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REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, SOUTH UM--ETC(U)
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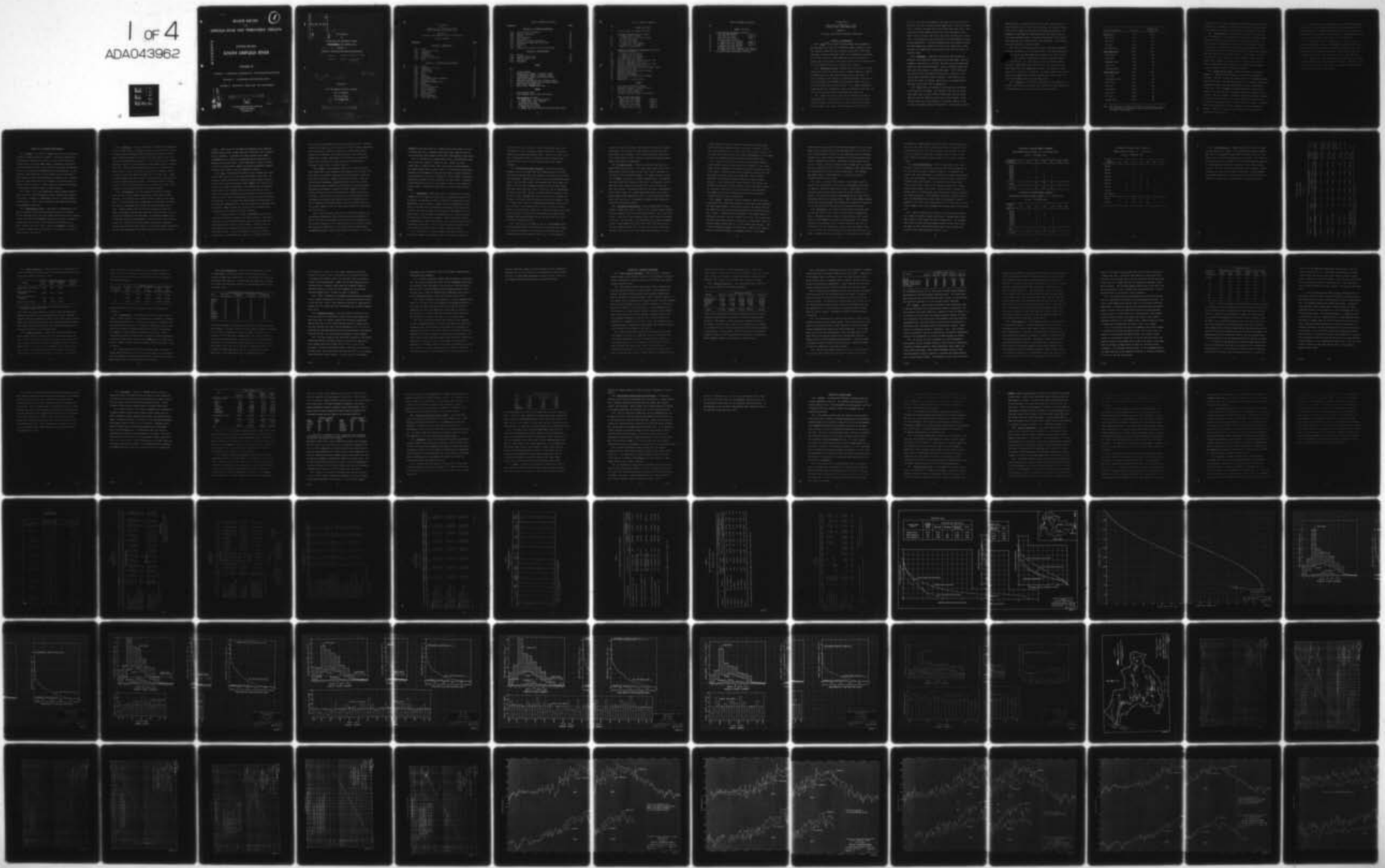

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REVIEW REPORT
ON
UMPQUA RIVER AND TRIBUTARIES, OREGON

INTERIM REPORT
SOUTH UMPQUA RIVER

VOLUME III

APPENDIX B - HYDROLOGY, METEOROLOGY, AND RESERVOIR REGULATION

APPENDIX C - FOUNDATION AND MATERIALS DATA

PPENDIX D - RECREATION, PUBLIC USE, AND ENVIRONMENT

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
DECEMBER 1971

186

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REVIEW REPORT
ON
UMPQUA RIVER AND TRIBUTARIES, OREGON
~~INTERIM REPORT~~, SOUTH UMPQUA RIVER
Volume III. APPENDIX B.
HYDROLOGY, METEOROLOGY, AND RESERVOIR REGULATION

Appendix C. Foundation and Materials Data.

Appendix D. Recreation, Public Use, and Environment.

⑨ Interim rept.

⑫ 320 p.

Prepared by

U.S. Army Engineer District, Portland
Corps of Engineers
Portland, Oregon

⑪ 10 Nov~~ember 19~~71

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Review Report
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Umpqua River and Tributaries, Oregon
Interim Report, South Umpqua River

Appendix B
Hydrology, Meteorology, and Reservoir Regulation

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Appendix B

Hydrology, Meteorology, and Reservoir Regulation

SECTION I - INTRODUCTION

1-01. Scope. - The hydrologic and meteorologic data presented in this appendix are the bases for establishing channel capacities, reservoir capacity, outlet capacities, spillway design flood, flood control regulation, and water-conservation plans for a comprehensive development of the water resources of South Umpqua River Basin as related to the proposed Days Creek project. That project would be the key storage project in the development of the water resources in the basin.

1-02. Description of basin. - Umpqua River drains an area of 4,560 square miles, which lies almost entirely in Douglas County in southwestern Oregon and is the 11th largest drainage basin in the State. The basin is bounded on the north by the Calapooya Mountains, on the east by the Cascade Range, on the south by the Rogue River Range, and on the west by the Coast Range and Pacific Ocean. It is roughly triangular in shape with the base, about 85 miles long, paralleling the Coast Range and the apex at the summit of the Cascade Range near Crater Lake.

1-03. Umpqua River has its origin at the confluence of South and North Umpqua Rivers, near Roseburg. The river from that point flows north and slightly west for 63 miles to Elkton, then westerly through the Coast Range to the Pacific Ocean at Reedsport, a total distance of

111 miles. An area of approximately 1,800 square miles in the southern section of the basin is drained by South Umpqua River. Days Creek project site is located in the upper third of the South Umpqua River Basin. Major tributaries of South Umpqua River are Deer Creek, Lookingglass Creek, Myrtle Creek, Cow Creek, Canyon Creek, Days Creek, Elk Creek, and Jackson Creek. The northeastern 1,347 square miles of the Umpqua Basin is drained by North Umpqua River. The basin downstream from the confluence of North and South Umpqua Rivers comprises an area of 1,451 square miles. Major tributaries of Umpqua River are Smith River, Mill Creek, Elk Creek, and Calapooya Creek.

1-04. Topography. - Umpqua River Basin rises from sea level at Reedsport to an elevation of 9,180 feet in the Cascade Range. The mean elevation of the basin is 2,170 feet. The basin lies in the depression between the Coast and Cascade Ranges. There is relatively little flat land, and a major portion is covered with timber. Valley lands along the streams are used principally for agriculture, especially in the central region from Riddle north to Oakland. Lands adjacent to the streams are subject to flooding. Limited areas of flat agricultural land exist in the tidal reach of Umpqua River.

1-05. Umpqua River cuts through the Coast Range in a relatively narrow canyon west of Elkton. The elevation of the north rim of the basin varies from less than 1,000 feet between the Coast and Cascade Ranges to more than 6,000 feet at the crest of the Cascades. On the east the basin rises, on Mt. Thielsen, to elevation 9,180 feet, mean sea level, the highest point in the watershed. To the south, the basin boundary varies from about 8,000 feet at the crest of the Cascades to about 3,000 feet at the crest of the Coast Range. The average elevation of the valleys ranges from about 500 to approximately 1,000 feet. The headwaters of both North and South Umpqua Rivers have their origin in very rough, mountainous areas in which the streams flow in deep, narrow canyons between steep, timber-covered ridges and buttes. In the valleys, the terrain generally is gently rolling.

1-06. Three area-elevation curves on chart 1 show the relationship of area to elevation for (1) the entire basin, (2) the North Umpqua River drainage, and (3) the South Umpqua River drainage. The curve on chart 2 shows the area-elevation relationship for the basin upstream from the Days Creek damsite. It is noted that 50 percent of the North Umpqua drainage is above 3,000-foot elevation, whereas only 25 percent of the South Umpqua drainage is above that elevation. The percentages above 4,000 feet are 33 and 10, respectively. The higher elevations and volcanic geology of the North Umpqua drainage contribute to a larger summer base flow in North Umpqua River than South Umpqua River.

1-07. Tributaries. - The principal tributaries, with drainage areas and the river mileage at which they enter Umpqua River, South Umpqua River, and North Umpqua River are shown in the following tabulation:

Stream and tributary	River mile	Drainage area, square miles
Umpqua River	0.0	4,560
Smith River	11.5	347
Mill Creek	24.2	135
Elk Creek	48.6	290
Calapooya Creek	102.7	247
North Umpqua River	111.7	1,347
Little River	29.1	206
Rock Creek	35.7	99
Steamboat Creek	53.0	227
Fish Creek	71.8	82
Clearwater River	75.4	77
South Umpqua River	111.7	1,762
Deer Creek	123.0	63
Lookingglass Creek	137.0	160
Myrtle Creek	150.7	117
Cow Creek	158.9	496
Canyon Creek	162.9	39
Days Creek	169.9	57
Elk Creek	187.0	80
Jackson Creek	192.6	159

Note: River mileages are upstream from mouth of Umpqua River, except on the tributaries to North Umpqua River which are upstream from the mouth of North Umpqua.

Drainage areas of the above tributaries represent about 90 percent of the drainage area of Umpqua River Basin, about 50 percent of the North Umpqua River drainage, and about 66 percent of the South Umpqua River drainage.

1-08. Stream profiles. - The water-surface profiles of Umpqua River and its tributaries are characterized by steep slopes in the upper reaches and moderate slopes as the streams emerge into the lower valleys. Condensed profiles of Umpqua River and its major tributaries are shown on plates 3 and 4. In the upper reaches, the stream gradients are as much as 400 to 800 feet per mile, whereas in the lower reaches of the tributaries the slopes vary from 10 to 30 feet per mile. In the 85-mile reach from river mile 27, head of tidewater, to the confluence of North and South Umpqua Rivers, Umpqua River slopes about 4.3 feet per mile. Table 1 shows a compilation of stream gradients for the lower and intermediate reaches of numerous streams in Umpqua River Basin.

1-09. Geology and soil cover. - Detailed coverage is presented in Appendix C. Umpqua River Basin includes parts of four physiographic provinces: the High Cascades, the Western Cascades, the Klamath Mountains, and the Coast Range. The High Cascade province is a relatively undissected north-south volcanic range with mountain peaks rising to approximately 10,000 feet. Only the headwaters of North Umpqua River reach into that province. The rocks and soils of the High Cascades are relatively porous, and much of the total runoff is naturally regulated by groundwater storage. The Western Cascades province, at a lower elevation and drained in part by North and South Umpqua Rivers, is much less porous. Runoff is relatively rapid, and low-water flows are not sustained by extensive groundwater storage. Slopes of the Western Cascades generally are steep, and the vegetation on them is dense.

1-10. The portion of the basin drained by Cow Creek and South Umpqua River between Tiller and Roseburg lies within a northern extremity of the Klamath Mountains. The Klamath Mountains also are at a lower elevation than the High Cascades, and the soils have much less water-holding capacity. Slopes generally are steep, with a local relief of 3,000 feet.

1-11. The geology of the Coast Range, which is drained in part by Umpqua and South Umpqua Rivers, is predominantly sandstone, shales, and conglomerates, with a north-south orientation and relatively little water-holding capacity. Through the Coast Range section, the river has many intrenched water courses, and a local relief of less than 2,000 feet.

1-12. Flora. - The rugged mountainous areas of the basin are covered with pine and Douglas fir with considerable underbrush. Nearly 90 percent of the basin is timbered. In the valleys, cottonwoods, willows, alders, and brush line the banks of many streams.

SECTION II - CLIMATOLOGY AND HYDROLOGY

2-01. Climate. - The climate of Umpqua River Basin is characterized by mild, wet winters and hot, dry summers. The general southward displacement of the Aleutian Low results in a westerly flow of moist air from the Pacific during the winter months. Temperatures are generally such that at high elevations a large portion of the winter precipitation occurs as snow, with rain predominating at the low elevations. On rare occasions, polar continental air masses invade the area, resulting in short periods of subfreezing temperatures and snowfall at all elevations. During the summer months the area is dominated by the Pacific High, resulting in hot, dry summers. Climate during the spring and fall months is transitional between the summer and winter extremes.

2-02. Tables 2 and 3 show climatological data by months for Reedsport, on the coast, and for Roseburg, a valley station in the interior of the basin. A summary of climatological data for selected stations is shown in table 4. Table 5 shows a summary of snow survey data observed in and adjacent to the basin.

2-03. Climatological records. - The density of climatological stations is dependent largely upon availability of observers; therefore, the more populated valleys have the greatest density as well as the longest records. The lack of climatological stations at the higher elevations is somewhat offset by snow courses for evaluating precipitation at the higher levels in the basin. Plate 1 shows the geographical location of the climatic stations and the snow courses. Their periods of record are shown on plate 2 and chart 31.

2-04. Temperature. - There is considerable variation in the temperature across the Umpqua Basin. Topography and distance from the Pacific Ocean to the Cascade Range contributed to that climatalogical condition. Average monthly minimum temperatures for January, the coldest month, varies from 37° F. at Reedsport on the coast to 17° F. at Crater Lake, which is located immediately outside the eastern boundary of North Umpqua Basin at elevation 6,475 feet. Average monthly maximum ranged from 70° F. at Reedsport in August to 85° F. in July at Roseburg, an inland valley station. Extremes of record are 110° F. at Riddle, and minus 21° F. at Crater Lake. Length of growing season varies from 220 days at Reedsport to less than 30 days at the high elevations along the Cascades. The range in length of growing season for most of the inland valley areas is 130-190 days. Table 4 shows a summary of air-temperature data for six selected stations.

2-05. Precipitation. - The normal annual precipitation of Umpqua River Basin has a wide geographical variation, ranging from less than 30 inches in the Roseburg area to about 110 inches along the Coast Range. Plate 5, a basin isohyetal map of normal annual precipitation, illustrates the effects of topographic barriers upon the moisture-bearing westerly winds. Initial lifting of the air over the Coast Range increases the annual precipitation from 80 inches along the coast to more than 110 inches at the high elevations in the Coast Range. The downslope movement of the air over the interior valleys results in a decrease to less than 30 inches. As the air is lifted over the Cascade Range, the annual precipitation increases to more than 70 inches, which is less than the annual precipitation over the Coast Range because of moisture depletion and decrease in wind velocity. About one-half of the annual precipitation occurs during the November-January period, at which time the flow of moist air is primarily from the southwest. In contrast, less than 5 percent of the annual precipitation occurs during the July-September period when the area is dominated by the Pacific High. At that time there is little or no flow of moist air from the ocean. Monthly and annual precipitation, together with other meteorological data, are summarized in table 4.

2-06. Snow. - Precipitation occurring as snow in Umpqua Basin varies widely, both with respect to elevation and proximity to the ocean. At Roseburg, a typical inland valley station, the average annual snowfall is about 6 inches, roughly equivalent to three-fourths inch of water, or 2 percent of the annual precipitation. Snow seldom remains on the ground for more than a week and depths rarely exceed 1 foot over the valley floor. At the mouth of Umpqua River near Reedsport, the average annual snowfall is only 2 inches, representing less than 1 percent of the annual precipitation. It is estimated that about one-half and three-fourths of the annual precipitation occur as snow at the 5,000- and 7,000-foot levels, respectively. Only 5 percent and 1 percent of the total Umpqua River drainage area lie above those respective elevations.

2-07. Although snowfall is of little significance in the valleys, it becomes increasingly important at the high elevations. Of particular significance is the accumulation of snow during the winter months and subsequent depletion during the spring snowmelt. Depths of snow and water equivalent vary considerably, with respect to elevation and geographic location. Greatest accumulation of snow occurs along the Cascade Range. At the Windigo Pass snow course, elevation 5,800 feet, the average and the maximum April 1st water equivalents of the accumulated snowpack, based upon 22 years of record, are 45 and 69 inches, respectively. The 32-year record at Whaleback snow course, located on the southern boundary of the watershed at elevation 5,140 feet, shows average and maximum April 1st water equivalents of 35 and 58 inches, respectively. Table 5 shows snow data at selected snow courses in Umpqua Basin. Locations of snow courses are shown on plate 1.

2-08. Storms. - Flood-producing storms occur chiefly during the winter months but are not uncommon in late autumn and early spring. All major storms are of Pacific origin and are associated with a strong onshore flow of moist air. Lifting of the moist air masses as they are forced over the mountainous topographic barriers cools the air below the saturation point, resulting in precipitation of varying intensities. Additional precipitation is produced by frontal activity, the fronts generally moving from west to east at intervals ranging from 12 hours to 48 hours. Some storms are associated with a quasi-stationary front with minor waves moving inland along the east-west orientation of the front. Additional precipitation often results from lifting caused by the cyclonic curvature of the air flow associated with low centers passing over the area.

2-09. Storms vary widely with respect to duration, intensity, and geographical distribution. Major storms may produce precipitation in excess of 10 inches at Reedsport near the coast, and at Diamond Lake in the Cascades, compared to 5 to 6 inches on the valley floor near Roseburg. Storm intensities normally vary in accordance with the normal annual precipitation pattern. Typical major storms are generally of 3- to 5-day duration but some may persist for a longer period as the result of a series of low-pressure waves. Frequently two or more storms reach the basin in close succession, causing double-crested floods with unusually large volumes.

2-10. In addition to the typical winter storms, convective-type storms occur in the area, generally during the late spring and early summer months. Because of their small areal extent and short duration, they rarely produce floods, except in the local area where the storm occurs. Intensity of precipitation in convective-type storms is high, with depths up to one-half inch and 1 inch, occurring in 5 and 15 minutes, respectively. Duration of that type of storm is generally less than 1 hour. Accumulated precipitation depths usually are very little in excess of the maximum 15-minute rainfall. Lightning and hail often are associated with convective storms.

2-11. Evaporation. - Umpqua River Basin is characterized by climatic elements which are conducive to high rates of evaporation during the summer months. No evaporation records are available for Umpqua River Basin. Evaporation records at Medford, in Rogue River Basin immediately to the south, are considered to be applicable to the Umpqua Basin because of the similarity and close proximity of the two basins. The 28-year record at Medford shows an average annual pan evaporation of 43.7 inches, of which 37 percent occurs during July and August. Progressively lesser amounts of evaporation occur during the spring and fall. During the winter season, evaporation is negligible. Table 6 shows, by months, the evaporation in inches together with meteorological elements affecting the rate.

2-12. Data in table 6 show that monthly evaporation correlates well with the mean monthly air-temperature, which is primarily a function of solar and terrestrial radiation. Wind is an important factor in the determination of daily evaporation amounts, but is not a significant factor when evaluating mean monthly values. Because of the wide variation in topographic features in Umpqua River Basin, varying rates of evaporation may occur at specific locations under given climatic conditions.

2-13. Miscellaneous weather phenomena. - Miscellaneous weather phenomena such as fog, high winds, hail, thunderstorms, and freezing rain, occur in varying degrees and frequency, but seldom are of destructive proportions. Highest winds generally are associated with the winter storms. Over the valley floor, average monthly wind speeds range from about 3 miles per hour in November to about 6 miles per hour in April. Daily wind speeds range from calm to 10 miles per hour for approximately 90 percent of the time. However, for short intervals, velocities reach 30 miles per hour. Maximum winds rarely exceed 50 miles per hour. At Roseburg, a first-order weather station, the wind speed during the storm of 12 October 1962 reached an estimated maximum 1-minute velocity of 50 miles per hour. Gusts probably were in excess of 60 miles per hour. Roseburg is not considered a windy area. Greater wind speeds occur at the higher elevations, as evidenced by pilot balloon observations, which frequently show speeds exceeding 50 miles per hour in the free air at the 5,000- to 10,000-foot levels.

2-14. Fog occurs in all months of the year, predominantly during the October-March period and particularly in the Elkton-Kellogg region. It is generally confined to late night and early morning hours, but occasionally may persist during the entire day. The distribution of fog over the basin is irregular, some localities being more susceptible than others. At elevations of several hundred feet above the valley floor, fog decreases somewhat. Areas that penetrate the cloud layers have a high frequency of fog occurrence, particularly during the winter months when cloudiness predominates.

2-15. Discharge records. - Sources of published runoff data for Umpqua River and tributaries are the annual water supply papers of the United States Geological Survey and the water resources bulletins of the office of the Oregon State Engineer. The longest record of streamflow in Umpqua River Basin is at Elkton on Umpqua River. That station gages the runoff from 78 percent of the basin. A continuous record has been kept at that station since October 1905. At the present time, there are 28 active stream-gaging stations in the basin. Approximately half of those stations are in South Umpqua River Basin. All stream-gaging stations with significant records are listed, with their respective records, on plate 2. Geographical location of those stations are shown on the basin map on plate 1.

2-16. Streamflow characteristics. - The streamflow pattern of most streams in Umpqua River Basin is similar to the seasonal rainfall pattern. Low flows normally prevail from June through September, the season of low rainfall. High flows, which fluctuate widely, occur during the remainder of the year. The exception is the flow pattern of the extreme headwater streams in North Umpqua River Basin, which reflect the high porosity of the lava formation in that area. Low base flows prevail in winter and moderately high flows occur in late spring when the snow melts. Even a major storm, such as that of December 1964, failed to produce high flows in that area comparable to those experienced downstream. Chart 9 shows unit discharges for the December 1964 flood at various stations in the basin, which illustrate the flood runoff characteristics of the streams in the basin including the upper headwaters of North Umpqua River.

2-17. Except for a small area of porous lava and pumice along the eastern boundary, and the storage effect of the snowpack in areas above 5,000 feet, the topography and geology of the basin is conducive to rapid surface runoff. Runoff from most of the tributaries produces peak flows within hours after the passage of a storm front. Daily discharge hydrographs for seven representative stations are shown on plates 6 through 21. They illustrate the flashy character of the streams, the magnitude and duration of floods, and the seasons of high and low runoff. The streamflow characteristics are also depicted by the mean monthly flow summaries on charts 3 through 8 and the annual peak discharge frequencies shown on charts 10 through 16.

2-18. Runoff. - Topography, geology, temperature, and the seasonal distribution of the annual precipitation are major factors which influence the annual runoff pattern. More than 95 percent of the annual runoff in the Umpqua River Basin occurs during the 8-month period, November through June. Plates 6 through 21 show the magnitude of the annual runoff for each year of record at seven key stations in the basin. The records show that the average annual runoff per square mile is considerably greater for the North Umpqua drainage than it is for the South Umpqua drainage. Table 7 shows the maximum, minimum, and average annual runoff for the period of record at seven representative stream-gaging stations. Near Elkton, downstream from the junction of North and South Umpqua Rivers, the average annual runoff of Umpqua River for the 1906-1968 period is 5,377,700 acre-feet, or approximately 27 inches over the 3,683 square miles of tributary drainage area. Normal annual precipitation over the basin upstream from Elkton is approximately 53 inches, indicating an average annual surface loss of 26 inches. Extremes in annual runoff of Umpqua River near Elkton have been 2,280,000 acre-feet in 1931 and 9,689,000 in 1956; those amounts are equivalent to 11.6 and 49.3 inches, respectively. The estimated mean annual runoff of South Umpqua River at Days Creek damsite is 935,000 acre-feet, or 29.4 inches.

2-19. Charts 3 through 8 show summaries of mean monthly runoffs, together with flow-duration curves for five stream-gaging stations and one damsite. The Azalea station on Cow Creek is approximately at the location of the Galesville damsite which will be the subject of later studies. The Days Creek damsite on South Umpqua River is about 16 miles downstream from the Tiller gaging station. Table 8 shows monthly extremes of observed runoff and monthly flows which may be equalled or exceeded 10, 20, 40, and 60 percent of the time at six locations in the basin.

2-20. Past floods. - The floods of December 1955 and December 1964 were the two largest recent floods that have occurred in Umpqua River Basin. Information on those floods is extensive because they occurred after the establishment of a network of gaging stations. The maximum discharge of South Umpqua River at Brockway during the 1964 flood is estimated to have been 105,000 c.f.s. and at Days Creek damsite 75,000 c.f.s. At Elkton, the peak discharge of the 1964 flood was 265,000 c.f.s., which is greater than the peak discharge of the historical flood of 1861.

At Winchester on North Umpqua River and at Brockway on South Umpqua River, the peak of the 1964 flood was slightly greater than for several of the previous major floods. Peak unit discharges of the December 1964 flood at several stations in the basin are shown on chart 9. Table 9 shows peak discharges at principal gaging stations in the basin for 10 major floods.

2-21. Flood characteristics. - Floods in Umpqua River Basin result primarily from heavy rains during the period from October through March, at a time when the ground is partially saturated. The magnitude and volume of the flood hydrograph is a function of the duration and intensity of the rain, and snowmelt. Generally, the runoff is rapid, resulting in relatively high peak discharges. The duration of the average flood seldom exceeds 4 days. Major floods, however, generally are of longer duration with unusually large volumes. Spring freshets resulting from melting snow are of long duration with peak discharges that are relatively low causing no damages. In the headwater tributaries, upstream from Fish Creek, on North Umpqua River winter floods are comparatively small in magnitude because part of the precipitation falls as snow, and as a result of the storage effect of the snowpack and the porous nature of the surface area.

2-22. About 75 percent of the floods of record have occurred during the 3 months of December, January, and February. Maximum annual floods have occurred in every month from October through April. The following tables show, for three principal gaging stations in Umpqua River Basin, the number of times that observed maximum annual peak discharges have occurred in each month during the period of record.

OCCURRENCES OF MAXIMUM ANNUAL DISCHARGES

SOUTH UMPQUA RIVER AT TILLER, D. A. = 449 Square Miles

Records: 1940-1968, Incl.

Discharge in 1,000 cfs	Oct	Nov	Dec	Jan	Feb	Mar	Apr
70-50			1				
50-40			1				
40-35	1						
35-30			1	1			
30-25		2	2				
25-20				3			
20-15		1	2		2		
15-10		1	3	3		2	
10-5			1	1	1		
Total	1	4	11	8	3	2	
Percent	3	14	38	28	10	7	

OCCURRENCES OF MAXIMUM ANNUAL DISCHARGES

SOUTH UMPQUA RIVER NEAR BROCKWAY, OREGON, D. A. = 1,670 Sq. Mi.

Records: 1942-1968, Incl.

Discharge in 1,000 cfs	Oct	Nov	Dec	Jan	Feb	Mar	Apr
110-90	1		2				
90-70		1		3			
70-60		1	3	2			
60-50				1			
50-40			1		2		
40-30			1	2	3		
30-20			1				
20-10		1	1		1		
10- 0							
Total	1	3	9	8	6		
Percent	4	11	33	30	22		

OCCURRENCES OF MAXIMUM ANNUAL DISCHARGES

UMPQUA RIVER AT ELKTON D.A. = 3,683 Sq. Mi.

Records: 1908-1968, Incl.

Range in 1,000 cfs	Oct	Nov	Dec	Jan	Feb	Mar	Apr
300-250			1				
250-200	1		1				
200-160		2	2	1	1		
160-120		1	2	3			
120-100			3	3	3	1	
100- 80		1	2	5	2		1
80- 60		1	6	4	4	1	
60- 40		1	1	1		2	2
Less than 40			1		1		
Total	1	6	19	17	11	4	3
Percent	1	10	31	28	18	7	5

2-23. <u>Flood frequencies</u>. - Damaging floods in the basin are almost an annual occurrence. Studies of flood probabilities have been made on the basis of instantaneous maximum annual discharges at the Days Creek damsite and at six other principal points in the basin. The results are illustrated on charts 10 through 16. The following tabulation summarizes the flood magnitudes which may be expected to recur, on the average, once in 5, 10, 25, 50, and 100 years at those seven locations. Maximum discharges of record also are shown in that table. In most instances the December 1964 flood had a peak discharge that can be expected to be equalled or exceeded once in approximately 50 years, on an average.

UMPQUA RIVER BASIN

FLOOD MAGNITUDES

IN C.F.S.

Stream	Station	Drainage area sq. mi.	Average recurrence interval in years					Maximum of record C.F.S. and date	Period of record
			5	10	25	50	100		
Umpqua River	Near **Elkton**	3,683	140,000	170,000	210,000	242,000	275,000	265,000 Dec. 1964	1908-1968
N. Umpqua R.	At Winchester	1,344	61,000	74,000	92,000	104,000	119,000	119,000 Dec. 1964	1909-1913 1923-1929 1954-1968
S. Umpqua R.	At Tiller	499	29,200	37,500	49,000	58,000	68,000	60,200 Dec. 1964	1910-1911 1939-1968
S. Umpqua R.	Near Brockway	1,670	59,500	73,500	92,000	106,000	121,000	105,000 Dec. 1964	1905-1912 1923-1926 1942-1968
Cow Creek	Near Azalea	78	3,500	4,550	6,050	7,300	8,600	8,430 Dec. 1964	1928-1968
Cow Creek	Near Riddle	456	26,000	32,200	40,800	47,000	54,000	37,500 Dec. 1964	1954-1968
S. Umpqua R.	Near Days Creek (Days Creek D.S.)	640	$38,000^e$	$48,500^e$	$63,500^e$	$76,000^e$	$88,000^e$	$78,900^e$ Dec. 1964	NONE

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e/ Estimated from Tiller damsite, D. A. = 446 sq. mi..

2-24. Channel capacities. - Bankfull capacities of Umpqua River and specific tributaries are shown in the following tabulation, together with the average recurrence frequency in years:

Station	Drainage area sq. mi.	Bankfull capacity Stage feet	Bankfull capacity Discharge c.f.s.	Recurrence frequency, years
Umpqua River near Elkton	3,683	25.0	85,500	2
North Umpqua River at Winchester	1,344	18.0	50,000	3
South Umpqua River near Brockway	1,670	21.0	45,000	3
Cow Creek near Riddle	456	13.0[1/]	12,000	2

[1/] Area between station and Umpqua River flood plain subject to flooding at stage of 13.0 feet.

Areas subject to serious flooding are located along South Umpqua River downstream from Tiller, Cow Creek downstream from Azalea, and along Calapooya, Yoncalla, Lookingglass, and Elk Creeks. Nearly every year the streams near Drain, Dillard, Yoncalla, and Roseburg overflow their banks. Flood damages have been particularly severe along South Umpqua River in the Myrtle Creek-Dillard reach and near Drain.

2-25. Channel velocities. - Umpqua River and its tributaries have slopes ranging from 400 to 800 feet per mile in the upper reaches and from 10 to 30 feet per mile along the lower reaches of the tributaries. Slopes average 3.5 to 9 feet per mile in the middle and lower reaches of Umpqua River. As a result of the comparatively steep gradients in the upper reaches, streams attain high velocities during floods and bank erosion occurs at a number of locations in the valleys. Velocities for various flows have been investigated at all stream-gaging stations in Umpqua River Basin. Discharges at which various average velocities are experienced at several of the gaging stations in the basin are shown in the following tabulation:

Mean velocity in feet per second	Discharge in c.f.s.				
	S. Umpqua at Tiller	Cow Creek at Azalea	S. Umpqua at Brockway	N. Umpqua at Winchester	Umpqua at Elkton
3	2,000	850	8,200	11,000	10,000
5	4,700	2,200	19,200	26,000	28,000
10	21,000	11,000	96,000	120,000	250,000

Maximum velocities may be 50 percent higher than the indicated mean velocities.

2-26. Sedimentation. - From February 1956 to date a water resources survey by Douglas County has been in progress for the purpose of compiling significant hydrologic data. Included in that survey are suspended sediment data that were compiled at 10 locations in Umpqua River Basin. Those data indicate that the sediment-producing characteristics of the Umpqua River Basin are similar to those of Willamette River Basin. Fairly comprehensive suspended sediment studies show that sediment concentrations in streams in both basins usually are not significant except during flood periods. During low flows, suspended sediment concentrations may be as low as a trace.

2-27. Based upon the above-referenced sediment data, an estimated average annual silting rate of 0.35 acre-foot per square mile of tributary area was considered to be reasonable and was used to determine the average annual silting rate of 224 acre-feet for Days Creek Lake.

2-28. Water temperatures. - Records of water temperature were kept for approximately a year and a half in 1961 and 1962 at several key stations in Umpqua River Basin by the U.S. Fish and Wildlife Service and Oregon State Game Commission. The following tabulation shows, by months, the average water temperature at those key stations based upon the above-referenced records:

Month	Mean monthly water temperature, degrees F.			
	Cow Creek below Riddle	S. Umpqua R. at Tiller	S. Umpqua R. at Winston	N. Umpqua R. at Winchester
January	40	39	42	37
February	45	43	46	42
March	45	43	46	41
April	51	45	51	47
May	56	49	56	51
June	69	60	68	61
July	76	68	75	67
August	74	69	74	66
September	64	62	66	59
October	54	48	56	50
November	44	42	44	40
December	42	42	43	40

The diurnal temperature fluctuations in the streams vary with the seasons and geographical locations. During the winter months the diurnal fluctuation is only a degree or two, whereas during the summer it will vary from a maximum of 6° F. at Winchester on North Umpqua River to more than 20° F. at Winston on South Umpqua River. During the year and a half that water temperatures were observed, the maximum temperatures observed were 85° F. below Riddle on Cow Creek, 84° F. at Tiller on South Umpqua River, 94° F. at Winston on South Umpqua River, and 73° F. at Winchester on North Umpqua River. Those temperatures were all observed during July.

North Umpqua River experiences lower summer temperatures than other streams in the basin. This is attributed to the large base flow that is sustained from snowmelt and the lava beds which exist in the upper reaches of North Umpqua Basin. Summer flows in South Umpqua River are relatively small in quantity, which makes the streamflow subject to excessive warming as it flows from its headwaters to the confluence with North Umpqua River, a distance in excess of 100 miles.

2-29. Charts 17 through 20 show maximum and minimum water temperatures at four stations in Umpqua River Basin for a one-and-one-half-year period in 1961 and 1962. Chart 21 shows maximum and minimum air temperatures at Roseburg for those months that water temperatures were observed in Umpqua River Basin.

2-30. Temperature control. - One of the primary functions of Days Creek Lake would be to supplement low-water flows in South Umpqua River with cooler water of a quality suitable for fish habitat enhancement. Studies show that, for Plan II with 480,000 acre-feet of storage space, the flows from Days Creek Lake could be maintained at 55° F. or less in most years by utilizing multilevel ports for releasing water from selected levels in the lake. Such ports would be required for other purposes.

2-31. The fishery agencies have based their estimates of fish habitat enhancement benefits on minimum releases from the lake at temperatures and in amounts which would provide water of 70° F. or less at the confluence of North and South Umpqua Rivers. Other than in a critically low runoff year, the released water would not exceed 55° F., the criterion established by the fishery agencies. In such a year, or an unusually warm summer, the released water could be a few degrees warmer than 55° during August and September.

2-32. Reservoir temperature studies have been made for a low runoff year, 1941, and an average year, 1958. For the recommended storage plan, the reservoir surface temperature in a year such as 1941 would reach a maximum of 85° F. and the maximum release temperature would be 56° F.. In a year such as 1958, the maximum surface temperature would be 85° F. and the maximum temperature of the released water would be 55° F.

2-33. Charts 22A and 22B show graphically, for the recommended gross storage of 480,000 acre-feet, the temperature distribution within Days Creek Lake, the inflow and outflow from the lake and the respective temperatures of those flows during the calendar year 1941 which is a low run-off year. Charts 23A and 23B show similar water temperatures and discharges for calendar year 1958, a year of average runoff.

2-34. The reservoir temperature data presented in this appendix are from a computerized analysis, made near the end of the study, which confirms that the released water in late summer can be maintained at temperatures at least as low as those shown in study results previously submitted to the fishery agencies for evaluating fishery benefits. The former study was based upon mean monthly values whereas the computerized study utilizes daily values and a greater number of meteorological parameters. The computer program for analyzing the temperature structure in a reservoir is a recent innovation that has shown the capacity to consistently reproduce observed temperatures in existing reservoirs. The reservoir temperature studies using that program are more comprehensive than those used to derive data used in evaluating the fishery benefits; therefore, it appears that temperatures at least as good as those used in evaluating fishery benefits would be dependably available.

SECTION III - RESERVOIR REGULATION

3-01. Basic reservoir regulation. - Days Creek Lake, a multiple-purpose project, would serve the functions of flood control, recreation, fishery enhancement, irrigation, municipal and industrial water supply, and water quality control.

3-02. Flood control requires that storage space be reserved from late fall through mid-spring to control floods. During December and January, the months with the greatest flood potential, maximum space would be reserved for controlling floods. After 1 February, storms are less intense and less frequent, and the space reserved for flood regulation would be filled gradually by 1 May, with the exception of a small space reserved for control of late-season floods. In the recommended plan, 15,000 acre-feet of space would be retained to regulate minor highwaters that could be generated from short-duration convective storms or late-season snowmelt augmented by a general rain. Records show that the probability of a highwater after 1 May is small. The 15,000-acre-foot reservation would be equivalent to approximately one-half inch of runoff from the entire basin tributary to the damsite.

3-03. Water stored between maximum conservation pool and minimum flood control pool would be retained until needed to meet downstream conservation requirements or until evacuation would be required for flood control purposes. By 1 December the reservoir would be drawn down to minimum flood control pool, either from providing for conservation requirements or by special evacuation for flood control. Chart 24 shows the basic pool levels that should not be exceeded, except during the regulation of a flood, throughout the year. When flood control space is filled in the process of regulating a flood, water stored above the pool level scheduled for that date would be evacuated to the scheduled level at the earliest possible date following the flood.

3-04. Reservoir capacities. - Five storage plans were studied for Days Creek, as shown in the following tabulation:

Storage	Storage in acre-feet				
	Plan Ia	Plan IIa	Plan I	Plan II	Plan III
Exclusive F.C.	10,000	15,000	10,000	15,000	20,000
Multiple-use	190,000	260,000	190,000	260,000	340,000
Carryover	---	---	90,000	130,000	170,000
Inactive	70,000	70,000	70,000	70,000	70,000
Dead	5,000	5,000	5,000	5,000	5,000
Total	275,000	350,000	365,000	480,000	605,000

Plans Ia and I would reserve a maximum of 200,000 acre-feet for flood regulation during December and January, the period of greatest flood potential. That amount of storage space would completely control, at the damsite, a 25-year flood. Plans IIa and II would reserve a maximum of 275,000 acre-feet for flood regulation which would completely control, at the damsite, a 100-year flood. Plan III would reserve a maximum of 360,000 acre-feet for flood regulation and that amount of storage space would completely control, at the damsite, a 400-year flood.

3-05. Environmental considerations require that a permanent, or minimum conservation, pool of at least 75,000 acre-feet be provided. Configuration of the reservoir area is such that a pool at any lower elevation would expose extensive areas of unsightly reservoir bottom, and thus be environmentally and esthetically unacceptable. Seventy thousand acre-feet below minimum conservation pool is inactive and 5,000 acre-feet dead storage.

3-06. Carryover storage generally would be used only when the multiple-use storage space did not fill following the flood season. In approximately 1 year out of 5 there would be a need to use some or all of the carryover storage. In 6 years out of the 40 studied, all or almost all of the carryover storage would have been required, and shortages would have been experienced in 3 of those 6 years; such shortages would be shared among all project purposes. Paragraph 3-20 contains additional details on shortages.

3-07. The 480,000-acre-foot reservoir would provide a source of low-temperature water during the summer months. Water released from the lower levels in the reservoir would be cooler than near the surface and would provide downstream water quality and fishery enhancement. Even in short water years it would not be necessary to draft the warmer water in the upper level of the reservoir until in the fall when there would be a natural cooling of flows downstream from the project. Since ports would be situated at several levels in the outlet tower, it would be possible to select the temperature of the water released.

3-08. The following tabulation shows, for each of the five alternative storage plans studied, pool elevations for pertinent pool levels.

Pool level	Elevation, feet, m.s.l.				
	Plan Ia	Plan IIa	Plan I	Plan II	Plan III
Maximum	972	993	997	1,026	1,053
Maximum conservation	969	989	995	1,022	1,049
Minimum flood control	888	888	934	948	992
Minimum conservation	888	888	888	888	888
Top of dead	816	816	816	816	816

The recommended project, Plan II, would have an average annual drawdown of approximately 74 feet below maximum conservation pool. In critical water supply years the pool could be drawn down about 134 feet, to elevation 888; this would have occurred in 5 of the 40 years studied, 1926-1965.

3-09. Outlets. - Outlets would be provided so that the project could be operated effectively for flood regulation and water conservation. For flood control, the outlets should have a capacity in excess of 16,000 c.f.s. at minimum flood control pool, the minimum acceptable capacity for effective utilization of the storage space above minimum flood control pool for regulating floods. With that capacity, inflows could be passed until it was forecast that a downstream bankfull stage would be exceeded. There would be no involuntary storing of floodwaters. Also, a full reservoir could be evacuated in less than a 2-week period, an essential consideration because of the possibility of a series of storms following one another.

3-10. The outlets also must be suitable for overall management of water quality, and for necessary releases of water stored for conservation purposes, including irrigation, fishery enhancement, water supply, and water quality improvement. Water quality management would be a basic joint-use element of project operation, to preclude any possible development of water quality problems. Accomplishment of that joint-use function requires the availability of multiple-level intake ports, sized as required for the total releases involved. Studies show that fixed ports on three levels probably would provide the required flexibility to fulfill that objective. The flood control outlet would provide one of the three levels. The other two levels would be higher in the pool. Each would have a capacity of about 1,000 c.f.s. With three intake levels, the two upper levels should be positioned to draft from the bottom of the upper third of the reservoir and at the top of the lower third. For the recommended project, those invert elevations would be 982 feet and 930 feet, respectively, with the invert of the main flood control outlet at elevation 816 feet. Recognizing the possibility that detailed planning studies might result in a decision to use more than three levels, and to insure that cost estimates would be adequate to achieve the desired results, Plan II cost estimates include intake ports at four levels.

3-11. Flood regulation. - Flood regulation would be a major function of the Days Creek project. Several storage plans were investigated to determine the most favorable flood control storage reservation for net benefit maximization. On the basis of those studies, as discussed in the main report and the appendix on economics, a storage of 275,000 acre-feet for flood regulation was selected. That amount of flood control storage space would completely control, at the project site, a 100-year flood. When filled for conservation purposes, it would provide adequate flows for conservation functions presently considered. Special flood-regulation curves that make optimum use of the available storage space would be used when complete control of the flood at the storage site otherwise would result in the reservoir filling before the end of the flood, resulting in a sudden large spill. The special flood regulation curves permit that situation to be anticipated and to call for an earlier increase in outflow so that there is no sudden spill and the remaining storage space is used more effectively. The resulting maximum release would be less than if complete storing were to occur, followed by an uncontrolled spill. Chart 26 illustrates the use of this type of flood regulation.

3-12. Days Creek Reservoir would regulate the runoff from 640 square miles, or approximately 36 percent, of the South Umpqua River Basin. The reach of South Umpqua River from Days Creek to the confluence with North Umpqua River, a distance of about 60 miles, would experience the greatest degree of benefit from flood reductions effected by a multiple-purpose storage project at the Days Creek site. Below the mouth of North Umpqua River the benefits would be less significant; however, there would be dependable reductions for all damaging floods. Bankfull stage near Elkton on Umpqua River is experienced once every 2 years, on an average.

3-13. Flood routings show that the recommended flood control storage of 275,000 acre-feet would completely control, at the project site, all floods of record including the 100-year flood. The results of those studies are illustrated on charts 11, 14, and 16, which show natural and regulated flows for South Umpqua River at Days Creek damsite, South Umpqua River at Brockway, and Umpqua River at Elkton for various recurrence frequencies. The following tabulation shows, for the recommended project, the stage reductions at key downstream locations for recurrence frequencies of 5, 10, 25, 50, 100, and 200 years.

Recurrence frequencies in years	Stage data in feet					
	South Umpqua R. at Brockway			Umpqua River near Elkton		
	Unregulated	Regulated	Reduction	Unregulated	Regulated	Reduction
Bankfull	21.0	21.0	0.0	25.0	25.0	0.0
5	24.7	21.0	3.7	34.2	32.4	1.8
10	27.7	21.0	6.7	39.0	36.1	2.9
25	31.7	21.0	10.7	46.3	42.8	3.5
50	34.4	21.8	12.6	49.0	45.0	4.0
100	37.2	23.5	13.7	52.6	48.5	4.1
200	40.0	24.8	15.2	56.5	51.7	4.8

3-14. a. The basic procedure for effecting flood regulation would be to store water in Days Creek Reservoir whenever an overbank stage is forecast for Brockway which is approximately 39 miles downstream from Days Creek Dam. Bankfull stage at Brockway is 45,000 c.f.s. which normally would require flood regulation to be effected at Days Creek when a flow of 16,000 c.f.s. or greater is expected at the dam. The travel time of flood flows between Days Creek Dam and Brockway is 6 hours, therefore flood regulation must anticipate downstream overbank stages far enough in advance so that the flow reductions are fully effective at Brockway. The Muskingum type of flood routings was used to route the regulated flows from Days Creek Dam to the key downstream stations of Brockway and Elkton.

b. The amount of storing during a flood would depend upon how much the flow at the damsite would have to be reduced to effect optimum downstream regulation. In a major flood the entire flow into the reservoir would have to be retained, with the exception of 100 c.f.s. released to sustain fish life immediately downstream from the project. Even with outflow reduced to 100 c.f.s., there would be times when local runoff downstream from the project would be great enough to produce overbank stages. Between the project and Brockway, a key downstream control point, there are 1,030 square miles of uncontrolled area. Days Creek project only controls 38 percent of the area tributary to Brockway on South Umpqua River.

c. Since the proposed flood control storage reservation will only effectively control a 100-year flood at the damsite, provisions would be made through the use of special flood regulation curves to obtain optimum use of the available storage space during larger floods. The special flood regulation curves indicate when it becomes prudent to effect a controlled increase in the outflow so as to make the maximum use of the remaining storage space. This procedure results in a gradual increase in the outflow in lieu of a sudden increase of a larger magnitude should the reservoir suddenly reach its full pool level before the end of the flood. The special flood regulation curves have pool elevations and regulated discharge as the two ordinates with the reservoir inflow shown as a parameter. To use the curves, current pool elevation and inflow, which are known, are referred to the curves which indicate for that particular combination of pool elevation and inflow what the outflow should be to make optimum use of the remaining flood control space. Chart 26 illustrates the results of using those special curves in regulating the Standard Project Flood.

3-15. After the flood had receded to within-bank stages, the stored water would be released and the reservoir pool evacuated to the scheduled elevation for that specific date. During the major flood months of December and January the reservoir would be evacuated to minimum flood control pool. After 1 February there is a gradual decrease in the flood potential and filling of the storage space reserved for flood regulation could be undertaken without jeopardizing the flood control effectiveness of the Days Creek project. Should a flood occur during the filling period, water stored above the flood control rule curve would be evacuated following the flood. Chart 24 illustrates the amounts of stored water that should not be exceeded throughout the year, except during the regulation of a flood.

3-16. Water rights. - Water is a valuable natural resource in Umpqua River Basin and competition for the resource is best illustrated by citing the various interests that have obtained water rights from the State of Oregon, and the totals for the respective filings. On many streams, the existing water rights exceed the minimum natural flows.

3-17. Water rights are of two types, consumptive and nonconsumptive. Consumptive rights include those for domestic water supply, water for stock, irrigation, pondage, municipal water supply, and industrial water supply. Irrigation accounts for 45 percent of the existing nonconsumptive water rights, which total 640 c.f.s. for the basin. Consumptive water rights are about equally divided between Umpqua River, North Umpqua River, and South Umpqua River. Nonconsumptive rights are those for power generation, mining, pollution abatement, and fishery. Power water rights account for 93 percent of the nonconsumptive rights, which total 4,272 c.f.s. for the basin. More than 90 percent of the power rights are in the North Umpqua River drainage. The following tabulation summarizes the unadjudicated water rights for the three areas as of 1 January 1958.

Item	Water rights in c.f.s.			
	Umpqua R.	North Umpqua R.	South Umpqua R.	Basin total
Consumptive rights:	177.23	198.30	264.93	640.46
Domestic	5.23	2.30	11.24	18.77
Camp	0.84	1.25	0.02	2.11
Stock	0.08	0.03	0.21	0.32
Irrigation	84.57	29.88	173.52	287.97
Pondage	8.03	6.38	30.41	44.82
Municipal	26.50	112.00	14.19	152.69
Industrial	51.98	46.46	35.34	133.78
Nonconsumptive rights:	302.80	3,636.88	333.54	4,273.22
Power	302.80	3,575.65	33.67	3,912.12
Mining	---	0.15	299.70	299.85
Fish	---	61.08	0.17	61.25
Total	480.03	3,835.18	598.47	4,913.68

3-18. There is a serious need to improve the water supply in the South Umpqua drainage during the critical low-flow months, merely to satisfy needs under present consumptive and nonconsumptive rights. No dependable supply is available for future needs, or even for some present needs. Water supplies are so undependable during the summer months that the situation will continue to be a serious deterrent to development of fish life potential and to any substantial basin development.

3-19. Releases for fishery enhancement. - Natural flows in South Umpqua River during the low-flow months are not adequate to sustain fish life. Federal and State fishery agencies concur that, by increasing the low flows and lowering the water temperatures, a substantial anadromous fish run can be developed in South Umpqua River and its tributaries. To accomplish that result, the temperature of the water in South Umpqua must not exceed 70^{o} F., summer flows must be increased to approximately

1,000 c.f.s. during critical months, and the increased flows must be of a quality compatible with improvement of fish habitat. Those criteria can be met with the proposed 480,000 acre-feet project. By use of multiple-level intake ports, as already described in paragraph 3-10, water of selected temperature would be released to meet fishlife needs. The releases, and the release temperatures, which could be provided by the recommended storage plan are shown in the following tabulation:

	Fishery release[1/]			Fishery release[1/]	
Month	c.f.s.	Temp. ° F.	Month	c.f.s.	Temp. ° F.
January	350	41	July	950	54
February	350	43	August	950	55
March	350	44	September	800	53
April	450	45	October	650	52
May	600	47	November	550	50
June	750	52	December	350	46

1/ Exclusive of additional releases, made at the same temperature but diverted from the stream to be used consumptively, for irrigation and municipal and industrial water supply.

Alternative storage plans I and III would have provided July and August releases of 800 c.f.s., and 1,100 c.f.s., respectively, compared to 950 c.f.s. for the recommended plan. Plan IIa would have provided flows of about the same magnitude as for Plan II, but at a higher temperature and with more frequent and greater shortages because there would be no carryover storage available to supplement the flows in low runoff years. Plan Ia would provide about the same flows as Plan I, but with approximately 75-percent shortages in the critical low-flow years and with temperatures in September and October at least 5° F. higher than for Plan II.

3-20. Releases as shown above could have been provided in all but 3 of the 40 years studied, through the utilization of carryover storage in the proposed 480,000-acre-foot project. In the 40 years studied, there were 8 years in which the multiple-use storage would not have been adequate to provide the minimum scheduled releases. In 6 of those 8 years all, or almost all, of the carryover storage would have been used. In 3 of those 6 years, shortages would have been experienced. In the 3 deficient years, one year experienced a shortage of 12 percent, 1 year 20 percent, and the largest deficiency was 23 percent in 1934.

3-21. Municipal and industrial water supply. - The present water rights for municipal and industrial use are less than 30 c.f.s. Those demands would increase appreciably if a dependable water supply were available. Included in the Days Creek plans are provisions for approximately 3,000 acre-feet of stored water for municipal and industrial use. The future demand for municipal and industrial water will grow as the communities in the lower South Umpqua drainage develop.

3-22. Irrigation. - Days Creek Reservoir would provide approximately 15,000 acre-feet of stored water for irrigation. Based on studies made in 1970 by the Bureau of Reclamation, that amount of storage would permit irrigation of 5,160 acres of new lands, and would provide a supplemental source of water for 4,100 additional acres. Those lands are all located along South Umpqua River; approximately 30 percent of the lands are located upstream from the mouth of Cow Creek.

3-23. Irrigation releases from Days Creek Reservoir, shown in the following tabulation, include those amounts to be supplied from storage plus available natural flows to fulfill downstream water rights on South Umpqua River.

Month	Release in acre-feet		
	Storage	Water rights	Total
April	840	900	1,740
May	1,680	1,300	2,980
June	2,580	2,350	4,930
July	4,430	4,400	8,830
August	3,780	3,620	7,400
September	1,920	1,850	3,770

The above releases reflect the use of return flows to satisfy irrigation needs. In years of water shortages, irrigation would share the available supply with other conservation purposes to the same relative extent as it would share in a full supply. In 1926, 1931, and 1934, respectively, there would have been 12-, 20-, and 23-percent reductions in irrigation diversions.

3-24. The above figures show that approximately one-half of the irrigation requirements that would be supplied from South Umpqua River would come from natural flow under existing water rights. Exercise of all existing consumptive water rights during critical low-flow months would take all of the natural flow in South Umpqua River. The program of the Oregon State Water Resources Board, however, requires that, when the natural flow in South Umpqua River recedes or is depleted to 60 c.f.s. at mouth of South Umpqua River, water rights granted after 1964 are restricted from further depleting the natural flow. Water rights granted prior to 1964 would continue to deplete the natural flow.

3-25. Power. - Generation of hydroelectric power at Days Creek is not economically justified at present power rates; therefore, no power-generating facilities are proposed. A more detailed discussion of the decision to eliminate power as a project function is presented in the main report.

3-26. Effectiveness of Days Creek for conservation. - Conservation functions to be served by the proposed Days Creek Lake are: fishery enhancement, irrigation, municipal and industrial water supply, water quality control, and recreation. Water released for fish would enhance the quality of the water downstream from the project for all other conservation uses.

3-27. Plate 22 illustrates graphically, for the recommended plan, the storage at the end of each month and the mean monthly inflows and outflows at the project over a 40-year period, 1926-1965. During 32 of the 40 years studied, all conservation goals could have been fulfilled without drafting the reservoir below the minimum flood control pool level. In the remaining 8 years carryover conservation storage would have been needed to fulfill the prescribed conservation goals. In 6 of the 8 years, the need for supplemental water would have required drafting all or well into the lower half of the carryover storage. In 3 of those years even the carryover storage would not have been adequate to provide for all the conservation needs.

3-28. Reservoir temperature studies indicate that the maximum temperature of the water released from Days Creek Reservoir would seldom exceed 55° F. The combination of release temperatures and rates would insure water at the mouth of South Umpqua River cooler than 70° F. under normal hydrologic and climatic conditions.

3-29. The multiple-use storage space of 260,000 acre-feet would have filled in 30 of the 40 years studied. In years of average water requirements and a full reservoir,there would be extra water to be released before 1 December. To provide a uniform annual pattern of reservoir operation, and to insure a gradual release of the extra storage in the interest of downstream uses, a rule curve was developed, which is shown on chart 24, that would lower the pool gradually starting in July, even when the water was not needed to meet downstream conservation goals. By studying plate 22 one can better understand how this regulation affects the reservoir releases and pool levels.

SECTION IV - DESIGN FLOODS

4-01. General. - In planning and designing a storage project the two most significant floods are: the spillway design flood, and the standard project flood. Both floods would occur infrequently and since streamflow records are relatively short, the hydrographs must be theoretically derived.

4-02. The standard project flood, the smaller of the two floods, would result from a sequence of maximum meteorological and hydrological conditions that could reasonably be expected to occur over a watershed. Those maximum meteorological and hydrologic values may be determined from an analysis of past flood-producing conditions in and adjacent to the basin. This can be a time-consuming study; therefore, a simplified and acceptable procedure for deriving the standard project storm has been developed by the engineering profession. This latter approach was used to derive the standard project flood for South Umpqua River at Days Creek. Basically, the simplified procedure is to use a percentage of the spillway design storm and snowmelt contribution. For Days Creek the percentages were 50 percent for the storm portion plus 80 percent of the snowmelt. This 50 percent is within the limits prescribed by the Office, Chief of Engineers.

4-03. The function of the standard project flood is to provide a means of evaluating the effectiveness of a storage project should the maximum reasonably expected flood potential of the basin be realized. The project itself may or may not be designed to control such a flood, more likely not. Economics usually do not justify building to that high a degree of control.

4-04. The spillway design flood is the more significant of the two floods as the safety of a storage project is involved. Safety is particularly important should the project be of considerable size and located upstream from any highly developed areas which would be subject to disastrous flooding should the dam fail.

4-05. The derivation of the flood is theoretical and involves developing the maximum probable meteorological and hydrologic conditions that can occur, and converting those conditions into a flood by means of a unit hydrograph. Much research has been done in the field of developing procedures for deriving probable maximum values of precipitation for specific areas. A probable maximum storm would be several times the maximum storm observed in a particular area.

4-06. The spillway design flood is used to size the spillway. This particular flood should be passed through the storage reservoir without encroaching on the freeboard. In some instances the storage could effect some regulation in the passage of the flood. The problem could be complicated by the possibility that a series of storms might occur that would result in a flood volume too large for the reservoir to effect a reduction in the peak inflow. Therefore, it is necessary that the spillway have the capacity to pass the uncontrolled spillway design flood. This latter situation exists at Days Creek on South Umpqua River.

4-07. Standard project flood. - The standard project flood for Days Creek is the product of a 72-hour storm following a flood such as that of December 1942-January 1943. The antecedent flood gives the effect of a flood series which is characteristic of the larger western Oregon floods.

Snowmelt comprised approximately one-third of the volume of the standard project flood. Surface losses during the 72-hour, 19-inch, storm were approximately 3.5 inches. The peak of the 6-hour unit hydrograph used in the derivation of the flood was 19,200 c.f.s., or 29.7 c.f.s. per square mile. It has a peak discharge of 111,700 c.f.s. and a volume of approximately 650,000 acre-feet, see chart 25. The peak discharge is 1.5 times the largest flood of record. The flood volume is more than twice the storage allocated to flood regulation. A flood routing shown on chart 26 indicates that the flood could be reduced by Days Creek Reservoir to a maximum discharge of 95,000 c.f.s., a reduction of 16,700 c.f.s.

4-08. Spillway design flood. - The spillway design flood, see chart 27, has a peak discharge of 290,000 c.f.s. and a volume of more than 1 million acre-feet, which corresponds to more than 29 inches of runoff in approximately a 6-day period. The peak discharge is 3.9 times the maximum flood of record and 2.6 times the standard project flood peak. Surface losses were 1.80 inches during the 72-hour storm, which reflects the effect of presaturated soil conditions at the start of the flood. All aspects of the meteorological and hydrologic conditions, as well as sequence of events, are the optimum conceivable for generating a flood.

4-09. The probable maximum storm was derived from the Hydrometeorological Report No. 43, "Probable Maximum Precipitation, Northwest States" by the Environmental Science Services Administration of the U.S. Weather Bureau. From that report it was possible to evaluate both the orographic and convergence aspects of a probable maximum storm for the South Umpqua River drainage tributary to the Days Creek damsite. The rain portion of the probable maximum storm amounted to 24.6 inches and the snowmelt 6.8 inches. The maximum 6- and 12-hour amounts were 5.5 and 9.83 inches, respectively. The 72-hour storm was arranged in a typical storm pattern in 6-hour increments.

4-10. The residual pattern of the probable maximum storm was converted into a flood hydrograph by means of a 6-hour unit hydrograph. Chart 28 shows the normal and design 6-hour unit hydrographs, with other descriptive features of a unit hydrograph. The normal 6-hour unit hydrograph reflects runoff conditions characteristic of the rainfall intensities normally experienced. The design 6-hour unit hydrograph represents runoff characteristics of rainfall amounts that would be experienced in a probable maximum storm. The higher storm intensities result in a faster concentration of runoff, because of the improved hydraulic conditions of the surface runoff and smaller water courses that feed into the numerous tributaries. The design peak of the 6-hour unit hydrograph is 28,800 c.f.s., 50 percent greater than the 19,200-c.f.s. peak of the normal 6-hour unit hydrograph.

4-11. Flood routings with Days Creek Lake at minimum flood control pool and at full pool, respectively, at the start of the flood are shown on chart 29. The results are basically the same. There would be no appreciable reduction in the peak outflow with the pool at minimum flood control level at the start of the flood; therefore, the spillway was designed to discharge the peak inflow at maximum pool elevation, less the amount that could be discharged through the flood control outlets. The spillway would have the capability of discharging 270,000 c.f.s. at pool level 1,026 feet. The spillway at Days Creek would be gated with the maximum pool and full pool at the same elevation, 1,026 feet. Surcharge storage was found to be uneconomical which accounts for the maximum and full pools being identical.

4-12. Wave action. - At Days Creek the 1-percent wave plus ride-up was determined to be 3.1 feet on the basis of computations made in accordance with the procedures prescribed in Engineer Technical Letter 1110-2-8, "Freeboard Allowances for Waves on Reservoirs," dated 1 August 1966. In computing the 1-percent wave height and ride-up, an overland wind speed of 35 miles per hour from the east, the direction from which the wind would have to blow to produce waves against the face of the dam, was used over an effective fetch of 1.1 miles. Chart 30 shows the relationship between wind velocity and the significant and 1-percent wave heights including ride-up for Days Creek Reservoir. The significant wave would be exceeded 13 times in a series of 100 waves, whereas the 1-percent waves would be exceeded only once in a series of 100 waves. Protection from the 1-percent wave provides a higher degree of safety which is desirable for a high embankment as proposed for Days Creek.

4-13. Freeboard. - Engineer Technical Letter 1110-2-17, dated 20 February 1968, specifies that earthquakes should be considered in establishing the freeboard for a storage project in specific zones. Days Creek damsite is located in a potential earthquake zone. The criteria allowance for an embankment-type structure are: (a) flood control pool elevation plus 3 percent of the height of dam, or (b) maximum water surface plus the conventional freeboard for wave height plus ride-up.

The allowance of 3 percent of the height of dam is for fill settlement that might result from an earthquake shock. At Days Creek this amounts to 7.6 feet. The conventional freeboard based upon wave height plus ride-up is 3.1 feet which is less than the minimum 5 feet prescribed for embankment-type structures. At Days Creek, maximum flood control pool and maximum pool are the same elevation, 1,026 feet. This situation exists because the spillway is gated and there is no provision for surcharge storage. For the purpose of establishing freeboard, maximum conservation pool, elevation 1,022 feet, was substituted for the maximum flood control pool level. The probability of the pool being at the maximum flood control pool level simultaneously with an earthquake is very remote, whereas, maximum conservation pool would occur annually and could prevail over a period of a month. However, the most critical of the two criteria would be the minimum 5 feet for wave action above maximum flood control pool. This places the top of dam at elevation 1,031 feet.

TABLE 1

STREAM GRADIENTS
UMPQUA RIVER BASIN

Stream	Reach in R. M.		Avg. gradient in feet per mile
	From	To	
Umpqua River	0	27	Tidewater
" "	27	56	3.3
" "	56	110	4.8
Smith River	0	27	1.9
" "	27	32	20.0
" "	32	82	11.0
" "	82	89	28.5
Elk Creek	0	23	7.2
Calapooya Cr.	0	14	6.4
" "	14	22	10.0
" "	22	36	45.8
North Umpqua R.	0	33	10.3
" "	33	55	22.8
" "	55	66	31.8
" "	66	70	62.5
" "	70	74	150.0
Little River	0	8	23.7
" "	8	16	57.5
" "	16	22	134.0
Rock Creek	0	2	100.0
" "	2	8	33.4
" "	8	12	62.0
" "	12	16	200.0
South Umpqua R.	0	36	5.3
" "	36	56	8.5
" "	56	76	14.3
" "	76	84	25.0
" "	84	97	38.7
" "	97	104	52.7
" "	104	109	163.0
Lookingglass Cr.	0	8	10.0
" "	8	13	28.0
" "	13	15	220.0
Cow Creek	0	20	11.4
" "	20	27	28.5
" "	27	35	37.5
" "	35	54	14.7
" "	54	72	37.8
" "	72	76	117.0
Days Creek	0	8	50.0
Elk Creek	0	8	60.0
" "	8	12	130.0

TABLE 2

CLIMATOLOGICAL SUMMARY
Reedsport, Oregon
Elevation 55 feet

Item and Description	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation, Inches														
Average	1937-65	10.64	9.99	9.46	5.02	3.15	1.74	0.44	0.46	2.18	5.32	11.43	12.07	71.90
Percent of average annual		15	14	13	7	4	2	1	1	3	7	16	17	100
Maximum Monthly	1937-69	22.07	20.34	19.83	11.63	10.27	8.32	2.53	6.06	5.66	16.72	21.15	23.25	99.67
Year of Maximum		1956	1961	1938	1955	1960	1937	1947	1968	1959	1947	1945	1955	1953
Minimum Monthly	1937-69	3.33	3.53	2.46	0.97	0.29	T	0.02	0.00	0.10	1.41	1.56	4.52	56.22
Year of Minimum		1962	1941	1965	1956	1947	1951[1]	1967[1]	1955[1]	1965	1952	1939	1943	1944
Greatest in 24 hours	1937-69	4.11	4.09	4.03	1.68	1.84	3.30	1.44	1.18	3.11	4.02	5.02	5.15	5.15
Year of greatest 24 hours		1953	1961	1938	1961	1963	1937	1947	1968	1937	1955	1960	1954	Dec.1954
Avg. No. days with .01 or more														
Average snowfall, unmelted	1950-65	0.7	0.4	0.2								0.1	0.5	1.9
Maximum snowfall, unmelted	1937-69	32.0	2.5	1.7		T						0.8	4.0	6.9
Year of maximum snowfall	- -	1969	1952	1954		1951						1955	1964	1951-52
Temperature, °F														
Average	1940-60	44.0	45.8	46.8	50.0	53.7	57.2	60.0	60.6	59.7	55.3	49.1	45.7	52.3
Average daily maximum	1937-60	50.7	53.1	54.7	58.4	62.5	66.1	69.3	70.0	69.8	64.2	56.5	52.0	60.6
Average daily minimum	1938-60	37.3	38.6	38.8	41.7	45.0	48.4	50.9	51.2	49.6	46.4	41.6	39.3	44.1
Absolute maximum	1938-69	67	75	77	90	96	92	94	97	96	88	73	69	97[1]
Year of absolute maximum	- -	1960	1968	1939	1947	1939	1966[1]	1952	1944	1955[1]	1958	1969	1938	Aug.1964
Absolute minimum	1938-69	13	17	25	26	31	31	39	41	32	28	23	19	13
Year of absolute minimum	- -	1962	1962	1960	1968	1950	1949	1962	1958[1]	1965	1949	1961[1]	1964	Jan.1962

[1] Extreme has been experienced in one or more subsequent years.

STATION HISTORY

Station moved several times to various locations from near Post Office to a maximum distance of 2 miles west of Post Office at Reedsport.

TABLE 3

CLIMATOLOGICAL SUMMARY
Roseburg, Oregon
Elevation 505 feet

Item and Description	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation, Inches														
Normal	1931-60	5.51	4.21	3.42	1.93	1.85	1.50	0.21	0.31	1.00	3.02	4.46	5.69	33.11
Percent of normal annual		17	13	10	6	6	4	1	1	3	9	13	17	100
Maximum	1877-69	12.23	12.19	8.61	5.28	4.63	5.94	2.79	2.46	3.81	12.53	10.68	15.74	46.90
Year of Maximum		1890	1904	1894	1963	1879	1888	1947	1968	1901	1950	1942	1955	1891
Minimum	1877-69	1.35	0.17	0.06	0.15	0.11	0.00	0.00	0.00	T	0.00	0.19	1.46	21.10
Year of Minimum		1949	1920	1926	1939	1935	1951	1967[1]	1969[1]	1965	1895	1890	1903	1905
Greatest in 24 hours	1877-69	3.45	4.25	1.90	2.27	1.51	1.68	1.52	1.64	1.70	3.94	4.80	4.03	4.80
Year of greatest 24 hours		1887	1961	1879	1907	1963	1937	1916	1899	1941	1950	1961	1955	Nov.1961
Avg. No. days with .01 or more	1931-65	18	16	16	13	11	7	2	2	5	11	14	17	131
Normal snowfall, unmelted	1931-60	3.4	0.4	0.8	0.1	0	0	0	0	0	M	0.5	0.6	5.8
Maximum snowfall, unmelted	1885-69	44.2	27.2	11.3	2.9	1.5	T	0	0	0	0.6	10.8	10.0	28.4
Year of maximum snowfall		1969	1887	1896	1911	1922	1950				1934	1961	1898	1949-50
Greatest 24 hour snowfall, unmelted	1893-69	13.5	6.6	6.7	2.4	1.5	T	0	0	0	0.6	9.4	7.5	9.4
Year of greatest 24 hour snowfall		1969	1949	1956	1953	1922	1950				1934	1961	1898	Nov.1961
Temperature, °F														
Normal	1931-60	40.3	43.3	46.6	51.5	56.5	61.5	67.9	67.6	62.8	54.4	46.1	42.0	53.4
Normal daily maximum	1931-60	47.2	51.9	56.7	63.5	69.4	75.1	84.0	83.8	78.0	65.9	53.8	48.3	64.8
Normal daily minimum	1931-60	33.4	34.6	36.4	39.4	43.5	47.9	51.8	51.4	47.5	42.9	38.4	35.6	41.9
Absolute maximum	1877-69	71	79	85	96	102	106	109	106	104	96	76	70	109
Year of absolute maximum	----	1888	1932	1923	1926	1887	1925	1946	1935	1944[1]	1934	1903	1940	July,1946
Absolute minimum	1893-69	-6	3	18	25	26	34	33	39	29	22	14	5	-6
Year of absolute minimum	----	1888	1884	1896	1936[1]	1954	1954	1948	1908[1]	1926	1881	1896	1932	Jan.1888
Miscellaneous Data														
Average number of days clear	1951-64	1	1	2	4	6	8	19	16	12	4	1	1	75
Average number of days partly cloudy	1951-64	5	6	7	8	8	10	7	8	9	11	6	4	89
Average number of days cloudy	1951-64	25	21	22	18	17	12	5	7	9	16	23	26	201
Average hourly wind speed, MPH	1951-64	3.9	4.1	4.8	4.9	4.9	5.3	5.9	5.4	4.6	3.5	3.6	3.6	4.5
Prevailing wind direction	1951-64	S	N	N	N	N	N	N	N	N	N	S	S	N
Wind speed of fastest mile, MPH	1912-64	38	38	40	29	34	27	25	30	32	50	38	40	50
Wind Direction of fastest mile	----	SW	SW	S	SW	SW	NW	NW	W	W	S	SW	SW	S
Year of fastest mile	----	1944	1961	1963	1960[1]	1940	1946	1959[1]	1951	1946	1962	1951	1951	Oct.1962
Average percent of possible sunshine	12 years	26	30	39	49	52	61	79	74	68	42	25	20	50
Average sky cover	----	8.7	8.4	8.0	7.2	6.8	5.7	3.0	3.8	4.8	7.1	8.5	8.9	6.7
Normal degree days below 65°F, base	1931-60	766	608	570	405	267	123	22	16	105	329	567	713	4491

[1] Extreme has been experienced in one or more subsequent years.

STATION HISTORY

Location	Period	Height of instruments above ground, feet
Da Motta Bldg., Jackson & Washington St.	July 15, 1877, to August 22, 1884	21
Marks Bldg., 228-1/2 Jackson St.	August 22, 1884, to October 5, 1905	56
Bell Cottage, 112 S. Jackson St.	October 5, 1905, to July 1, 1927	28
Pacific Bldg., Rose & Cass St.	July 1, 1927, to November 10, 1933	76
Federal Bldg., Cass & Stephens St.	November 10, 1933, to December 12, 1952	46
Roseburg Municipal Airport	December 12, 1952, to Date	5

TABLE 4

CLIMATOLOGICAL SUMMARY FOR SELECTED STATIONS
(UMPQUA RIVER BASIN)

Item	Drain	Reedsport	Riddle (2NE)	Roseburg	Steamboat	Tiller (15 ENE)
Elevation, feet above mean sea level	372	55	700	505	1200	2500
Period of record	1903-69[2]	1937-69	1899-69[3]	1877-69	1955-69	1955-69
Average annual precipitation, inches	48.63	71.90	31.71	33.11	51.59	34.19
Maximum annual precipitation, inches	63.63	99.67	43.34	46.90	72.48	47.74
Year of maximum annual precipitation	1950	1953	1950	1891	1964	1964
Minimum annual precipitation, inches	29.84	56.22	21.15	21.10	39.16	24.65
Year of minimum annual precipitation	1930	1944	1945	1905	1959	1959
Maximum monthly precipitation, inches	21.93	23.25	15.55	15.74	24.19	17.37
Month and year of maximum monthly precipitation	Dec.1955	Dec.1955	Dec.1964	Dec.1955	Dec.1964	Dec.1964
Minimum monthly precipitation, inches	0.00	0.00	0.00	0.00	0.00	0.00
Month and year of minimum monthly precipitation	July 1905[1]	Aug.1938[1]	July 1899[1]	Aug.1882[1]	Aug.1955[1]	Aug.1956[1]
Maximum 24-hour recorded precipitation, inches	4.54	5.15	4.00	4.80	3.81	3.25
Month and year of maximum 24-hour precipitation	Jan.1907	Dec.1954	Dec.1939	Nov.1961	Nov.1961	Nov.1961
Greatest seasonal snowfall, inches	22.9	32.5	43.9	46.3	No Data	No Data
Season of greatest snowfall	1949-50	1968-69	1949-50	1966-69	No Data	No Data
Average temperature, °F.	53.7	52.3	54.1	53.4	No Data	No Data
Average maximum temperature, °F.	65.5	60.6	65.4	64.8	No Data	No Data
Average minimum temperature, °F.	41.8	44.1	41.5	41.9	No Data	No Data
Absolute maximum temperature, °F.	108	97	110	109	No Data	No Data
Month and year of absolute maximum temperature	July 1946	Aug.1944[1]	Aug.1935	July 1946	No Data	No Data
Absolute minimum temperature, °F.	-1	13	-3	-6	No Data	No Data
Month and year of absolute minimum temperature	Dec.1924	Jan.1962	Jan.1962	Jan.1888	No Data	No Data
January average temperature, °F.	41.0	44.0	41.1	40.3	No Data	No Data
July average temperature, °F.	67.0	60.0	68.5	67.9	No Data	No Data
Difference Jan.-July average temperature °F.	26.0	16.0	27.4	27.6	No Data	No Data

[1] These measurements have been recorded at later dates also.

[2] Missing record 1936-1941.

[3] Missing record 1903-1912

TABLE 5

SNOW SURVEY SUMMARY
(Selected Snow Courses)

Umpqua River Basin

	Champion Mine	Diamond Lake	Goolaway Mountain	North Umpqua	Silver Burn	Trap Creek	Windigo Pass	Whaleback
Elevation, feet m.s.l.	4,500	5,315	3,780	4,215	3,720	3,800	5,800	5,140
February 1								
Years of record, years[1]	30	33	13	23	32	22	18	29
Average snow depth, inches	48.0	47.3	18.2	32.2	28.8	28.1	84.5	68.7
Average water equivalent, inches	16.8	14.7	4.7	9.9	9.5	8.9	29.0	22.3
Highest water equivalent, inches	42.7	31.5	24.2	22.2	19.4	19.8	45.3	45.3
Year of highest	1952	1943	1937	1951	1969	1951	1965	1946
Lowest water equivalent, inches	0.0	3.0	0.0	00.0	0.0	0.0	6.4	0.0
Year of lowest	1961	1959	1942	1959	1940	1959	1959	1963
March 1								
Years of record, years[1]	31	33	10	18	33	16	18	22
Average snow depth, inches	59.3	54.9	11.9	35.9	32.0	28.9	94.7	80.3
Average water equivalent, inches	22.3	19.4	3.3	12.5	11.8	10.0	35.8	29.8
Highest water equivalent, inches	50.3	38.4	10.9	22.5	24.1	21.0	66.6	54.1
Year of highest	1952	1952	1939	1956	1969	1956	1956	1952
Lowest water equivalent, inches	0.0	1.2	0.0	0.0	0.0	0.0	15.4	1.2
Year of lowest	1963	1963	1957	1963	1963	1963	1963	1963
April 1								
Years of record, years[1]	31	33	13	33	33	31	22	32
Average snow depth, inches	69.2	57.8	15.1	33.5	28.0	28.7	112.6	86.8
Average water equivalent, inches	29.1	22.7	6.3	13.0	11.6	10.8	45.4	34.7
Highest water equivalent, inches	59.2	40.7	24.5	27.7	26.6	24.0	68.6	58.1
Year of highest	1952	1952	1956	1952	1952	1952	1956	1952
Lowest water equivalent, inches	0.0	1.6	0.0	0.0	0.0	0.0	17.5	5.5
Year of lowest	1941	1963	1947	1941	1968	1968	1963	1963

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[1] Through 1969.

JDH 3/12/70

TABLE 6

EVAPORATION AND RELATED DATA
Medford, Oregon

Month	Yrs of[1] Record	Mean Temp. (^{o}F)	Relative Humidity 4 PM (%)	Vapor Pressure (mb)	Wind 6" above pan (mph)	Wind 19-foot level (mph)	Sky Cover (tenths)	Solar Radiation (langleys)	Pan Evap-oration (inches)
Jan	14	38	74	6.3	0.9	4.6	8.2	122	NA
Feb	15	42	59	6.7	0.8	4.3	7.6	234	1.12
Mar	18	45	49	6.8	1.0	5.3	7.2	344	2.40
Apr	23	51	42	7.8	0.9	6.0	6.6	505	3.86
May	23	57	39	8.9	0.6	5.8	5.8	590	5.63
Jun	23	63	36	10.4	0.6	5.9	4.9	666	6.76
Jul	23	70	27	11.8	0.6	5.6	2.1	705	8.82
Aug	23	68	26	11.2	0.5	5.1	2.2	613	7.43
Sep	24	63	31	10.2	0.3	4.1	3.4	454	4.72
Oct	20	53	47	9.2	0.3	3.5	5.5	268	1.97
Nov	18	43	65	7.5	0.5	3.0	7.3	181	0.67
Dec	12	39	79	7.0	0.7	3.3	8.7	92	NA

[1] Years of record apply to evaporation and mean temperature. Other items have varying periods of record sufficient to indicate average conditions.

TABLE 7

RUNOFF FOR REPRESENTATIVE STREAM GAGING STATIONS

Gaging Station	Period of Record	D. A. sq.mi.	Annual Runoff		
			Maximum Ac.- Ft.	Minimum Ac.- Ft.	Average Ac.- Ft.
South Umpqua River at Tiller, Ore.	Oct. 1939-Sept.1968	449	1,229,000	362,100	741,250
Cow Creek near Azalea, Ore.	April 1929-Dec.1931 April 1932-Sept.1968	78	169,800	20,700	76,900
West Fork Cow Creek near Glendale, Ore.	Oct. 1955-Sept. 1968	86.9	327,000	141,300	199,540
South Umpqua River near Brockway	Dec. 1905-June 1912 Oct. 1923-Sept. 1926 Jan. 1942-Sept. 1968	1670	3,893,000	994,100	2,183,620
North Umpqua River above Copeland Cr.	Oct. 1949-Sept.1968	475	1,510,000	744,000	1,100,940
Calapooya Creek near Oakland	Oct. 1955-Sept. 1968	210	657,200	210,500	356,880
Umpqua River near Elkton, Ore.	Oct. 1905-Sept. 1968	3683	9,689,000	2,280,000	5,377,700

Days Creek dam site on South Umpqua; drainage area = 640 sq. mi.

TABLE 8

Mean Monthly Discharge Data

Umpqua River Basin

Stream	Station	Drainage Area sq.mi.	Period of Record	Mean monthly discharge, cfs						
				Max.	Min.	Ave.	Percent of time equalled or exceeded			
							10%	20%	40%	60%
N. Umpqua R.	Abv. Copeland Cr.	475	1950-68	5,163	653	1520	2,600	2,200	1,700	1,300
S. Umpqua R.	At Days Creek D.S.	640	None	9,874^e	26^e	1291^e	3,050^e	2,200^e	1,300^e	450^e
S. Umpqua R.	At Tiller	449	1939-68	7,480	30	1023	2,550	1,800	1,000	400
Cow Creek	Near Azalea	78	1926-68	752	5	106	300	210	105	45
S. Umpqua R.	Near Brockway	1,670	1943-68	19,540	69	3014	7,820	5,500	2,600	800
Umpqua R.	Near Elkton	3,683	1906-68	51,220	703	7423	20,400	15,800	7,700	3,700

"e" Estimated from flow records for South Umpqua River at Tiller, an upstream station.

TABLE 9

MAJOR FLOODS

Umpqua River Basin

Stream	D.A. sq.mi.	Unit	Nov. 1909	Feb. 1927	Dec. 1942	Dec. 1945	Jan. 1948	Oct. 1950	Jan. 1953	Nov. 1953	Dec. 1955	Nov. 1961	Dec. 1964
NORTH FORK													
Clearwater R. at mouth	41.6	c.f.s.			451	366	445	487	400	435	598		1020
		cfs/sq.mi.			10.8	8.8	10.7	11.7	9.6	10.5	14.4		24.5
Fish Cr. at Big Camas Ranger Station	68.8	c.f.s.						3750	5160	4700	9880[1]	1880	12,100
		cfs/sq.mi.						54.5	75.0	68.3	143.7	27.3	175.9
North Umpqua above Copeland	475	c.f.s.						12,200	14,100	13,500	25,000	6,930	40,700
		cfs/sq.mi.						25.7	29.7	28.4	52.6	14.6	85.7
North Umpqua above Rock Creek	886	c.f.s.		53,000	52,100								
		cfs/sq.mi.		59.8	58.8								
North Umpqua at Winchester	1344	c.f.s.	100,000	78,200						89,000	92,500	68,900	119,000
		cfs/sq.mi.	74.4	58.2						66.1	68.7	51.3	88.5
SOUTH FORK													
Cow Creek near Azalea	78	c.f.s.				4400	4550	5920	4260	3360	5180	2840	8430
		cfs/sq.mi.				56.4	58.3	63.2	54.6	43.1	66.4	36.4	108.1
South Umpqua River at Tiller	449	c.f.s.			29,900	28,200	21,300	37,400	31,600	27,900	33,300	24,500	60,200
		cfs/sq.mi.			66.6	62.8	47.5	83.4	70.4	62.2	74.2	54.6	134.1
South Umpqua River near Brockway	1670	c.f.s.	70,700	101,000	70,000	72,200	78,400	102,000	89,200	81,800	91,300	63,300	105,000
		cfs/sq.mi.	42.4	60.5	41.9	43.2	46.9	61.1	53.4	49.0	54.6	37.9	62.9
MAIN STEM:													
Umpqua River near Elkton	3683	c.f.s.	144,000	185,000	186,000	179,000	154,000	208,000	199,000	195,000	218,000	176,000	265,000
		cfs/sq.mi.	39.1	50.3	50.5	48.6	41.8	56.5	54.1	53.0	59.2	47.8	72.0

Historical Floods:

Feb. 1890 Flood at Brockway, estimated at 130,000 c.f.s.

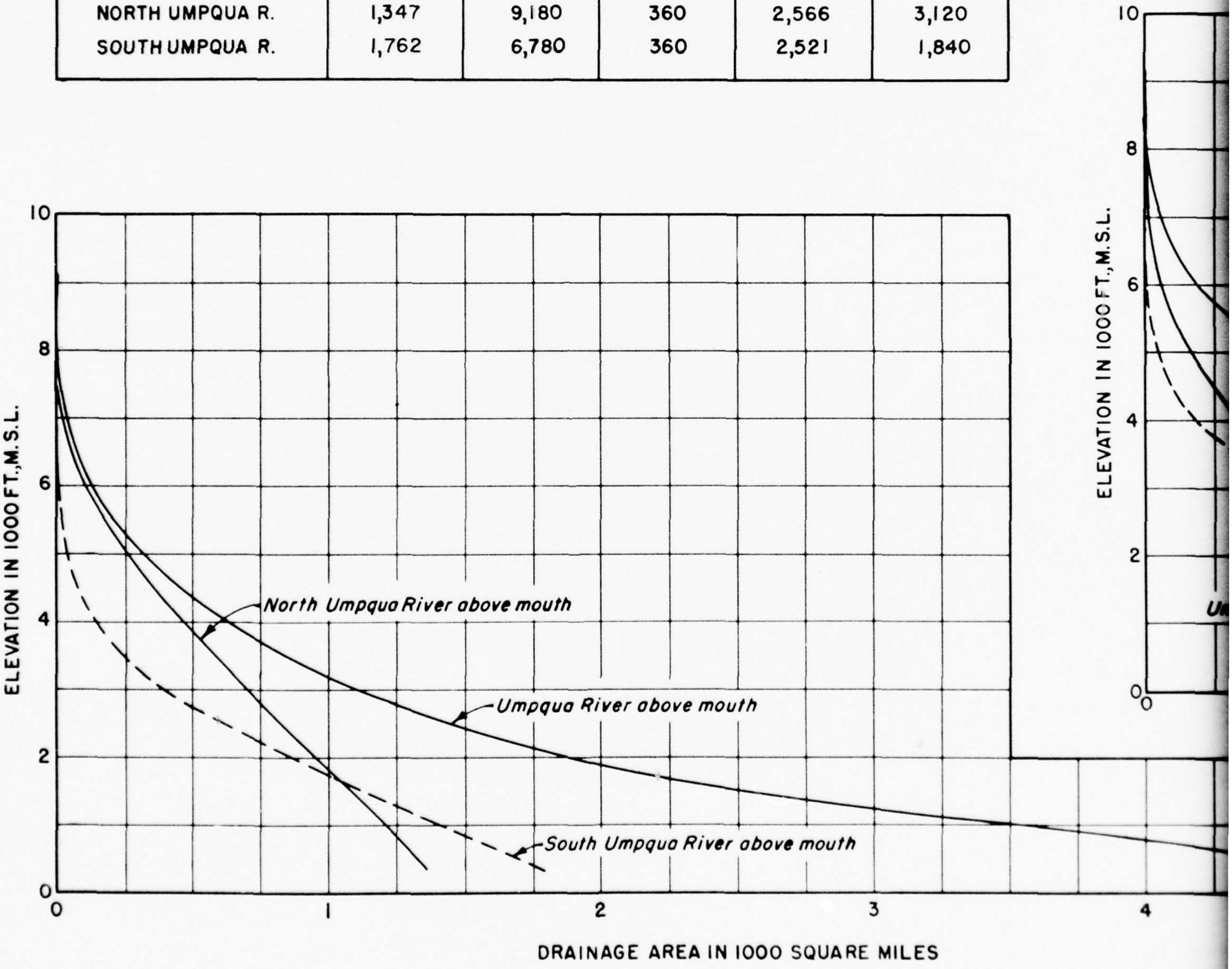
Dec. 1861 Flood at Elkton, estimated at 218,000 c.f.s.

[1] Affected by failure of power canal diversion dam 2 miles upstream.

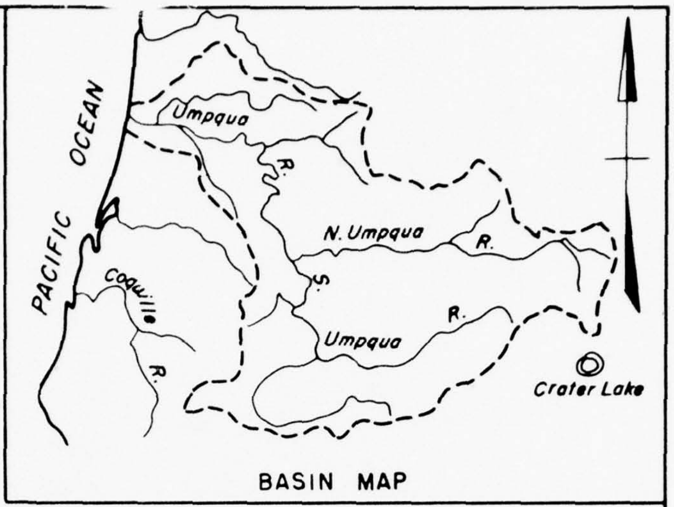
Source: U. S. G. S. Water Supply Paper No. 1318 and those for years 1951-1968, incl.

