitude 147° 32' 50" E. The U. S. Geological Survey publication, Surface Waters of Alaska 1961, gives a drainage area of 4,140 square miles above the gaging station, which has been accepted for use in this study. We have made two previous flood studies for damsites on the Susitna River.

1. Denali Damsite, upstream from Vee site; drainage area 1,280 square miles. Reconnaissance study of April 29, 1959.

2. Devil Canyon Damsite, downstream from Vee Damsite; drainage area 6,100 square miles considered contributing. Feasibility study of June 29, 1959.

A drainage area map of the Susitna River basin is shown on Plate 4.

Data from the previous flood studies supplemented by additional recent runoff records have been used in this study.

Description of the basin

The basin description given in the Devil Canyon flood study is quoted below because the Vee site controls a great part of the basin:

"...The headwaters of the Susitna River originate in the Alaska Range, which contains a perennial cover of snow and ice which is the source of the glaciers which come out of the Alaska Range and feed the Susitna River. The braided stream channels shown /on the map/ depict the drainage from these glaciers, which also carry an extremely heavy sediment load. Immediately below the mountains, the area is flat, with hundreds of lakes caused by depressions left as the glaciers receded. Many of these depressions lack surface outlets, while others have small natural outlets that are conducive to long lag times. The reason for the lack of drainage patterns is that the recession of the glaciers has been so recent that there has not been sufficient time to develop an adequate drainage pattern.

"The vegetative cover immediately below the perennial snow cover of the Alaska Range consists of muskeg and tundra, underlain by permafrost. Below the 3,000-foot elevation some small spruce and hemlocks, mostly under 20 feet in height, and small birch trees are found. The tundra and muskeg have the capability to detain rainfall or snowmelt, causing extremely long lag times.

"The Susitna River is rather deeply entrenched for 25 miles or so above Devil Canyon dam site, with somewhat steeper slopes. There are some bare rock outcroppings in this area, which would result in lower retention rates than in the upper and middle part of the basin. In the next 25 miles there is a gradual transition from the deeply entrenched channel to the broad, flat plains of the middle portion of the Susitna drainage basin. The southeast portion of this drainage area is confined to the very flat lake area drained by the Tyone River. It is believed that any flood peaks from this area would be flattened due to the effect of the lakes.

"The Susitna River also drains the Talkeetna Mountains, which form a ridge along the southwest portion of the drainage basin. These mountains, although somewhat lower than the Alaska Range, contain small glaciers, and some of the streams originating from this area are glacier fed. The Talkeetna Mountain Range forms a natural barrier to the moist air from Bering Sea and the Cook Inlet, thereby reducing the storm potential of the Susitna drainage basin.".

It is understood that present plans contemplate an operating level for Vee Reservoir of elevation 2,350 feet, which is the tailwater elevation at Denali Dam. Vee Reservoir will inundate many miles of the main Susitna River channel between Denali Damsite and Vee Damsite and the lower channel of Tyone River. This inundation will accelerate concentration of inflow to Vee Reservoir.

Streamflow Records

The following discharge records were available for streams in the Susitna River basin:

Susitna River at Gold Creek
- Drainage area--6,160 square miles (U.S. Geological Survey figure used in this study)
- Period of record--August 1949--September 1962
- Maximum peak discharge--80,600 cfs, June 15, 1962
- Maximum 15-day volume, acre-feet--1,583,800, June 10-24, 1962

Susitna River near Cantwell
- Drainage area--4,140 square miles
- Period of record--May 1961--September 1962
- Maximum peak discharge--54,700 cfs, June 1962 (probably 15th)
- Maximum 15-day volume, acre-feet--not determinable because of periods of averaged discharges

Susitna River near Denali
Drainage area--950 square miles
Period of Record--May 1957-September 1962
Maximum peak discharge--18,700 cfs (estimated) June 7, 1957
Maximum 15-day volume, acre-feet--414,000 (estimated June 4-18, 1957

McClaren River near Paxson
Drainage area--280 square miles
Period of record--June 1958-September 1962
Maximum peak discharge--8,920 cfs, September 13, 1960
Maximum 15-day volume, acre-feet--128,000, July 28-August 11, 1960

Precipitation Records

There are no reliable precipitation data for stations within the basin. Some efforts have been made since 1958 to obtain precipitation data in the vicinity of Denali but no usable data have been obtained. Knowledge of precipitation characteristics within the Susitna basin remains essentially the same as assembled for the Devil Canyon flood study.

Critical Flood Conditions

A maximum probable seasonal snowmelt and glacier-melt design flood was estimated in the reconnaissance study for Denali Dam because a large amount of surcharge in the reservoir could be used to control the flood. A maximum probable reinflood added to about average August glacier-melt was derived in the feasibility flood study for Devil Canyon Damsite.

At Vee Damsite, it is believed the same critical flood conditions as envisioned for Devil Canyon will result from runoff from a maximum probable rainstorm added to high glacier-melt runoff during the July-September period.

Limitations Due to Available Data

Analyses of recorded flood events and computation of the inflow design flood were made using mean daily discharge amounts and 24-hour precipitation amounts because data for using shorter time increments were not available. A greater than usual reliance on judicious selection of flood-producing factors had to be used in this study. There is great need for collection of additional hydrologic data within the Susitna River basin before final designs for the proposed dams are made.

Development of Inflow Design Floods

It was believed advisable to present inflow design floods for Vee Damsite for two conditions:

1. Upstream Denali Dam not constructed
2. Upstream Denali Dam constructed and operating

This required the development of design rainflood inflow at Denali Damsite and design rainflood inflow to Vee Damsite from the intervening area between Denali Damsite and Vee Damsite.

Unitgraph development. Discharges recorded for the Susitna River near Cantwell will hereinafter be referred to as discharges at Vee Damsite.

Concurrent records at the Denali gage and at Vee Damsite were available for rain runoff for a storm of August 3-4, 1961. The maximum mean daily discharge at Denali gage was 15,000 cfs, August 5; at Vee Damsite, 31,300 cfs, August 6. Discharges at Denali gage were routed to Vee by method of successive averages using 1-day travel time. Routed discharges were subtracted from Vee discharges to give inflow from the area below Denali gage. These discharges were plotted on cartesian paper and a base flow estimated graphically. The net flow after subtracting the base flow was considered representative of rainfall runoff. Daily net discharges were expressed as percent of total net volume. Time of occurrence of 50 percent of total volume was computed and considered as time of lag plus semi-duration. Accumulative discharges, in percent, were plotted versus percent of lag plus semi-duration as an S-curve distribution graph as shown on Plate 5.

The 24-hour unitgraph developed in the Devil Canyon flood study (Ref. Plate 6, Devil Canyon study) was expressed as accumulative percent of volume and plotted versus percent of lag plus semi-duration as shown on Plate 5. Net rainfall runoff for the 1961 event recorded at the Denali gage was obtained by estimating a base flow graphically and points of a similarly computed S-curve are indicated on Plate 5.

After examining the S-curve data shown on Plate 5, it was decided that a representative S-curve for the subject areas would be to use the S-curve of the Susitna River at Vee to 100-percent of lag plus semi-duration and thereafter use a constructed average curve as shown; averaging the curve for Vee with the curve for Devil Canyon. It was believed the S-curve portion representing the recession portion of the net rainfall runoff at Denali gage was unrealistically steep.