PERTINENT DATA

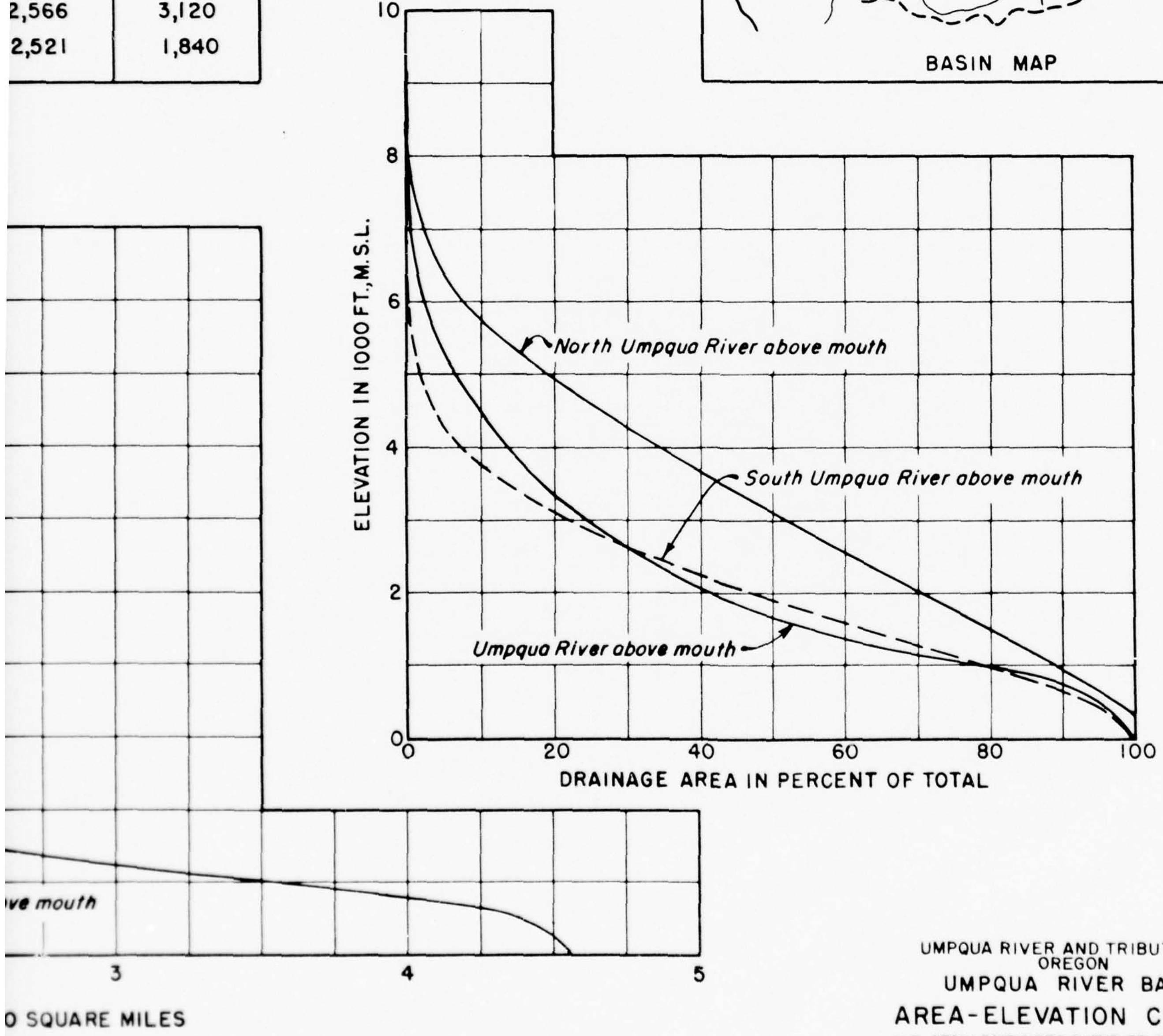
STREAM ABOVE MOUTH	TOTAL DRAINAGE AREA SQ. MI.	ELEVATION, FEET ABOVE M.S.L.			
		MAXIMUM	MINIMUM	WEIGHTED AVERAGE	50 %
UMPQUA RIVER	4,560	9,180	0	2,170	1,650
NORTH UMPQUA R.	1,347	9,180	360	2,566	3,120
SOUTH UMPQUA R.	1,762	6,780	360	2,521	1,840



BOVE M.S.L.	
EIGHTED /VERAGE	50 %
2,170	1,650
2,566	3,120
2,521	1,840



BASIN MAP

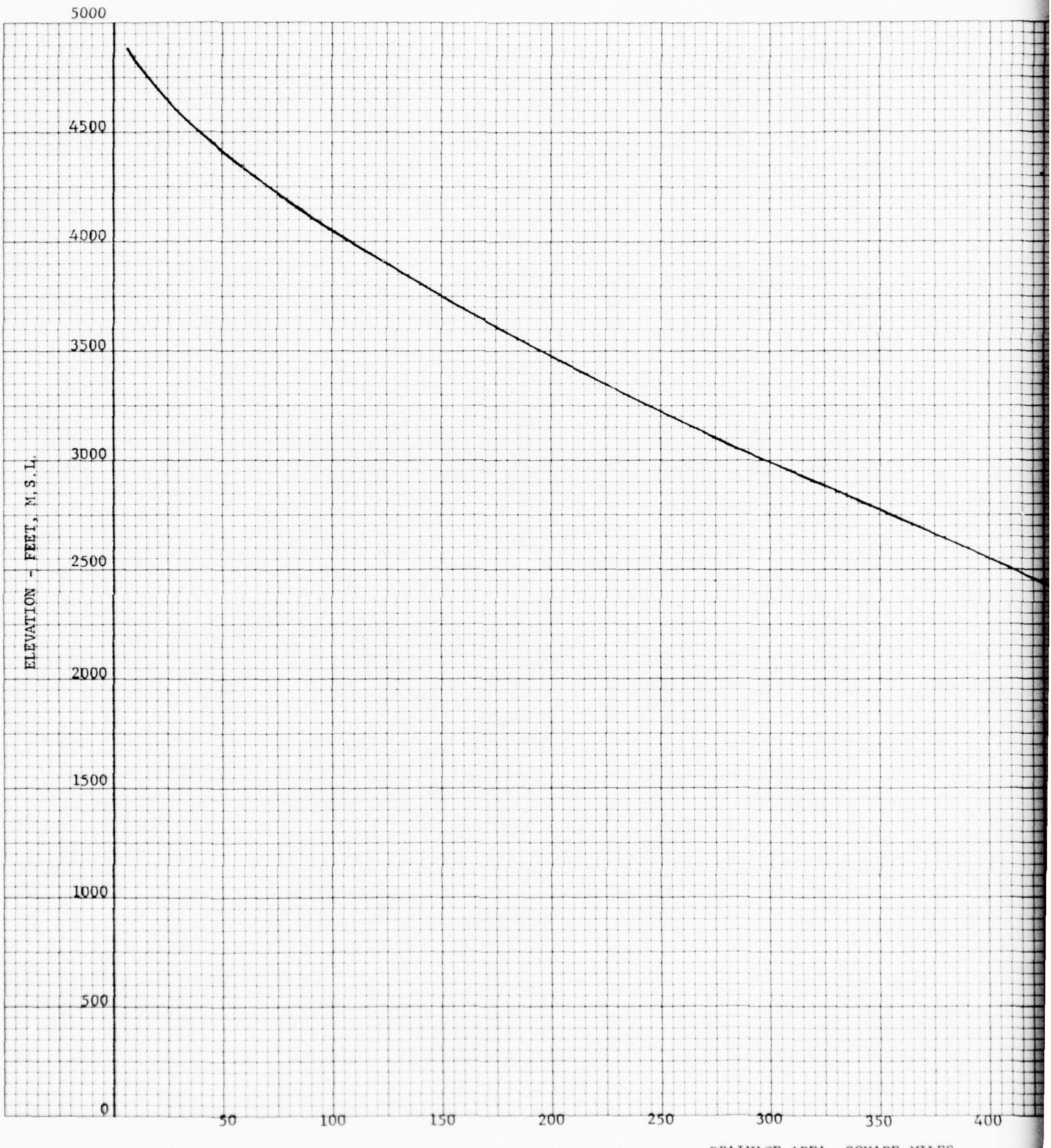


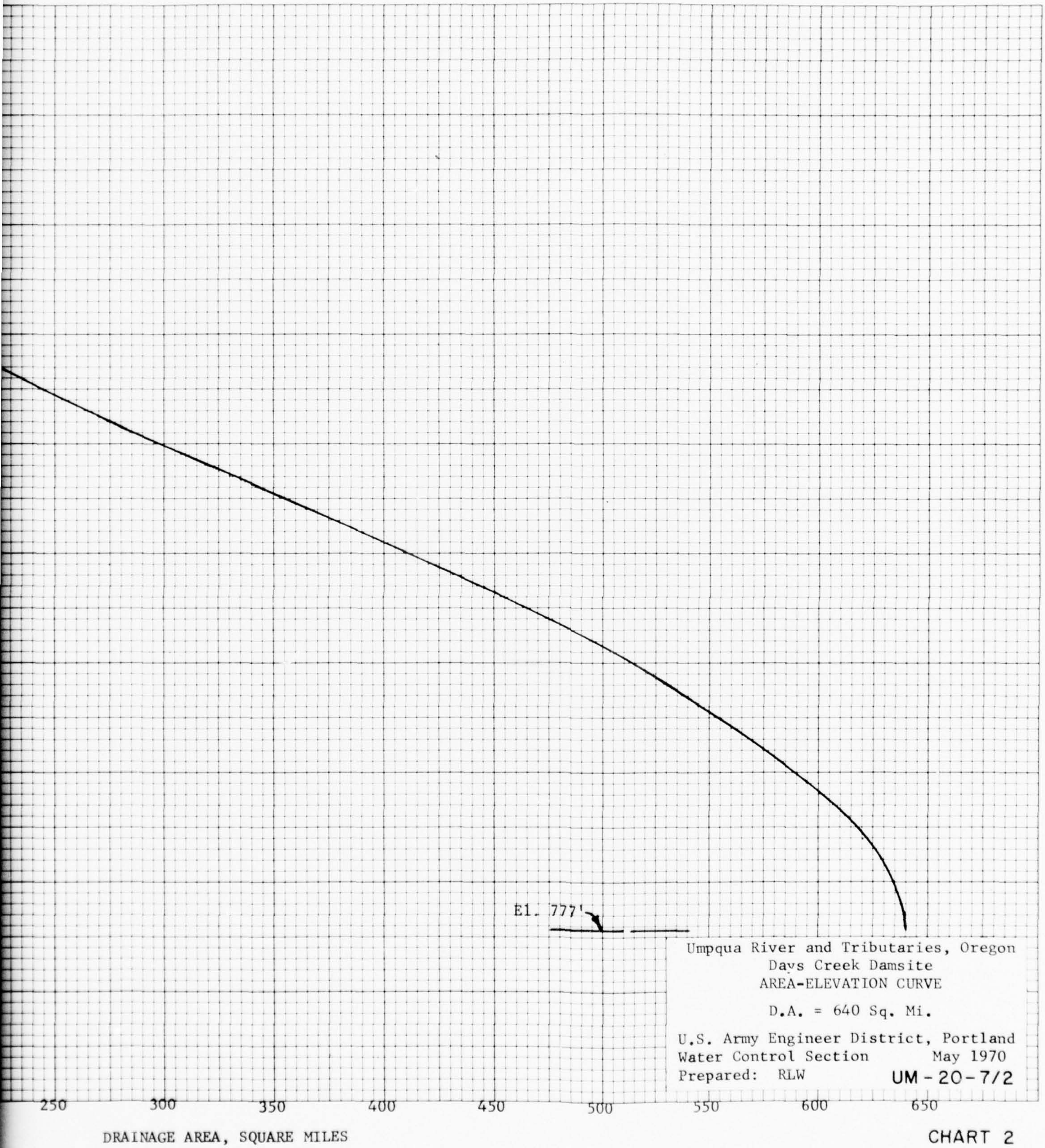
UMPQUA RIVER AND TRIBUTARIES
OREGON
UMPQUA RIVER BASIN

AREA-ELEVATION CURVES

U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MAY 1966

UM-20-7/1
CHART I


5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
ELEVATION - FEET, M.S.L.
50
100
150
200
250
300
350
400
DRAINAGE AREA, SQUARE MILES

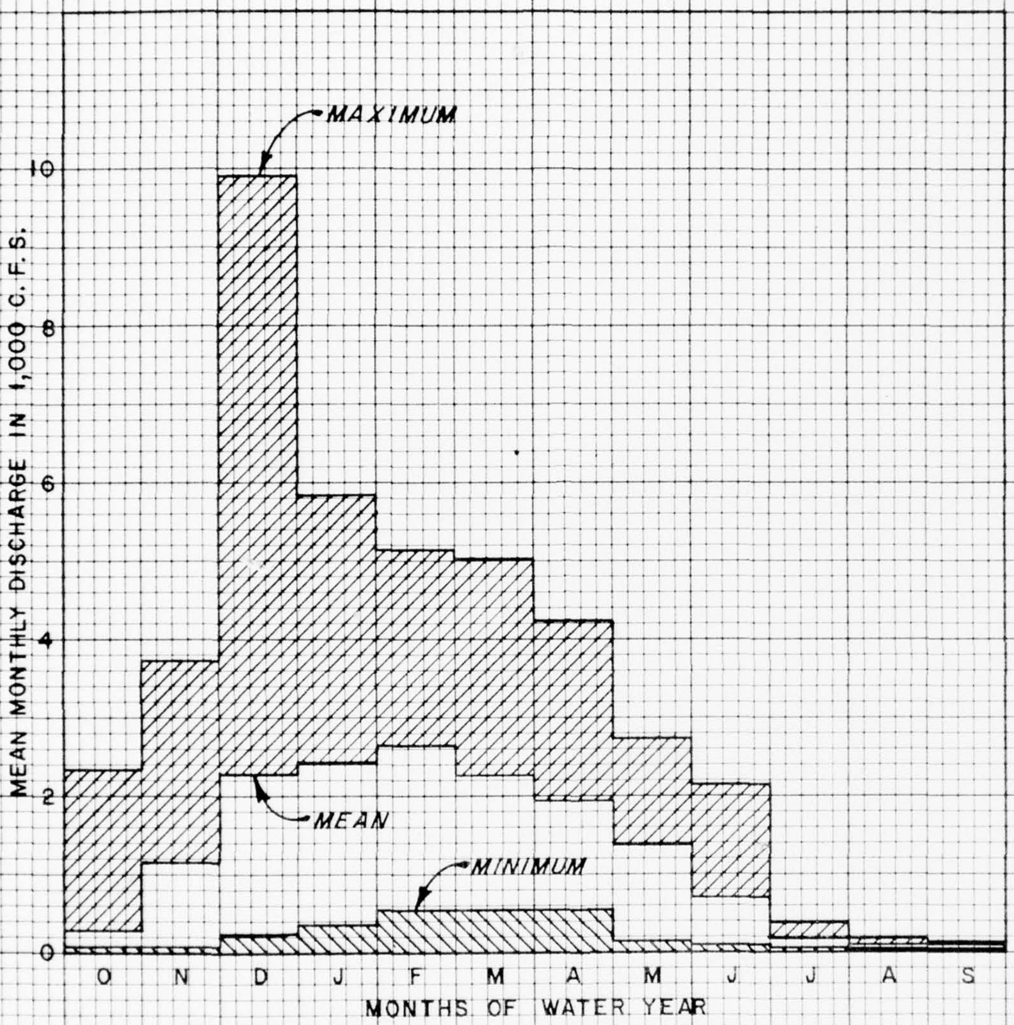


Umpqua River and Tributaries, Oregon
Days Creek Damsite
AREA-ELEVATION CURVE

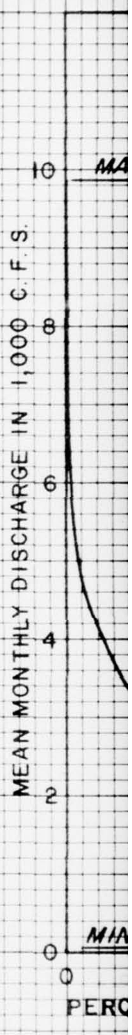
D.A. = 640 Sq. Mi.

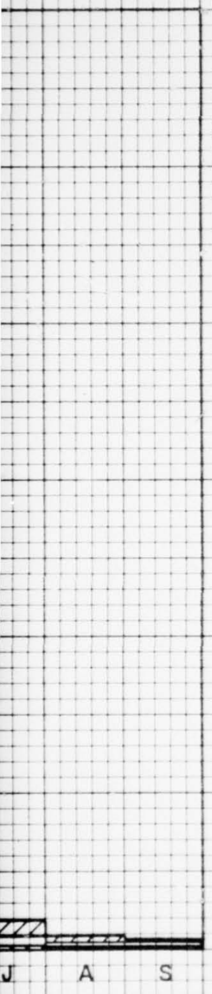
U.S. Army Engineer District, Portland
Water Control Section May 1970
Prepared: RLW UM-20-7/2

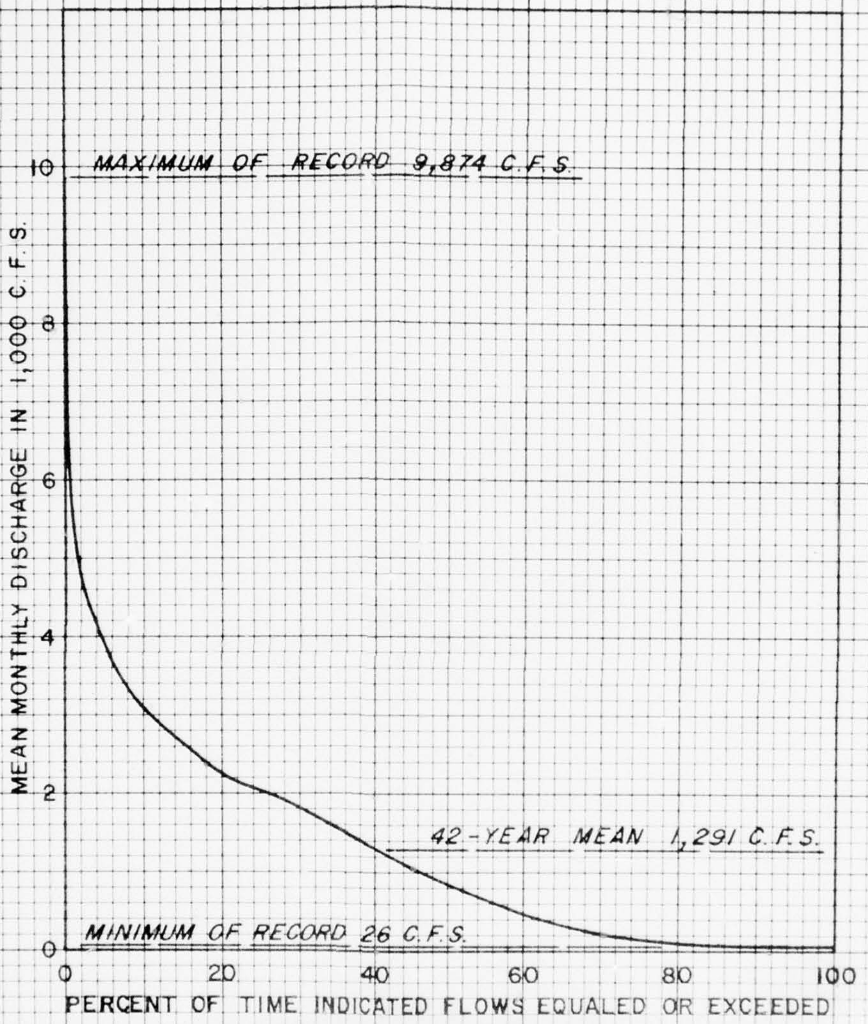
CHART 2



MONTHLY RUNOFF SUMMARY







MEAN MONTHLY FLOW DURATION CURVE

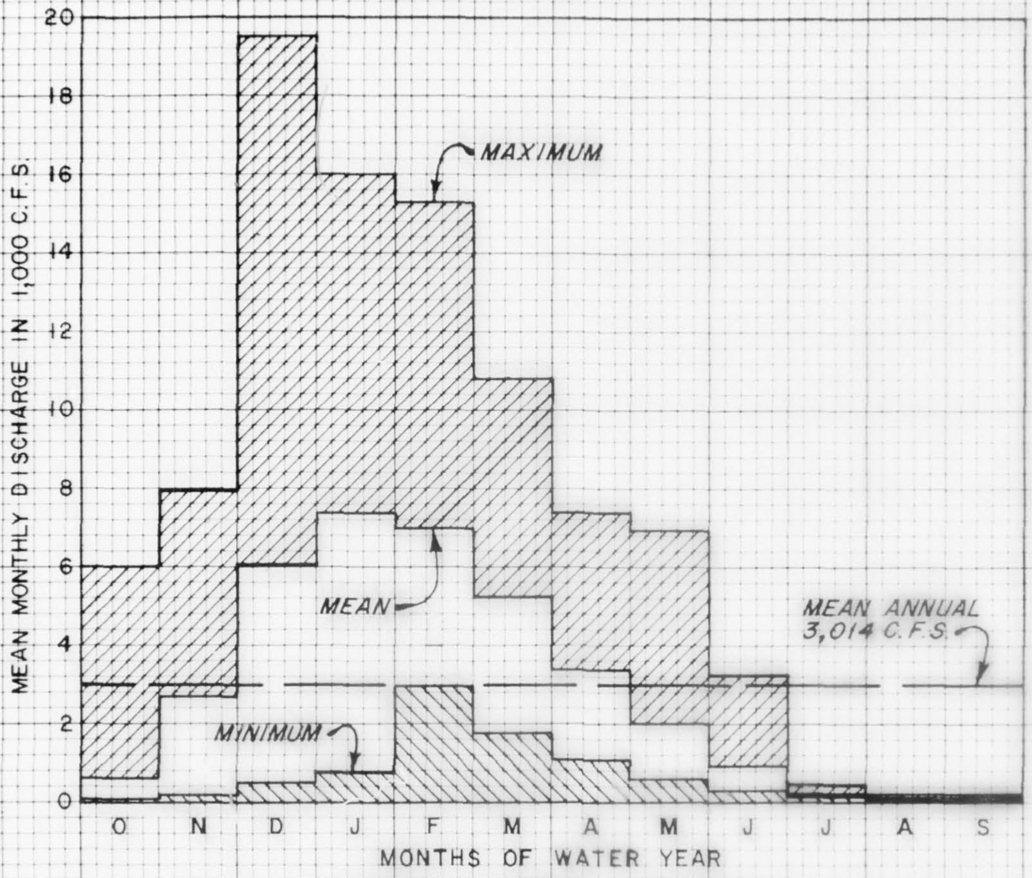
Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Damsite

RUNOFF SUMMARY

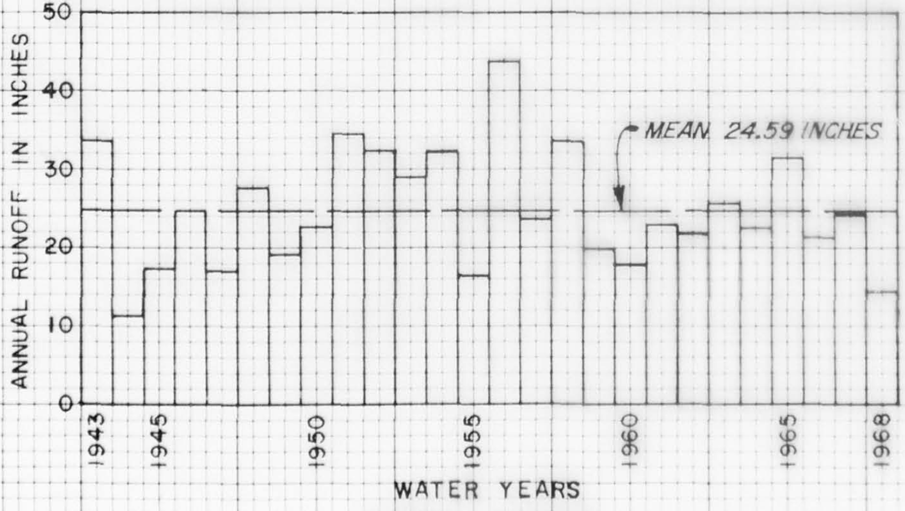
D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section Feb. 1970
Prepared: RLW UM-20-8/1

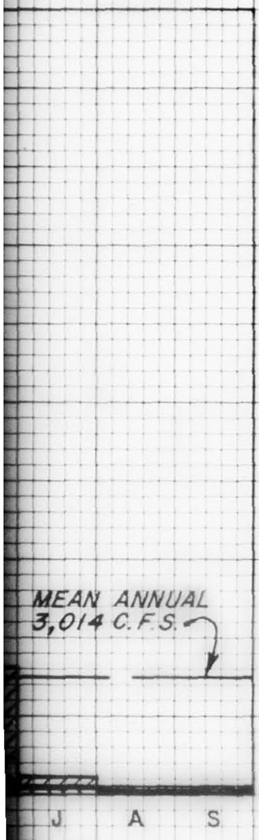
CHART 3

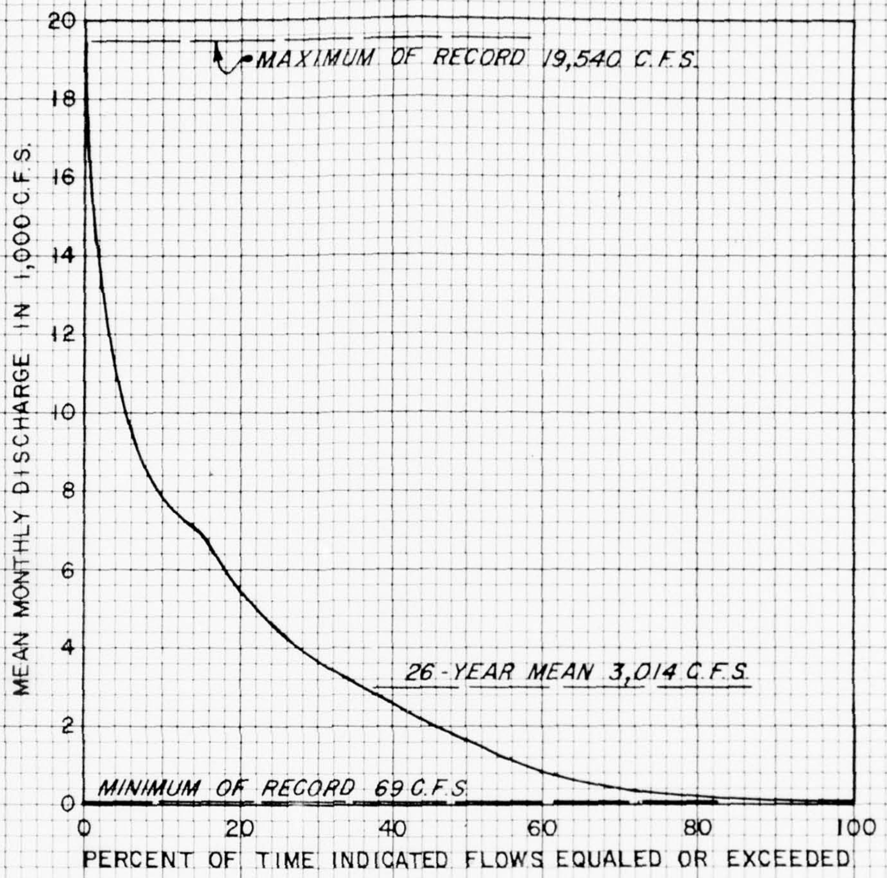


MONTHLY RUNOFF SUMMARY

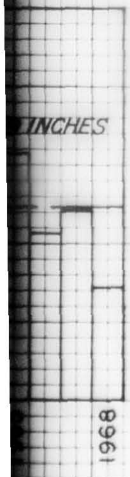


ANNUAL RUNOFF





MEAN MONTHLY FLOW DURATION CURVE



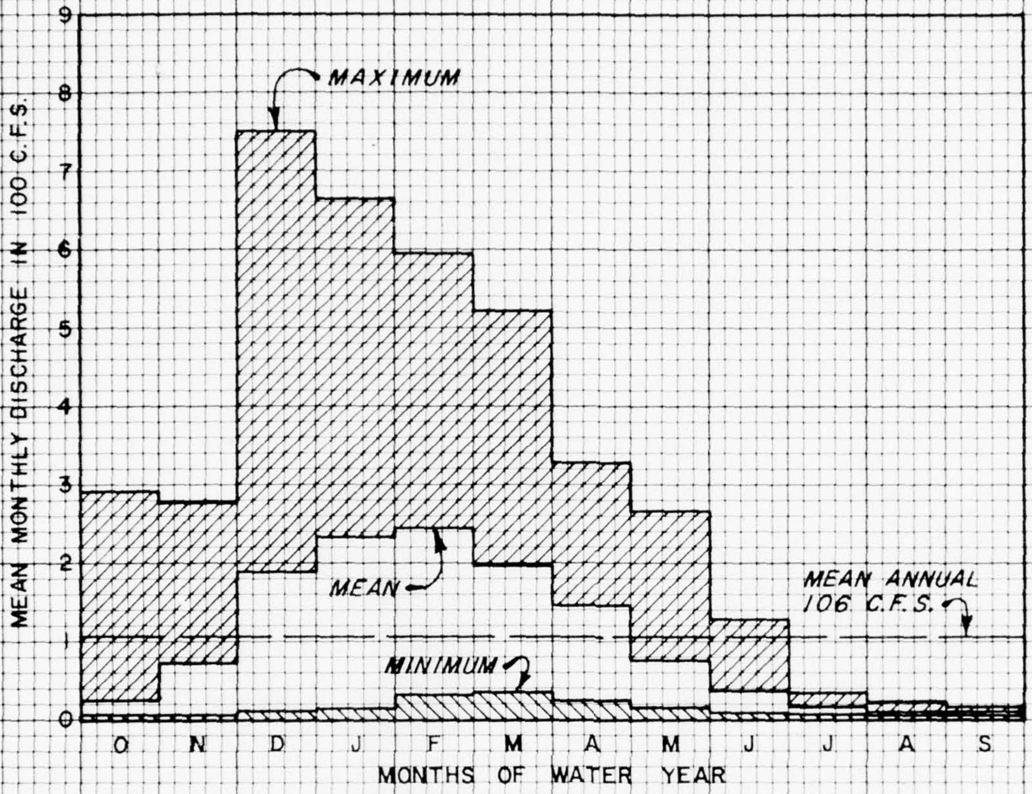
Umpqua River and Tributaries, Oregon
South Umpqua River
Near Brockway

RUNOFF SUMMARY

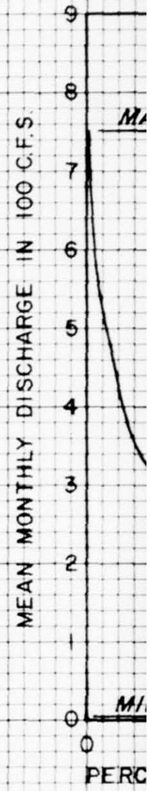
D.A. = 1,670 Sq. Mi.

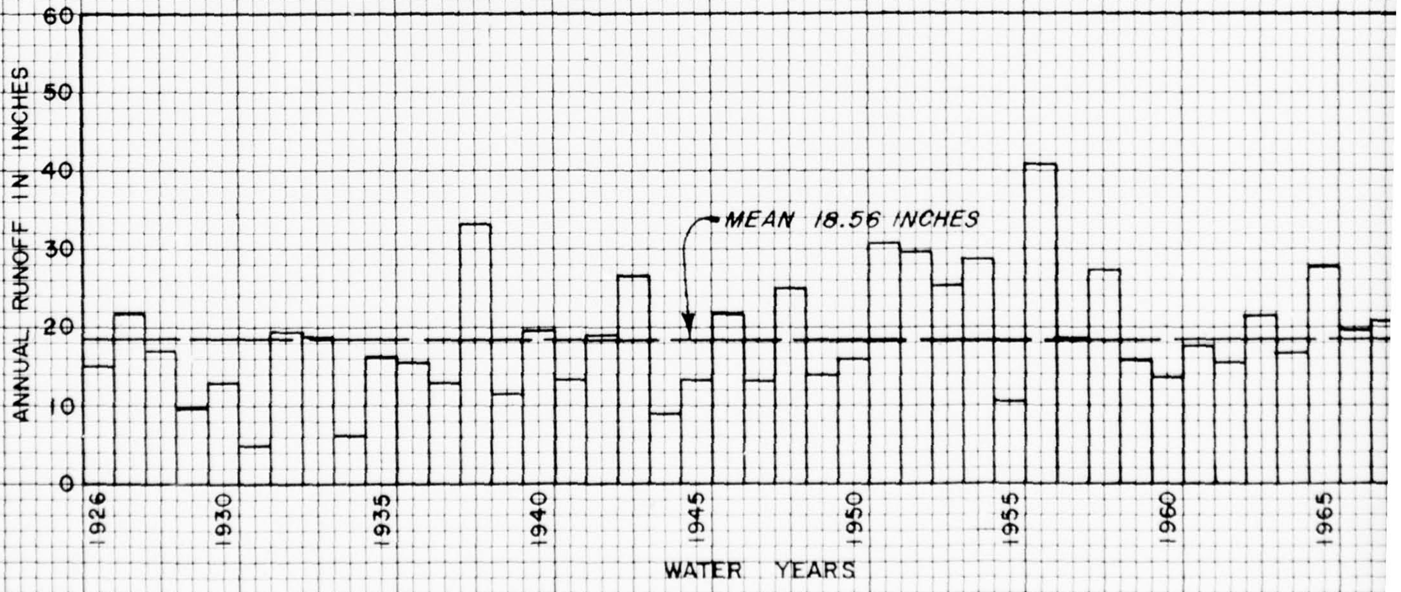
U.S. Army Engineer District, Portland
Water Control Section March 1970
Prepared: DAR UM-20-8/2

CHART 4

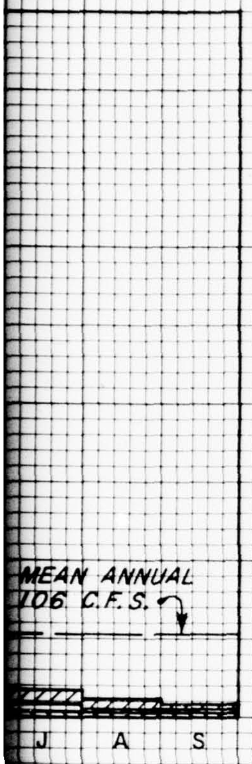


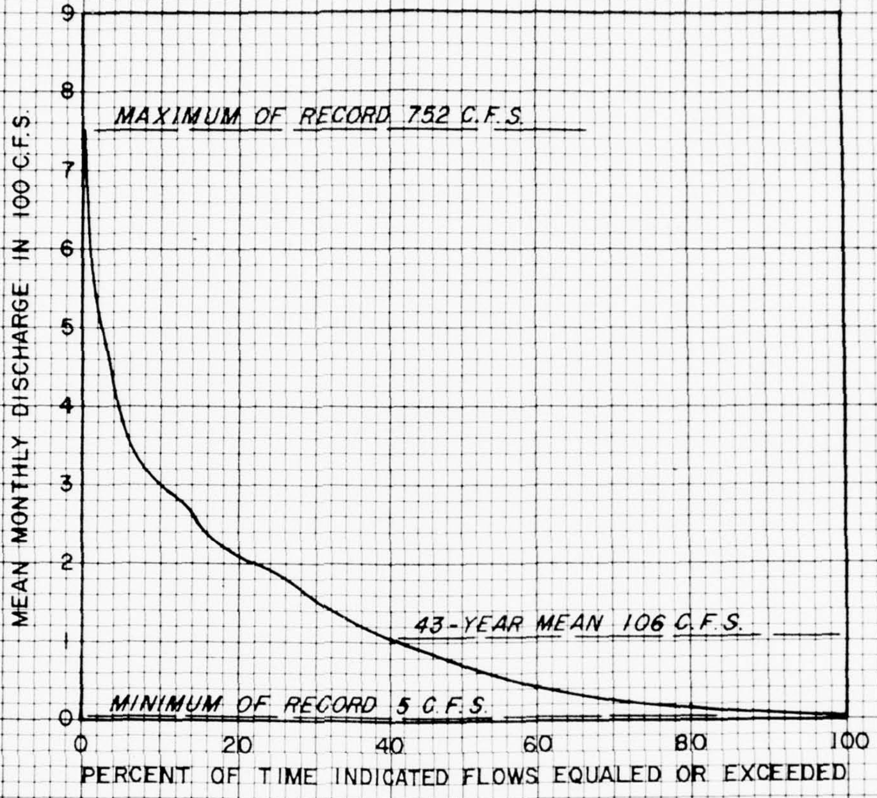
MONTHLY RUNOFF SUMMARY



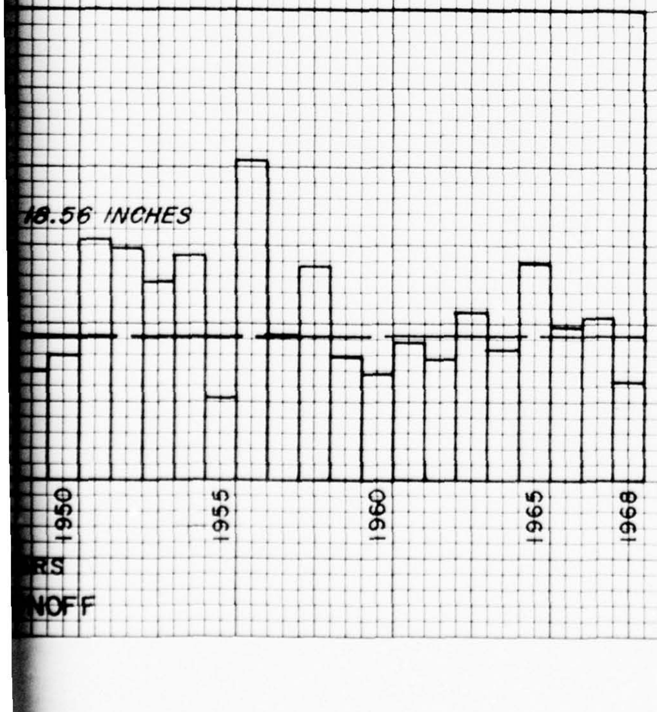


ANNUAL RUNOFF





MEAN MONTHLY FLOW DURATION CURVE



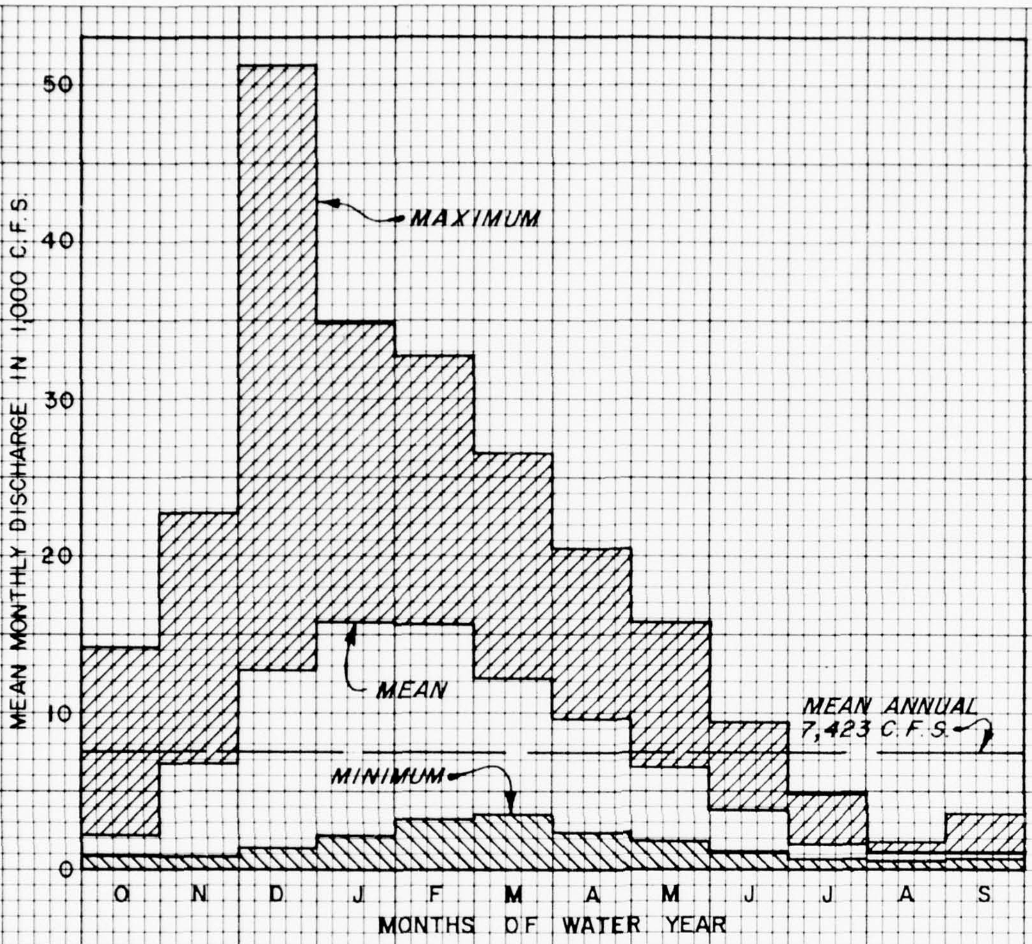
Umpqua River and Tributaries, Oregon
Cow Creek
Near Azalea

RUNOFF SUMMARY

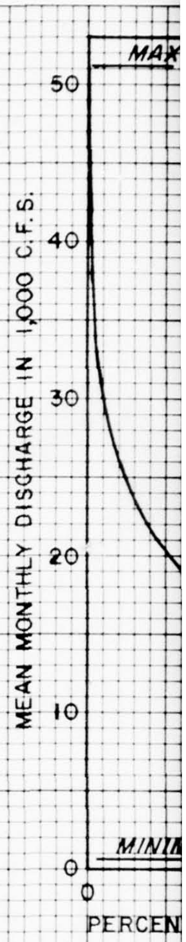
D.A. = 78 Sq. Mi.

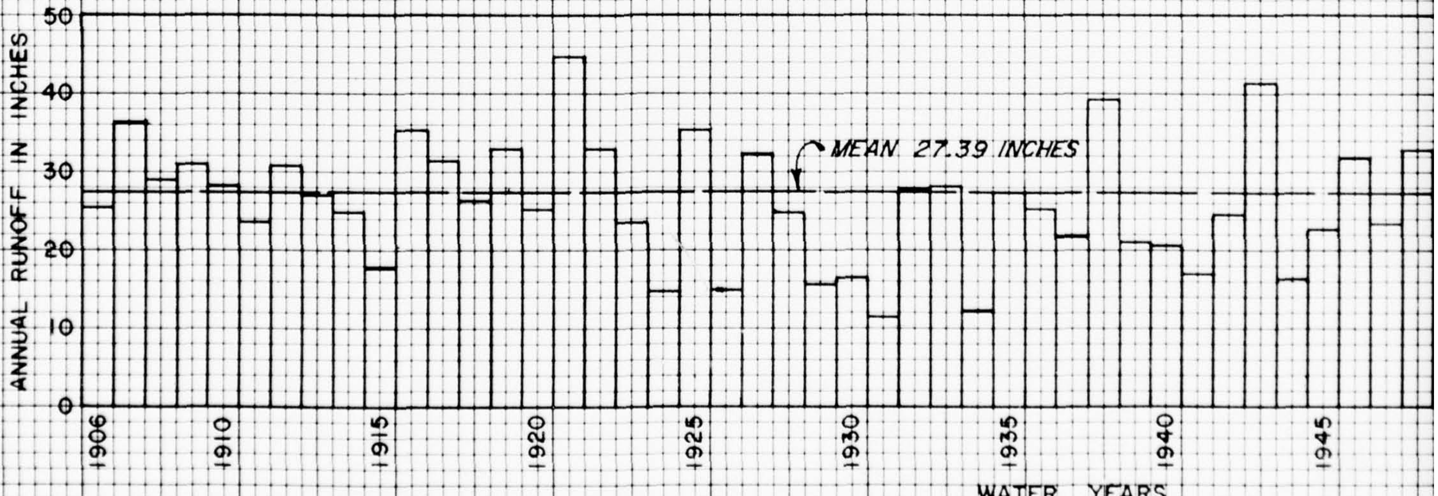
U.S. Army Engineer District, Portland
Water Control Section February 1970
Prepared: RLW UM-20-8/3

CHART 5

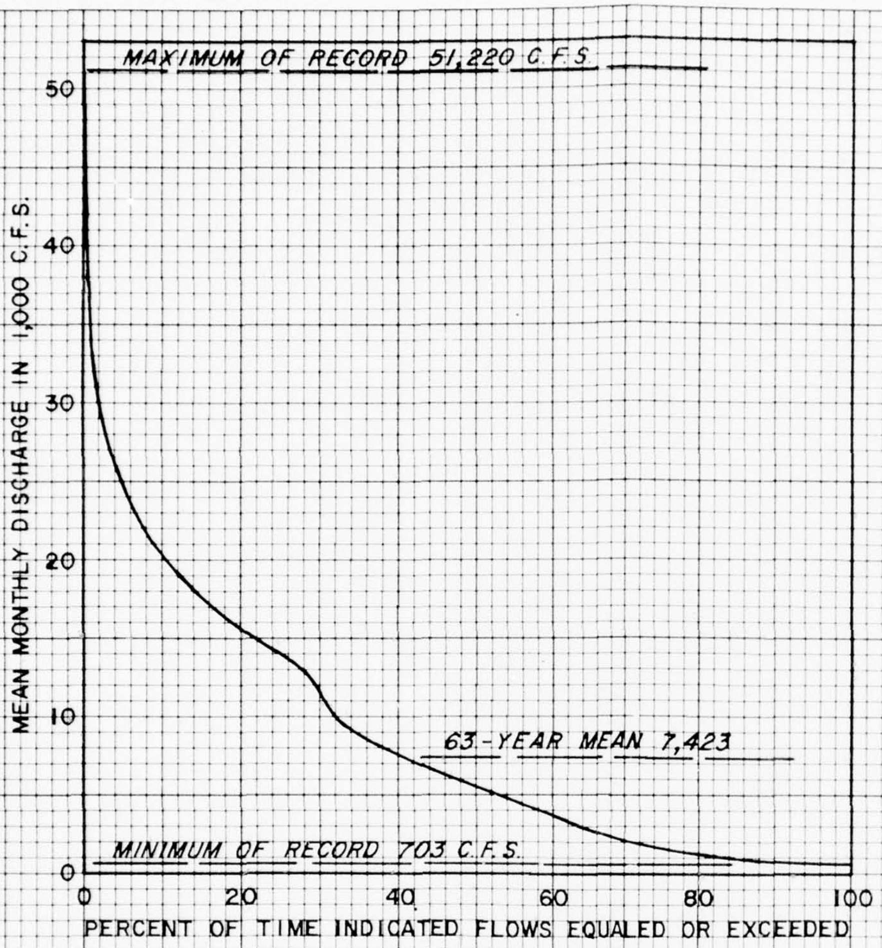


MONTHLY RUNOFF SUMMARY

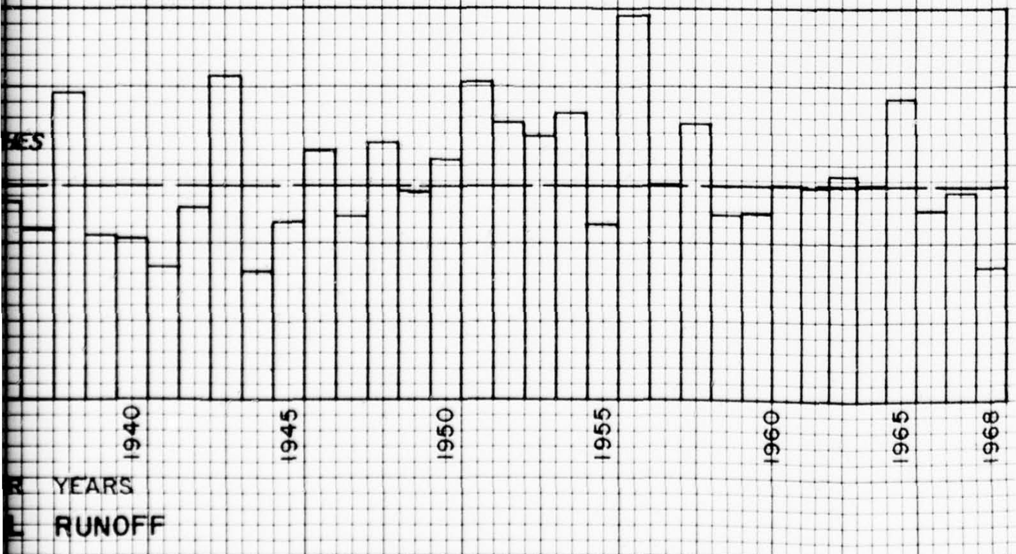




ANNUAL RUNOFF



MEAN MONTHLY FLOW DURATION CURVE



RUNOFF

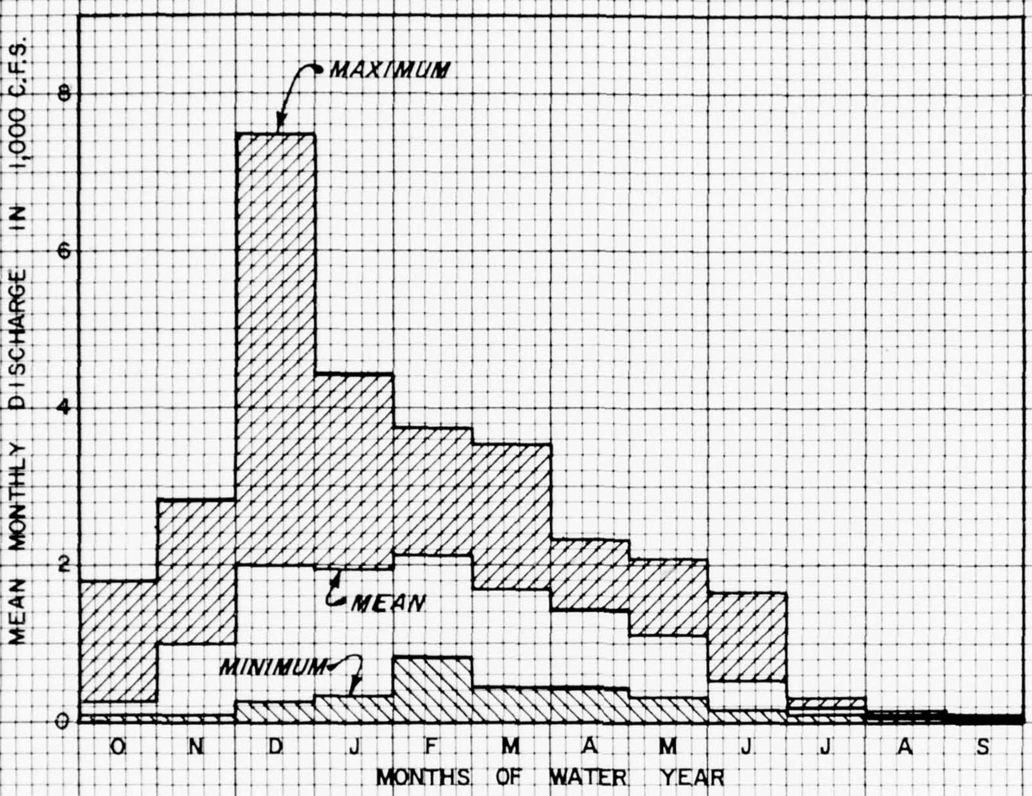
Umpqua River and Tributaries, Oregon
Umpqua River
Near Elkton

RUNOFF SUMMARY

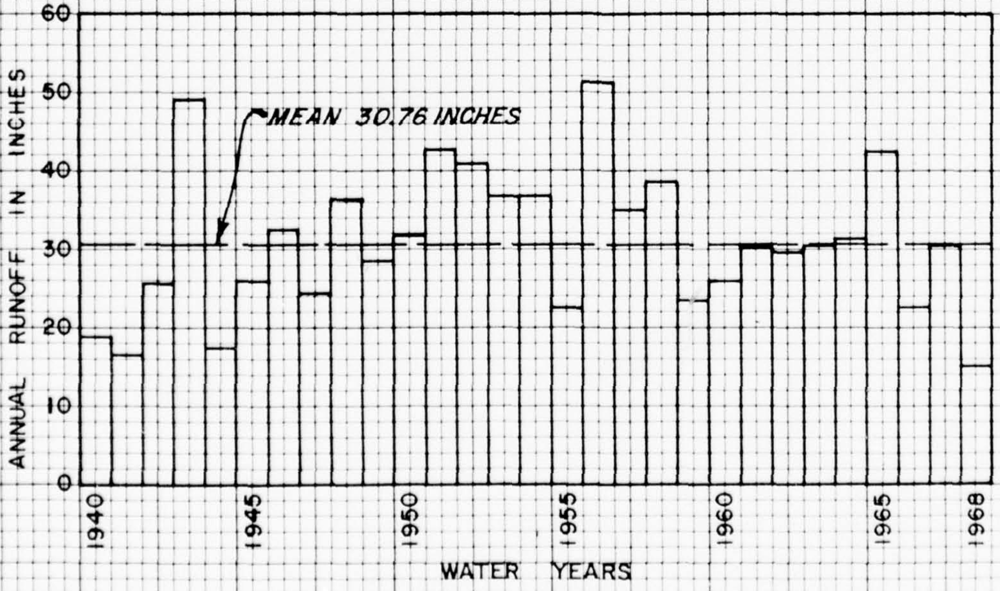
D.A. = 3,683 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section March 1970
Prepared: RLW UM-20-8/4

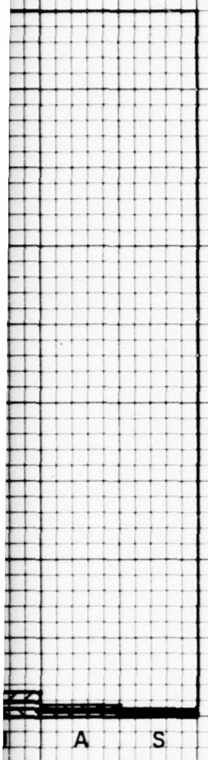
CHART 6

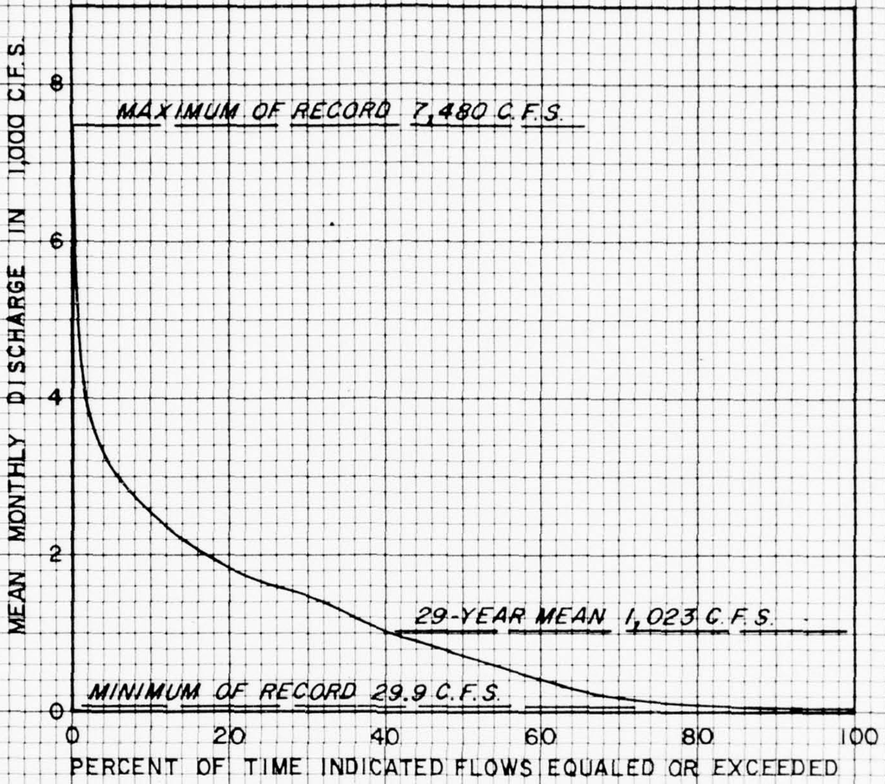


MONTHLY RUNOFF SUMMARY

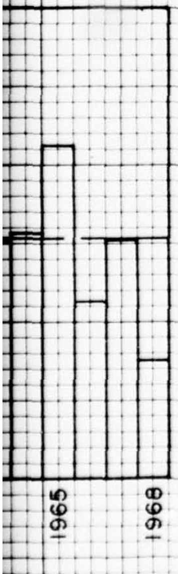


ANNUAL RUNOFF





MEAN MONTHLY FLOW DURATION CURVE



Umpqua River and Tributaries, Oregon
South Umpqua River
At Tiller

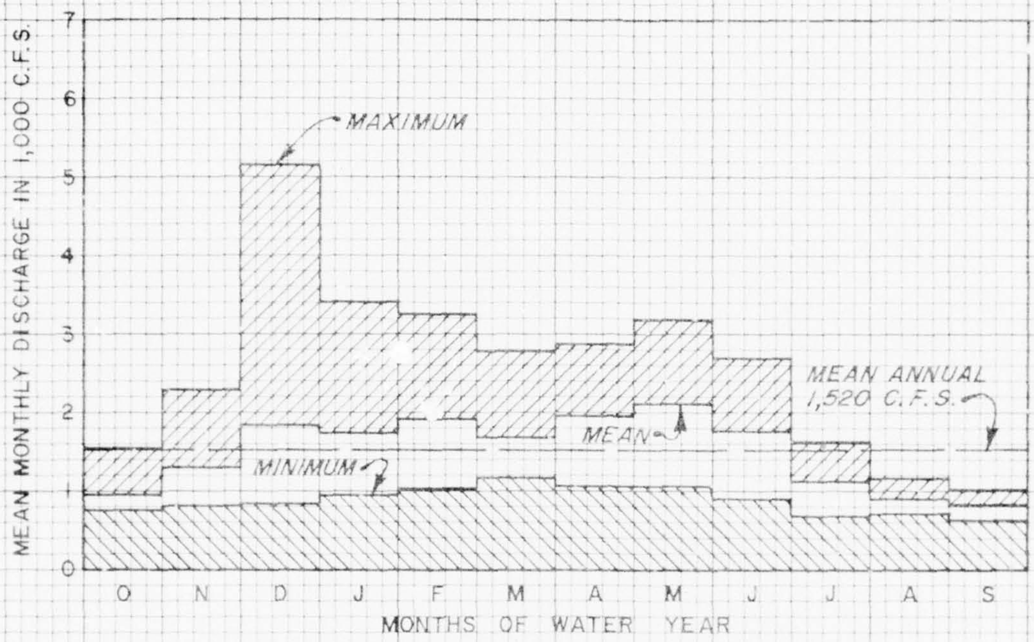
RUNOFF SUMMARY

D.A. = 449 Sq. Mi.

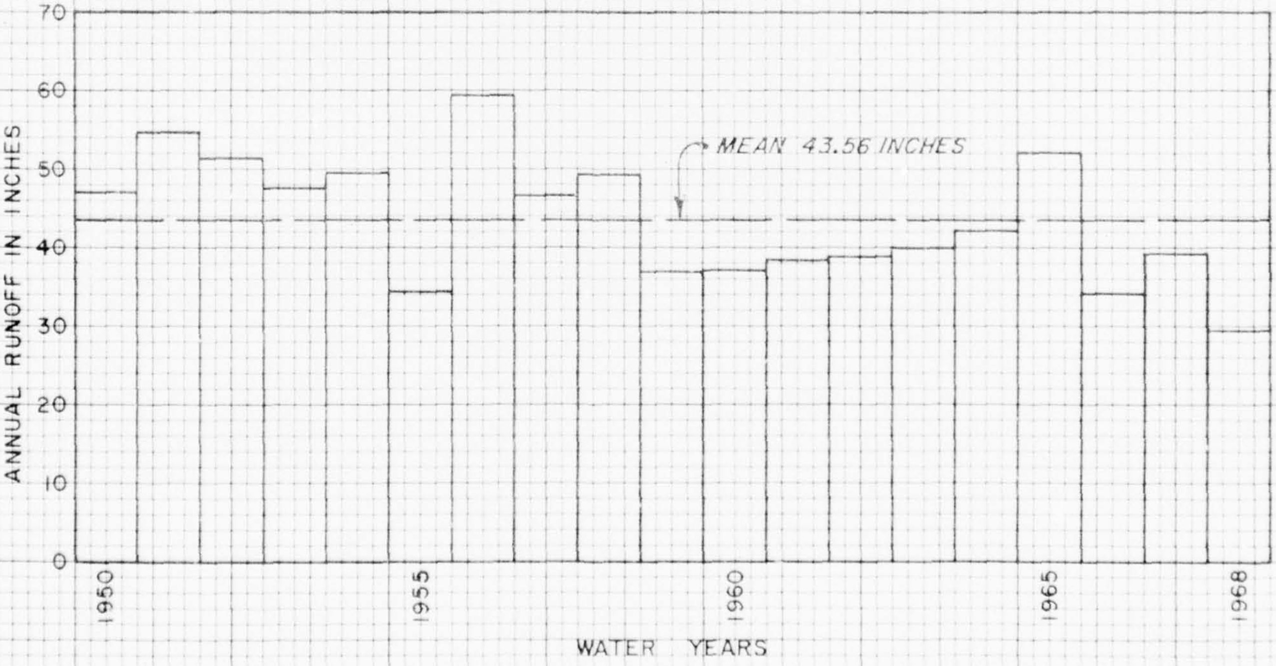
U.S. Army Engineer District, Portland
Water Control Section Feb. 1970
Prepared: RLW UM-20-8/5

CHART 7

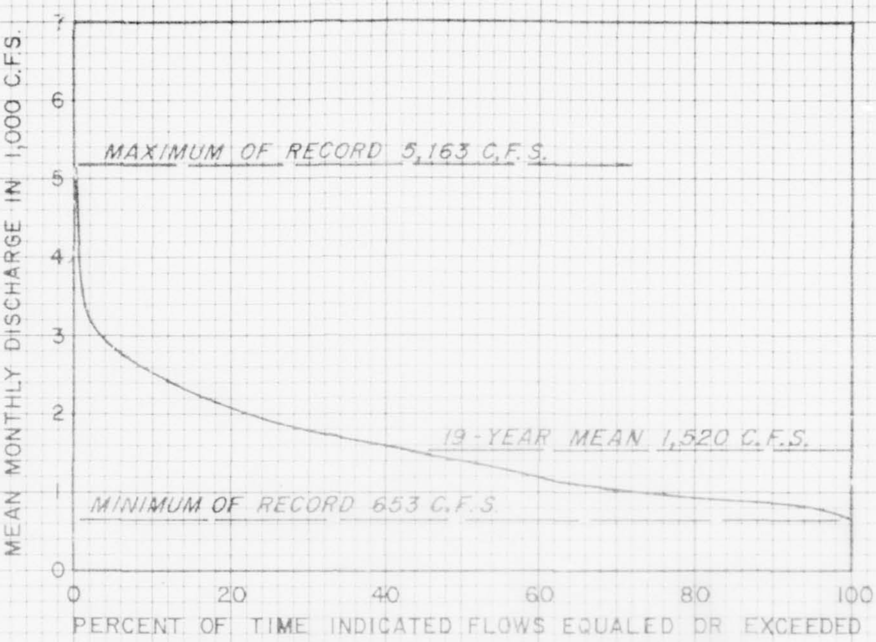
2



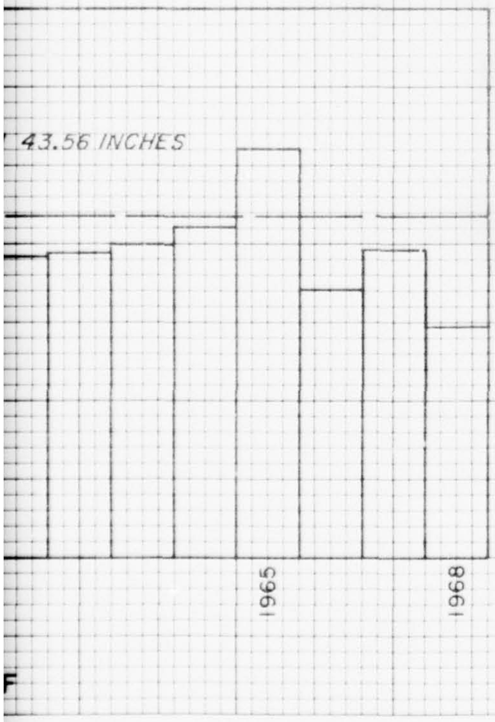
MONTHLY RUNOFF SUMMARY



ANNUAL RUNOFF



MEAN MONTHLY FLOW DURATION CURVE



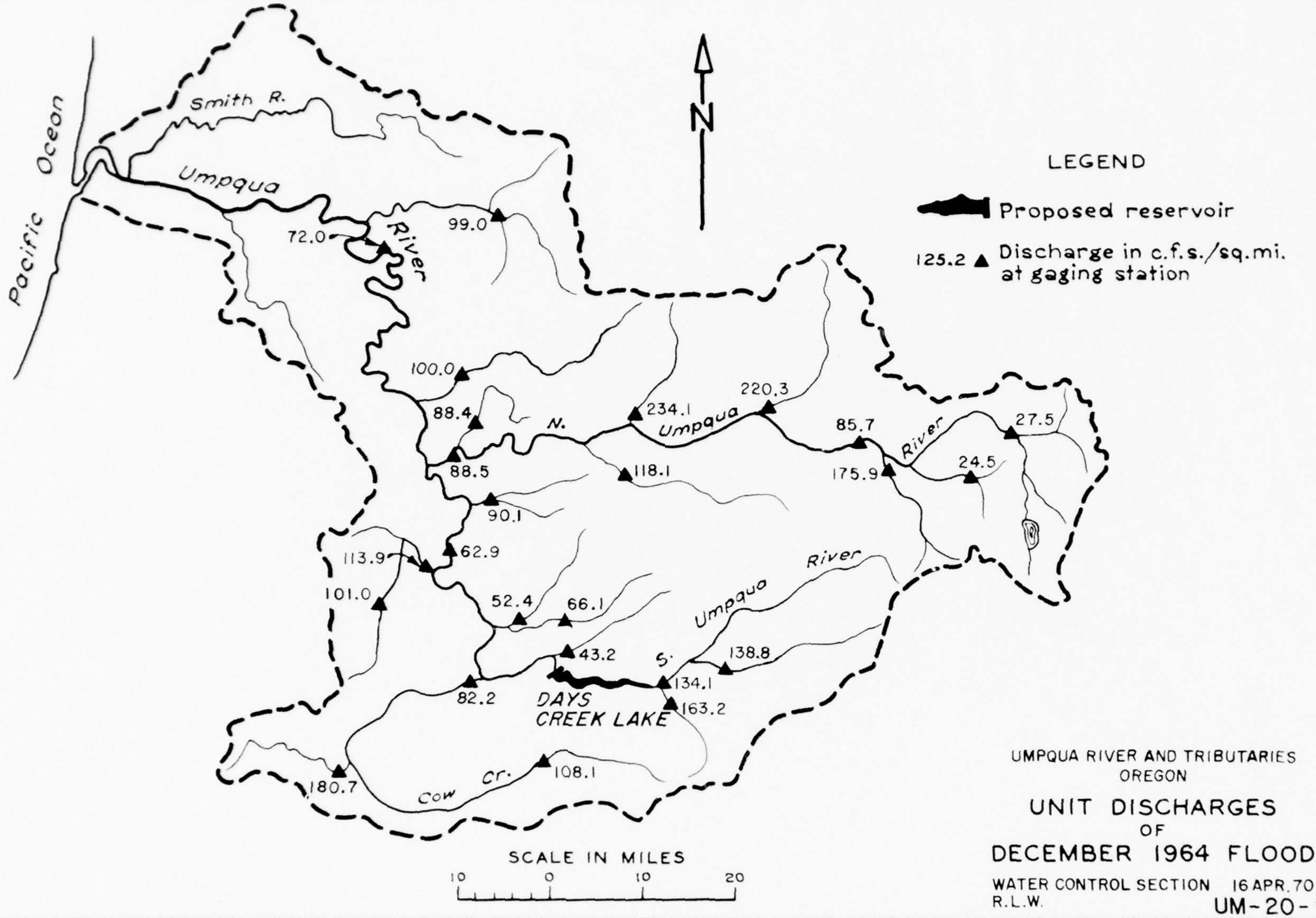
Umpqua River and Tributaries, Oregon
North Umpqua River
Above Copeland Creek
Near Toketee Falls

RUNOFF SUMMARY

D.A. = 475 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section March 1970
Prepared: DAR UM-20-8/6

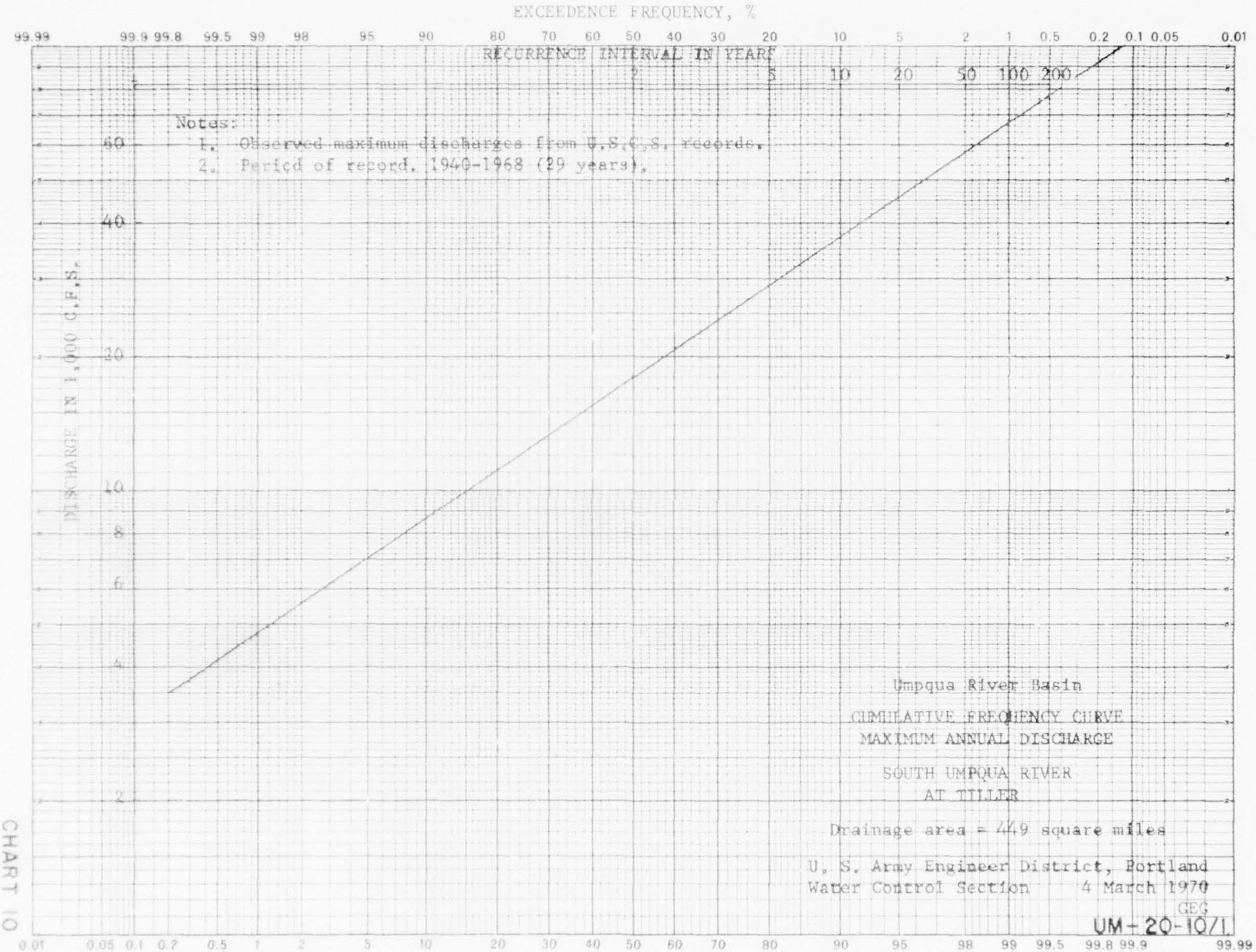
CHART 8



UMPQUA RIVER AND TRIBUTARIES
OREGON

UNIT DISCHARGES
OF
DECEMBER 1964 FLOOD

WATER CONTROL SECTION 16 APR. 70
R.L.W.
UM-20-9
CHART 9



Notes:
1. Observed maximum discharges from U.S.G.S. records.
2. Period of record, 1940-1968 (29 years).

Umpqua River Basin

CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

SOUTH UMPQUA RIVER
AT TILLER

Drainage area = 449 square miles

U. S. Army Engineer District, Portland
Water Control Section 4 March 1970
GEG

UM-20-10/1

CHART 10

CHART 10

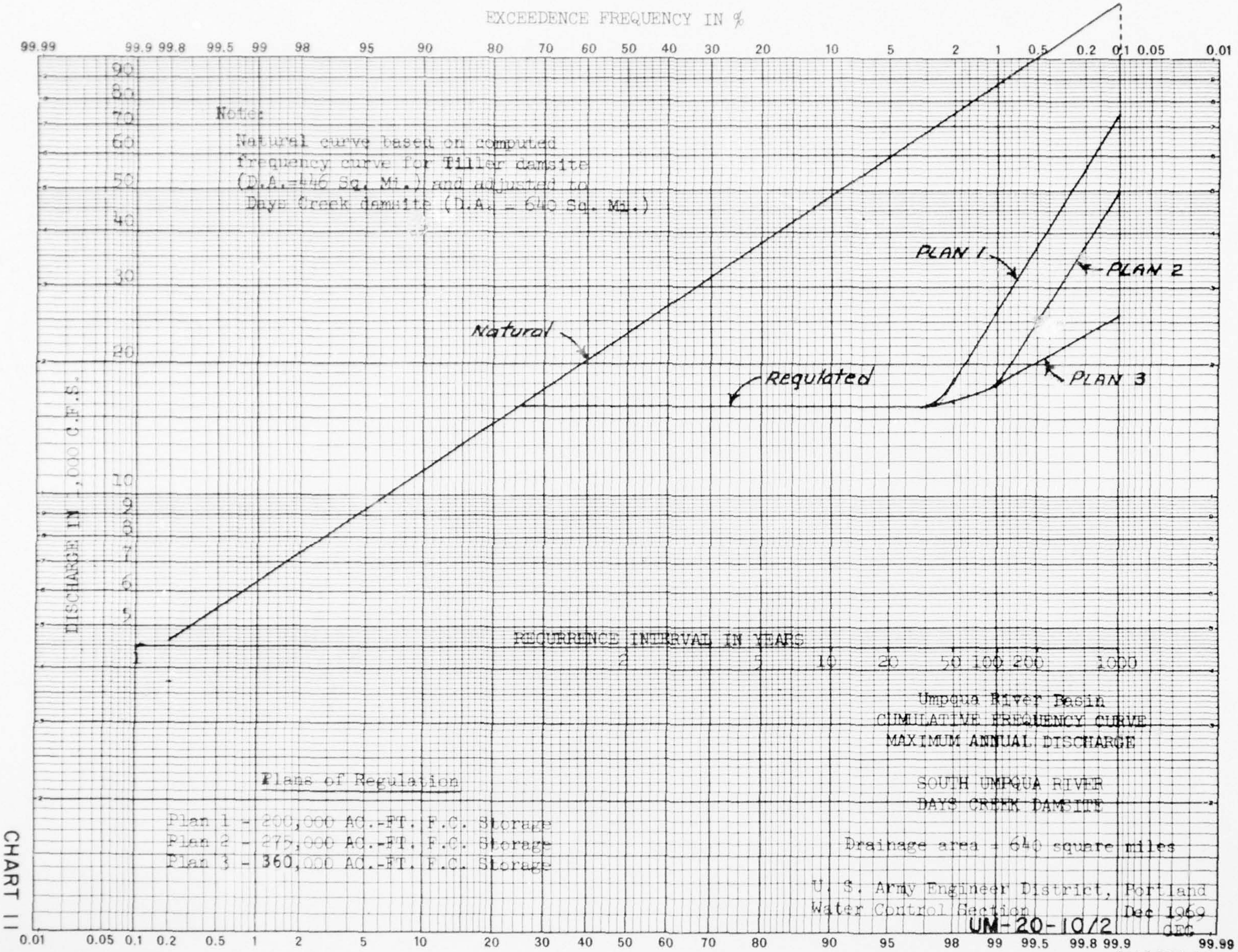
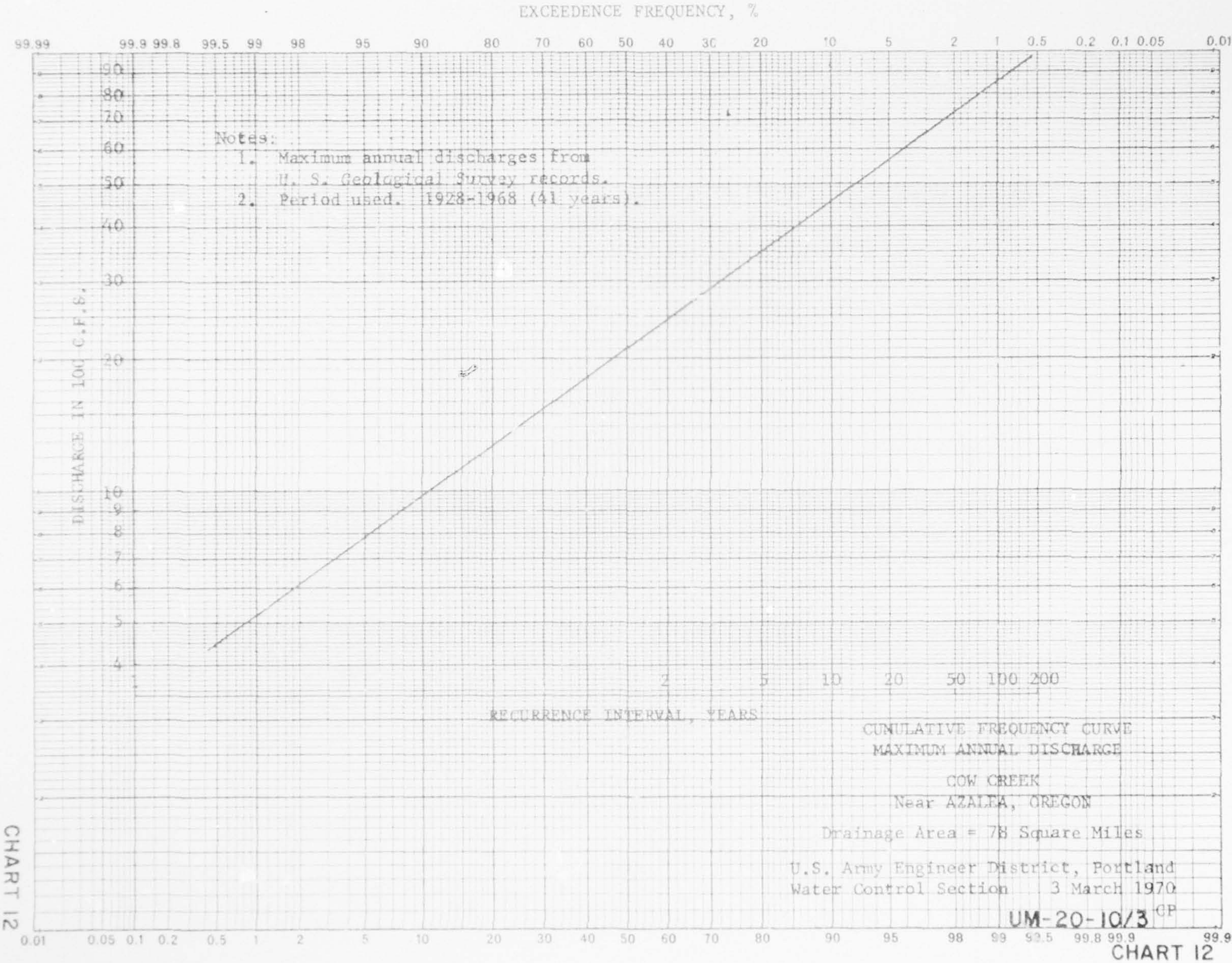


CHART 11

CHART 11



Notes:
1. Maximum annual discharges from U. S. Geological Survey records.
2. Period used. 1928-1968 (41 years).

CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

COW CREEK
Near AZALEA, OREGON

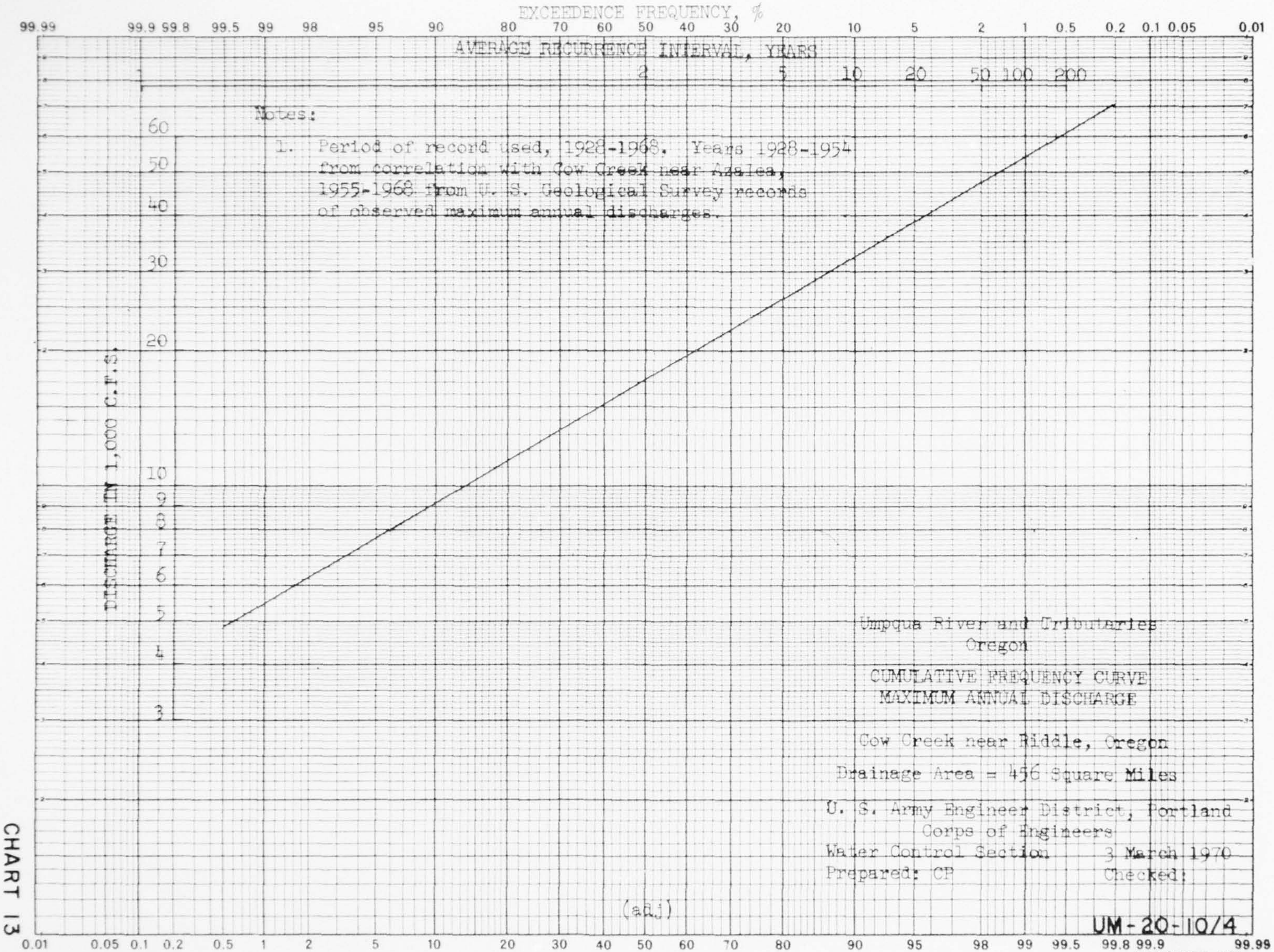
Drainage Area = 78 Square Miles

U.S. Army Engineer District, Portland
Water Control Section 3 March 1970

UM-20-10/3 CP

CHART 12

CHART 12



Notes:

1. Period of record used, 1928-1968. Years 1928-1954 from correlation with Cow Creek near Azalea, 1955-1968 from U. S. Geological Survey records of observed maximum annual discharges.

Umpqua River and Tributaries
Oregon

CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

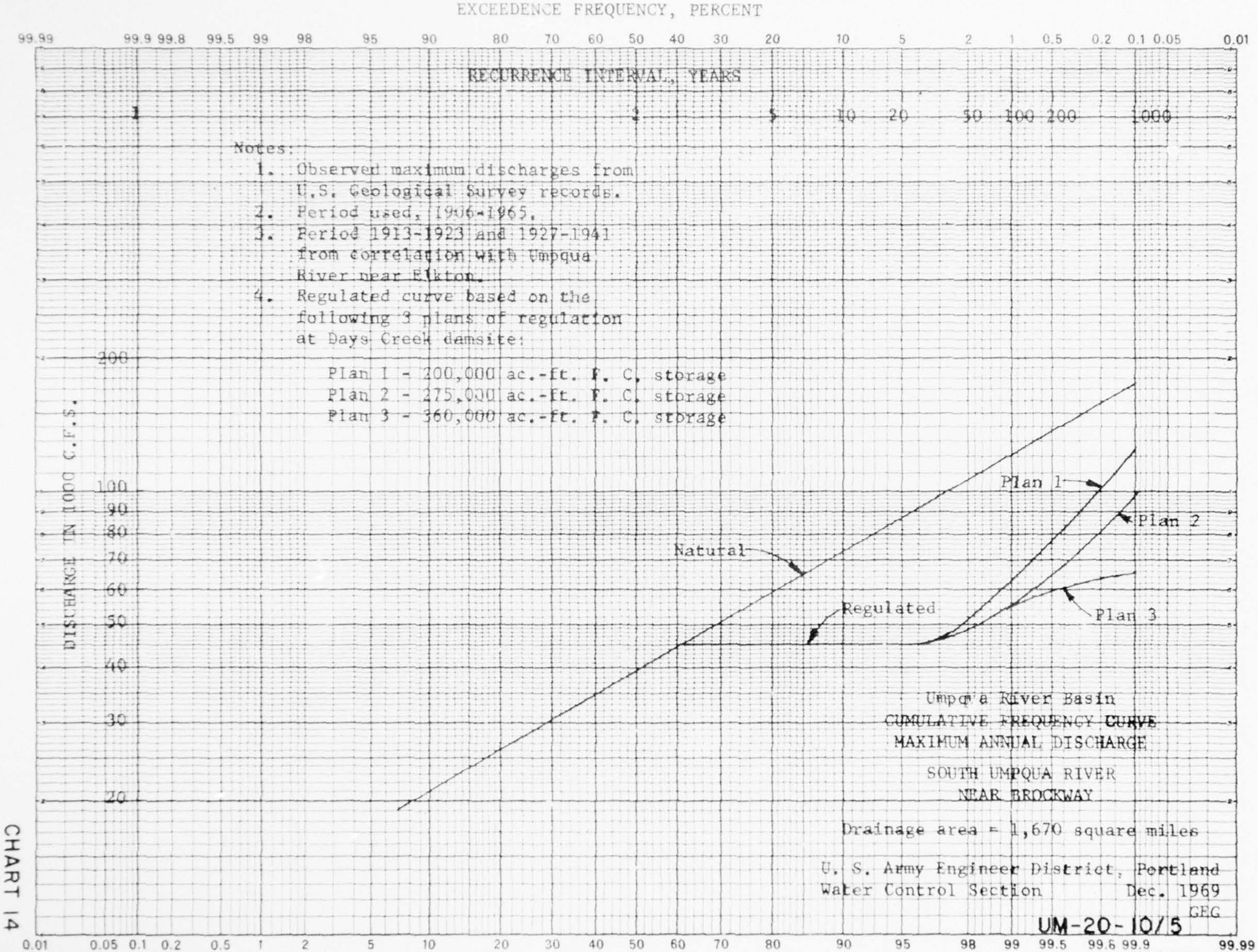
Cow Creek near Riddle, Oregon

Drainage Area = 456 Square Miles

U. S. Army Engineer District, Portland
Corps of Engineers
Water Control Section 3 March 1970
Prepared: CP Checked:

CHART 13

CHART 13



Notes:

1. Observed maximum discharges from U.S. Geological Survey records.
2. Period used, 1906-1965.
3. Period 1913-1923 and 1927-1941 from correlation with Umpqua River near Elkton.
4. Regulated curve based on the following 3 plans of regulation at Days Creek damsite:

Plan 1 - 200,000 ac.-ft. F. C. storage
Plan 2 - 275,000 ac.-ft. F. C. storage
Plan 3 - 360,000 ac.-ft. F. C. storage

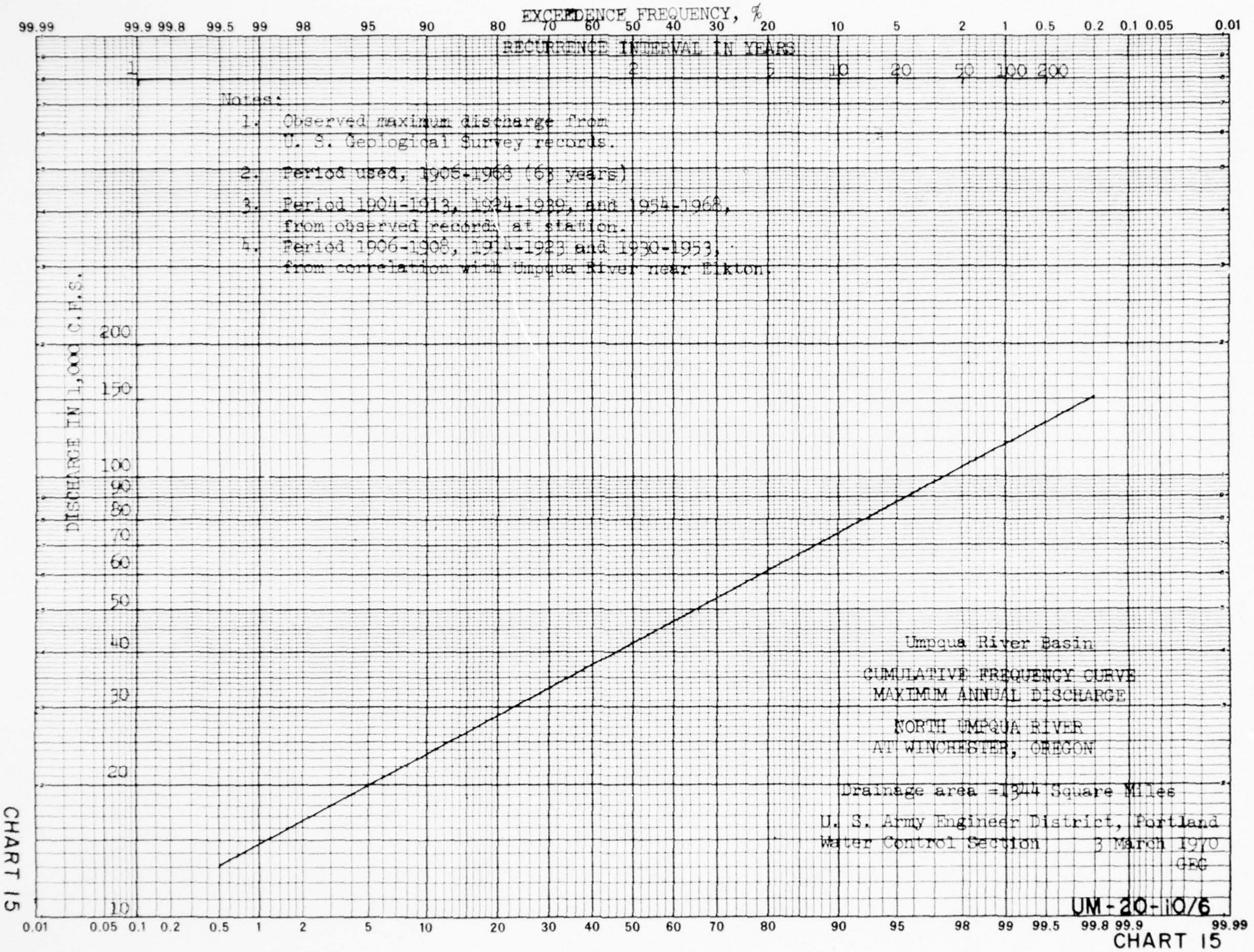
Umpqua River Basin
CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

SOUTH UMPQUA RIVER
NEAR BROCKWAY

Drainage area = 1,670 square miles

U. S. Army Engineer District, Portland
Water Control Section Dec. 1969

CHART 14



Notes:

1. Observed maximum discharge from U. S. Geological Survey records.
2. Period used, 1905-1968 (63 years)
3. Period 1904-1913, 1924-1939, and 1954-1968, from observed records at station.
4. Period 1906-1908, 1914-1923 and 1930-1953, from correlation with Umpqua River near Elkton.

Umpqua River Basin

CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

NORTH UMPQUA RIVER
AT WINCHESTER, OREGON

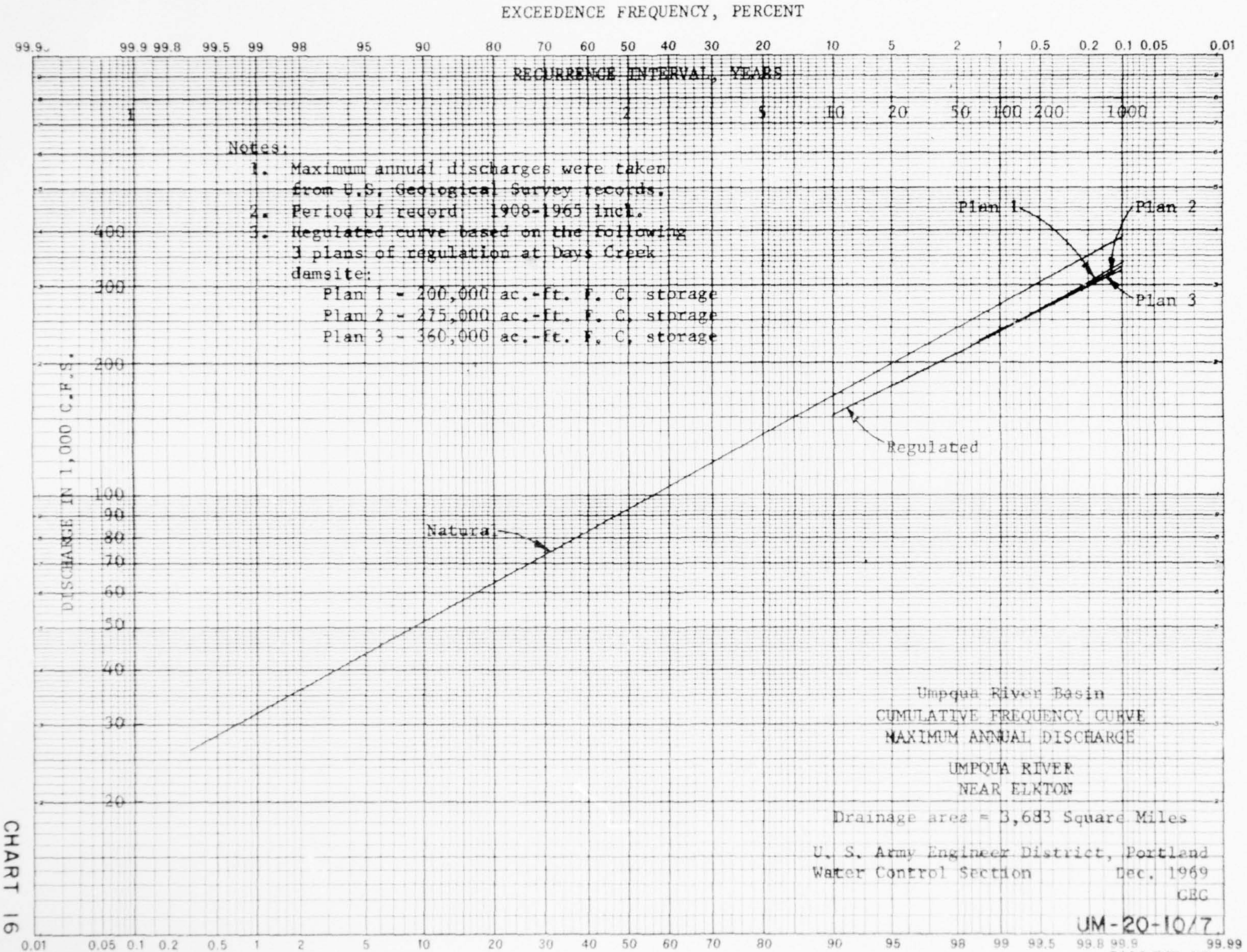
Drainage area =1344 Square Miles

U. S. Army Engineer District, Portland
Water Control Section 3 March 1970
GEG

UM-20-10/6

CHART 15

CHART 15



Notes:

1. Maximum annual discharges were taken from U.S. Geological Survey records.
2. Period of record: 1908-1965 incl.
3. Regulated curve based on the following 3 plans of regulation at Days Creek damsite:

Plan 1 - 200,000 ac.-ft. F. C. storage
Plan 2 - 275,000 ac.-ft. F. C. storage
Plan 3 - 360,000 ac.-ft. F. C. storage

Umpqua River Basin
CUMULATIVE FREQUENCY CURVE
MAXIMUM ANNUAL DISCHARGE

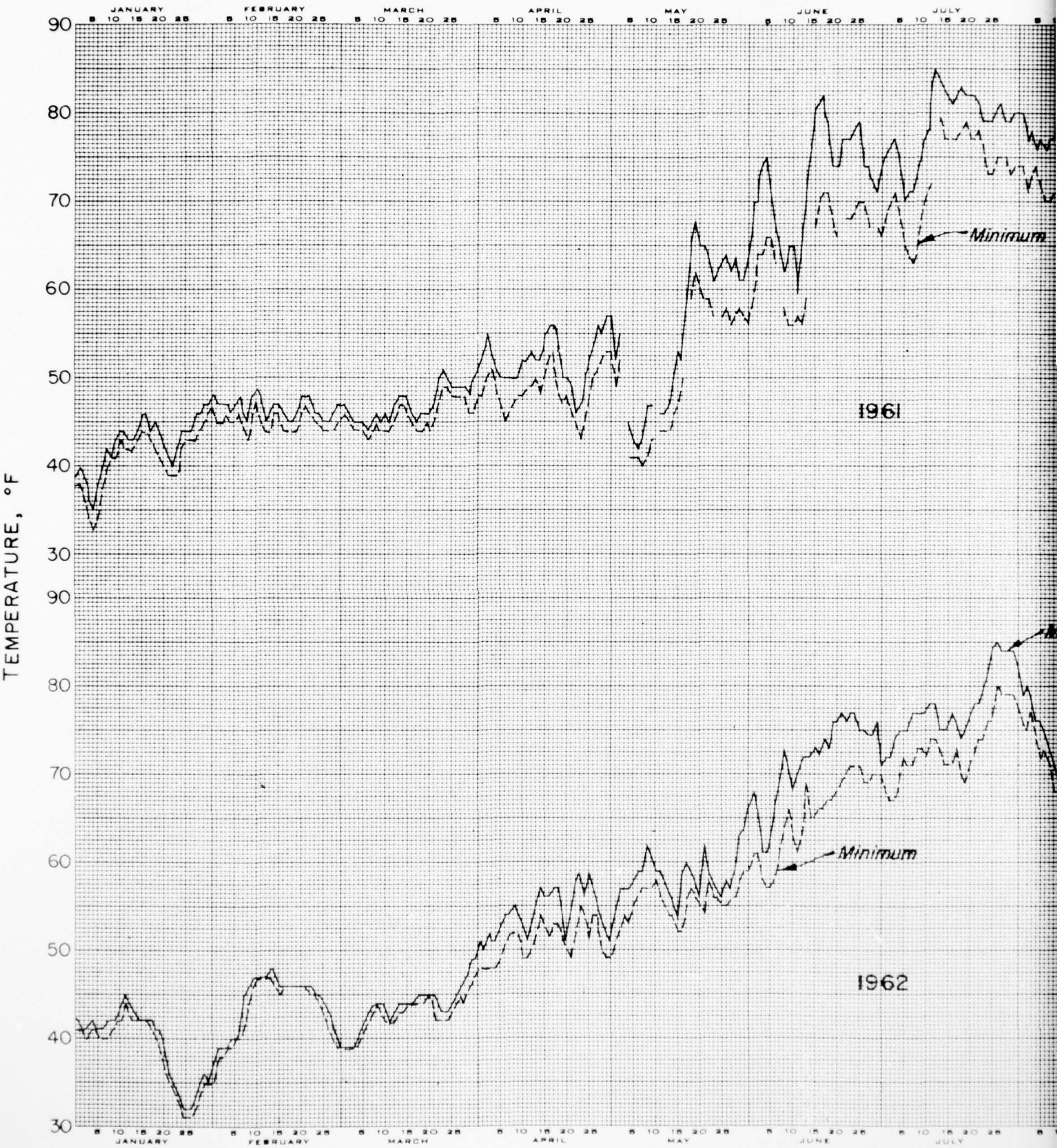
UMPQUA RIVER
NEAR ELKTON

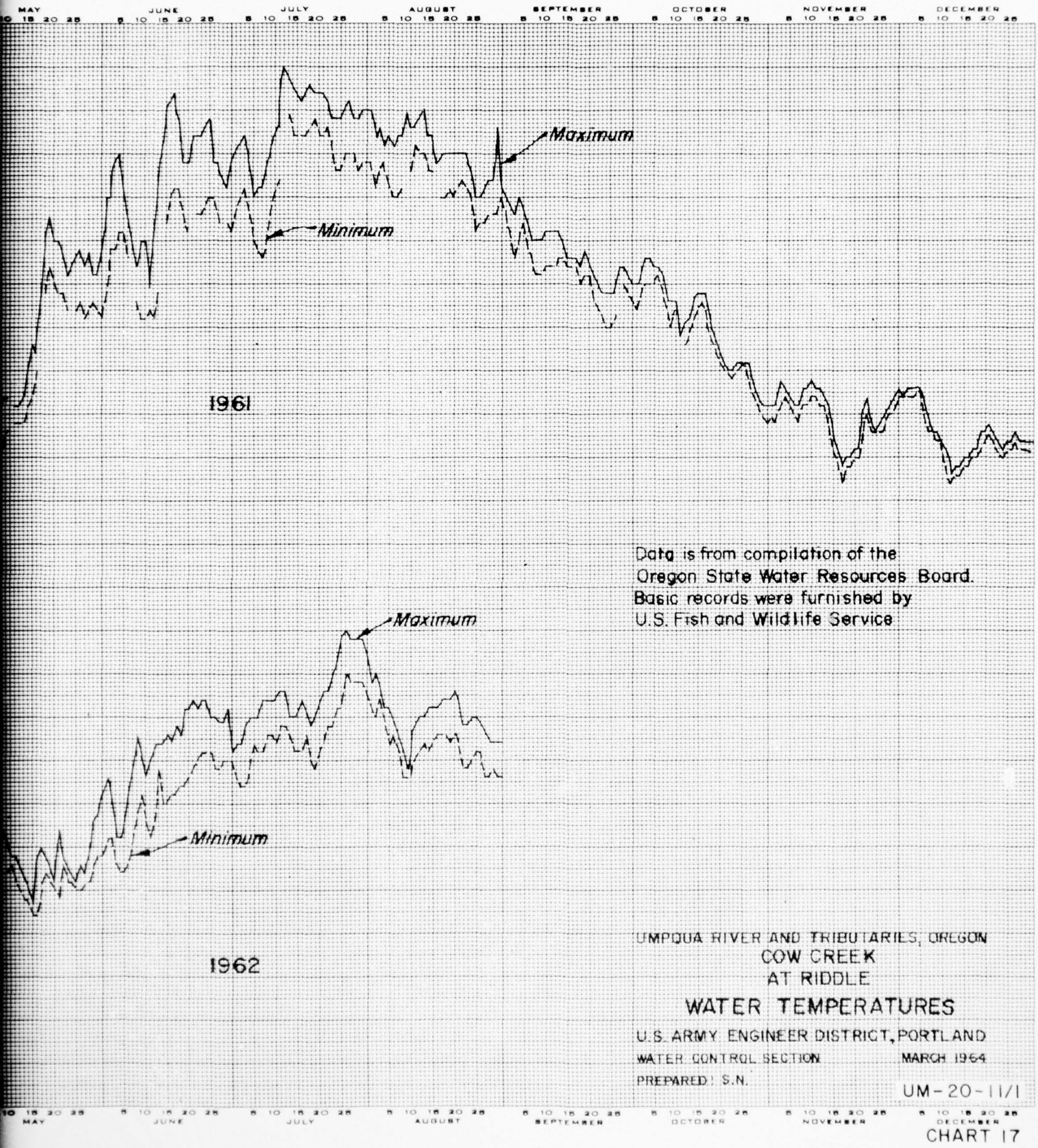
Drainage area = 3,683 Square Miles

U. S. Army Engineer District, Portland
Water Control Section Dec. 1969
CEC

UM-20-10/7

CHART 16


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
5 10 15 20 25
TEMPERATURE, °F
90
80
70
60
50
40
30
Minimum
1961
1962



Data is from compilation of the Oregon State Water Resources Board. Basic records were furnished by U.S. Fish and Wildlife Service

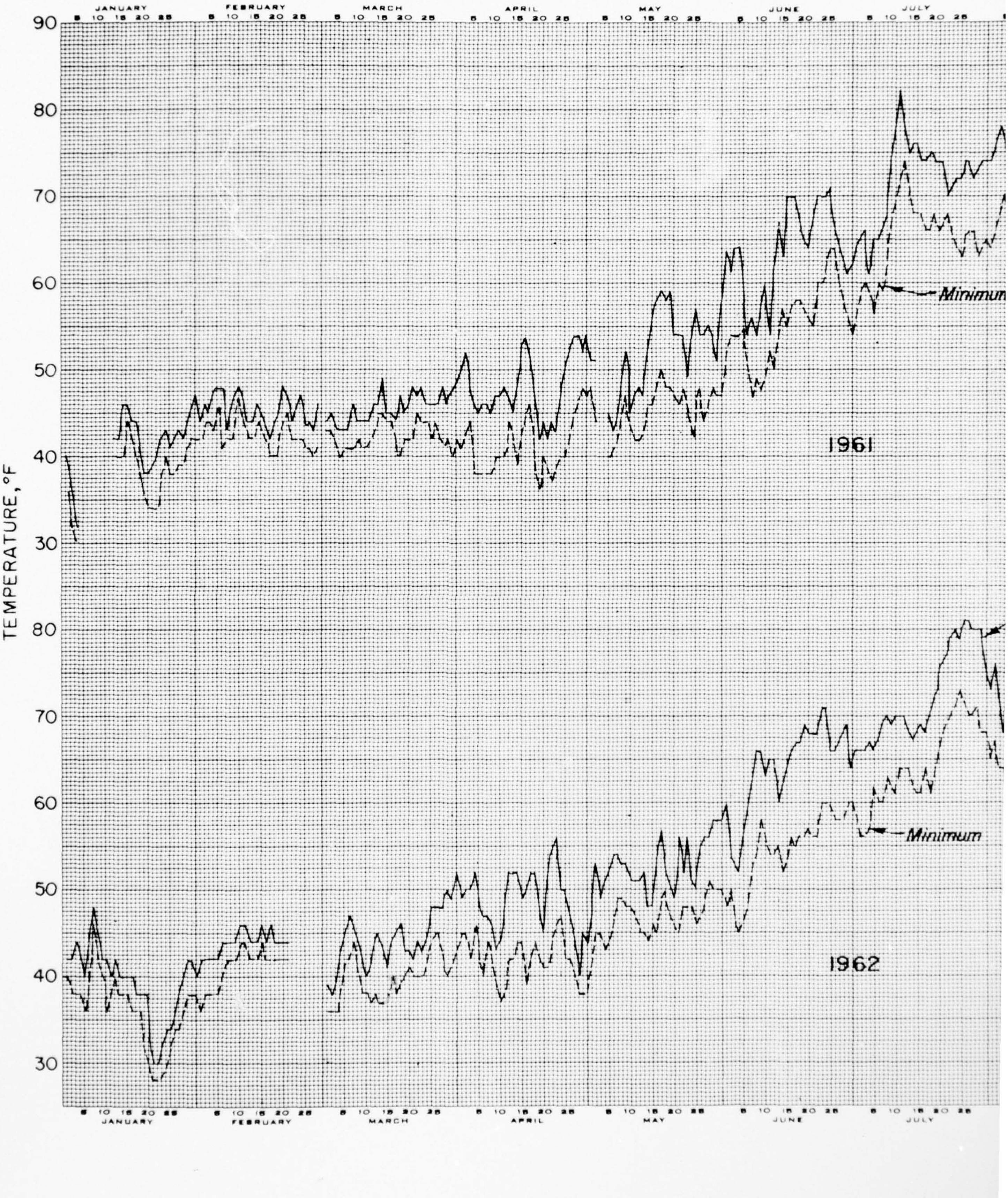
UMPQUA RIVER AND TRIBUTARIES, OREGON
COW CREEK
AT RIDDLE

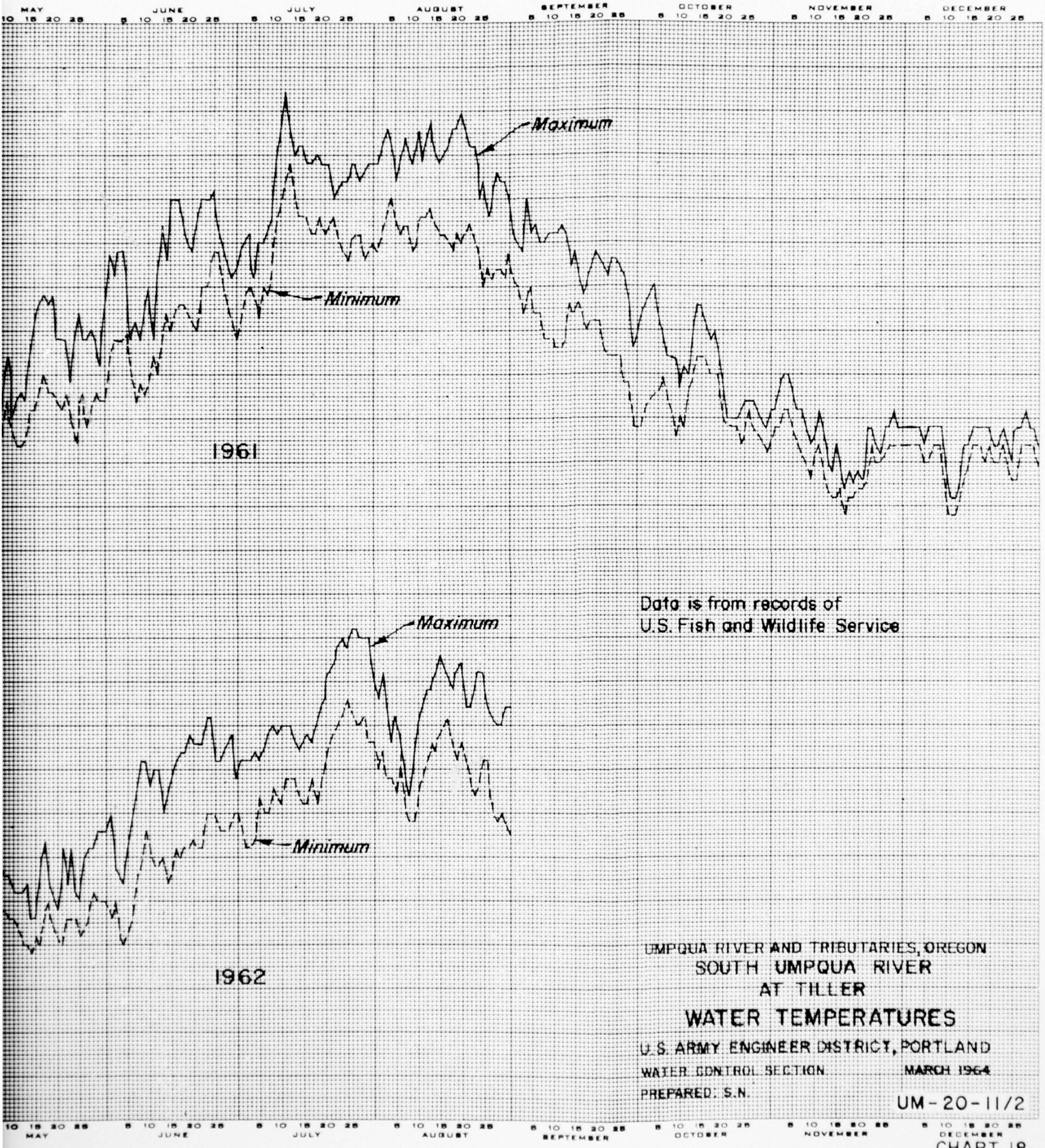
WATER TEMPERATURES

U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MARCH 1964
PREPARED: S.N.

UM-20-11/1

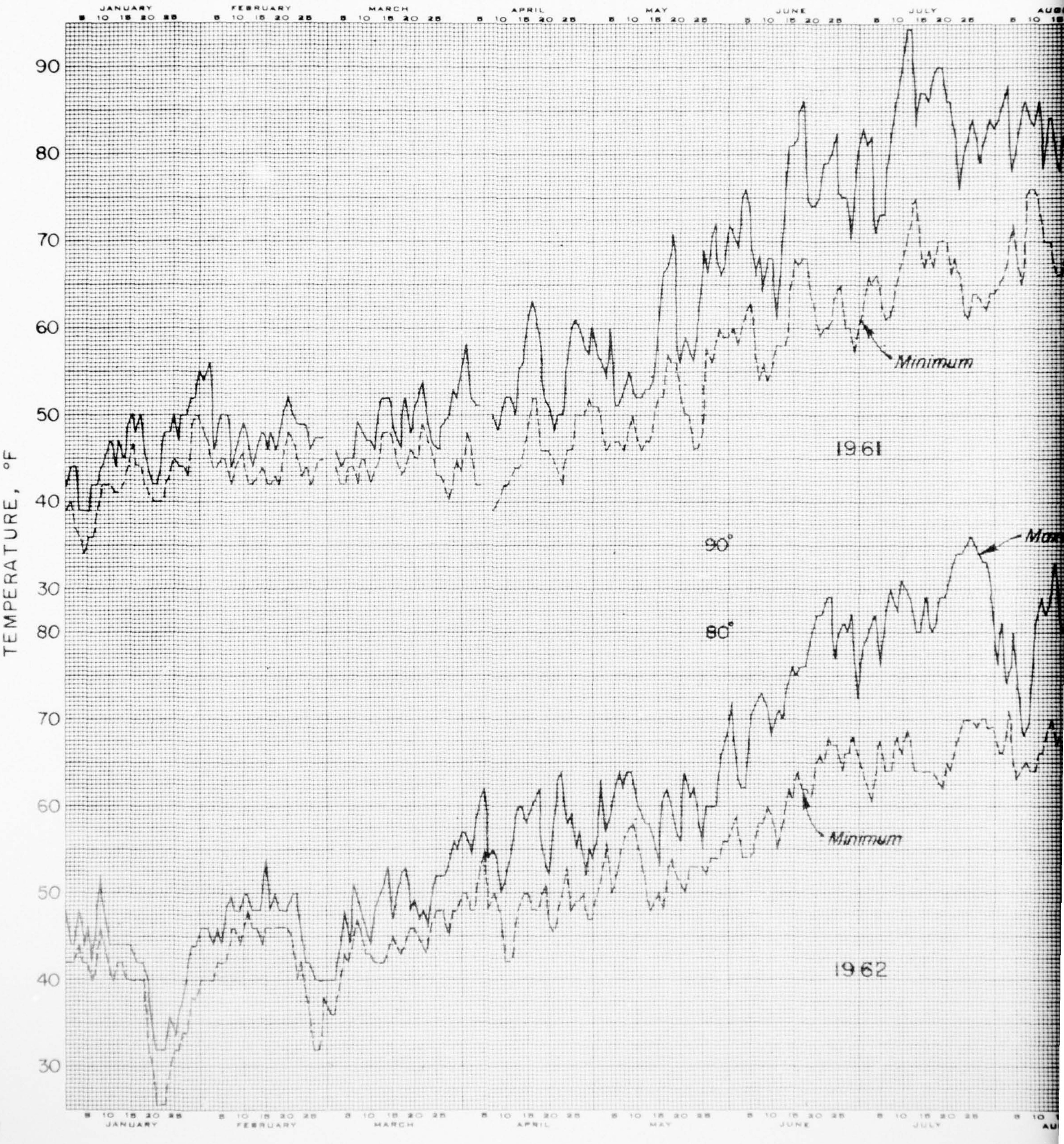
CHART 17


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
5 10 15 20 25
90
80
70
60
50
40
30
TEMPERATURE, °F
Minimun
1961
Minimum
1962

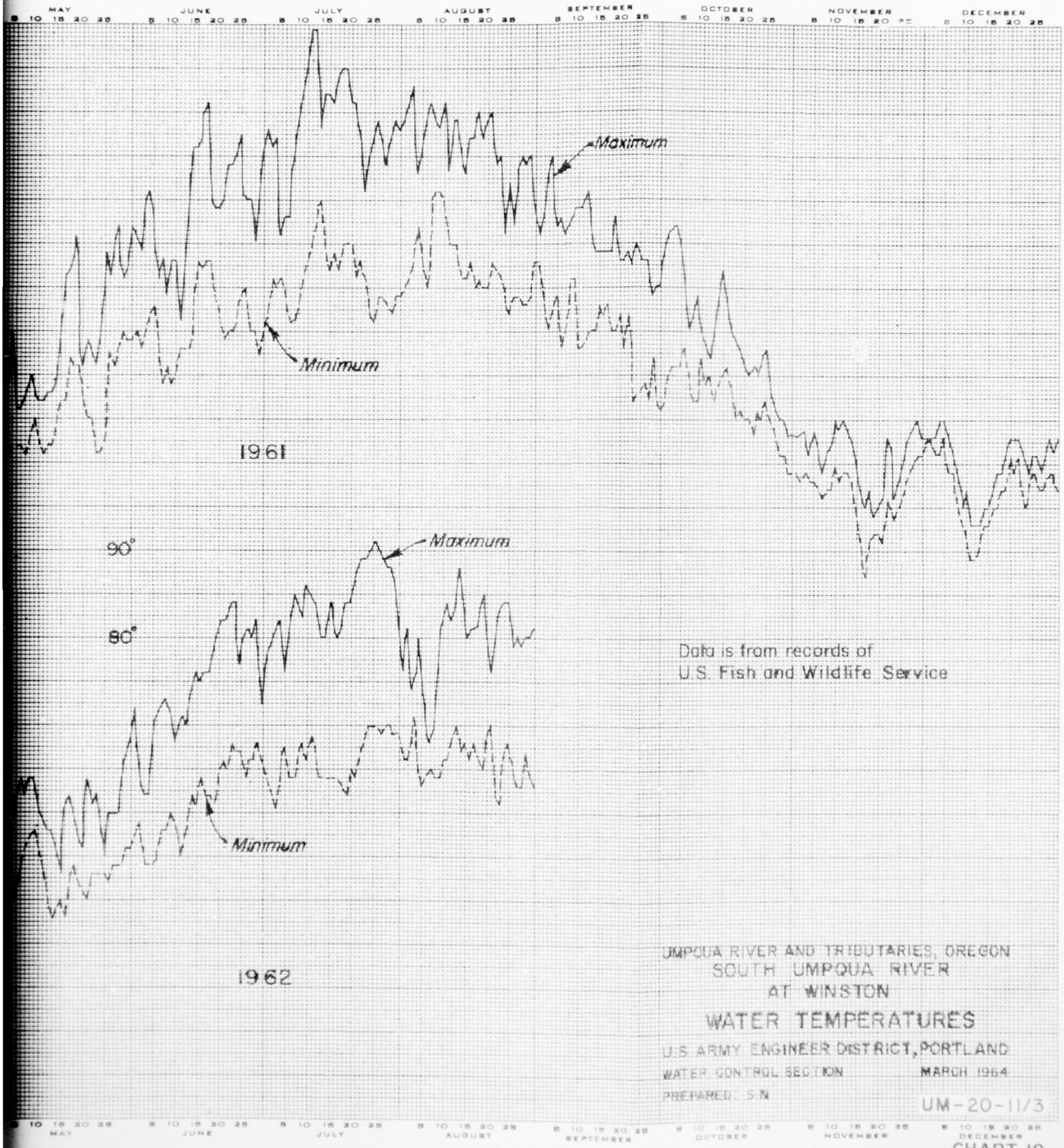


UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
AT TILLER
WATER TEMPERATURES
U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MARCH 1964
PREPARED: S.N.
UM-20-11/2

CHART 18



JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
5 10 15 20 25
90
80
70
60
50
40
30
TEMPERATURE, °F
Minimum
1961
90°
80°
Minimum
1962



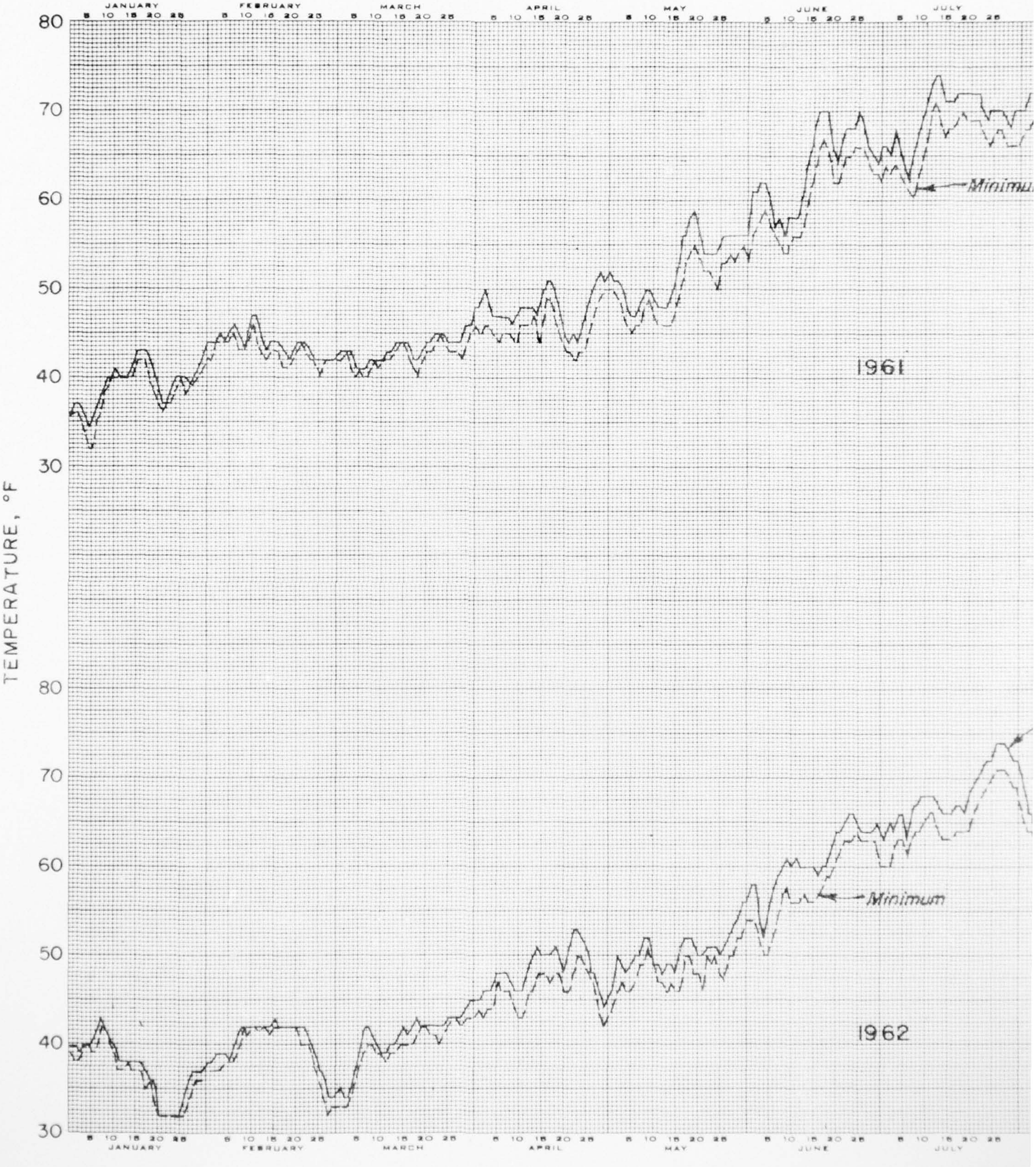
Data is from records of
U.S. Fish and Wildlife Service

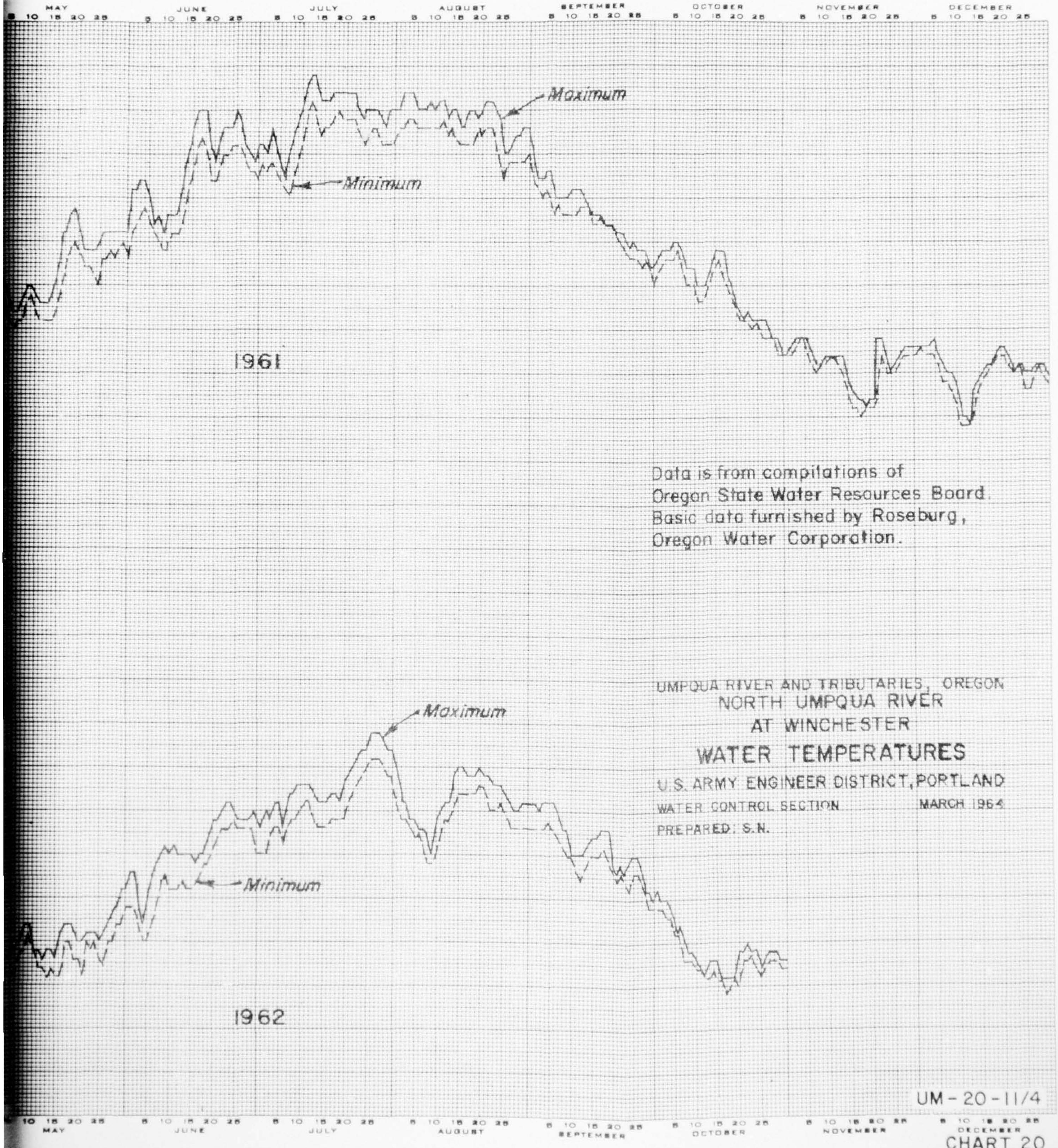
UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
AT WINSTON

WATER TEMPERATURES

U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MARCH 1964
PREPARED: S.N.
UM-20-11/3

CHART 19


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
5 10 15 20 25
80
70
60
50
40
30
TEMPERATURE, °F
Minimu
1961
Minimum
1962

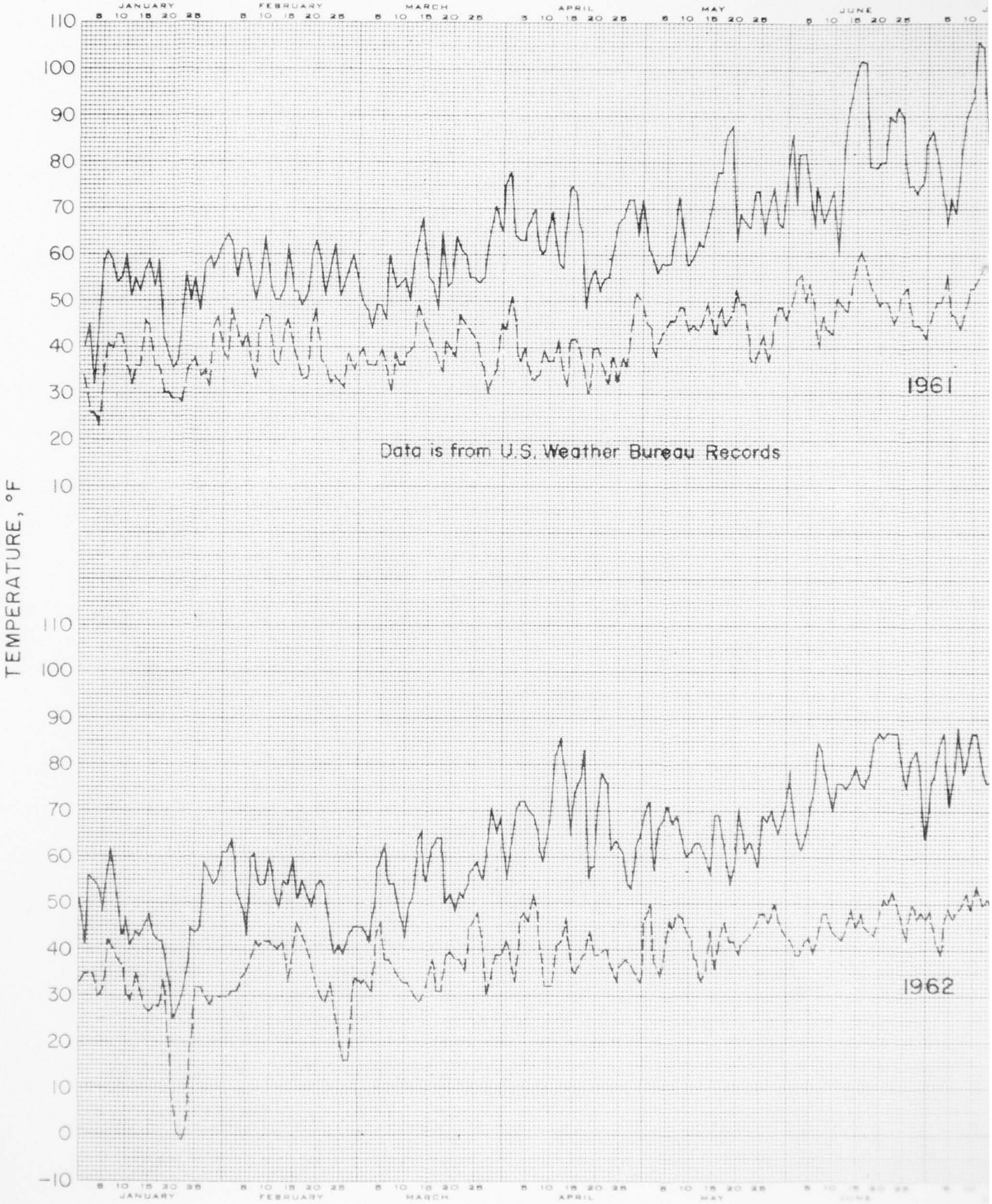


Data is from compilations of
Oregon State Water Resources Board.
Basic data furnished by Roseburg,
Oregon Water Corporation.

UMPQUA RIVER AND TRIBUTARIES, OREGON
NORTH UMPQUA RIVER
AT WINCHESTER
WATER TEMPERATURES
U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MARCH 1964
PREPARED: S.N.

UM-20-11/4

CHART 20

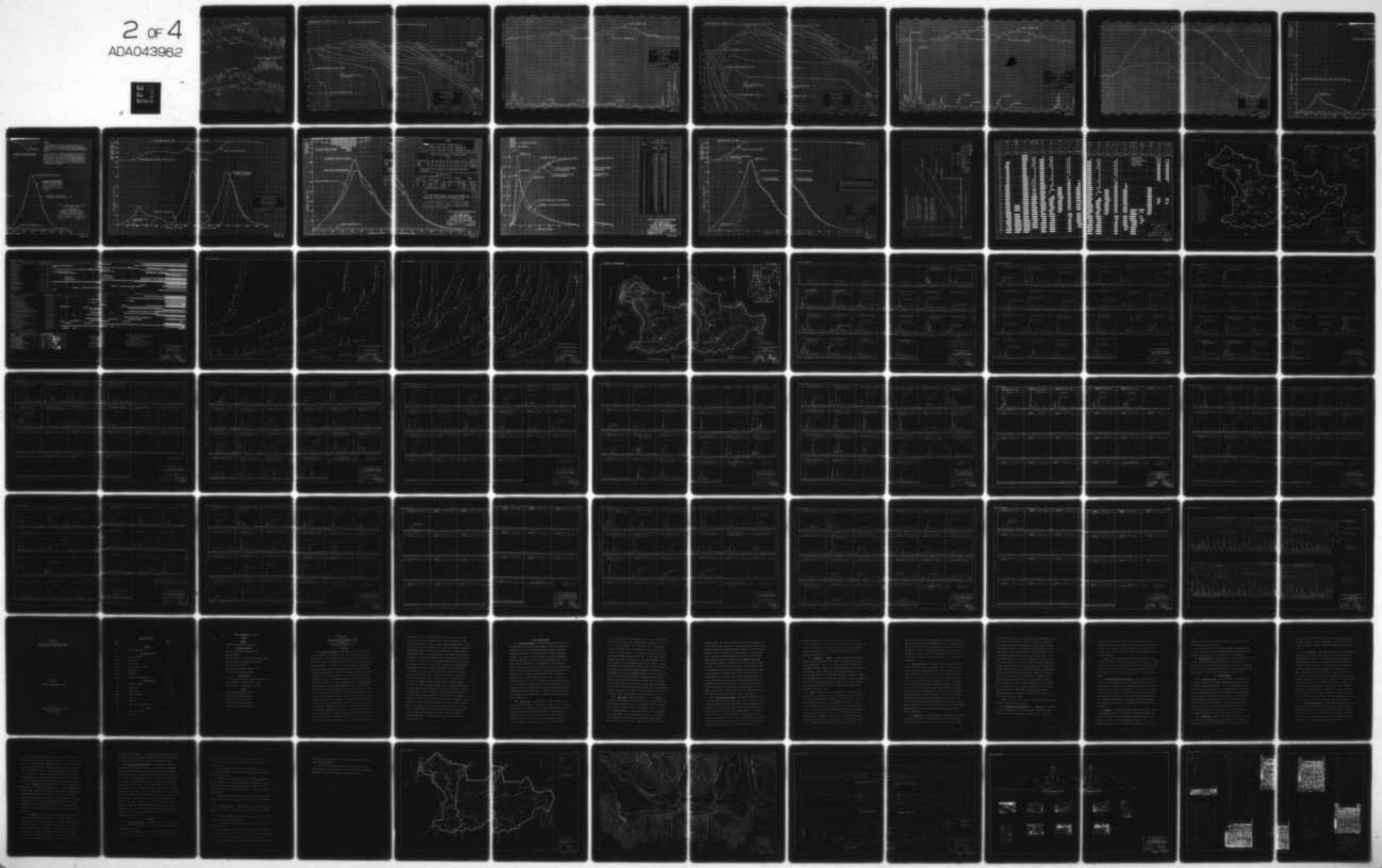


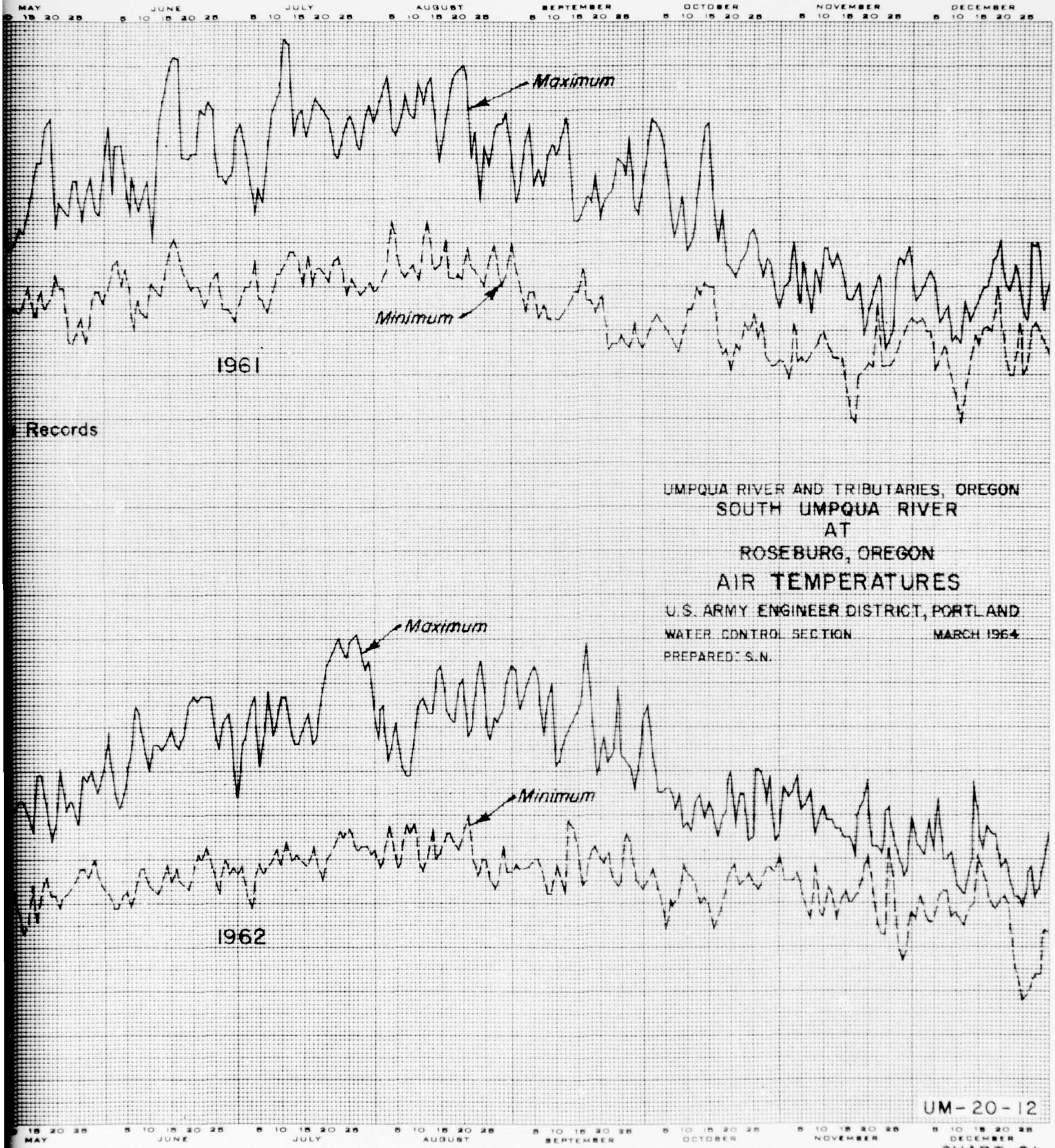
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
5 10 15 20 25
TEMPERATURE, °F
110
100
90
80
70
60
50
40
30
20
10
0
-10
1961
Data is from U.S. Weather Bureau Records
1962

AD-A043 962 ARMY ENGINEER DISTRICT PORTLAND OREG F/G 8/6
REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, SOUTH UM--ETC(U)
NOV 71

UNCLASSIFIED NL

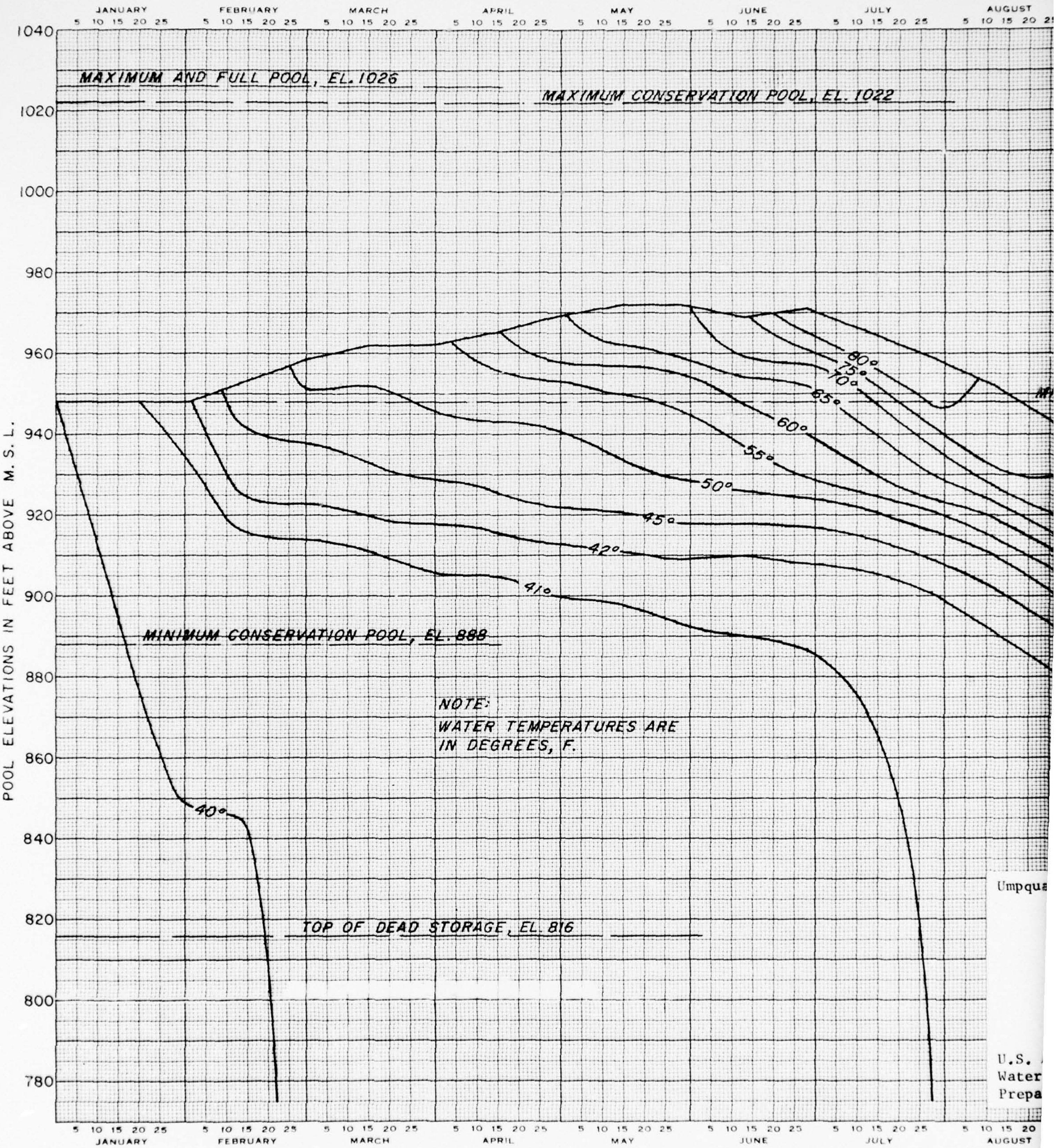
2 OF 4
ADA043962





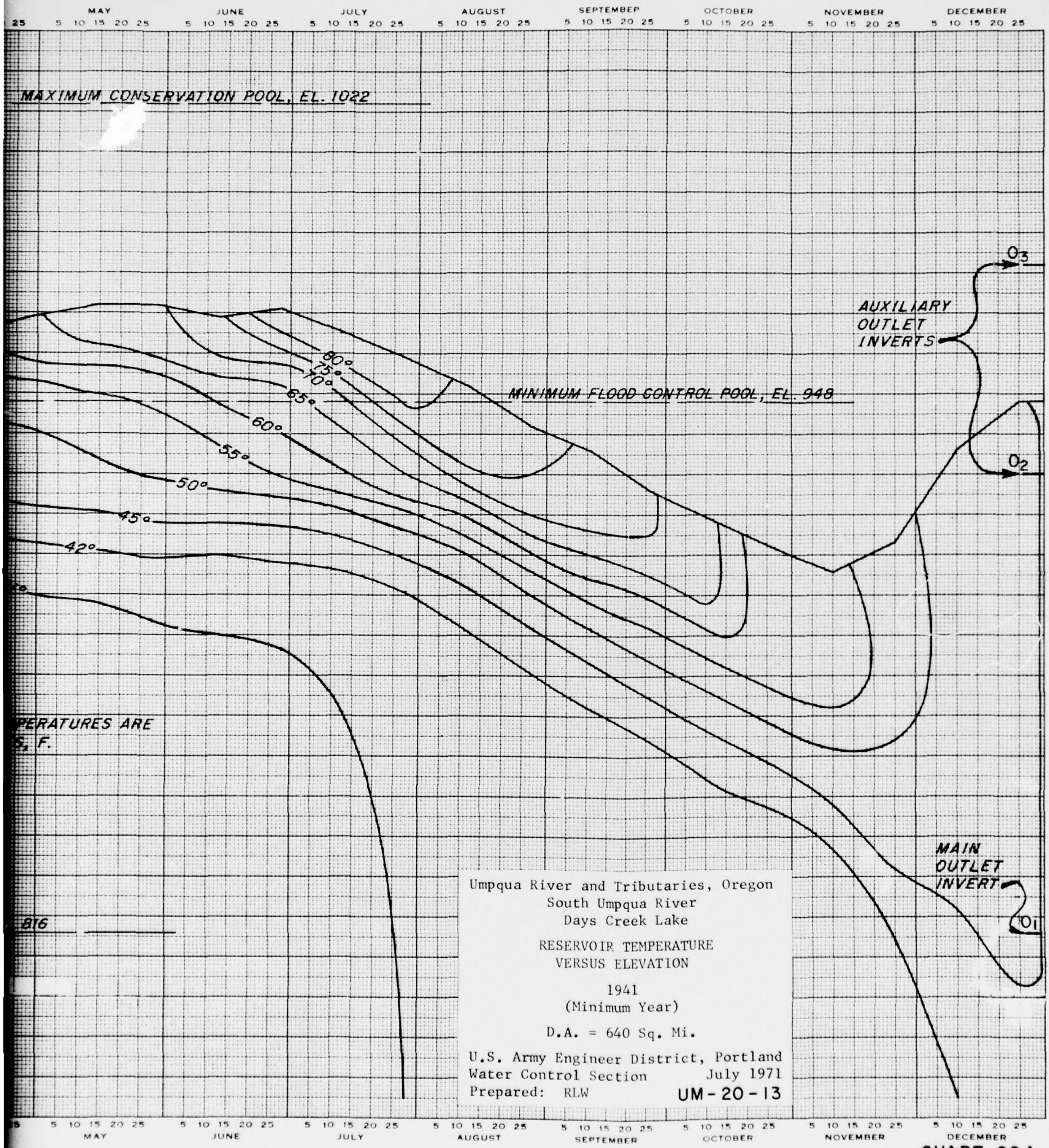
UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
AT
ROSEBURG, OREGON
AIR TEMPERATURES
U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MARCH 1964
PREPARED: S.N.

CHART 21



Umpqua

U.S.
Water
Prepa



Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Lake

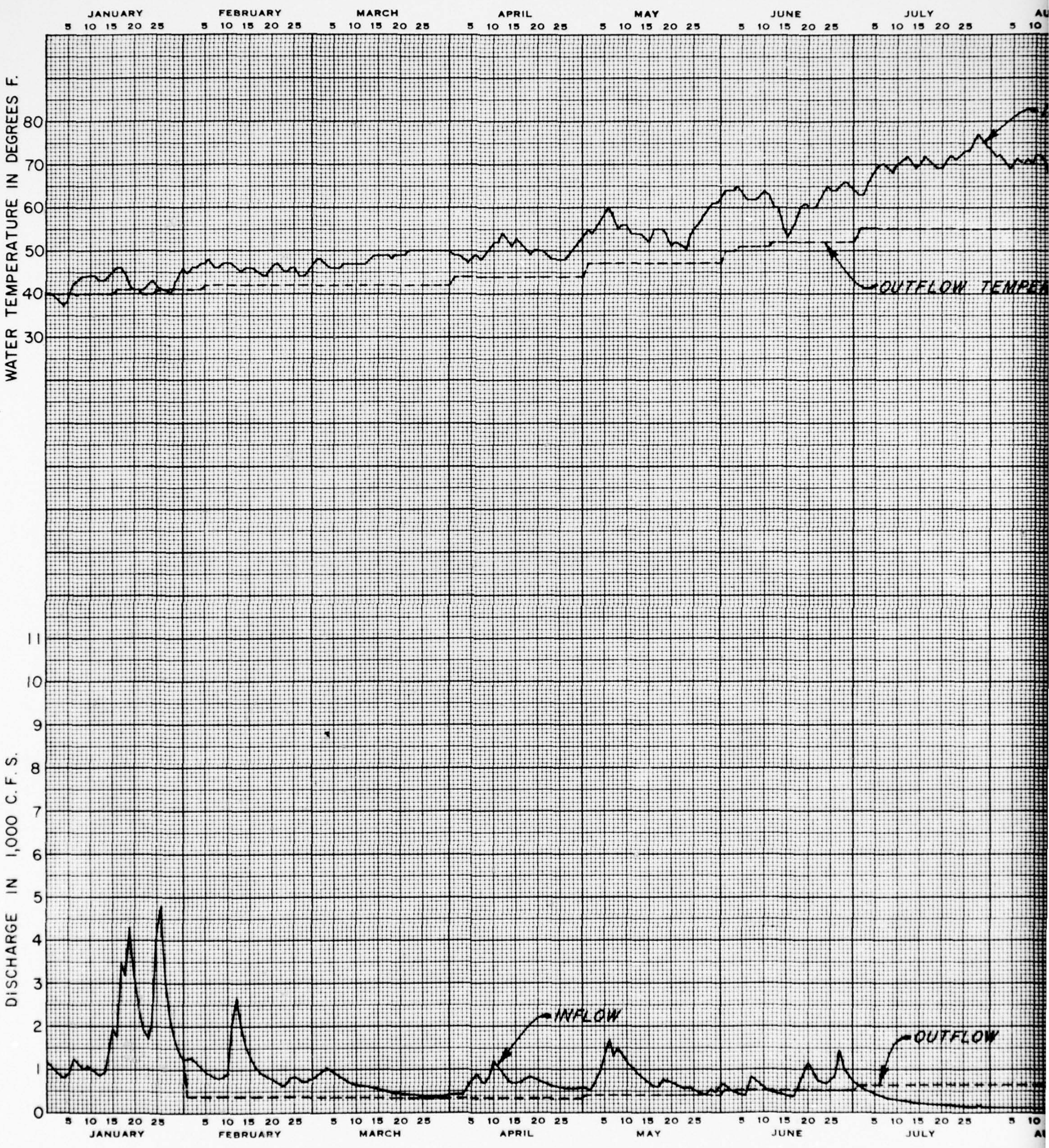
RESERVOIR TEMPERATURE
VERSUS ELEVATION

1941
(Minimum Year)

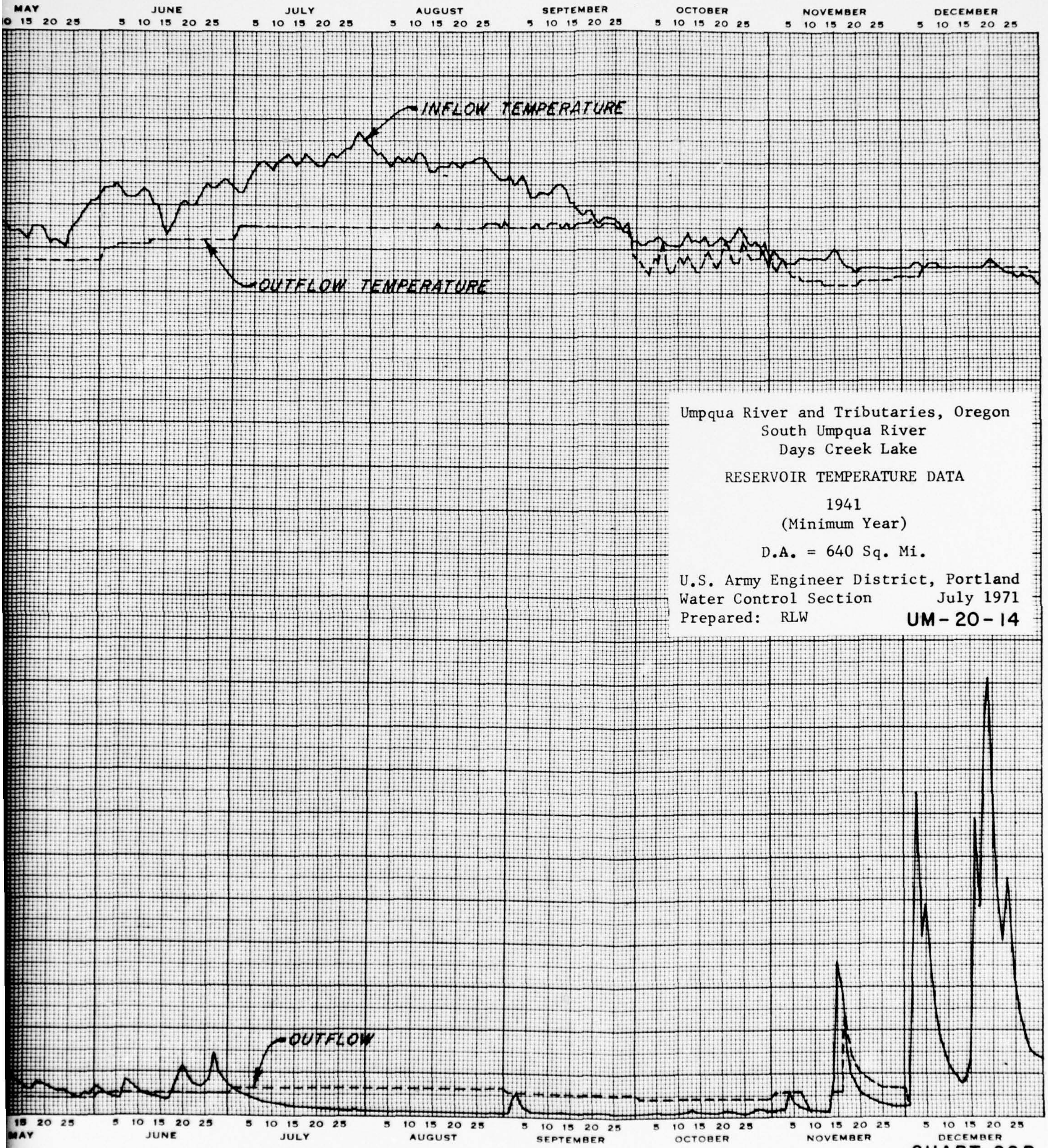
D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: RLW UM-20-13

CHART 22A



JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
5 10 15 20 25
WATER TEMPERATURE IN DEGREES F.
30
40
50
60
70
80
OUTFLOW TEMPER
DISCHARGE IN 1,000 C.F.S.
0
1
2
3
4
5
6
7
8
9
10
11
INFLOW
OUTFLOW



Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Lake

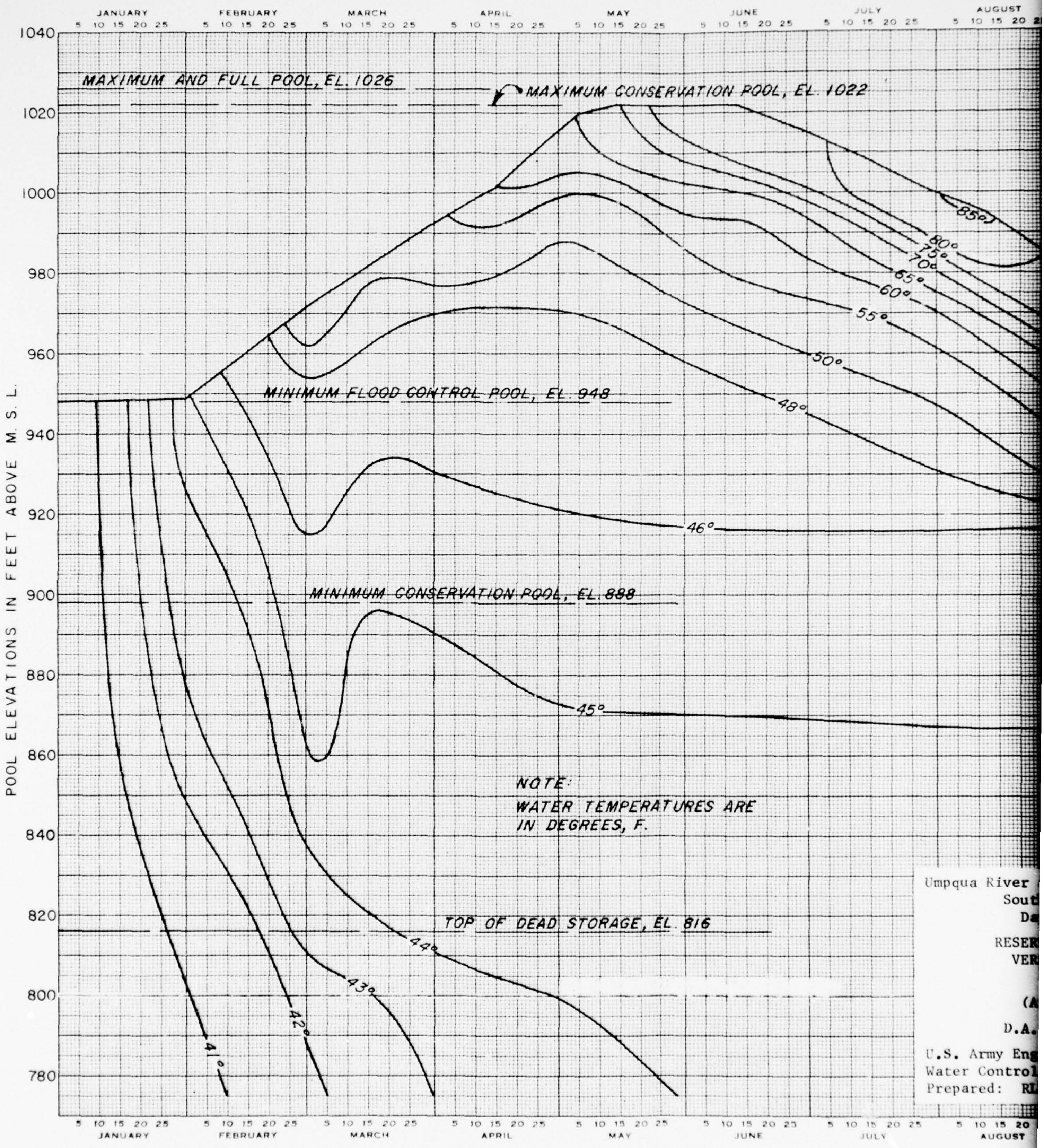
RESERVOIR TEMPERATURE DATA

1941
(Minimum Year)

D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: RLW **UM-20-14**

CHART 22B



NOTE:
WATER TEMPERATURES ARE
IN DEGREES, F.

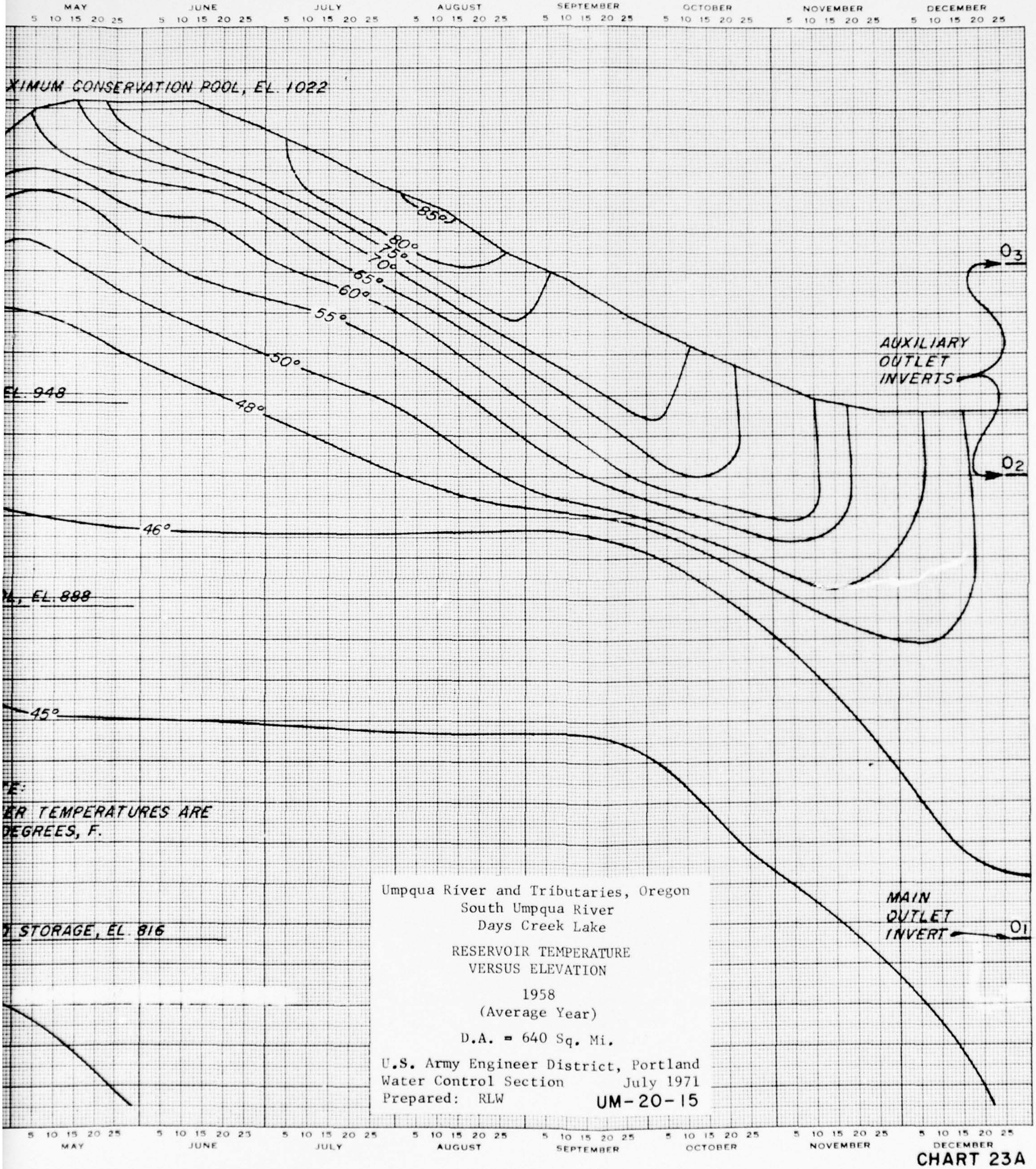
Umpqua River
Sout
Da

RESER
VER

(A

D.A.

U.S. Army Eng
Water Control
Prepared: RL



Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Lake

RESERVOIR TEMPERATURE
VERSUS ELEVATION

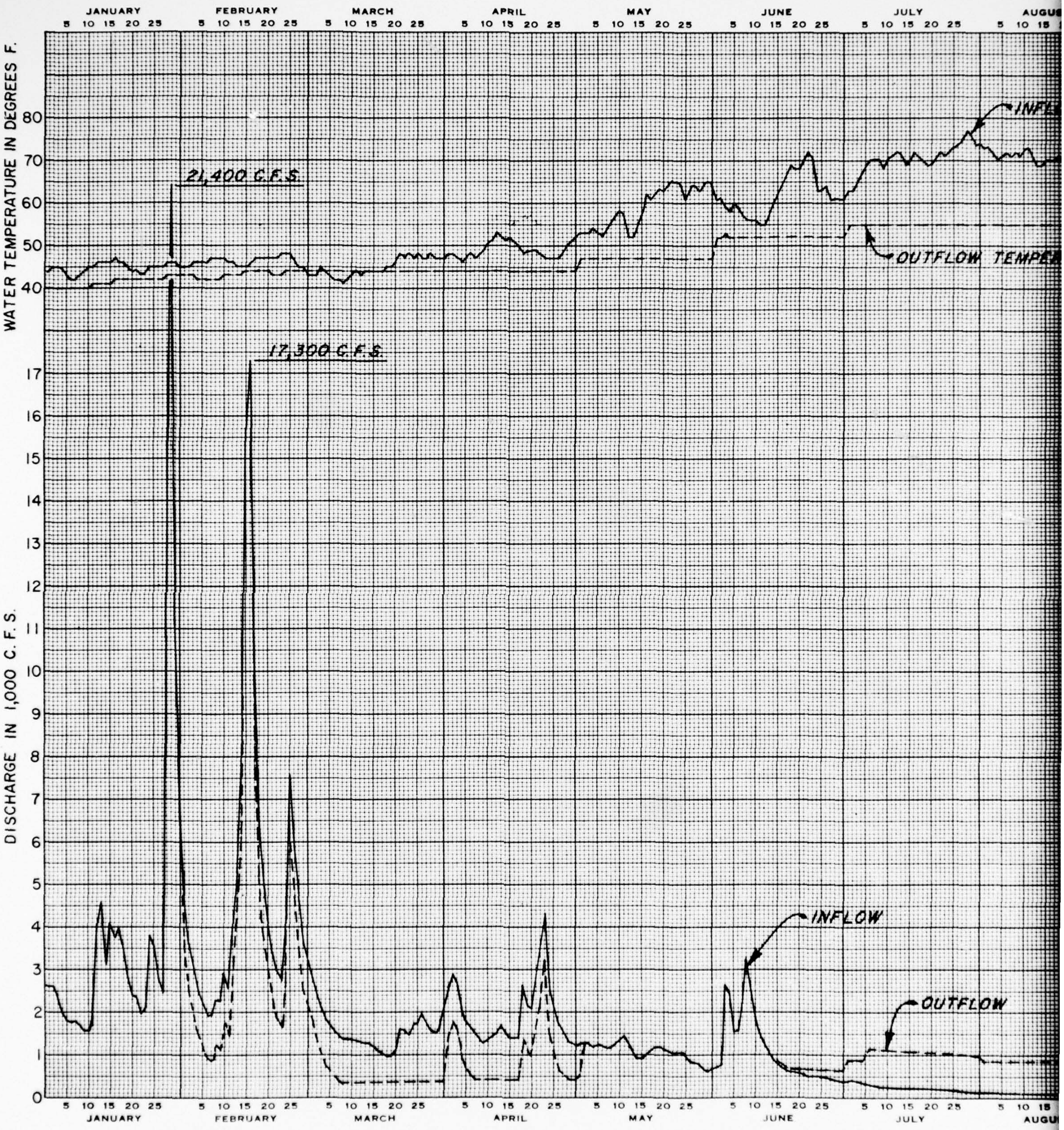
1958
(Average Year)

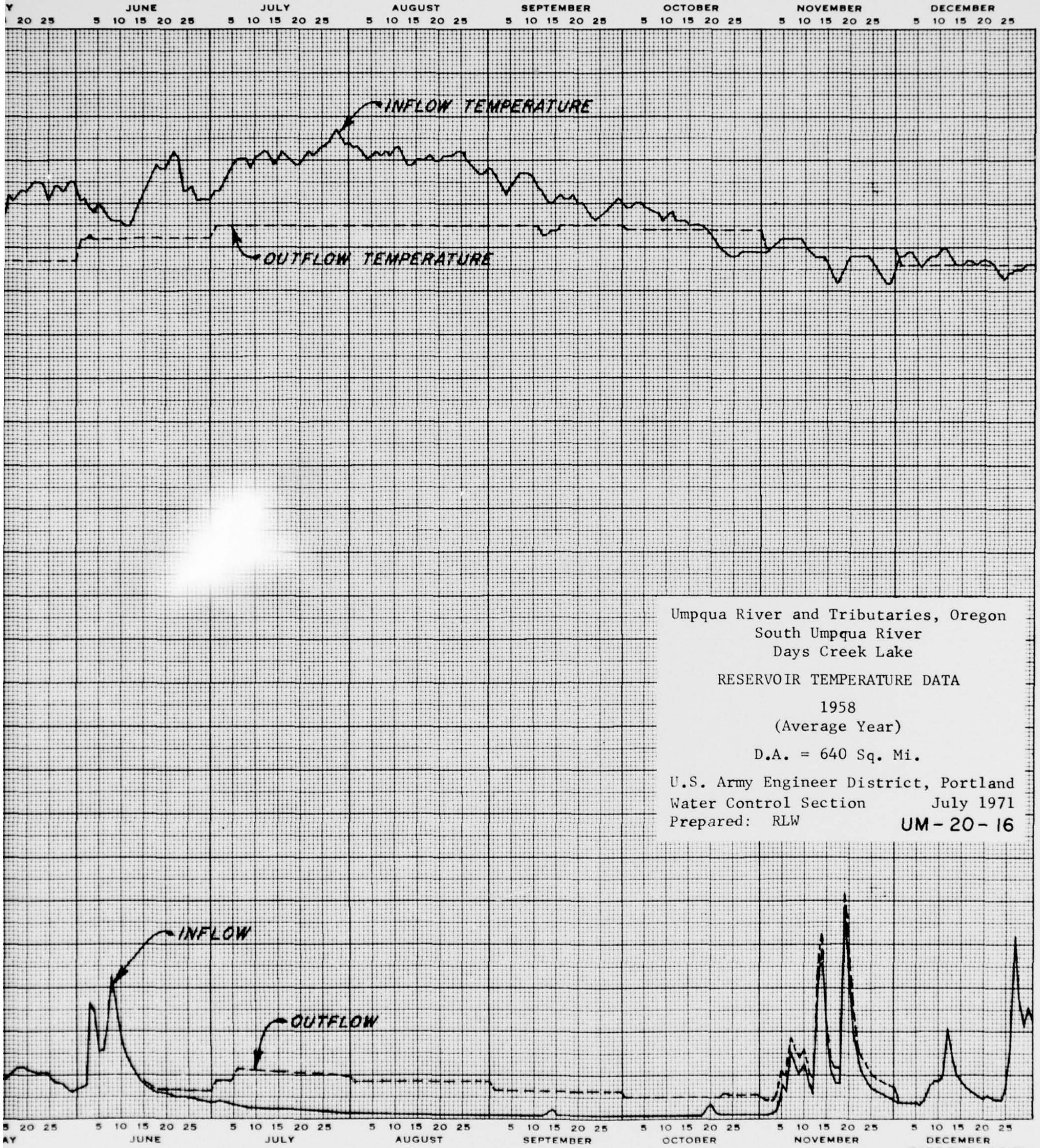
D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: RLW UM-20-15

CHART 23A

2


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGU
5 10 15 20 25
WATER TEMPERATURE IN DEGREES F.
80
70
60
50
40
21,400 C.F.S.
17,300 C.F.S.
INFL
OUTFLOW TEMPE
DISCHARGE IN 1,000 C.F.S.
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
INFLOW
OUTFLOW



Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Lake

RESERVOIR TEMPERATURE DATA

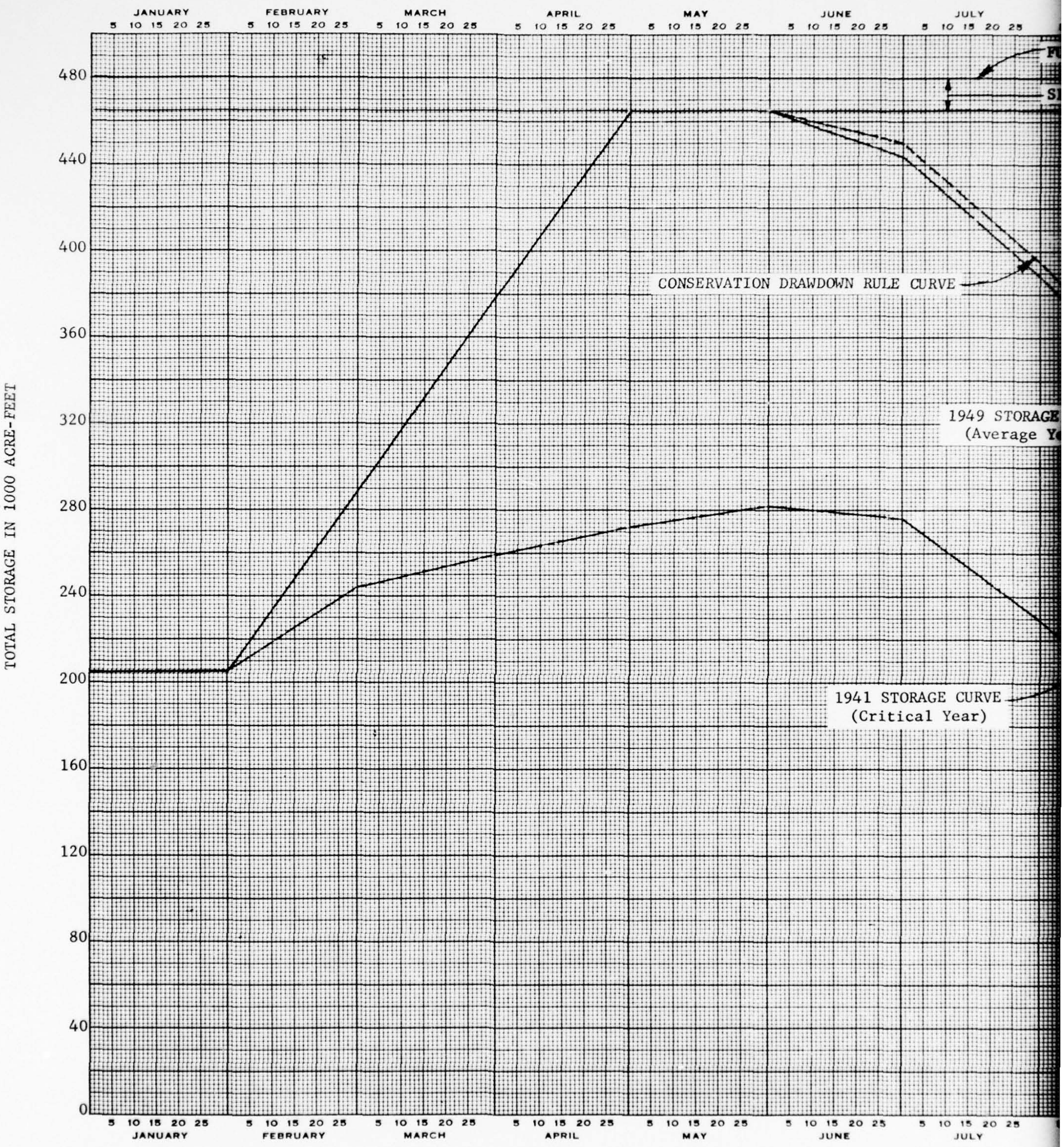
1958
(Average Year)

D.A. = 640 Sq. Mi.

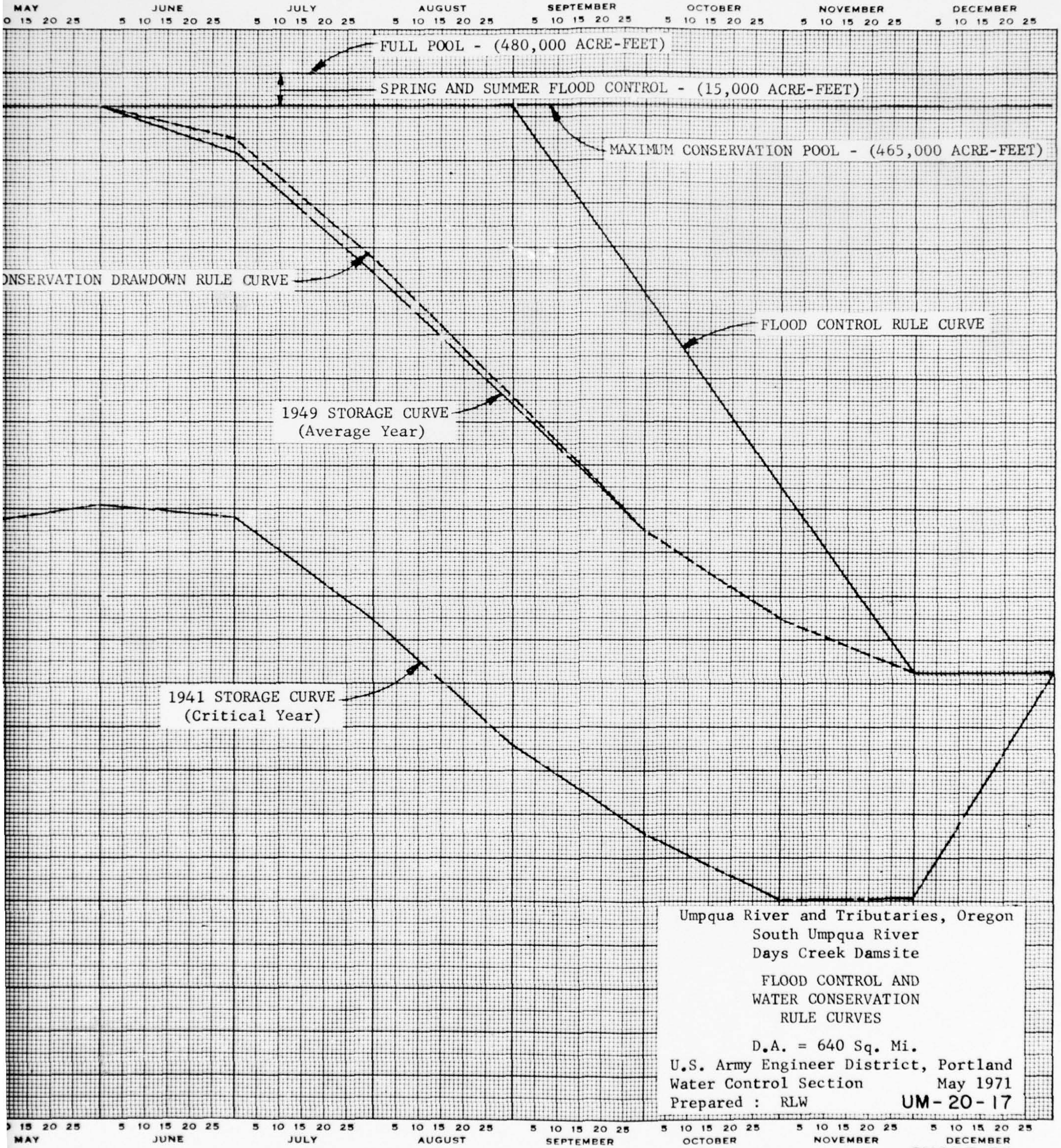
U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: RLW **UM-20-16**

CHART 23B

STATION	CHAMPION	DIAMOND CRATER	DIAMOND	NORTH UMPQUA NEAR	SILVER BURN	TRAP CREEK	WEAVER CREEK	WHALEBACK	WINDIGO PASS



					RED BUTTE	EDEN	GOLDEN		



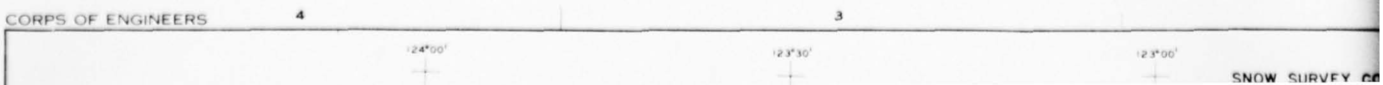
Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Damsite

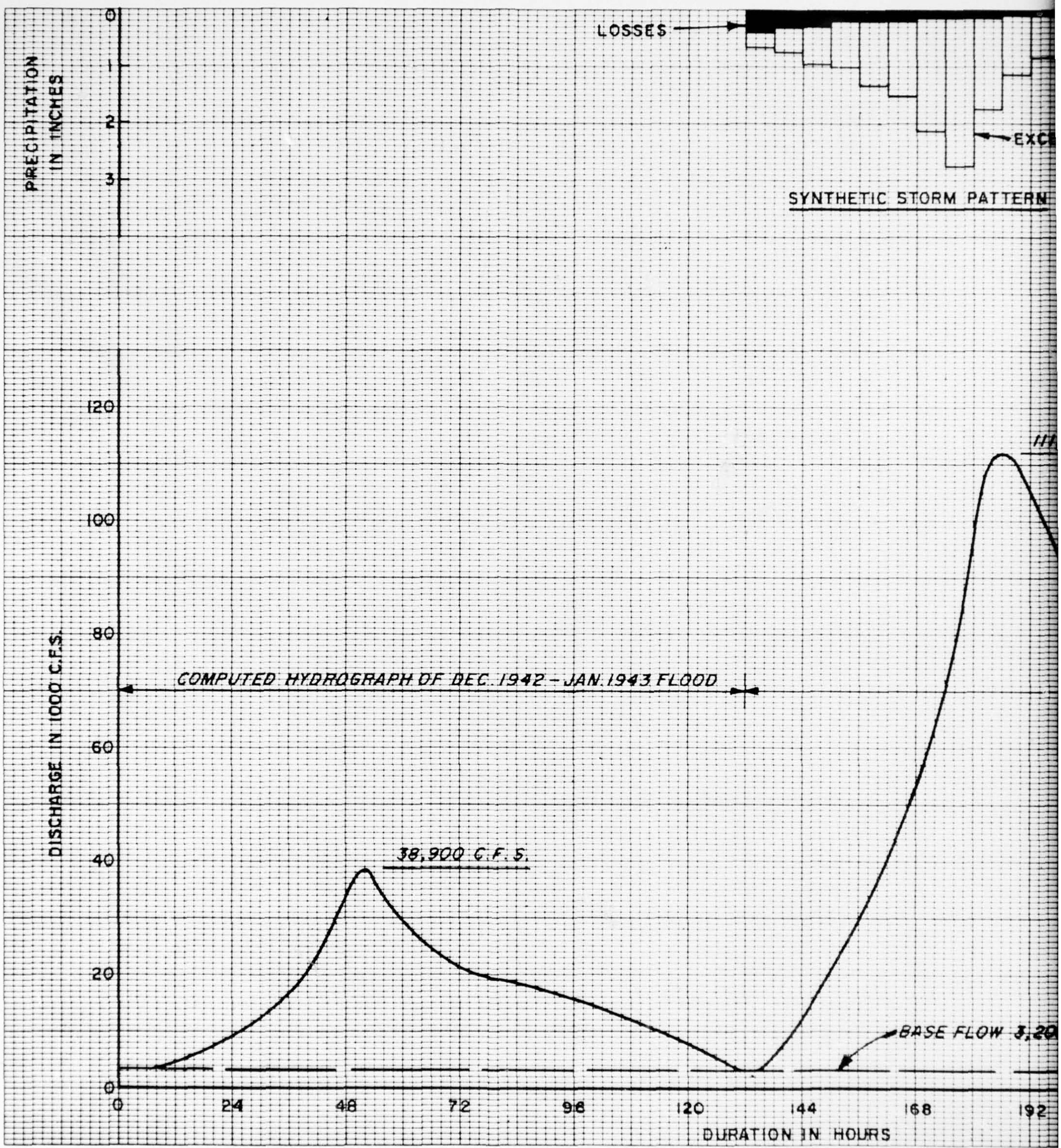
FLOOD CONTROL AND
WATER CONSERVATION
RULE CURVES

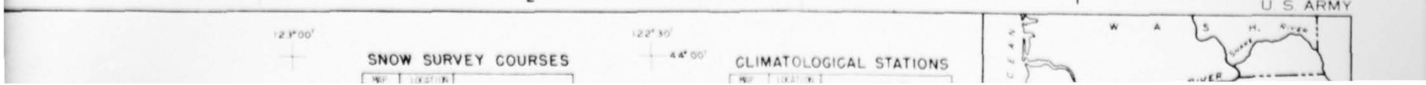
D.A. = 640 Sq. Mi.
U.S. Army Engineer District, Portland
Water Control Section May 1971
Prepared : RLW **UM-20-17**

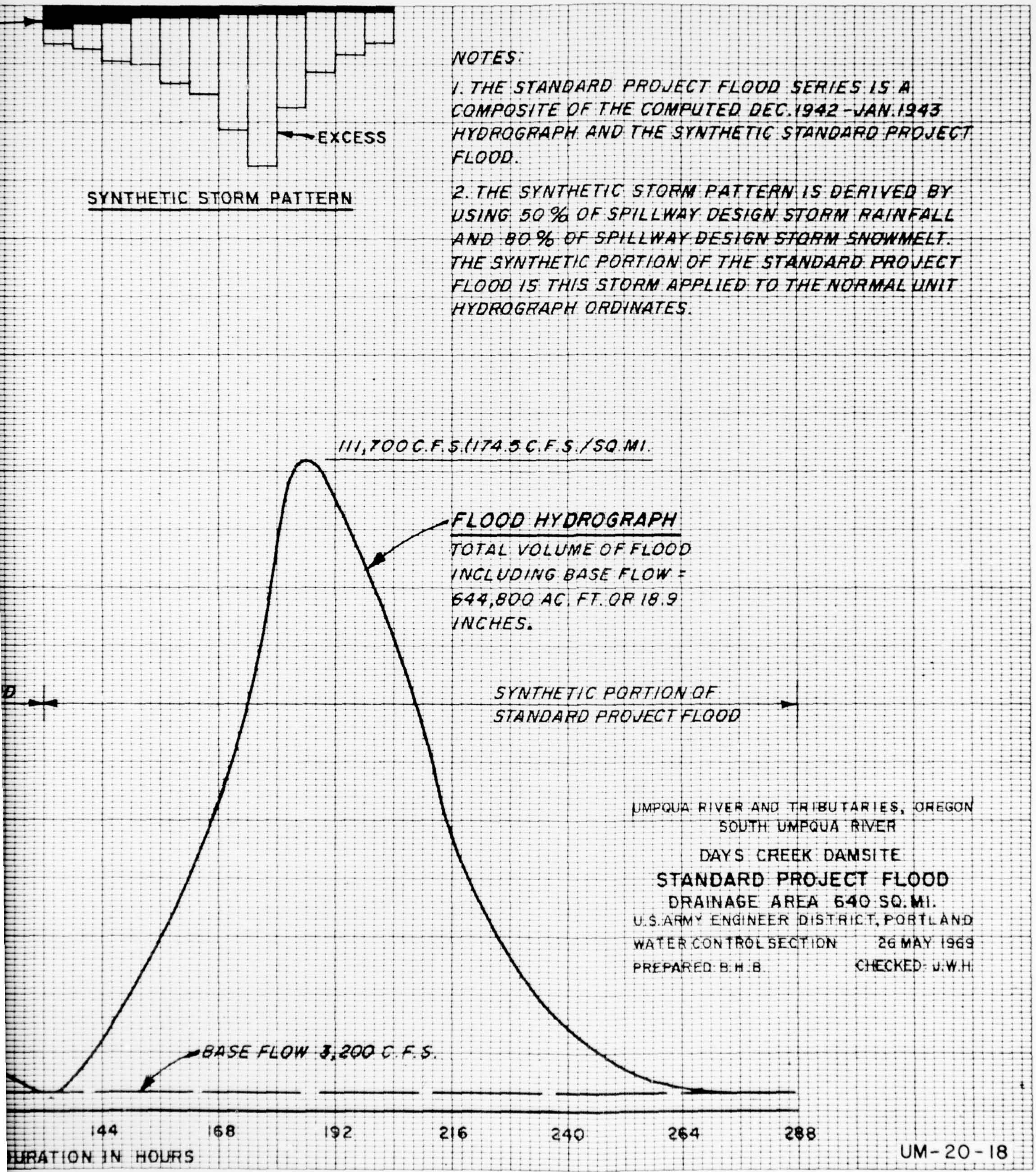
CHART 24

2




PRECIPITATION IN INCHES
0
1
2
3
LOSSES
EXC
SYNTHETIC STORM PATTERN
DISCHARGE IN 1000 C.F.S.
120
100
80
60
40
20
0
111
COMPUTED HYDROGRAPH OF DEC. 1942 - JAN. 1943 FLOOD
38,900 C.F.S.
BASE FLOW 3,20
0
24
48
72
96
120
144
168
192
DURATION IN HOURS


2
1
U. S. ARMY
123°00'
122°30'
44°00'
SNOW SURVEY COURSES
CLIMATOLOGICAL STATIONS
W
A
S
H.
RIVER



NOTES:

1. THE STANDARD PROJECT FLOOD SERIES IS A COMPOSITE OF THE COMPUTED DEC. 1942 - JAN. 1943 HYDROGRAPH AND THE SYNTHETIC STANDARD PROJECT FLOOD.

2. THE SYNTHETIC STORM PATTERN IS DERIVED BY USING 50% OF SPILLWAY DESIGN STORM RAINFALL AND 80% OF SPILLWAY DESIGN STORM SNOWMELT. THE SYNTHETIC PORTION OF THE STANDARD PROJECT FLOOD IS THIS STORM APPLIED TO THE NORMAL UNIT HYDROGRAPH ORDINATES.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER

DAYS CREEK DAMSITE

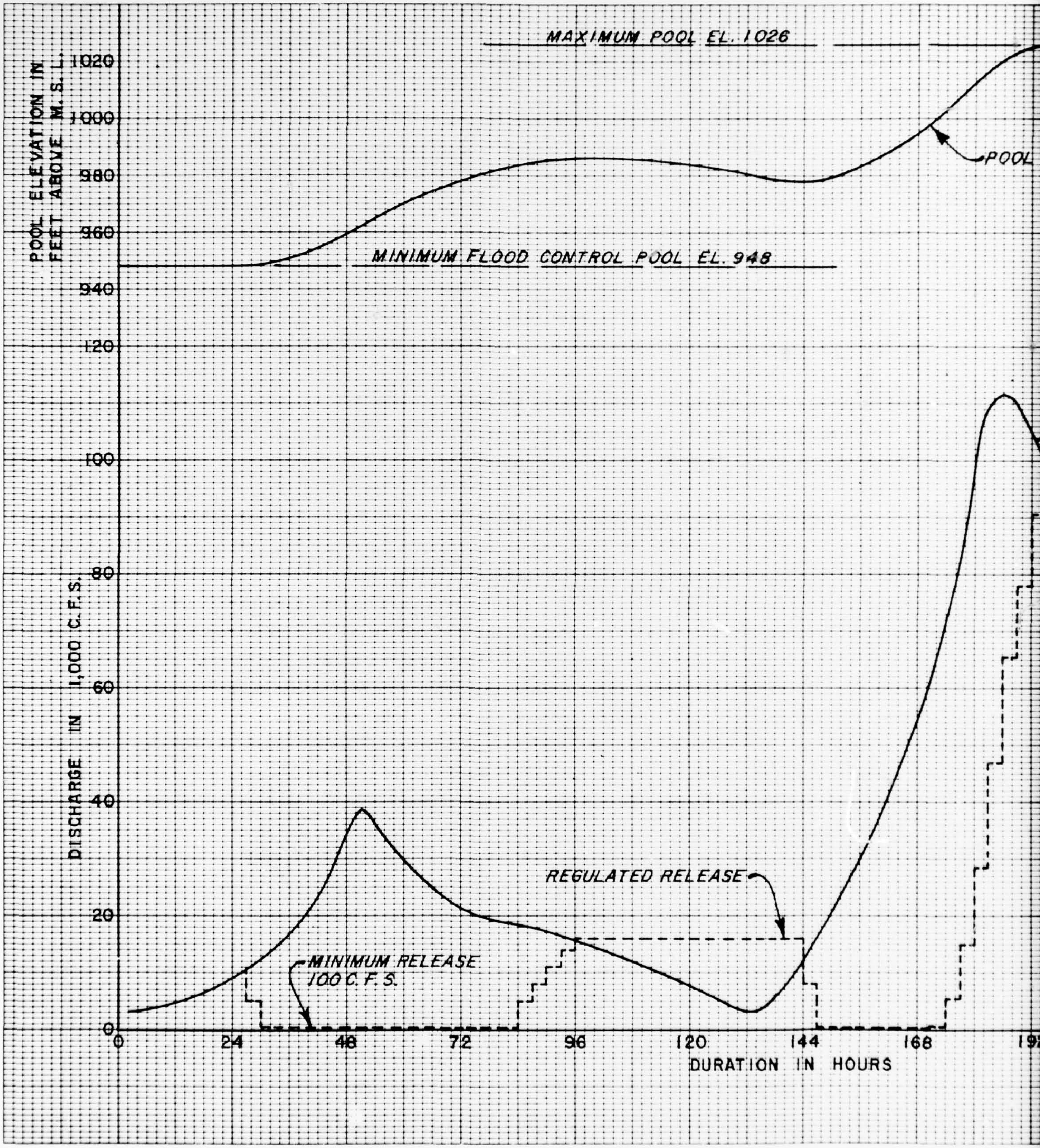
STANDARD PROJECT FLOOD

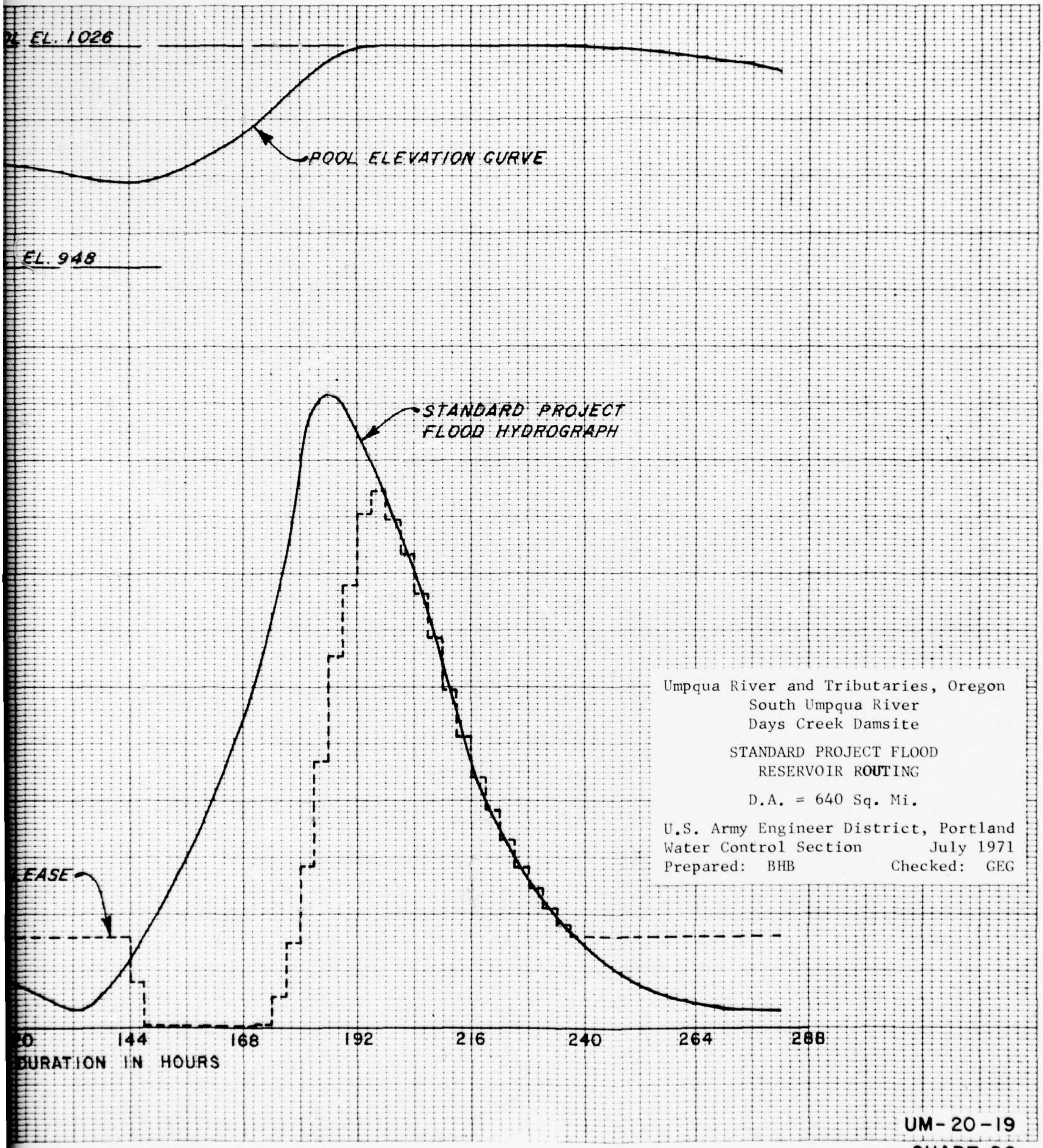
DRAINAGE AREA 640 SQ. MI.