Lag times. The 24-hour unitgraph developed for Devil Canyon Damsite had a lag time of 80 hours. This lag time was plotted versus an $LL_{ca}/\sqrt{S}$ factor of 2,610 as shown on Plate 6. A curve was drawn through this point parallel to our Mountain Lag Curve as shown. Only limited supporting data for lag time estimates could be obtained from analyses of the 1961 event because of lack of rainfall data. The center of volume of the net hydrograph for the area between Denali gage and Vee was 2.94 days, 70 hours. Assuming 24 hours' excess, lag time would be 58 hours, which falls on the constructed curve as an $LL_{ca}/\sqrt{S}$ factor of 540

was computed for this area. However, if the rainfall excess were 48 hours, the lag time would be 46 hours, which falls well below the constructed curve.

By judgment, it was decided to use the constructed curve to obtain lag times. An $LL_{ca}/\sqrt{S}$ factor of 96 which gives a lag time of 42 hours was computed for the area above Denali gage and used as representative of the area above the damsite. This was a compromise value used to eliminate separate computations for existence of a reservoir above Denali and nonexistence of a reservoir.

Vee Reservoir was assumed at elevation 2350 feet and $LL_{ca}/\sqrt{S}$ factors computed for the McClaren drainage and the Oshetna drainage. A weight of two-thirds was given for the McClaren factor and a weight of one-third given the Oshetna factor. The weighted factor of 260 gave a lag time of 50 hours, which was accepted for the area between Denali Damsite and Vee Damsite.

Unitgraph distribution. A 24-hour distribution graph consisting of incremental 24-hour percentages of total volume was obtained for each area using the above lag times and the representative S-curve discussed previously.

Design Storm. The design storm derived in the Devil Canyon flood study gave an average depth of 6.8 inches of precipitation in 72 hours over the entire watershed above Devil Canyon Damsite. It was not necessary in that study to estimate variation in rainfall over different subbasins of the watershed but the belief that a variation was present was discussed.

No additional meteorological data which would change the Devil Canyon design storm estimate have been acquired since making that study. It was decided, therefore, to use the Devil Canyon design storm values in this study but to estimate a variation in subbasin storm amounts due to topographic influences. Such an estimate is feasible because of the locations of the damsites. Design storm conditions postulate a strong flow of moist air northeastward from Cook Inlet over the Talkeetna Mountains into the Susitna River basin. Precipitation would be heavy along the Talkeetna Mountain Divide, about 5,000 to 6,000 feet in elevation, but would decrease on the lee side (northeastward). Referring to the drainage map, Plate 4, it will be seen that most of the precipitation along the lee side of the Talkeetna Mountains will contribute to runoff from the area between Vee Damsite and Devil Canyon Damsite. As the moist air flow continues northeastward across the midpart of the basin, it is believed precipitation would be less heavy than along the lee side of the Talkeetna Mountains because of the lower elevation--about 3,000 feet. Vee Damsite and the Tyone River drainage lie in this

area. As the moist air continues northeastward, it encounters sharp lifting against the Alaska Range, which rises abruptly to peaks of 12,000 to 13,000 feet. This lifting should produce increased precipitation over the higher elevations. A large part of the Denali Damsite drainage lies in this area.

An analysis of the August 3-4, 1961 storm runoff gave some support to the above reasoning. Runoff at the Denali gage and at the McClaren River gage was combined and routed to Vee Damsite. These two records measure a large part of the runoff from the high elevations. Routed discharges were subtracted from Vee discharges, base flows estimated graphically, and net rain runoff computed. These computations indicated 0.87 inch runoff from 1,230 square miles, Denali gage drainage plus McClaren River gage drainage, compared with 0.25 inch runoff from 2,190 square miles, the intervening area between the upstream gages and Vee Damsite. Assuming a 2-day storm and the retention loss adopted in the Devil Canyon study, 0.8 inch per day, an indicated total storm depth was estimated as 2.47 inches for the high elevations compared with 1.85 inches for the intervening area, a ratio of 1.33. Unfortunately, this type analysis could not be extended to include the area between Vee Damsite and the Gold Creek gage because of incomplete runoff records at Gold Creek gage for this event.

By judgment, it was decided to assign the central portion of the basin a weight of 1.0, in this instance considering the central portion to consist of all the area between Denali Damsite and Vee Damsite; the area above Denali Damsite a weight of 1.3, and the area between Vee Damsite and Devil Canyon Damsite a weight of 1.2. Using these weights and the design storm average precipitation of 6.8 inches over 6,160 square miles (area used in Devil Canyon study for Gold Creek gage), the following subbasin 72-hour design storm values were computed:

Subbasin	Drainage area (square-miles)	Average precip. (inches)
Above Denali Dam	1,280	7.8
Intervening area, Denali Dam to Vee Damsite	2,860	6.0
Vee Damsite to Devil Canyon site	2,020	7.2

Incremental 24-hour amounts were made proportional to incremental amounts of the Devil Canyon design storm. Listed below in design arrangement are adopted subbasin design storm values along with excesses computed using a daily retention loss of 0.8 inch.

Time, hours	Design Storm: Above Denali Dam 1,280 square miles Precip. (inches)	Above Denali Dam 1,280 square miles Excess (inches)	Denali to Vee 2,860 square miles Precip. (inches)	Denali to Vee 2,860 square miles Excess (inches)
0 - 24	2.2	1.4	1.7	0.9
24 - 48	4.0	3.2	3.1	2.3
48 - 72	1.6	0.8	1.2	0.4
	7.8	5.4	6.0	3.6

Average precipitation over 4,140 square miles above Vee--6.56 inches

The adoption of the retention loss of 0.8 inch per day was discussed in the Devil Canyon study, pointing out that due to limited data it should be considered as an "index" value, and was "tied-in" with the design storm derivation. There is no basis for changing this rate for this study.

Design flood glacier-melt base flow. Available streamflow records at Denali and for the McClaren River show that the period of maximum annual 15-day volume of runoff from the upper portion of the watershed most often has been within the period July 20 to August 10. Although intense rainstorms causing the largest rainfloods in the brief period of record have occurred after mid-August, it is believed reasonable for design to combine the computed design rainflood with the maximum late July-August runoff of record. The 1962 runoff meets this criterion.

A maximum 15-day runoff at Denali gage of 191,400 cfs-days was recorded July 21-August 4, 1962. This volume was divided by 15 to give an average daily discharge of 12,760 cfs, which was used as an average 15-day base flow for design flood computations of inflow at Denali Damsite.

The recorded 15-day volume at Vee site, July 21-August 4, 1962, was 332,000 cfs-days. Subtracting the volume recorded at Denali from that at Vee and dividing the result by 15 gave an average daily discharge of 9,730 cfs, which was used as an average 15-day base flow originating from the area between Denali Damsite and Vee Damsite.

Inflow design flood--Denali Dam not constructed. Design rainflood runoff for the area above Denali Damsite and for the intervening area between Denali Damsite and Vee Damsite was computed using respective 24-hour distribution graphs and the respective excesses previously tabulated. Respective base flow was added to each rainflood. The total flood computed at Denali Damsite was added directly to the flood computed for the intervening area to Vee site without routing because of the short travel distance between Denali Damsite and the head of the proposed Vee Reservoir. The hydrograph shown on Plate 1 having a peak

discharge of 140,000 cfs and a 15-day volume of 1,575,000 acre-feet was constructed using the computed daily discharges.