U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION 26 MAY 1969
PREPARED B.H.B. CHECKED J.W.H.

UM-20-18
CHART 25

2


MAXIMUM POOL EL. 1026
MINIMUM FLOOD CONTROL POOL EL. 948
POOL
POOL ELEVATION IN FEET ABOVE M. S. L.
1020
1000
980
960
940
120
100
80
60
40
20
0
DISCHARGE IN 1,000 C.F.S.
REGULATED RELEASE
MINIMUM RELEASE 100 C.F.S.
0
24
48
72
96
120
144
168
DURATION IN HOURS



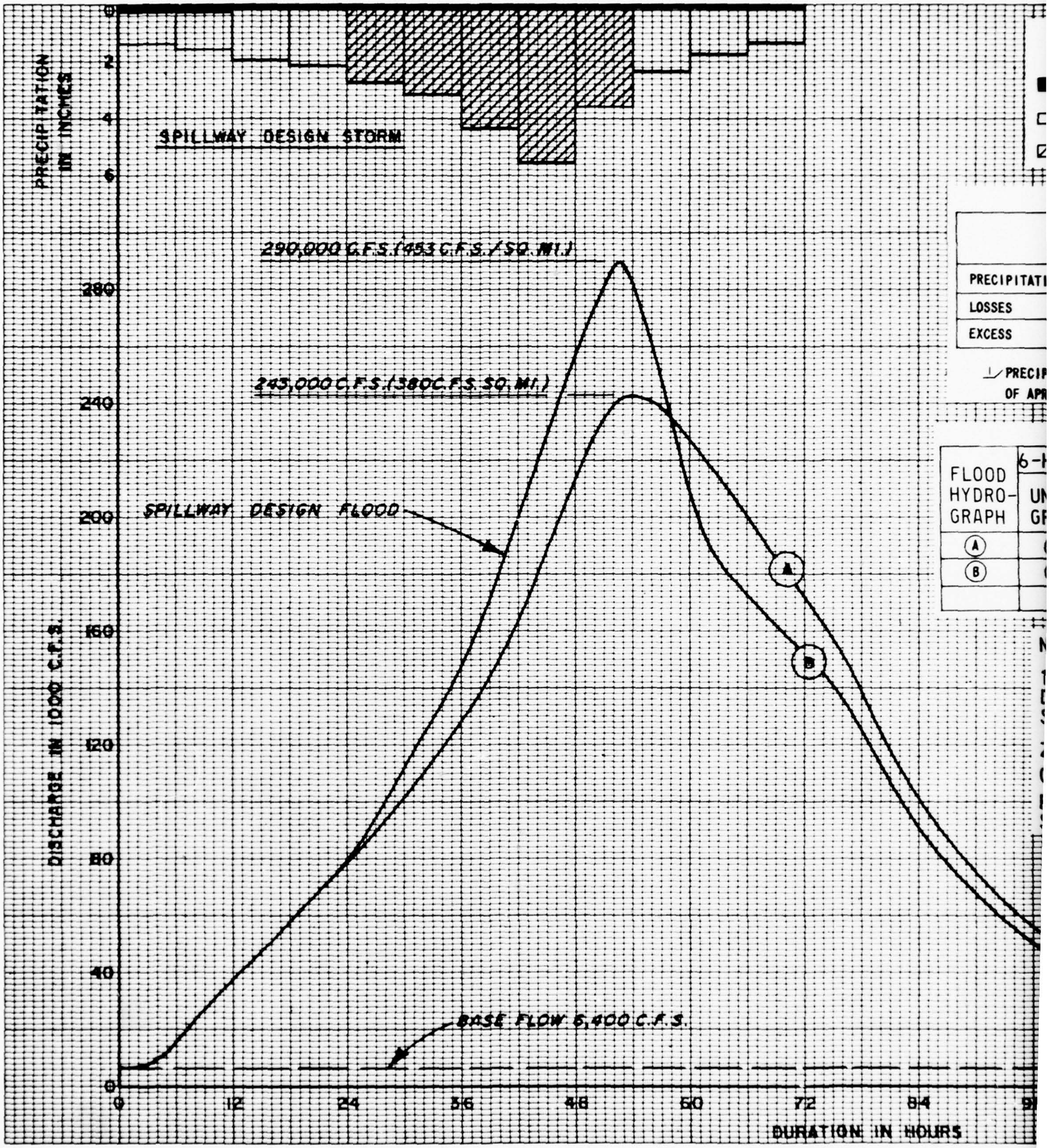
Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Damsite

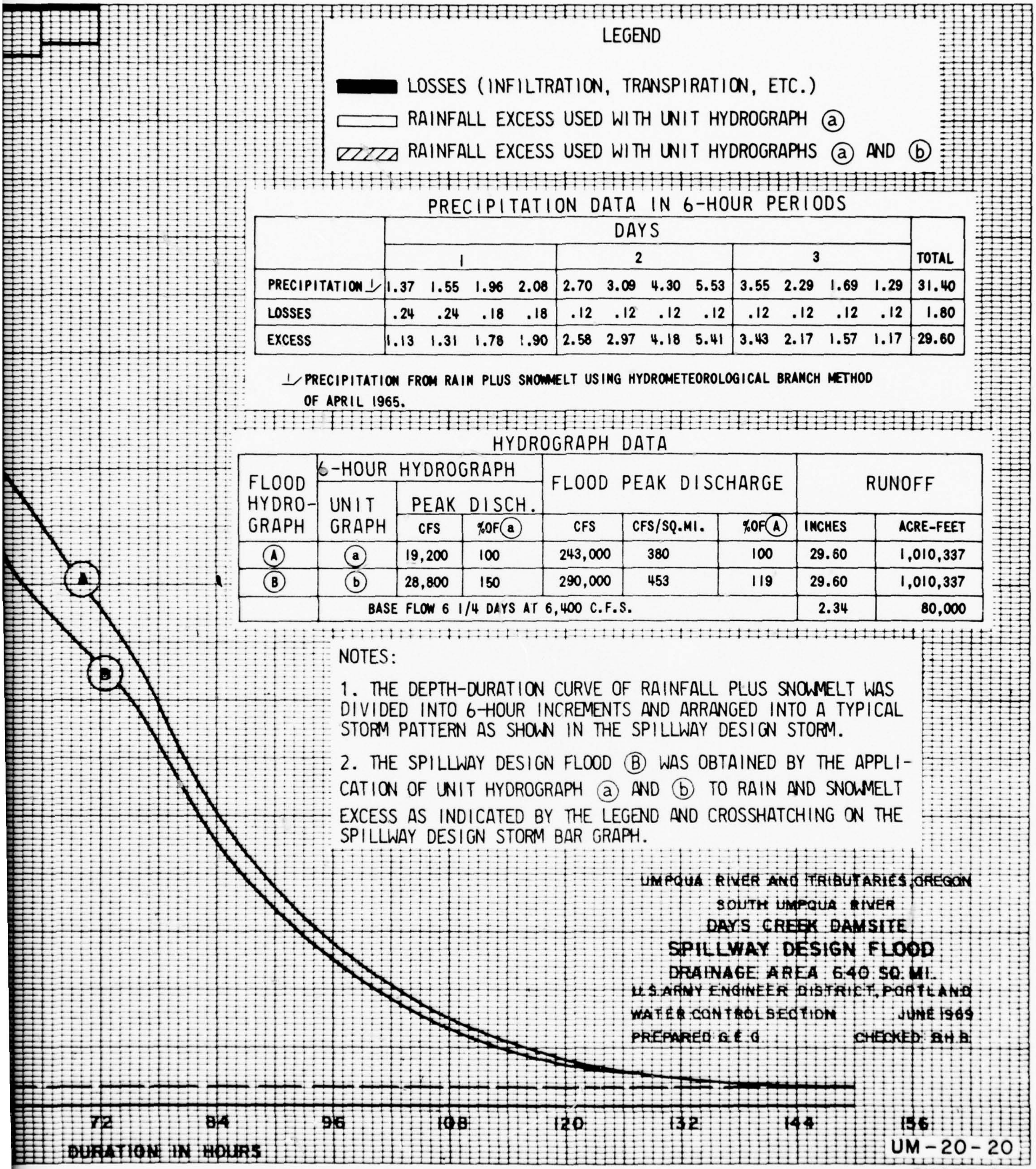
STANDARD PROJECT FLOOD
RESERVOIR ROUTING

D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: BHB Checked: GEG

UM-20-19
CHART 26


PRECIPITATION IN INCHES
0
2
4
6
SPILLWAY DESIGN STORM
290,000 C.F.S. (453 C.F.S./SQ. MI.)
243,000 C.F.S. (380 C.F.S. SQ. MI.)
SPILLWAY DESIGN FLOOD
BASE FLOW 6,400 C.F.S.
DISCHARGE IN 1000 C.F.S.
0
40
80
120
160
200
240
280
A
B
0
12
24
36
48
60
72
84
DURATION IN HOURS
PRECIPITATI
LOSSES
EXCESS
PRECIP
OF APR
FLOOD HYDRO-GRAPH
6-H
UN GR
A
B



LEGEND

■ LOSSES (INFILTRATION, TRANSPIRATION, ETC.)

☐ RAINFALL EXCESS USED WITH UNIT HYDROGRAPH ⓐ

▨ RAINFALL EXCESS USED WITH UNIT HYDROGRAPHS ⓐ AND ⓑ

PRECIPITATION DATA IN 6-HOUR PERIODS

	DAYS												TOTAL
	1				2				3				
PRECIPITATION [1]	1.37	1.55	1.96	2.08	2.70	3.09	4.30	5.53	3.55	2.29	1.69	1.29	31.40
LOSSES	.24	.24	.18	.18	.12	.12	.12	.12	.12	.12	.12	.12	1.80
EXCESS	1.13	1.31	1.78	1.90	2.58	2.97	4.18	5.41	3.43	2.17	1.57	1.17	29.60

[1] PRECIPITATION FROM RAIN PLUS SNOWMELT USING HYDROMETEOROLOGICAL BRANCH METHOD OF APRIL 1965.

HYDROGRAPH DATA

FLOOD HYDRO-GRAPH	6-HOUR HYDROGRAPH			FLOOD PEAK DISCHARGE			RUNOFF	
	UNIT GRAPH	PEAK DISCH.						
		CFS	%OF ⓐ	CFS	CFS/SQ.MI.	%OF Ⓐ	INCHES	ACRE-FEET
Ⓐ	ⓐ	19,200	100	243,000	380	100	29.60	1,010,337
Ⓑ	ⓑ	28,800	150	290,000	453	119	29.60	1,010,337
	BASE FLOW 6 1/4 DAYS AT 6,400 C.F.S.						2.34	80,000

NOTES:

1. THE DEPTH-DURATION CURVE OF RAINFALL PLUS SNOWMELT WAS DIVIDED INTO 6-HOUR INCREMENTS AND ARRANGED INTO A TYPICAL STORM PATTERN AS SHOWN IN THE SPILLWAY DESIGN STORM.

2. THE SPILLWAY DESIGN FLOOD Ⓑ WAS OBTAINED BY THE APPLICATION OF UNIT HYDROGRAPH ⓐ AND ⓑ TO RAIN AND SNOWMELT EXCESS AS INDICATED BY THE LEGEND AND CROSSHATCHING ON THE SPILLWAY DESIGN STORM BAR GRAPH.

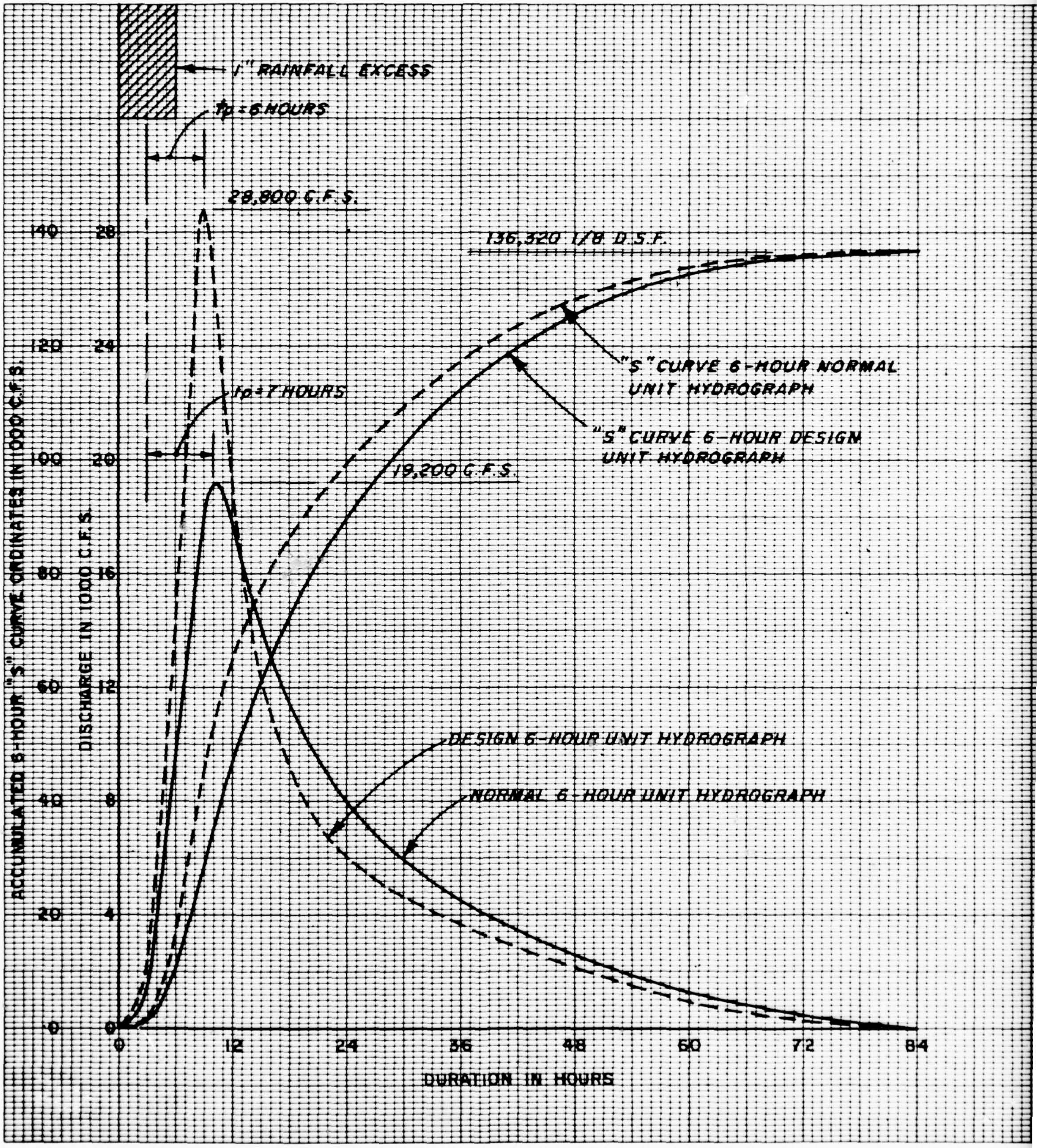
UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK DAMSITE

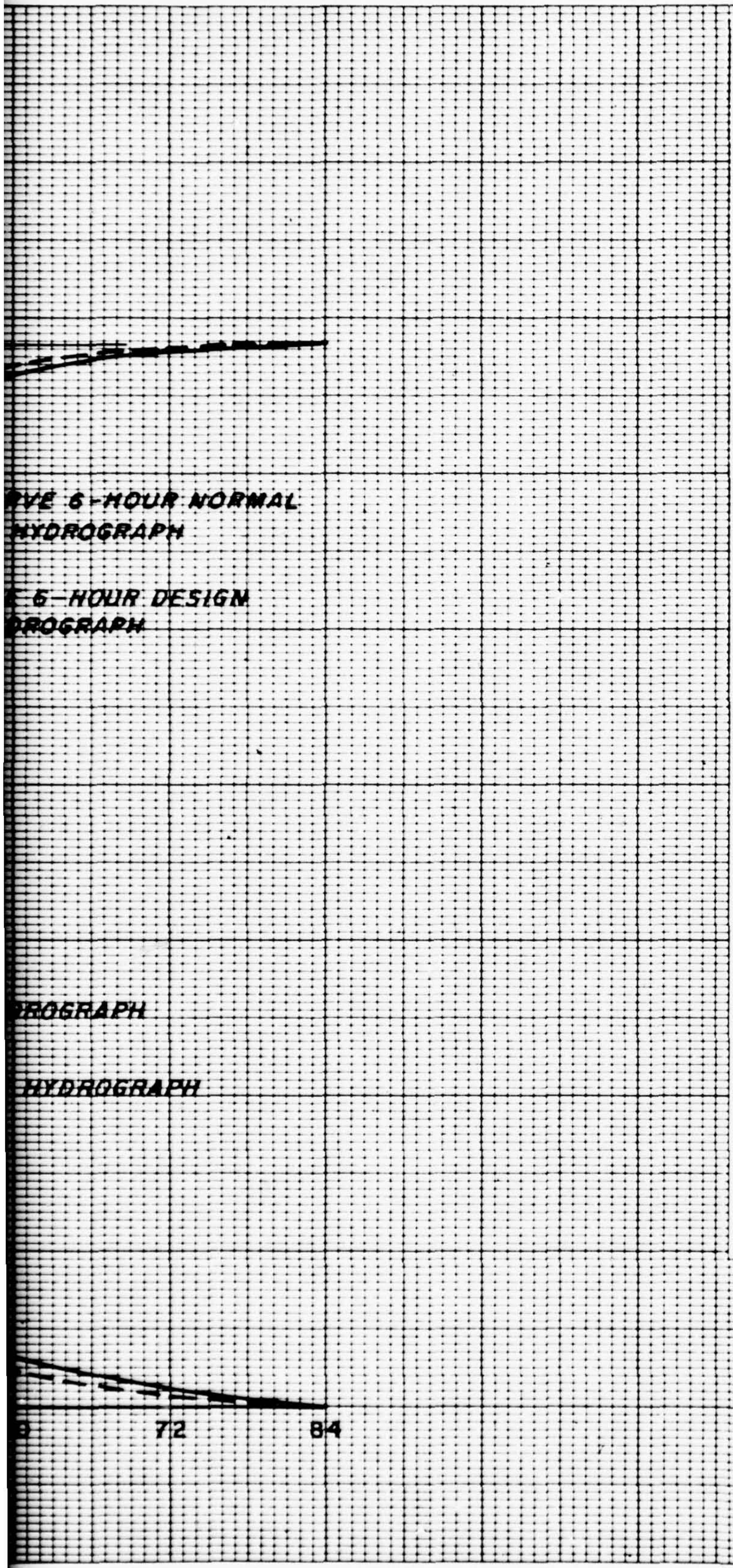
SPILLWAY DESIGN FLOOD

DRAINAGE AREA 640 SQ. MI.
U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION JUNE 1969
PREPARED G.E.G. CHECKED B.H.B.

UM-20-20

CHART 27


1" RAINFALL EXCESS
tp=6 HOURS
28,800 C.F.S.
136,320 1/8 D.S.F.
"S" CURVE 6-HOUR NORMAL UNIT HYDROGRAPH
tp=7 HOURS
"S" CURVE 6-HOUR DESIGN UNIT HYDROGRAPH
19,200 C.F.S.
DESIGN 6-HOUR UNIT HYDROGRAPH
NORMAL 6-HOUR UNIT HYDROGRAPH
ACCUMULATED 6-HOUR "S" CURVE ORDINATES IN 1000 C.F.S.
DISCHARGE IN 1000 C.F.S.
140
120
100
80
60
40
20
0
28
24
20
16
12
8
4
0
0
12
24
36
48
60
72
84
DURATION IN HOURS



TIME IN HOURS	6-HOUR UNIT HYDROGRAPH ORDINATES IN C.F.S.	
	NORMAL	DESIGN
0	0	0
3	1,800	2,600
6	9,800	14,100
9	18,000	28,800
12	17,800	19,400
15	14,100	12,400
18	11,300	9,100
21	9,400	7,200
24	7,900	6,100
27	6,800	5,200
30	6,000	4,700
33	5,200	4,100
36	4,500	3,700
39	4,000	3,300
42	3,500	2,900
45	3,000	2,500
48	2,600	2,100
51	2,220	1,900
54	1,900	1,500
57	1,600	1,300
60	1,300	950
63	1,000	750
66	800	600
69	700	400
72	500	350
75	300	200
78	200	100
81	100	70
84	0	0

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK DAMSITE

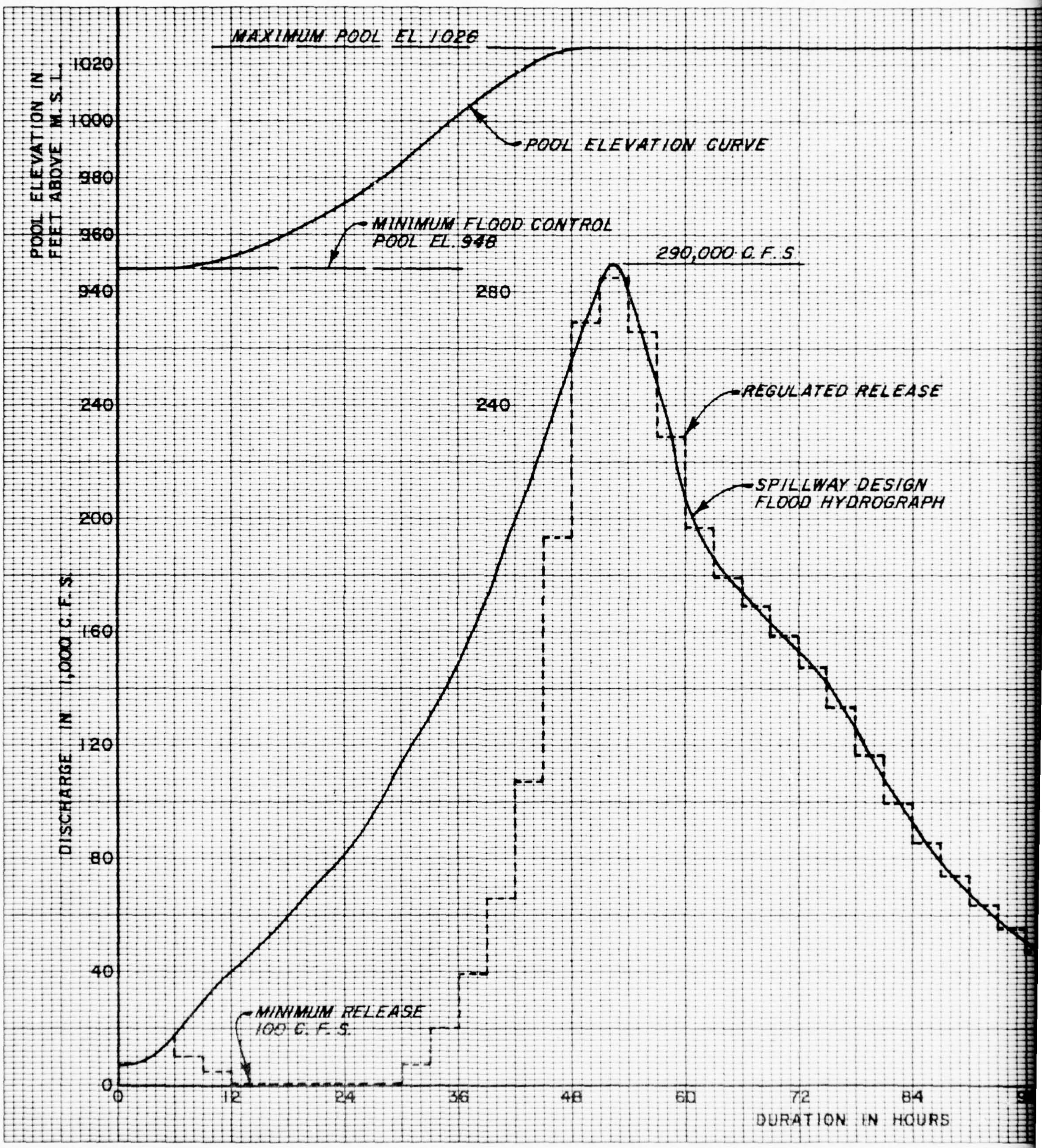
6-HOUR UNIT HYDROGRAPHS

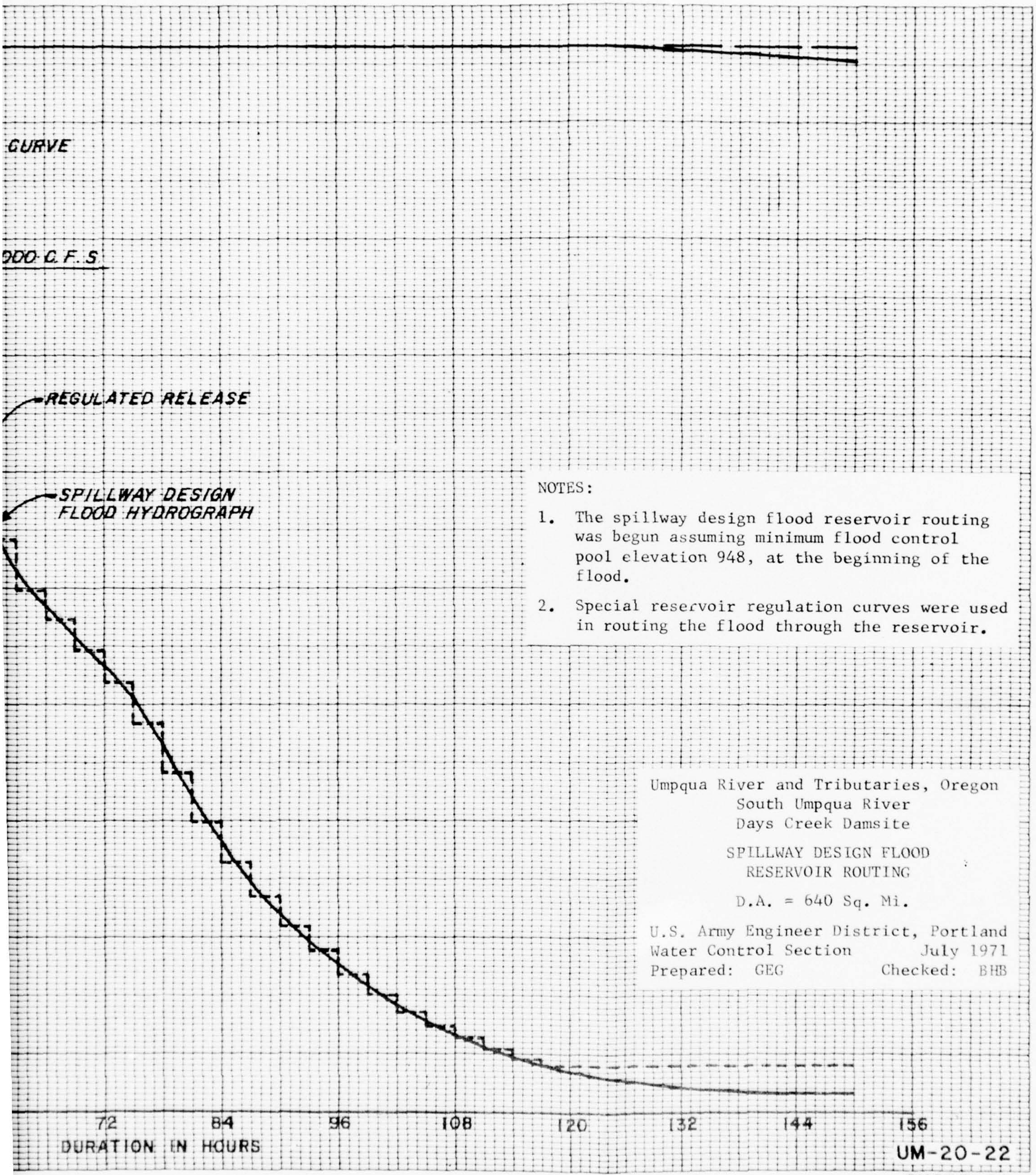
DRAINAGE AREA 640 SQ.MI.
U.S.ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION MAY 1969
PREPARED G.E.G., J.W.H.
CHECKED J.W.H.

UM-20-21

CHART 28

2


MAXIMUM POOL EL. 1026
POOL ELEVATION CURVE
MINIMUM FLOOD CONTROL POOL EL. 948
290,000 C.F.S
REGULATED RELEASE
SPILLWAY DESIGN FLOOD HYDROGRAPH
MINIMUM RELEASE 100 C.F.S.
POOL ELEVATION IN FEET ABOVE M.S.L.
1020
1000
980
960
940
280
240
200
160
120
80
40
0
DISCHARGE IN 1,000 C.F.S.
0
12
24
36
48
60
72
84
DURATION IN HOURS



NOTES:

1. The spillway design flood reservoir routing was begun assuming minimum flood control pool elevation 948, at the beginning of the flood.
2. Special reservoir regulation curves were used in routing the flood through the reservoir.

Umpqua River and Tributaries, Oregon
South Umpqua River
Days Creek Damsite

SPILLWAY DESIGN FLOOD
RESERVOIR ROUTING

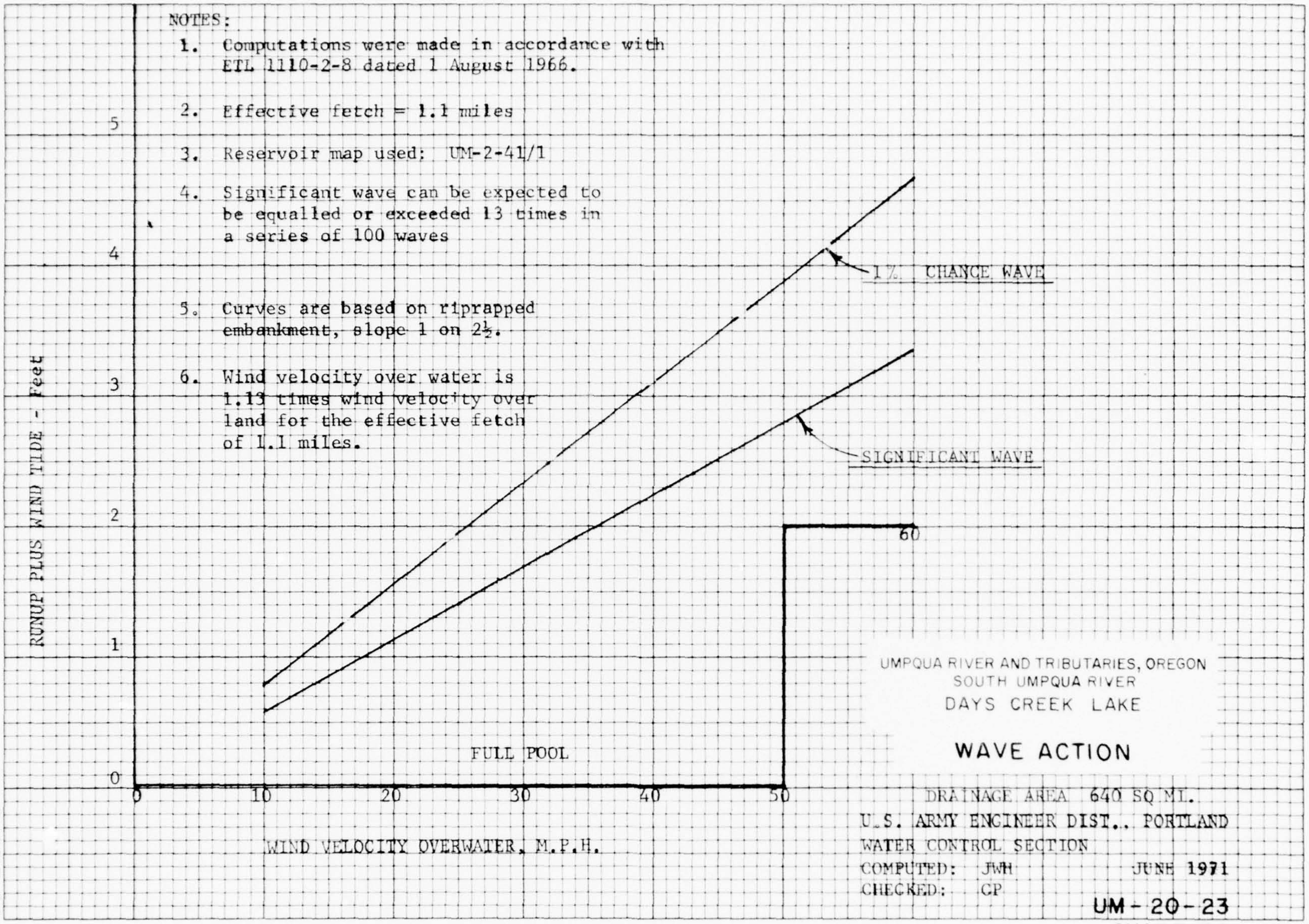
D.A. = 640 Sq. Mi.

U.S. Army Engineer District, Portland
Water Control Section July 1971
Prepared: GEG Checked: BHB

UM-20-22

CHART 29

2



NOTES:

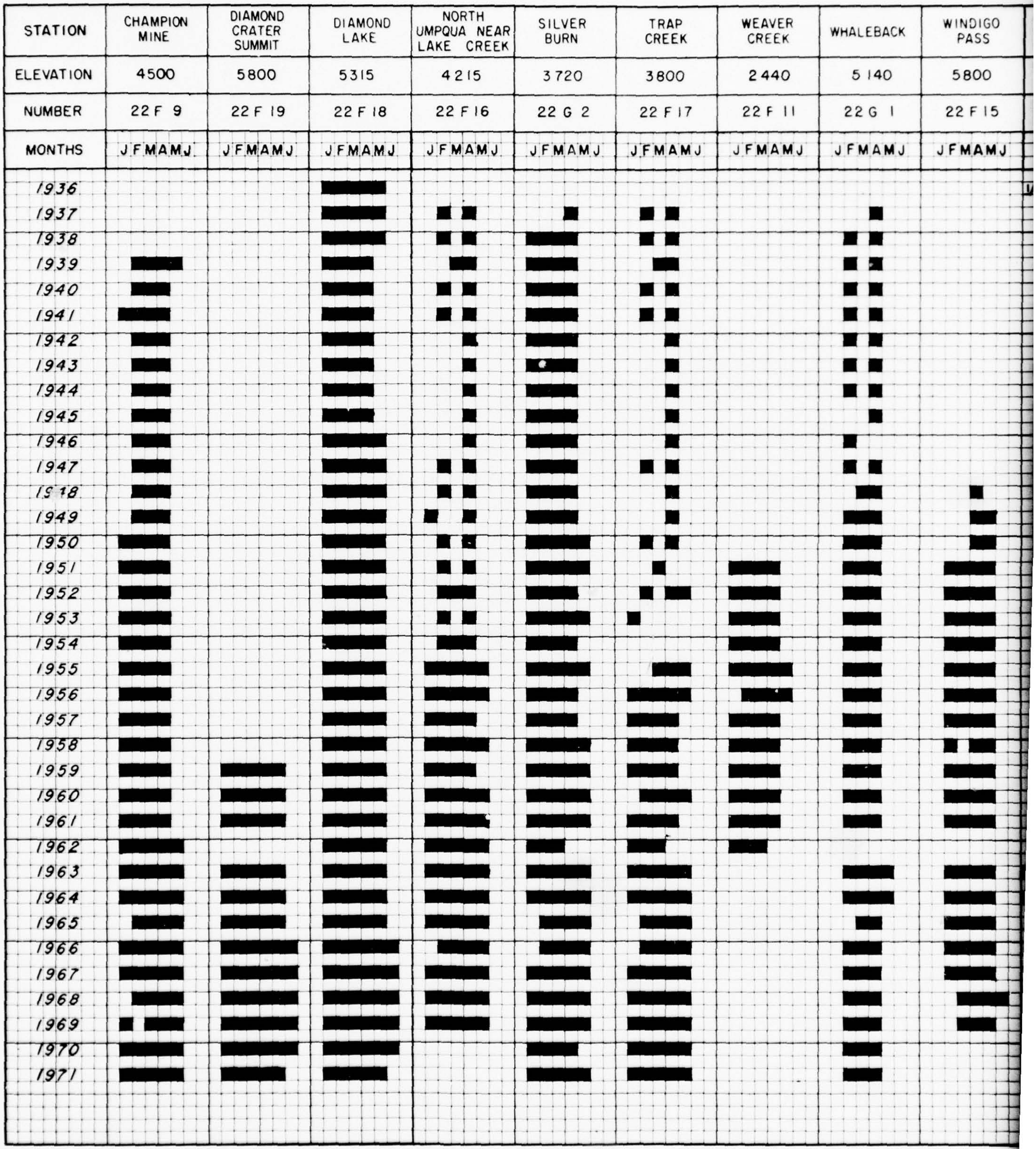
1. Computations were made in accordance with ETL 1110-2-8 dated 1 August 1966.
2. Effective fetch = 1.1 miles
3. Reservoir map used: UM-2-41/1
4. Significant wave can be expected to be equalled or exceeded 13 times in a series of 100 waves
5. Curves are based on riprapped embankment, slope 1 on 2½.
6. Wind velocity over water is 1.13 times wind velocity over land for the effective fetch of 1.1 miles.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK LAKE

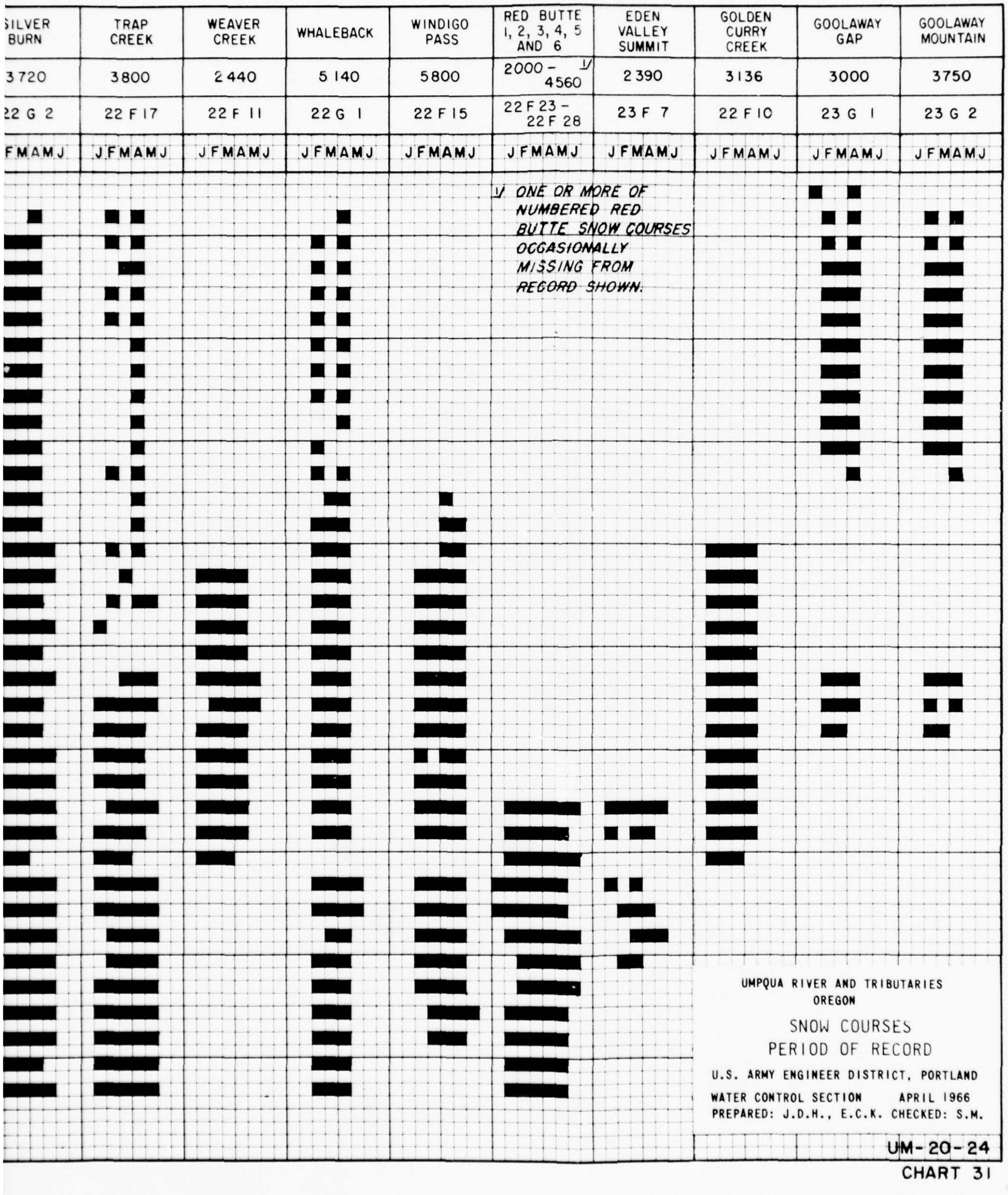
WAVE ACTION

DRAINAGE AREA 640 SQ MI.
U.S. ARMY ENGINEER DIST., PORTLAND
WATER CONTROL SECTION
COMPUTED: JWH JUNE 1971
CHECKED: CP

UM-20-23
CHART 30



STATION	CHAMPION MINE	DIAMOND CRATER SUMMIT	DIAMOND LAKE	NORTH UMPQUA NEAR LAKE CREEK	SILVER BURN	TRAP CREEK	WEAVER CREEK	WHALEBACK	WINDIGO PASS
ELEVATION	4500	5800	5315	4215	3720	3800	2440	5140	5800
NUMBER	22 F 9	22 F 19	22 F 18	22 F 16	22 G 2	22 F 17	22 F 11	22 G 1	22 F 15
MONTHS	J F M A M J	J F M A M J	J F M A M J	J F M A M J	J F M A M J	J F M A M J	J F M A M J	J F M A M J	J F M A M J



1/ ONE OR MORE OF NUMBERED RED BUTTE SNOW COURSES OCCASIONALLY MISSING FROM RECORD SHOWN.

UMPQUA RIVER AND TRIBUTARIES
OREGON

SNOW COURSES
PERIOD OF RECORD

U.S. ARMY ENGINEER DISTRICT, PORTLAND
WATER CONTROL SECTION APRIL 1966
PREPARED: J.D.H., E.C.K. CHECKED: S.M.

UM-20-24

CHART 31

CORPS OF ENGINEERS

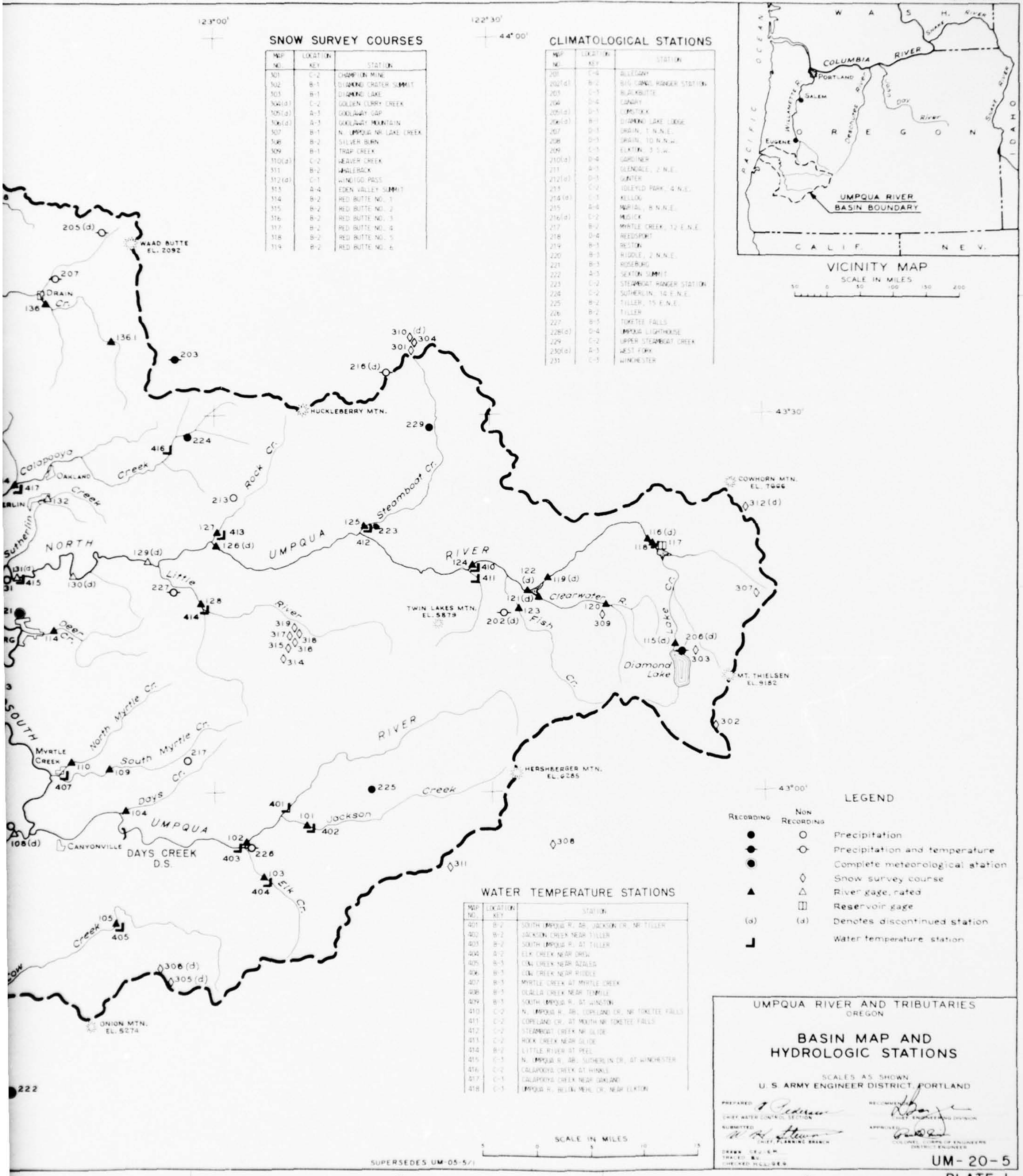
STREAM GAGING STATIONS

MAP NO.	LOCATION KEY	STATION
101	B-2	JACKSON CREEK NEAR TILLER
102	B-2	SOUTH UMPQUA RIVER AT TILLER
103	A-2	ELK CREEK NEAR DREW
104	B-3	DAYS CREEK AT DAYS CREEK
105	A-3	COW CREEK NEAR AZALEA
106	A-3	WEST FORK COW CREEK NEAR GLENDALE
107	B-3	COW CREEK NEAR RIDDLE
108(d)	B-3	COW CREEK AT RIDDLE
109	B-3	SOUTH MYRTLE CREEK NEAR MYRTLE CREEK
110	B-3	NORTH MYRTLE CREEK NEAR MYRTLE CREEK
111	B-3	OLALLA CREEK NEAR TENMILE
112	B-3	LOOKINGGLASS CREEK AT BROCKWAY
113	B-3	SOUTH UMPQUA RIVER NEAR BROCKWAY
114	B-3	DEER CREEK NEAR ROSEBURG
115(d)	B-1	LAKE CREEK AT DIAMOND LAKE NEAR FORT KLAMATH
116(d)	C-1	NORTH UMPQUA RIVER BELOW LAKE CREEK NR TOKETEE FALLS
117	C-1	LEMOLO RESERVOIR NEAR TOKETEE FALLS
118	C-1	N. UMPQUA R. BELOW LEMOLO RESERVOIR NR TOKETEE FALLS
119(d)	C-2	N. UMPQUA R. ABOVE CLEARWATER RIVER NR TOKETEE FALLS
120	B-1	CLEARWATER R. ABOVE TRAP CREEK NR TOKETEE FALLS
121(d)	B-2	CLEARWATER R. AT MOUTH NEAR TOKETEE FALLS
122(d)	B-2	NORTH UMPQUA RIVER AT TOKETEE FALLS
123	B-2	FISH CR. AT BIG CAMAS RANGER STATION NR TOKETEE FALLS
124	C-2	N. UMPQUA R. ABOVE COPELAND CREEK NR TOKETEE FALLS
125	C-2	STEAMBOAT CREEK NEAR GLIDE
126(d)	C-2	NORTH UMPQUA RIVER ABOVE ROCK CREEK NEAR GLIDE
127	C-2	ROCK CREEK NEAR GLIDE
128	B-2	LITTLE RIVER AT PEEL
129(d)	C-3	NORTH UMPQUA RIVER NEAR GLIDE
130(d)	C-3	NORTH UMPQUA RIVER NEAR OAKCREEK
131(d)	C-3	NORTH UMPQUA RIVER AT WINCHESTER (ABOVE SUTHERLIN CR.)
132	C-3	SUTHERLIN CREEK AT SUTHERLIN
133	C-3	NORTH UMPQUA RIVER AT WINCHESTER (BELOW SUTHERLIN CR.)
134	C-3	CALAPOOYA CREEK NEAR OAKLAND
135	C-3	UMPQUA RIVER NEAR ELKTON
136	D-3	ELK CREEK NEAR DRAIN
137(d)	C-4	MILL CREEK NEAR ASH, OREGON
138	D-3	SMITH RIVER NEAR GARDINER
139(d)	C-4	UMPQUA RIVER NEAR SCOTTSBURG
111.1	B-3	TENMILE CREEK AT TENMILE
136.1	D-3	ELK CREEK NEAR ELKHEAD

SNOW SURVEY CO

MAP NO.	LOCATION KEY	STAT
301	C-2	CHAMPION MIN
302	B-1	DIAMOND CRAT
303	B-1	DIAMOND LAKE
304(d)	C-2	GOLDEN CURRY
305(d)	A-3	GOOLAWAY GAP
306(d)	A-3	GOOLAWAY MOU
307	B-1	N. UMPQUA NR
308	B-2	SILVER BURN
309	B-1	TRAP CREEK
310(d)	C-2	WEAVER CREEK
311	B-2	WHALEBACK
312(d)	C-1	WINDIGO PASS
313	A-4	EDEN VALLEY S
314	B-2	RED BUTTE NO.
315	B-2	RED BUTTE NO.
316	B-2	RED BUTTE NO.
317	B-2	RED BUTTE NO.
318	B-2	RED BUTTE NO.
319	B-2	RED BUTTE NO.

U. S. ARMY



SNOW SURVEY COURSES

MAP NO.	LOCATION KEY	STATION
301	C-2	CHAMPION MINE
302	B-1	DIAMOND CRATER SUMMIT
303	B-1	DIAMOND LAKE
304(d)	C-2	GOLDEN CURRY CREEK
305(d)	A-3	GOOLAWAY GAP
306(d)	A-3	GOOLAWAY MOUNTAIN
307	B-1	N. UMPQUA NR LAKE CREEK
308	B-2	SILVER BURN
309	B-1	TRAP CREEK
310(d)	C-2	WEAVER CREEK
311	B-2	WHALEBACK
312(d)	C-1	WINDIGO PASS
313	A-4	EDEN VALLEY SUMMIT
314	B-2	RED BUTTE NO. 1
315	B-2	RED BUTTE NO. 2
316	B-2	RED BUTTE NO. 3
317	B-2	RED BUTTE NO. 4
318	B-2	RED BUTTE NO. 5
319	B-2	RED BUTTE NO. 6

CLIMATOLOGICAL STATIONS

MAP NO.	LOCATION KEY	STATION
201	C-4	ALLEGANY
202(d)	B-2	BIG CAMAS RANGER STATION
203	C-3	BLACKBUTTE
204	D-4	CANARY
205(d)	D-3	COMSTOCK
206(d)	B-1	DIAMOND LAKE LODGE
207	D-3	DRAIN, 1 N.N.E.
208	D-3	DRAIN, 10 N.N.W.
209	C-3	ELKTON, 3 S.W.
210(d)	D-4	GARDINER
211	A-3	GLENDALE, 2 N.E.
212(d)	D-3	GUNTER
213	C-2	IDLEYLD PARK, 4 N.E.
214(d)	C-3	KELLOG
215	A-4	MARIAL, 8 N.N.E.
216(d)	C-2	MUSICK
217	B-2	MYRTLE CREEK, 12 E.N.E.
218	D-4	REEDSPORT
219	B-3	RESTON
220	B-3	RIDDLE, 2 N.N.E.
221	B-3	ROSEBURG
222	A-3	SEXTON SUMMIT
223	C-2	STEAMBOAT RANGER STATION
224	C-2	SUTHERLIN, 14 E.N.E.
225	B-2	TILLER, 15 E.N.E.
226	B-2	TILLER
227	B-3	TOKETEE FALLS
228(d)	D-4	UMPQUA LIGHTHOUSE
229	C-2	UPPER STEAMBOAT CREEK
230(d)	A-3	WEST FORK
231	C-3	WINCHESTER

WATER TEMPERATURE STATIONS

MAP NO.	LOCATION KEY	STATION
401	B-2	SOUTH UMPQUA R. AB. JACKSON CR. NR TILLER
402	B-2	JACKSON CREEK NEAR TILLER
403	B-2	SOUTH UMPQUA R. AT TILLER
404	A-2	ELK CREEK NEAR DREW
405	B-3	COW CREEK NEAR AZALEA
406	B-3	COW CREEK NEAR RIDDLE
407	B-3	MYRTLE CREEK AT MYRTLE CREEK
408	B-3	OLALLA CREEK NEAR TENMILE
409	B-3	SOUTH UMPQUA R. AT WINSTON
410	C-2	N. UMPQUA R. AB. COPELAND CR. NR TOKETEE FALLS
411	C-2	COPELAND CR. AT MOUTH NR TOKETEE FALLS
412	C-2	STEAMBOAT CREEK NR GLIDE
413	C-2	ROCK CREEK NEAR GLIDE
414	B-2	LITTLE RIVER AT PEEL
415	C-3	N. UMPQUA R. AB. SUTHERLIN CR. AT WINCHESTER
416	C-2	CALAPOOYA CREEK AT HINKLE
417	C-3	CALAPOOYA CREEK NEAR OAKLAND
418	C-3	UMPQUA R. BELOW MEHL CR. NEAR ELKTON

LEGEND

Recording	Non Recording	
●	○	Precipitation
-●-	-○-	Precipitation and temperature
◉		Complete meteorological station
	◊	Snow survey course
▲	△	River gage, rated
	◫	Reservoir gage
(d)	(d)	Denotes discontinued station
⌟		Water temperature station

UMPQUA RIVER AND TRIBUTARIES
OREGON

BASIN MAP AND HYDROLOGIC STATIONS

SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND

PREPARED
CHIEF, WATER CONTROL SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

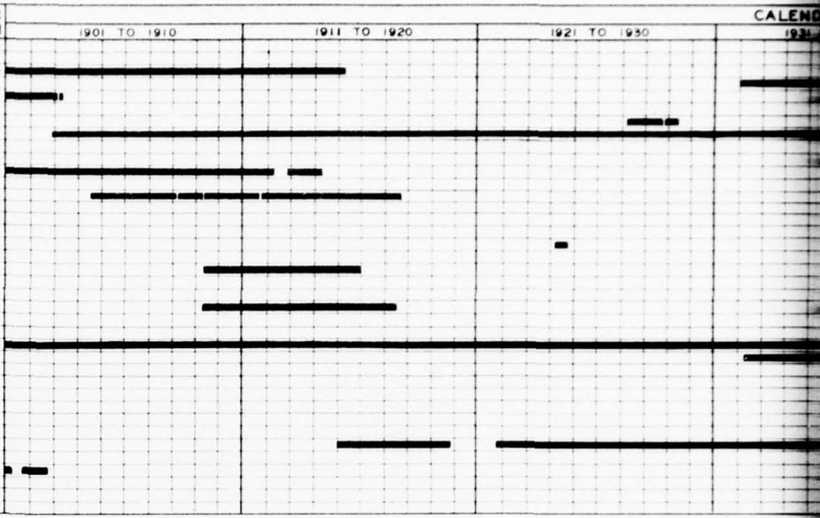
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN CEJ/GM
TRACED BU
CHECKED HGL/GEW

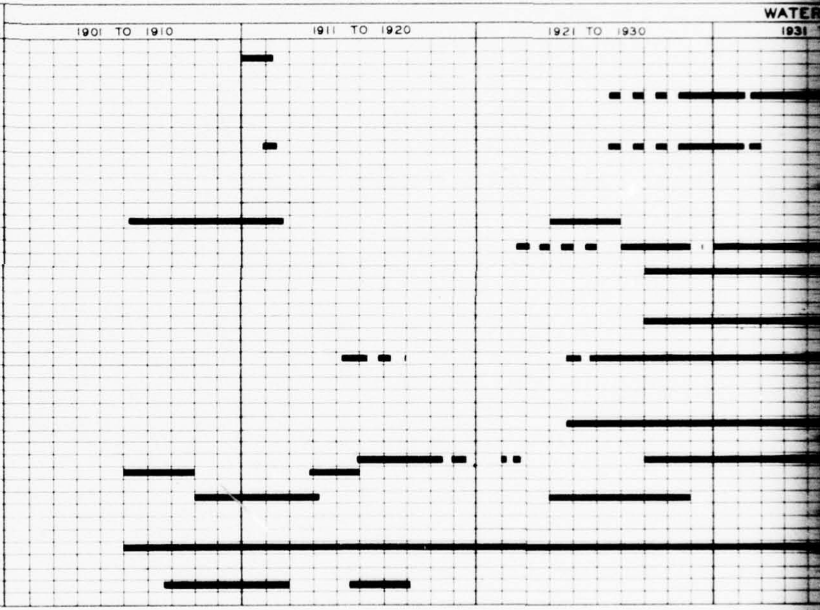
UM-20-5

PLATE I

MAP NO.	CLIMATOLOGICAL STATIONS	ELEVATION FEET, M.S.L.	U.S.W.B NO.	PRIOR TO 1901
201	Allegany	35	0126	
202(d)	Big Camas Ranger Station	3090	M	
203	Blackbutte 1N	970	0781	1 Dec 1900-
204	Canary	85	1324	
205(d)	Comstock	468	M	1 Nov 1891-
206(d)	Diamond Lake Lodge	5195	2313	
207	Drain 1NNE	372	2406	
208	Drain 10 NNW	740	2408	
209	Elkton 3 SW	114	2633	
210(d)	Gardner	30	M	4 Jan 1888-
211	Glendale	1390	3305	
212(d)	Gunter	750	3562	
213	Idleyld Park 4 NE	1080	4126	
214(d)	Kellogg	200	4388	
215	Marial 8 NNE	2080	5217	
216(d)	Musick	5530		
217	Myrtle Creek 12 ENE	1120	5892	
218	Reedsport	60	7082	
219	Reston	890	7112	
220	Riddle 2 NNE	663	7169	
221	Roseburg KQEN	465	7331	15 Jul 1877-
222	Sexton Summit WSO	3836	7698	
223	Steamboat Ranger Station	1200	8102	
224	Sutherlin 12 ENE	360	8263	
225	Tiller 15 ENE	2500	8512	
226	Tiller	1040	8514	
227	Toketee Falls	2060	8536	
228(d)	Umpqua Lighthouse	110	M	
229	Upper Steamboat Creek	1855	8790	
230(d)	West Fork	1045	M	
231	Winchester	460	9461	



MAP NO.	STREAM GAGING STATIONS	U.S.G.S.[1] STA. NO.	D.A. SQ. MI.
101	Jackson Creek near Tiller	14-3077	152
102	South Umpqua River at Tiller	3080	449
103	Elk Creek near Drew	3085	54.4
104	Days Creek at Days Creek	3087	55.3
105	Cow Creek near Azalea	3090	78.0
106	West Fork Cow Creek near Glendale	3095	86.9
107	Cow Creek near Riddle	3100	456
108(d)	Cow Creek at Riddle	3106	485
109	South Myrtle Creek near Myrtle Creek	3107	43.9
110	North Myrtle Creek near Myrtle Creek	3110	54.2
111.1	Tenmile Creek at Tenmile	3113	29.6
111	Olalla Creek near Tenmile	3112	61.3
112	Lookingglass Creek at Brockway	3115	158
113	South Umpqua River near Brockway	3120	1,670
114	Deer Creek near Roseburg	3122	53.2
115(d)	Lake Creek at Diamond Lake near Fort Klamath	3125	57
116(d)	North Umpqua River below Lake Creek near Toketee Falls [2]	(3135)	165
117	Lemolo Reservoir near Toketee Falls	3130	170
118	North Umpqua River below Lemolo Reservoir near Toketee Falls [2]	3135	170
119(d)	North Umpqua River above Clearwater River near Toketee Falls	3140	258
120	Clearwater River above Trap Creek near Toketee Falls	3145	41.6
121(d)	Clearwater River at mouth near Toketee Falls	3150	76.6
122(d)	North Umpqua River at Toketee Falls	3155	339
123	Fish Creek at Big Camas Ranger Station near Toketee Falls	3160	68.8
124	North Umpqua River above Copeland Creek near Toketee Falls	3165	475
125	Steamboat Creek near Glide	3167	227
126(d)	North Umpqua River above Rock Creek near Glide	3175	886
127	Rock Creek near Glide	3176	97.4
128	Little River at Peel	3180	177
129(d)	North Umpqua River near Glide	3185	1,210
130(d)	North Umpqua River near Oak Creek	3190	1,276
139(d)	Umpqua River near Scottsburg	3229	4,095
131(d)	North Umpqua River at Winchester (above Sutherlin Creek) [3]	(3195)	1,306
132(d)	Sutherlin Creek at Sutherlin	3192	16.4
133	North Umpqua River at Winchester (below Sutherlin Creek) [3]	3195	1,344
134	Calapooya Creek near Oakland	3207	210
135	Umpqua River near Elkton	3210	3,683
136.1	Elk Creek near Elkhead	3214	28.7
136	Elk Creek near Drain	3220	104
137(d)	Mill Creek near Ash	3230	90
138	Smith River near Gardiner	3231	206

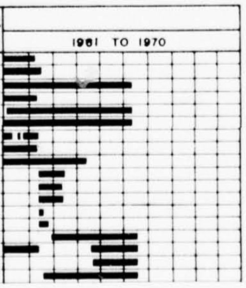


[1] All USGS numbers in Umpqua Basin are prefixed by a 14.

[2] Records from 116(d) and 118 combined in USGS publications

[3] Records from 131(d) and 133 combined in USGS publications

MAP NO.	WATER TEMPERATURE STATIONS	COMP. NUMBER	AT OR NR. U.S.G.S. GAGE	RIVER MILE
401	South Umpqua ab Jackson Cr nr Tiller	276		81.0
402	Jackson Cr nr Tiller	277	14-3077	
403	South Umpqua at Tiller	278	3080	75.6
404	Elk Creek near Drew	279	3085	
405	Cow Creek near Azalea	281	3090	58.5
406	Cow Creek near Riddle	288	3100	6.7
407	Myrtle Creek at Myrtle Creek	286		0.4
408	Olalla Creek near Tenmile	287	3112	11.7
409	South Umpqua at Winston	289		24.9
410	N. Ump. ab Copeland Cr nr Toketee Falls	302	3165	67.2
411	Copeland Cr at Mouth nr Toketee Falls	303		0.2
412	Steamboat Creek nr Glide	304	3167	0.5
413	Rock Creek near Glide	305	3176	1.0
414	Little River at Peel	307	3180	6.6
415	N. Ump. R. ab Sutherlin Cr at Winchester	308		7.0
416	Calapooya Creek at Hinkle	311		
417	Calapooya Creek near Oakland	312	3207	10.4
418	Umpqua River below Mehl Creek near Elkton	314		

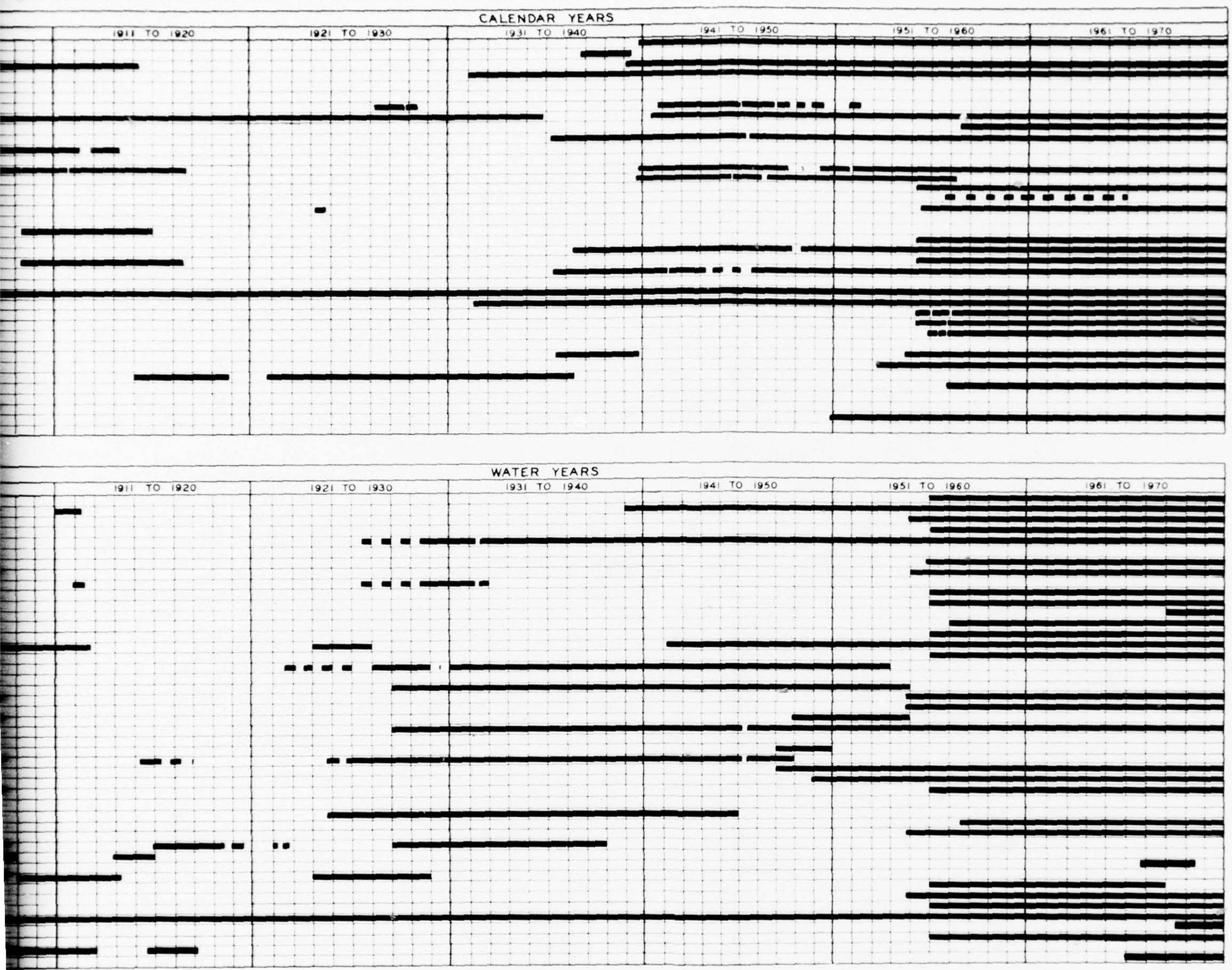


ALL THERMOGRAPHS FURNISHED BY U.S
STATION 303 BY OREGON STATE GAME COM

ADDITIONAL SHORT-TERM THERMOGRAPH
SOUTH UMPQUA AT ROSEBURG,
COW CREEK AT BRANDT, JUNE
UMPQUA RIVER AT ELKTON,
SOUTH UMPQUA AT MYRTLE CR

SPOT OBSERVATIONS HAVE BEEN TAKEN
STATIONS IN THE UMPQUA RIVER BASIN.
FAR BACK AS 1947; HOWEVER, MOST RECO

A COMPLETE LIST OF WATER-TEMPERAT
"COMPILATION OF WATER TEMPERATURE DAT
THE INTERIOR, GEOLOGICAL SURVEY, PORT



NOTES

ALL THERMOGRAPHS FURNISHED BY U.S. FISH AND WILDLIFE SERVICE EXCEPT THE FOLLOWING: STATION 303 BY OREGON STATE GAME COMMISSION AND STATION 308 BY ROSEBURG-OREGON WATER CORPORATION.

ADDITIONAL SHORT-TERM THERMOGRAPH RECORDS AVAILABLE AT FOLLOWING LOCATIONS:
SOUTH UMPQUA AT ROSEBURG, JUNE 1963 TO SEP. 1964
COW CREEK AT BRANDT, JUNE 1963 TO MAY 1964
UMPQUA RIVER AT ELKTON, APRIL 1962 TO MAY 1964
SOUTH UMPQUA AT MYRTLE CREEK, JULY 1963 TO JAN. 1964

SPOT OBSERVATIONS HAVE BEEN TAKEN AT 11 OF THE ABOVE THERMOGRAPH STATIONS, AND AT 23 OTHER STATIONS IN THE UMPQUA RIVER BASIN. PERIODS DURING WHICH SPOT OBSERVATIONS WERE MADE EXTEND AS FAR BACK AS 1947; HOWEVER, MOST RECORDS BEGAN IN THE MID-FIFTIES.

A COMPLETE LIST OF WATER-TEMPERATURE STATIONS IN OREGON IS CONTAINED IN THE REPORT "COMPILATION OF WATER-TEMPERATURE DATA FOR OREGON STREAMS", PREPARED BY THE U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, PORTLAND, OREGON, 1964.

UMPQUA RIVER AND TRIBUTARIES
OREGON

HYDROLOGIC STATIONS
PERIOD OF RECORD

U.S. ARMY ENGINEER DISTRICT, PORTLAND

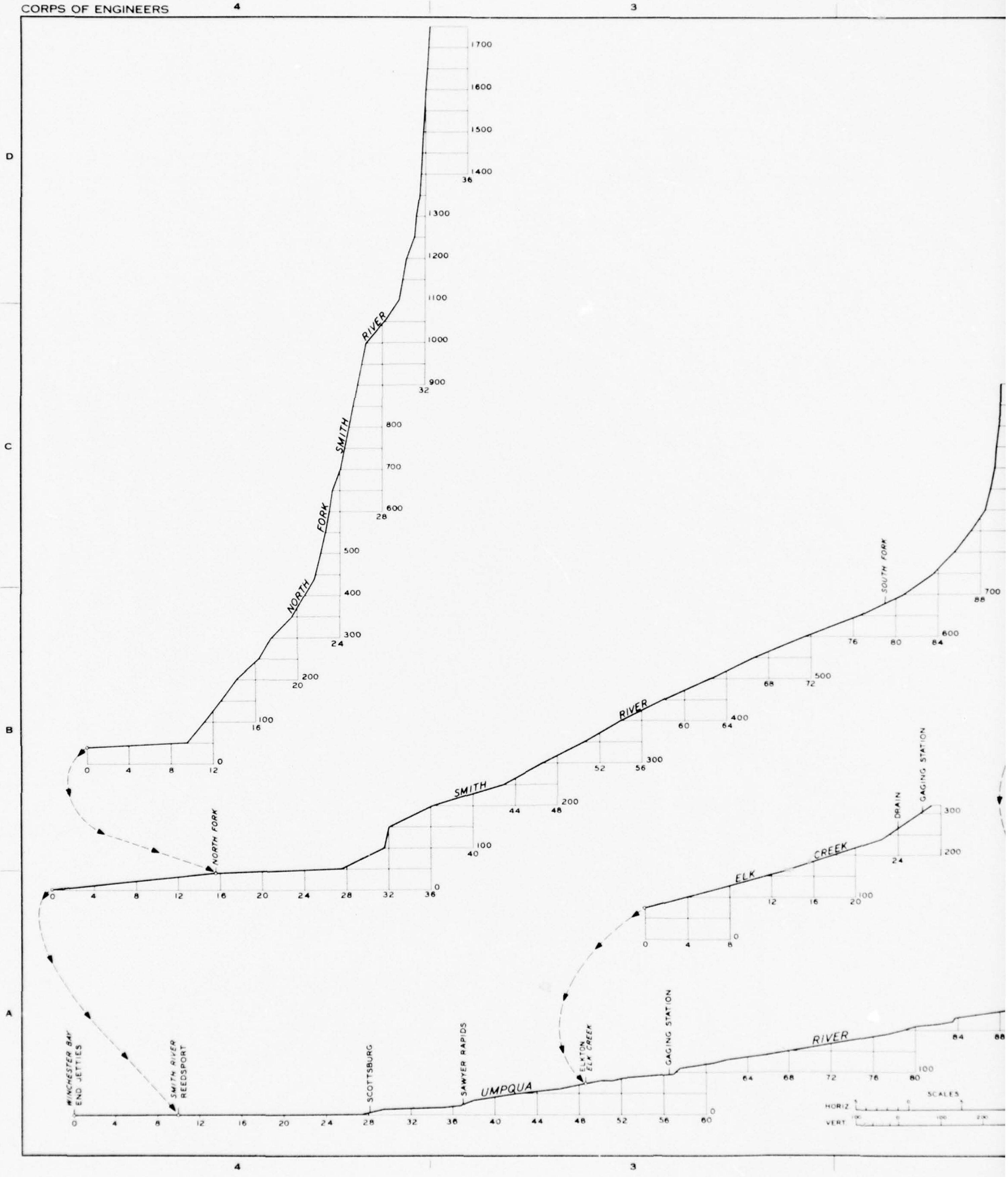
PREPARED: C. Peterson
CHIEF, WATER CONTROL SECTION
RECOMMENDED:
CHIEF, ENGINEERING DIVISION
SUBMITTED:
CHIEF, PLANNING BRANCH
APPROVED:
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN: CTJ
TRACED: RSB, F&B
CHECKED: EM
TRANSMITTED WITH REPORT
DATED:

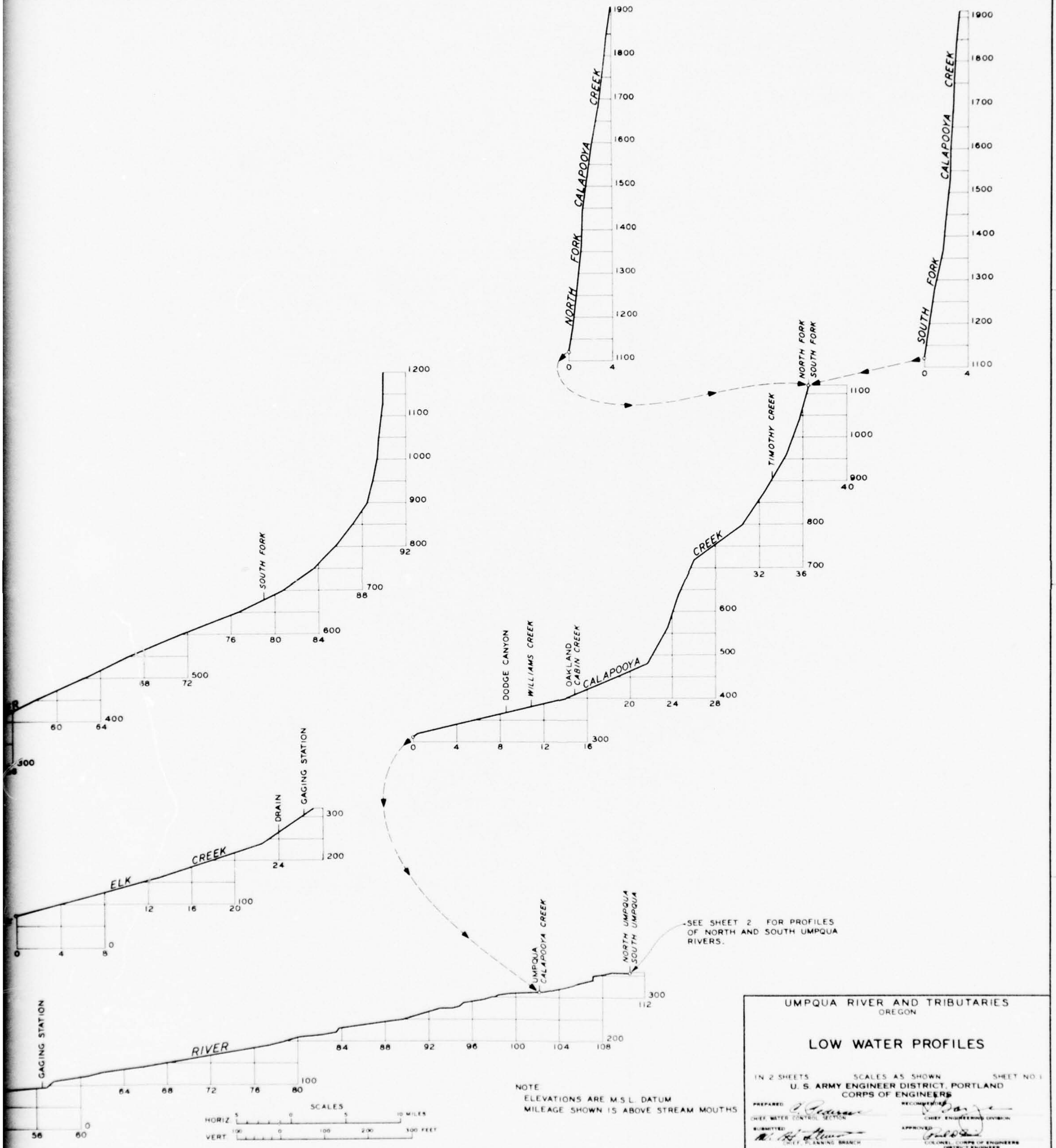
SUPERSEDES UM-05-5/2

UM-20-2

PLATE 2

CORPS OF ENGINEERS





NOTE
ELEVATIONS ARE M.S.L. DATUM
MILEAGE SHOWN IS ABOVE STREAM MOUTHS

SCALES
HORIZ. 5 0 5 10 MILES
VERT. 100 0 100 200 300 FEET

UMPQUA RIVER AND TRIBUTARIES
OREGON

LOW WATER PROFILES

IN 2 SHEETS SCALES AS SHOWN SHEET NO. 1
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED
CHIEF, WATER CONTROL SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

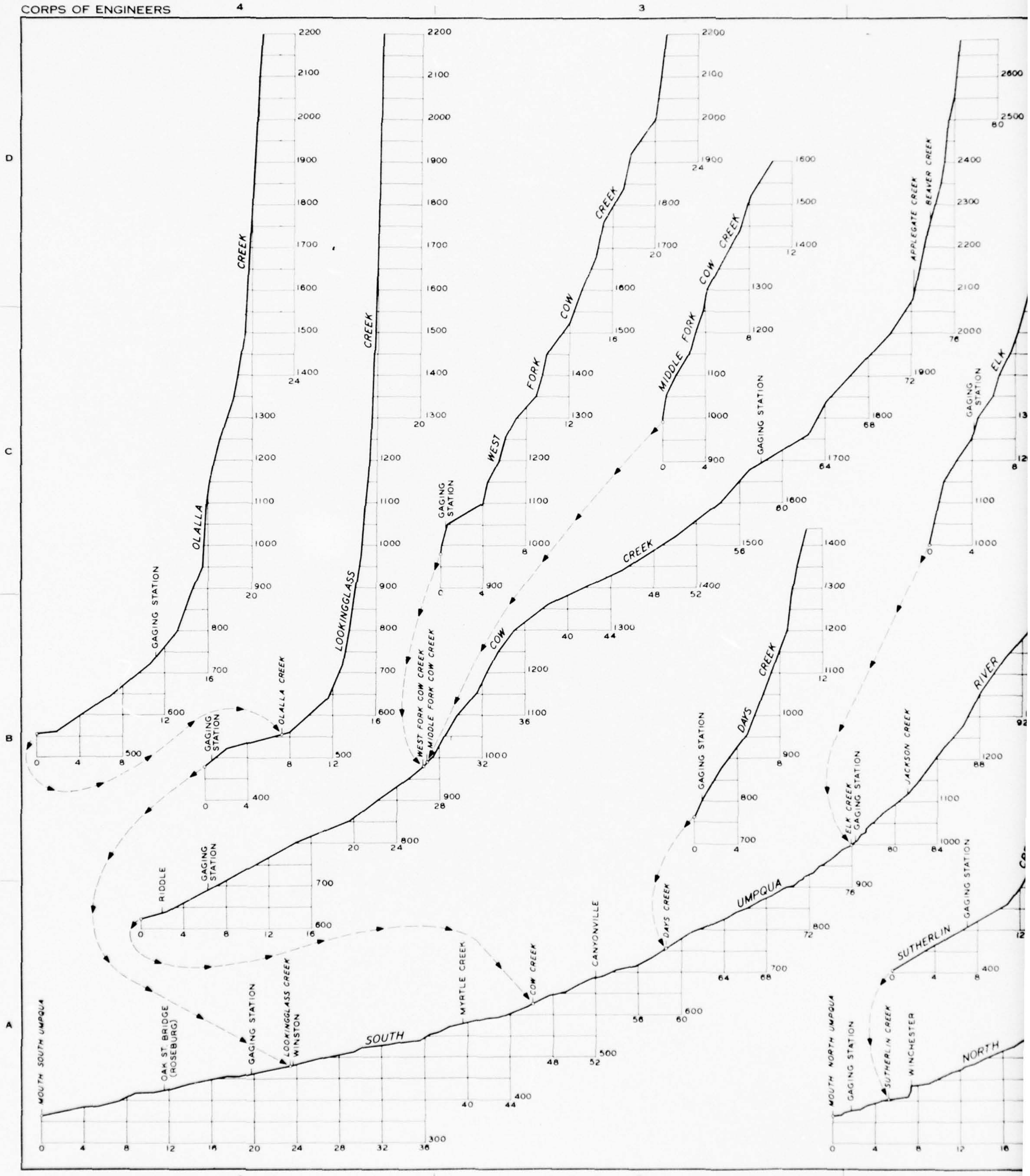
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

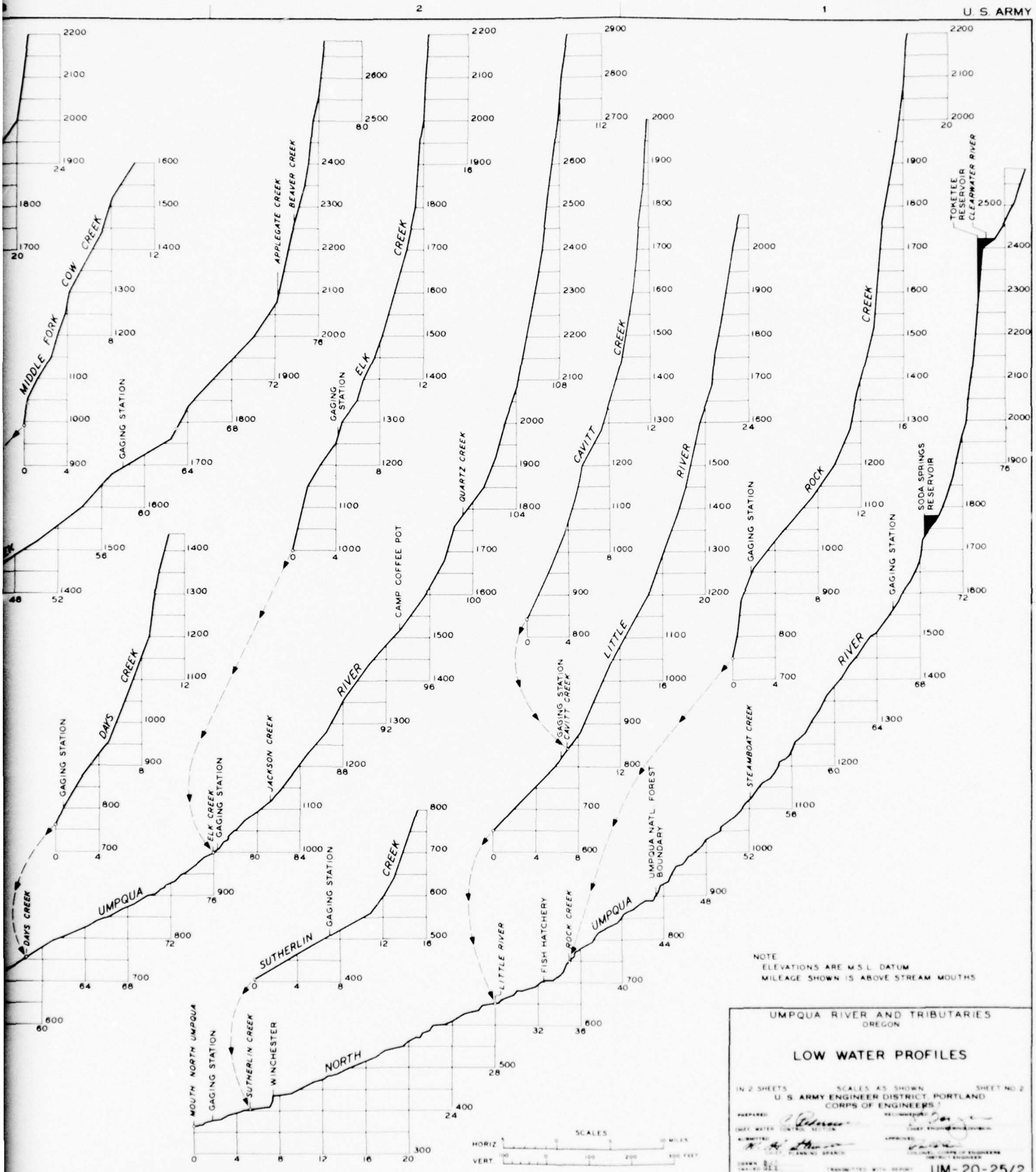
DRAWN B.J.T.
TRACED B.J.T.
CHECKED H.C.L.

TRANSMITTED WITH REPORT
DATED

UM-20-25/1

CORPS OF ENGINEERS





NOTE
ELEVATIONS ARE M.S.L. DATUM
MILEAGE SHOWN IS ABOVE STREAM MOUTHS

UMPQUA RIVER AND TRIBUTARIES
OREGON

LOW WATER PROFILES

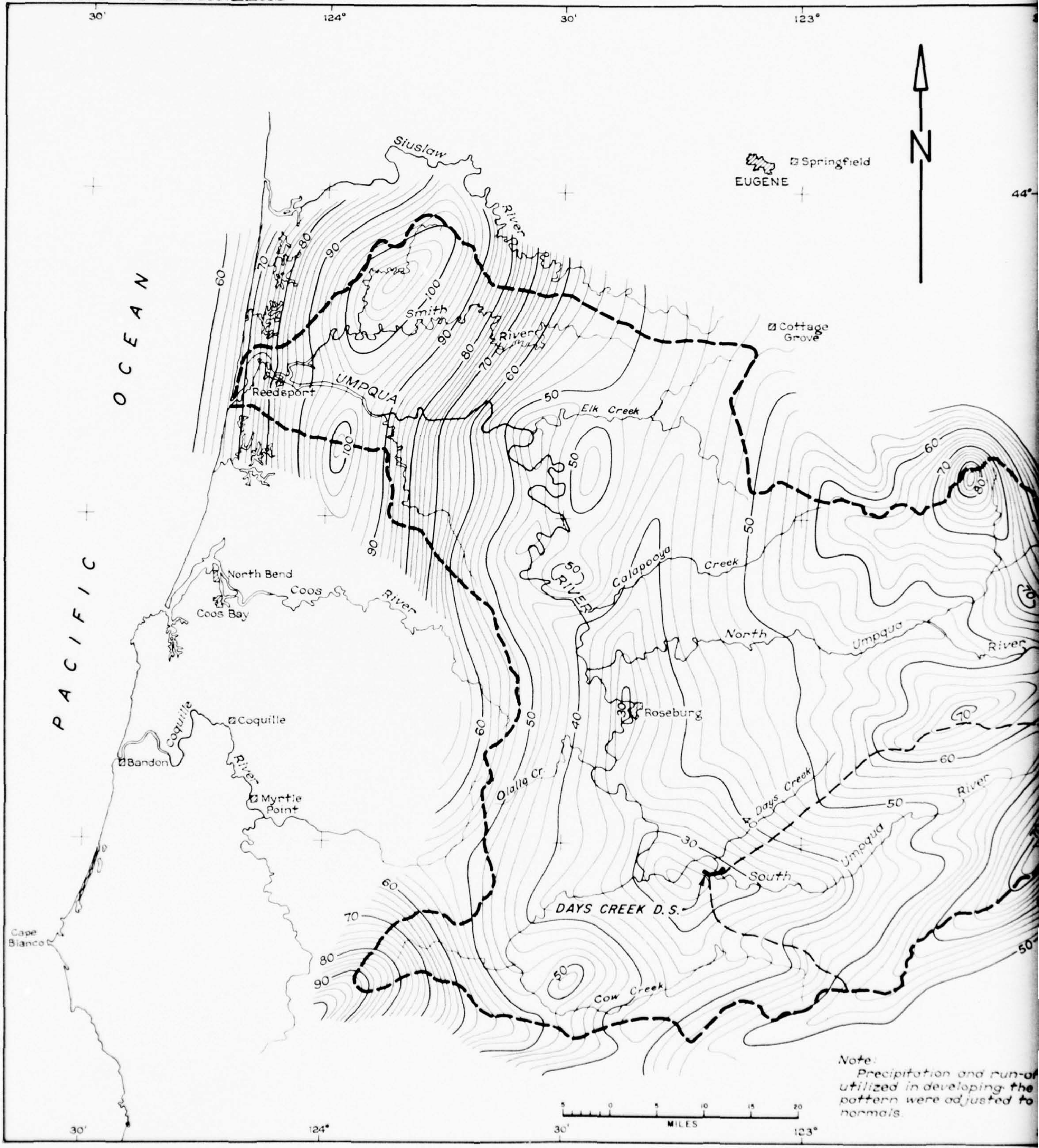
IN 2 SHEETS SCALES AS SHOWN SHEET NO. 2
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED
CHIEF, WATER CONTROL SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN
TRACED
CHECKED
TRANSMITTED WITH REPORT
DATED

UM-20-25/2

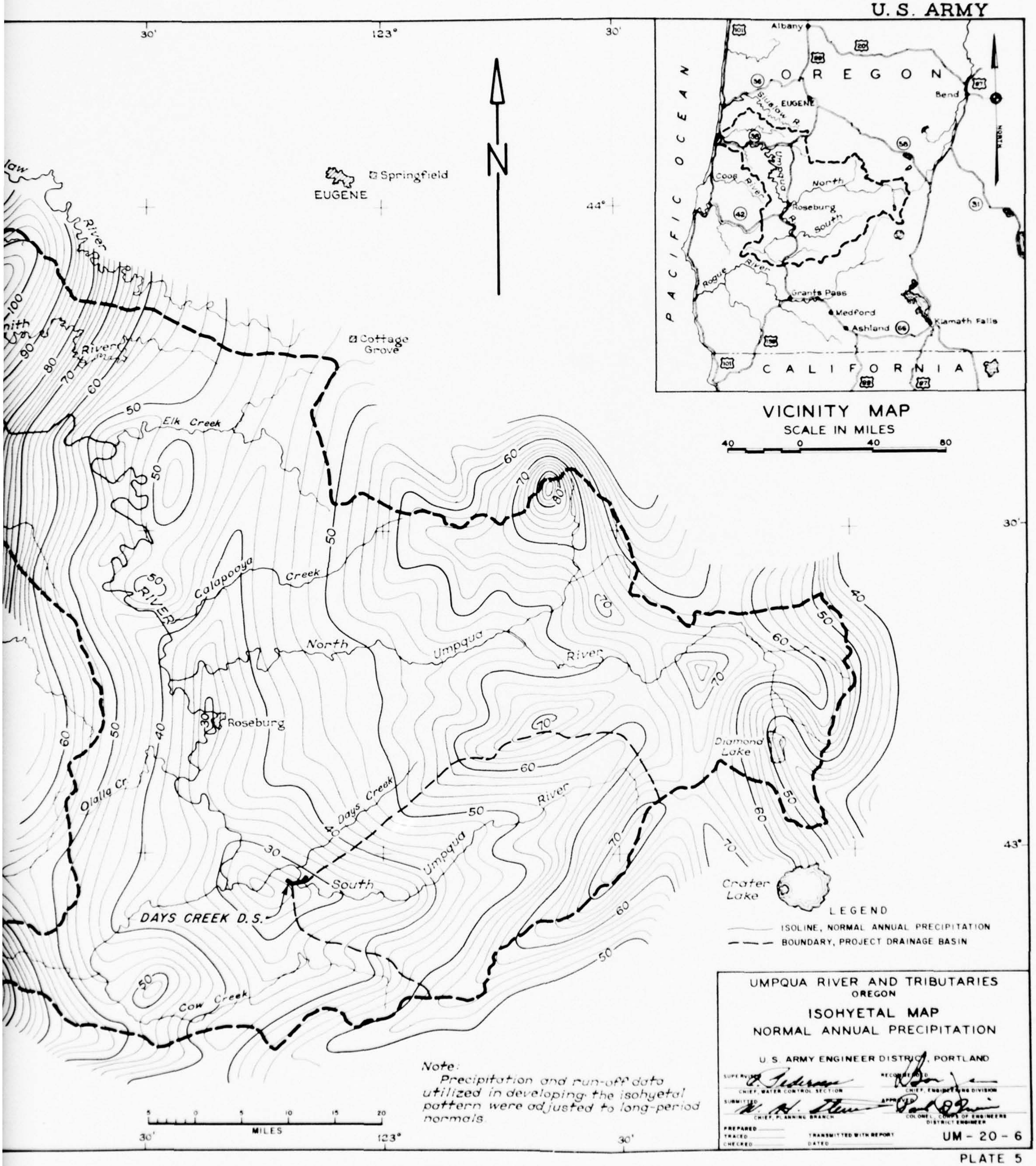
PLATE 4

CORPS OF ENGINEERS



Note:
Precipitation and run-of
utilized in developing the
pattern were adjusted to
normals.

U. S. ARMY



VICINITY MAP

SCALE IN MILES

40 0 40 80

LEGEND

—— ISOLINE, NORMAL ANNUAL PRECIPITATION

— — BOUNDARY, PROJECT DRAINAGE BASIN

Note:
Precipitation and run-off data utilized in developing the isohyetal pattern were adjusted to long-period normals.

UMPQUA RIVER AND TRIBUTARIES
OREGON

ISOHYETAL MAP
NORMAL ANNUAL PRECIPITATION

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED O. Pedersen
CHIEF, WATER CONTROL SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED W. H. Hem
CHIEF, PLANNING BRANCH

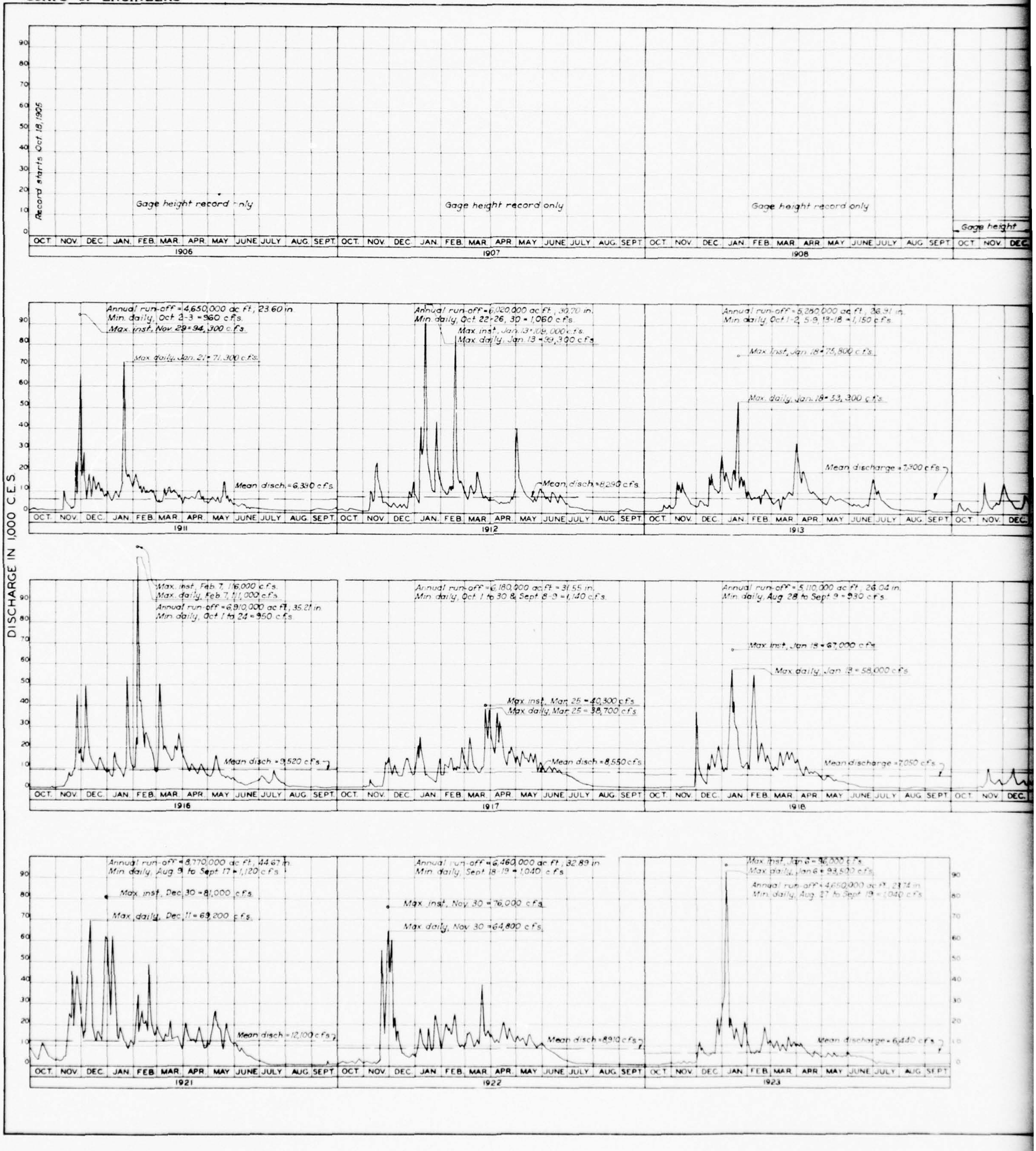
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED
TRACED
CHECKED

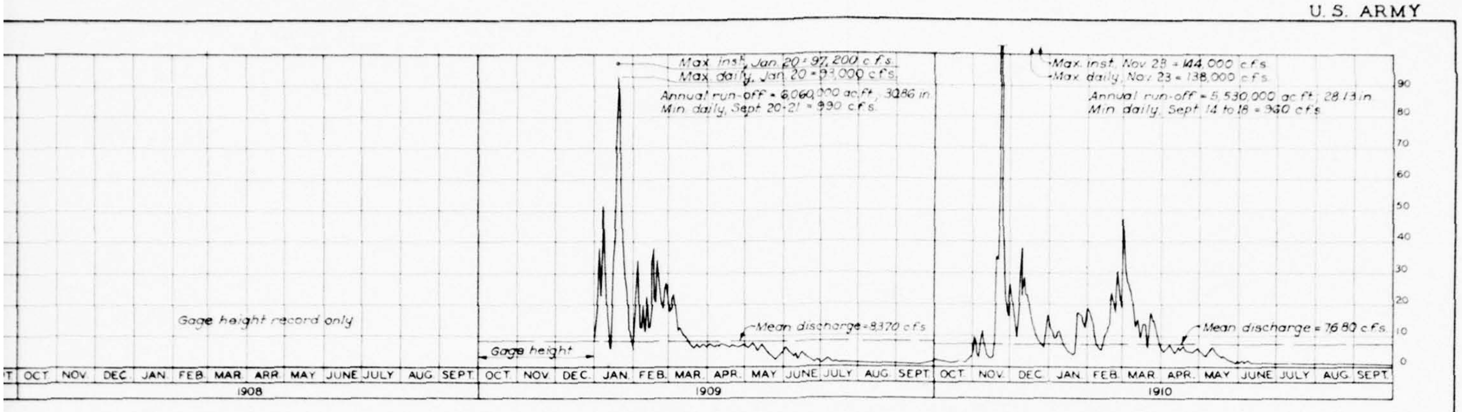
TRANSMITTED WITH REPORT
DATED

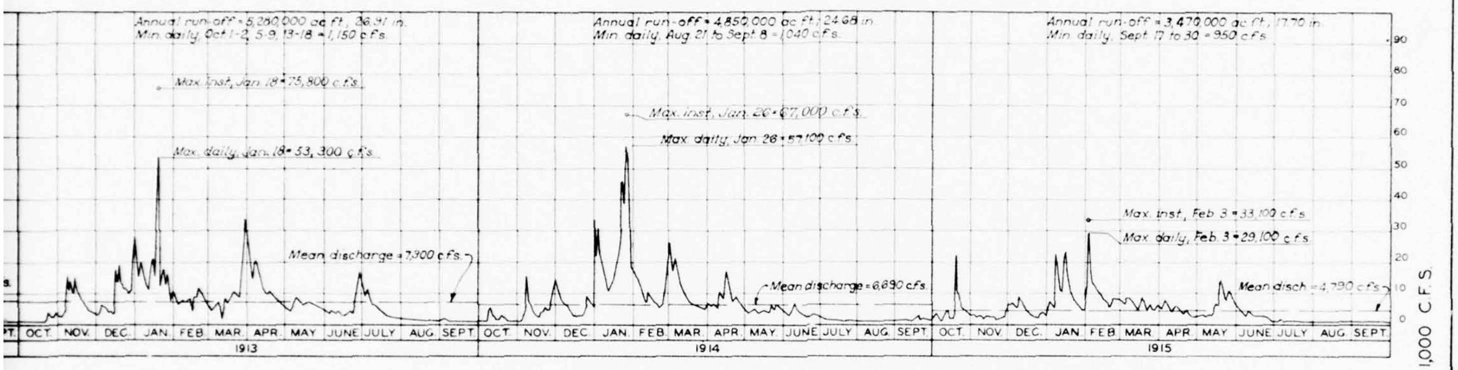
UM - 20 - 6

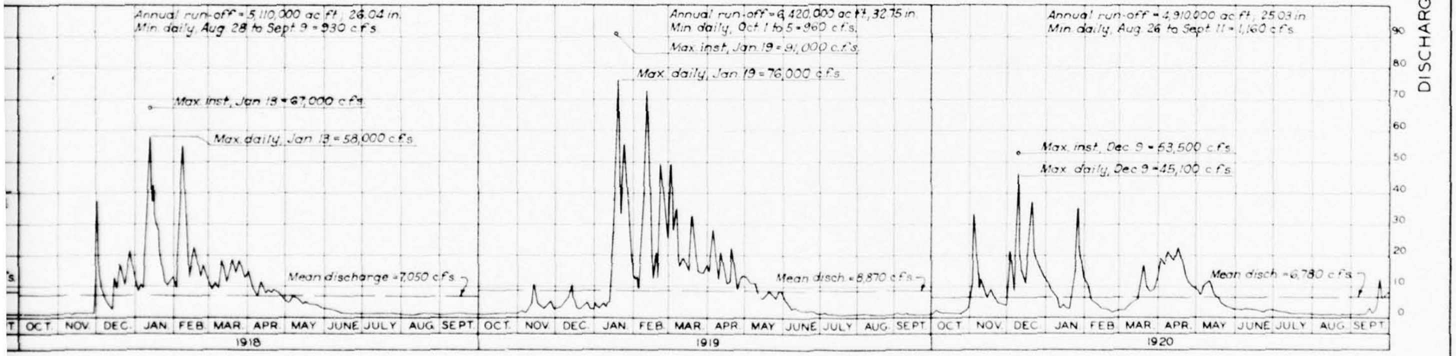
PLATE 5

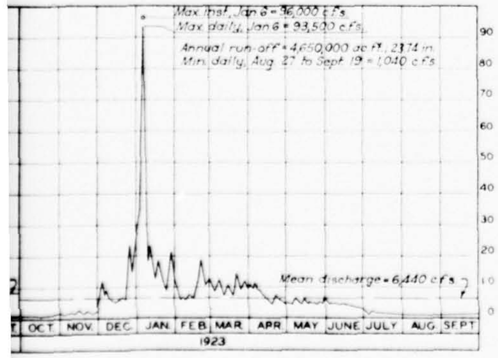

DISCHARGE IN 1,000 C.F.S.
0
10
20
30
40
50
60
70
80
90
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
Record starts Oct 18, 1905
Gage height record only
1906
Gage height record only
1907
Gage height record only
1908
Gage height
Annual run-off = 4,650,000 ac ft, 23.60 in.
Min. daily, Oct 2-3 = 960 c.f.s.
Max. inst. Nov 29 = 94,300 c.f.s.
Max daily, Jan. 21 = 71,300 c.f.s.
Mean disch. = 6,390 c.f.s.
1911
Annual run-off = 6,020,000 ac ft., 30.70 in.
Min. daily, Oct 22-26, 30 = 1,060 c.f.s.
Max. inst., Jan. 13 = 109,000 c.f.s.
Max. daily, Jan. 13 = 99,300 c.f.s.
Mean disch. = 8,290 c.f.s.
1912
Annual run-off = 5,280,000 ac ft., 36.91 in.
Min daily, Oct 1-2, 5-9, 13-18 = 1,150 c.f.s.
Max Inst, Jan 18 = 75,800 c.f.s.
Max. daily, Jan. 18 = 53,300 c.f.s.
Mean discharge = 7,300 c.f.s.
1913
Max. inst, Feb 7, 116,000 c.f.s.
Max. daily, Feb 7, 111,000 c.f.s.
Annual run-off = 6,910,000 ac ft., 35.21 in.
Min. daily, Oct 1 to 24 = 950 c.f.s.
Mean disch. = 9,520 c.f.s.
1916
Annual run-off = 6,180,000 ac. ft. = 31.55 in.
Min. daily, Oct 1 to 30 & Sept 8-9 = 1,140 c.f.s.
Max inst., Mar. 25 = 40,300 c.f.s.
Max daily, Mar. 25 = 38,700 c.f.s.
Mean disch. = 8,550 c.f.s.
1917
Annual run-off = 5,110,000 ac ft., 26.04 in.
Min. daily, Aug 28 to Sept 9 = 930 c.f.s.
Max. inst., Jan 18 = 67,000 c.f.s.
Max. daily, Jan 18 = 58,000 c.f.s.
Mean discharge = 7,050 c.f.s.
1918
Annual run-off = 8,770,000 ac ft., 44.67 in.
Min. daily, Aug 9 to Sept 17 = 1,120 c.f.s.
Max. inst., Dec 30 = 81,000 c.f.s.
Max. daily, Dec 11 = 69,200 c.f.s.
Mean disch. = 12,100 c.f.s.
1921
Annual run-off = 6,460,000 ac ft., 32.89 in.
Min. daily, Sept 18-19 = 1,040 c.f.s.
Max. inst., Nov 30 = 76,000 c.f.s.
Max. daily, Nov 30 = 64,800 c.f.s.
Mean disch. = 8,910 c.f.s.
1922
Max. inst., Jan 6 = 96,000 c.f.s.
Max. daily, Jan 6 = 93,500 c.f.s.
Annual run-off = 4,650,000 ac ft., 23.74 in.
Min. daily, Aug. 27 to Sept 19 = 1,040 c.f.s.
Mean discharge = 6,440 c.f.s.
1923

U. S. ARMY









STATION DESCRIPTION

Station	Dr. Area Sq. Mi.	Records		Type of Gage	Location	Datum (M.S.L.) 1929 adj.
		Available	Character			
Elkton	3,680	Oct. 1905 Nov. 1908	Incomplete	Vert. Staff	Sec. 8, T. 23 S., R. 7 W.	91.33
Elkton	3,683	Nov. 1908 Oct. 31, 1956	Continuous	Vert. Staff	Sec. 8, T. 23 S., R. 7 W.	91.33
Elkton	3,683	Nov. 1, 1956 Present	Continuous	W.S.R.	Sec. 8, T. 23 S., R. 7 W.	90.42

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

UMPQUA RIVER NEAR ELKTON, OREGON
DRAINAGE AREA 3,680 SQUARE MILES

IN 4 SHEETS SHEET NO. 1

PORTLAND DISTRICT, CORPS OF ENGINEERS, FEB. 1, 1951

PREPARED: O. Pedersen
HEAD, HYDROLOGY, METEOROLOGY & POWER SECTION

RECOMMENDED:
CHIEF, ENGINEERING DIVISION

SUBMITTED: Mark L. Nelson
HEAD, PLANNING BRANCH

APPROVED:
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

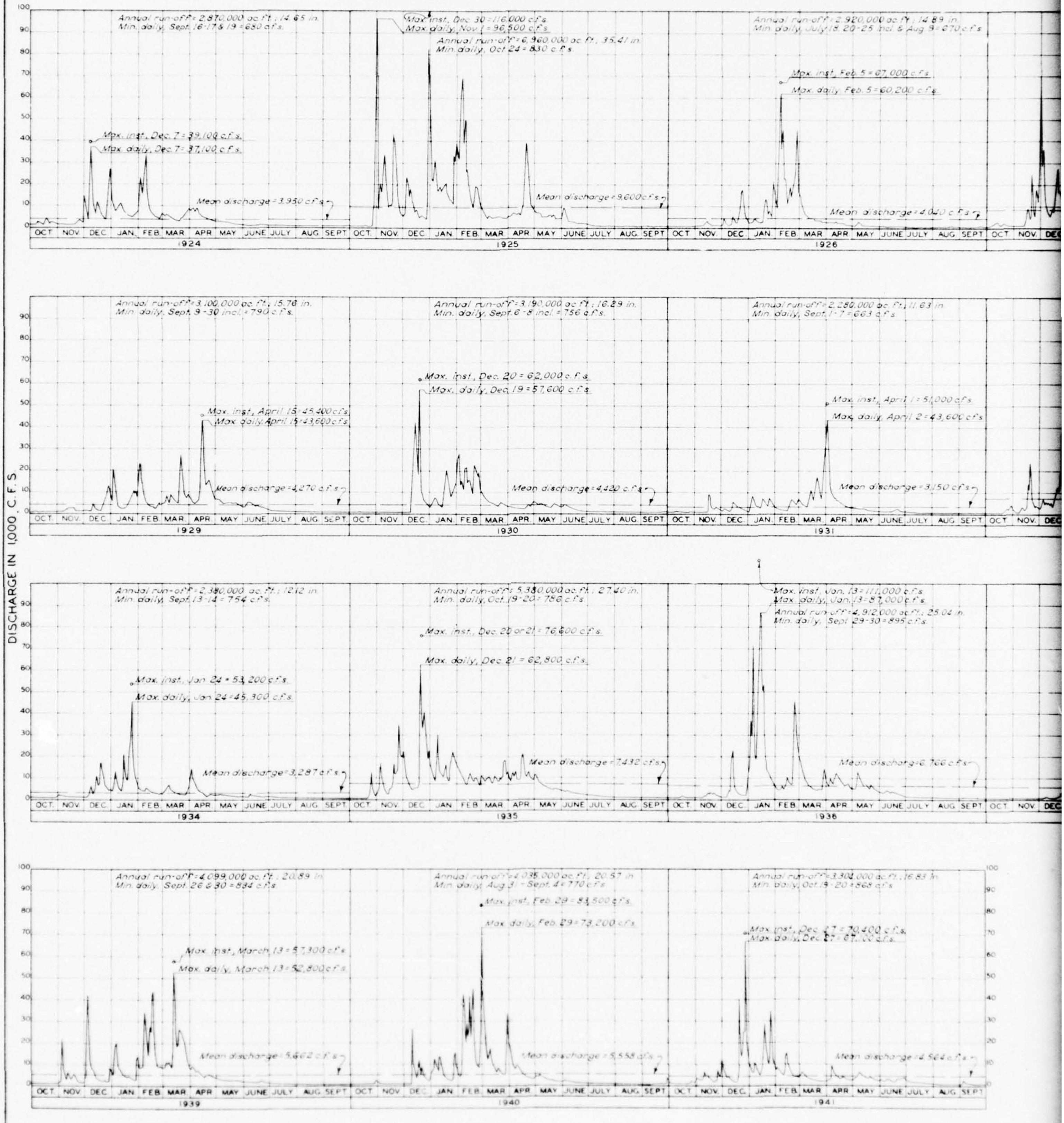
DRAWN BY: O.J.
TRACED BY: C.S.& G.V.L.
CHECKED BY: O.J. W.A.M.

PD-25-25/1

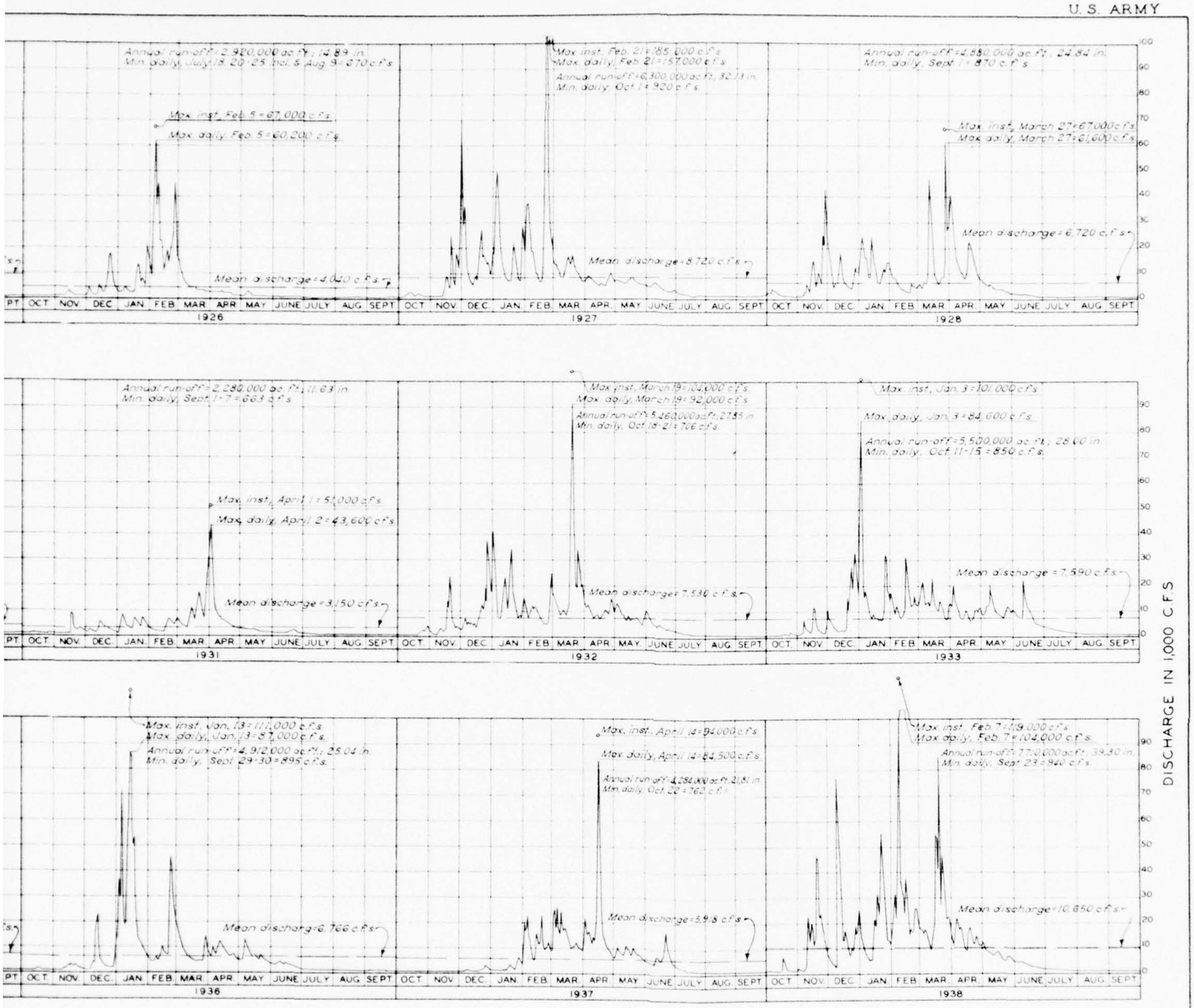
PLATE 6

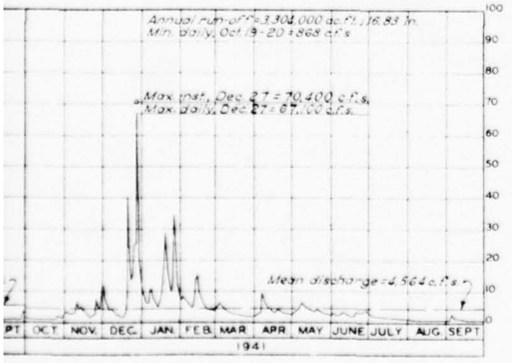
2

CORPS OF ENGINEERS



U.S. ARMY





SEE SHEET NO. 1 FOR STATION DESCRIPTION

UMPQUA RIVER AND TRIBUTARIES
OREGON
DAILY DISCHARGE HYDROGRAPH
UMPQUA RIVER NEAR ELKTON, OREGON
DRAINAGE AREA 3,680 SQUARE MILES

IN 4 SHEETS SHEET NO. 2

PORTLAND DISTRICT, CORPS OF ENGINEERS, FEB. 1, 1951

PREPARED: J. Pedersen
HEAD, HYDROLOGY, METEOROLOGY & POWER SECTION

RECOMMENDED:
CHIEF, ENGINEERING DIVISION

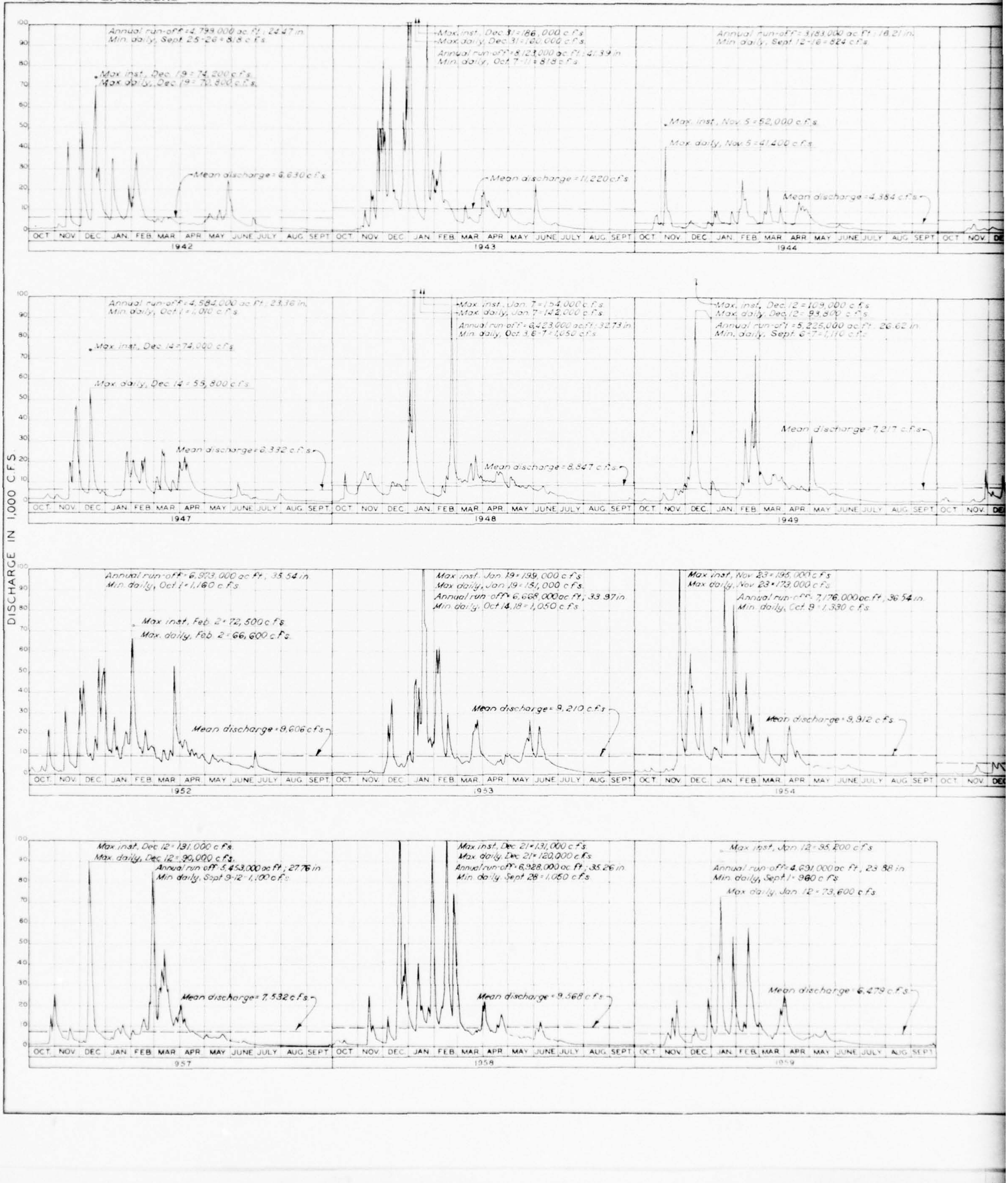
SUBMITTED:
HEAD, PLANNING BRANCH

APPROVED:
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

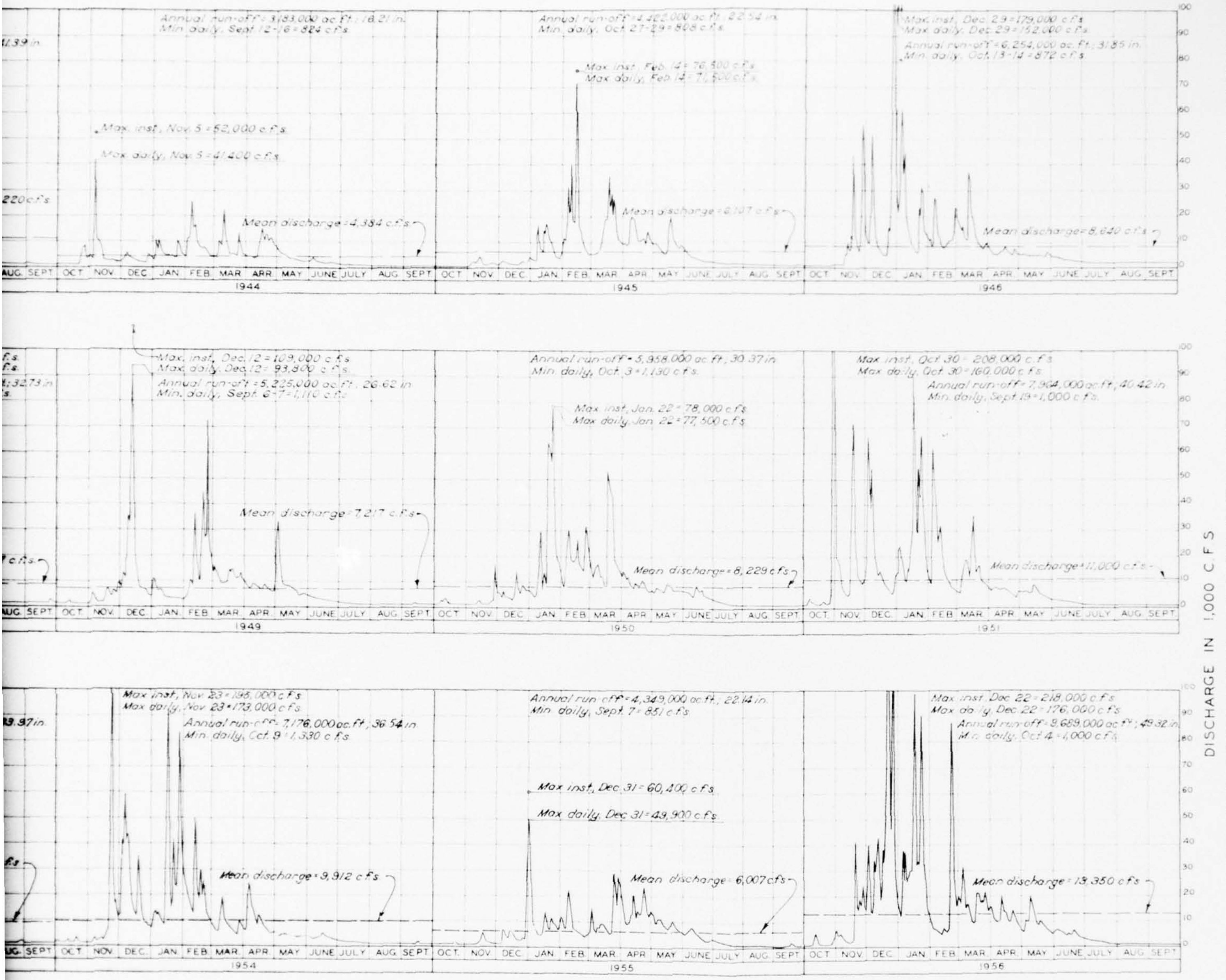
DRAWN BY: D.J. C.M.C.
TRACED BY: C.S.G. B.V.
CHECKED BY: D.J. W.A.M.

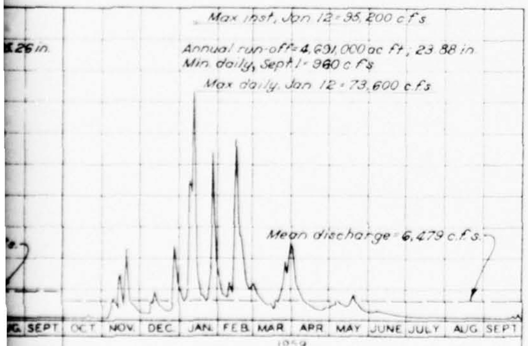
PD-25-25/2

PLATE 7


DISCHARGE IN 1,000 C.F.S.
0
10
20
30
40
50
60
70
80
90
100
OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT.
1942
Annual run-off = 4,799,000 ac. ft.; 24.47 in.
Min. daily, Sept. 25-26 = 818 c.f.s.
Max. inst., Dec. 19 = 74,200 c.f.s.
Max. daily, Dec. 19 = 70,800 c.f.s.
Mean discharge = 6,630 c.f.s.
1943
Max. inst., Dec. 31 = 186,000 c.f.s.
Max. daily, Dec. 31 = 160,000 c.f.s.
Annual run-off = 8,123,000 ac. ft.; 41.39 in.
Min. daily, Oct. 7-11 = 818 c.f.s.
Mean discharge = 11,220 c.f.s.
1944
Annual run-off = 3,183,000 ac. ft.; 16.21 in.
Min. daily, Sept. 12-16 = 824 c.f.s.
Max. inst., Nov. 5 = 52,000 c.f.s.
Max. daily, Nov. 5 = 41,400 c.f.s.
Mean discharge = 4,384 c.f.s.
1947
Annual run-off = 4,584,000 ac. ft.; 23.36 in.
Min. daily, Oct. 1 = 1,010 c.f.s.
Max. inst., Dec. 14 = 74,000 c.f.s.
Max. daily, Dec. 14 = 55,800 c.f.s.
Mean discharge = 6,332 c.f.s.
1948
Max. inst., Jan. 7 = 154,000 c.f.s.
Max. daily, Jan. 7 = 142,000 c.f.s.
Annual run-off = 6,423,000 ac. ft.; 32.73 in.
Min. daily, Oct. 3, 6-7 = 1,050 c.f.s.
Mean discharge = 8,847 c.f.s.
1949
Max. inst., Dec. 12 = 109,000 c.f.s.
Max. daily, Dec. 12 = 93,800 c.f.s.
Annual run-off = 5,225,000 ac. ft.; 26.62 in.
Min. daily, Sept. 6-7 = 1,110 c.f.s.
Mean discharge = 7,217 c.f.s.
1952
Annual run-off = 6,973,000 ac. ft.; 35.54 in.
Min. daily, Oct. 1 = 1,160 c.f.s.
Max. inst., Feb. 2 = 72,500 c.f.s.
Max. daily, Feb. 2 = 66,600 c.f.s.
Mean discharge = 9,606 c.f.s.
1953
Max. inst. Jan. 19 = 199,000 c.f.s.
Max. daily, Jan. 19 = 151,000 c.f.s.
Annual run-off = 6,668,000 ac. ft.; 33.97 in.
Min. daily, Oct. 14, 18 = 1,050 c.f.s.
Mean discharge = 9,210 c.f.s.
1954
Max. inst., Nov. 23 = 195,000 c.f.s.
Max. daily, Nov. 23 = 173,000 c.f.s.
Annual run-off = 7,176,000 ac. ft.; 36.54 in.
Min. daily, Oct. 9 = 1,330 c.f.s.
Mean discharge = 9,912 c.f.s.
1957
Max. inst., Dec. 12 = 131,000 c.f.s.
Max. daily, Dec. 12 = 90,000 c.f.s.
Annual run-off = 5,453,000 ac. ft.; 27.76 in.
Min. daily, Sept. 9-12 = 1,100 c.f.s.
Mean discharge = 7,532 c.f.s.
1958
Max. inst., Dec. 21 = 131,000 c.f.s.
Max. daily, Dec. 21 = 120,000 c.f.s.
Annual run-off = 6,928,000 ac. ft.; 35.26 in.
Min. daily, Sept. 28 = 1,050 c.f.s.
Mean discharge = 9,568 c.f.s.
1959
Max. inst., Jan. 12 = 95,200 c.f.s.
Annual run-off = 4,691,000 ac. ft.; 23.88 in.
Min. daily, Sept. 1 = 960 c.f.s.
Max. daily, Jan. 12 = 73,600 c.f.s.
Mean discharge = 6,479 c.f.s.

U.S. ARMY





SEE SHEET NO. 1 FOR STATION DESCRIPTION

UMPQUA RIVER AND TRIBUTARIES
OREGON
DAILY DISCHARGE HYDROGRAPH
UMPQUA RIVER NEAR ELKTON, OREGON
DRAINAGE AREA 3,680 SQUARE MILES

IN 4 SHEETS SHEET NO. 3

PORTLAND DISTRICT, CORPS OF ENGINEERS, FEB. 1, 1951

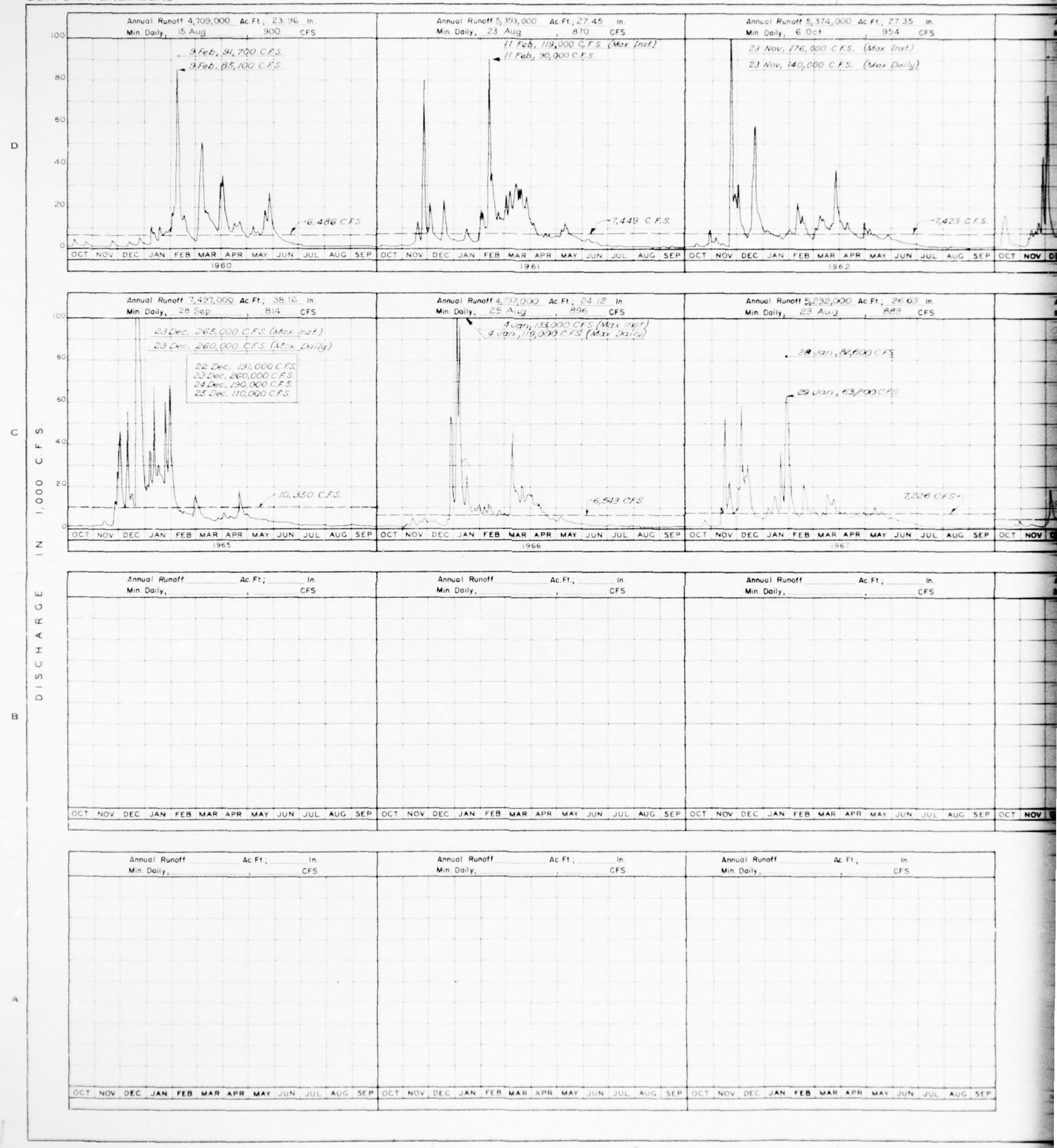
PREPARED: HEAD, HYDROLOGY, METEOROLOGY & POWER SECTION
RECOMMENDED: CHIEF, ENGINEERING DIVISION
SUBMITTED: HEAD, PLANNING BRANCH
APPROVED: COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER

DRAWN BY: C.W.E.
TRACED BY: C.S.S. B.V.
CHECKED BY: O.U. N.A.M.

PD-25-25/3

PLATE 8

CORPS OF ENGINEERS



Annual Runoff 4,709,000 Ac.Ft.; 23.96 In.
Min. Daily, 15 Aug, 900 CFS

Annual Runoff 5,393,000 Ac.Ft.; 27.45 In.
Min. Daily, 23 Aug, 870 CFS

Annual Runoff 5,374,000 Ac.Ft.; 27.35 In.
Min. Daily, 6 Oct, 954 CFS

Annual Runoff 7,497,000 Ac.Ft.; 38.16 In.
Min. Daily, 28 Sep, 814 CFS

Annual Runoff 4,737,000 Ac.Ft.; 24.12 In.
Min. Daily, 25 Aug, 896 CFS

Annual Runoff 5,232,000 Ac.Ft.; 26.63 In.
Min. Daily, 23 Aug, 883 CFS

Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS

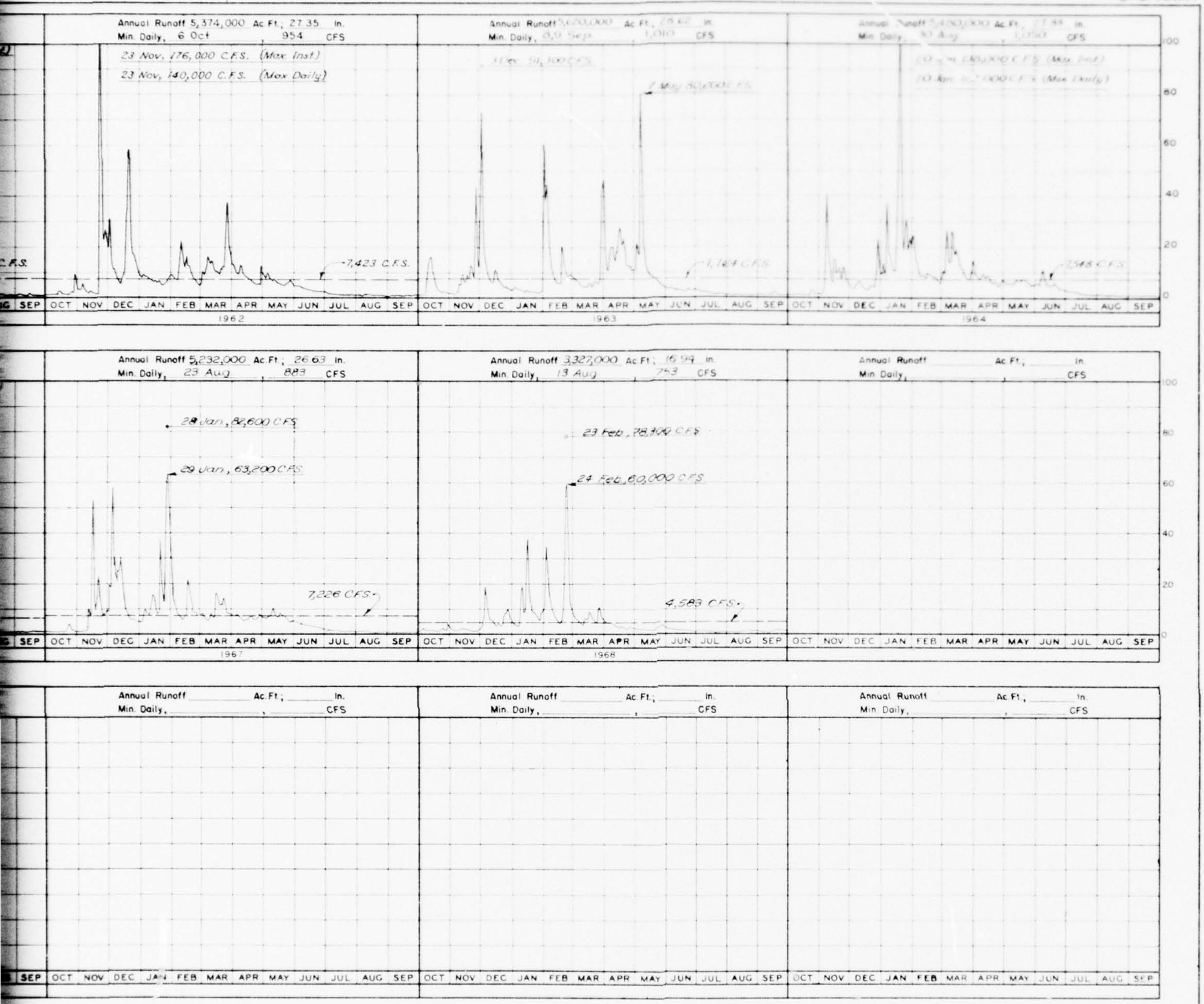
Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS

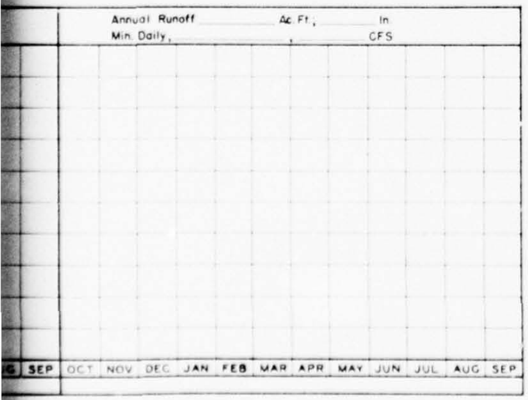
Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS

Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS

Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS

Annual Runoff ________ Ac.Ft.; ________ In.
Min. Daily, ________, ________ CFS





LEGEND

- MAXIMUM INSTANTANEOUS DISCHARGE
- MAXIMUM DAILY DISCHARGE
- MEAN DISCHARGE

SEE SHEET NO 1 FOR STATION DESCRIPTION

A

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

UMPQUA RIVER NEAR ELKTON, OREGON

IN 4 SHEETS SHEET NO 4

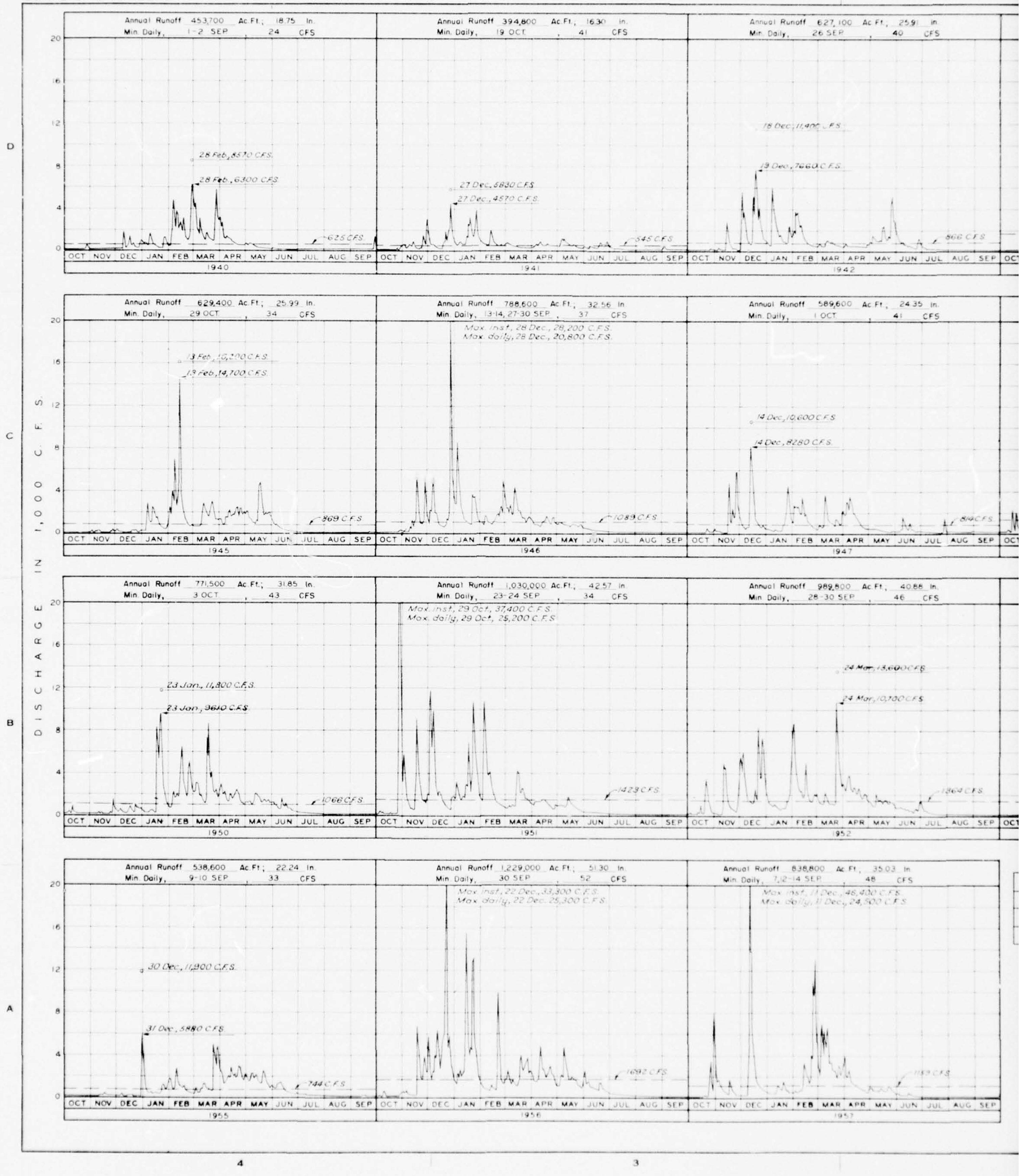
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

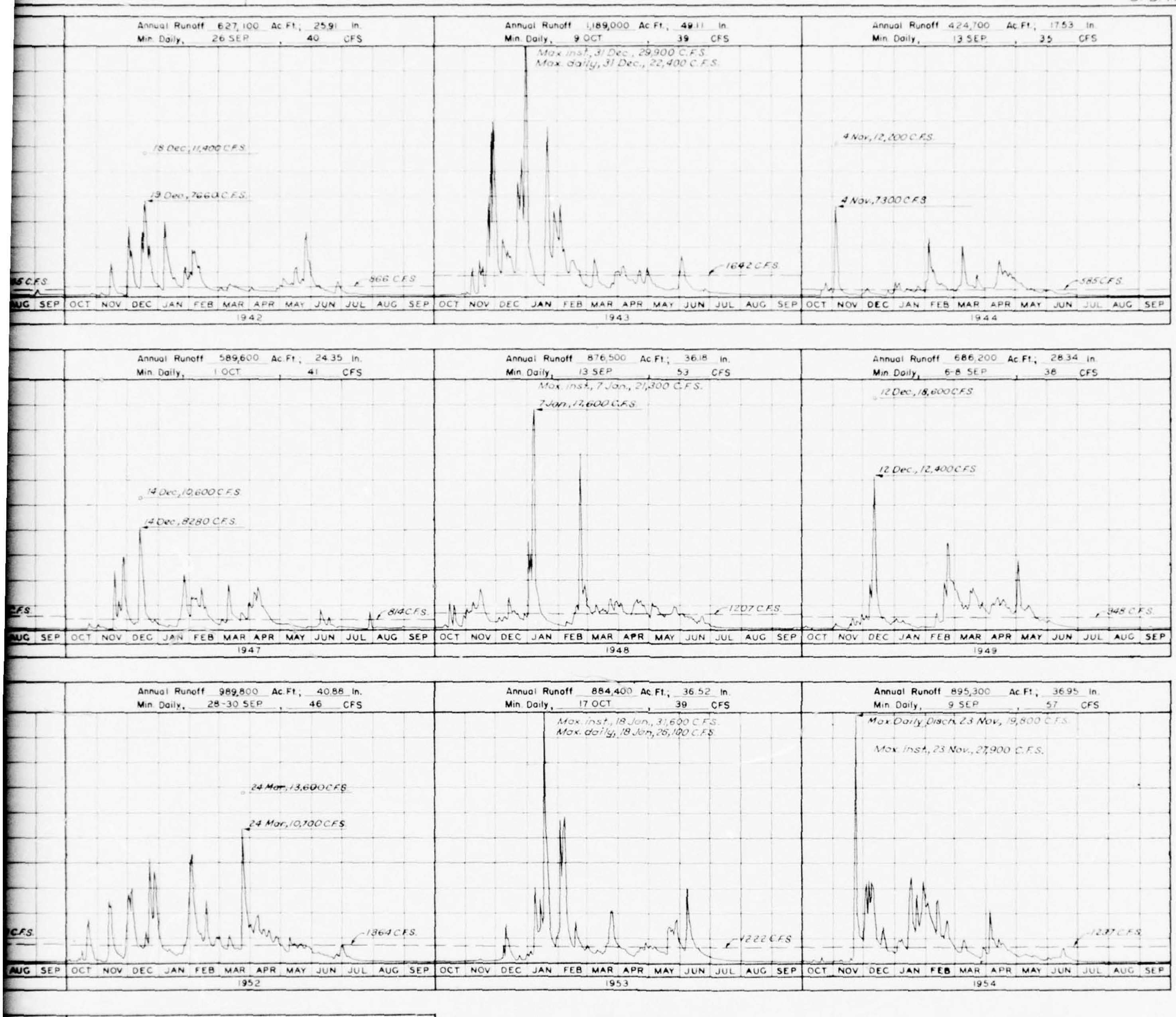
SUPERVISED C Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN D.F.J.
TRACED H.F.E.
CHECKED R.B.

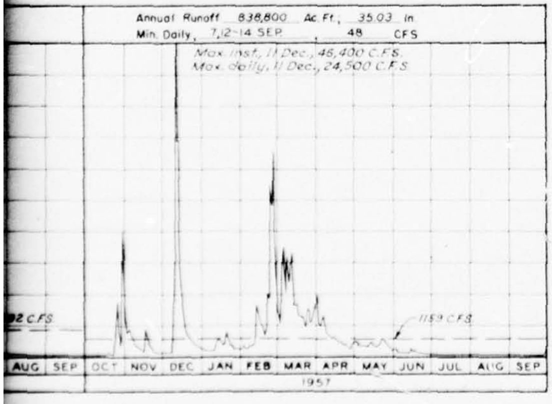
PD-25-25/4

PLATE 9

CORPS OF ENGINEERS







STATION DESCRIPTION

Station	Dr. Area Sq. Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			
At Tiller	449	Oct. 1939 to Present	Continuous	W.S.R.	NE¼ Sec. 33, T30S, R2W	991.8

LEGEND

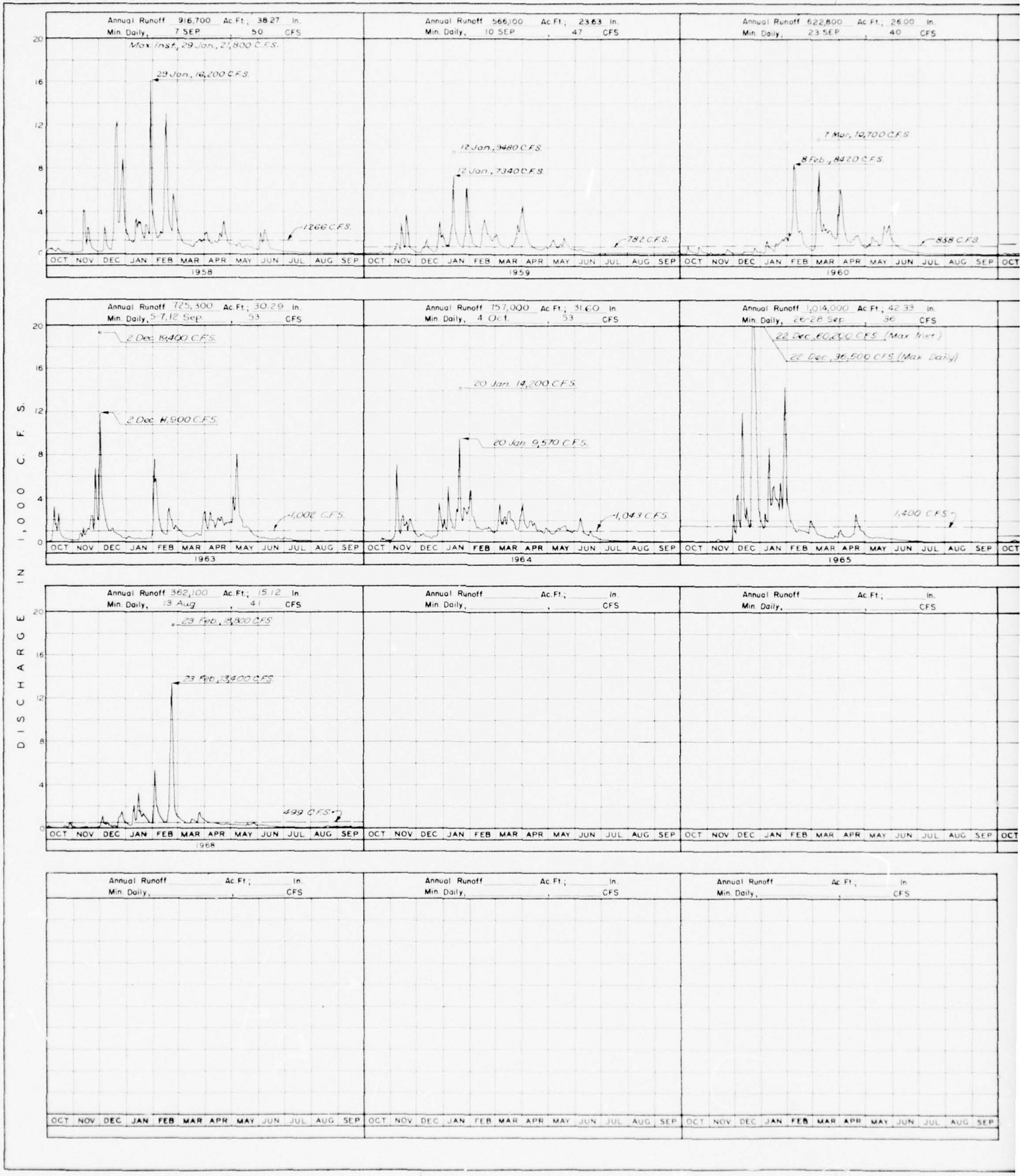
- ○ MAXIMUM INSTANTANEOUS DISCHARGE
- ← MAXIMUM DAILY DISCHARGE
- ----- MEAN DISCHARGE

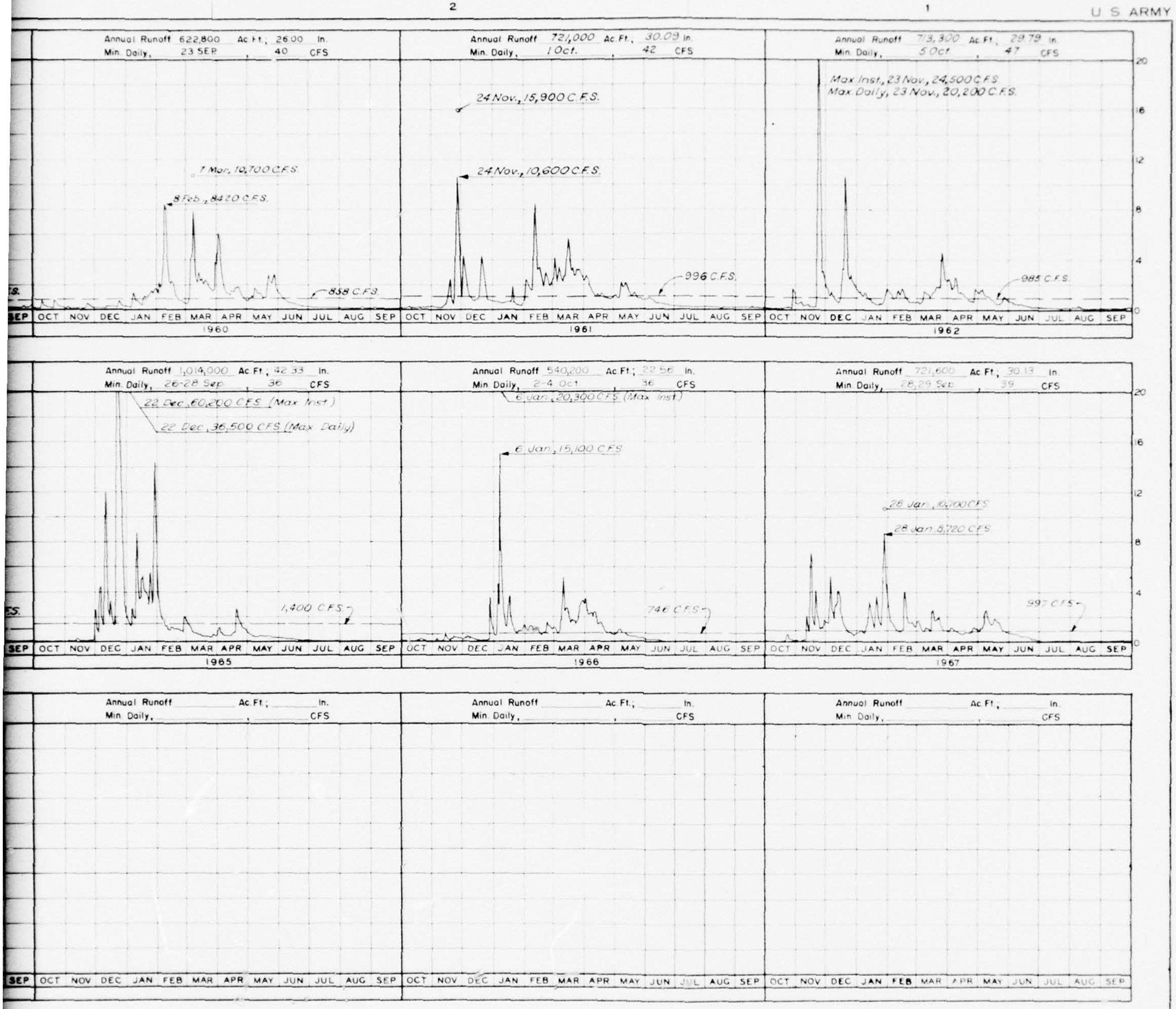
UMPQUA RIVER AND TRIBUTARIES
OREGON
DAILY DISCHARGE HYDROGRAPH
SOUTH UMPQUA RIVER AT TILLER, OREGON

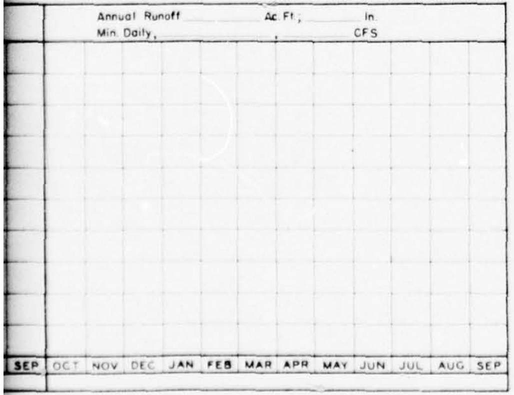
IN 2 SHEETS SHEET NO. 1
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED C. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN D.C.J.
TRACED C.E.R.
CHECKED E.B.B.

PD-25-27/1


D
C
B
A
DISCHARGE IN 1,000 C.F.S.
0
4
8
12
16
20
Annual Runoff 916,700 Ac.Ft.; 38.27 In.
Min. Daily, 7 SEP , 50 CFS
Max Inst, 29 Jan, 21,800 C.F.S.
29 Jan, 16,200 CFS
1266 CFS
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
1958
Annual Runoff 566,100 Ac.Ft.; 23.63 In.
Min. Daily, 10 SEP , 47 CFS
12 Jan, 9480 CFS
12 Jan, 7340 CFS
782 CFS
1959
Annual Runoff 622,800 Ac.Ft.; 26.00 In.
Min. Daily, 23 SEP , 40 CFS
7 Mar, 10,700 CFS
8 Feb, 8420 CFS
858 CFS
1960
Annual Runoff 725,300 Ac.Ft.; 30.29 In.
Min. Daily, 5-7,12 Sep , 53 CFS
2 Dec 19,400 CFS
2 Dec 11,900 CFS
1,002 CFS
1963
Annual Runoff 757,000 Ac.Ft.; 31.60 In.
Min. Daily, 4 Oct , 53 CFS
20 Jan 14,200 CFS
20 Jan 9,570 CFS
1,043 CFS
1964
Annual Runoff 1,014,000 Ac.Ft.; 42.33 In.
Min. Daily, 26-28 Sep , 36 CFS
22 Dec, 60,200 CFS (Max Inst)
22 Dec, 36,500 CFS (Max Daily)
1,400 CFS
1965
Annual Runoff 362,100 Ac.Ft.; 15.12 In.
Min. Daily, 13 Aug , 41 CFS
23 Feb, 18,800 CFS
23 Feb, 13,400 CFS
499 CFS
1968
Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS





LEGEND

× MAXIMUM INSTANTANEOUS DISCHARGE
◄ MAXIMUM DAILY DISCHARGE
— — — MEAN DISCHARGE

NOTE:
SEE SHEET NO. 1 FOR STATION DESCRIPTION

A

UMPQUA RIVER AND TRIBUTARIES
OREGON

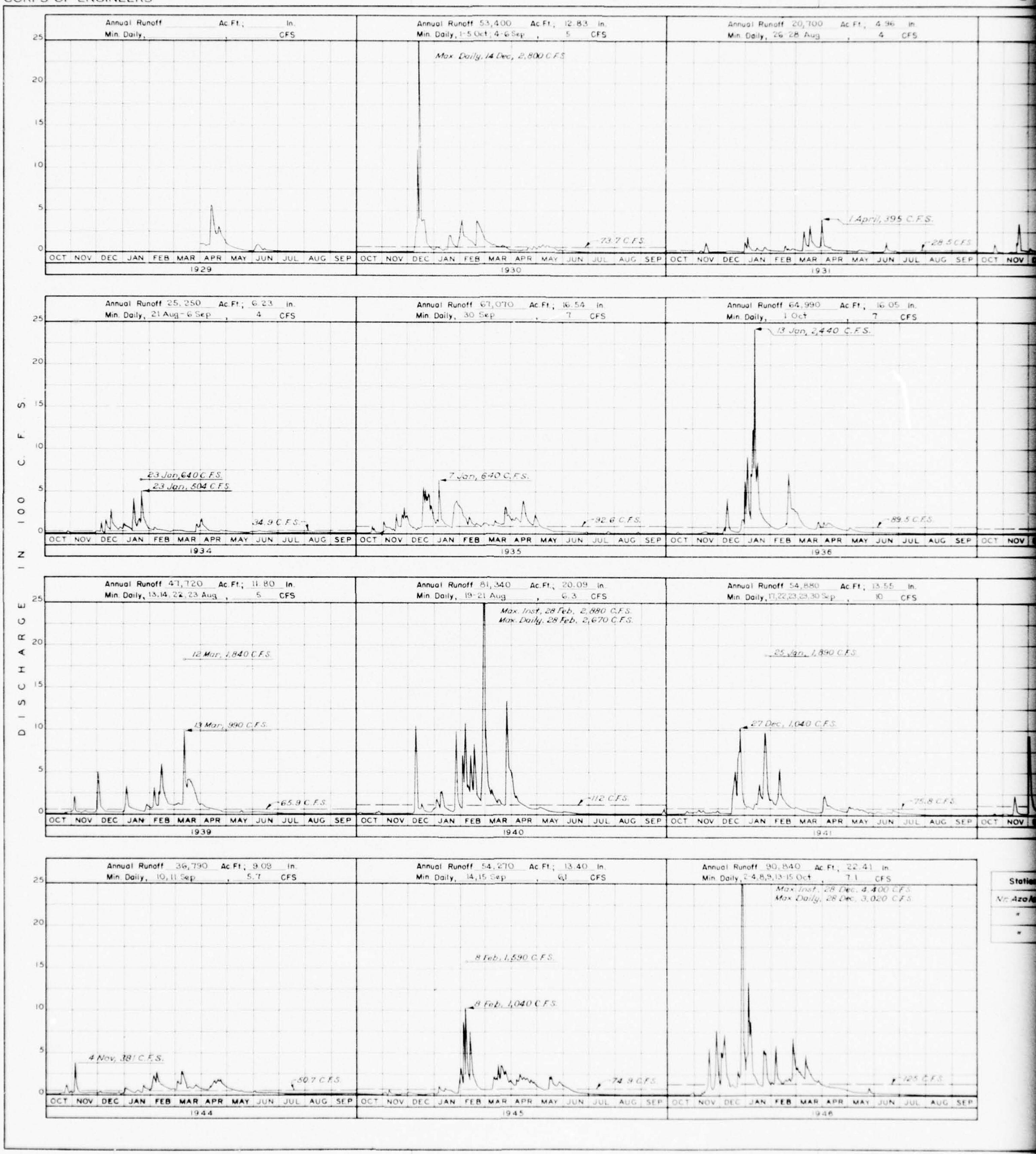
DAILY DISCHARGE HYDROGRAPH

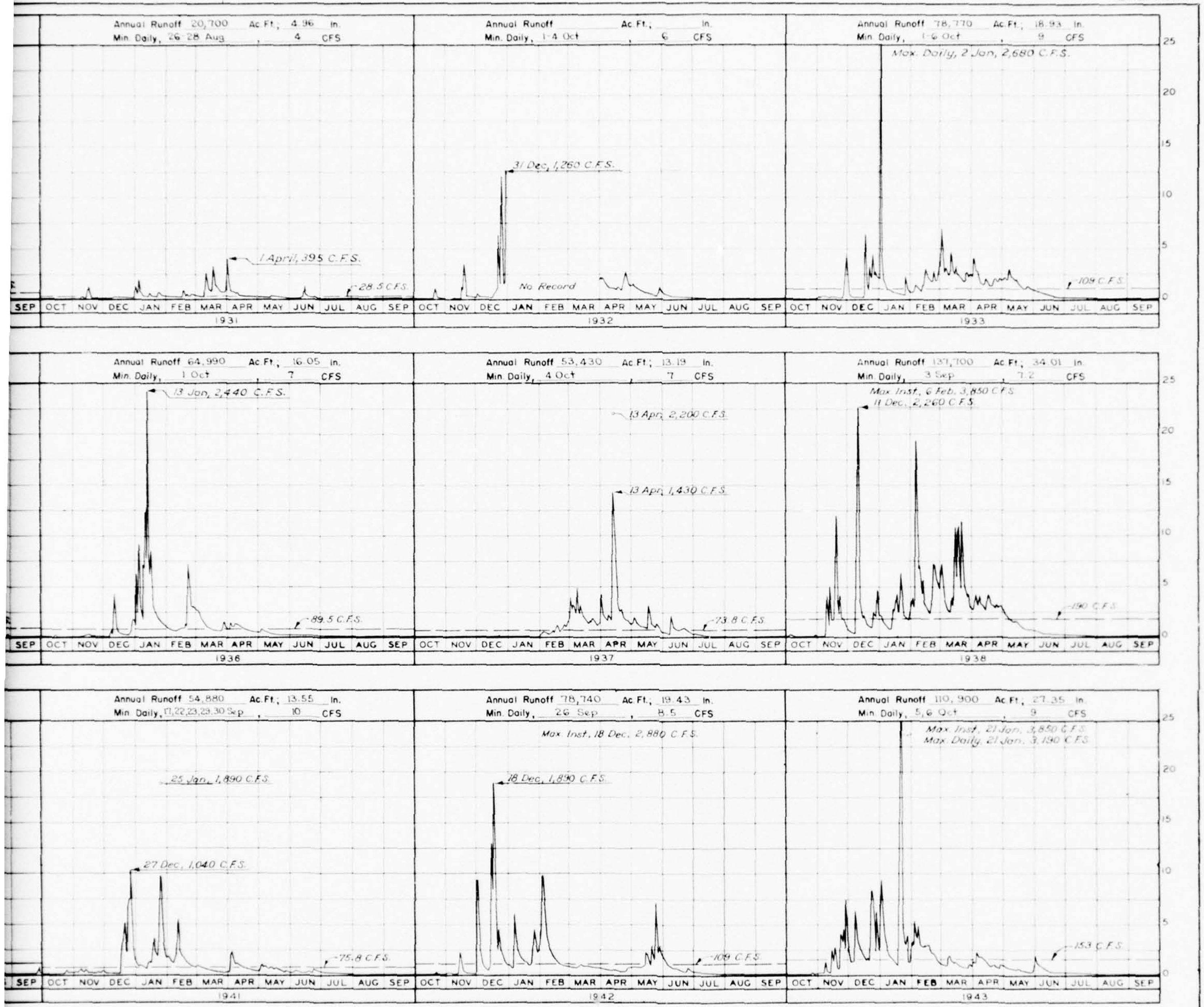
SOUTH UMPQUA RIVER AT TILLER, OREGON

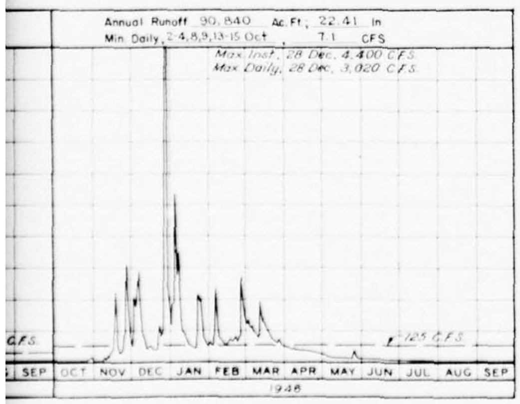
IN 2 SHEETS SHEET NO. 2
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED C. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN D.E.J.
TRACED T.C.R.
CHECKED F.B.R.

PD-25-27/2


D
C
B
A
DISCHARGE IN 100 C.F.S.
0
5
10
15
20
25
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS
1929
Annual Runoff 53,400 Ac.Ft.; 12.83 In.
Min. Daily, 1-5 Oct; 4-6 Sep , 5 CFS
Max. Daily, 14 Dec, 2,800 C.F.S.
73.7 C.F.S.
1930
Annual Runoff 20,700 Ac.Ft.; 4.96 In.
Min. Daily, 26-28 Aug , 4 CFS
1 April, 395 C.F.S.
28.5 C.F.S.
1931
Annual Runoff 25,250 Ac.Ft.; 6.23 In.
Min. Daily, 21 Aug-6 Sep , 4 CFS
23 Jan, 640 C.F.S.
23 Jan, 504 C.F.S.
34.9 C.F.S.
1934
Annual Runoff 67,070 Ac.Ft.; 16.54 In.
Min. Daily, 30 Sep , 7 CFS
7 Jan, 640 C.F.S.
92.6 C.F.S.
1935
Annual Runoff 64,990 Ac.Ft.; 16.05 In.
Min. Daily, 1 Oct , 7 CFS
13 Jan, 2,440 C.F.S.
89.5 C.F.S.
1936
Annual Runoff 47,720 Ac.Ft.; 11.80 In.
Min. Daily, 13,14,22,23 Aug , 5 CFS
12 Mar, 1,840 C.F.S.
13 Mar, 990 C.F.S.
65.9 C.F.S.
1939
Annual Runoff 81,340 Ac.Ft.; 20.09 In.
Min. Daily, 19-21 Aug , 6.3 CFS
Max. Inst, 28 Feb, 2,880 C.F.S.
Max. Daily, 28 Feb, 2,670 C.F.S.
112 C.F.S.
1940
Annual Runoff 54,880 Ac.Ft.; 13.55 In.
Min. Daily, 17,22,23,29,30 Sep , 10 CFS
25 Jan, 1,890 C.F.S.
27 Dec, 1,040 C.F.S.
75.8 C.F.S.
1941
Annual Runoff 36,790 Ac.Ft.; 9.09 In.
Min. Daily, 10,11 Sep , 5.7 CFS
4 Nov, 381 C.F.S.
80.7 C.F.S.
1944
Annual Runoff 54,270 Ac.Ft.; 13.40 In.
Min. Daily, 14,15 Sep , 6.1 CFS
8 Feb, 1,590 C.F.S.
8 Feb, 1,040 C.F.S.
74.9 C.F.S.
1945
Annual Runoff 90,840 Ac.Ft.; 22.41 In.
Min. Daily, 2-4,8,9,13-15 Oct , 7.1 CFS
Max. Inst, 28 Dec, 4,400 C.F.S.
Max. Daily, 28 Dec, 3,020 C.F.S.
125 C.F.S.
1946
OCT NOV
Statio
Nr. Azo
"
"





STATION DESCRIPTION

Station	Dr Area Sq Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			
Nr. Azalea	78	Apr. 1929 to Dec. 1931	Continuous	Staff	N½ Sec 4, T32S, R4W	1685
"	"	Apr. 1932 to July 1949	"	"	"	"
"	"	Aug 1949 to present	"	W.S.R.	"	"

LEGEND

·	MAXIMUM INSTANTANEOUS DISCHARGE
◄	MAXIMUM DAILY DISCHARGE
-----	MEAN DISCHARGE

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

COW CREEK NEAR AZALEA, OREGON

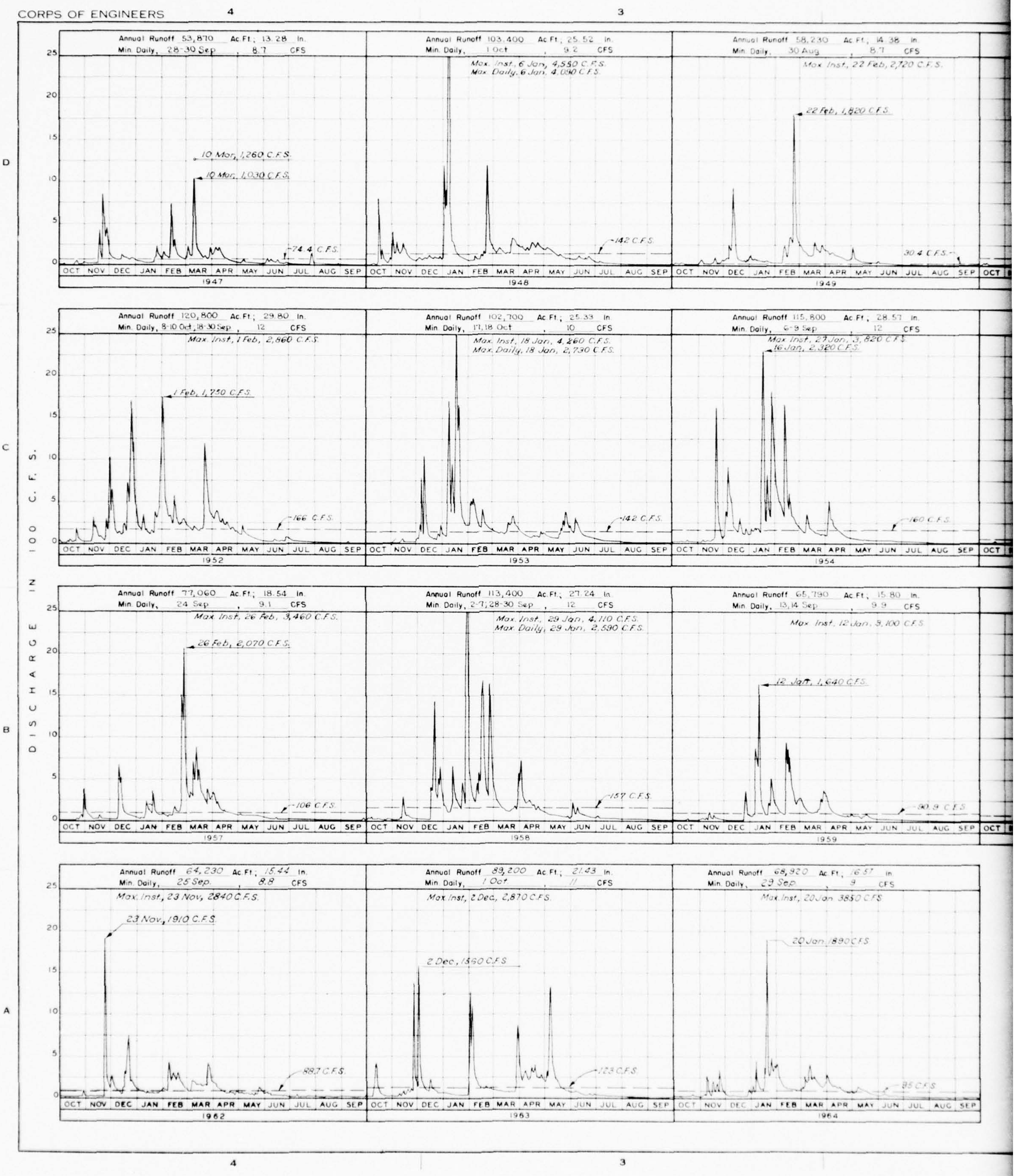
IN 3 SHEETS SHEET NO. 1
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED A. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN D.G.H.
TRACED
CHECKED

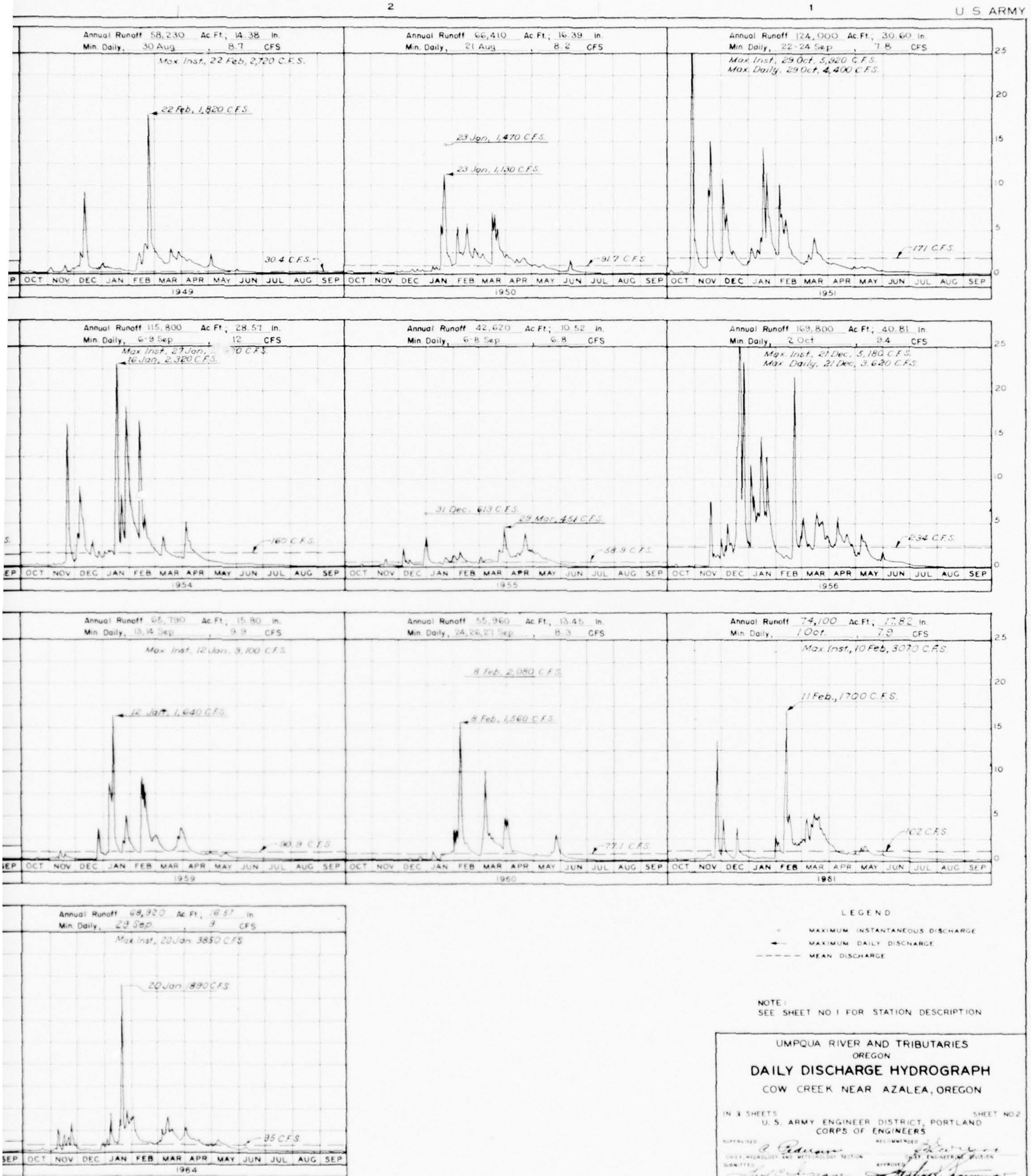
PD-25-29/1

CORPS OF ENGINEERS



4

3



NOTE:
SEE SHEET NO I FOR STATION DESCRIPTION

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

COW CREEK NEAR AZALEA, OREGON

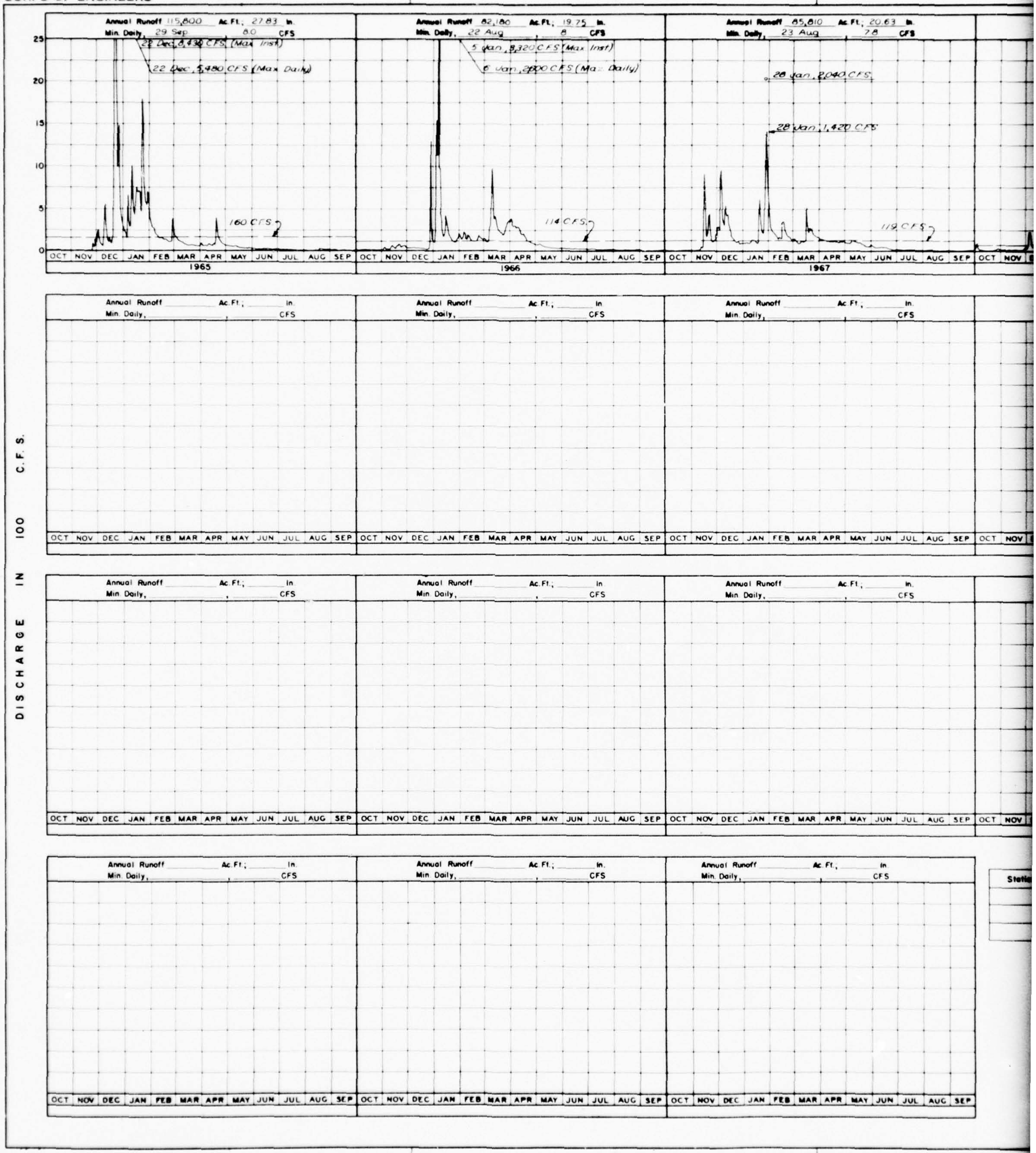
IN 3 SHEETS SHEET NO.2
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED C. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN G.C.J.
TRACED H.L.B.
CHECKED P.B.A.