Inflow design flood--Denali Dam constructed. The design rainflood originating above Denali Damsite was routed through Denali Reservoir using reconnaissance designs for that structure, assuming the reservoir full to top of active conservation storage at the beginning of the rainflood. The outflow discharges of this routing were added directly to the rainflood computed for the intervening area, Denali Damsite to Vee Damsite. The hydrograph shown on Plate 2 having a peak discharge of 105,000 cfs and a 15-day volume of 1,575,000 acre-feet was constructed using the computed mean daily discharges. Denali Dam will reduce the peak discharge from the upstream area but only temporarily delay a part of the runoff volume.

Envelope Curves

Envelope curve data for recorded maximum peak discharges for Interior Alaska streams are presented on Plate 7. Susitna River basin points are indicated by special symbol. A curve has been drawn controlled by Susitna basin points; Susitna River at Gold Creek, 6,290 square miles, 80,600 cfs, June 15, 1962, and McClaren River near Paxson, 280 square miles, 8,920 cfs, September 13, 1960. This curve envelops all plotted points except those for the Copper River near Chitina, the Little Susitna River near Palmer and the Matanuska River near Palmer. Cursory inspection indicates these streams have higher storm potential than does the Susitna basin. It is believed reasonable to use the curve as drawn for comparisons at Vee site because the gage at Gold Creek measures total basin runoff from over 6,000 square miles and the McClaren River gage measures runoff from the high elevations for a relatively small area. This curve indicates a peak discharge of 60,000 cfs for 4,140 square miles, area above Vee Damsite.

Maximum 15-day volumes recorded at stations within the Susitna River basin have been plotted as shown on Plate 8. A curve indicative of volume at Vee Damsite is controlled by a 15-day volume of 414,000 acre-feet, June 4-18, 1957, at Denali and a 15-day volume of 1,583,000 acre-feet, June 10-24, 1962, at Gold Creek. This curve indicates a 15-day volume of 1,180,000 acre-feet for 4,140 square miles.

Diversion requirements during construction

The 13-year record of streamflow at Gold Creek gage was used to estimate probable 5-, 10-, and 25-year floods at Vee Damsite as follows: A Hazen's frequency computation was made using annual maximum peak discharges and annual maximum 15-day volumes at the Gold Creek gage. The 5-, 10-, and 25-year values at Gold Creek given by these computations were adjusted from 6,160 square miles to 4,140 square miles by the area relationship shown by the slope of the envelope curves. A summary of these computations follows.

At Gold Creek, 6,160 square miles

	Peak discharge	15-day volume
c.v.	0.26	0.21
c.s.	1.80	1.60
mean	49,023 cfs	1,044,780 acre-feet

Frequency in years	Peak (cfs)	Volume (acre-feet)
5	57,360	1,190,000
10	66,180	1,337,000
25	77,950	1,536,000

Adjustment factor, 6,160 square miles to 4,140 square miles

Peak discharge	0.744
15-day volume	0.743

At Vee Damsite, 4,140 square miles

Frequency in years	Peak discharge (cfs)	15-day volume (acre-feet)
5	42,700	884,000
10	49,200	993,000
25	58,000	1,141,000

The above flood values at Vee Damsite were used to construct the diversion requirement hydrographs, Plate 3.