PD-25-29/2

A

CORPS OF ENGINEERS



Annual Runoff 115,800 Ac.Ft.; 27.83 in.
Min. Daily, 29 Sep, 8.0 CFS

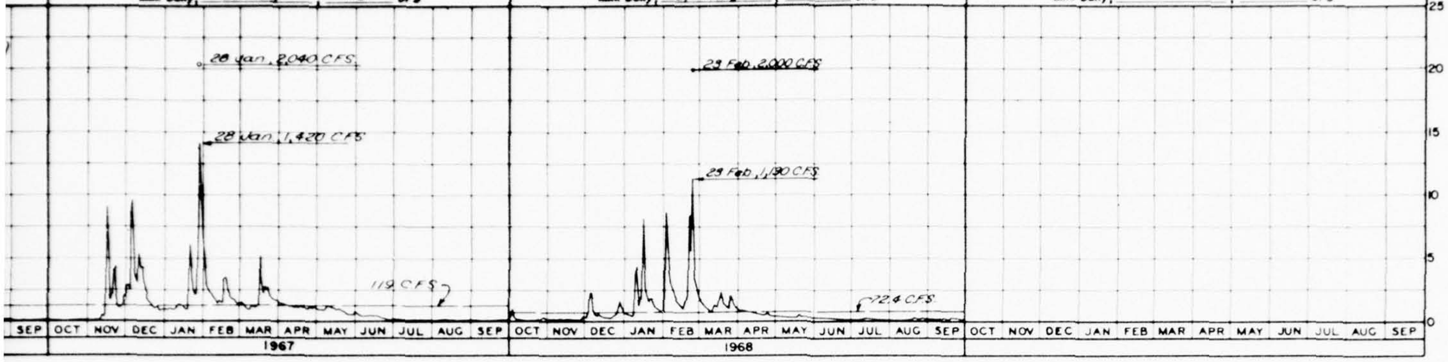
Annual Runoff 82,180 Ac.Ft.; 19.75 in.
Min. Daily, 22 Aug, 8 CFS

Annual Runoff 85,810 Ac.Ft.; 20.63 in.
Min. Daily, 23 Aug, 7.8 CFS

Annual Runoff 85,810 **Ac. Ft.;** 20.63 **in.**
Min. Daily, 23 Aug , 7.8 **CFS**

Annual Runoff 52,550 **Ac. Ft.;** 12.63 **in.**
Min. Daily, 12, 13 Aug , 6.0 **CFS**

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS



Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

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

C

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

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

B

Annual Runoff ______ Ac. Ft.; ______ in.
Min. Daily, ______ , ______ CFS

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

STATION DESCRIPTION

Station	Dr. Area Sq. Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			

LEGEND

- ∘ MAXIMUM INSTANTANEOUS DISCHARGE
- ← MAXIMUM DAILY DISCHARGE
- ----- MEAN DISCHARGE

A

UMPQUA RIVER BASIN, OREGON
COW CREEK

DAILY DISCHARGE HYDROGRAPH

COW CREEK
NR AZALEA, OREGON

IN 3 SHEETS SCALE AS SHOWN SHEET NO. 3
U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED C. Pedersen
CHIEF, WATER CONTROL SECTION

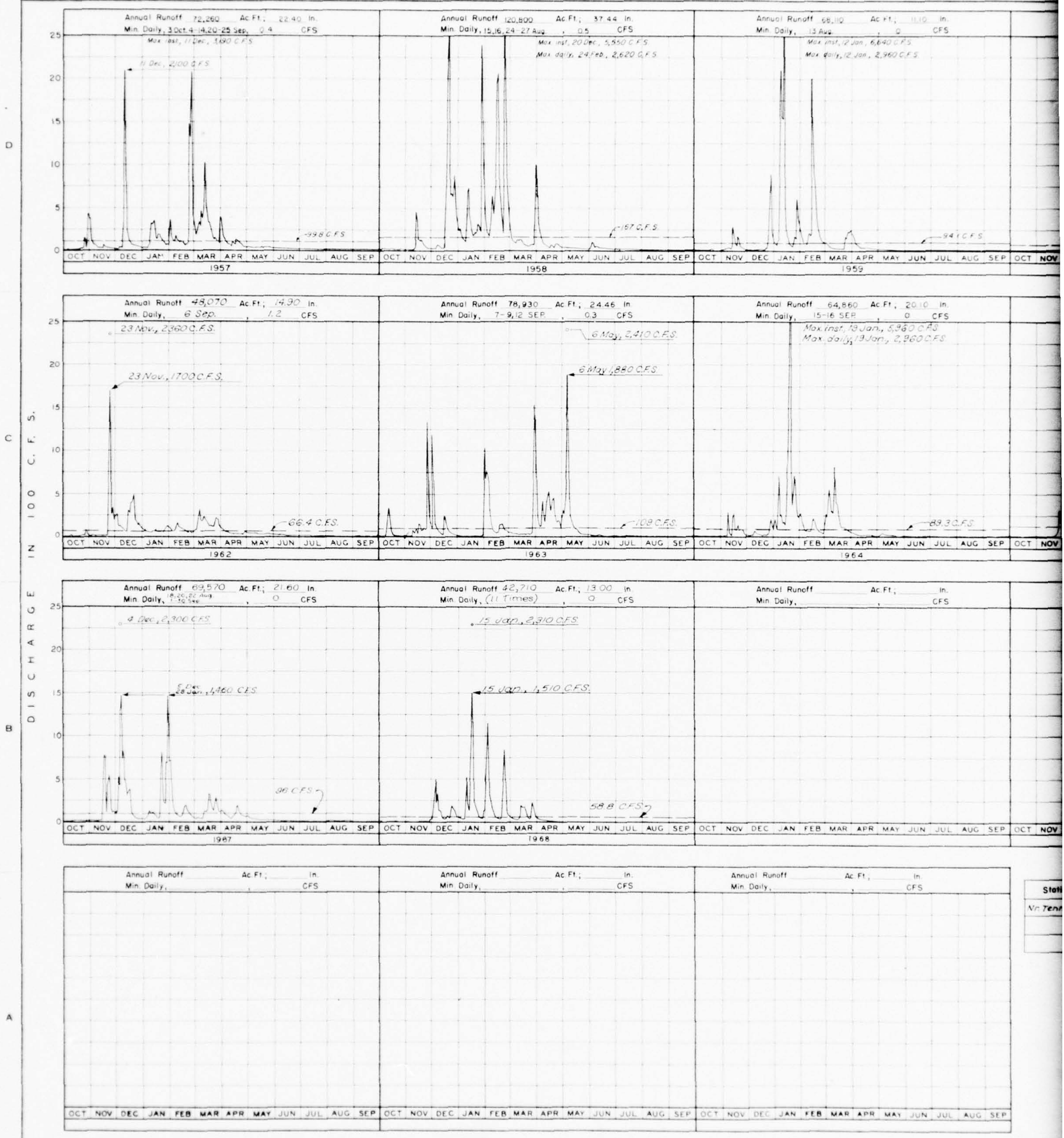
RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED W. H.
CHIEF, PLANNING BRANCH

APPROVED Robert
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN B.H.B
TRACED D.M.A
CHECKED B.H.B

PD-25-29/3



1957
Annual Runoff 72,260 Ac.Ft.; 22.40 In.
Min. Daily, 3 Oct. 4-14, 20-25 Sep., 0.4 CFS

1958
Annual Runoff 120,800 Ac.Ft.; 37.44 In.
Min. Daily, 15, 16, 24-27 Aug, 0.5 CFS

1959
Annual Runoff 68,110 Ac.Ft.; 11.10 In.
Min. Daily, 13 Aug., 0 CFS

1962
Annual Runoff 48,070 Ac.Ft.; 14.90 In.
Min. Daily, 6 Sep., 1.2 CFS

1963
Annual Runoff 78,930 Ac.Ft.; 24.46 In.
Min. Daily, 7-9, 12 SEP., 0.3 CFS

1964
Annual Runoff 64,860 Ac.Ft.; 20.10 In.
Min. Daily, 15-16 SEP., 0 CFS

1967
Annual Runoff 69,570 Ac.Ft.; 21.60 In.
Min. Daily, 18, 20, 22 Aug 1-30 Sep, 0 CFS

1968
Annual Runoff 42,710 Ac.Ft.; 13.00 In.
Min. Daily, (11 Times), 0 CFS

Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS

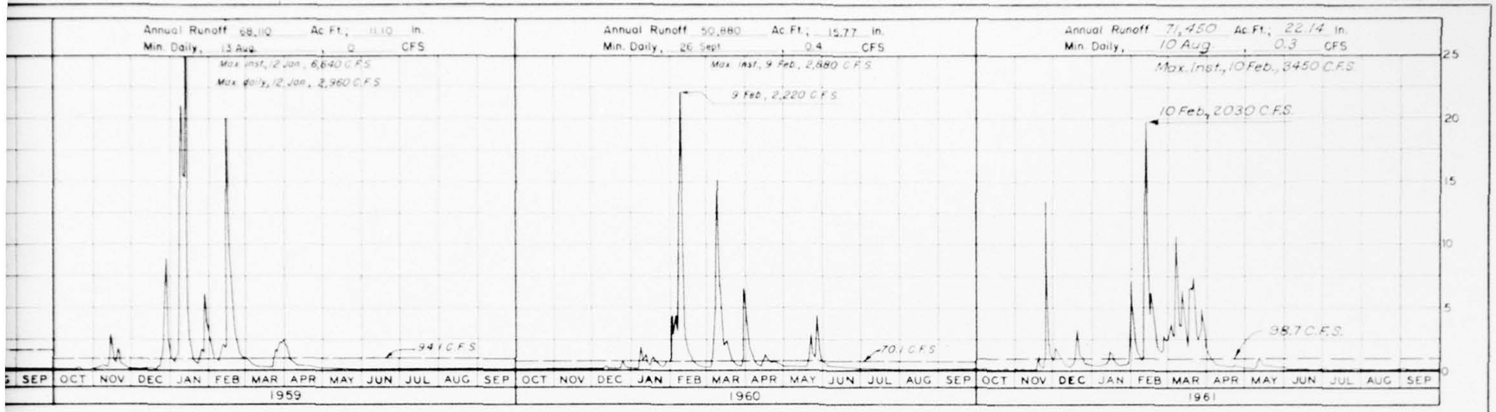
Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac.Ft.; In.
Min. Daily, , CFS

Annual Runoff 68,110 Ac.Ft.; 11.10 In.
Min. Daily, 13 Aug., 0 CFS

Annual Runoff 50,880 Ac.Ft.; 15.77 In.
Min. Daily, 26 Sept., 0.4 CFS

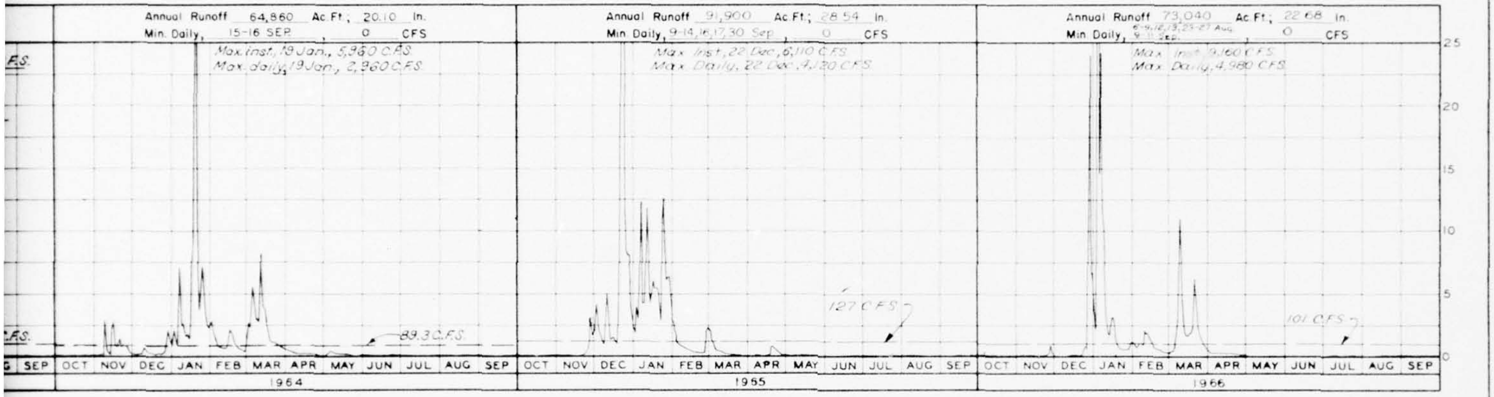
Annual Runoff 71,450 Ac.Ft.; 22.14 In.
Min. Daily, 10 Aug, 0.3 CFS



Annual Runoff 64,860 Ac.Ft.; 20.10 In.
Min. Daily, 15-16 SEP., 0 CFS

Annual Runoff 91,900 Ac.Ft.; 28.54 In.
Min. Daily, 9-14,16,17,30 Sep., 0 CFS

Annual Runoff 73,040 Ac.Ft.; 22.68 In.
Min. Daily, 6-9,12,13,25-27 Aug. 9-11 Sep., 0 CFS



Annual Runoff ______ Ac.Ft.; ______ In.
Min. Daily, ______, ______ CFS

Annual Runoff ______ Ac.Ft.; ______ In.
Min. Daily, ______, ______ CFS

Annual Runoff ______ Ac.Ft.; ______ In.
Min. Daily, ______, ______ CFS

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

B

Annual Runoff ______ Ac.Ft.; ______ In.
Min. Daily, ______, ______ CFS

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

STATION DESCRIPTION

Station	Dr. Area Sq. Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			
Nr. Tenmile	60.5	Oct. 1956 to Present	Continuous	W.S.R.	NW¼ Sec. 21, T29S, R7W	749.53

LEGEND

- ◦ MAXIMUM INSTANTANEOUS DISCHARGE
- ← MAXIMUM DAILY DISCHARGE
- - - - - MEAN DISCHARGE

A

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

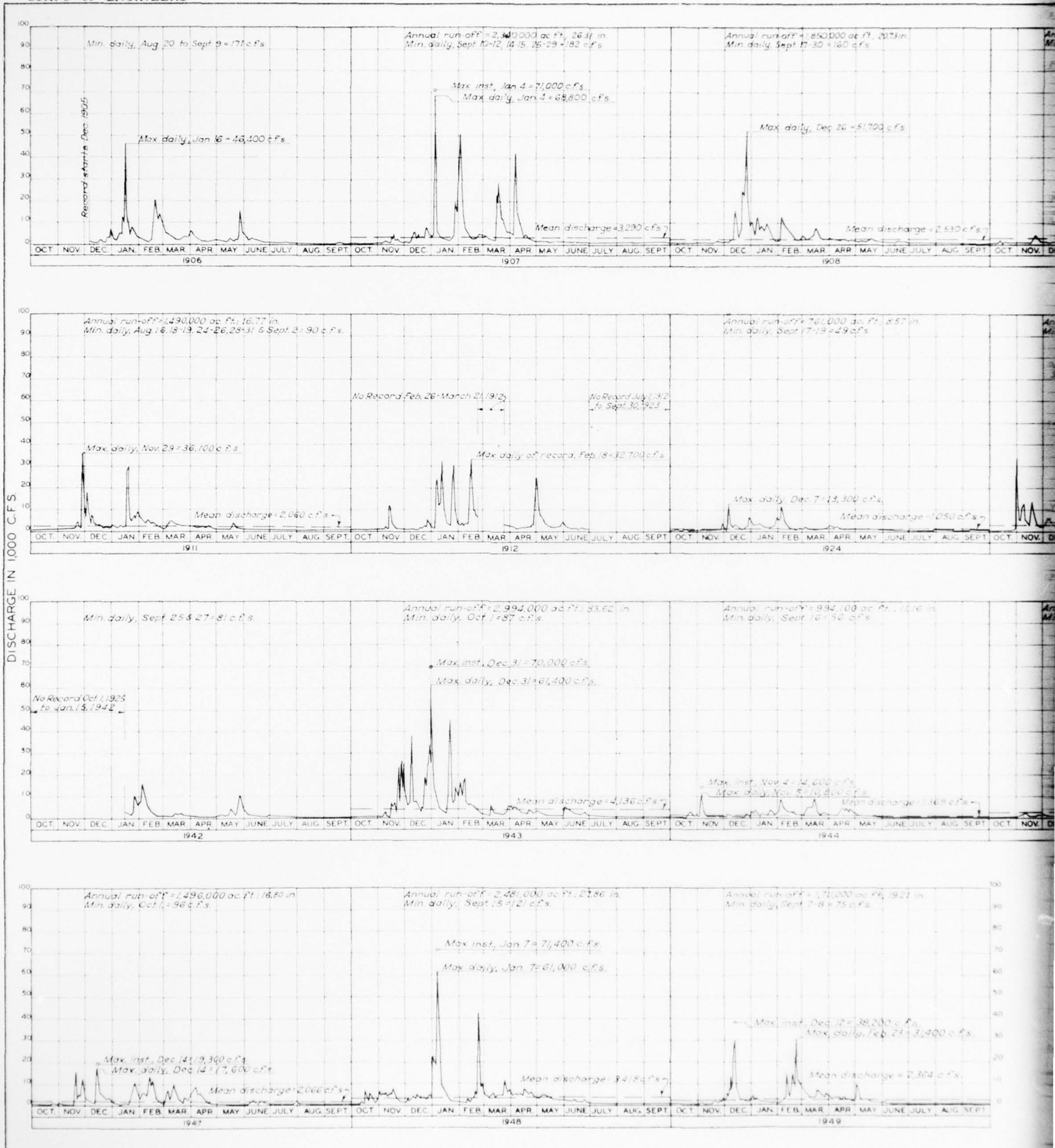
OLALLA CREEK NEAR TENMILE, OREGON

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

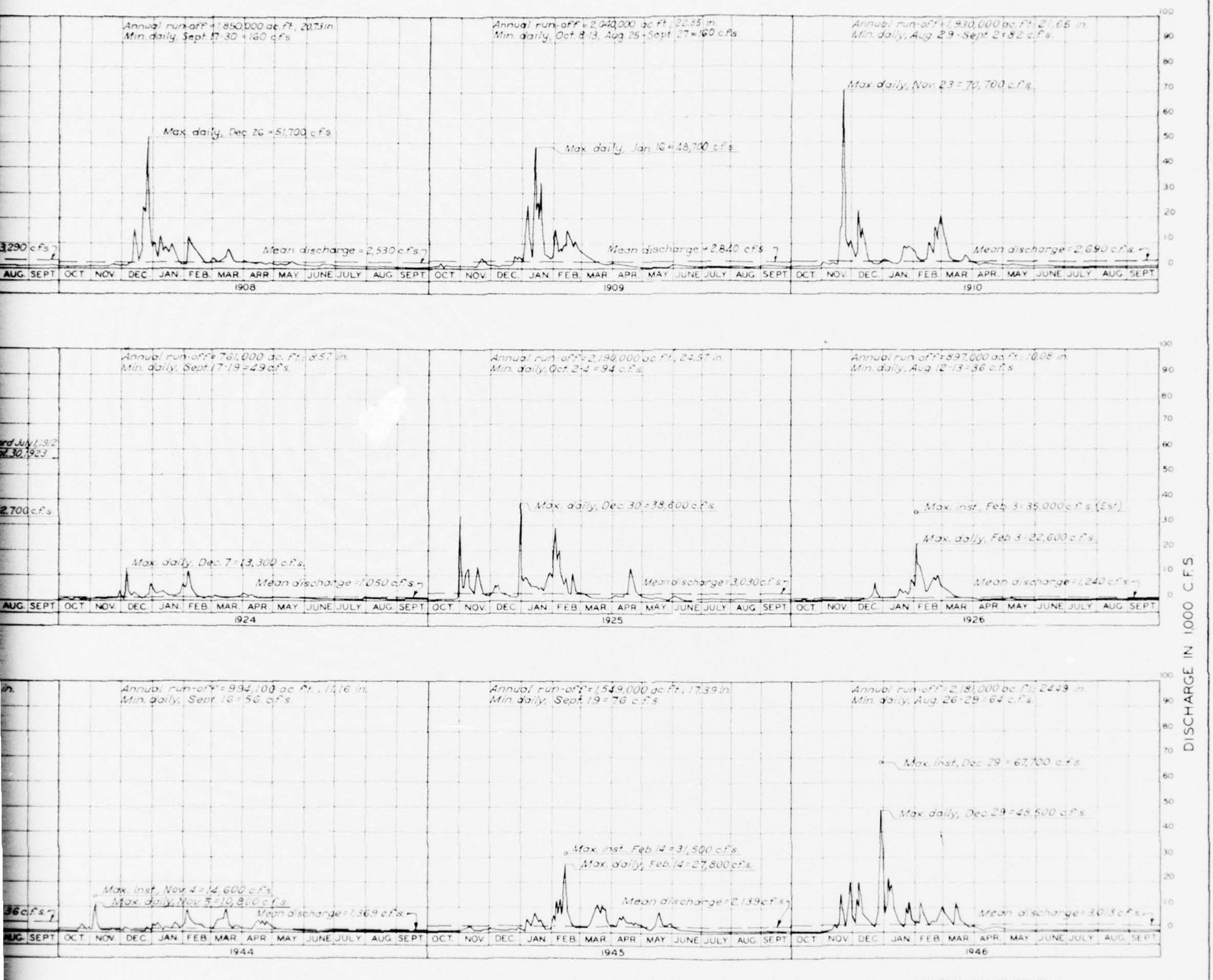
SUPERVISED C. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN D.C.J.
TRACED G.A.A.
CHECKED R.A.B.

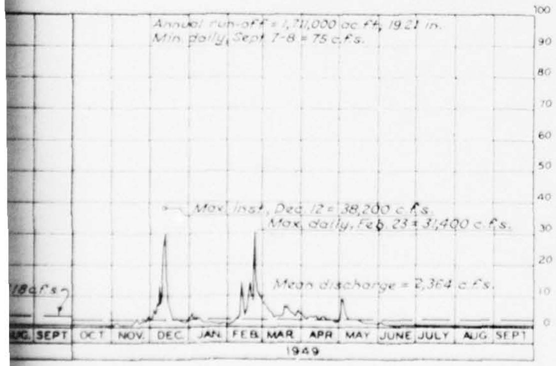
PD-25-31

CORPS OF ENGINEERS



U.S. ARMY





STATION DESCRIPTION

Station	Dr. Area Sq. Mi.	Available Records		Type of Gage	Location	Datum (M.S.L.) 1929 adj.
		Period	Character			
Nr. Brockway	1670	1906-1910	Incomplete	Staff	SW¼ Sec. 15, T.28S., R6W.	Not determined
Nr. Brockway	1670	1911-1912	Incomplete	Chain	SW¼ Sec. 15, T.28S., R6W.	Not determined
Nr. Brockway	1670	1924-1926	Continuous	Chain	SW¼ Sec. 15, T.28S., R6W.	Not determined
Nr. Brockway	1670	1942-1949	Incomplete	Chain	SW¼ Sec. 15, T.28S., R6W.	461.84
Nr. Brockway	1670	1949-Present	Complete	W.S.R.	SW¼ Sec. 15, T.28S., R6W.	461.84

Note:
All run-off in inches is computed for a drainage area of 1670 sq. mi.

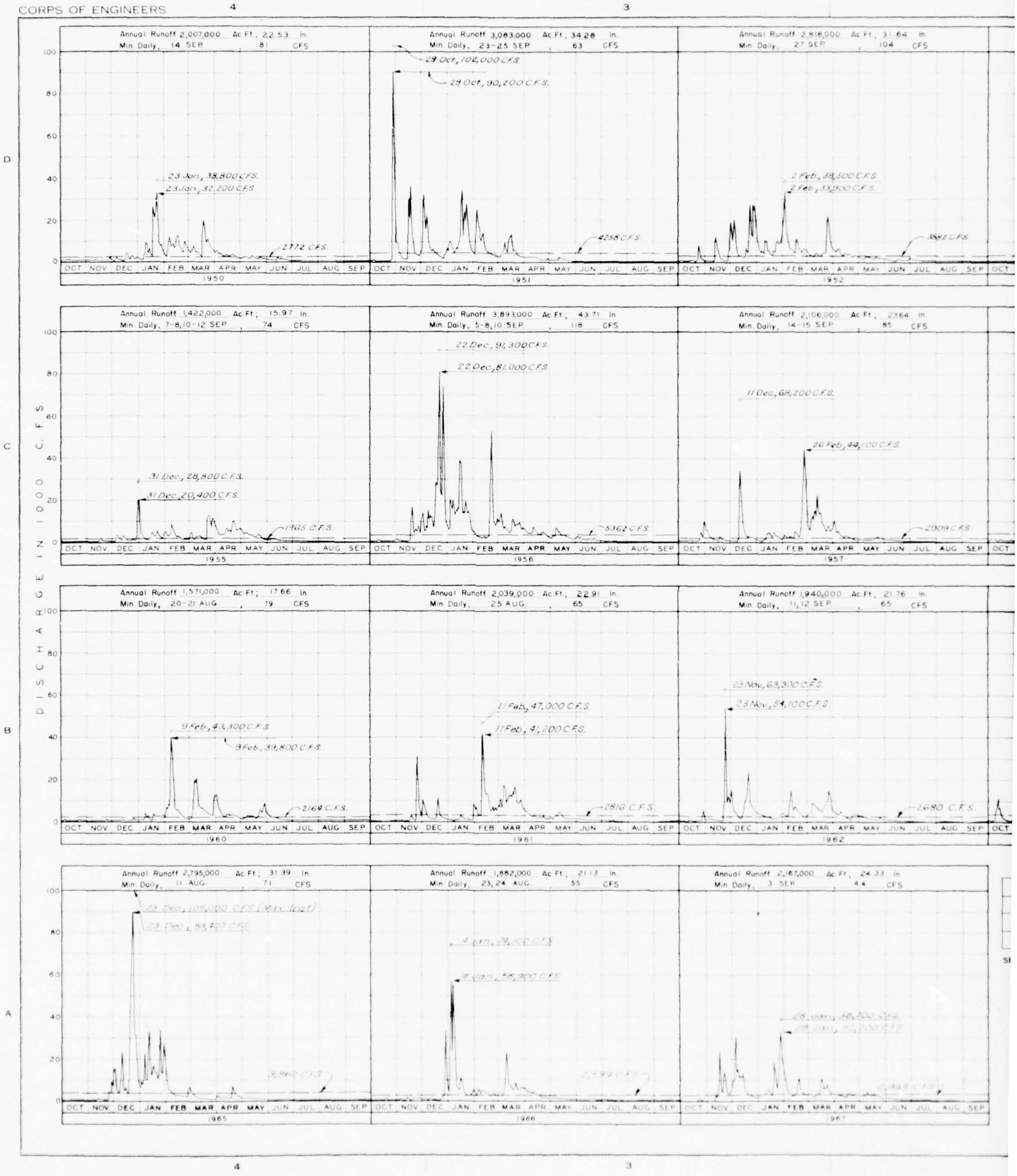
UMPQUA RIVER AND TRIBUTARIES
OREGON
DAILY DISCHARGE HYDROGRAPH
SOUTH UMPQUA RIVER NEAR BROCKWAY
DRAINAGE AREA 1,670 SQUARE MILES
IN 3 SHEETS SHEET NO. 1
PORTLAND DISTRICT, CORPS OF ENGINEERS, FEB. 1, 1951

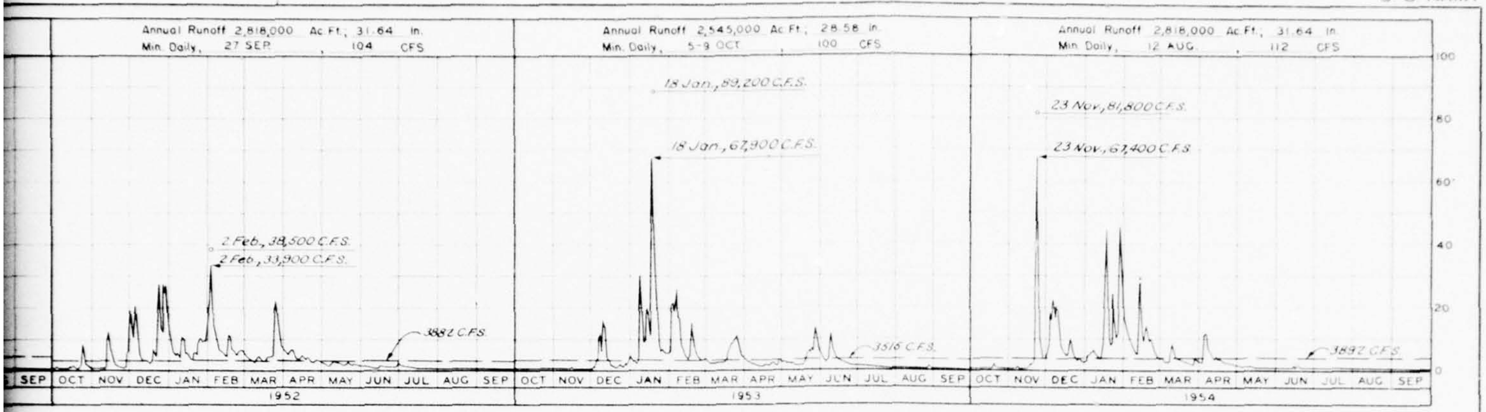
PREPARED:
HEAD, HYDROLOGY, METEOROLOGY & POWER SECTION
RECOMMENDED:
CHIEF, ENGINEERING DIVISION
SUBMITTED:
HEAD, PLANNING BRANCH
APPROVED:
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN BY: A.K.B.
TRACED BY: N.N.H. - D.V.
CHECKED BY: W.A.M.

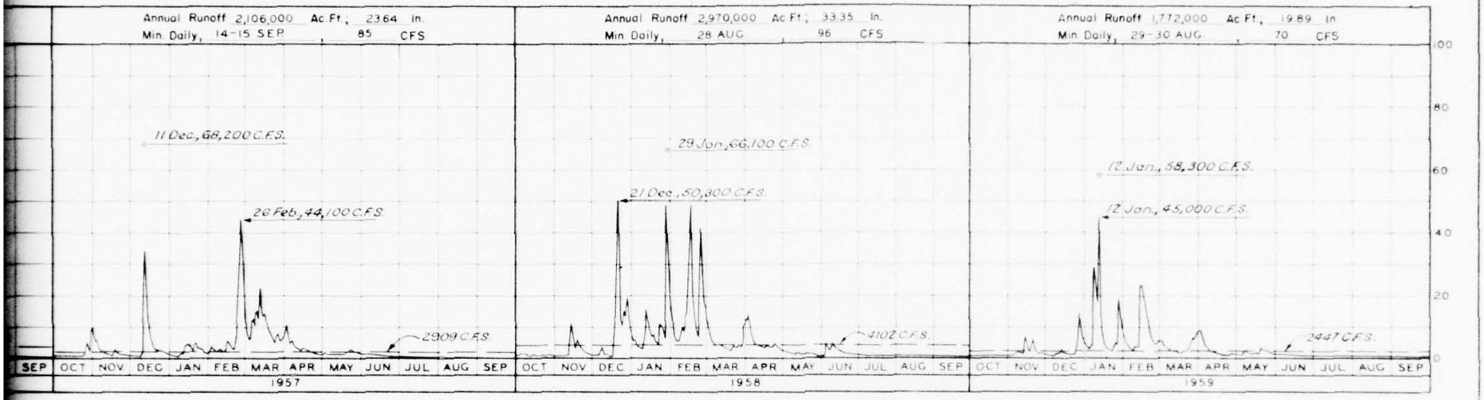
PD-25-26/1

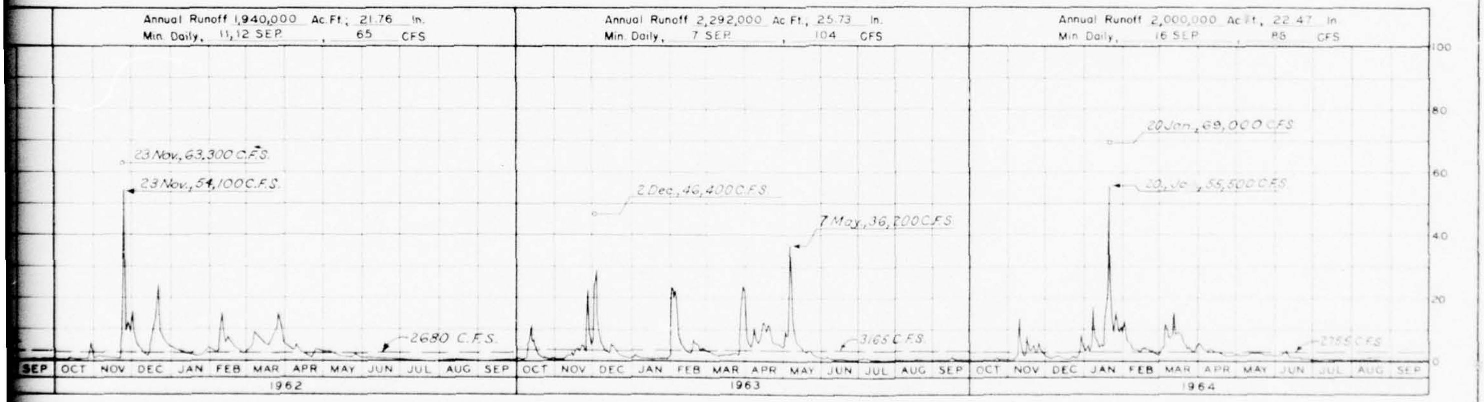
PLATE 16

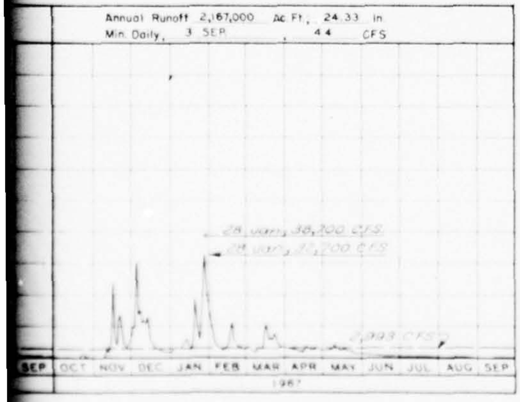
CORPS OF ENGINEERS











STATION DESCRIPTION

Station	Dr. Area Sq. Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			

SEE SHEET NO. 1 FOR STATION DESCRIPTION

LEGEND

∘ MAXIMUM INSTANTANEOUS DISCHARGE
← MAXIMUM DAILY DISCHARGE
— — — MEAN DISCHARGE

A

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

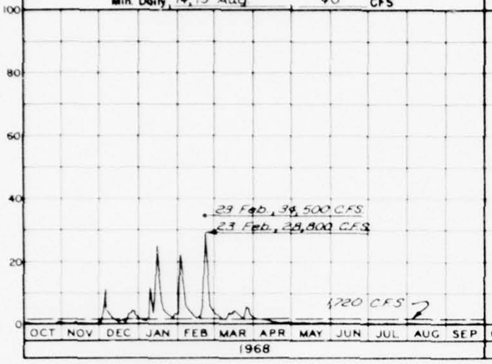
SOUTH UMPQUA RIVER NEAR BROCKWAY
DRAINAGE AREA 1,670 SQUARE MILES
IN 3 SHEETS SHEET NO. 2
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED RECOMMENDED
CHIEF, HYDROLOGY AND METEOROLOGY SECTION CHIEF, ENGINEERING DIVISION
SUBMITTED APPROVED
CHIEF, PLANNING BRANCH COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN: D.C.Z.
TRACED: T.G.B.
CHECKED: P.B.B.

PD-25-26/2

CORPS OF ENGINEERS

Annual Runoff 1,248,000 Ac. Ft.; 14.02 In.
Min. Daily, 14, 15 Aug, 40 CFS



DISCHARGE IN 1000 C.F.S.

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

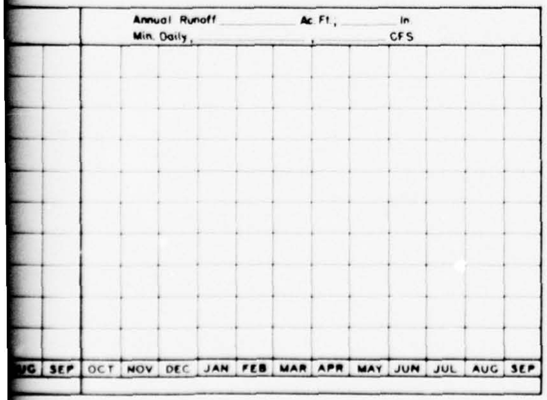
Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

Annual Runoff Ac. Ft.; In.
Min. Daily, , CFS

U S ARMY



STATION DESCRIPTION

Station	Dr. Area Sq. Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			

LEGEND

- • MAXIMUM INSTANTANEOUS DISCHARGE
- ◄— MAXIMUM DAILY DISCHARGE
- - - - - MEAN DISCHARGE

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

SOUTH UMPQUA RIVER NEAR BROCKWAY
DRAINAGE AREA 1,670 SQUARE MILES
IN 3 SHEETS SHEET NO. 3
U. S. ARMY ENGINEER DISTRICT, PORTLAND

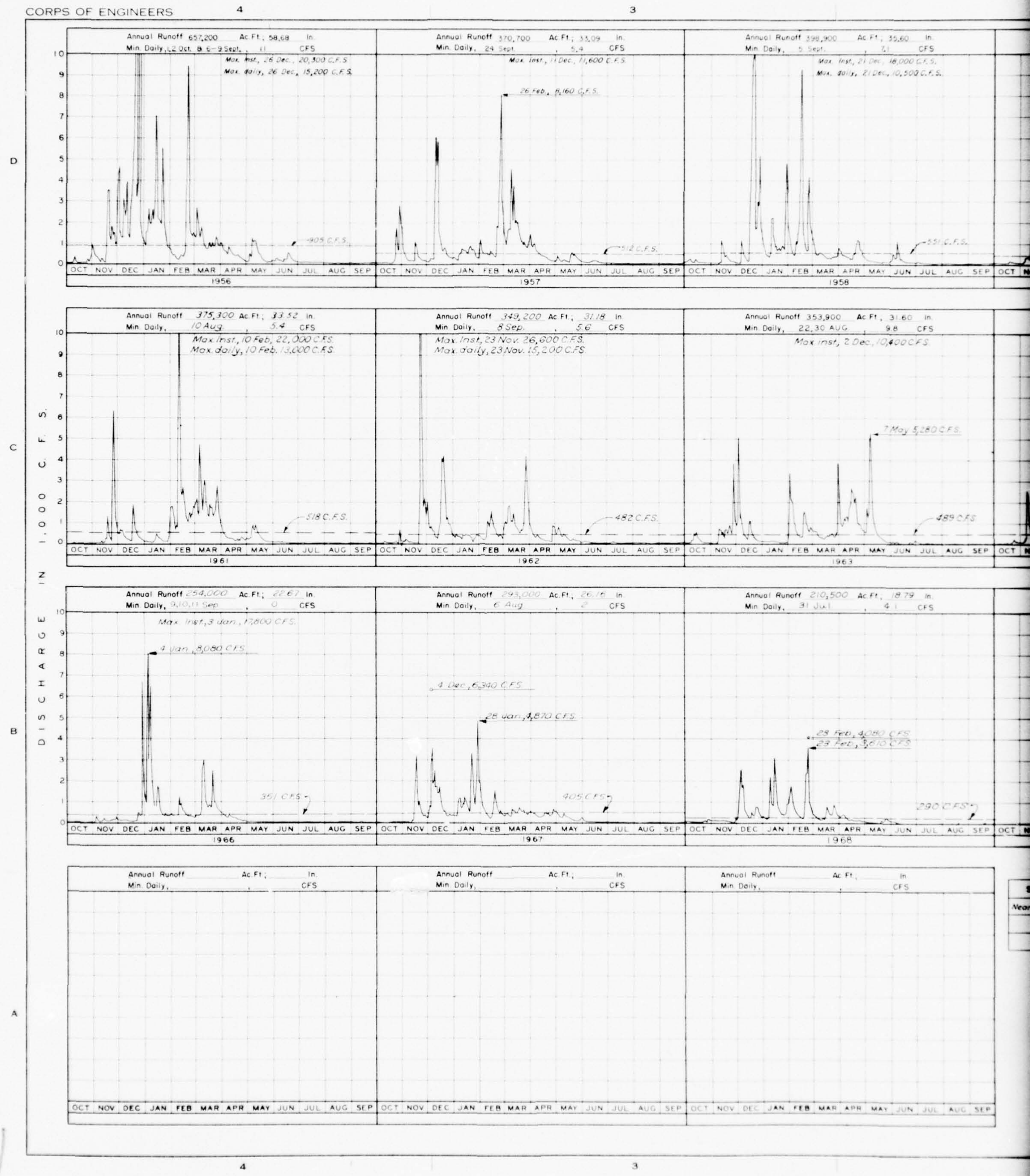
SUPERVISED
CHIEF, WATER CONTROL SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, PLANNING BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
DRAWN
TRACED
CHECKED

PD-25-26/3

A

2 1

PLATE 18


CORPS OF ENGINEERS
4
3
D
C
B
A
DISCHARGE IN 1,000 C.F.S.
0
1
2
3
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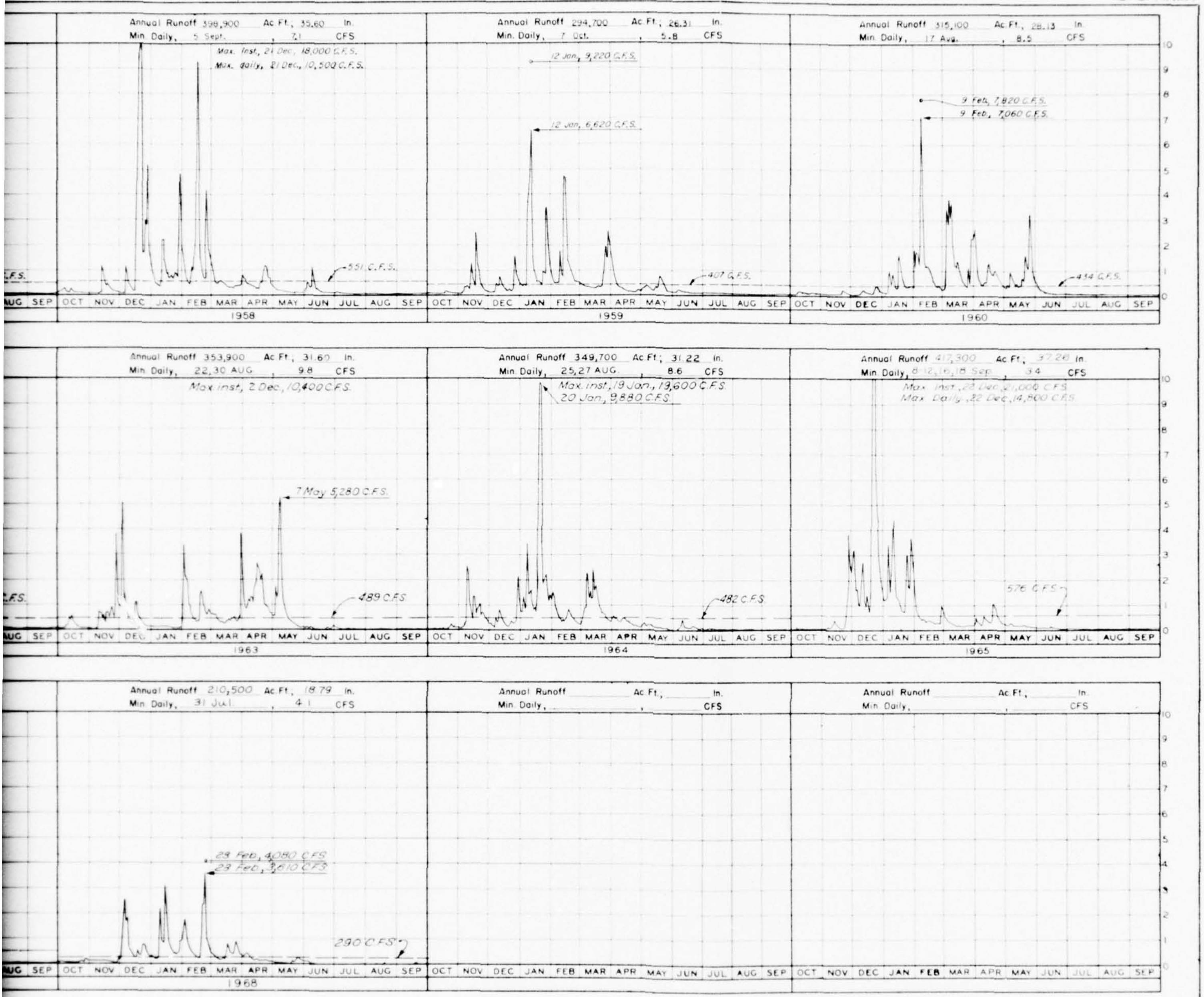
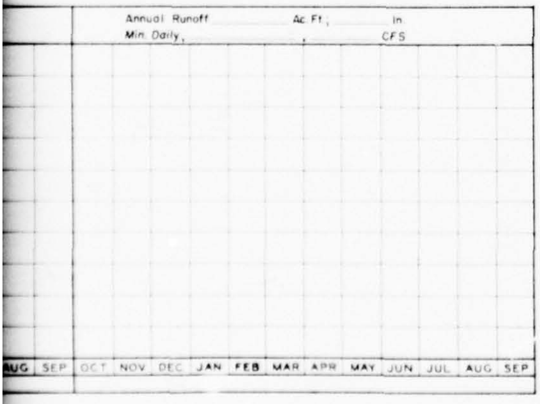
6
7
8
9
10
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
Annual Runoff 657,200 Ac.Ft.; 58.68 In.
Min. Daily, 1,2 Oct. & 6-9 Sept., 11 CFS
Max. Inst., 26 Dec., 20,300 C.F.S.
Max. daily, 26 Dec., 15,200 C.F.S.
905 C.F.S.
1956
Annual Runoff 370,700 Ac.Ft.; 33.09 In.
Min. Daily, 24 Sept., 5.4 CFS
Max. Inst., 11 Dec., 11,600 C.F.S.
26 Feb., 8,160 C.F.S.
512 C.F.S.
1957
Annual Runoff 398,900 Ac.Ft.; 35.60 In.
Min. Daily, 5 Sept., 7.1 CFS
Max. Inst., 21 Dec., 18,000 C.F.S.
Max. daily, 21 Dec., 10,500 C.F.S.
551 C.F.S.
1958
Annual Runoff 375,300 Ac.Ft.; 33.52 In.
Min. Daily, 10 Aug, 5.4 CFS
Max. Inst., 10 Feb, 22,000 C.F.S.
Max. daily, 10 Feb. 13,000 C.F.S.
518 C.F.S.
1961
Annual Runoff 349,200 Ac.Ft.; 31.18 In.
Min. Daily, 8 Sep., 5.6 CFS
Max. Inst, 23 Nov. 26,600 C.F.S.
Max. daily, 23 Nov. 15,200 C.F.S.
482 C.F.S.
1962
Annual Runoff 353,900 Ac.Ft.; 31.60 In.
Min. Daily, 22,30 AUG, 9.8 CFS
Max. inst, 2 Dec., 10,400 C.F.S.
7 May 5,280 C.F.S.
489 C.F.S.
1963
Annual Runoff 254,000 Ac.Ft.; 22.67 In.
Min. Daily, 9,10,11 Sep, 0 CFS
Max. Inst., 3 Jan., 17,800 CFS.
4 Jan., 8,080 CFS
351 CFS
1966
Annual Runoff 293,000 Ac.Ft.; 26.16 In.
Min. Daily, 6 Aug, 2 CFS
4 Dec, 6,340 CFS
28 Jan., 4,870 CFS
405 CFS
1967
Annual Runoff 210,500 Ac.Ft.; 18.79 In.
Min. Daily, 31 Jul, 4.1 CFS
28 Feb., 4,080 CFS
23 Feb., 3,610 CFS
290 CFS
1968
Annual Runoff Ac.Ft.; In.
Min. Daily, CFS
Annual Runoff Ac.Ft.; In.
Min. Daily, CFS
Annual Runoff Ac.Ft.; In.
Min. Daily, CFS
OCT N





STATION DESCRIPTION

Station	Dr Area Sq Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			
Near Oakland	210	Oct. 1955 to Present	Continuous	Wire-Wt	NW¼ Sec 24,T26S, R6W	371.26

LEGEND

·	MAXIMUM INSTANTANEOUS DISCHARGE
←	MAXIMUM DAILY DISCHARGE
- - - - -	MEAN DISCHARGE

A

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

CALAPOOYA CREEK NEAR OAKLAND, OREGON

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED
CHIEF, HYDROLOGY AND METEOROLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

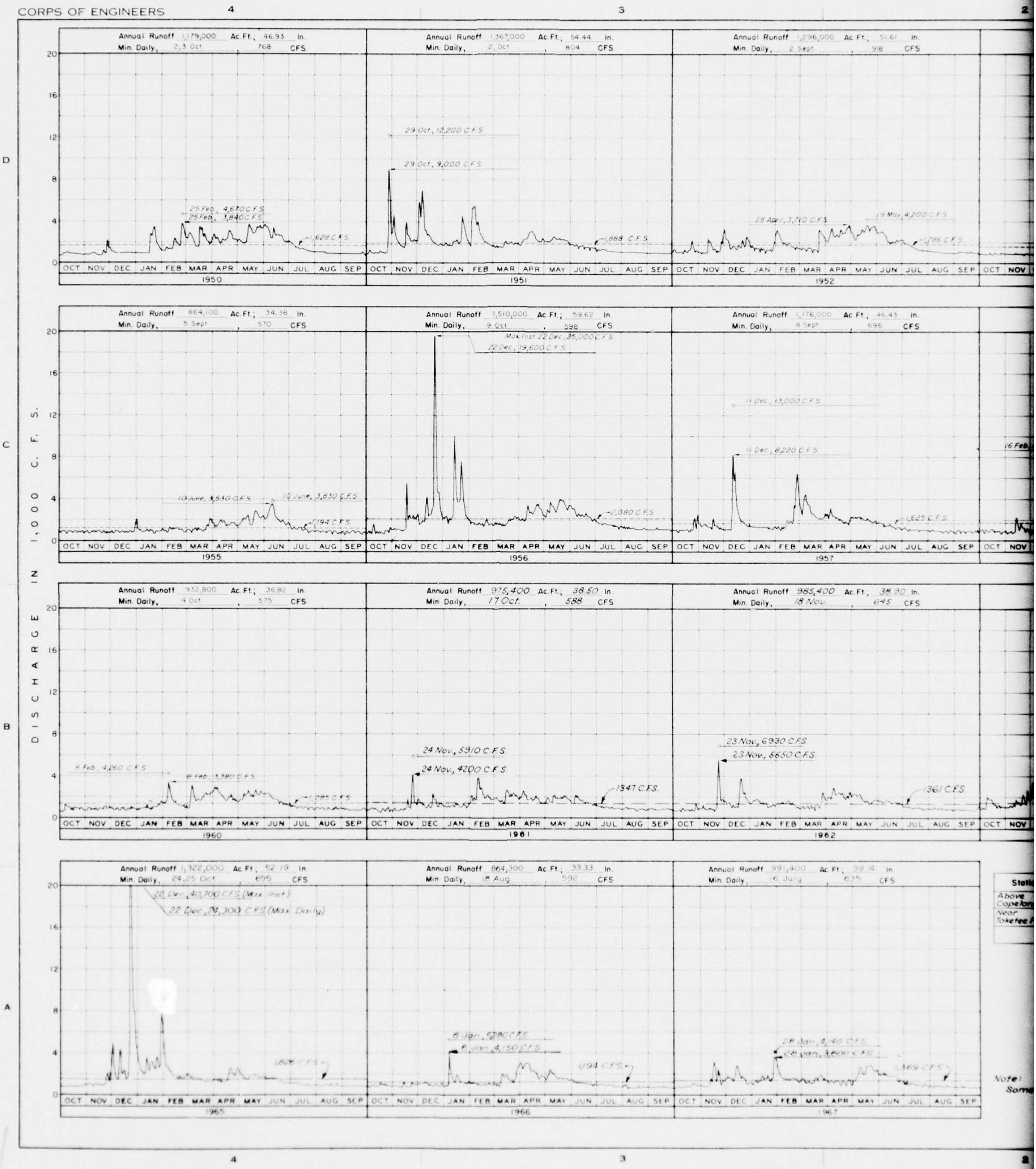
SUBMITTED
CHIEF, PLANNING BRANCH

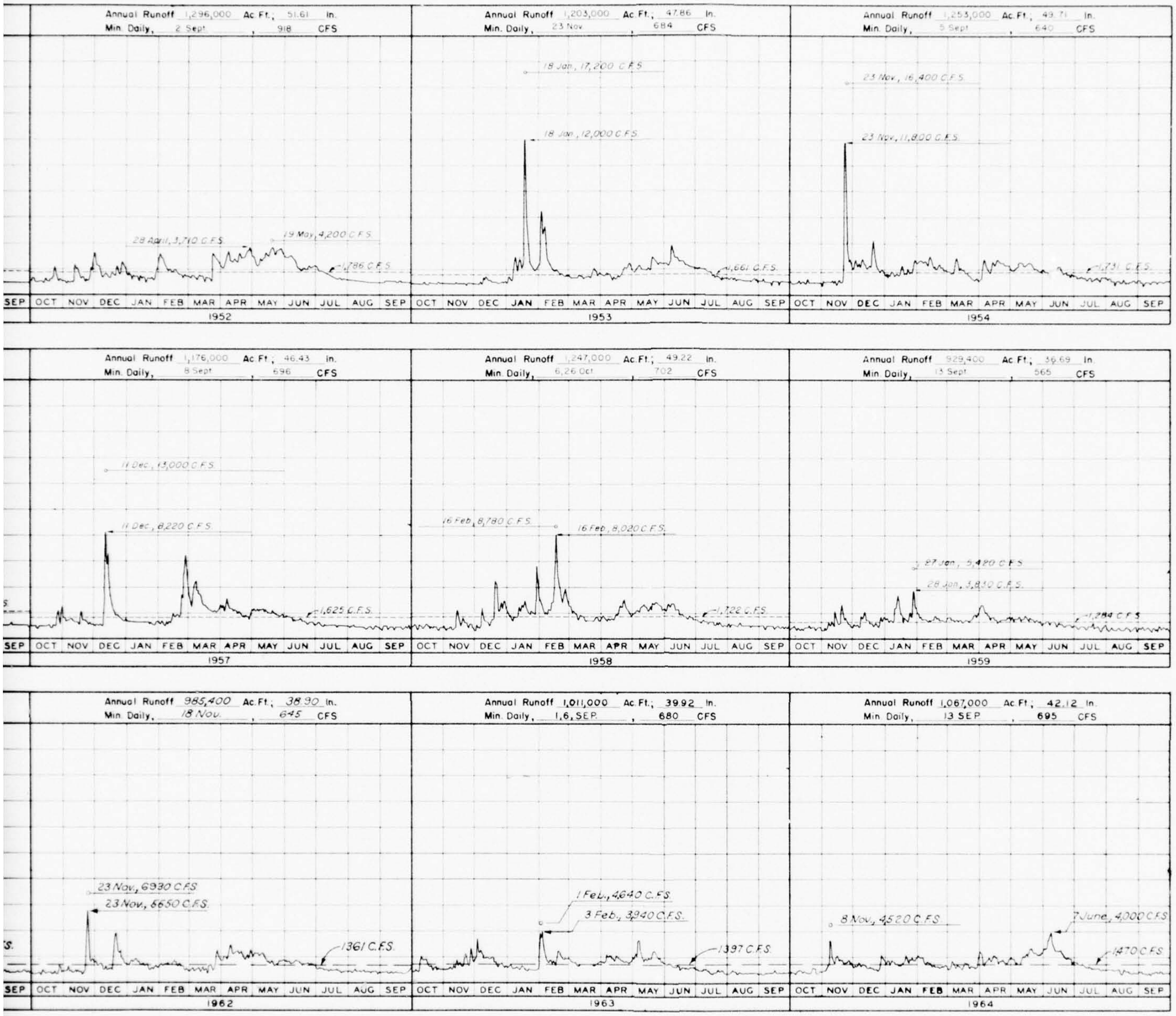
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

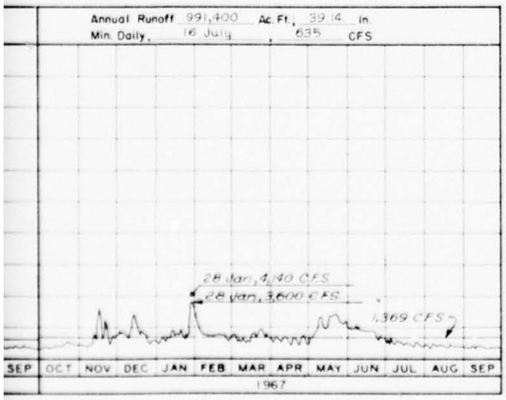
DRAWN G.C.J.
TRACED B.E.F.
CHECKED P.R.R.

PD-25-30

CORPS OF ENGINEERS







STATION DESCRIPTION

Station	Dr Area Sq Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			
Above Copeland Cr.	475	Sept. 1949 to Sept. 1952	Continuous	W.S.R	NW¼ Sec. 24, T26S, R2E	1580
Near Toketee Falls	"	Oct. 1952 to Present	"	"	"	"

LEGEND

○ MAXIMUM INSTANTANEOUS DISCHARGE

← MAXIMUM DAILY DISCHARGE

– – – – MEAN DISCHARGE

Note:
Some regulation by Diamond Lake and Lemolo Reservoir.

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

NORTH UMPQUA RIVER ABOVE COPELAND CREEK
NEAR TOKETEE FALLS, OREGON

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

SUPERVISED C. Pedersen
CHIEF, HYDROLOGY AND METEOROLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

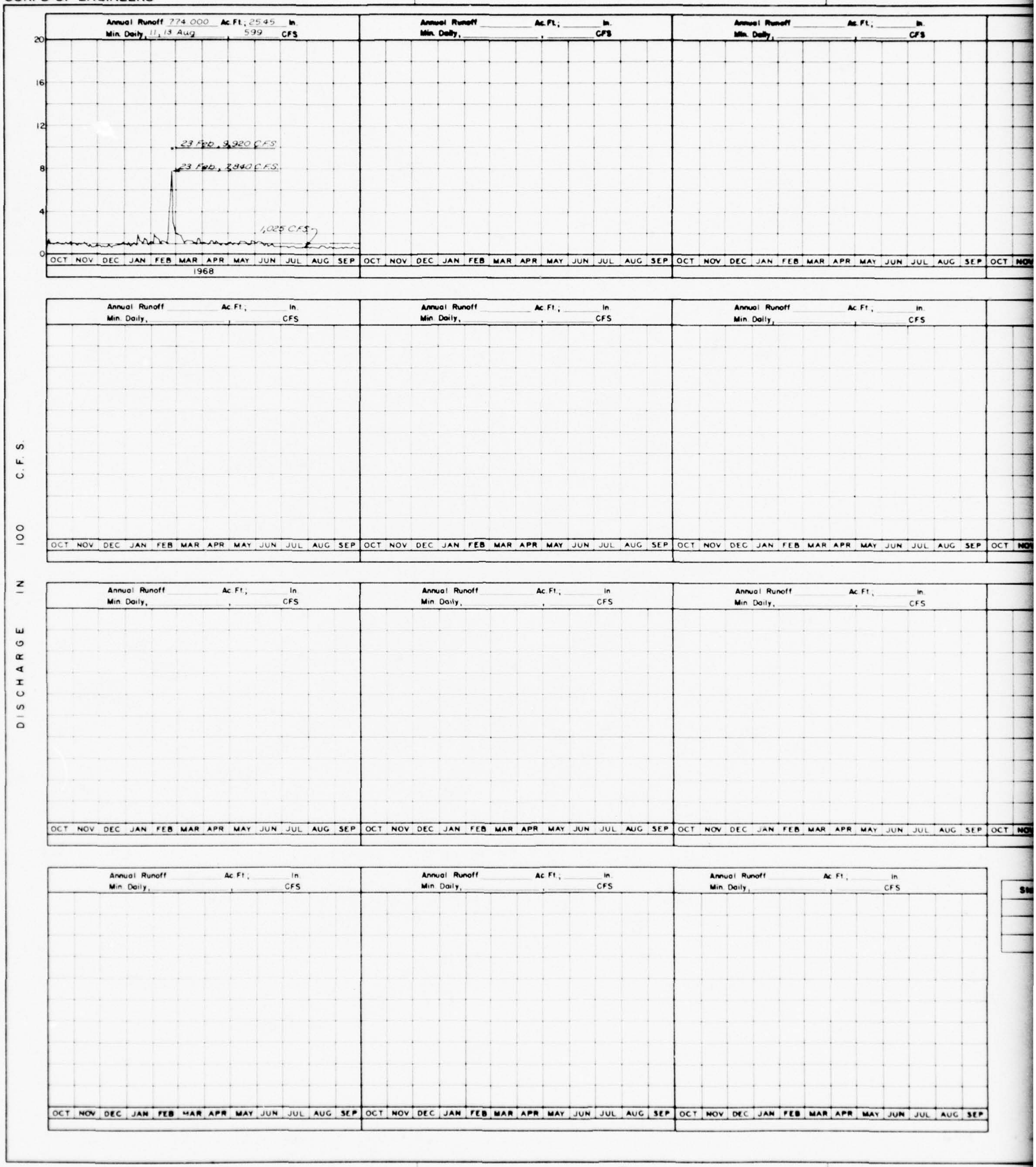
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN D.C.J.
TRACED R.J.A.
CHECKED P.A.B.

PD-25-28/1

A

CORPS OF ENGINEERS



Annual Runoff 774,000 Ac.Ft.; 25.45 In.
Min. Daily, 11, 13 Aug, 599 CFS

2 1 U. S. ARMY

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

D

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

C

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

B

Annual Runoff ______ Ac. Ft.; ______ In.
Min. Daily, ______ , ______ CFS

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

STATION DESCRIPTION

Station	Dr Area Sq Miles	Records		Type of Gage	Location	Datum MSL
		Available	Character			

LEGEND

•	MAXIMUM INSTANTANEOUS DISCHARGE
←	MAXIMUM DAILY DISCHARGE
- - - - -	MEAN DISCHARGE

UMPQUA RIVER AND TRIBUTARIES
OREGON

DAILY DISCHARGE HYDROGRAPH

NORTH UMPQUA RIVER ABOVE COPELAND CREEK
NEAR TOKETTEE FALLS, OREGON

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED
CHIEF, WATER CONTROL SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN
TRACED
CHECKED

PD-25-28/2

A

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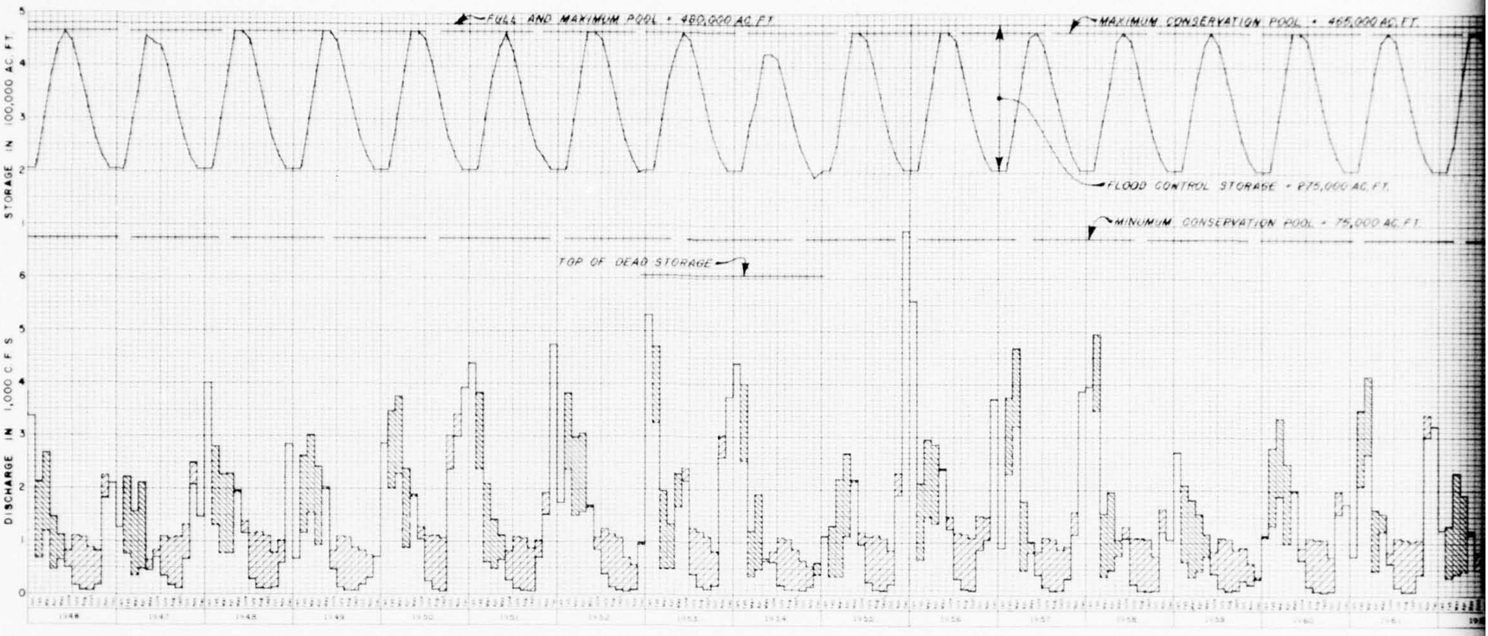
PLATE 21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MAXIMUM CONSERVATION POOL = 465,000 AC. FT.
FLOOD CONTROL STORAGE = 275,000 AC. FT.
MINUMUM CONSERVATION POOL = 75,000 AC. FT.
TOP OF DEAD STORAGE
STORAGE IN 100,000 AC. FT.
DISCHARGE IN 1,000 C.F.S.
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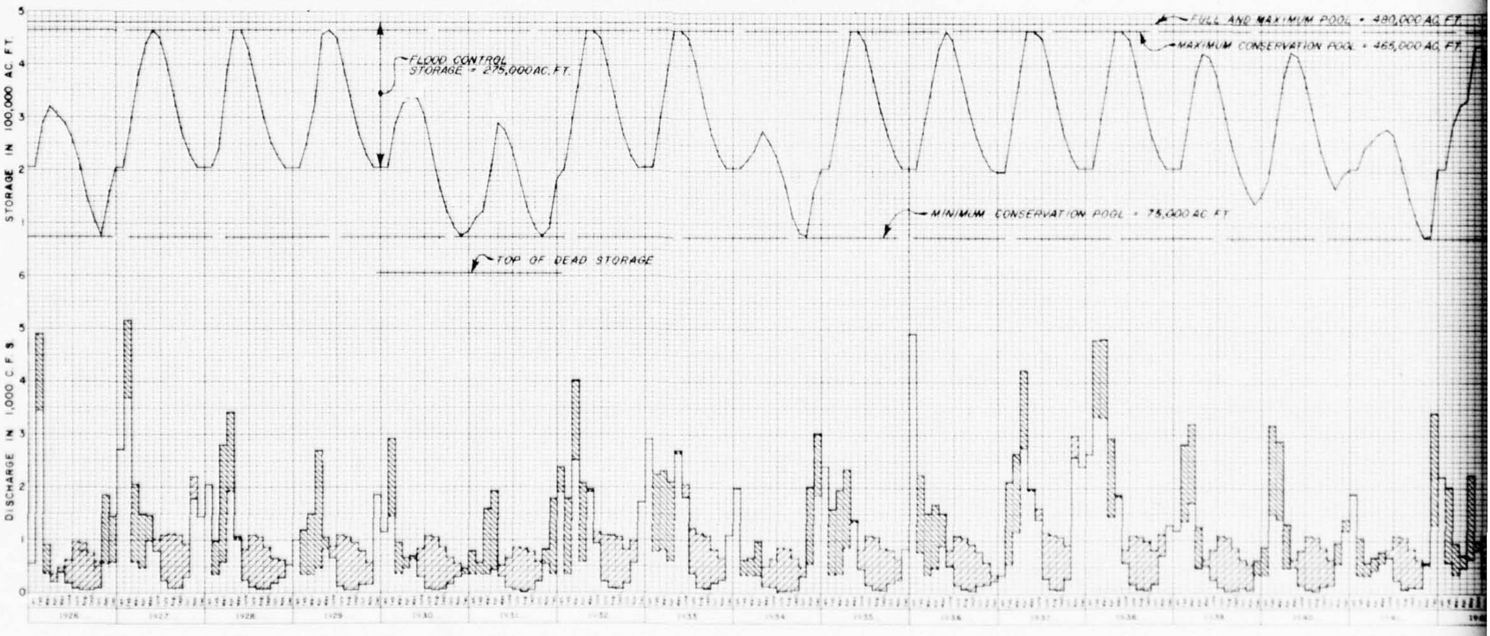
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MINIMUM CONSERVATION POOL = 75,000 AC. FT.
TOP OF DEAD STORAGE
STORAGE IN 100,000 AC. FT.
DISCHARGE IN 1,000 C.F.S.
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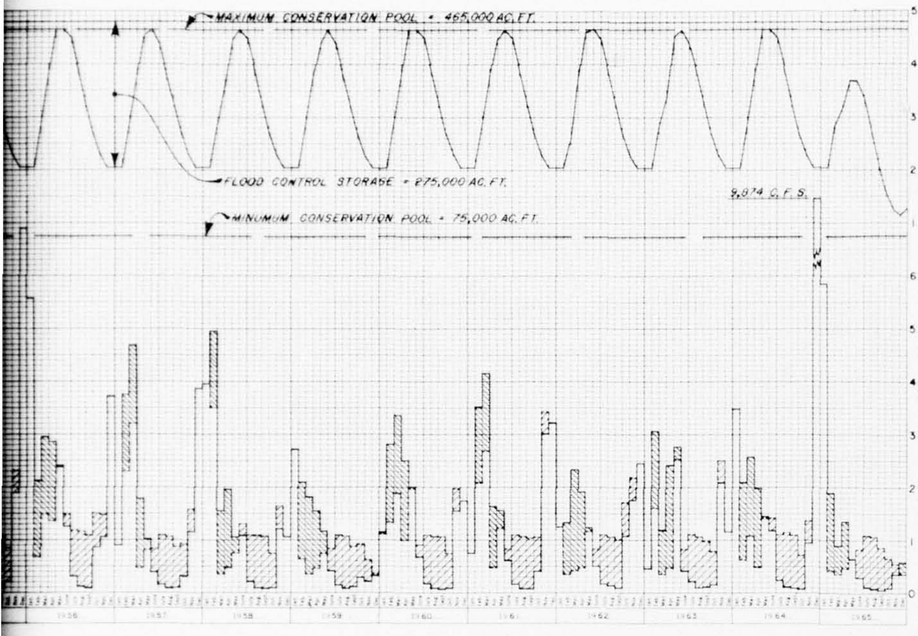
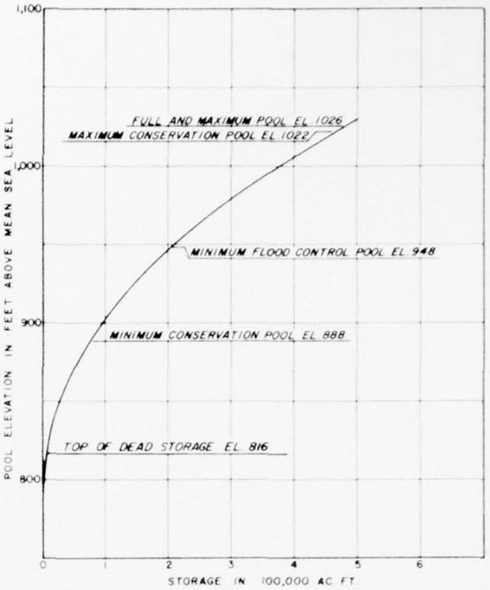




STORAGE CAPACITY

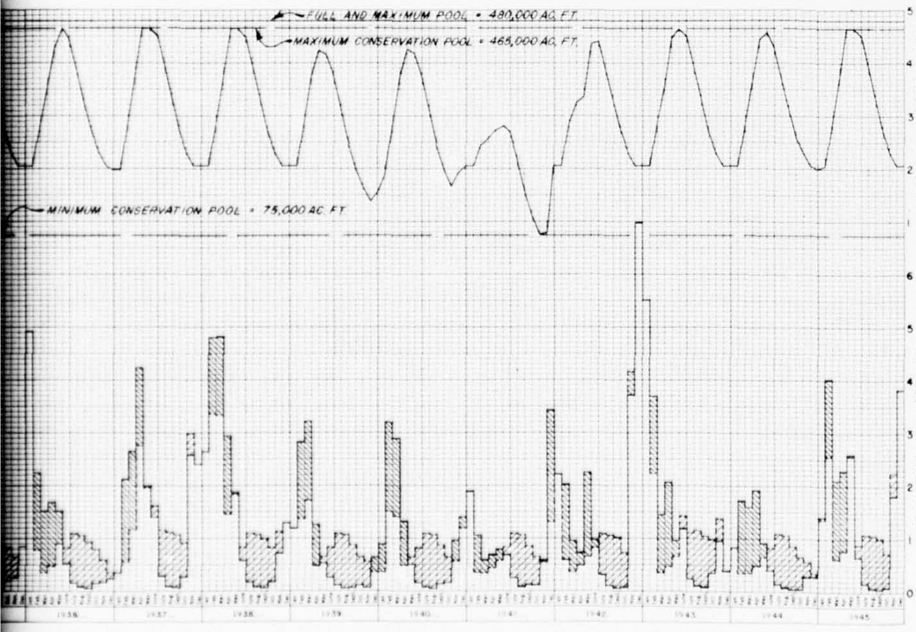
LEGEND

▯ NATURAL INFLOW

┆ REGULATED OUTFLOW

▨ WATER STORED IN RESERVOIR

▨ WATER RELEASED FROM STORAGE (IN EXCESS OF NATURAL INFLOW)



NOTES

1. THIS PLATE ILLUSTRATES, AT THE DAYS CREEK DAMSITE FOR THE PERIOD 1926 - 1965, THE INFLOW, OUTFLOW, AND RESERVOIR CONTENTS AS AFFECTED BY A PLAN TO DEVELOP THE ULTIMATE WATER RESOURCES OF A 480 000 ACRE FOOT STORAGE PROJECT ON SOUTH UMPQUA RIVER AT THE DAYS CREEK SITE.
2. SEE TEXT FOR EXPLANATION OF SEASONAL RESERVOIR REGULATION.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER

DAYS CREEK LAKE

SEASONAL RESERVOIR REGULATION
1926 — 1965

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED C. Pedersen
CHIEF, WATER CONTROL SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED
TRACED
CHECKED

TRANSMITTED WITH REPORT
DATED

UM-20-26

REVIEW REPORT
ON
UMPQUA RIVER AND TRIBUTARIES, OREGON
INTERIM REPORT, SOUTH UMPQUA RIVER

APPENDIX C

FOUNDATION AND MATERIALS DATA

Prepared by
U. S. Army Engineer District, Portland
Corps of Engineers
Portland, Oregon

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REVIEW REPORT
ON
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I - GENERAL

1-01. Basin Characteristics. The Umpqua River Basin, although having a length of only about 115 miles, extends through five distinct physiographic divisions presenting great contrasts in topography, geology, and soils (Plate 1). Engineering problems related to dam construction are varied accordingly. From east to west major elements of the drainage system pass from the High Cascades successively through the Western Cascades, Klamath Mountains and Coast Range, and terminate in the narrow Coastal Plain. The Tiller Damsite is in the Klamath Mountains but the reservoir is largely in the Western Cascades. The Days Creek Damsite and reservoir are located in the Klamath Mountains. The High Cascades are comprised of a narrow plateau formed by a series of basaltic and basaltic andesite shield volcanoes and assorted volcanic forms. Dissection is highly variable but overall is not well developed and slopes of 5^o and less are common. Weathering is usually slight with soil commonly being comprised of sand or volcanic ash. The Western Cascades are comprised of a series of partly altered pyroclastics, volcanic sediments and lava flows. This part of the range is deeply dissected with narrow stream valleys separated by sharp ridges. Slopes of 10^o to 20^o are common and the valleys frequently show remnants of earlier, higher stream levels which appear as discontinuous benches. In the western part of the Western Cascades valleys are wider and slopes more subdued. Weathering frequently is deep and intense and swelling volcanic clays are common. The Klamath Mountains are characterized by advanced dissection, rugged topography, oversteepened slopes, narrow ridges and deep canyons. Weathering is highly variable according to rock type and intensity of fracturing. Intense weathering is usually shallow with staining of joints extending to considerable depth. The Klamath Mountains are formed of pre-tertiary sedimentary, igneous and metamorphic rocks. Regionally the mountains are comprised of a thick series of sedimentary and volcanic rocks which have been intruded by batholith-sized granitic intrusives producing regional metamorphism and intense folding and faulting of the affected units. Locally the units may vary from slightly altered sediments to complete alteration to schist or gneiss. Bodies of serpentine or serpentine-alteration have produced weak rock zones subject to frequent slide-failures. The Klamath Mountains feature general northeast trending structures with beds or flows frequently tilted at extremely high angles. The Coast Range generally features elevations of 1,500 feet and less with well developed dissection. However, topography in the eastern part of the Coast Range features elevations of 2,000-3,000 feet and a general configuration similar to the Western Cascades. The Coast Range consists mainly of tertiary sandstones, siltstones, mudstones and basic volcanics. Weathering in much of the Coast Range is intense and deep. The Coastal Plain is a narrow discontinuous strip that fringes the western edge of the Coast Range featuring low slopes, marine terrace remnants and drowned valley mouths. Only a very minor part of the Umpqua Basin is in the Coastal Plain.

II - DAYS CREEK DAMSITE

2-01. Reservoir Geology. The Days Creek Damsite is located in the northeastern part of the Klamath Mountains but the reservoir will extend eastward to the margin of the Western Cascades. The South Umpqua River and many of the major tributaries head in the Western Cascades. The reservoir area is underlain by upturned metamorphic rocks with some areas of related granitic intrusives present in the upper part of the reservoir. The metamorphic rocks include meta-igneous greenstone and serpentine, schist, gneiss, and meta-sedimentary slaty siltstone with some interbeds of silicified sandstone and conglomerate. The metamorphic rocks have been folded, sheared and faulted and have a northeast regional strike. Dip of the beds is predominately southeast at 70° to near vertical but in places the dip is to the northwest at similar angles. Some rock types, particularly serpentine, have been intensively sheared resulting in very weak rock conditions with major slides common. Attitude of joints and faults is variable but both commonly have a northeast strike and a dip southeast at 30° to 60°.

2-02. Exploration. Four NX core drill holes totalling 387 L.F. were drilled at the damsite. (See Plates 2, 3 and 5.) DH-1, 2 and 4 were drilled along a proposed axis to determine foundation conditions, excavation problems and grouting requirements. DH-3 was drilled to determine foundation conditions near the proposed spillway area on the right abutment. Water pressure tests were made of bedrock portions of the borings. Water pressure tests results are given in

Plate 5 in the right hand log column as cubic feet per minute at specified pounds per square inch. Figures shown in parenthesis are "K" values in feet per minute x 10^{-4}. Asterisks refer to special water testing procedures, either maintained head or water drop tests, as noted at the bottom of the log. Formulation as shown on the logs as unit weights represents specific gravities. To obtain unit weight multiply the specific gravity by 62.3. Materials investigations include excavation of nine backhoe pits (see Plates 6 and 7). Eight pits were dug in river deposits at areas II and IV, 0.5 and 3.0 miles upstream from the damsite to determine quantity and suitability of these materials for use as embankment gravel. One pit was excavated in an old slide debris area on the left abutment upstream from the dam axis to determine the suitability of the material for impervious core. Surface examination was made of 17 gravel borrow areas bordering the river between the damsite and Corn Creek about 11 miles upstream. Surface examination was also made of two rock prospects and one area of possible random rock embankment material (see Plate 8).

2-03. Site Geology. The site features a steep left abutment, a 1,200 foot wide, gently-sloping valley floor and a moderately sloping right abutment (see Plates 2 and 3). The channel of the South Umpqua River is about 100 feet wide and is entrenched in bedrock. The site area is underlain primarily by meta-igneous greenstone. Unweathered rock is gray-green, fine to medium-grained and hard. There are many closely spaced fractures and extensive crushed or sheared zones. Three main joint sets are evident: N40^{o} - 70^{o}E with 30^{o} - 60^{o} dip southeast; N40^{o} - 70^{o} with 70^{o} - 90^{o} dip southeast and northwest; and N10^{o} - 20^{o} with near vertical dip. Exploration along the proposed axis indicates that weathering depth generally ranges up to 30 feet on the abutments and up to 15 feet in the valley section. In the spillway area in the right abutment weathering ranges up to 40 feet in depth. Unconsolidated material over bedrock in the abutment and spillway areas include 0-5 feet of slopewash and talus over 0-6 feet of decomposed rock. In the valley section 0-4 feet of alluvium and 0-5 feet of decomposed rock are found overlying bedrock. Water pressure tests indicate bedrock is relatively tight below 26 feet in depth on the left abutment, below 16 feet in the valley section and below 30 feet on the right abutment. Exploration indicates that groundwater will not present major excavation problems. Rock in the spillway area is intensely fractured to at least 932 feet elevation (the full 149 foot depth of DH-3Z) but is comparatively tight in the water pressure tests below 1040 feet elevation (the 39 foot depth). See Plate 5.

2-04. Slope Stability Problems. One large old landslide area is located just upstream from the site on the left side of the valley and a second less well defined unstable area is located downstream on the left side of the valley (see Plate 2). Additional investigation of these areas will be required, particularly in respect to relocation of the county road on the left abutment. Investigations thus far have not included geologic studies or exploration specifically directed at relocation routes and problems. Reconnaissance and photogeologic studies of the reservoir area indicates that slope stability is primarily dependent upon the angle at which the valley crosses the regional northeast strike and upon the distribution of weak serpentine units. The reservoir will traverse a broad section of the upturned metamorphic sequence and it is probable that slides will be a major problem in road relocation.

2-05. Materials. a. Gravel. Seventeen gravel areas, upstream from the dam axis were evaluated by surface observation and driller's logs of water wells. Areas II and IV were subsequently explored with a backhoe to provide information for quantity estimates and suitability of materials. Areas I through V, located within three miles of the damsite, are estimated to contain about 7,000,000 cubic yards of gravel and 2,000,000 cubic yards of sand capping the gravel. Based upon depths and areas indicated by exploration, the gravel volume in the reservoir within eleven miles of the damsite is estimated at 10,600,000 cubic yards (see Plates 6 and 7).

b. Rock. Based upon surface examination of the Section 16 Rock Prospect it is estimated that about 12,000,000 cubic yards of rock is available above elevation 850. Surface examination of the Section 21 Rock Prospect indicates that about 9,000,000 cubic yards of rock is available above elevation 1046 (see Plate 8). Rock at both prospects is a fine to medium-grained meta-igneous greenstone with some scattered stringers of serpentine. Most of the rock is hard, gray-green and closely jointed. Additional random rock prospects upstream from the damsite were evaluated by surface examination. One additional prospect located 3,000 feet upstream on the left side of the valley is a rock terrace with varying types and thicknesses of overburden. Quantities here are estimated at about 5,000,000 cubic yards. A second prospect south of Area IV (see Plate 6) is apparently similar to the first area but greater in size. A third possible prospect for random rock is an alluvial fan in the valley east of gravel borrow area V. All of the potential rock sources will require exploration to confirm quality and quantity.

c. Impervious Borrow. Preliminary investigation was made of several potential sources for impervious borrow. The old slide area upstream on the left abutment was explored with one backhoe pit and surface examination (see Plates 6 and 7). It is estimated that the backhoe pit is representative of a 25 acre area and that the top 15 feet contains 500,000 cubic yards of material. The total volume in the old slide area may approach 10,000,000 cubic yards, a substantial part of which will probably be classed as impervious. The second slide area, located downstream from the damsite on the left abutment, also may be suitable for impervious borrow. Other possible sources include the deeply weathered rock material that overlies the three random rockfill prospects and the thick deposits of weathered river gravel on the sides of the valley upstream from the site. All potential areas mentioned will require exploration and testing to establish quality and quantity.

2-06. Turbidity. No special studies of colloidal suspension type turbidity have been made in the Days Creek Reservoir and drainage basin areas, however, these studies will be made in the near future.

The Days Creek Reservoir will lie within an area of metamorphic rock and insitu soils which are relatively low in colloidal materials. The drainage basin above Dompier Creek is almost entirely composed of pyroclastic materials of the Western Cascade Mountains which are characterized by deep weathering and the formation of clays. This area has many unstable slopes and soil which erodes easily. The pyroclastic materials of the upper drainage basin could be a source of colloidal material which could be transported into the reservoir. However, the existence in the reservoir area and the drainage basin of materials from which silts or colloidal turbidity could be derived does not establish as a fact that reservoir turbidity would result. Of the eleven reservoirs built by the Corps of Engineers in the adjacent Willamette River Basin, only one reservoir has suffered that coincidence of natural and man-produced factors which resulted in a turbid condition. The control of excavations in the drainage basin, the design of outlet works, and the proper management of reservoir operation can prevent a deleterious turbid condition in the reservoir from those causes.

Studies of all the factors relating to producing a unsatisfactory reservoir condition should be made.

2-07. <u>Other Design Considerations</u>. a. <u>Embankment</u>. The foundation for the embankment is slightly weathered to unweathered rock. See Plate 5 for logs and photographs of drill cores. The limited explorations and reconnaissance reveal that the stripping depth of overburden and alluvium to embankment foundation rock ranges from zero to eleven feet; five feet on the left abutment, little excavation in the river section, eight feet in the valley section and eleven feet on the right abutment.

b. Core. The core foundation will require excavation to groutable rock. See Plate 5 for logs and photographs of drill cores. Exploration indicates the stripping depth for the core foundation ranges from zero to 27 feet; 26 feet on the left abutment, no excavation on the river section, 16 feet in the valley section and 27 feet on the right abutment.

c. Foundation Treatment and Grouting. Water pressure test data, from the four exploratory drill holes, indicates the base of cement groutable rock at 26 feet on the left abutment, 16 feet in the valley section and 40 feet on the right abutment. A 0.2 cubic foot per minute water flow at any pressure was used as a basic guide to determine the cement groutability of the rock. To provide a conservative grout curtain estimate, the grouting cost estimate was made using a standard split stage grouting system with depth of grout holes up to 60 feet. (See Exhibit 1.)

d. Spillway. The preliminary design places the spillway on the right abutment near DH-3Z. The drill hole information indicates the rock in this area is closely fractured and crushed to 149 feet, the depth of the boring. The rock is unweathered below 37 feet. The permeability is low, as indicated by water pressure tests, even though there is much core loss and short cores due to the close fractured and crushed condition of the rock.

The old slide debris area on the left abutment upstream from the dam axis and the area of deep overburden downstream from the dam axis appear to preclude founding the spillway on the left abutment.

e. Regulating Works. Foundation conditions appear favorable for use of a cut-and-cover regulating outlet in the river section. A diversion tunnel and regulating work appears feasible in the right abutment but not in the left abutment due to the previously mentioned slide areas present both upstream and downstream in the portal areas.

III - TILLER DAMSITE

3-01. Reservoir Geology. The Tiller Damsite is located at the northeastern margin of the Klamath Mountains but the reservoir would be largely in the Western Cascades. The site is underlain by metamorphics but the reservoir area will be almost entirely in volcanic rocks of the Western Cascades. The contact between the metamorphics and the volcanics is about one-half mile northeast of the site and is marked by massive slides more than one mile wide in the volcanics on the south side of the South Umpqua River and up Dompier Creek which enters from the north. The volcanic rocks include massive lapilli tuff and breccia with basalt and andesite flows. Pumice deposits are found on some parts of the valley floor and terraces.

3-02. Exploration. Three NX core holes totalling 378 L. F. have been drilled at the damsite (see Plates 9, 10 and 11). All three holes were drilled on the right abutment, DH-3 located on the lower slopes only slightly above the valley floor. Water pressure tests were made of bedrock sections of the holes. Two test pits were made to obtain samples in a gravel prospect 7,000 feet upstream from the site.

3-03. Site Geology. The valley at the site is fairly symmetrical (see Plate 9). The left abutment slopes at about 40° and the right abutment slopes at about 35°. The valley section is approximately 150 feet wide and consists of a 100 foot terrace and a 50-foot-wide entrenched channel. The site is located in a 2 to 4 mile wide belt of highly metamorphosed rocks, primarily schist and gneiss. This belt, trends generally north paralleling a intrusive granitic mass to the west. The banding or schistosity strikes northeast with a dip generally varying from 45° to 85° to the southeast. The rock is closely jointed with major joint sets northeast and northwest inclined at very high angles. Weathering except for staining of joints, is usually restricted to the upper few feet of bedrock at the site. Water tests show DH-1 and DH-3 to be comparatively open with substantial water takes in most sections of the holes. However, this may be due largely to a few open joints. DH-2 is moderately tight the entire depth.

3-04. Landslide Problems. Although minor slide areas are found on both abutments upstream from the site within a few hundred feet, these are not expected to present significant problems. An area upstream 1/2 mile to 1-1/2 miles however, contains a massive old slide on the left side and a major recent slide in the Dompier Creek canyon on the right side. These present major problems relating to road relocations. The slide on Dompier Creek has had at least two major failures within recent years, involving an area of more than one square mile. This has periodically dammed Dompier Creek forming a small lake. Additional investigation and study will be required prior to construction to determine the effect of reservoir saturation and drawdown on this slide and on the massive old slide area on the south side of the South Umpqua River. A brief reconnaissance of the proposed reservoir margins also noted numerous other potential slope stability problems.

3-05. Turbidity. No special studies of colloidal suspension type turbidity have been made in the Tiller Reservoir area. The reservoir area is almost entirely in the Western Cascades which are characterized by deep weathering and the formation of clays. This has produced widespread unstable slope conditions in the reservoir area. Wave action combined with effects of saturation and drawdown can be expected to accelerate slide activity and add to both the turbidity carried by spring run-off and any colloidal suspension type turbidity which might occur.

3-06. Materials. Only a brief reconnaissance has been made of possible materials sources for this site. One major gravel deposit was located comprising a terrace on the right bank starting 7,000 feet upstream from the axis. The terrace is about 7,000 feet long and is 500 to 1,300 feet wide. Exposures along the riverbank are of silty sandy gravel. The gravels are hard, fresh, rounded, mostly 4-inch minus, but with cobbles up to 12 inches. The fines are nonplastic. A thickness of more than 10 feet and a total of 2.5 million cubic yards is estimated for the deposit. It is expected that impervious fill can be obtained from a high flat 700 feet above the river on the right side or from the old landslide area a mile upstream on the left bank.

3-07. Other Design Considerations. Site foundation conditions are suitable for the construction of either a concrete or embankment-type dam. Overburden depths are shallow along the axis with maximum depth less than 10 feet. Extensive areas with no overburden are present in the axis area and weathering is slight. Closely jointed, inflated rock extends to about 30 feet depth on the abutments and to less than 10 feet in the valley section. The site topography is not favorable for construction of a side-channel spillway. Construction of an embankment-type dam would require stripping to groutable rock in the core area. This will be from 0 to 10 feet in most of the core area but will range up to a maximum of more than 30 feet locally in the abutment areas. Except for the upper 5 to 30 feet, water takes are variable and in general not excessive. Based on this limited exploration, a basic single line grout curtain with primary, secondary, and tertiary holes spaced 20, 10 and 5 feet and extending in depth to about 2/3 of dam height, should be adequate.

IV - SUMMARY

4-01. Days Creek Damsite. a. Foundation conditions and other site considerations are favorable for construction of an embankment-type dam at the proposed site.

b. The site is suitable for use of cut-and-cover construction for the regulating outlet and the diversion conduit. Construction of a diversion tunnel in the right abutment also appears feasible.

c. The right abutment appears suitable for construction of a side-channel spillway.

d. Adequate gravel, rock, filter material and impervious core material for construction of an embankment-type dam are indicated in the site and reservoir area.

e. Relocation of State Highway 227 and of the Beals Creek Road will be required. Slide areas both upstream and downstream of the left abutment present difficult relocation problems. Local, small scale slide problems can be expected along route 227 throughout the length of the reservoir.

f. The reservoir will be located entirely in an area underlain by rock units which usually have a very shallow cover of soil and weathered rock.

4-02. Tiller Damsite. a. Foundation conditions are favorable for construction of either a concrete dam or an embankment-type dam at the site.

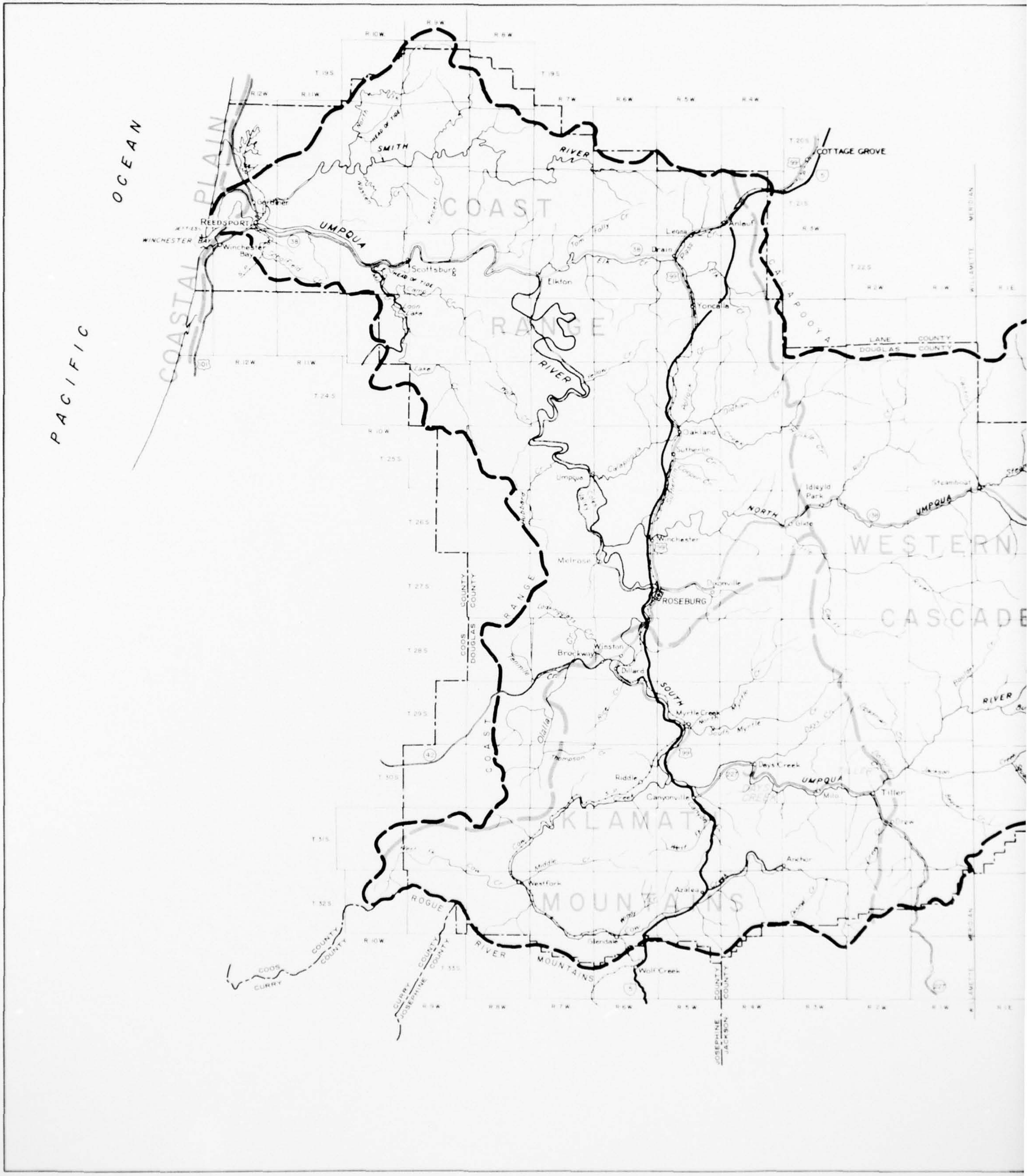
b. Adequate foundation conditions are indicated for construction of a diversion tunnel in either abutment.

c. Site topography is not favorable for construction of a side-channel spillway.

d. Limited reconnaissance indicates that materials for a concrete dam or embankment-type dam probably can be obtained in the reservoir area.

e. Relocation of FAS 801 above the site would be required. This would present extremely difficult stability problems in the Dompier Creek slide area, one mile upstream, as well as in numerous other unstable areas along the reservoir.

f. The reservoir would be located almost entirely in an area underlain by deeply weathered volcanic rocks of the Western Cascades. The soil cover usually is deep and commonly includes clay.