Donald L. Miller

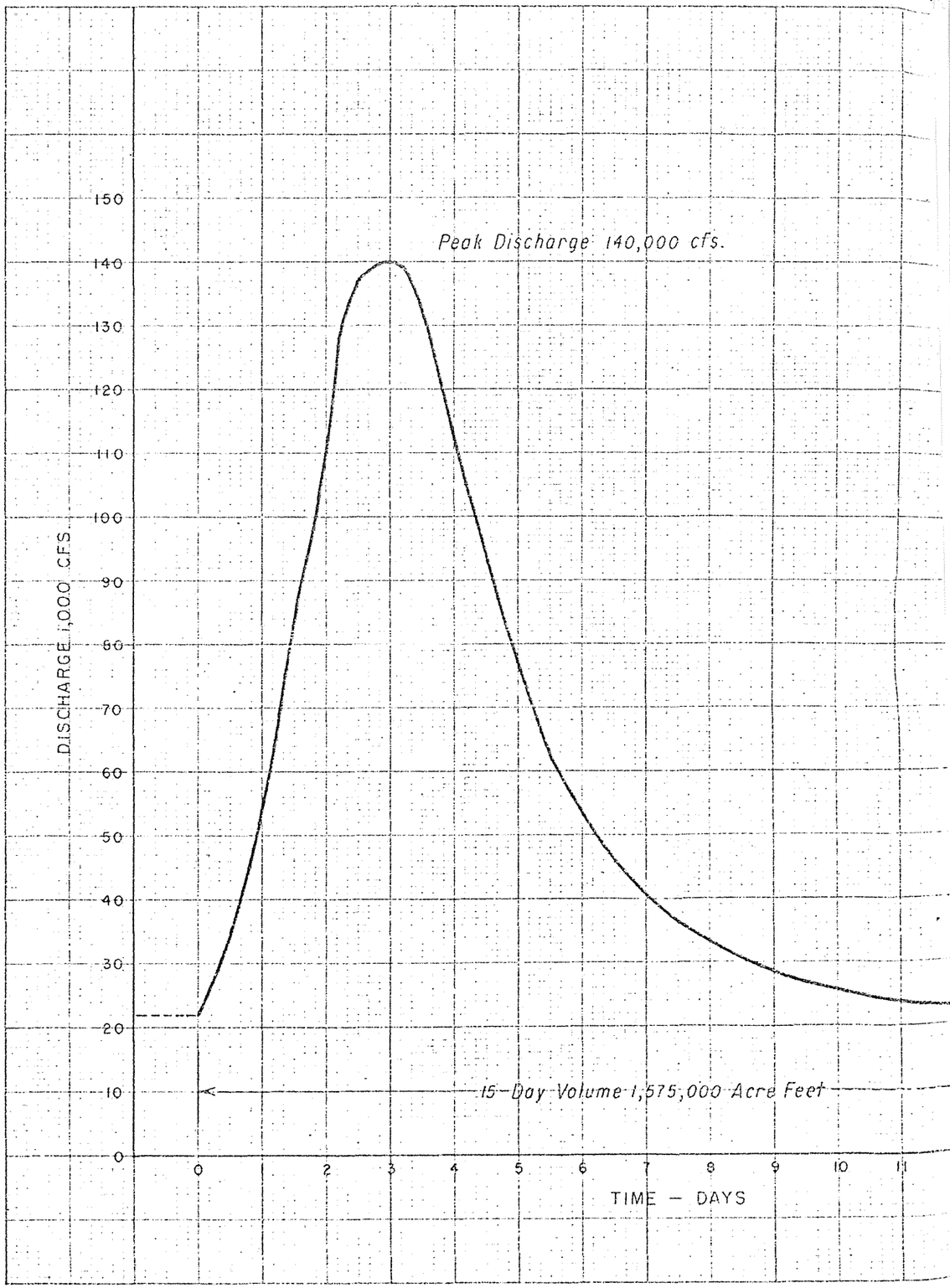
I concur

Harold P. Grunt
Head, Flood Hydrology Section

Approved

H. S. Riesbol

Chief, Hydrology Branch

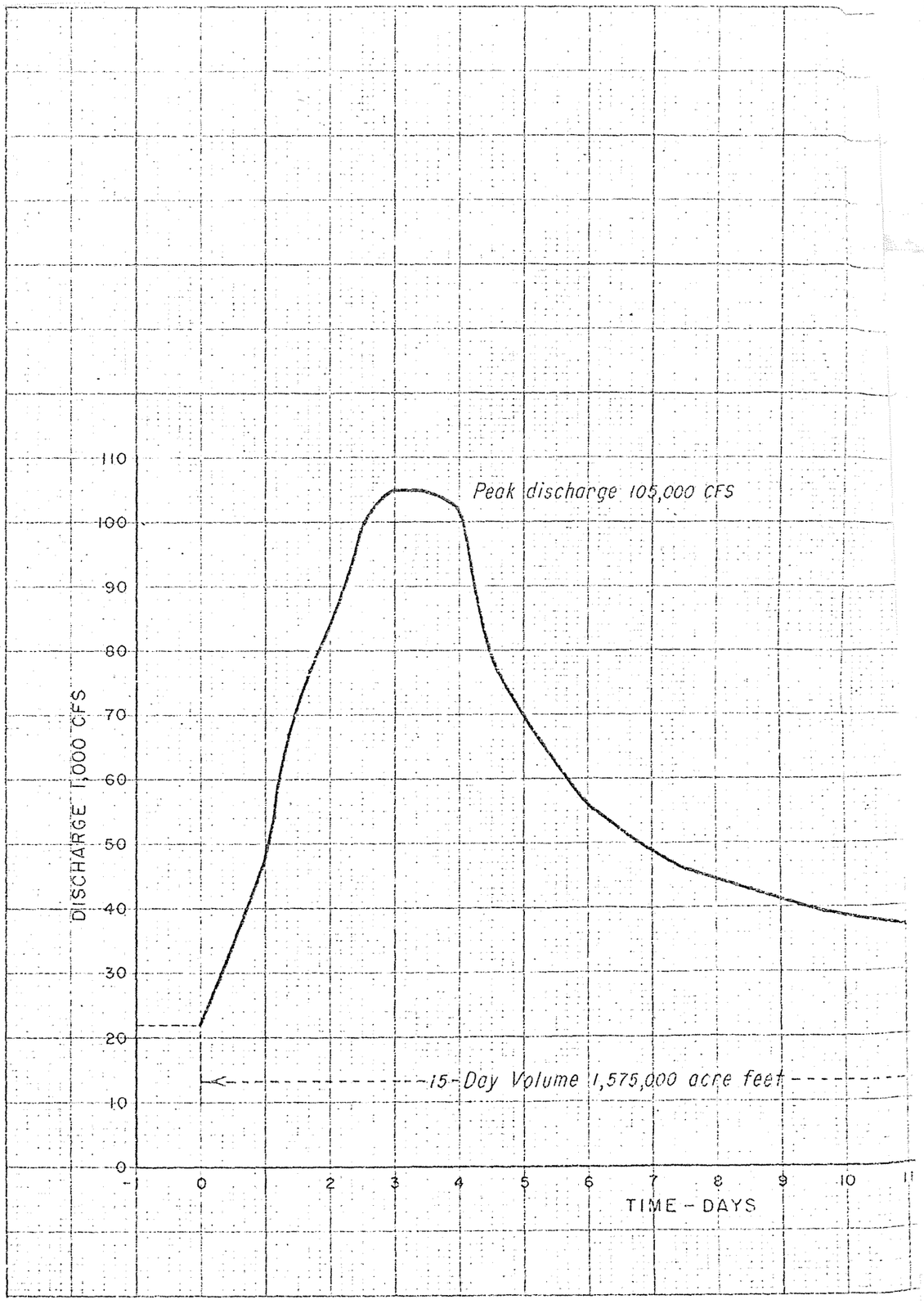


Instantaneous Discharges
1,000 cfs

Day	Hour, ending	Q	Day	Hour ending	Q
	0	22.0	7	12	45.7
1	12	34.6		24	41.0
	24	54.1	8	12	36.4
	12	83.6		24	33.6
2	24	108.9	9	12	30.7
	6	130.0		24	28.8
	12	137.0	10	12	26.9
3	18	139.0		24	25.8
	24	140.0	11	12	24.6
	6	139.0		24	23.8
4	12	130.6	12	12	23.1
	18	123.0		24	22.8
	24	112.6	13	12	22.6
5	12	94.7		24	22.4
	24	78.6	14	12	22.2
	12	62.5		24	22.2
6	24	54.1	15	12	22.2
				24	22.2

VEE PROJECT - ALASKA
VEE DAM SITE
INFLOW DESIGN FLOOD
UPSTREAM DENALI DAM NOT CONSTRUCTED
HYDROLOGY BRANCH, DENVER, COLO.
D.L.M. 3-15-63

PLATE I

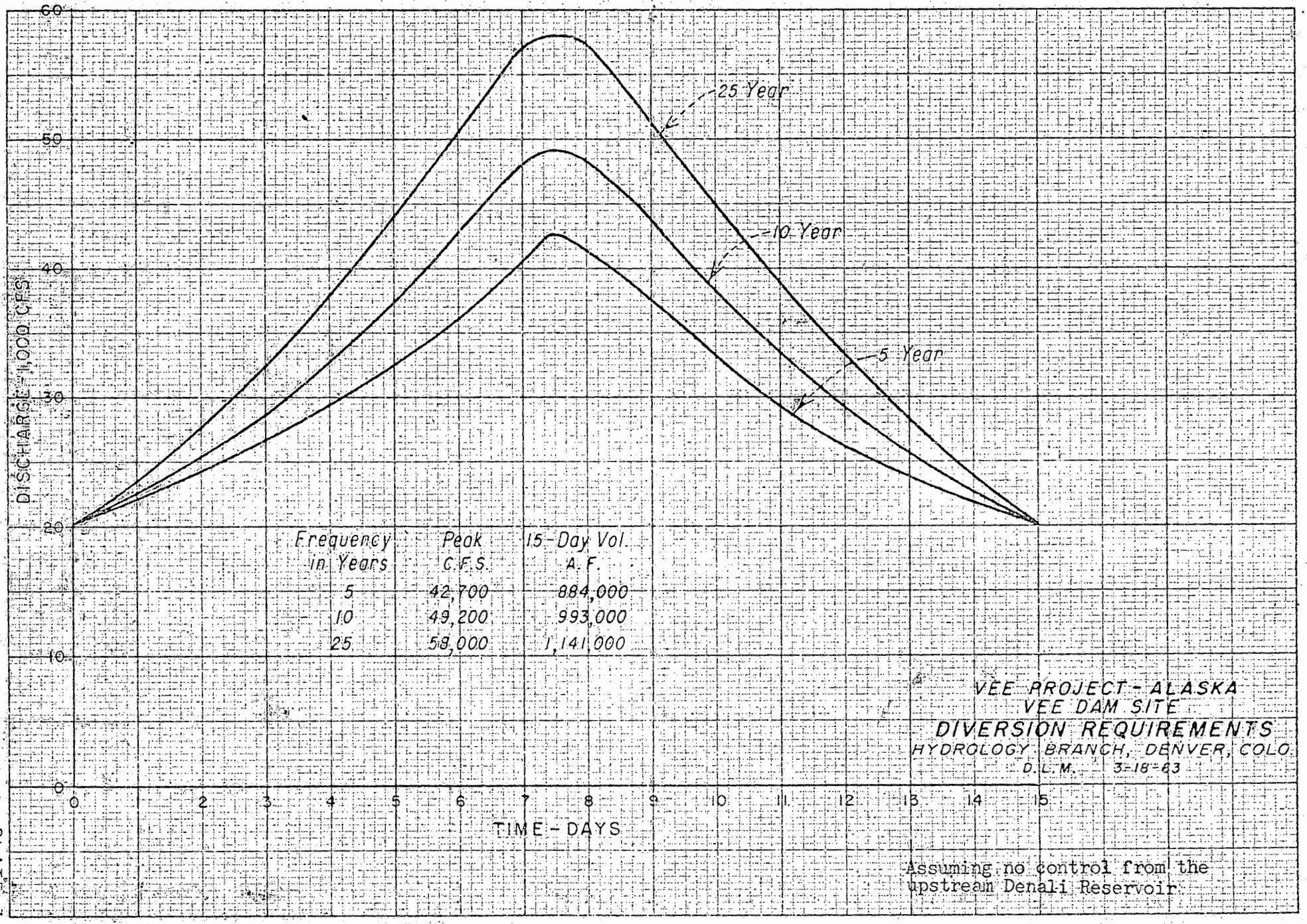


Instantaneous Discharges
1,000 cfs

Day	Hour, ending	Q	Day	Hour, ending	Q
	0	22.0	8	12	46.0
1	12	34.6		24	44.4
	24	47.4	9	12	42.8
2	12	71.4		24	41.3
	24	83.8	10	12	39.8
3	12	99.0		24	38.8
	24	105.0	11	12	37.8
4	12	104.7		24	37.2
	24	102.0	12	12	36.5
5	12	80.0		24	36.1
	24	70.0	13	12	35.7
6	12	63.0		24	33.4
	24	56.0	14	12	31.1
7	12	52.0		24	26.6
	24	49.0	15	12	22.2
				24	22.2

VEE PROJECT - ALASKA
VEE DAM SITE
INFLOW DESIGN FLOOD
UPSTREAM DENALI DAM CONSTRUCTED
HYDROLOGY BRANCH, DENVER, COLO.
D.L.M. 3-15-63

PLATE 2



Frequency in Years	Peak C.F.S.	15-Day Vol. A.F.
5	42,700	884,000
10	49,200	993,000
25	58,000	1,141,000