PACIFIC OCEAN
COASTAL PLAIN
COAST RANGE
WESTERN CASCADE
KLAMATH MOUNTAINS
CALAPOOYA
ROGUE RIVER MOUNTAINS
UMPQUA RIVER
SMITH RIVER
NORTH UMPQUA
SOUTH UMPQUA
HEAD OF TIDE
COTTAGE GROVE
Reedsport
Gardiner
Winchester Bay
Scottsburg
Elkton
Leona
Drain
Anlauf
Yoncalla
Oakland
Sutherlin
Umpqua
Idleyld Park
Glide
Steamboat
Winchester
Melrose
Dixonville
ROSEBURG
Winston
Brockway
Dillard
Myrtle Creek
Riddle
Canyonville
Days Creek
Tiller
Milo
Azalea
Anchor
Westfork
Glendale
Wolf Creek
LANE COUNTY
DOUGLAS COUNTY
COOS COUNTY
DOUGLAS COUNTY
CURRY COUNTY
JOSEPHINE COUNTY
JACKSON COUNTY
WILLAMETTE MERIDIAN
R.12W
R.11W
R.10W
R.9W
R.8W
R.7W
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R.5W
R.4W
R.3W
R.2W
R.1W
R.1E
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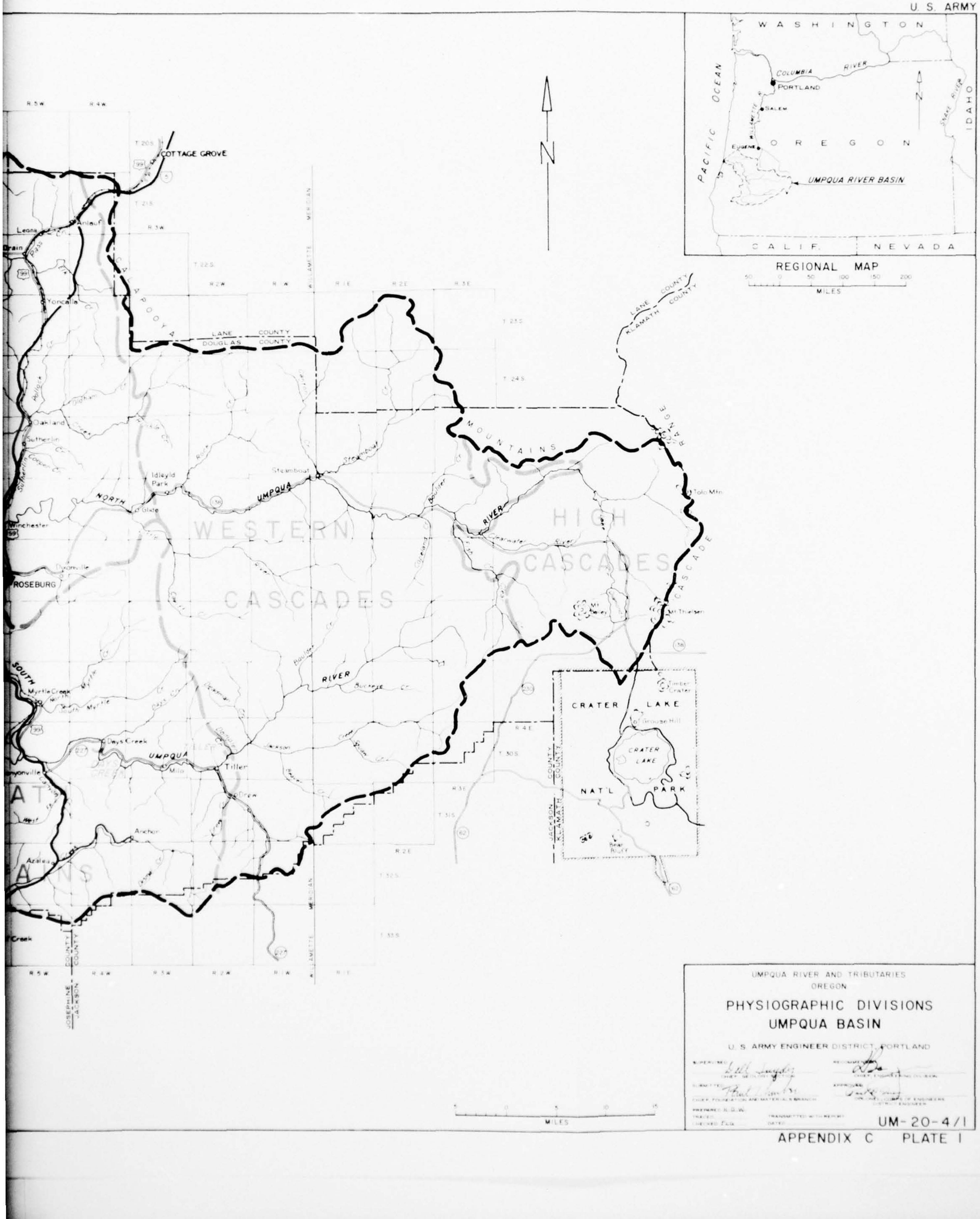


UMPQUA RIVER AND TRIBUTARIES
OREGON

PHYSIOGRAPHIC DIVISIONS
UMPQUA BASIN

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED
CHIEF, GEOLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, FOUNDATION AND MATERIALS BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

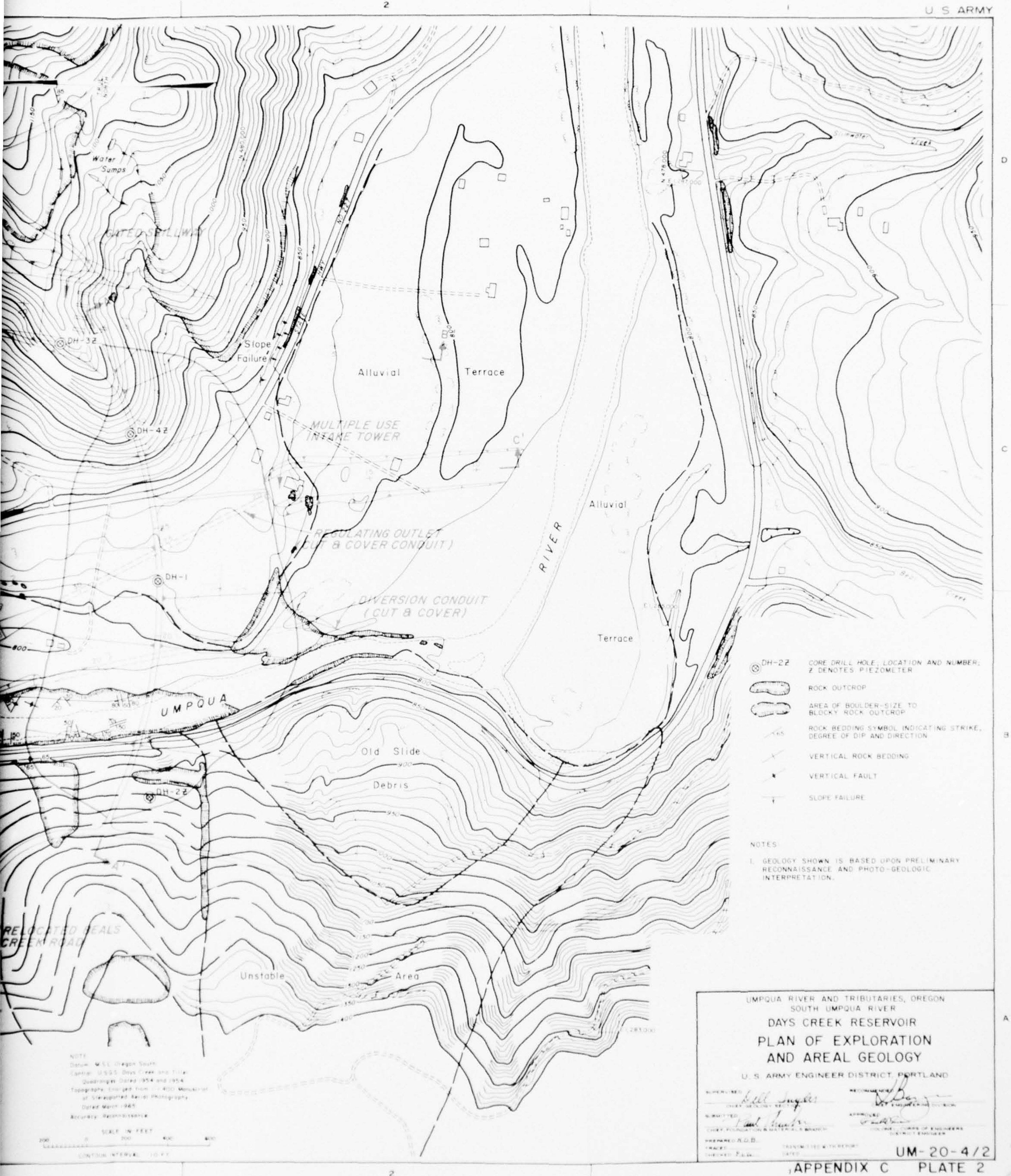
PREPARED R.G.W.
TRACED
CHECKED F.L.G.

TRANSMITTED WITH REPORT
DATED

UM-20-4/1

APPENDIX C PLATE I

CORPS OF ENGINEERS



⊗ DH-22 CORE DRILL HOLE, LOCATION AND NUMBER; Z DENOTES PIEZOMETER

ROCK OUTCROP

AREA OF BOULDER-SIZE TO BLOCKY ROCK OUTCROP

ROCK BEDDING SYMBOL INDICATING STRIKE, DEGREE OF DIP AND DIRECTION

VERTICAL ROCK BEDDING

VERTICAL FAULT

SLOPE FAILURE

NOTES:

1. GEOLOGY SHOWN IS BASED UPON PRELIMINARY RECONNAISSANCE AND PHOTO-GEOLOGIC INTERPRETATION.

NOTE:

Datum: M.S.L. Oregon South

Control: U.S.G.S. Days Creek and Tiller Quadrangles Dated 1954 and 1954

Topography: Enlarged from 1"=400' Manuscript of Stereoplotted Aerial Photography Dated March 1965

Accuracy: Reconnaissance

SCALE IN FEET

200 0 200 400 600

CONTOUR INTERVAL 10 FT.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER

DAYS CREEK RESERVOIR

PLAN OF EXPLORATION AND AREAL GEOLOGY

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED Dell Snyder
CHIEF, GEOLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED Paul Shuler
CHIEF, FOUNDATION & MATERIALS BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED R.D.B.
TRACED
CHECKED F.L.G.

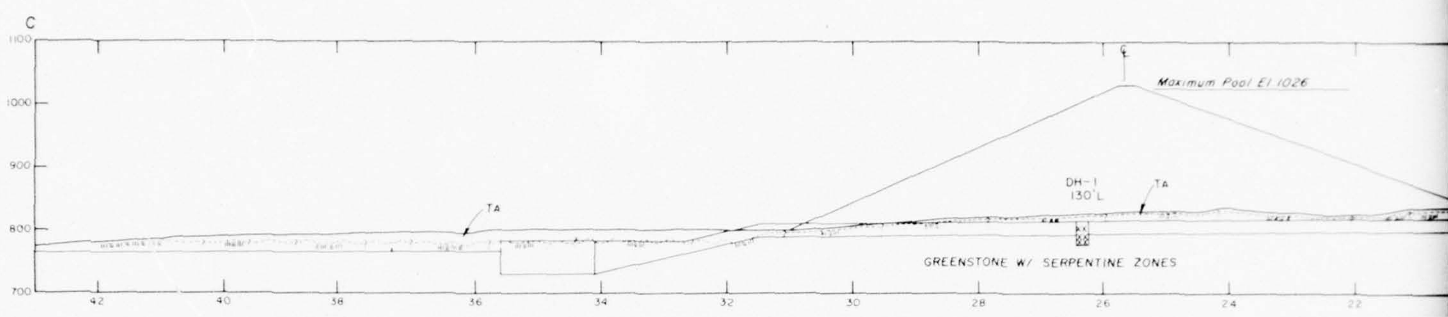
TRANSMITTED WITH REPORT
DATED

UM-20-4/2

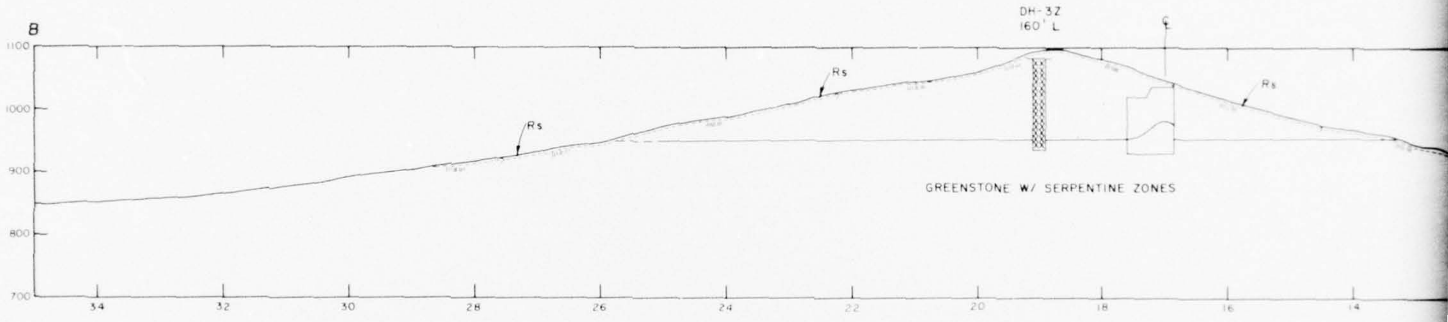
APPENDIX C PLATE 2

CORPS OF ENGINEERS

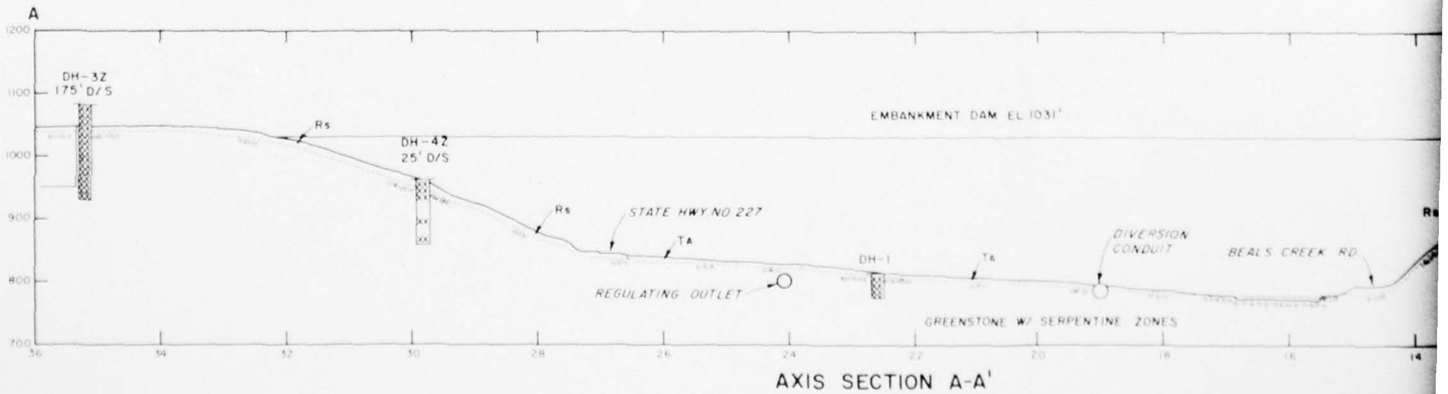
ELEVATION IN FEET ABOVE M.S.L.



REGULATED OUTLET SECTION C-C'



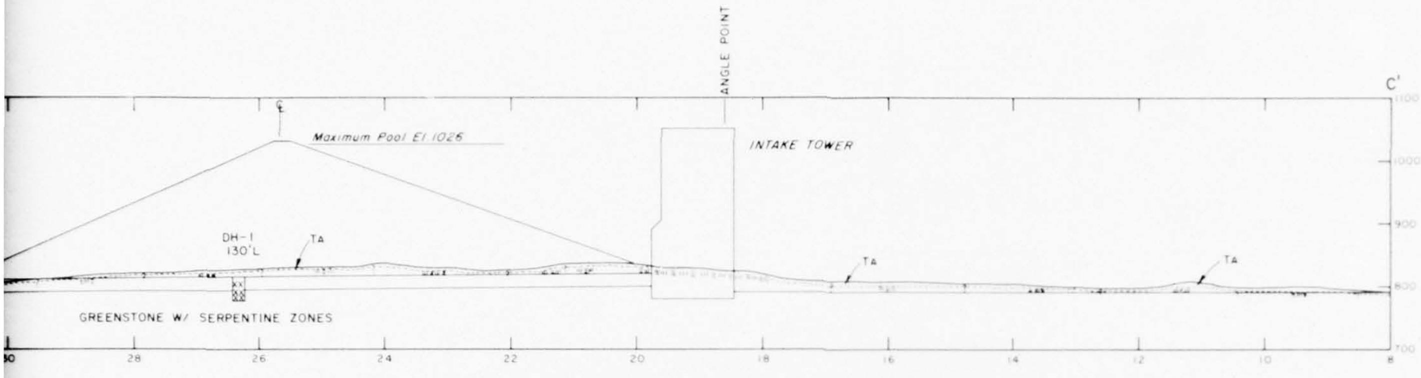
SPILLWAY SECTION B-B'



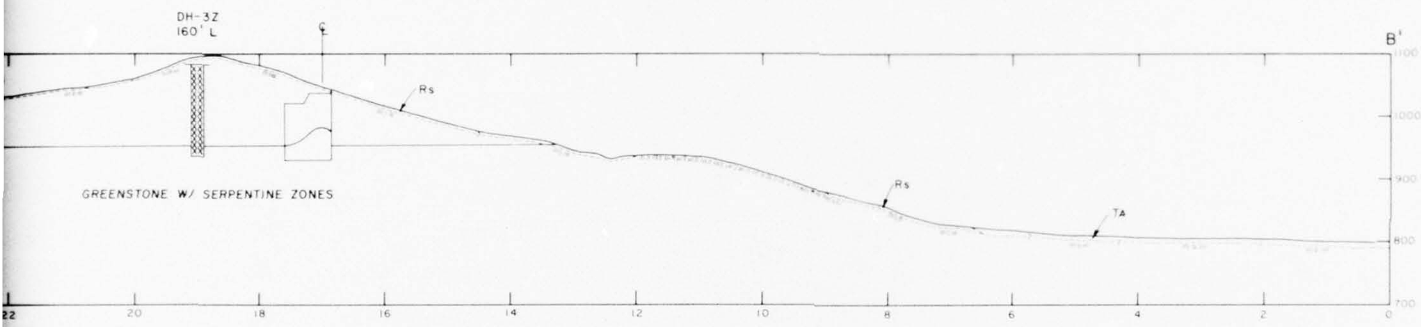
AXIS SECTION A-A'

(LOOKING UPSTREAM)

STATIONS IN 100' INTERVALS



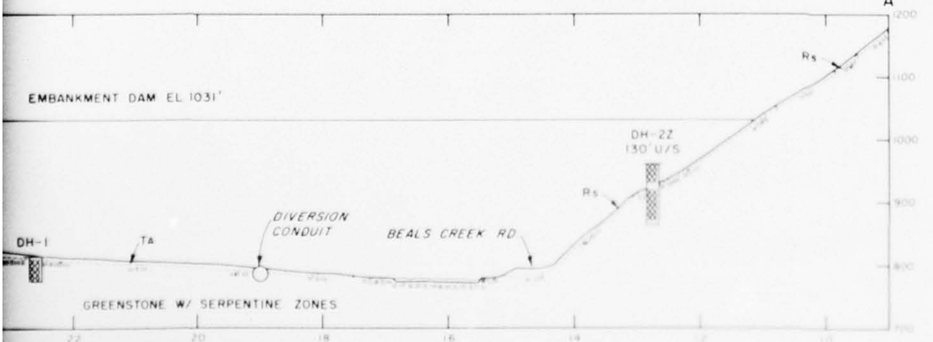
REGULATED OUTLET SECTION C-C'



SPILLWAY SECTION B-B'

LEGEND

▥	BEDROCK	-------	ESTIMATED TOP OF BEDROCK BASED UPON LOCAL OUTCROP AND EXPLORATION DATA
TA	ALLUVIUM		
Rs	SLOPEWASH, RESIDUAL SOIL & WEATHERED ROCK	-?-?-	GENERALIZED TOP OF BEDROCK BASED UPON REGIONAL WEATHERING AND EROSIONAL CHARACTERISTICS
DH-3Z	DRILL HOLE		
▩	ZONE OF FRAGMENTAL CORE		



SECTION A-A'

KING UPSTREAM)

N 100' INTERVALS

Note: See Plate 2 for location of Geologic Sections.
See Plates 2 and 5 for Drill Hole Logs.

100 0 100 200 300 400
FEET

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK RESERVOIR

GEOLOGIC SECTIONS

U. S. ARMY ENGINEER DISTRICT, PORTLAND

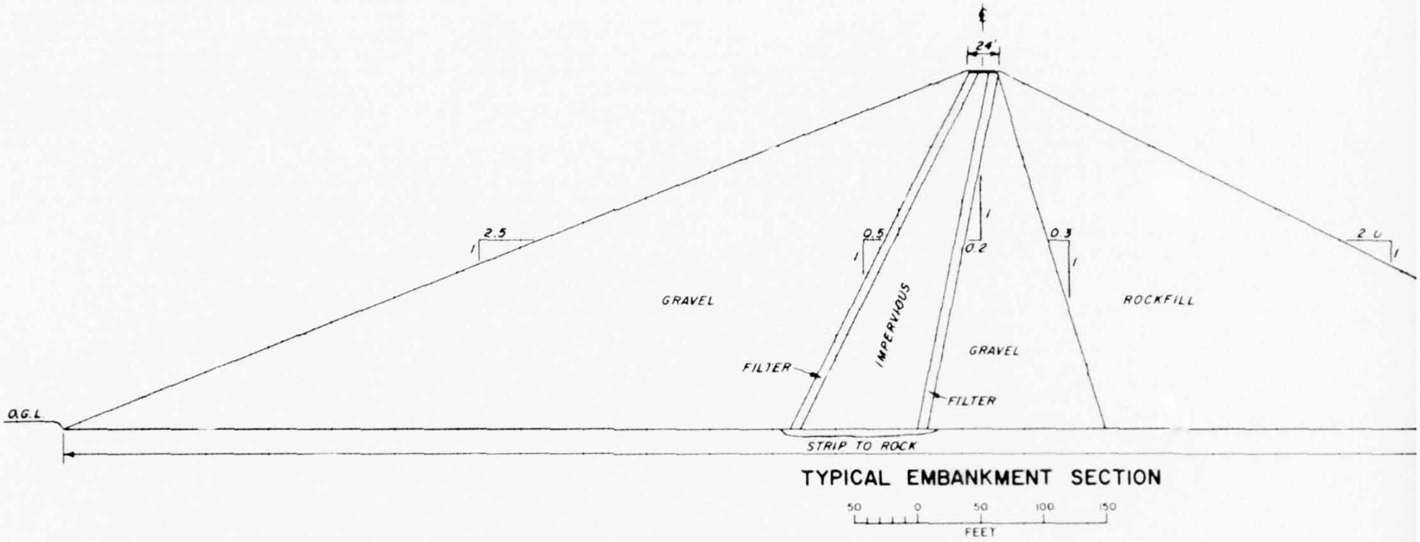
PREPARED
CHIEF, GEOLOGY SECTION
RECOMMENDED
CHIEF, ENGINEERING DIVISION
SUBMITTED
CHIEF, FOUNDATION AND MATERIALS BRANCH
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

FIELD WORK
DRAWN
CHECKED
TRANSMITTED WITH REPORT
DATED

UM-20-4/3

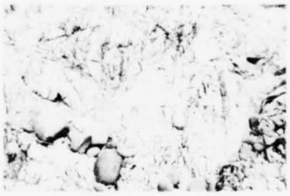
APPENDIX C PLATE 3

CORPS OF ENGINEERS



TYPICAL EMBANKMENT SECTION

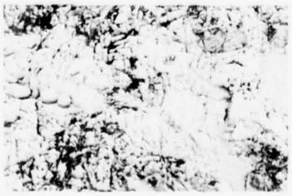
Days Creek Dunite. Right side of river channel upstream from dam axis. Rock structure dips upstream. Circled [illegible] [illegible] [illegible] in center of photo.



Days Creek Dunite. Right side of river channel upstream from dam axis. Note size of fragments related to size of river gravels and cobbles.

Days Creek Dunite. Right side of river channel upstream from dam axis. Note [illegible] [illegible] at right edge of photo. The river gravel and cobbles [illegible] [illegible] [illegible] channel [illegible] of [illegible] [illegible].

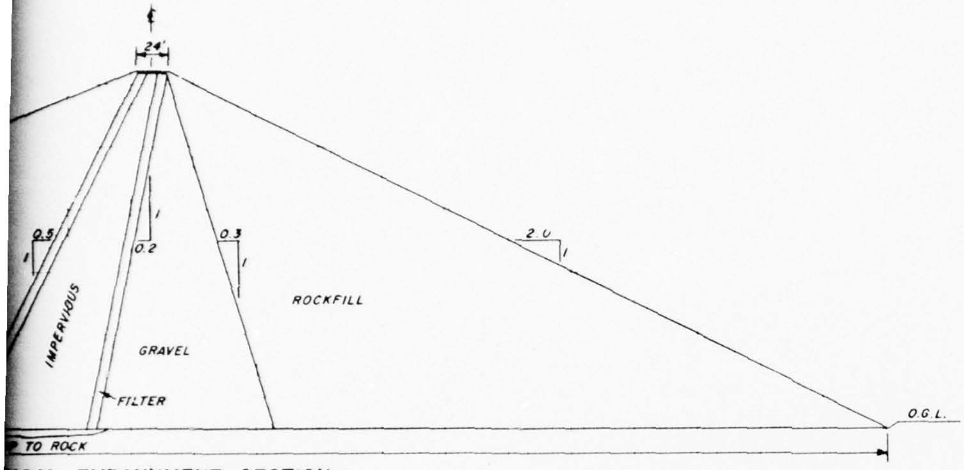
Days Creek Dunite. Right side of river upstream from dam axis. Note principal fracture plane along pencil, and related fracture planes making a [illegible] appearance.



Days Creek Dunite. Right side of river upstream from dam axis. Note exposed rock [illegible] from left middle to right bottom of photo; fracture plane from left bottom to right top of photo, and vertical fracture planes.

Days Creek Dunite. Right side of river [illegible] [illegible] from dam axis. [illegible] of [illegible] [illegible] [illegible] [illegible].

U. S. ARMY



ICAL EMBANKMENT SECTION

Days Creek Damsite. Right side of river channel upstream from dam axis. Note wide [illegible] sheared zone at right edge of photo. The river gravel and cobbles also lie in a crushed zone of hard argillite rock.

Days Creek Damsite. Right side of river [illegible] from dam axis. Note general [illegible] of Argillite.

Days Creek Damsite. Right side of river channel upstream from dam axis. [illegible]

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK RESERVOIR

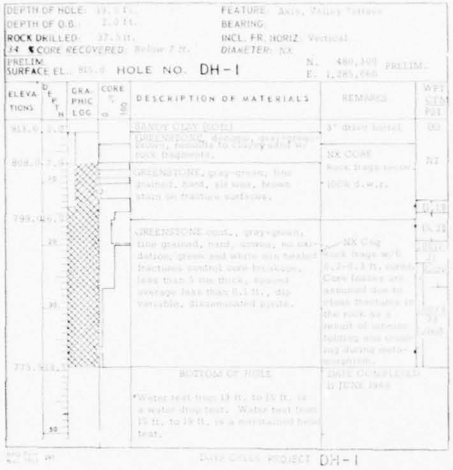
TYPICAL EMBANKMENT SECTION AND ROCK STRUCTURE PHOTOS

U. S. ARMY ENGINEER DISTRICT, PORTLAND

PREPARED Robert Pope
CHIEF, SOILS ENGINEERING SECTION
SUBMITTED Paul Thurston
CHIEF, FOUNDATION AND MATERIALS BRANCH
RECOMMENDED Bazin
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER
FIELD WORK R.D.B.
DRAWN
CHECKED J.D.W.
TRANSMITTED WITH REPORT
DATED

UM-20-4/4

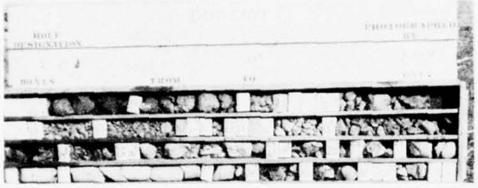
APPENDIX C PLATE 4

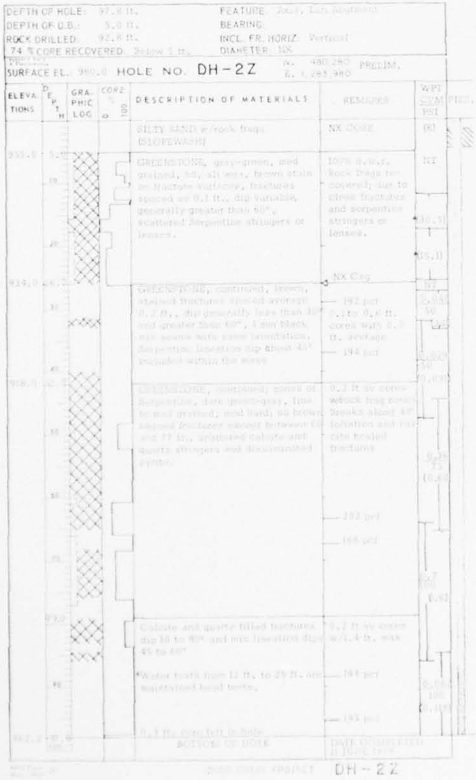


DEPTH OF HOLE: 39.5 ft.
DEPTH OF O.B.: 2.0 ft.
ROCK DRILLED: 37.5 ft.
34 % CORE RECOVERED: Below 7 ft.
FEATURE: Axis, Valley Terrace
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX
PRELIM. SURFACE EL. 815.0 HOLE NO. DH-1
N. 480,300 E. 1,285,060 PRELIM.

ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
813.0	2.0	SANDY CLAY (SOIL)	3" drive barrel	DD
		GREENSTONE, decomp., gray-green, brown, remolds to clayey sand w/ rock fragments.		
808.0	7.0	GREENSTONE, gray-green, fine grained, hard, sl wea., brown stain on fracture surfaces.	NX CORE Rock frags recov. 100% d.w.r.	NT
799.0	16.0	GREENSTONE cont., gray-green, fine grained, hard, unwea., no oxidation, green and white min healed fractures control core breakage, less than 5 mm thick, spaced average less than 0.1 ft., dip variable, disseminated pyrite.	NX Csg Rock frags w/0.2-0.3 ft. cores. Core losses are assumed due to close fractures in the rock as a result of intense folding and crushing during metamorphism.	
775.5	39.5	BOTTOM OF HOLE *Water test from 13 ft. to 15 ft. is a water drop test. Water test from 15 ft. to 19 ft. is a maintained head test.	DATE COMPLETED 11 JUNE 1968	

DAVIS CREEK PROJECT DH-1

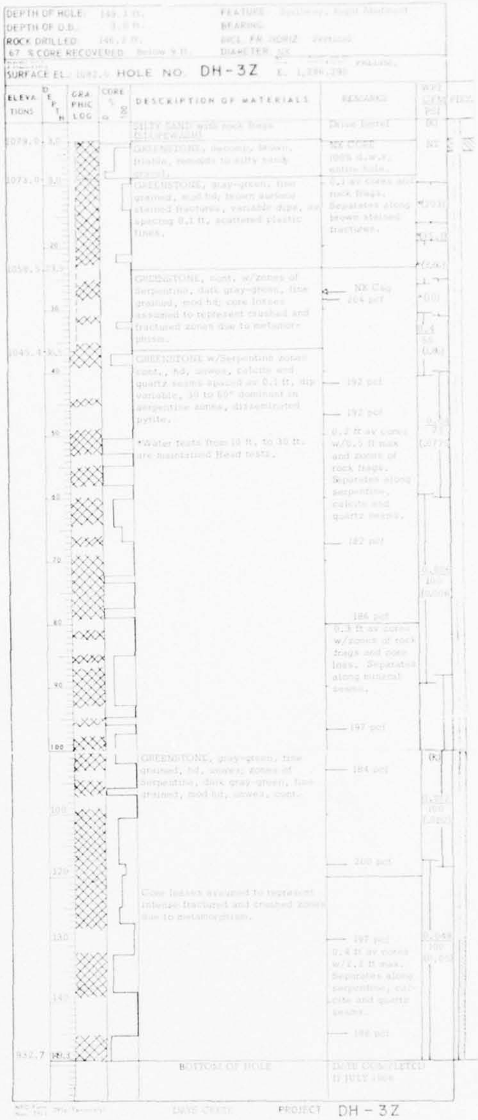




DEPTH OF HOLE: 97.8 ft.
DEPTH OF O.B.: 5.0 ft.
ROCK DRILLED: 92.8 ft.
74 % CORE RECOVERED: Below 5 ft.
FEATURE: Axis, Left Abutment
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX
SURFACE EL. 960.0 HOLE NO. DH-2Z
N. 480,280 E. 1,283,980 PRELIM.

ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
		SILTY SAND w/rock frags (SLOPEWASH)	NX CORE	(8)
955.0	5.0	GREENSTONE, gray-green, med grained, hd, sl wea., brown stain on fracture surfaces, fractures spaced av 0.1 ft., dip variable, generally greater than 60°, scattered Serpentine stringers or lenses.	100% d.w.r. Rock frags recovered; due to close fractures and serpentine stringers or lenses.	NT
934.0	26.0	GREENSTONE, continued, brown stained fractures spaced average 0.2 ft., dip generally less than 30° and greater than 60°, 1 mm black min seams with same orientation. Serpentine lineation dip about 45° included within the mass	NX Csg — 192 pcf 0.1 to 0.6 ft. cores with 0.2 ft. average — 194 pcf	NT
918.0	42.0	GREENSTONE, continued; zones of Serpentine, dark green-gray, fine to med grained, mod hard; no brown stained fractures except between 66 and 77 ft., scattered calcite and quartz stringers and disseminated pyrite.	0.2 ft av cores w/rock frag zones. Breaks along 45° foliation and calcite healed fractures — 202 pcf — 168 pcf	
	79.0	Calcite and quartz filled fractures dip 10 to 80° and min lineation dips 45 to 60° *Water tests from 12 ft. to 25 ft. are maintained head tests.	0.2 ft av cores w/1.4 ft. max — 194 pcf — 193 pcf	
862.2	97.8	0.1 ft. core left in hole BOTTOM OF HOLE	DATE COMPLETED 11 JUNE 1968	

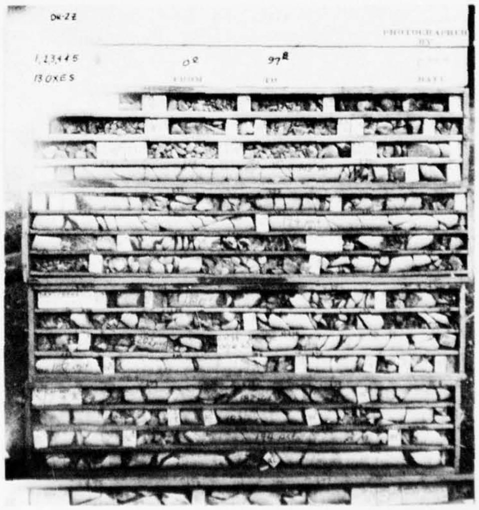
DAVIS CREEK PROJECT DH-2Z

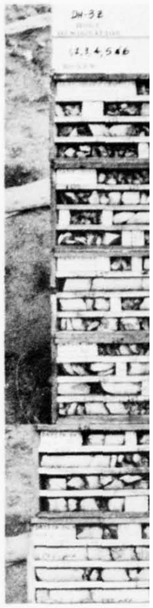


DEPTH OF HOLE: 149.3 ft.
DEPTH OF O.B.: 3.0 ft.
ROCK DRILLED: 146.3 ft.
67 % CORE RECOVERED: Below 9 ft.
FEATURE: Spillway, Right Abutment
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX
SURFACE EL. 1082.0 HOLE NO. DH-3Z
E. 1,286,190 PRELIM.

ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
		SILTY SAND with rock frags (SLOPEWASH)	Drive barrel	DD
1079.0	3.0	GREENSTONE, decomp, brown, friable, remolds to silty sandy gravel.	NX CORE 100% d.w.r. entire hole.	NT
1073.0	9.0	GREENSTONE, gray-green, fine grained, mod hd, brown surface stained fractures, variable dips, av spacing 0.1 ft, scattered plastic fines.	0.1 av cores and rock frags. Separates along brown stained fractures.	
1058.5	23.5	GREENSTONE, cont. w/zones of Serpentine, dark gray-green, fine grained, mod hd; core losses assumed to represent crushed and fractured zones due to metamorphism.	NX Csg 204 pcf	
1045.4	36.6	GREENSTONE w/Serpentine zones cont., hd, unwea, calcite and quartz seams spaced av 0.1 ft, dip variable, 10 to 60° dominant in serpentine zones, disseminated pyrite. *Water tests from 10 ft. to 30 ft. are maintained Head tests.	— 192 pcf — 192 pcf 0.2 ft av cores w/0.5 ft max and zones of rock frags. Separates along serpentine, calcite and quartz seams. — 182 pcf — 186 pcf 0.3 ft av cores w/zones of rock frags and core loss. Separates along mineral seams. — 197 pcf	
		GREENSTONE, gray-green, fine grained, hd, unwea; zones of Serpentine, dark gray-green, fine grained, mod hd, unwea, cont.	— 184 pcf — 200 pcf	
		Core losses assumed to represent intense fractured and crushed zones due to metamorphism.	— 197 pcf 0.4 ft av cores w/2.2 ft max. Separates along serpentine, calcite and quartz seams. — 188 pcf	
932.7	149.3	BOTTOM OF HOLE	DATE COMPLETED 11 JULY 1968	

DAVIS CREEK PROJECT DH-3Z





DRI

av - averag
CFM - cubic
cont - contin
decomp - decom
d.w.r. - drill w
frag(s) - fragme
hd - hard
K - coeffi
max - maxim
med - mediu

ROCK HARDNES

Soft
Mod. Hard
Hard
Very Hard

Unit weights
mined by usin
and in water.
Unit w

Drill water ret
approximate c

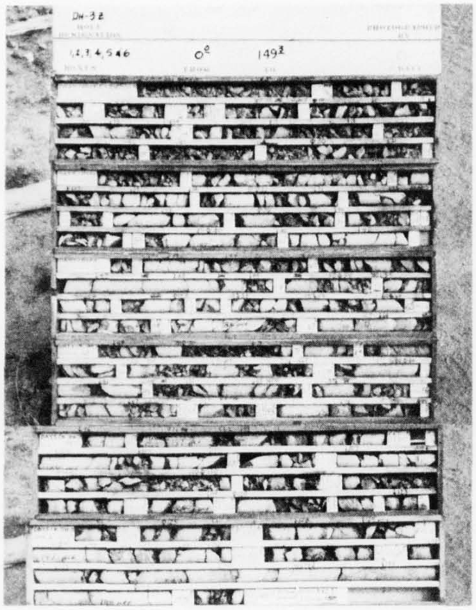
"K" values sh

U. S. ARMY

E: Spillway, Right Abutment
G:
R. HORIZ: Vertical
ER: NX
N. [illegible] PRELIM.
E. 1,246,290

TERIALS	REMARKS	WPT CFM PSI
gs	Drive barrel	(K)
brown, sandy	NX CORE 100% d.w.r. entire hole.	NT
n, fine surface ble dips, av d plastic	0.1 av cores and rock frags. Separates along brown stained fractures.	
zones of reen, fine sses ushed and etamor-	NX Csg 204 pcf	
ine zones ite and 0.1 ft. dip inant in minated	192 pcf 192 pcf	
to 30 ft. ts.	0.2 ft av cores w/0.5 ft max and zones of rock frags. Separates along serpentine, calcite and quartz seams. 183 pcf	
	186 pcf 0.3 ft av cores w/zones of rock frags and core loss. Separates along mineral seams. 197 pcf	
en, fine nes of green, fine s, cont.	184 pcf 200 pcf	(K)
represent rushed zones	197 pcf 0.4 ft av cores w/2.2 ft max. Separates along serpentine, calcite and quartz seams. 188 pcf	
LE	DATE COMPLETED 11 JULY 1968	

PROJECT DH – 3Z



DEPTH OF HOLE: 100.5 ft.
DEPTH OF O.B.: 7.7 ft.
ROCK DRILLED: 92.8 ft.
89 % CORE RECOVERED: Below 7.7 ft.
PRELIM. SURFACE EL: [illegible]
FEATURE: Axis, Right Abutment
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX

HOLE NO. DH – 4Z

N. 480,460 PRELIM.
E. 1,285,800

ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
		SILTY SAND w/rock fragments (SLOPEWASH)	NX CORE 100% d.w.r.	NT
955.3	1.7	GREENSTONE, brown-gray, fine grained, soft, sl wea		
952.0	2.0	GREENSTONE cont., gray-green, fine grained, mod hd; sli wea along brown surface stained fractures, spacing av 0.1 ft, scattered plastic fines. Unit Weight range: 183 to 192 pcf.	0.2 ft av cores w/rock frags. Separates along brown-stained fractures. NX Csg	
934.0	25.5	GREENSTONE cont., gray-green, fine grained, hd, unwea, with zones and seams of Serpentine, dark gray-green, fine grained, mod hd, unwea. Calcite and quartz seams with disseminated pyrite, av spacing 0.1 ft, dips variable. Serpentine generally drills to rock frags with sands and fines. Core losses assumed to be in crushed and closely fractured rock and in part in serpentine rock due to differential hardness and low abrasive strength. *Water tests from 9 ft. to 29 ft. are maintained head tests.	0.3 ft av cores. Separates along serpentine, calcite and quartz seams. Unit Weight range: 179 to 196 pcf.	
862.5	100.5	BOTTOM OF HOLE	DATE COMPLETED 23 JULY 1968	

DAYS CREEK PROJECT DH – 4Z

DRILL LOG LEGEND

Unified Soil Classification System symbols (field determinations)
Badly weathered (decomposed) rock (hand-crushable)
Slightly weathered (oxidized) rock
Mixed slightly weathered and unweathered rock
Zone of fragmented core and rock fragments
Water level measured in piezometer on 29 Jul 68

DRILL LOG ABBREVIATIONS

av	- average(s)	min	- mineral
CFM	- cubic feet per minute	mod	- moderately
cont	- continued	NT	- not tested
decomp	- decomposed	pcf	- pounds per cubic foot
d.w.r.	- drill water return	PIEZ	- piezometer
frag(s)	- fragment(s)	PSI	- pounds per square inch
hd	- hard	sli	- slight(ly)
K	- coefficient of permeability	unwea	- unweathered
max	- maximum	w/	- with
med	- medium	WPT	- water pressure test

EXPLANATORY NOTES

ROCK HARDNESS

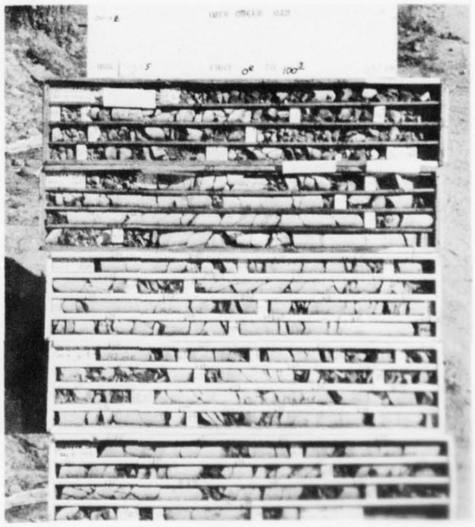
Soft	- can be scratched with fingernail.
Mod. Hard	- can be scratched with knife; cannot be scratched with fingernail.
Hard	- difficult to scratch with knife.
Very Hard	- cannot be scratched with knife.

Unit weights of rock shown are approximate only and were determined by using a spring-loaded scale to weigh specimens in air and in water; unit weight was then computed from the formula:

$$\text{Unit wt.} = \frac{(\text{specimen wt. in air}) \times (\text{specific gravity of water})}{(\text{specimen wt. in air}) - (\text{specimen wt. in water})}$$

Drill water return percentages were visually estimated and are approximate only.

"K" values shown are in feet/minute x 10^{-4}.



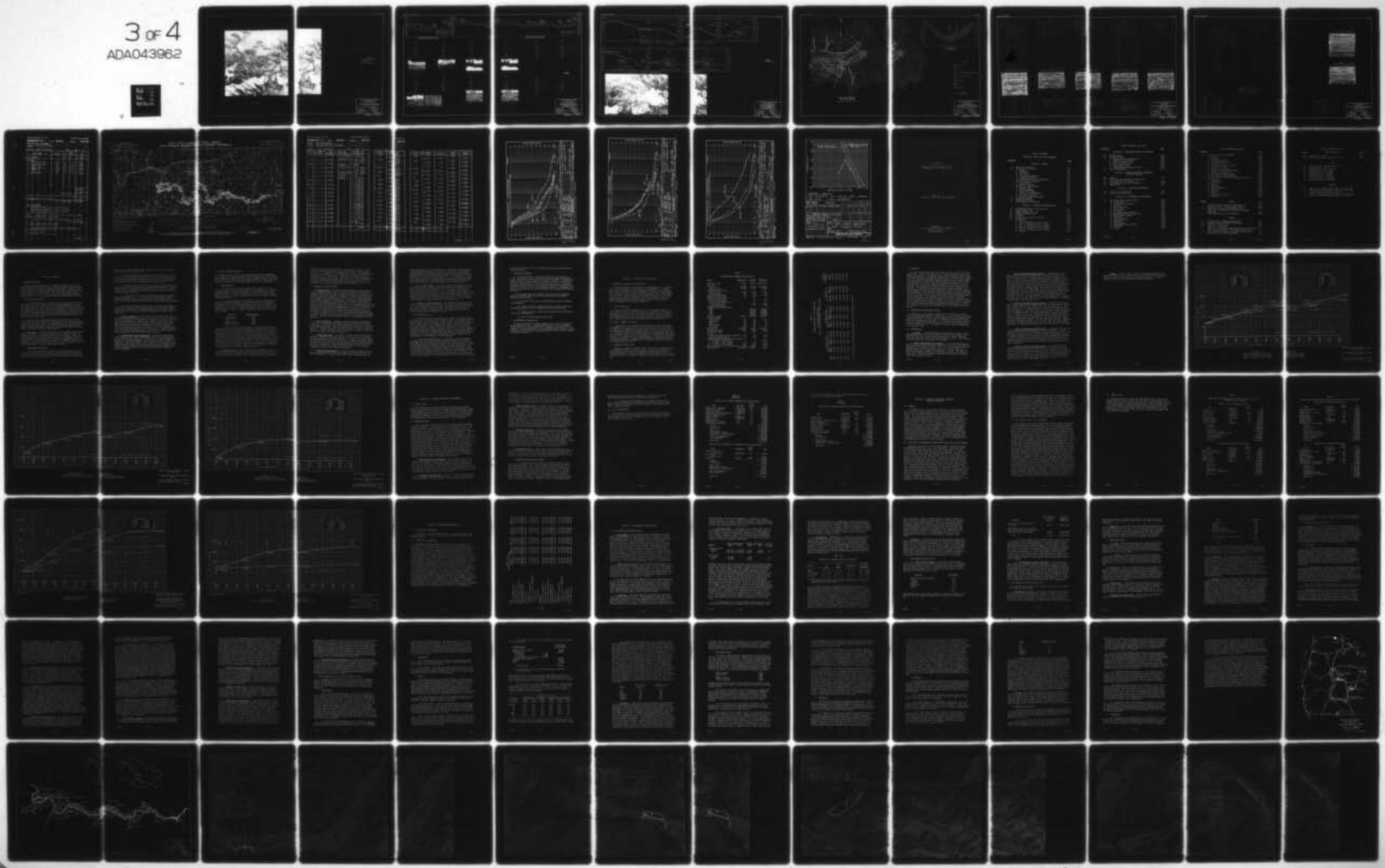
UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK RESERVOIR
LOGS AND PHOTOS OF FOUNDATION DRILL CORES
U. S. ARMY ENGINEER DISTRICT, PORTLAND

APPENDIX [illegible]

AD-A043 962 ARMY ENGINEER DISTRICT PORTLAND OREG F/G 8/6
REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, SOUTH UM--ETC(U)
NOV 71

UNCLASSIFIED NL

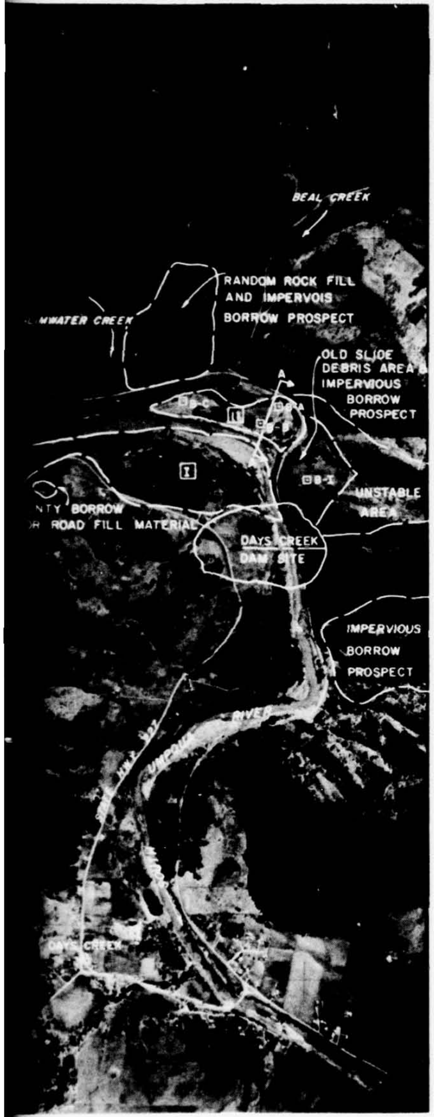
3 OF 4
ADA043962



CORPS OF ENGINEERS

APROX. SCALE (FEET)
0 1000 2000

U. S. ARMY



LEGEND

(Ⅰ) GRAVEL BORROW PROSPECTS

⊡ B-A BACKHOE PIT

A—A' CROSS SECTION LIMITS

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
DAYS CREEK RESERVOIR

PLAN OF BORROW EXPLORATION

U. S. ARMY ENGINEER DISTRICT, PORTLAND

PREPARED: Robert J. Piper
CHIEF, SOILS ENGINEERING SECTION

RECOMMENDED:
CHIEF, ENGINEERING DIVISION

SUBMITTED: Paul Thanke
CHIEF, FOUNDATION AND MATERIALS BRANCH

APPROVED:
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

FIELD WORK H.D.B.
DRAWN T.A.B.
CHECKED J.D.J.

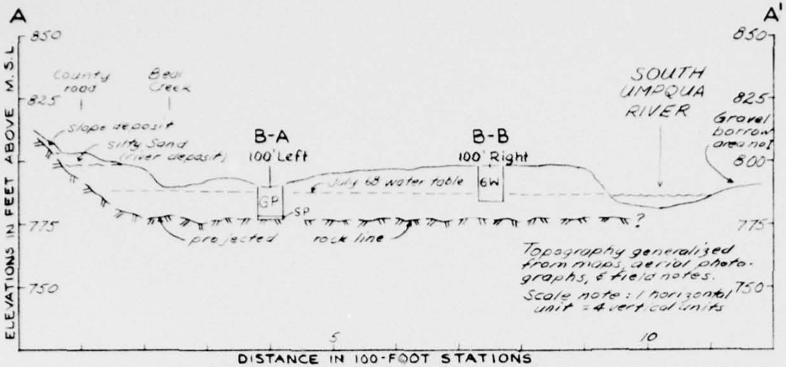
TRANSMITTED WITH REPORT
DATED

UM-20-4/6

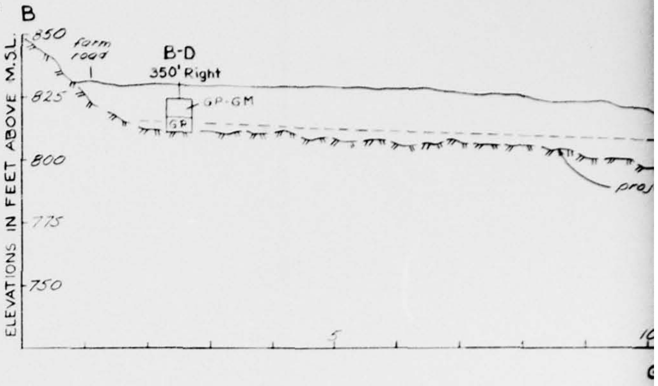
APPENDIX C PLATE 6

2

CORPS OF ENGINEERS

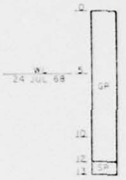


GRAVEL BORROW AREA NO. II



B - A

Backhoe Pit



Sandy gravel and cobbles, gray, dry to wet, loose, (alluvium)

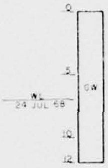
Gravelly sand and cobbles, gray, wet, loose

Bottomed due to caving - possible bedrock
24 Jul 68

River gravel bank between backhoe pits B-A and B-B. Indicates type of material in backhoe pit B-B. Bank eight feet high.

B - C

Backhoe Pit



Sandy gravel and cobbles, gray, dry to wet, loose, (alluvium)

Bottomed due to caving
24 Jul 68

Excavated material from backhoe pit B-C.

B - E

Backhoe Pit

Sandy gravel and cobbles, gray, dry to wet, loose, (alluvium)

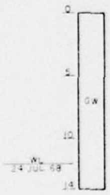
Sand content decreases below 10 feet

Bottomed on rock
25 Jul 68

Excavated material from backhoe pit B-E.

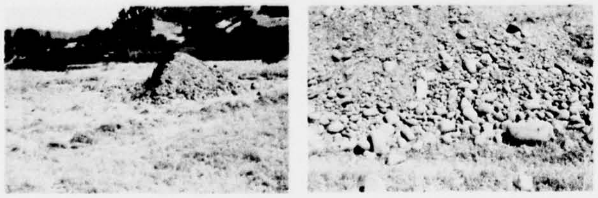
B - B

Backhoe Pit



Sandy gravel and cobbles, gray, dry to wet, loose, (alluvium)

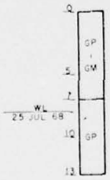
Bottomed due to caving
24 Jul 68



Excavated material from pit B-B. Level book in photo is 4.5" x 7".

B - D

Backhoe Pit



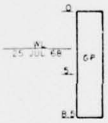
Silty sandy gravel and cobbles, gray-brown, dry to moist, compact, (alluvium)

Sandy gravel and cobbles, gray, moist to wet, compact, (alluvium)

Bottomed on rock
25 Jul 68

B - F

Backhoe Pit

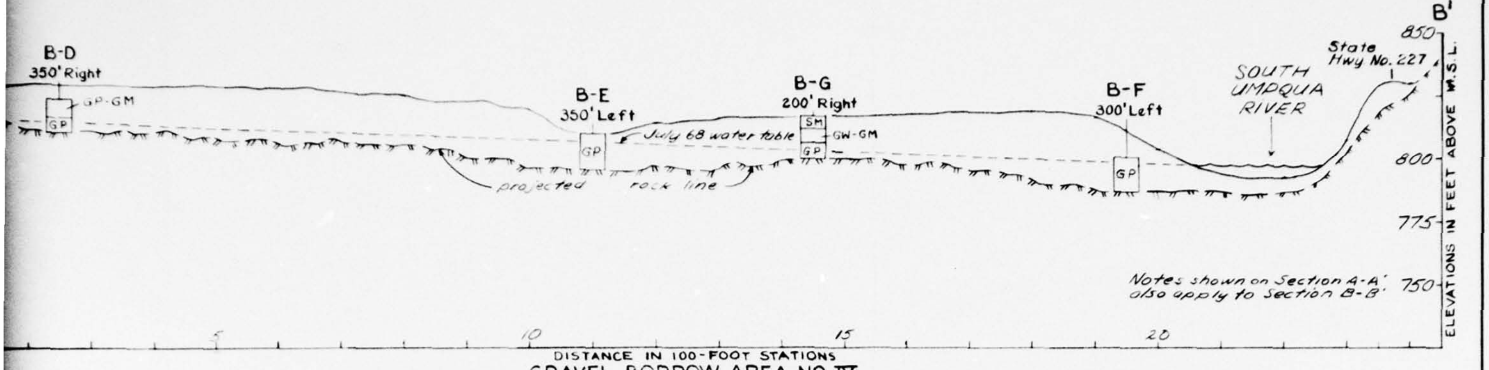


Sandy gravel, cobbles and boulders, gray, dry to wet, loose, (alluvium)

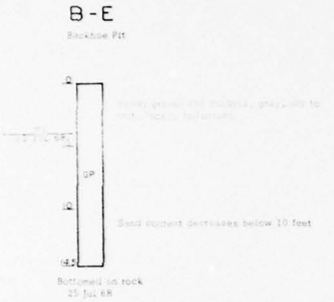
Bottomed on rock
25 Jul 68

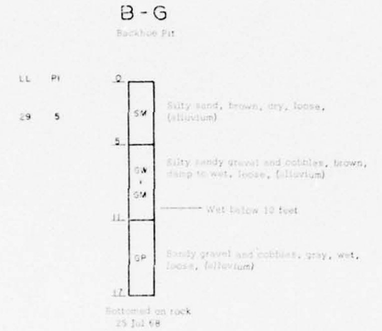
Excavated material from backhoe pit B-F. Level book in photo is 4.5" x 7".

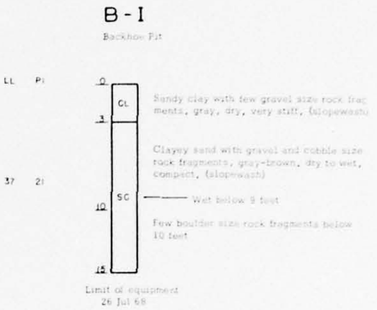
U. S. ARMY



GRAVEL BORROW AREA NO. IV

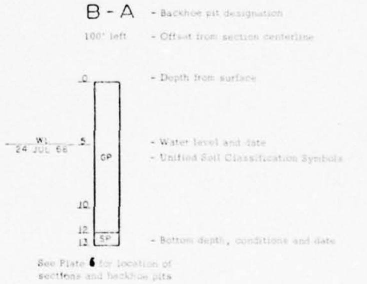


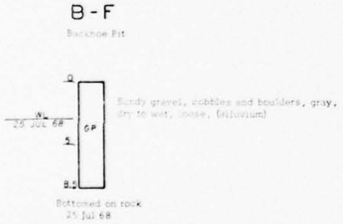




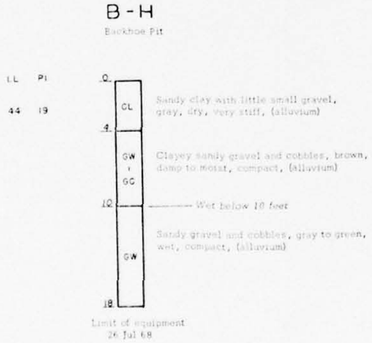
Excavated material from backhoe pit B-E.

LEGEND





Excavated material from backhoe pit B-F.
Level book in photo is 4.5" x 7".



UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER

DAYS CREEK RESERVOIR

CROSS SECTIONS AND LOGS OF BACKHOE PITS

U. S. ARMY ENGINEER DISTRICT, PORTLAND

PREPARED Robert Piper
CHIEF, SOILS ENGINEERING SECTION

RECOMMENDED
CHIEF ENGINEERING DIVISION

SUBMITTED Paul Thurber
CHIEF FOUNDATION AND MATERIALS BRANCH

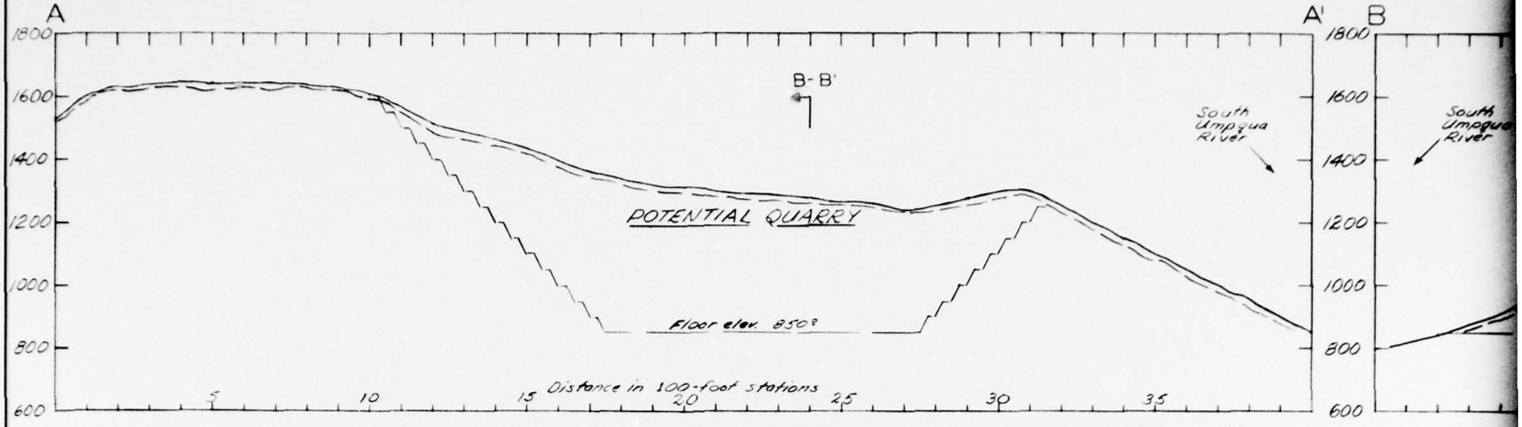
APPROVED
COLONEL CORPS OF ENGINEERS
DISTRICT ENGINEER

FIELD WORK H.B.B.
DRAWN T.E.B.
CHECKED L.O.J.

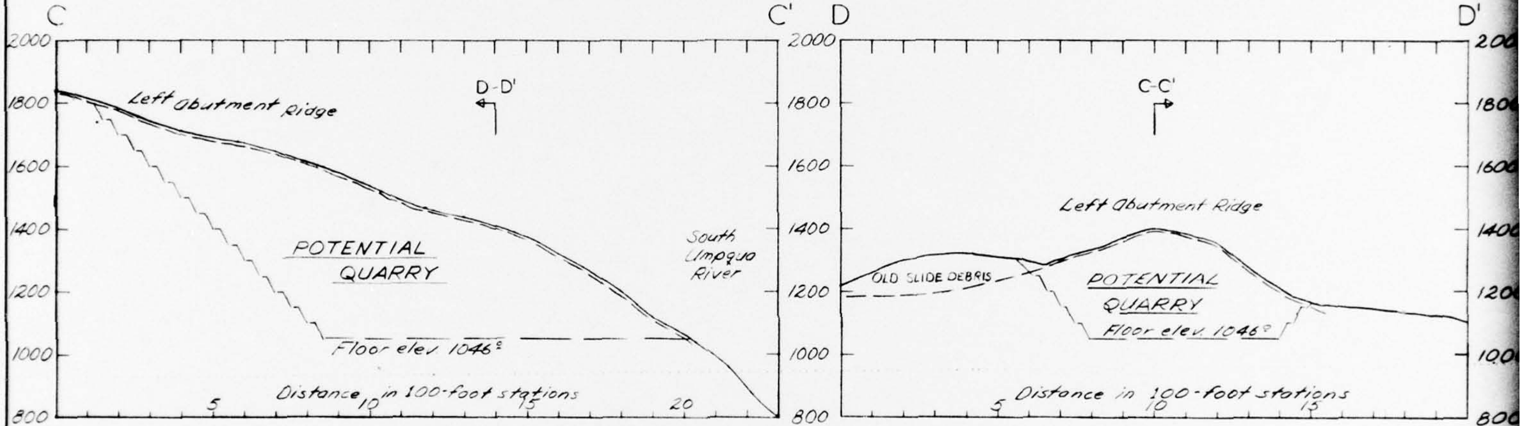
TRANSMITTED WITH REPORT
DATED

UM-20-4/7

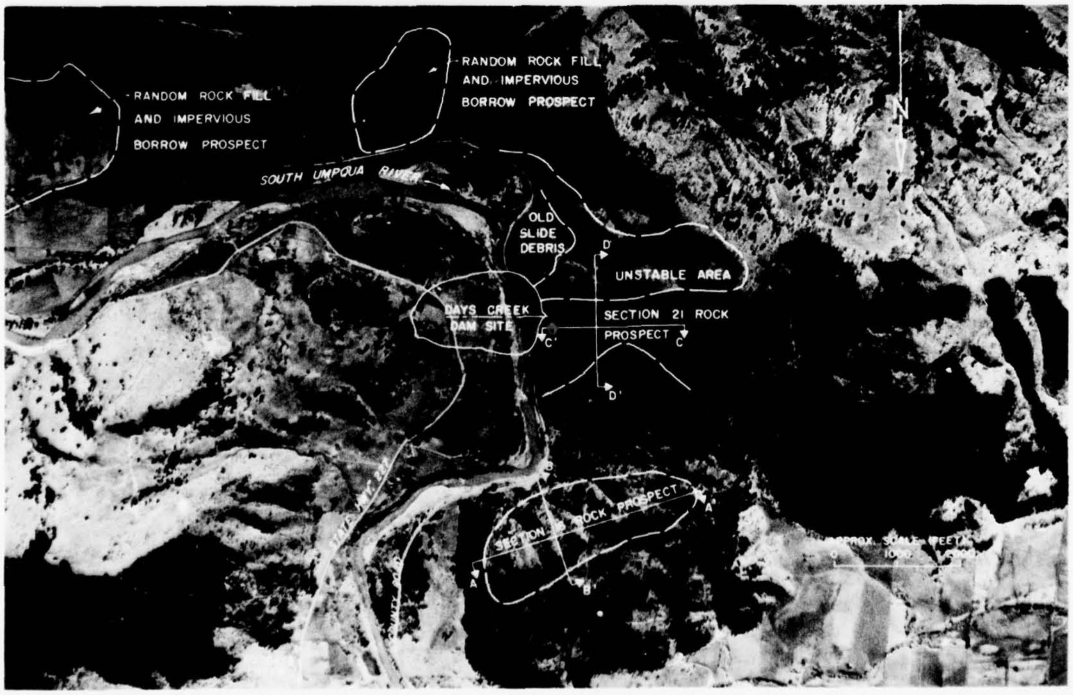
APPENDIX C PLATE 7



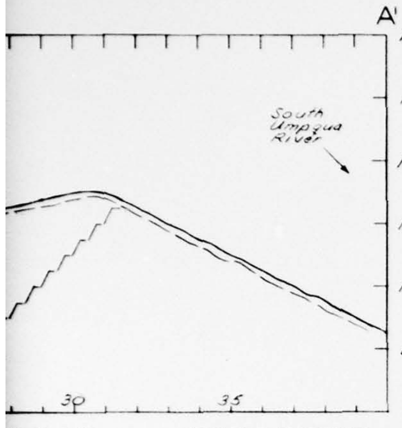
SECTION 16 ROCK PROSPECT



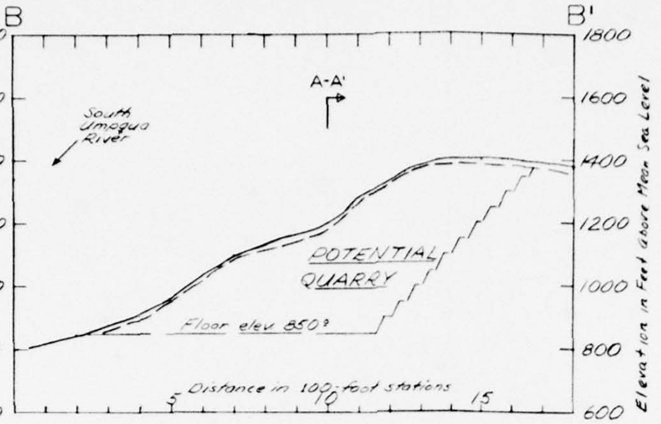
SECTION 21 ROCK PROSPECT

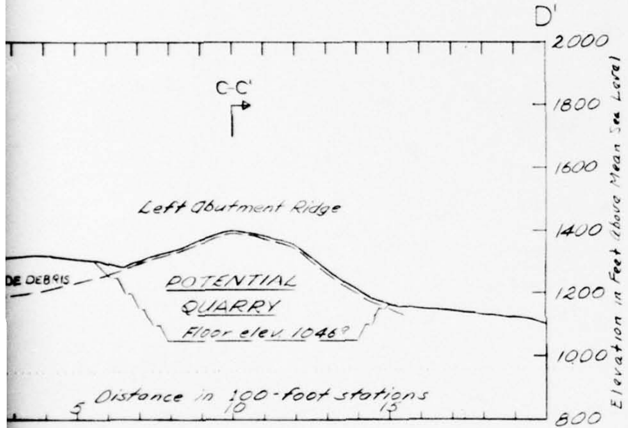


U. S. ARMY



ROCK PROSPECT





PECT

LEGEND

B B CROSS SECTION LIMITS

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER

DAYS CREEK RESERVOIR

ROCK AND RANDOM ROCK FILL PROSPECTS

PLAN AND CROSS SECTIONS

U. S. ARMY ENGINEER DISTRICT, PORTLAND

PREPARED Dall Snyder
CHIEF, GEOLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED Paul
CHIEF, FOUNDATION AND MATERIALS BRANCH

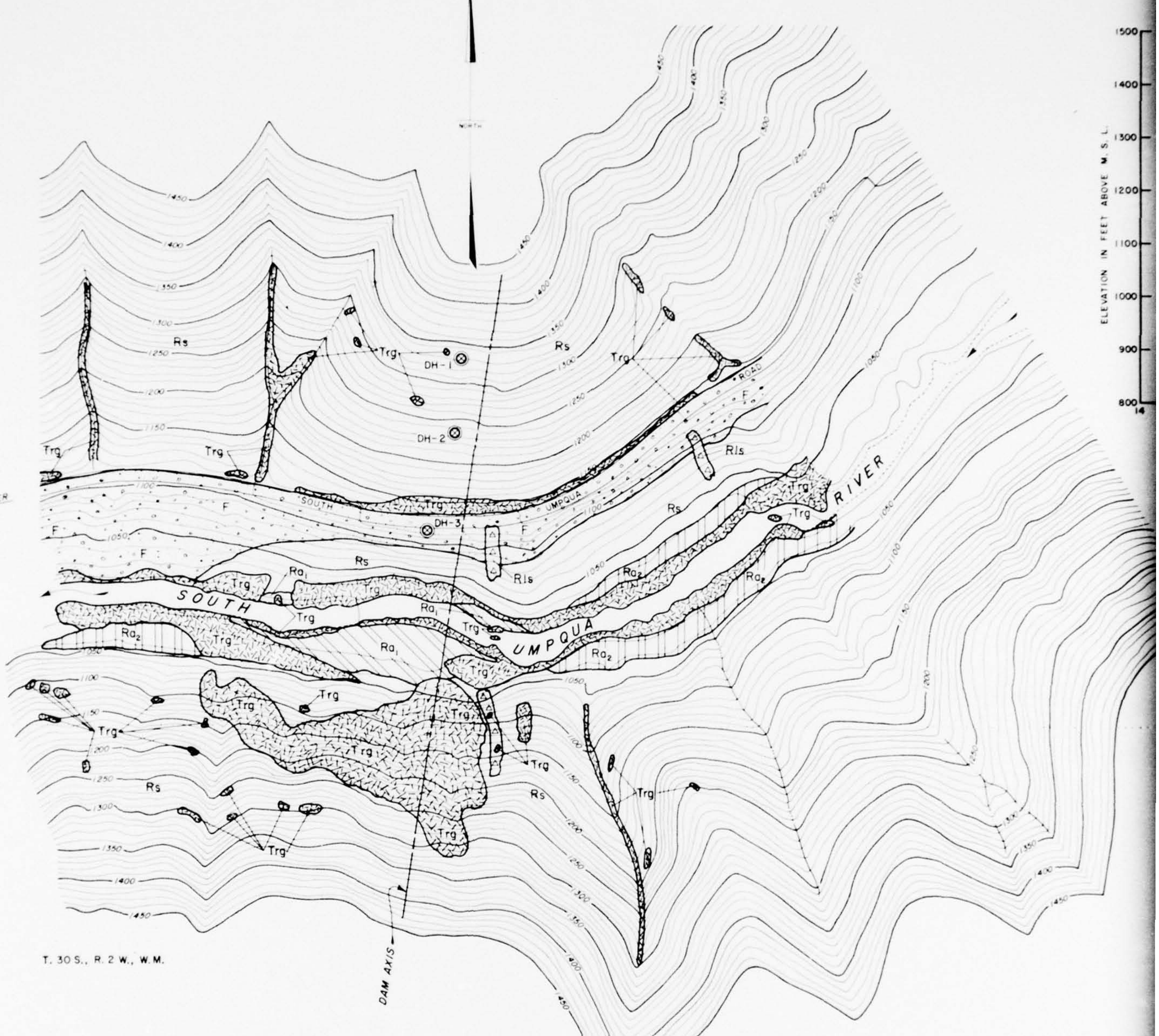
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

FIELD WORK T.E.B.
DRAWN T.E.B.
CHECKED P.L.G.

TRANSMITTED WITH REPORT
DATED

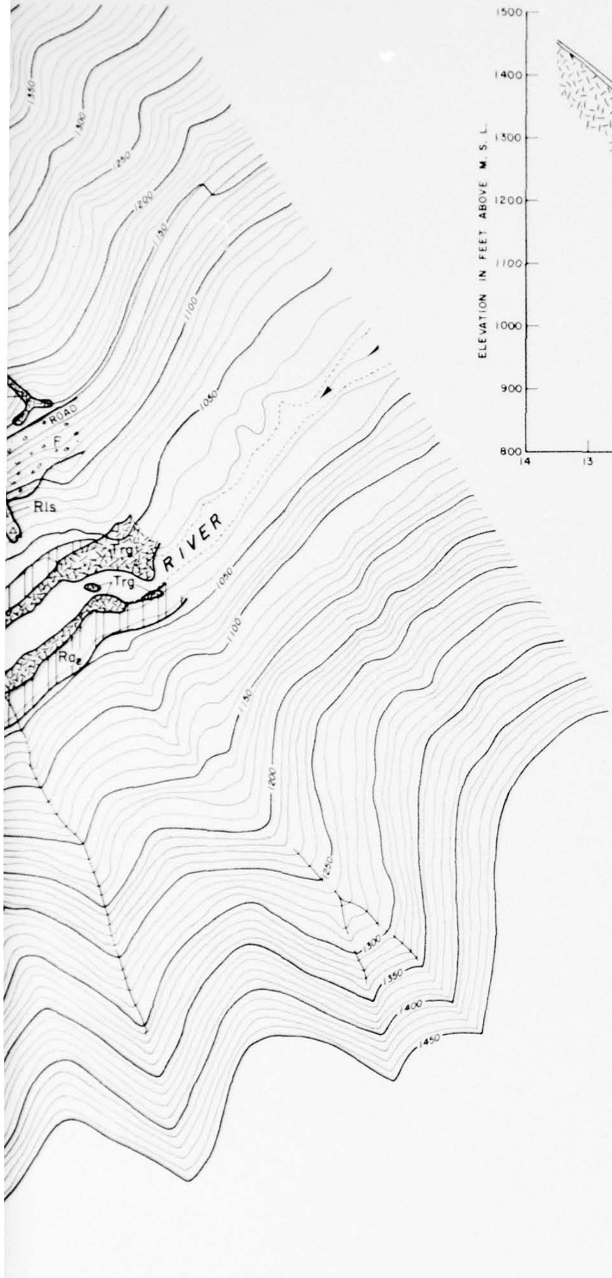
UM-20-4/8

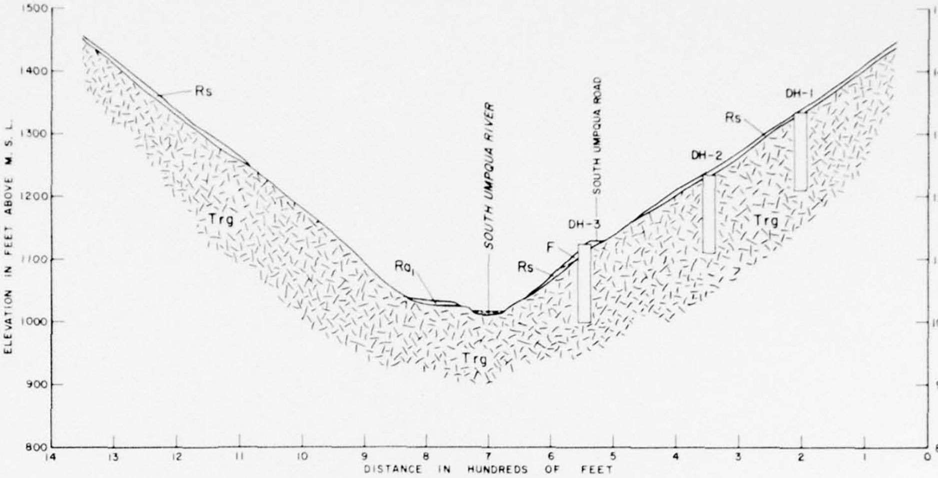
APPENDIX C PLATE 8



PLAN OF EXPLORATION AND AREAL GEOLOGY

100 0 100 200 300 400
FEET





AXIS SECTION
VIEW DOWNSTREAM

LEGEND

Rls	RECENT LANDSLIDES
F	ROAD FILL
Rs	TALUS, SLOPEWASH, SOIL AND BROKEN WEATHERED ROCK
Ra1	CHANNEL ALLUVIUM AND FIRST TERRACE
Ra2	SECOND TERRACE
Trg	SCHIST
⊗DH-1	CORE DRILL HOLE

NOTE: SEE PLATE 10 AND 11 FOR
DRILL LOGS AND PHOTOS.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
TILLER DAM SITE

PLAN OF EXPLORATION, AREAL GEOLOGY AND AXIS SECTION

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED
CHIEF, GEOLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, FOUNDATION AND MATERIALS BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED R.A.L.
TRACED R.D.W.
CHECKED PLG

TRANSMITTED WITH REPORT
DATED

UM-20-4/9

APPENDIX C PLATE 9

CORPS OF ENGINEERS

DEPTH OF HOLE: 127.2 ft.
DEPTH OF O.B.: 2.0 ft.
ROCK DRILLED: 125.2 ft.
% CORE RECOVERED: 97%
FEATURE: Right Abutment
BEARING:
INCL. FR HORIZ: Vertical
DIAMETER: NX

SURFACE EL. 1337.2 HOLE NO. DH-1

ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM / PSI
1337.2	0.0	CLAY: Silty, plastic, dark gy-brn	NX Core	
		SCHIST: Fine to med grained; comprised of 70-90% hornblende w/sch or banding at 70°-85°; some alt to chlorite and serpentine; small irregular quartz veins parallel to sch or cutting sch at 45°-60°; wea along jts with coating of red-brown plastic clay; mod hd except along joints; joints dip at 60°-75° to 10' depth - below this to bottom of hole dips are mostly 20°-45° but vary from near horizontal to vertical; dark green-gray	d.w.r. 100% green-gray joint spacing mostly 0.2'-0.4' to 10' depth with occ 1' spacing	NJ 2.95 / 2 2.62 / 10
		At 36' sch or banding changes to 60°-70°		2.46 / 25
1287.2	50	Below 50' joints stained but rock is still mod hard; some alteration of the hornblende to chlorite and serpentine	d.w.r. 90% gray-green d.w.r. 40% From 50' to 110' depth jt spacing up to 3.0' and est av 1.0' and w/occ zones of 0.2'-0.4'	0.46 / 80
		Fine grained from 66' - 75'		
1262.2	75.0	No clay in joints below 72' but [illegible] continues. [illegible] sch or banding changes to [illegible] and rock becomes coarser [illegible] 75°-90° red-brown garnet [illegible], also some quartz	d.w.r. 20% gray-green d.w.r. 3-10%	
		At 98' gouge-breccia zone at 65°	Water loss zone	2.04 / 60
1237.2				

TILLER DAM PROJECT DH-1

SURFACE EL. HOLE NO. DH-1

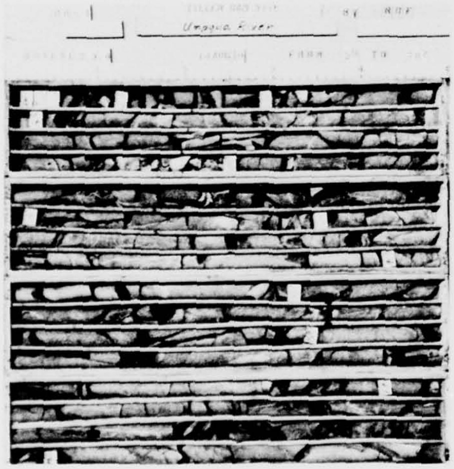
ELEVATIONS	DEPTH	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM / PSI
1237.2	100	Color - dark green; sch at 60°-70°; joints healed with quartz; rock increasingly hard; medium grained	d.w.r. 10% green. From 110' to bottom joint spacing est av 0.5' and max 1.5' d.w.r. green-gray	1.27 / 100
1210.0	127.2	BOTTOM OF HOLE	DATE COMPLETED 27 October 1958	

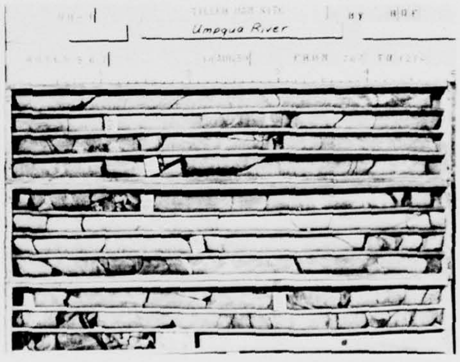
TILLER DAM PROJECT DH-1

DEPTH OF HOLE: 126.1 ft.
DEPTH OF O.B.: 6.0 ft.
ROCK DRILLED: 120.1 ft.
% CORE RECOVERED: 92%

SURFACE EL. 1235.5' HOLE NO.

ELEVATIONS	DEPTH	DESCRIPTION
1235.5		SAND: Silty ments, av 0 city; light b
1229.5	6.0	SCHIST: Me ed of 70-90% or banding a to chlorite a ed small qua with clay to stained but healed with in minor zon 40°-70° but zontal to ve
1185.5	50	

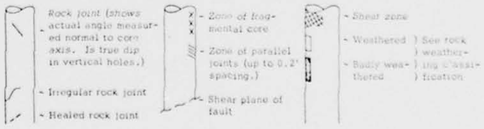




ABBREVIATIONS

ACL	- average core length	hly	- highly
alt	- altered	in	- inches
av	- average	jt(s)	- joint(s)
bs	- basalt	lt	- light
bldr	- boulder	max	- maximum
brn	- brown	MCL	- maximum core length
crbs	- carbonaceous	med	- medium
crbz	- carbonized	mod	- moderately
crs	- coarse	occ	- occasional
csg	- casing	pcf	- pounds per cubic foot
ct	- contact	pcs	- pieces
d.w.r.	- drill water return	ptly	- partly
est	- estimated	scat	- scattered
fn	- fine	sch	- schistosity
frac	- fracture	sdy	- sandy
frags	- fragments	sli	- slightly
fr	- from	slk	- slickenside
ft	- feet	vert	- vertical
gr	- grained	vesic	- vesicular
grn	- green	w/	- with
gy	- gray	wea	- weathered
hd	- hard	wtr dep	- water deposited
WPT	- water pressure test	PSI	- pounds per square inch
CFM	- cubic feet per minute		

LEGEND



- Rock joint (shows actual angle measured normal to core axis. Is true dip in vertical holes.)
- Irregular rock joint
- Healed rock joint
- Zone of fragmental core
- Zone of parallel joints (up to 0.2' spacing.)
- Shear plane of fault
- Shear zone
- Weathered) See rock
- Badly weathered) weathering classification

ROCK HA

Soft - Can be scratched with
Mod Hard - Can be scratched with
Hard - Difficult to scratch w
Very Hard - Cannot be scratched

ROCK WEA

1. Badly weathered - more by che reduct
2. Weathered - up to by che some
3. Stained - indica by pro engine
4. Fresh or Unweathered - core weath

U. S. ARMY

	REMARKS	WPT CFM PSI
70°;	d.w.r. 10% green	
ed	From 110' to bottom joint spacing not av 0.5' and max 1.5'	
		1.5 100
	d.w.r. green-gray	
	DATE COMPLETED 27 October 1958	

PROJECT DH-1

DEPTH OF HOLE: 126.1 ft.
DEPTH OF O.B.: 6.0 ft.
ROCK DRILLED: 120.1 ft.
% CORE RECOVERED: 92%

FEATURE: Right Abutment
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX

SURFACE EL. 1235.5' HOLE NO. DH - 2

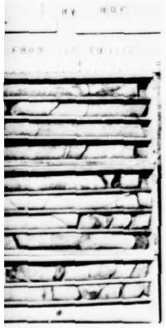
ELEVATIONS	DEPTH	GRAPHIC LOG	CORE %	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
1235.5				SAND: Silty w/angular rock fragments, av 0.8'; matrix low plasticity; light brown		
1229.5	6.0			SCHIST: Medium grained; comprised of 70-90% hornblende with sch or banding at 60°-70°; some alt to chlorite and serpentine; scattered small quartz veins; joints wea with clay to 12'; below 12' joints stained but not softened, some healed with quartz; mod hard except in minor zones; joints mostly from 40°-70° but vary from near horizontal to vertical	NX Core d.w.r. 100% green-gray joint spacing av <0.2' to 12' depth; av 0.8' from 32' to 60'; av >1.0' from 60' to 85'; av <0.5' from 85' to bottom of hole	NT
						0.18 15
1185.5	50					0.12 55
						0.30 90
	80				d.w.r. 100% gray-green	
						0.30 100
1135.5	100					

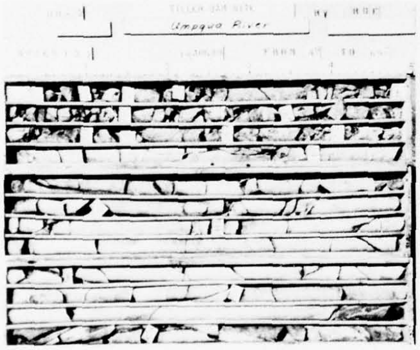
TILLER DAM PROJECT DH-2

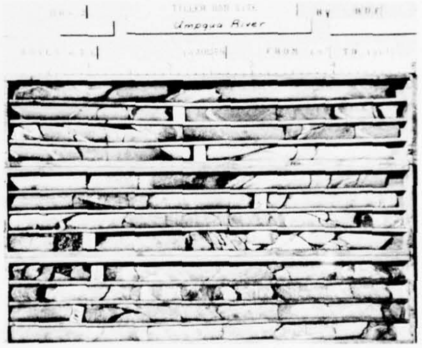
SURFACE EL. HOLE NO. DH - 2

ELEVATIONS	DEPTH	GRAPHIC LOG	CORE %	DESCRIPTION OF MATERIALS	REMARKS	WPT CFM PSI
	100			Fault breccia zone from 102'-103.5'; light gray-brown; upper contact sharp, at 65°; slicks, gouge; considerable healing by quartz	d.w.r. 100% gray	
	110			Fault breccia zone from 111.0' to 115.0'; some gouge, light green-gray with blue-gray gouge. Red-brown clay filling in joints from 111' - 120'; upper contact sharp at 65°; lower contact transitional		
	120					0.11 100
1109.4	126.1					
	130			BOTTOM OF HOLE	DATE COMPLETED 31 October 1958	

TILLER DAM PROJECT DH-2







GEND

- e of fragtal core
- e of parallel ts (up to 0.2' cing.)
- ar plane of t

ROCK HARDNESS CLASSIFICATION

Soft - Can be scratched with fingernail.
Mod Hard - Can be scratched with knife, not by fingernail.
Hard - Difficult to scratch with knife.
Very Hard - Cannot be scratched with knife.

ROCK WEATHERING CLASSIFICATION

1. Badly weathered - more than 50% of core is decomposed and/or disintegrated by chemical and physical processes, with extensive reductions in most rock engineering properties.
2. Weathered - up to 50% of core is decomposed and/or disintegrated by chemical and physical means, with reductions in some rock engineering properties.
3. Stained - indicates discoloration of core either by alteration or by precipitation, without appreciable change in rock engineering properties.
4. Fresh or Unweathered - core with no changes in original properties due to weathering processes.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
TILLER DAM SITE

LOGS AND PHOTOS OF FOUNDATION DRILL CORES

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED Dell Snyder
CHIEF, GEOLOGY SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED Paul Thumler
CHIEF, FOUNDATION AND MATERIALS BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED H.D.W.
TRACED H.D.W.
CHECKED P.L.G.
TRANSMITTED WITH REPORT
DATED

UM-20-4/10

APPENDIX C PLATE 10

CORPS OF ENGINEERS

DEPTH OF HOLE: 125.2 ft.
DEPTH OF O.B.: 7.0 ft. [illegible]
ROCK DRILLED: 118.2 ft.
% CORE RECOVERED: 99.9%

FEATURE: Right Abutment
BEARING:
INCL. FR. HORIZ: Vertical
DIAMETER: NX

SURFACE EL. 1122.8' HOLE NO. DH-3

DESCRIPTION OF MATERIALS	REMARKS	WPT CFM/PSI
FILL: Angular gravel to boulder sized rock in loosely compacted fines	NX Core 10% recovery d.w.r. 0-20% gray-green	NT
SCHIST: Medium grained, composed of 60-75% hornblende with [illegible] or banding at 50°-80°; small irregular quartz veins parallel to sch and cutting sch; fresh; mod hard to hard; joints dip at 10°-60°, some open, some rehealed with quartz; near vertical joints at 21.0'-22.0' and 32.5'-35.0'; sulphides on some joints; green-gray with gray to white bands	No d.w.r. Max NX cap Joint spacing av <0.5' to 53' w/1.2' max; 53'-70' av 1.5' w/2.7' max; 70'-77' av <0.5'; 77'-93' massive w/two joints; 93'-100' av < 0.6'; 100' to bottom - massive with four joints No d.w.r.	2.97/10 0.15/45 2.88/45 0.77/100

NPD Form 291

TILLER DAM PROJECT DH-3

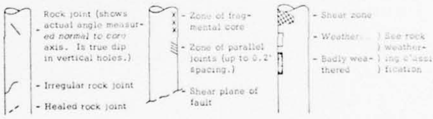
SURFACE EL. HOLE NO. DH-3

DESCRIPTION OF MATERIALS	REMARKS	WPT CFM/PSI
Sch well developed	Water loss zone	1.41/100
BOTTOM OF HOLE	DATE COMPLETED 5 November 1968	

NPD Form 291

TILLER DAM PROJECT DH-3

LEGEND



ABBREVIATIONS

ACL	- average core length	hly	- highly
alt	- altered	in	- inches
av	- average	jt(s)	- joint(s)
bs	- basalt	lt	- light
bldr	- boulder	max	- maximum
brn	- brown	MCL	- maximum core length
crbs	- carbonaceous	med	- medium
crbz	- carbonized	mod	- moderately
crs	- coarse	occ	- occasional
csg	- casing	pcf	- pounds per cubic foot
ct	- contract	pcs	- pieces
d.w.r.	- drill water return	ptly	- partly
est	- estimated	scat	- scattered
fn	- fine	sch	- schistosity
frac	- fracture	sdy	- sandy
frags	- fragments	sli	- slightly
fr	- from	slk	- slickenside
ft	- feet	vert	- vertical
gr	- grained	vesic	- vesicular
grn	- green	w/	- with
gy	- gray	wea	- weathered
hd	- hard	wtr dep	- water deposited
WPT	- water pressure test	PSI	- pounds per square inch
CFM	- cubic feet per minute		

Soft - Can b
Mod Hard - Can b
Hard - Diffic
Very Hard - Cann

1. Badly weathered

2. Weathered

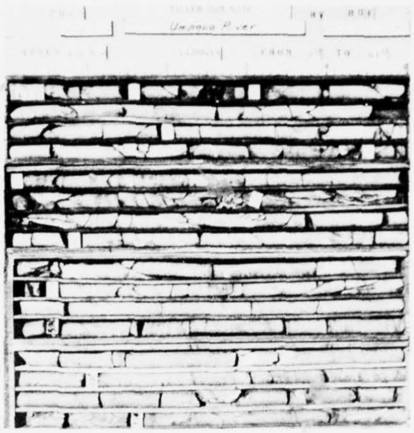
3. Stained

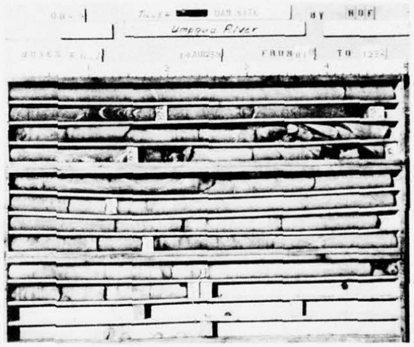
4. Fresh or Unwea

HOLE NO. DH - 3

DESCRIPTION OF MATERIALS	REMARKS
[illegible]	Water loss zone
BOTTOM OF HOLE	DATE COMPLETED: [illegible]

TILLER DAM PROJECT DH-3





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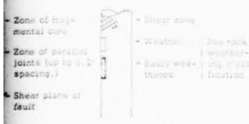


ROCK HARDNESS CLASSIFICATION

Soft	- Can be scratched with fingernail.
Mod Hard	- Can be scratched with knife, not by fingernail.
Hard	- Difficult to scratch with knife.
Very Hard	- Cannot be scratched with knife.

ROCK WEATHERING CLASSIFICATION

1.	Badly weathered	- more than 50% of core is decomposed and/or disintegrated by chemical and physical processes, with extensive reductions in most rock engineering properties.
2.	Weathered	- up to 50% of core is decomposed and/or disintegrated by chemical and physical [illegible], with reductions in some rock engineering properties.
3.	Stained	- indicates discoloration of core either by alteration or by precipitation, without appreciable change in rock engineering properties.
4.	Fresh or Unweathered	- core with no changes in original properties due to weathering processes.

UMPQUA RIVER AND TRIBUTARIES, OREGON
SOUTH UMPQUA RIVER
TILLER DAM SITE

LOGS AND PHOTOS OF FOUNDATION DRILL CORES

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED Dell Snyder
CHIEF GEOLOGY SECTION

RECOMMENDED
CHIEF ENGINEERING DIVISION

SUBMITTED Paul Thau Jr
CHIEF FOUNDATION AND MATERIALS BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

PREPARED H.D.W.
TRACED H.D.W.
CHECKED P.L.G.