VEE PROJECT - ALASKA
VEE DAM SITE
DIVERSION REQUIREMENTS
HYDROLOGY BRANCH, DENVER, COLO.
D.L.M. 3-18-63

Assuming no control from the upstream Denali Reservoir

PLATE 3

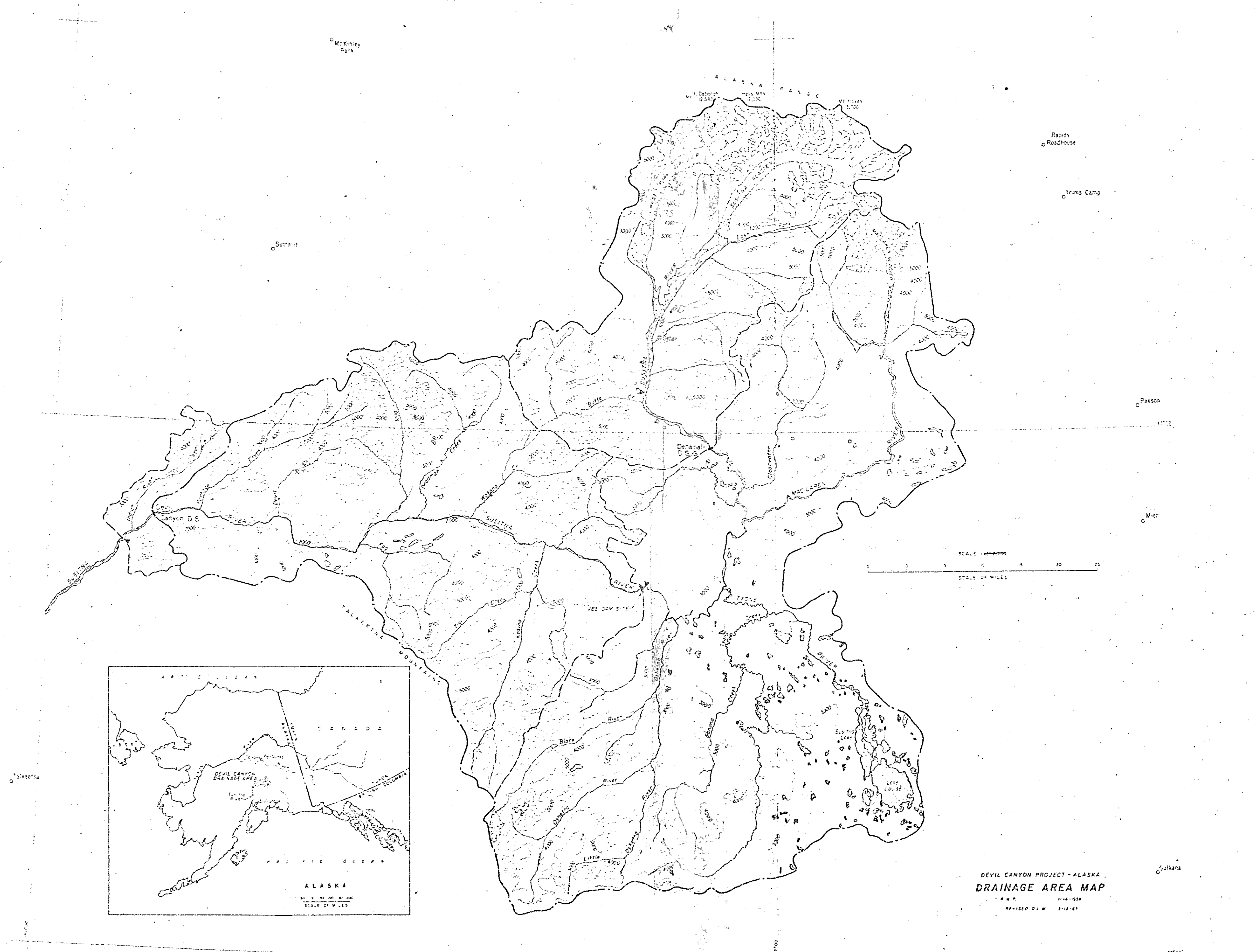
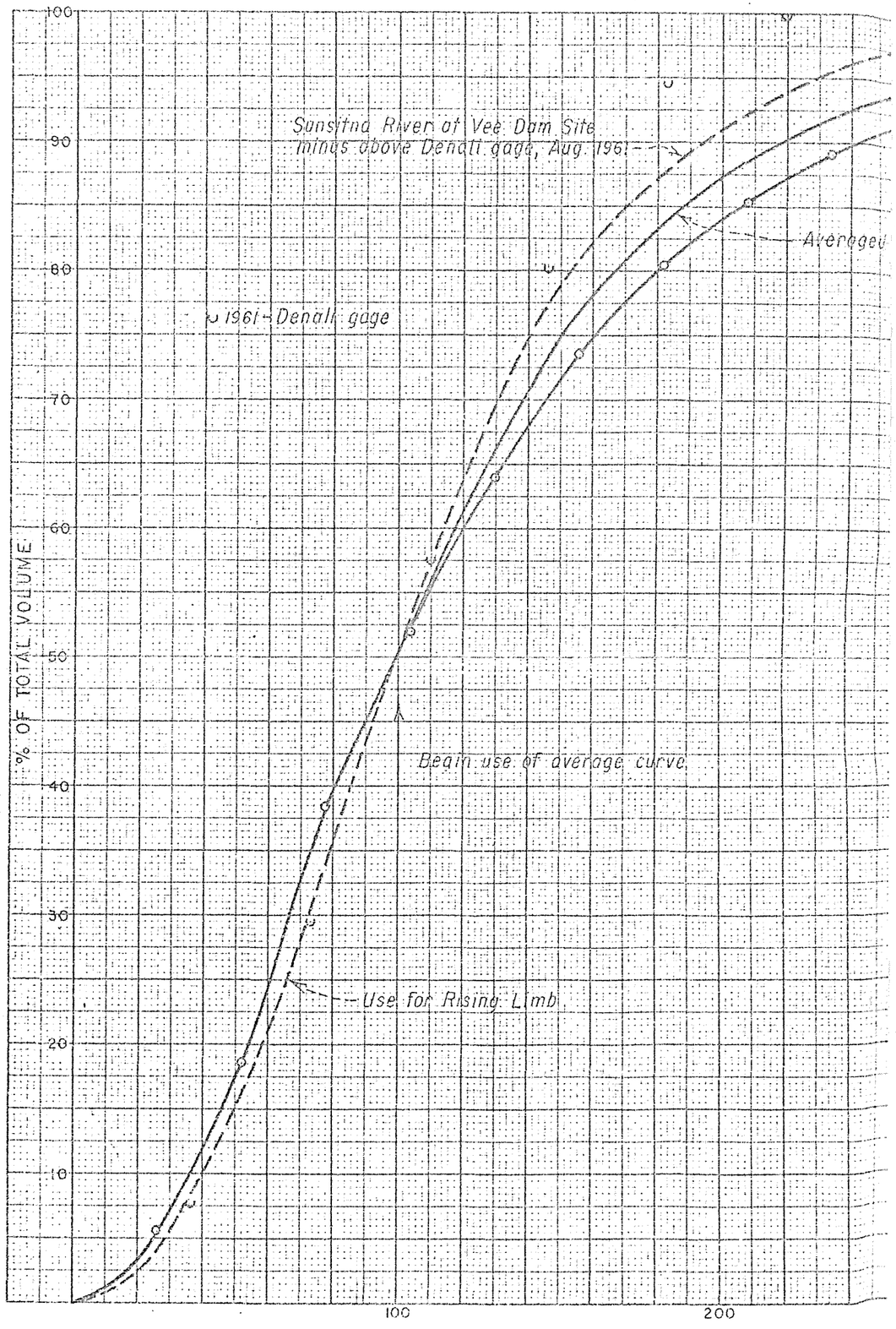
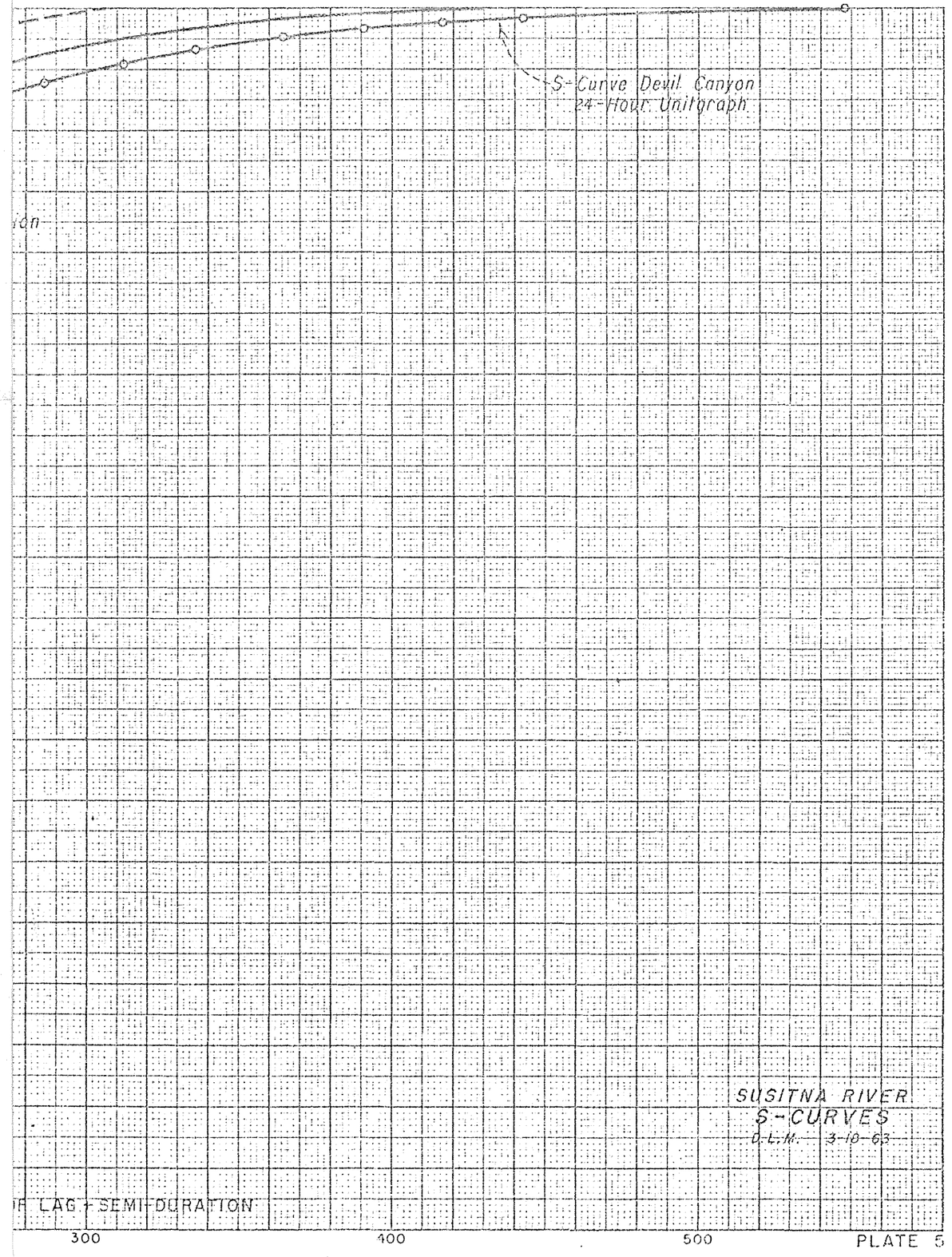

McKinley Park
ALASKA RANGE
Summit
Rapids Roadhouse
Trims Camp
Paxson
Talkeetna
Gulkana
SUSITNA
RIVER
Denali D.S.
Devil Canyon D.S.
Watana
Butte Cr.
MAC LAREN
TALKEETNA MOUNTAINS
VEE DAM SITE
TYONE
Lake Louise
Little
Black River
Oshetna River
CANADA
DEVIL CANYON DRAINAGE AREA
PACIFIC OCEAN
ALASKA
SCALE OF MILES
DEVIL CANYON PROJECT - ALASKA
DRAINAGE AREA MAP
REVISED

PLATE 4





SUSITNA RIVER
S-CURVES
D.L.M. 3-10-63

PLATE 5

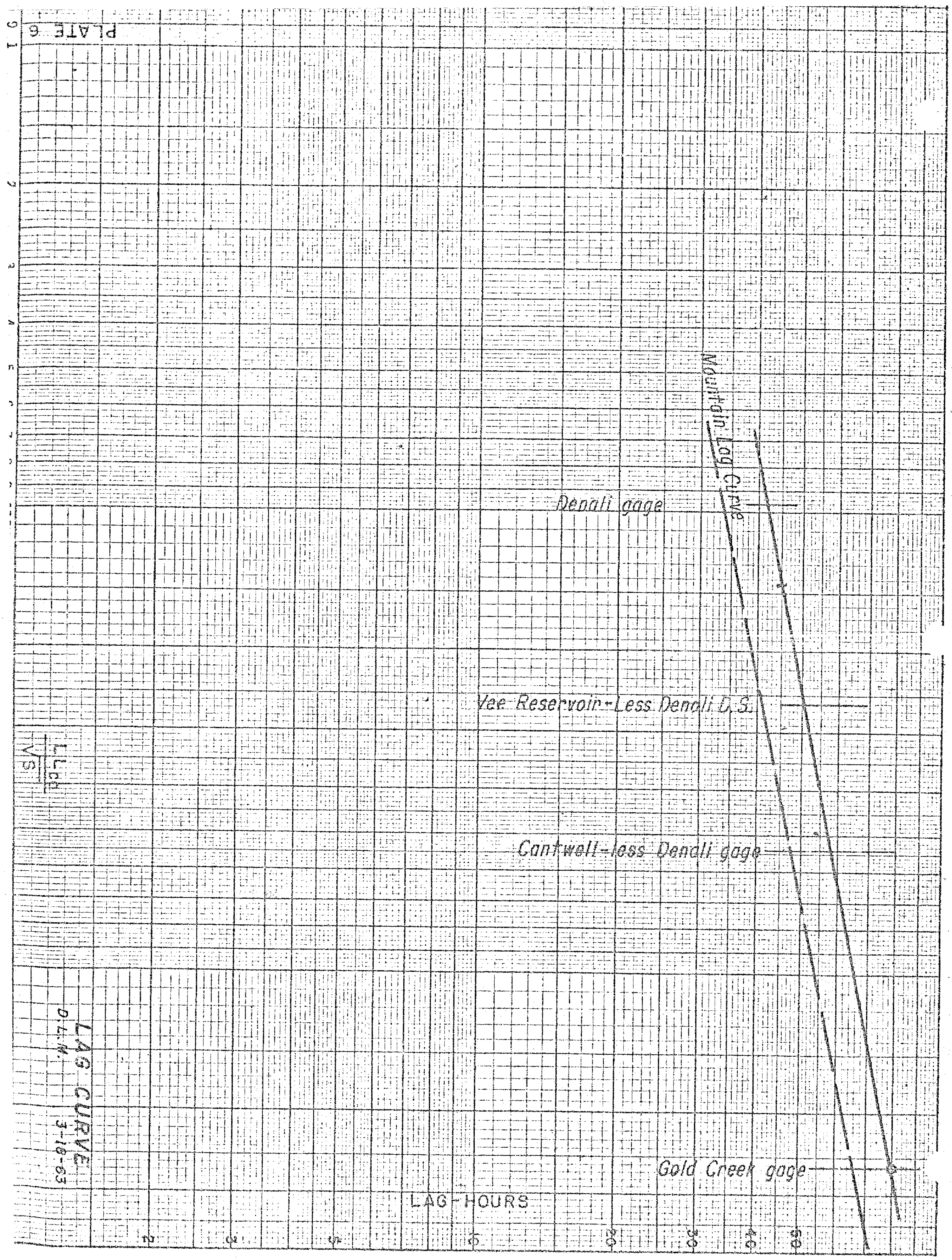


PLATE 6
Mountain Lag Curve
Denali gage
Vee Reservoir-Less Denali D.S.
Cantwell-less Denali gage
Gold Creek gage
LAG-HOURS
2
3
5
10
20
30
40
50
$\frac{L \cdot L_{ca}}{\sqrt{S}}$
LAG CURVE
D.L.M. 3-18-63

OF RECLAMATION

DIVISION OF PROJECT INVESTIGATIONS
HYDROLOGY BRANCH

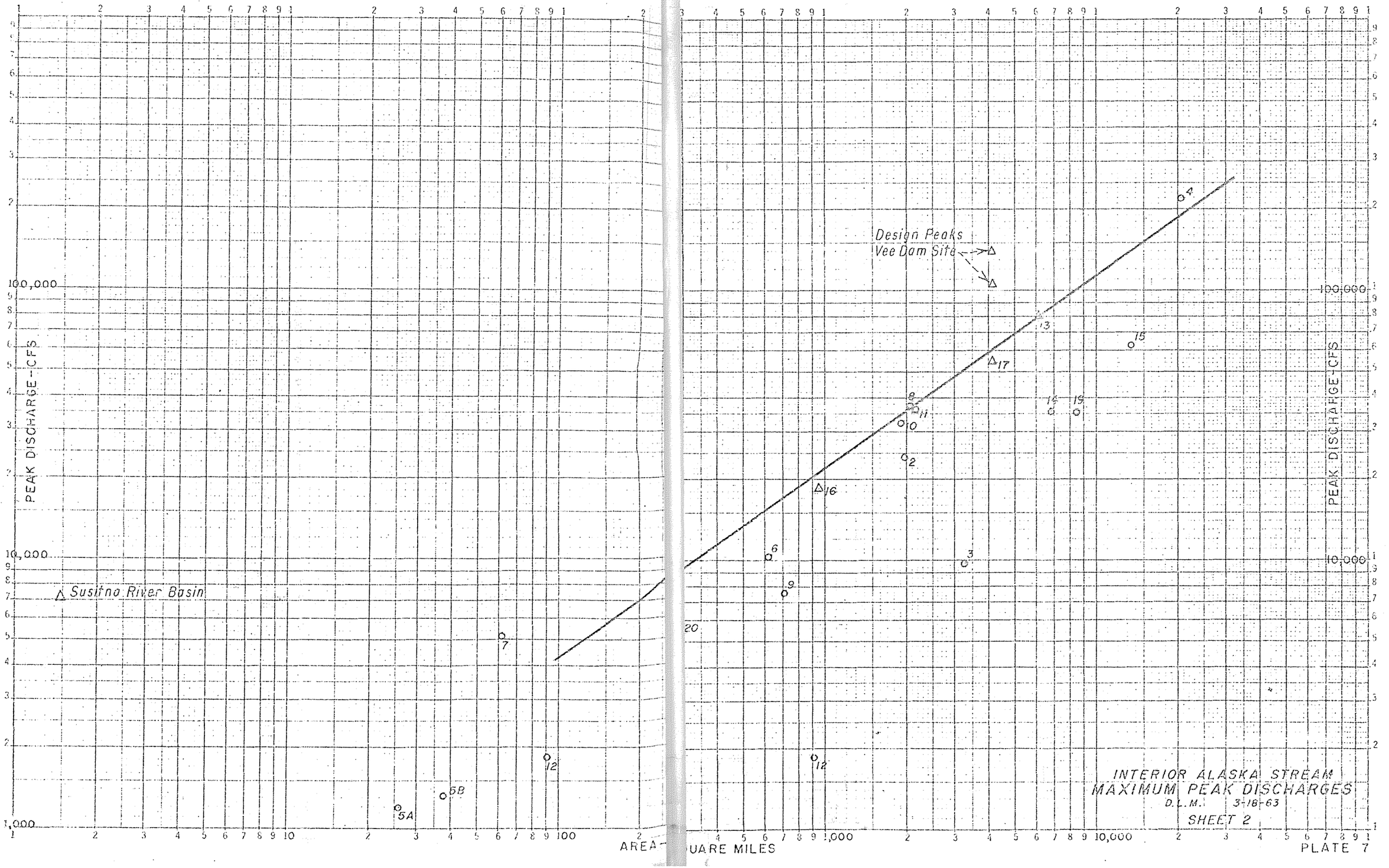
HD-7
(10-5
BURE

COMPUTED BY DLM
DATE 3-5-63
CHECKED BY
DATE

ENVELOPE CURVE DATA FOR
Interior Alaska Streams

NO.	STREAM	LOCATION	DRAINAGE AREA SQUARE MILES	DATE	DISCHARGE IN C F S
1	SF Campbell Creek	nr Anchorage	29.4	21 Jun 1949	891
2	Chena River	at Fairbanks	1,980	21 May 1948	24,200 1/
3	Chesana River	nr Northway	3,280	5 Jul 1959	9,750
4	Copper River	nr Chitina	20,600	Jul 1951	220,000
5a	West Fk Eklutna Crk	nr Palmer	26	12 Sep 1961	1,200 2/
5b	East Fk Eklutna Crk	nr Palmer	38	12 Sep 1961	1,320 2/
6	Gakona River	at Gakona	620	1 Aug 1956	10,300
7	Little Susitna Riv	nr Palmer	61.9	24 Aug 1959	5,160
8	Matanuska River	nr Palmer	2,070	24 Aug 1959	37,300
9	Nenana River	nr Windy	710	25 Aug 1955	7,640
10	Nenana River	nr Healy	1,910	4 Aug 1961	32,700
11	Salcha River	nr Salchet	2,170	23 Jun 1956	36,500
12	Ship Creek	nr Anchorage	91.2	21 Jun 1949	1,860
13	Susitna River	at Gold Creek	6,160	15 Jun 1962	80,600
14	Tanana River	nr Tok Junction	6,800	7 Aug 1953	35,700
15	Tanana River	nr Big Delta	13,500	29 Jul 1949	62,800
16	Susitna River	nr Denali	950	7 Jun 1957	18,500 3/
17	Susitna River	nr Cantwell	4,140	15 Jun 1962	54,700
18	Maclaren River	nr Paxson	280	13 Sep 1960	8,920
19	Tanana River	nr Tanacross	8,550	9 Aug 1953	35,500
20	Caribou Creek	nr Sutton	289	20 Jun 1961	5,700

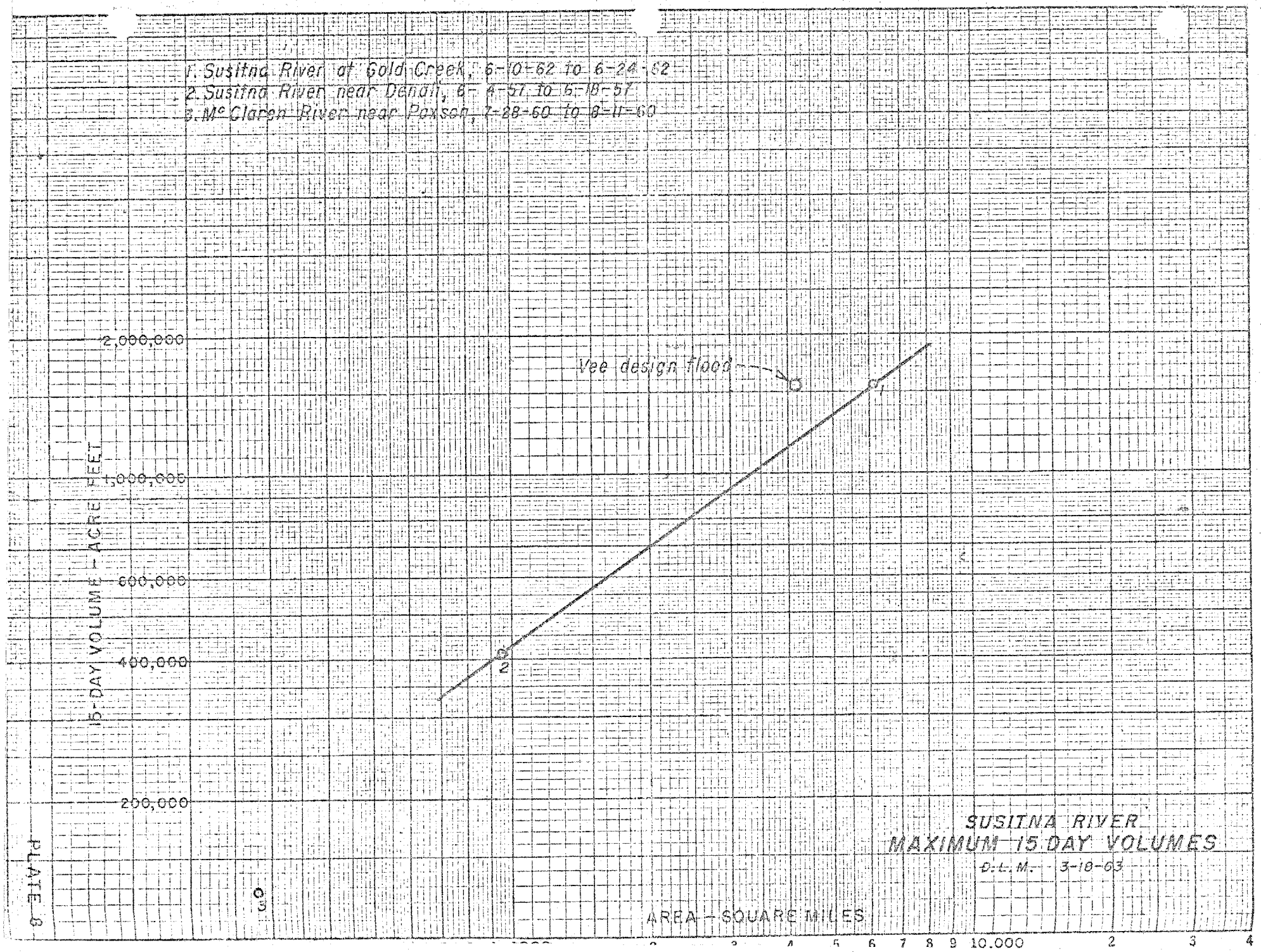
1/ Higher stage in Aug 1930 and May 1937
2/ Record began June 1960
3/ Estimated



INTERIOR ALASKA STREAM
MAXIMUM PEAK DISCHARGES
D.L.M. 3-18-63
SHEET 2

PLATE 7

1. Susitna River at Gold Creek, 6-10-62 to 6-24-62
2. Susitna River near Denali, 6-4-57 to 6-18-57
3. Mc Clarey River near Paxson, 7-28-60 to 8-11-60



SUSITNA RIVER
MAXIMUM 15 DAY VOLUMES
D. L. M. 3-10-63

PLATE 8