TRANSMITTED WITH REPORT
DATED

UM-20-4/11

APPENDIX C PLATE 11

CORPS OF ENGINEERS, U.S. ARMY PORTLAND, OREGON DISTRICT

ENGINEERING DIV. F&M BRANCH Geology SECTION

PROJECT Days Creek Damsite

SUBJECT Grouting Cost Estimate

BY Brown DATE 19 Sep 68 CHECKED PART PAGE OF

	Cost Item	Quantity	Unit	Unit Price	Cost
A.	Mob and demob		Job	$	$ 5,000
B.	Grouting				
	1. Drilling EX holes	14,700	L.F.	5.00	73,500
	2. Pipe and fittings	4,830	Lbs.	1.50	7,245
	3. Connections	735	Ea.	5.00	3,675
	4. Cement, Type III	4,410	C.F.	2.00	8,820
	5. Fluidifier	4,410	Lbs.	1.00	4,410
	6. Placing grout	7,350	C.F.	4.00	29,400
					$127,050
			GROUTING TOTAL		$127,000
C.	Contingencies - 15% X Grouting				$ 19,000
		A., B., C.	GRAND TOTAL		$151,000

Basis of Estimate:

1. Primary holes spaced 20 ft. at 60 ft. depth
   Secondary holes spaced 10 ft. at 40 ft. depth
   Tertiary holes spaced 5 ft. at 20 ft. depth

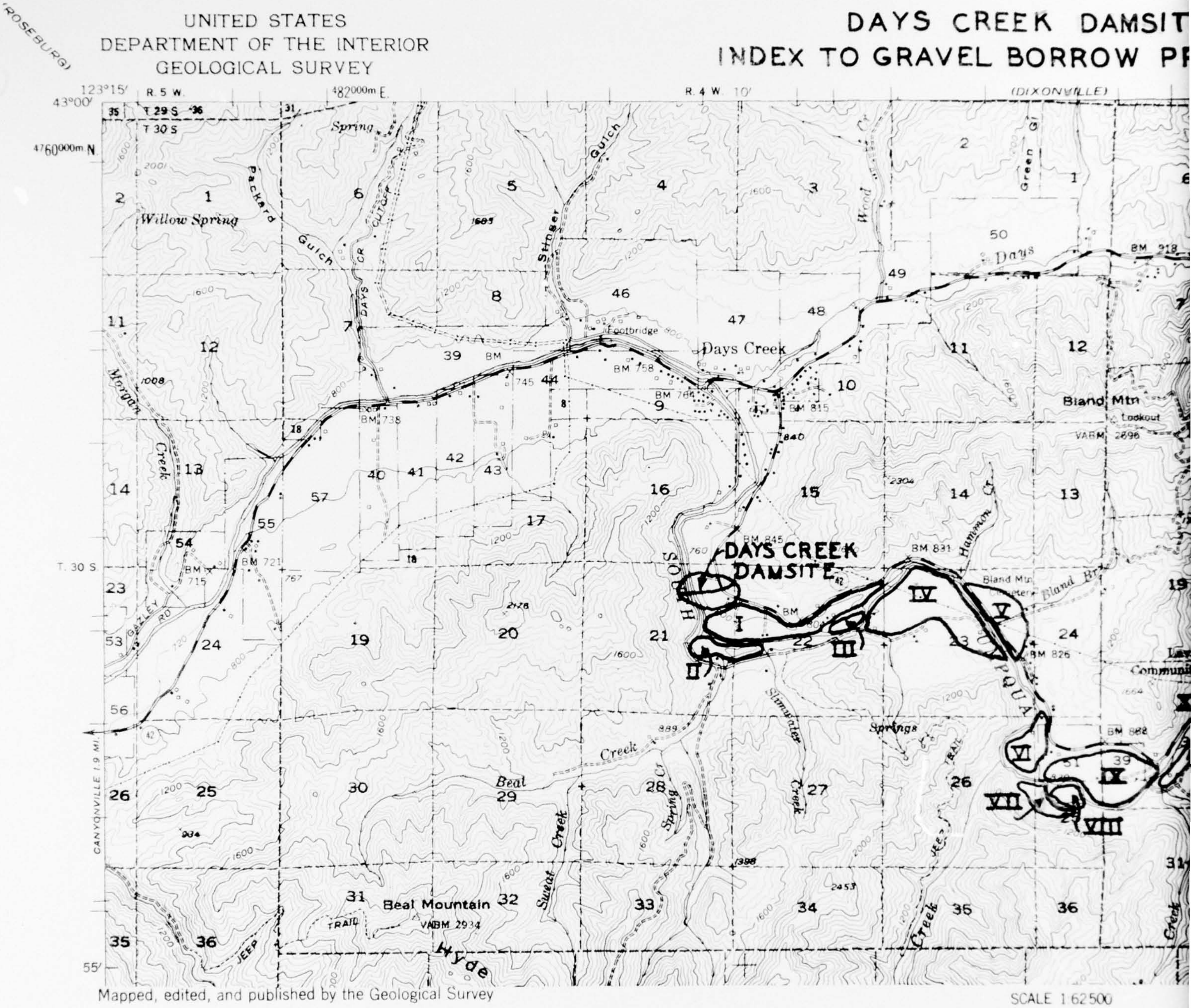
100 L.F. (5 holes at 60 ft. = 300 L.F.)
Grout (5 holes at 40 ft. = 200 L.F.) = 700 L.F./100 ft. curtain
Curtain (10 holes at 20 ft. = 200 L.F.)
(2,100 L.F. curtain)(700 L.F. drilling/100 L.F. curtain) =
14,700 L.F. drilling

2. 2.5 ft. pipe + cap = 11.5 lbs/hole
   (420 holes)(11.5 lbs) = 4,830 lbs
3. (35 connections/100 L.F. curtain)(2100 L.F. curtain) = 735
4. Estimate 0.3 C.F./L.F. of hole
5. 1 lb/C.F. cement
6. Estimate 0.5 C.F./L.F. of hole

EXHIBIT 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DAYS CREEK DAMSIT
INDEX TO GRAVEL BORROW PR



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1951. Field check 1954

Polyconic projection. 1927 North American datum
10,000-foot grid based on Oregon coordinate system, south zone

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

1000-meter Universal Transverse Mercator grid ticks,
zone 10, shown in blue

APPROXIMATE MEAN
DECLINATION, 1954

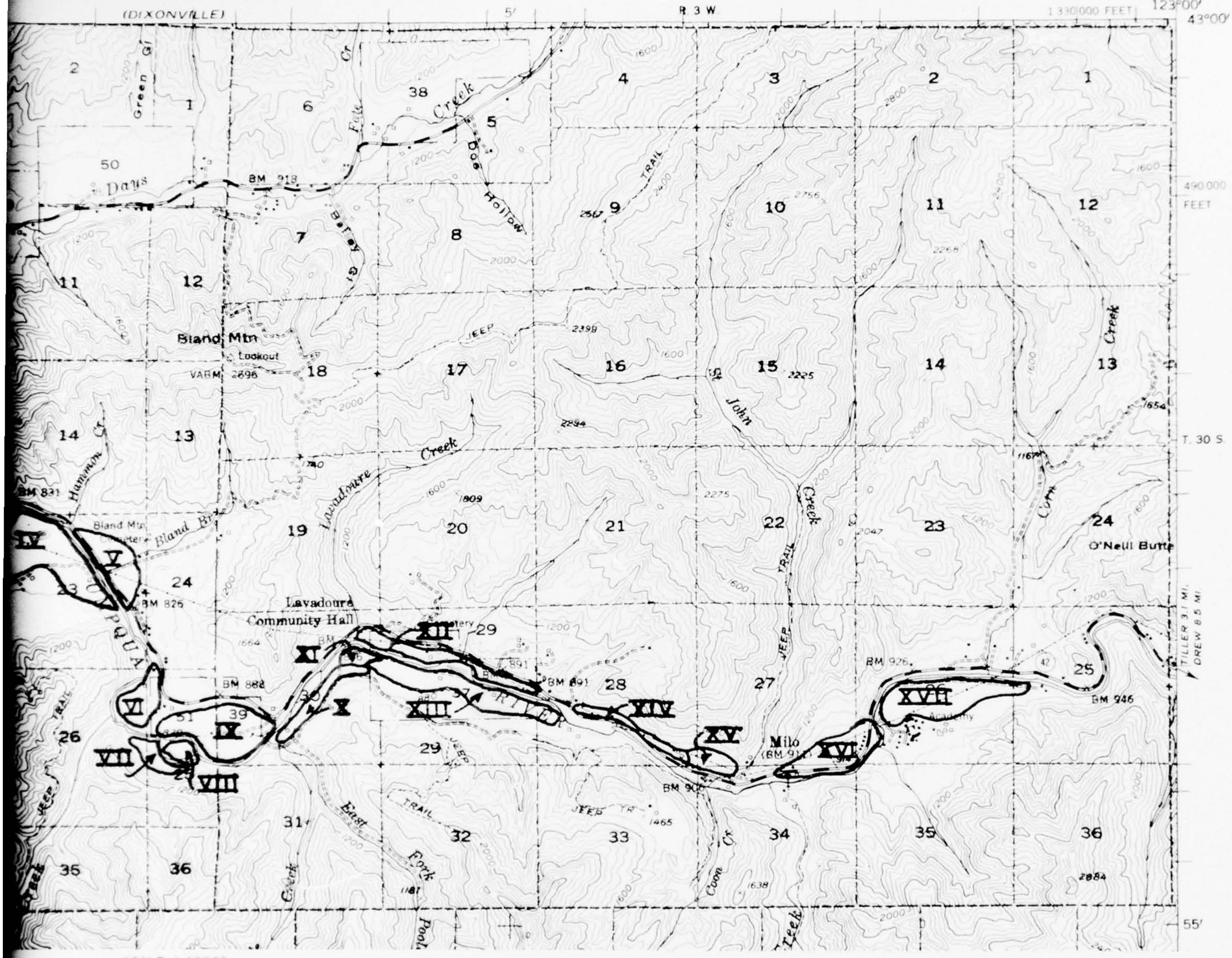
SCALE 1:62500

CONTOUR INTERVAL 80 FEET
CONTOUR INTERVAL ON RIVER SURFACE 20 FE
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLOR
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS A

YS CREEK DAMSITE
RAVEL BORROW PROSPECTS

DAYS CREEK QUADRANGLE
OREGON
15 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:62500

1 2 3 4 MILES

6000 9000 12000 15000 18000 21000 FEET

1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET
CONTOUR INTERVAL ON RIVER SURFACE 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
1963

Heavy-duty	▬	Light-duty	—
Medium-duty	‒ ‒ ‒	Unimproved dirt	┈
U. S. Route		State Route	○

QUADRANGLE LOCATION

DAYS CREEK, OREG.
N4245—W12300/15
1954

P COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
OGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
ING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

EXHIBIT 2

2

CORPS OF ENGINEERS, U.S. ARMY PORTLAND, OREGON DISTRICT

ENGINEERING DIV. F&M BRANCH Geology SECTION

PROJECT Days Creek Damsite

SUBJECT Sand and Gravel Borrow Estimates

BY HDB DATE 17 Sep 68 CHECKED PART PAGE 1 OF 1

Area No.	River Miles from Axis	Area (Square Feet)	Basis of Mtl. Types	Material Type and Sequence	Quantity (Cubic Y	
					Sand	Gr
I	0.2 - 1.6	4,280,000	Surface exam, nearby pits	3 ft. sand on 15 ft. gravel	475,000	2,375
II	0.3 - 0.8	1,000,000	Backhoe pits	1-1/2 ft. sand on 15 ft. gravel	56,000	500
III	1.2 - 1.5	480,000	Surface examination	No sand, 4 ft. gravel	---	71
IV	1.4 - 2.9	6,640,000	Backhoe pits	4-1/2 ft. sand on 12 ft. gravel	1,110,000.	2,960
V	2.3 - 2.9	2,400,000	Surface exam, nearby pits	4-1/2 ft. sand on 12 ft. gravel	400,000	1,060
VI	3.3 - 3.7	1,400,000	Surface examination	No sand, 6 ft. gravel	None	310
VII	3.9 - 4.3	720,000	"	2 ft. sand on 4 ft. gravel	53,000	106
VIII	4.1 - 4.3	840,000	"	3 ft. sand on 4 ft. gravel	93,000	124
IX	4.0 - 5.0	4,460,000	"	6 ft. sand on 6 ft. gravel	1,010,000	1,010
X	4.9 - 6.1	1,360,000	"	7 ft. sand on 4 ft. gravel	353,000	201
XI	5.7 - 6.1	600,000	"	7 ft. sand on 2 ft. gravel	156,000	50
XII	5.9 - 7.3	1,840,000	"	6 ft. sand on 2 ft. gravel	409,000	136
XIII	5.7 - 7.4	3,040,000	"	5 ft. sand on 3 ft. gravel	563,000	338
XIV	7.5 - 8.1	1,000,000	"	2 ft. sand on 5 ft. gravel	74,000	185
XV	8.2 - 8.5	1,000,000	"	2 ft. sand on 5 ft. gravel	74,000	185
XVI	8.9 - 9.7	1,600,000	"	1 ft. sand on 5 ft. Gravel	59,000	297
XVII	9.8 - 11.0	4,480,000	"	No sand, 4 ft. gravel	None	66
				TOTALS:	4,885,000 CY	[illegible],572

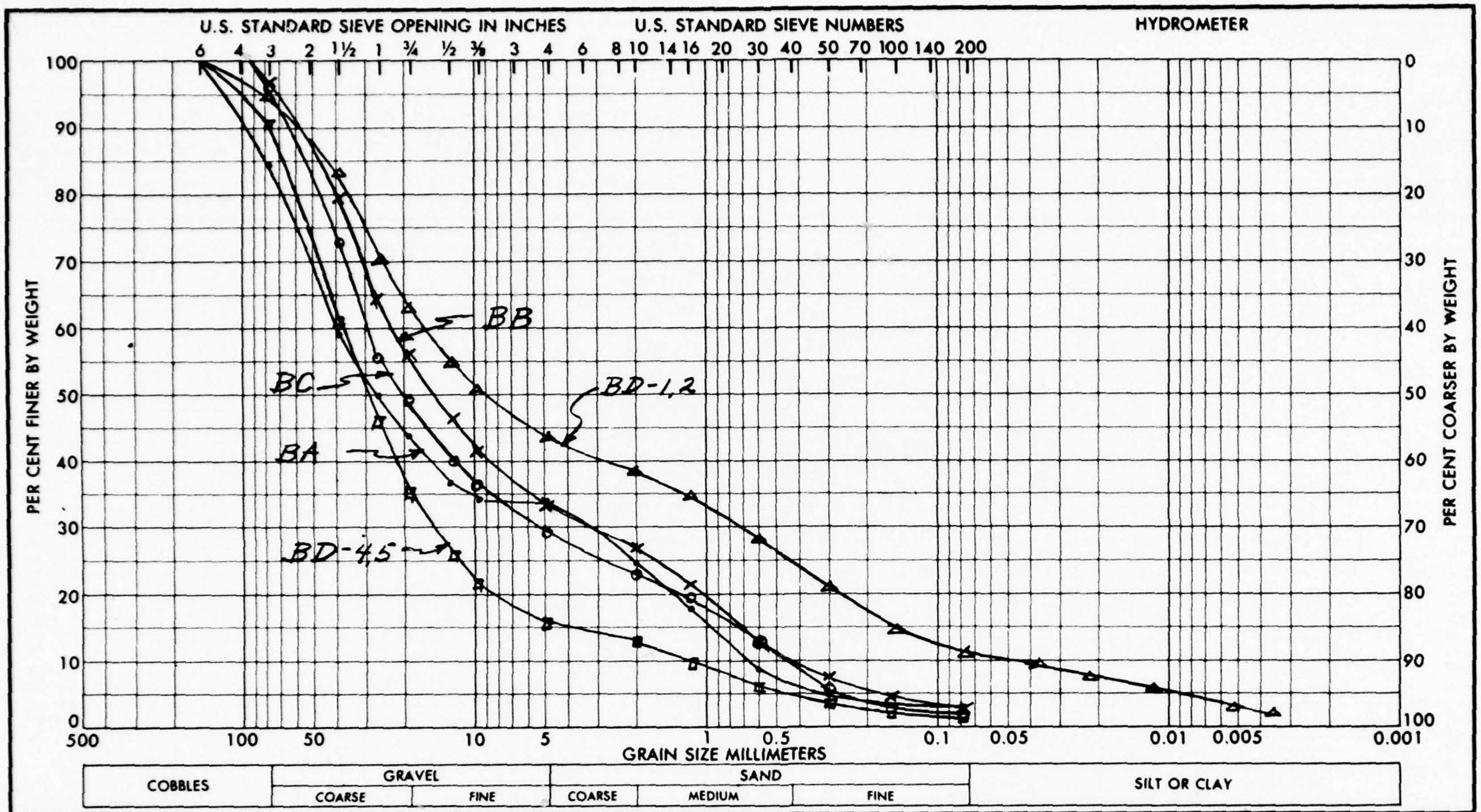
REGON DISTRICT

SECTION

1 OF 1

Type ence	Quantity (Cubic Yards)		Sand and Gravel Sum	Cumulative Sand	Cumulative Gravel
	Sand	Gravel			
nd on	475,000			475,000	
gravel		2,375,000	2,850,000		2,375,000
sand on	56,000			531,000	
gravel		500,000	616,003		2,935,000
4 ft.	---			531,000	
		71,000	71,000		3,006,000
sand on	1,110,000.			1,641,000	
gravel		2,960,000	4,070,000		5,966,000
sand on	400,000			2,041,000	
gravel		1,060,000	1,460,000		6,966,000
	None			2,041,000	
ravel		310,000	310,000		7,276,000
nd on	53,000			2,094,000	
ravel		106,000	159,000		7,382,000
nd on	93,000			2,187,000	
ravel		124,000	217,000		7,506,000
nd on	1,010,000			3,197,000	
ravel		1,010,000	2,020,000		8,516,000
nd on	353,000			3,550,000	
ravel		201,000	554,000		8,717,000
nd on	156,000			3,706,000	
gravel		50,000	206,000		8,767,000
nd on	409,000			4,115,000	
ravel		136,000	545,000		8,903,000
nd on	563,000			4,678,000	
ravel		338,000	901,000		9,241,000
nd on	74,000			4,752,000	
ravel		185,000	259,000		9,426,000
nd on	74,000			4,826,000	
ravel		185,000	259,000		9,611,000
nd on	59,000			4,885,000	
Gravel		297,000	356,000		9,908,000
	None			4,885,000	
gravel		664,000	664,000		10,572,000
TOTALS:	4,885,000 CY	10,572,000 CY	15,457,0 CY		

EXHIBIT 3



	SAMPLE NO.	~~ELEV OR~~ DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
•	BA-1,2,3	0 – 12'	Sa. GRAVEL (GP)				
×	BB-1,2,3	0 – 14'	Sa. GRAVEL (GW)				
o	BC-1,2,3	0 – 12'	Sa. GRAVEL (GW)				
△	BD-1,2	0 – 7'	Si. Sa. GRAVEL (GP-GM)				
⊠	BD-4,5	7' – 13'	Sa. GRAVEL (GP)				

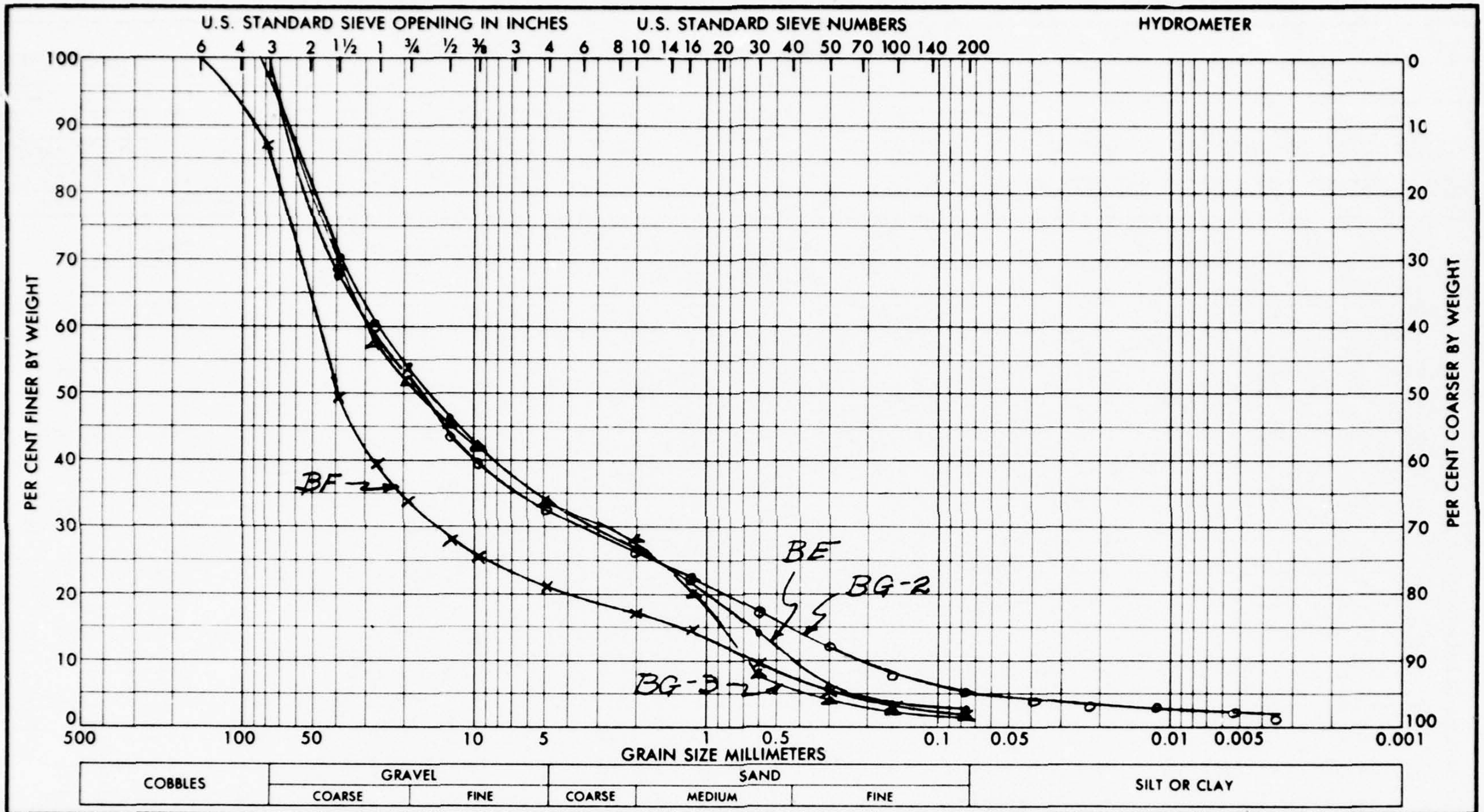
GRADATION CURVES NPD

PROJECT DAYS CREEK DAMSITE
South Umpqua River
AREA
BORING NO. BA, BB BC & BD
DATE 10 Oct 1968 69-S-733

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE. (TRANSLUCENT)

U.S. GOVERNMENT PRINTING OFFICE : 1963 OF—709-124



	SAMPLE NO.	~~ELEV OR~~ DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
•	BE-1,2	0 - 10'	Sa. GRAVEL (GP)				
×	BF-1,2	0 - 8.5'	Sa. GRAVEL (GP)				
o	BG-2	5 - 10'	Si Sa. GRAVEL (GW-GM)				
Δ	3	11 - 15'	Sa. GRAVEL (GP)				
	4	0 - 5'	ML		29	24	5

GRADATION CURVES NPD

PROJECT DAYS CREEK DAMSITE

South Umpqua River

AREA

BORING NO. BE, BF & BG

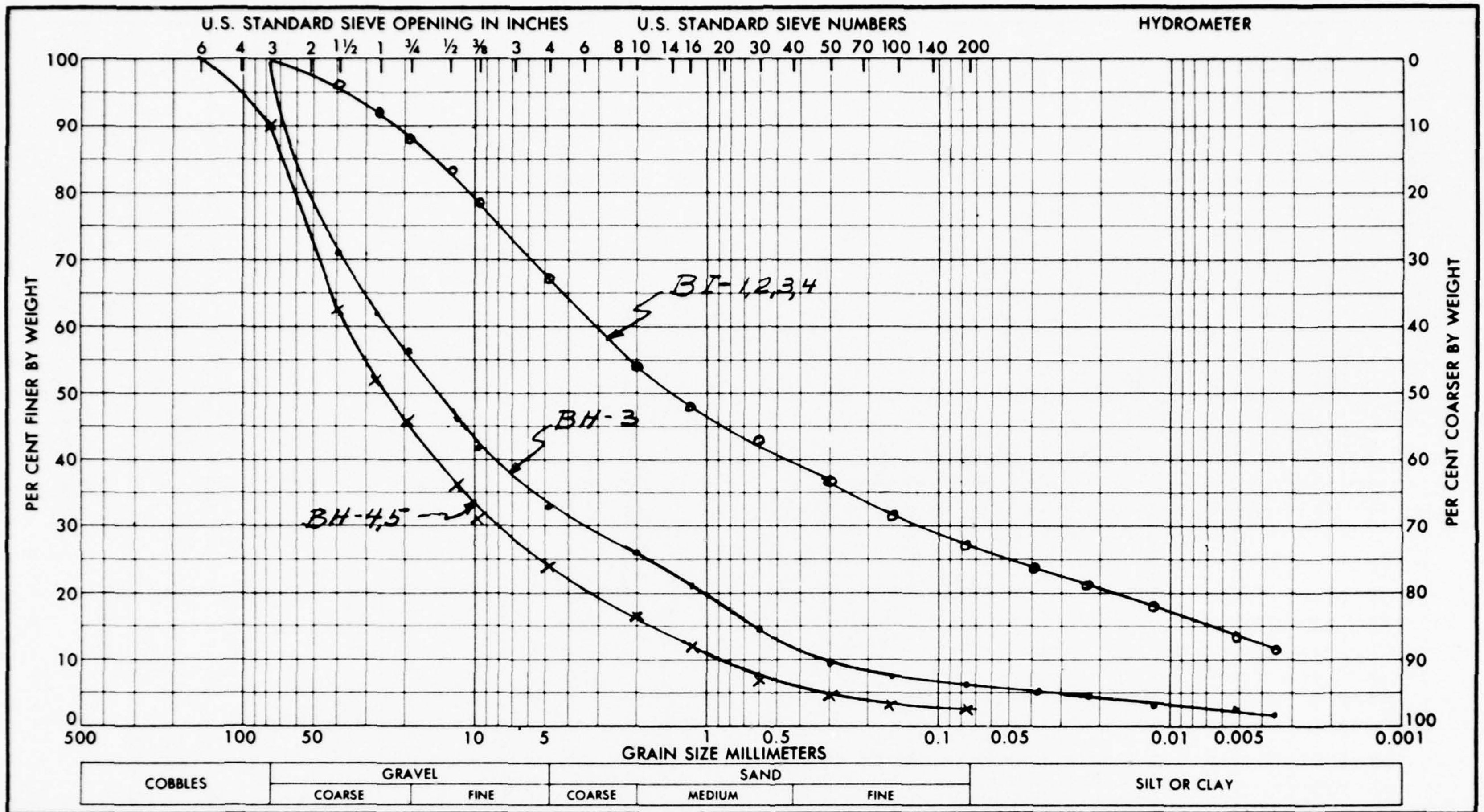
DATE 10 Oct. 1968 69-S-733

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE. (TRANSLUCENT)

U.S. GOVERNMENT PRINTING OFFICE 1963 OF—709-128

EXHIBIT 4, PAGE 2



SAMPLE NO.	~~ELEV OR~~ DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
BH-1	0 - 4.0	Cl		44	25	19
3	4.0 - 10.0'	Cl. Sa. GRAVEL (GW-GC)				
4,5	10.0 - 18.0'	Sa. GRAVEL (GW)				
BI-1,2,3,4	0 - 15.0'	Cl. Gr. SAND (SC)		37	21	16

PROJECT DAYS CREEK DAMSITE
South Umpqua River

AREA

BORING NO. BH & BI

DATE 10 Oct. 1968 69-S-733

GRADATION CURVES NPD

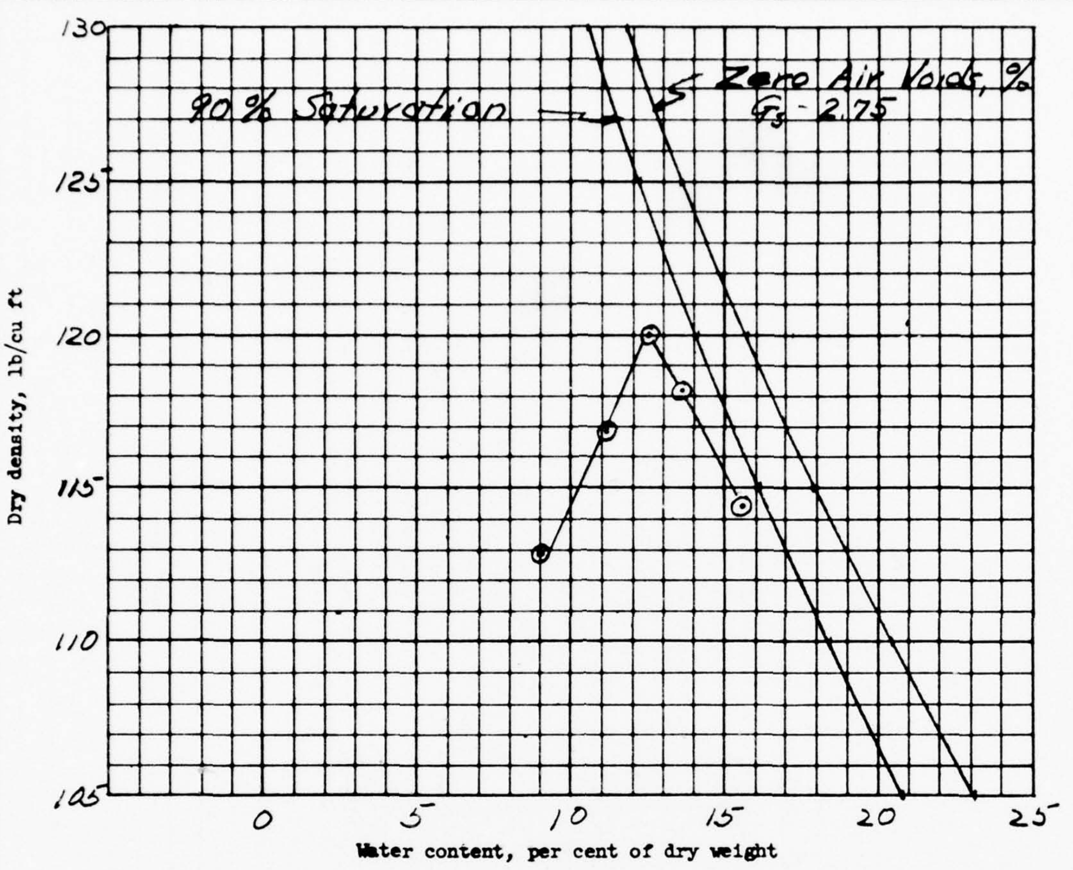
ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE. (TRANSLUCENT)

U.S. GOVERNMENT PRINTING OFFICE : 1963 OF—709-126

• × o

EXHIBIT 4, PAGE 3



Standard compaction test

56 blows per each of 3 layers, with 5.5 lb rammer and

12 inch drop. 6 inch diameter mold

Sample No.	~~Elev or~~ Depth	Classification	G	LL	PL	% > No. 4	% > 3/4 in.
Comp.	0-15	Cl. Gr. SAND (SC)		37	21	33	11

Sample No. Comp.	1,2,3 & 4			
Natural water content in per cent				
Optimum water content in per cent	12.5			
Max dry density in lb/cu ft	120.0			

Remarks Minus 1" material. No replacement.

Project DAYS CREEK DAMSITE South Umpqua River

Area

Boring No. B-1

Date 10 Oct. 1968

COMPACTION TEST REPORT NPD

69-S-733

EXHIBIT 5

REVIEW REPORT
ON
UMPQUA RIVER AND TRIBUTARIES, OREGON
INTERIM REPORT, SOUTH UMPQUA RIVER

APPENDIX D
RECREATION, PUBLIC USE, AND ENVIRONMENT

Prepared by
U.S.Army Engineer District, Portland
Corps of Engineers
Portland, Oregon

R 3/72

TABLE OF CONTENTS

RECREATION, PUBLIC USE, AND ENVIRONMENT

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

PLATES

EXHIBITS

SECTION I - GENERAL

1. RECREATION RESOURCES

Outdoor recreation pursuits in the Umpqua River Basin cover a wide range of activities including boating, swimming, hunting, fishing, sightseeing, hiking, water skiing, camping, and picnicking. Existing recreation facilities in the area are receiving heavy usage and additional parks will be required to meet the demand. The Oregon State Parks system, Douglas County, U. S. Forest Service, Bureau of Land Management, private organizations, and various cities operate public parks within the basin.

2. THE PROJECT AND VICINITY

a. The South Umpqua River is located within a scenic valley in southwest Oregon. The river originates high in the Cascade Range and merges with North Umpqua River about 10 miles downstream from Roseburg, Oregon. The proposed Days Creek Lake project, to be located about one mile upstream from the town of Days Creek, would total 7,600 acres. It would consist of an embankment-type dam, about 254 feet high and about 2,600 feet long at its crest. The embankment would be constructed from rock and gravel, with an impervious clay core. The total volume of the embankment would be about 7½ million cubic yards.

b. The lake which would form upstream from the dam would be about 16 miles long and have a capacity of 480,000 acre-feet. Days Creek project would control the runoff from about 640 square miles of forested mountains drained by South Umpqua River. The project would be operated for flood control, fishery enhancement, recreation, municipal and industrial water supply, irrigation, and water quality control.

c. Tree cover. - Tree cover indigenous to the reservoir area includes Douglas fir, white fir, yellow pine, Jeffrey pine, white and black oak, California live oak, chinquapin, madrone, alder, and maple. Lower cover includes manzanita, vine maple, salal, and fern. Topography in the area to be inundated is generally rugged except on and immediately above the flood plain. Few developed recreation areas are available along the South Umpqua River within the project area; however, the undeveloped resource is used by recreationists such as hunters and fishermen.

d. The proposed operation. -

(1) Water-associated recreation use would be an integral part of the operation schedule for the project. Ample storage would be carried to provide an esthetically pleasing lake during periods of drawdown and while the lake is at minimum pool. A balance to provide for a high quality

lake resource and provision of ample downstream flows for maximum downstream river use has been achieved.

(2) From 1 December to 1 February, the reservoir would be maintained at the minimum flood control pool level, to make 275,000 acre-feet of storage space available for flood control operation. The drawdown at that level would be 78 feet below maximum pool level, the water surface area would be 2,840 acres, and the shoreline length 34 miles.

(3) Between 1 February and 1 May, the flood control storage space would be filled from flows in excess of downstream requirements. Full conservation pool level would be at elevation 1,022 feet, m.s.l. The water surface area at maximum conservation pool would be 4,270 acres and have a shoreline length of 50 miles.

(4) The stored water would be withdrawn throughout the summer as needed for downstream uses. By 1 December, the pool would be down to elevation 948 feet, m.s.l., to provide flood control storage space. At that level, the lake would remain desirable for water-associated recreation use.

(5) During infrequent low-water years, when water from carryover storage must be used for conservation releases, the pool may be drawn lower than to elevation 948. The maximum drawdown under those conditions would be 138 feet. The pool at that level would have a surface area of 1,610 acres.

e. Climatic conditions. - South Umpqua River drains an area that is drier than the Umpqua River Basin as a whole. That fact is well borne out by casual observation of the landscape -- scattered oak groves in the lowlands and pine-Douglas fir forest in the uplands present a much drier aspect than the green valleys and vigorous stands of Douglas fir lying immediately to the north. The transition in vegetation between the Pacific northwest and California is evident as one travels through the area along South Umpqua River. At the reservoir site, climatic conditions are very favorable for recreation use. The active recreation season in normal years would extend from April through October.

f. Accessibility for user populations. - Days Creek Lake would be located about 35 miles south of Roseburg, Oregon, the major population center in the day-use market area. Vehicular access from Roseburg would be south via Interstate Highway 5, then east about 8 miles via State Highway 227. Interstate Highway 5 also affords convenient access to the project from other nearby cities such as Grants Pass in Josephine County. The many tourists traveling north and south on Interstate Highway 5 and traveling Highway 227 east to Crater Lake would find Days Creek Lake readily accessible.

3. FISH AND WILDLIFE RESOURCES

The major fishery resource of South Umpqua River is its anadromous fish. Tributary streams also support some cutthroat trout. The rainbow trout population is maintained primarily by stocking hatchery fish. Black-tailed deer, black bear, and grouse inhabit the basin. Beaver, mink, and muskrat are present along the South Umpqua River and its tributaries.

a. Fish resource. -

(1) Days Creek Lake would eliminate about 30 miles of free-flowing streams that are presently utilized for spawning by the following estimated numbers of anadromous salmonids: 100 spring chinook, 1,000 winter steelhead, 1,250 coho, and 1,000 cutthroat. The loss of natural production from the inundated stream sections would be mitigated through hatchery production.

(2) Fish would benefit from improved downstream temperatures and flows resulting from regulated releases at the project. Spawning and rearing conditions for salmon and steelhead along the South Umpqua from the dam to its confluence with North Umpqua River would be improved also. Fish Commission of Oregon estimates of increased escapement to the South Umpqua system as a result of improved downstream flows and temperatures are as follows:

Species	Escaping Adults
Spring chinook	3,300
Fall chinook	6,900
Coho	660
Summer steelhead	3,100
Winter steelhead	1,300

(3) The reservoir rearing program for spring chinook salmon is expected to result in an additional escapement of 10,300 spring chinook. The reservoir also will provide a substantial fishery for resident trout. Based on the expected angler resource, the Oregon State Game Commission estimates that a stocking rate of 50 fish per pound and three pounds per acre would result in an average of 78,000 angler-days annually. Recreation facilities to be provided would include boat-launching ramps, parking, and access for reservoir and stream angling. Other improvements, such as camping areas and picnicking facilities, also would be utilized by hunters and fishermen. Increased summer flows and lower temperatures downstream from the dam also would improve conditions for resident trout, although no benefits have been claimed for that improvement.

b. Wildlife resource. - Days Creek Lake would inundate 4,340 acres of wildlife habitat that support a large population of blacktail deer and smaller populations of whitetail deer and bear. Upland game species in the project area include valley quail, silver-gray squirrels, and lesser numbers of mountain quail, pheasants, ruffed grouse, and doves. Furbearing animals include beaver, mink, otter, muskrat, skunks, coyotes, and foxes. The Oregon State Game Commission estimates such habitat loss would result in reduction of 2,200 days of deer hunting annually, and 500 hunter-days for upland game. Populations of furbearers are not expected to change significantly. The river section to be inundated now provides approximately 100 hunter-days annually for waterfowl. The reservoir created by the project would provide some resting areas for waterfowl, but a change in hunter use is not expected.

4. INTERESTS OF OTHER AGENCIES

a. Douglas County. - The Douglas County Commission, Water Resources Advisory Committee, Water Resources Survey, and Parks Department have cooperated throughout the study. Valuable information on flooding, sedimentation, and runoff was made available by the Water Resources Survey. Douglas County has a progressive recreation program as evidenced by the large number of high quality parks in its system. The Parks Department has declared willingness to participate in developing, under Public Law 89-72, the recreation potential that would be created by the proposed project. This includes both the lake and some of the downstream recreation resources associated with South Umpqua River. The Carl Hill Memorial, a Douglas County Park, would be inundated by the reservoir. This is the only public recreation facility that would be flooded by the project. Assurances of cooperation and comments from Douglas County Commissioners are shown in Exhibits 1 and 2. It is recommended that Douglas County be assigned responsibility for administration of the reservoir's recreational resource. (See also discussion under "Bureau of Land Management", Paragraph 4d.)

b. City of Roseburg. - Roseburg, with an estimated 1970 population of 14,461 is situated on South Umpqua River about 50 river miles downstream from the dam site. The city has furnished assurances to cooperate in recreation development along South Umpqua River within the city, under provisions of Public Law 89-72. The city's letter of intent is shown in Exhibit 3. Details concerning plan of development, facilities, and potential for recreation are shown in Section IV.

c. Oregon State Parks. - The State of Oregon's Parks and Recreation Section, a progressive recreation agency, has assisted in evaluating the recreation potential of Days Creek project. A joint field reconnaissance was accomplished with personnel of that agency; however, they have stated they have no direct interest in participating in park development connected with Days Creek project. The Parks and Recreation Section has offered continued assistance with future recreation planning. Their comments concerning the project are attached as Exhibit 4.

d. Bureau of Land Management. - The project would inundate about 820 acres of BLM-administered land. Days Creek Project would influence the future management of the BLM's South Umpqua Timber Management area and would indirectly affect some 40,000 acres of BLM land. The Department of the Army and the Department of Interior are formulating a memorandum of understanding which will provide guidelines and define administrative responsibilities for the recreation development and management of public lands affected by such projects as Days Creek. In the absence of formal agreement with BLM, it is recommended the responsibility for administration of the project's recreation resource be assigned to Douglas County under Public Law 89-72, the Federal Water Projects Recreation Act.

e. U. S. Forest Service. - The project would have limited effect on the resources, uses, and activities of the Umpqua National Forest. The major effect would be relocation of the Tiller Ranger Station complex which is near full pool elevation. It is anticipated that visitors attracted to the area because of the project may find the recreation areas crowded and would be attracted to the nearby Umpqua National Forest. Development of additional recreation facilities would be needed in Umpqua National Forest to provide for the overflow visitors. It is anticipated those facilities would be provided by the Forest Service.

f. Bureau of Outdoor Recreation. - The agency has participated in a field reconnaissance and has assisted in evaluating the recreation potential of the proposed Days Creek project. They have furnished comments on the Corps' recreation analysis and what role the project will play in meeting the regional recreation needs. The comments of the Bureau of Outdoor Recreation are contained in Exhibit 5.

5. LOCAL PARTICIPATION

a. Federal Water Projects Recreation Act (Public Law 89-72), passed by Congress on 9 July 1965, requires that in order for recreation benefits to be included in determining the economic benefits of the project non-Federal public bodies must indicate their intent in writing to provide not less than 50 percent of the separable recreation costs and all of the recreation OM&R costs "unless such areas or facilities are included or proposed for inclusion within a national recreation area, or are appropriate for administration by a Federal agency as a part of the national forest system, as a part of the public lands classified for retention in Federal ownership, or in connection with an authorized Federal program for the conservation and development of fish and wildlife."

b. If local participation were not available, minimum development utilizing roads and other facilities would be proposed. The extent of development would be limited to that required to protect the project from despoilation and provide adequate sanitary and safety conditions. Extent of development would be limited to guard rails and turn-arounds at pre-existing and construction roads and minimum sanitary facilities. Land acquisition as proposed is required to preserve the recreational potential of the project as authorized in Section 3 (b) of Public Law 89-72. The proposed land acquisition is considered necessary even if local written intent of participation had not been obtained. The lands would be required to assure the protection of the recreation and other desirable environmental resources.

6. EVALUATION STANDARDS

a. The monetary value of one recreation day was determined to be \$1.50. That user day value is within the range provided in Supplement 1, Senate Document 97, 87th Congress, 2nd Session, "Evaluation Standards for Primary Outdoor Recreation Benefits," dated 4 June 1964. That document defines a recreation day as a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24-hour period. The methodology contained in Supplement 1 to Senate Document 97 was utilized to determine the \$1.50 general recreation day value.

b. The maximum value was assigned to Days Creek Lake, determined from the evaluation check list based on the project's outstanding qualities, which include:

(1) Excellent road access and high-quality facilities proposed for development.

(2) Project conditions highly conducive to multiple activities and highly productive for fish, wildlife, and boating activities.

(3) Highly attractive, esthetically pleasing sites, and climate conducive to recreation use.

(4) Lack of nearby competing water areas.

7. ENVIRONMENTAL CONSIDERATIONS

In conjunction with the studies leading to this report, an environmental analysis was made. A detailed discussion of the environmental factors relative to the proposed plan is contained in Section VI of this appendix. A separate document, the Environmental Impact Statement, which is required by the National Environmental Policy Act of 1969 (P.L. 91-190) also has been prepared.

SECTION II - FORECAST OF RECREATION USE

8. STANDARDIZED RECREATION USE PREDICTION

In order to estimate recreational use for development of a recreation plan, criteria contained in the Corps Technical Report No. 2, October 1969, titled "Estimated Initial Reservoir Recreation Use" were utilized. That regulation provides technical information to develop a standardized initial recreation use prediction for multipurpose projects. The methodology utilizes a comparative analysis between similar existing projects and the proposed project to estimate initial use. Table I, Page D - 8, shows pertinent data comparison for Days Creek with similar projects. Refer to paragraph 2d. for project operations.

9. DAY-USE MARKET AREA

In order to establish probable recreation use for development of a plan, a market area for Days Creek project was established. The day-use market area is defined as the area which contributes 80 percent or more of the annual day-use visitation to a reservoir project as shown in Plate 1, Day-Use Market Area. The per capita rates, projected county populations, and estimated recreation days are shown in Table II on page D-9.

10. SUPPLY, DEMANDS, AND NEEDS

As identified in the Oregon State Comprehensive Outdoor Recreation Plan (SCORP), Days Creek project is located in District 6, Douglas County. The SCORP report, supplemented in 1967, points out that District 6 had recreational use double the statewide average. This is a clear indication it is an import district hosting non-resident use. Furthermore, the existing slack-water areas are not located within the recommended day-use travel distances of district population concentrations. If the present District 6 standard of 250 surface acres per 1,000 residents is applied to the projected 1985 population, an additional 5,000 surface acres will be required to maintain the 1967 standard.

11. ESTIMATE OF PUBLIC USE

Public use attendance, Table II, page D-9, shows the estimated public use attendance for the life of the project. Because of the shortage of nearby competing projects and the proximity of Days Creek project to Interstate Highway 5, tourist and camping users who would come from outside the market area are estimated to account for nearly 40 percent of the total use.

TABLE I

PERTINENT DATA COMPARATIVE TABULATION

Item	Days Creek	Detroit	Pine Flat
Location (State)	Oregon	Oregon	California
Max pool:			
Acre-feet	480,000	461,450	1,000,000
Surface acres	4,300	3,721	6,000
Average recreation pool:			
Surface acres	4,000	3,708	3,450
Shoreline miles	50	38	53
Year impoundment began	N/A	1952	1954
Number of access areas	3	11	5
Recreation facilities:			
Tent & trailer spaces		394	194
Day-use areas (capacity in recreation days)		8,000	15,000
Boat-launching lanes		7	11
Attendance (recreation days):			
1968		598,000	529,000
1967		572,000	592,000
1966		561,000	589,000
1965		384,000	491,000
Recreation season	Apr-Oct	May-Sep	Apr-Oct
Project purpose:			
Flood control	yes	yes	yes
Recreation	yes	no	no
Power	no	yes	no
Water supply	yes	no	no
Irrigation	yes	yes	no
Timber cover	moderate	dense	moderate
Reservoir terrain	steep	steep	steep
In national forest	no	yes	no
Access:			
Paved road (within ½ mi of reservoir)	yes	yes	yes
Overnight lodging nearby	yes	yes	yes
Competing water-oriented recreation areas:			
0 - 25 miles - lake (acres)	0	0	11,023
0 - 25 miles - river (miles)	0	2	5
25 - 50 miles - lake (acres)	4,720	3,720	8,488
Min. pool quality for recreation use	good	poor	poor
Water quality	excellent	excellent	good

TABLE II

GENERAL RECREATION - DAYS CREEK LAKE

VISITATION PROJECTIONS
PLAN II 480,000 ACRE-FEET - ELEVATION 1026

	Douglas County			Josephine County			Tourist 1/		General Recreation
Year	Population	Per Capita	Day Use	Population	Per Capita	Day Use	Day Use	Camping	Total
1980	85,000	1.800	153,000	39,900	.8211	33,000	44,000	55,000	285,000
2000	120,000	1.800	216,000	52,800	.8211	44,000	50,000	75,000	385,000
2020	165,000	1.800	297,000	70,300	.8211	58,000	53,000	87,000	495,000
2050	212,000	1.800	381,600	100,000	.8211	82,000	74,000	102,400	640,000
2080	236,000	1.800	424,800	140,000	.8211	115,000	105,200	130,000	775,000

1/ Tourist day-use and camping-use estimated from total general recreation.

12. TURBIDITY

In the course of the cooperative studies of the potential Days Creek storage site, it was found that, as for any other project in the Cascade Range, there would be a possibility that a turbidity problem might develop. In developing public use attendance, predictions were based on the assumption that no turbidity problems would be present. In case such a problem were to develop, the anticipated fishery enhancement and recreation benefits might not be realized to the full extent now estimated. It is conceivable that, if a serious turbidity condition were to develop in the reservoir, the fishery and recreation resources could be affected detrimentally. An agreement was reached among the cooperating agencies, who have interest and responsibilities in fishery resources and water quality, that construction of the potential Days Creek project should be contingent on confirmation, in the course of detailed preconstruction planning studies, that the net effect of the project on the fishery and recreation resources would be beneficial. In accordance with that agreement, a detailed reservoir turbidity study would be initiated as soon as the first preconstruction planning funds become available. At present a study of turbidity in an existing reservoir project in an adjacent drainage basin is underway. The results of that study would be available and would serve as a basis for outlining the scope of the turbidity study of the proposed Days Creek project.

13. RECREATION USE WITHOUT THE PROJECT

Current use of the proposed project area is estimated to be about 4,000 recreation days annually. General recreation use includes picnicking in Carl Hill Memorial Wayside, a county park, and hiking or sightseeing in undeveloped areas. Use of the area is somewhat restricted by the large amount of surrounding private land. It is expected that general recreation use of the reservoir area would continue to increase at a moderate rate, reaching 15,000 at the end of 100 years if the area remains substantially in its present state.

14. MAXIMIZATION

a. General. - Several different-size projects were studied to determine proper sizing. Except where stated, evaluations were based on the assumption that the reservoir would be operated in a manner compatible with recreation and no turbidity problems would be present. The recreation potential under each of the plans is as follows:

b. Plan I (365,000 acre-foot storage). - At elevation 997 the water surface would be about 3,750 acres. This pool level would correspond with about 700 acres of usable recreation land. The overall annual recreation attendance is estimated as follows: 1st year - 275,000; 20th year - 365,000; 50th year - 515,000; and 100th year - 725,000. (See Chart 1). Plan I provides both enhancement of downstream recreation and reservoir public use. Downstream recreation use would be reduced about 10 percent from benefits shown in Plan II.

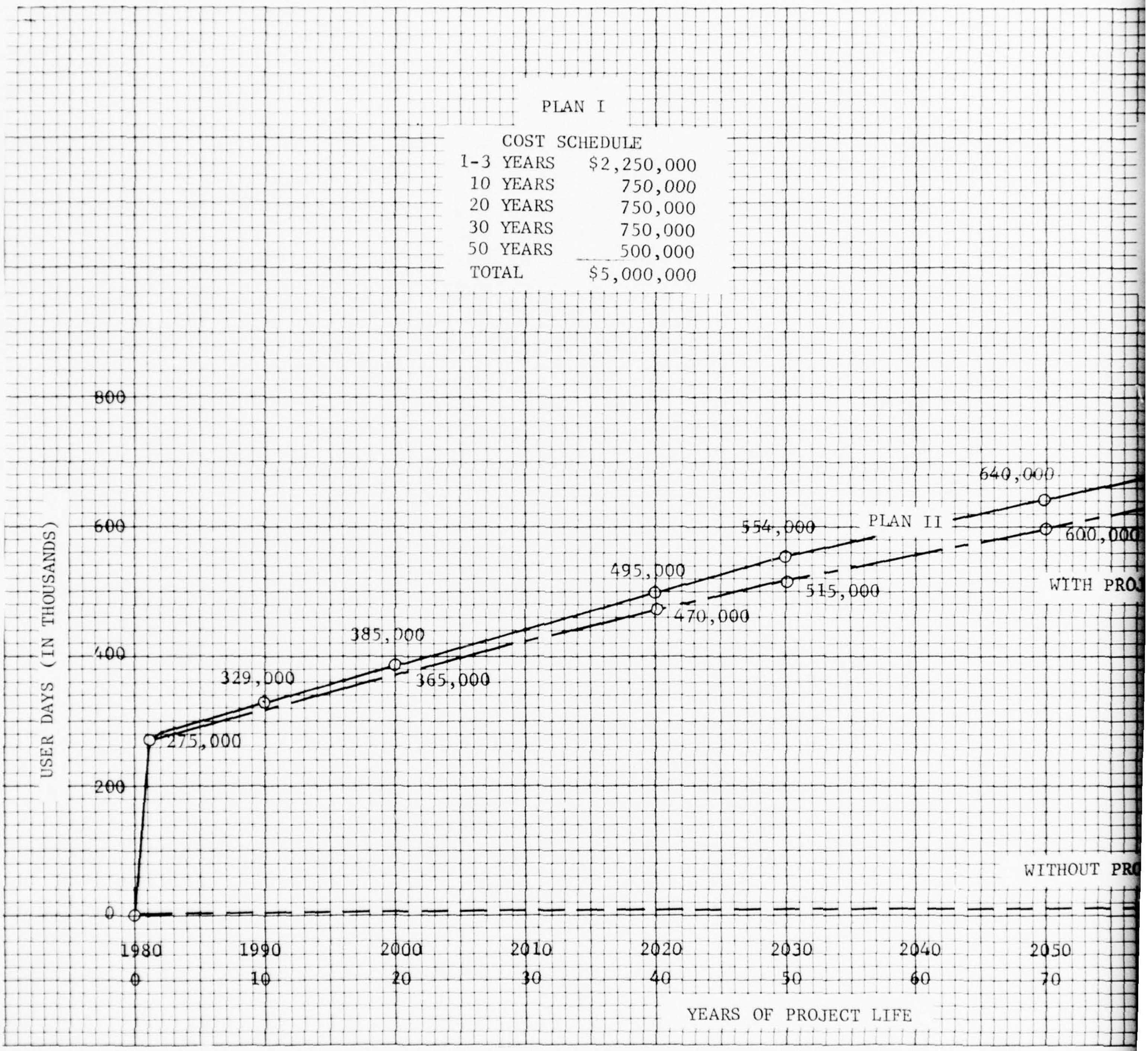
c. Plan II (480,000 acre-foot storage). - At elevation 1,026 the water surface would be about 4,300 acres. At that higher pool level, recreation usage would be somewhat higher than usage as projected for Plan I. About 750 acres of recreation land would be available. An estimated 50 acres of potential recreation land, between elevation 997 and 1,026 and included in Plan I, would be inundated. That land would be situated primarily in low-density, minor access sites, and the large pool (with about 700 acres greater usable water surface) would compensate for the slightly reduced recreation land. Under Plan II, 50 acres of land currently occupied by the Tiller Ranger Station, would be available for recreation use. The area southeast of that recreation area would provide added potential for utilization of the upstream transitional area not available under Plan I. It is estimated that the general public use would be: 1st year - 285,000; 20th year - 385,000; 50th year - 554,000; and 100th year - 775,000. Plan II provides both enhancement of downstream recreation and reservoir public use.

d. Plan III (605,000 acre-foot storage). - At elevation 1,053 the water surface would be about 5,000 acres. At that higher pool recreation usage would be markedly less than for the pools in Plans I and II. Compared to Plan II, an estimated 200 acres of potential recreation land would be inundated. The nature of the reservoir site is such that benches situated immediately above the Plan II pool provide the only developable land. The higher the pool, the smaller would be the usable acreage of land. A larger pool with about 1,100 acres greater usable water surface than Plan I would partially compensate for the lesser recreation land. However, probable usage would be less than with Plans I and II. Annual recreation attendance would be: 1st year - 100,000; 20th year - 280,000; 50th year - 415,000; and 100th year - 625,000. Plan III provides both enhancement of downstream recreation and reservoir public use. (See Chart 2).

e. Plan Ia (275,000 acre-foot storage). - At elevation 971 the water surface would total about 3,300 acres. At that elevation, a greater acreage of usable land would compensate for the smaller pool. It is estimated that the general public use would be reduced considerably because of drawdown required for flood control and flow augmentation. (See Chart 3). Also it is doubtful if sufficient water would be available both to enhance downstream recreation use and provide a recreation pool. Downstream recreation use would be reduced nearly 50 percent from benefits shown for Plan II.

f. Plan IIa (350,000 acre-foot storage). - At elevation 993 the water surface would total about 3,600 acres. This plan would provide similar recreation resources to Plan I; however, operation for flood control and flow augmentation would reduce the pool surface and lower the public usage of the project. It is doubtful if sufficient water would be available both to enhance downstream recreation use and provide a high quality recreation pool. Downstream recreation use would be reduced about 30 percent from benefits shown for Plan II.

g. Summary. - Plan II (pool elevation 1,026 with 480,000 acre-foot storage) is considered to provide the best overall benefit for recreation. That plan allows sufficient storage to adequately provide for reservoir public use as well as downstream recreational enhancement.

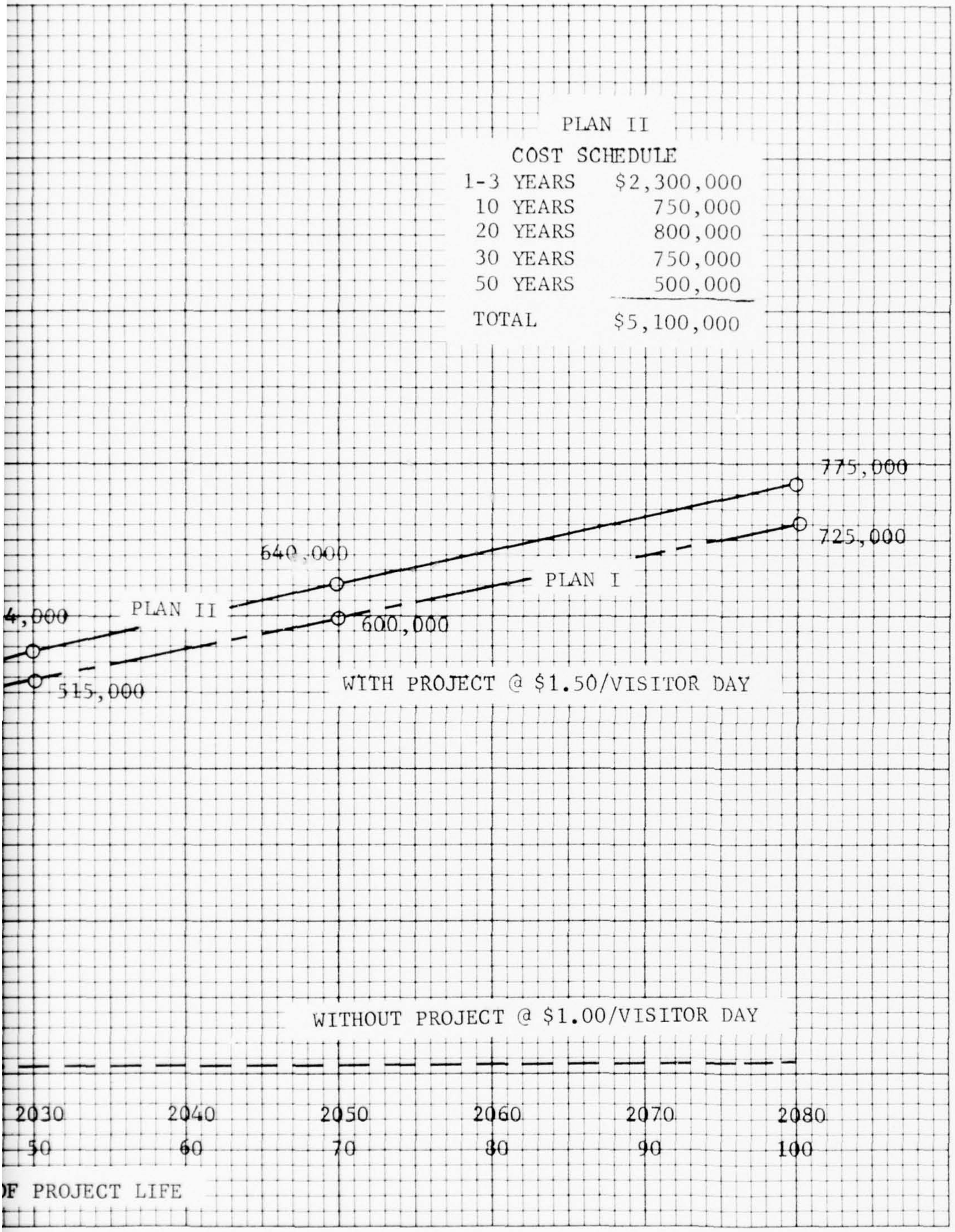


PLAN I

COST SCHEDULE

1-3 YEARS	$2,250,000
10 YEARS	750,000
20 YEARS	750,000
30 YEARS	750,000
50 YEARS	500,000
TOTAL	$5,000,000

DAYS CREEK LAKE
Preliminary Public Use Projections
PLAN I - 365,000 acre-foot storage
PLAN II 480,000 acre-foot storage



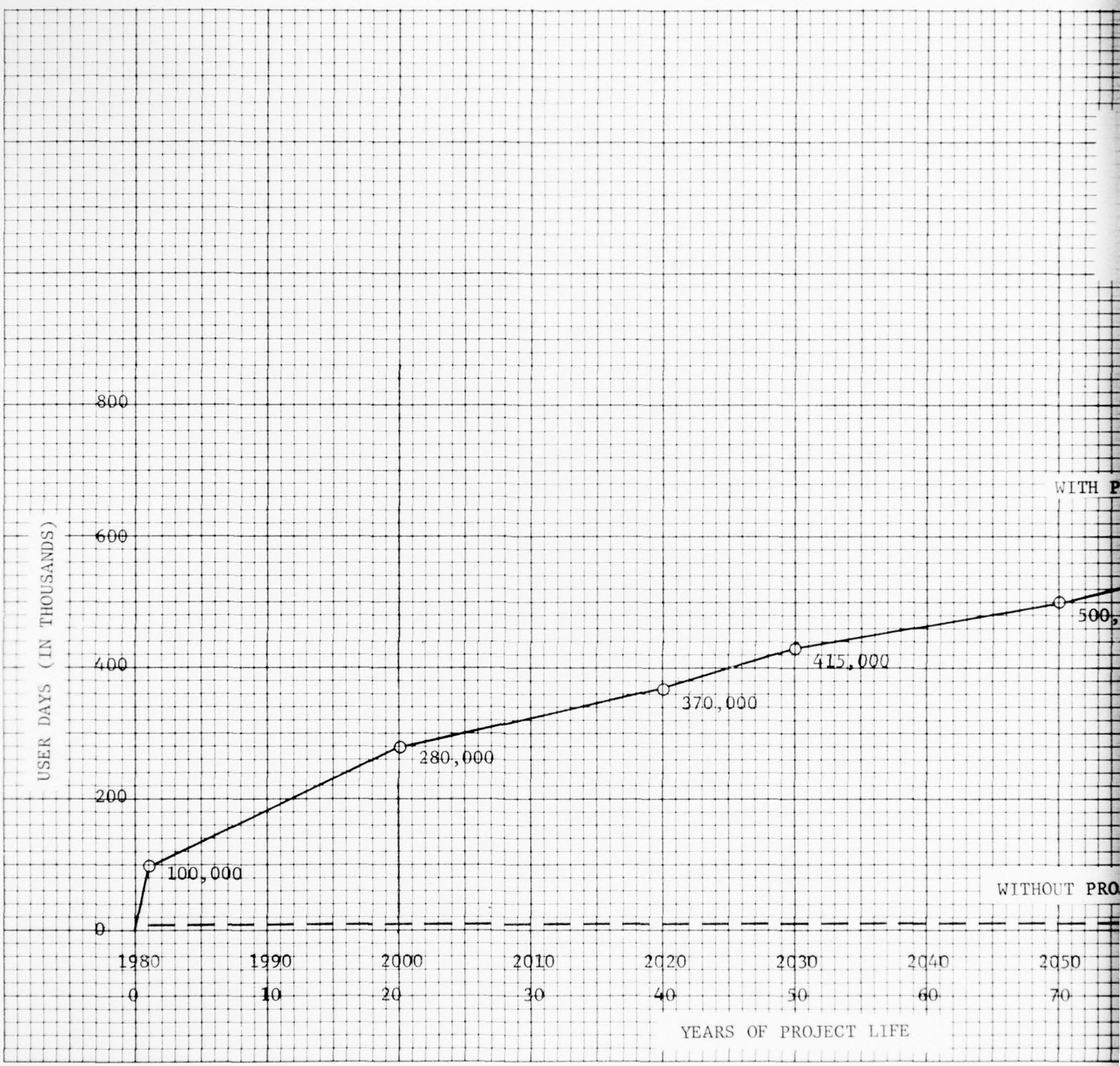
CREEK LAKE
ublic Use Projections
000 acre-foot storage
000 acre-foot storage

Umpqua River and Tributaries, Oregon
Days Creek Lake

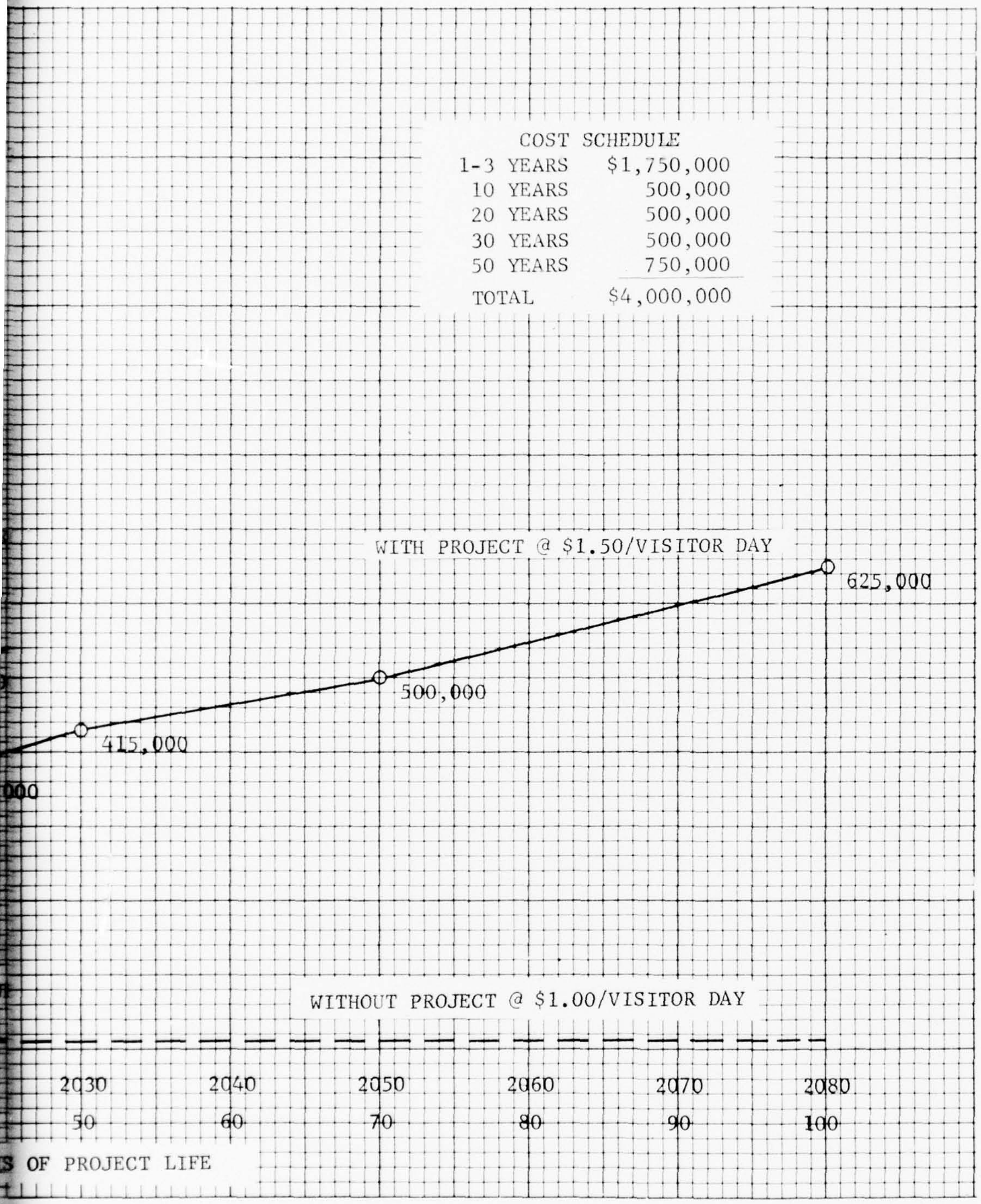
PRELIMINARY PUBLIC USE PROJECTIONS
PLAN I & PLAN II

U.S.Army Engineer District, Portland
Recreation Planning Section

CHART 1



DAYS CREEK LAKE
Preliminary Public Use Projections
PLAN III - 605,000 acre-foot storage



COST SCHEDULE

1-3 YEARS	$1,750,000
10 YEARS	500,000
20 YEARS	500,000
30 YEARS	500,000
50 YEARS	750,000
TOTAL	$4,000,000

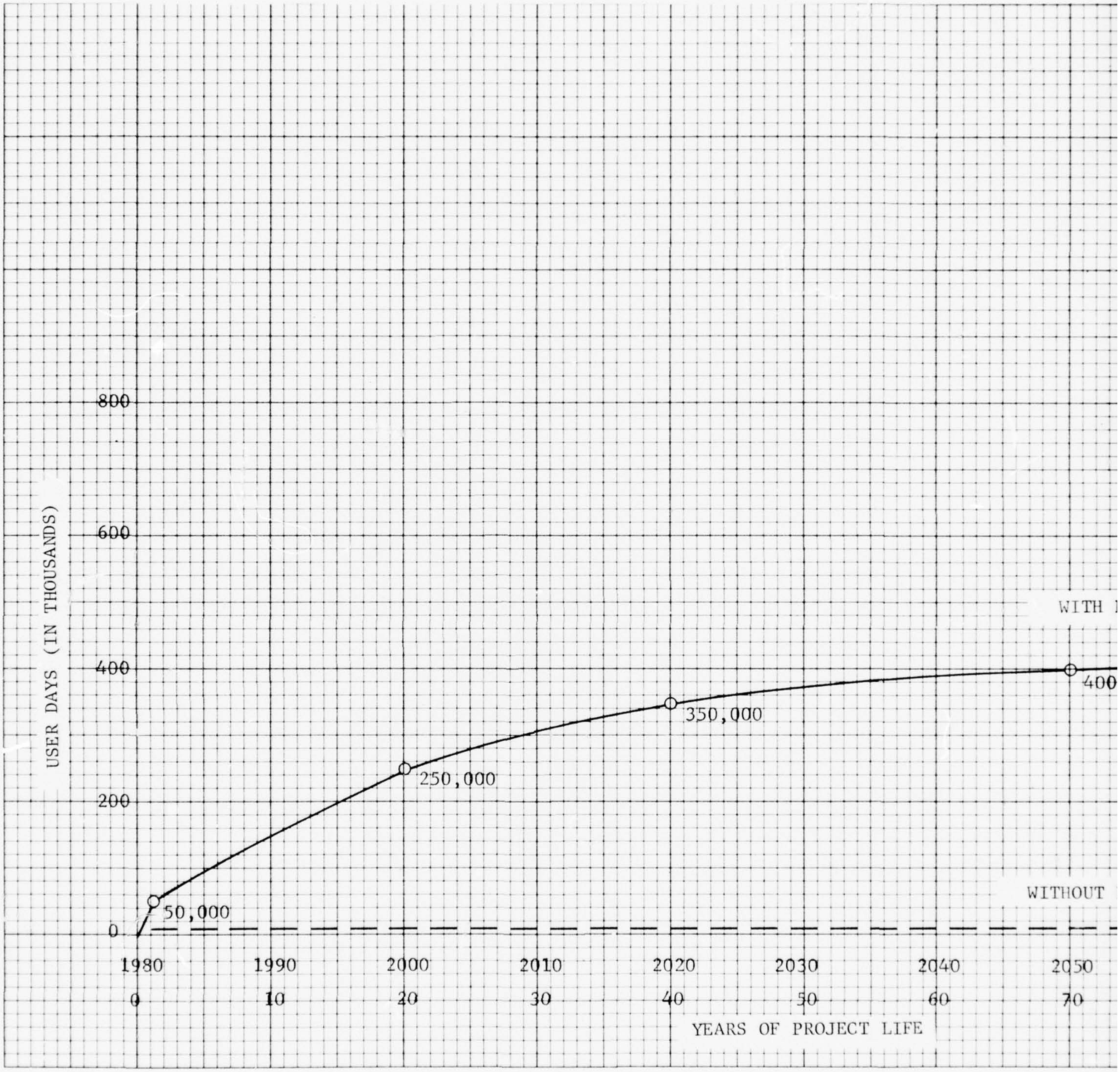
DAYS CREEK LAKE
ry Public Use Projections
II - 605,000 acre-foot storage

Umpqua River and Tributaries, Oregon
Days Creek Lake

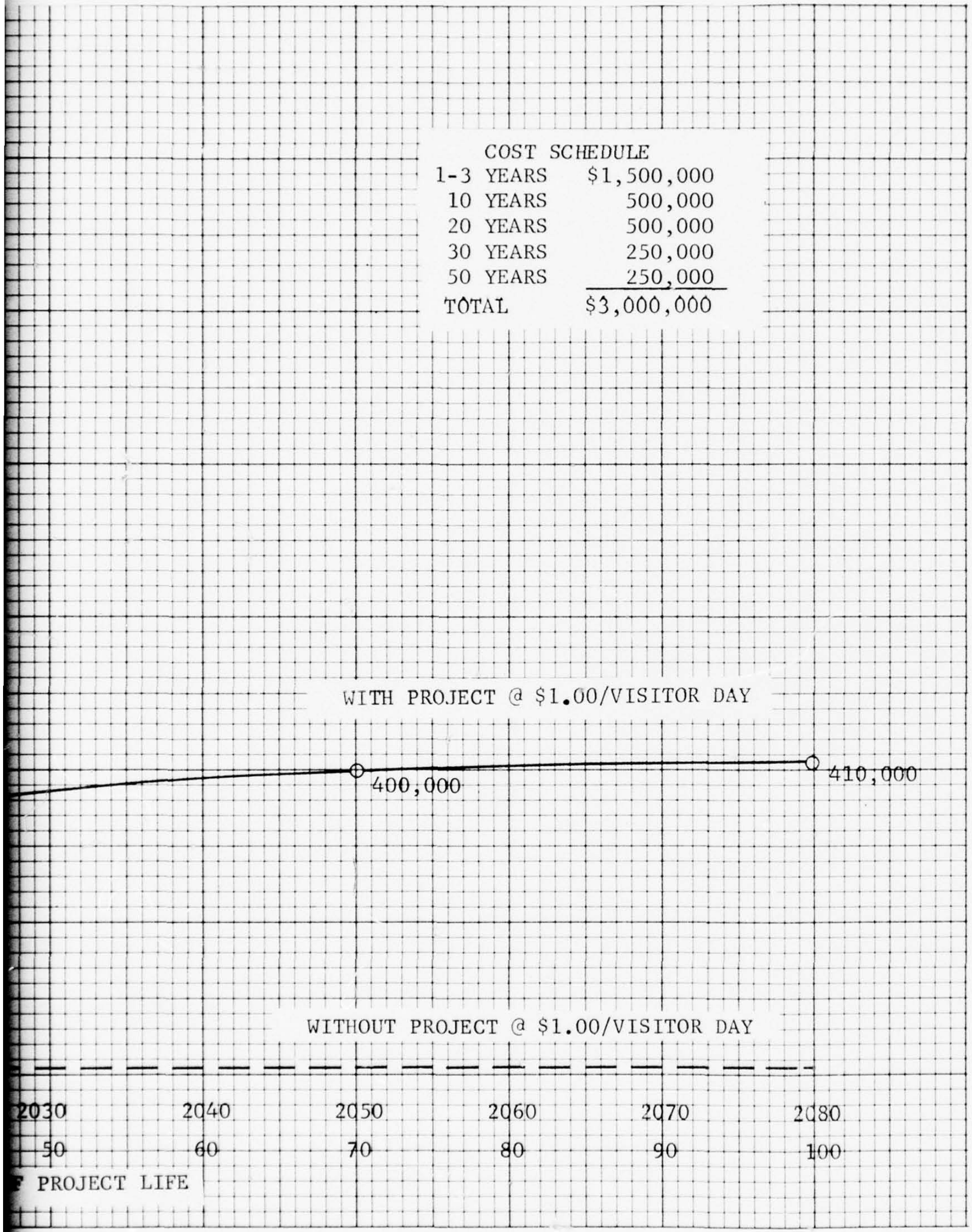
PRELIMINARY PUBLIC USE PROJECTIONS
PLAN III

U.S.Army Engineer District, Portland
Recreation Planning Section

CHART 2



DAYS CREEK LAKE
Preliminary Public Use Projections
PLAN IV - 275,000 acre-foot storage



COST SCHEDULE

1-3 YEARS	$1,500,000
10 YEARS	500,000
20 YEARS	500,000
30 YEARS	250,000
50 YEARS	250,000
TOTAL	$3,000,000

CREEK LAKE
ublic Use Projections
275,000 acre-foot storage

Umpqua River and Tributaries, Oregon
Days Creek Lake

PRELIMINARY PUBLIC USE PROJECTIONS
PLAN I a

U.S.Army Engineer District, Portland
Recreation Planning Section

CHART 3

SECTION III - RECREATION POTENTIAL OF RESERVOIR

15. PROJECT ACCESS

Days Creek Reservoir would be readily accessible via Interstate Highway 5 to Canyonville and thence easterly approximately 8 miles along State Highway No. 227 (See Plate 1). Highway 227 is a major travel route to Crater Lake National Park and points east and south. In the project the relocated Highway 227 would be on the right bank of Days Creek Lake, thereby providing public access to the entire north shore of the pool. A secondary road is planned to provide access to the south shore.

16. RECREATION AREAS

Four sites having high potential for major recreational development have been identified. Those areas were selected because of their size, moderate topography, good shoreline access, and usable tree cover. All recreation sites would be accessible from relocated roads proposed to parallel both shorelines. Trail development taking advantage of shoreline and geologic features would be proposed for the initial period. Close coordination with the Bureau of Land Management in design and siting of trails would be maintained. Recreation development planned for the initial period includes facilities necessary to support the reservoir fishery, as evaluated by the Bureau of Sports Fisheries and Wildlife. Facilities would include boat ramps, docks, and parking areas at the developed recreation sites, hiking trails, and access and minimum facilities at bank-fishing and miscellaneous areas. Indigenous tree and shrub cover would be planted to provide winter forage for wildlife and for enhancement and restoration of the esthetic beauty of the project where appropriate. Special attention would be given to early plantings in potential public-use sites where tree cover forms an integral part of the development. Plate 2, Area Map, shows the potential recreation sites. The following narrative briefly describes each major public-use area:

a. Right-abutment recreation area. - The site, of about 100 acres, extends upstream from the right abutment of the proposed damsite. The land lies in a series of benches well adapted to day-use development. Tree cover is generally restricted to clumps scattered throughout the area. Douglas fir, madrone, yellow pine, white, black, and live oak, and chinquapin are included. The area provides excellent potential for viewpoint facilities, boat launching, and picnic development. The area should be partially developed during the initial period.

b. Lavadoure recreation area. - The area, on the north bank about five miles upstream from the proposed damsite, includes three moderately sloped peninsulas. More than 220 acres of land would be available for development of day-use and camping facilities. Tree growth is scattered but adequate to provide cover and includes Douglas fir, yellow pine, Jeffrey pine, white and black oak, California live oak, and madrone. Day-use facilities including boat launching and 50 camping units are being considered for initial development. The remaining undeveloped land would be available for resource protection and future expansion.

c. Tiller recreation area. - The area, located at the upstream end of the proposed reservoir, consists of about 150 acres of usable land. Generally, tree cover is scattered and limited to Douglas fir, yellow pine, and madrone. Topography is excellent for development of recreation facilities. About 50 acres currently occupied by the Tiller Ranger Station would be available. This area would cover the transitional zone where lake meets stream and provide an excellent fishing access site. The principal disadvantage of the site lies in its location on the upper end of the reservoir where a drop in the pool level would have its maximum effect. When the pool is lowered for downstream requirements, the shoreline would be some distance from the facilities. The area is expected to provide good shoreline and stream-fishing opportunity throughout the year. Day-use facilities including picnicking would be included initially.

d. Milo recreation area. - The area is located on the south bank about seven miles upstream from the proposed damsite. More than 270 acres of excellent land are available for development. Tree cover is excellent and consists largely of Douglas fir, white fir, yellow pine, and white and black oak, California live oak, madrone, and other desirable varieties. Topography is well-suited for major camping and day-use development. The site is well-oriented to all phases of water-associated recreation. Initial development should include camping units and full day-use facilities including picnicking and boat launching. After initial development, adequate lands would remain for expansion as the need arises.

e. Miscellaneous areas. - Three smaller sites totaling about 260 acres and affording access and limited day-use potential would be available for public use. One area would be developed initially to provide boat access. The remaining two sites would have minimum angler facilities and would be reserved for future use as the need is evidenced.

f. Viewpoints and operational areas. -

(1) Viewpoint facilities would be provided to afford a view of the dam during construction. Pertinent project information with visual aids would be featured. Other sites affording vistas of the project's lands and water areas would be developed after completion of Days Creek Dam. They would feature project data and visitor information. Native trees and shrubs would be planted to enhance the esthetics of the viewpoint developments. Architectural treatment would utilize indigenous building materials compatible with the surrounding land and project structures. Facilities required to accommodate visitors to the project operational areas would be provided. Those facilities would include parking,

sanitary facilities and picnic development. It would be necessary to provide boat-launching facilities for operational purposes.

(2) Construction and management of viewpoint facilities and operational areas generally are considered Corps responsibilities chargeable to buildings and grounds and are not subject to cost-sharing provisions of Public Law 89-72.

17. COST OF DEVELOPMENT

The estimated construction cost of initial recreation facilities for Days Creek Reservoir (feature 14) during the first three years of operation is shown in Table III. Alternative costs in the absence of local participation also are shown.

TABLE III
RESERVOIR

INITIAL COST (PROGRAM ASSUMING LOCAL PARTICIPATION)

Unit	Unit cost	No. of units	Cost
Camping unit (complete)	$ 3,500/each	150	$ 525,000
Picnic unit (complete)	2,500/each	120	300,000
Roads, bituminous	75,000/mile	2	150,000
Boat ramps with parking(lanes)	25,000/each	6	150,000
Sewage disposal system	L.S.	L.S.	100,000
Comfort stations	30,000/each	4	120,000
Hiking trails	5,000/mile	15	75,000
Swimming beach	L.S.	L.S.	40,000
Landscaping and grading	L.S.	L.S.	75,000
Miscellaneous features	L.S.	L.S.	50,000
Subtotal			$1,585,000
Contingencies			235,000
Direct cost			$1,820,000
Engineering & design			265,000
Supervision & administration			215,000
TOTAL DEVELOPMENT COST			$2,300,000
Land acquisition			159,000
TOTAL COST			$2,459,000

INITIAL COST (ALTERNATIVE IN ABSENCE OF LOCAL PARTICIPATION)

Unit	Unit cost	No. of units	Cost
Sanitary facilities @ 4 access sites	$3,000/each	10	$ 30,000
Turn-around @ 4 access sites	L.S.	L.S.	30,000
Guard rails	5.00/L.F.	4,000	20,000
Subtotal			$ 80,000
Contingencies			12,000
Direct cost			$ 92,000
Engineering & design			14,000
Supervision & administration			11,000
TOTAL DEVELOPMENT COST			$ 117,000
Land Acquisition			159,000
TOTAL COST			$ 276,000

The cost of recreational facilities throughout the remaining years of project life is estimated as follows:

TABLE IV
RESERVOIR

FUTURE COSTS (PROGRAM ASSUMING LOCAL PARTICIPATION)

Unit	Unit cost	No. of units	Cost
Camping units	$ 3,500/each	150	$ 525,000
Picnic units	2,500/each	270	675,000
Boat ramp with parking (lanes)	25,000/each	4	100,000
Roads, bituminous	75,000/mile	2	150,000
Sewage disposal system	L.S.	L.S.	100,000
Comfort stations	30,000/each	4	120,000
Hiking trails	5,000/mile	20	100,000
Swimming beach	L.S.	L.S.	45,000
Landscaping & grading	L.S.	L.S.	75,000
Miscellaneous features	L.S.	L.S.	50,000
Subtotal			$1,940,000
Contingencies			277,000
Direct cost			$2,217,000
Engineering & design			324,000
Supervision & administration			259,000
TOTAL COST			$2,800,000

SECTION IV - RECREATION POTENTIAL DOWNSTREAM FROM DAYS CREEK LAKE

18. GENERAL

South Umpqua River, under current conditions, is lacking adequate water-oriented recreation opportunities, especially during the dry season, when much of its streamflow becomes too low and polluted for water-contact sports. The stream also becomes visually undesirable because of algae growth. The proposed Days Creek project would provide improved water quality, increased flow quantities, and public-use facilities in and along South Umpqua River downstream from the dam. The demand for recreation facilities oriented to the river is expected to increase because of the improved resource. Those recreation facilities along the improved reach of the stream required to meet the demand would be provided as a part of the project and would be readily accessible to the local and traveling public over Interstate and state highways. According to the Statewide Comprehensive Outdoor Recreation Plan there is a demonstrated need for stream-oriented recreation facilities. For study purposes, South Umpqua River is divided into two segments showing different use patterns. The river sections are delineated as follows: (1) Days Creek Dam downstream to Umpqua River (excluding the reach within the city of Roseburg) and (2) South Umpqua River within the city of Roseburg.

19. DAYS CREEK DAM DOWNSTREAM TO UMPQUA RIVER (EXCLUDING CITY OF ROSEBURG)

Primarily, this section of river flows through a flood plain valley and presents an attractive, scenic rural atmosphere. Intensively farmed, fertile agricultural land borders the river in many places. Several existing parks, wooded banks, and small rural communities are associated with the river. Under present conditions, water-related activities are usually curtailed from mid-summer through the end of the recreation season because of low river flows. Primary use, therefore, occurs early in the season or on dry lands near the river. Douglas County Parks Department's Comprehensive Parks Plan, published in October 1967, indicates a county-wide need for additional parks, especially oriented to the Umpqua system. Extension of the higher quality water-related recreation season by provision of supplemental water during summer and fall low-flow periods would have a profound effect on recreation use, as reflected on Chart 4. Recreation facilities proposed for development in cooperation with Douglas County would be provided as a part of the project. Six sites, totaling 223 acres, shown and described on Plates 3 through 6 and 8 and 9, would provide opportunity for development of water-associated recreation facilities. Initial facilities compatible with water-associated activities at those sites include: access roads and parking, boat access and launching areas, picnic and camping units, trail development, bathing beaches, landscaping and tree planting, and adequate sanitary and service facilities. Future development would consider expansion of facilities on a demonstrated-need basis. Those potential areas range in size from 25 to 50 acres and contain suitable river shoreline, topography, tree cover, and vehicular access from main roads for recreation development. Value of land under county ownership used for park purposes would be credited toward the 50-percent cost-sharing requirement. Transfer of land title from local interests to the Federal government would be accomplished to allow participation under principles of Public Law 89-72. Douglas County and the Corps of Engineers will develop the sites in accordance with provisions of Public Law 89-72. Formal letter of intent from Douglas County is attached as Exhibit 2. The estimated construction cost of initial and future recreation facilities associated with the development is shown on Table V.

20. SOUTH UMPQUA RIVER, CITY OF ROSEBURG

The section of the river located within the city represents the most intensive recreation-oriented resource. The river meanders through the heart of Roseburg and is an integral part of the recreation potential. The city parks system has title to more than 230 acres of land, including several miles of river frontage having potential for recreation development. The city has title to about 90 acres of land having suitable river shoreline, topography, and tree cover for recreation development. About 85 additional acres having high potential for development have been identified and would be acquired. Plate 7 describes total proposed land. Value of land under city ownership for park purposes associated with the river would be credited towards the 50-percent cost sharing requirement. Transfer of land title from local interests to the Federal government would be accomplished to allow participation under principles of Public Law 89-72. Their current program as related to river-oriented development is minimal because of low flows during the peak recreation season. Extension of the water-related recreation season by provision of supplemental water during the summer and fall low-flow periods would over-tax existing facilities and create demands for new facilities and have a profound effect on recreation use, as reflected on Chart 5. Recreation facilities proposed for development in cooperation with the city of Roseburg would be provided as a part of the project. Initial facilities compatible with water-associated activities include: access roads and parking, boat launching, fishermen access and docks, picnic units, hiking trails, adequate sanitary and service facilities, site grading, and landscaping and tree plantings. Future development would consider expansion of facilities on a demonstrated-need basis. Lands shown on Plate 7 would provide opportunity for development of river-associated recreation facilities. The city of Roseburg and the Corps of Engineers will develop the land in accordance with provisions of Public Law 89-72. Formal letter of intent from the city is attached as Exhibit 3. The estimated construction cost of initial and future recreation facilities associated with the development is shown on Table VI.

21. UMPQUA RIVER

From the confluence of North and South Umpqua Rivers, Umpqua River meanders through fertile valleys, the Coast Range, and terminates in its estuary on the Pacific Ocean at Winchester Bay. The South Umpqua currently causes discoloration and pollution of Umpqua River during flood periods and low-flow periods. Additional summer flows and regulation of winter floods will significantly enhance the recreational resource, especially water-associated activities such as fishing, streamside picnicking, camping, boating, and swimming.

TABLE V

UMPQUA AND SOUTH UMPQUA RIVERS DOWNSTREAM FROM DAYS CREEK DAM (EXCLUDING CITY OF ROSEBURG)

INITIAL COST OF RECREATION FACILITIES

Unit	Unit cost	No. of units	Cost
Boat access sites	$8,000/each	3	$ 24,000
Parking areas	5.00/yd^2	15,000	60,000
Access roads	40,000/mile	2	80,000
Picnic units	1,000/each	300	300,000
Camping units	3,000/each	50	150,000
Trail development	L.S.	L.S.	50,000
Swimming beach	L.S.	L.S.	40,000
Comfort stations	30,000/each	6	180,000
Subtotal			$ 884,000
Contingencies			176,000
Direct cost			$1,060,000
Engineering & design			159,000
Supervision & administration			127,000
TOTAL DEVELOPMENT COST			$1,346,000
Land acquisition			170,000
TOTAL COST			$1,516,000

FUTURE COST OF RECREATION FACILITIES

Unit	Unit cost	No. of units	Cost
Boat access sites	$8,000/each	2	$ 16,000
Parking area expansion	4.00/yd^2	10,000	40,000
Access roads	40,000/mile	2	80,000
Picnic units	1,000/each	200	200,000
Camping units	3,000/each	100	300,000
Swimming beach	L.S.	L.S.	50,000
Comfort stations	30,000/each	4	120,000
Subtotal			$ 806,000
Contingencies			161,000
Direct cost			$ 967,000
Engineering & design			130,000
Supervision & administration			103,000
TOTAL COST			$1,200,000

TABLE VI

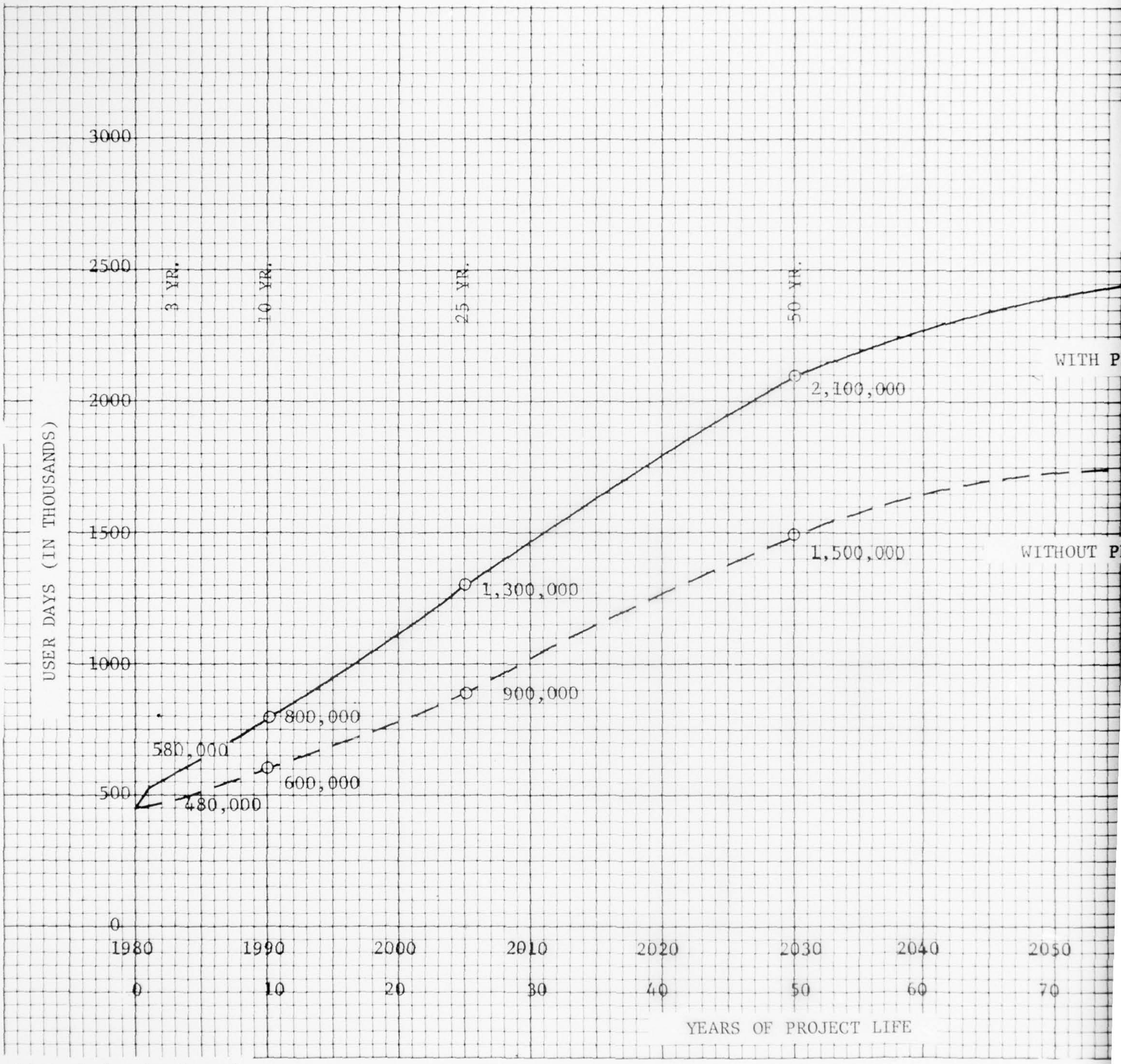
SOUTH UMPQUA RIVER DOWNSTREAM FROM DAYS CREEK LAKE, CITY OF ROSEBURG

INITIAL COST OF RECREATION FACILITIES

Unit	Unit cost	No. of units	Cost
Boat-launching area	\$20,000/each	1	\$ 20,000
Access road	40,000/mile	1.5	60,000
Fishermen access & dock	L.S.	L.S.	25,000
Picnic units	1,000/each	150	150,000
Swimming beach	L.S.	L.S.	50,000
Hiking trails	L.S.	L.S.	25,000
Comfort stations	30,000/each	3	90,000
Parking areas	4.00/yd^2	8,000	32,000
Landscaping & tree planting	L.S.	L.S.	50,000
Subtotal			\$ 502,000
Contingencies			100,000
Direct cost			\$ 602,000
Engineering & design			90,000
Supervision & administration			72,000
TOTAL DEVELOPMENT COST			\$ 764,000
Land acquisition			373,000
TOTAL COST			\$1,137,000

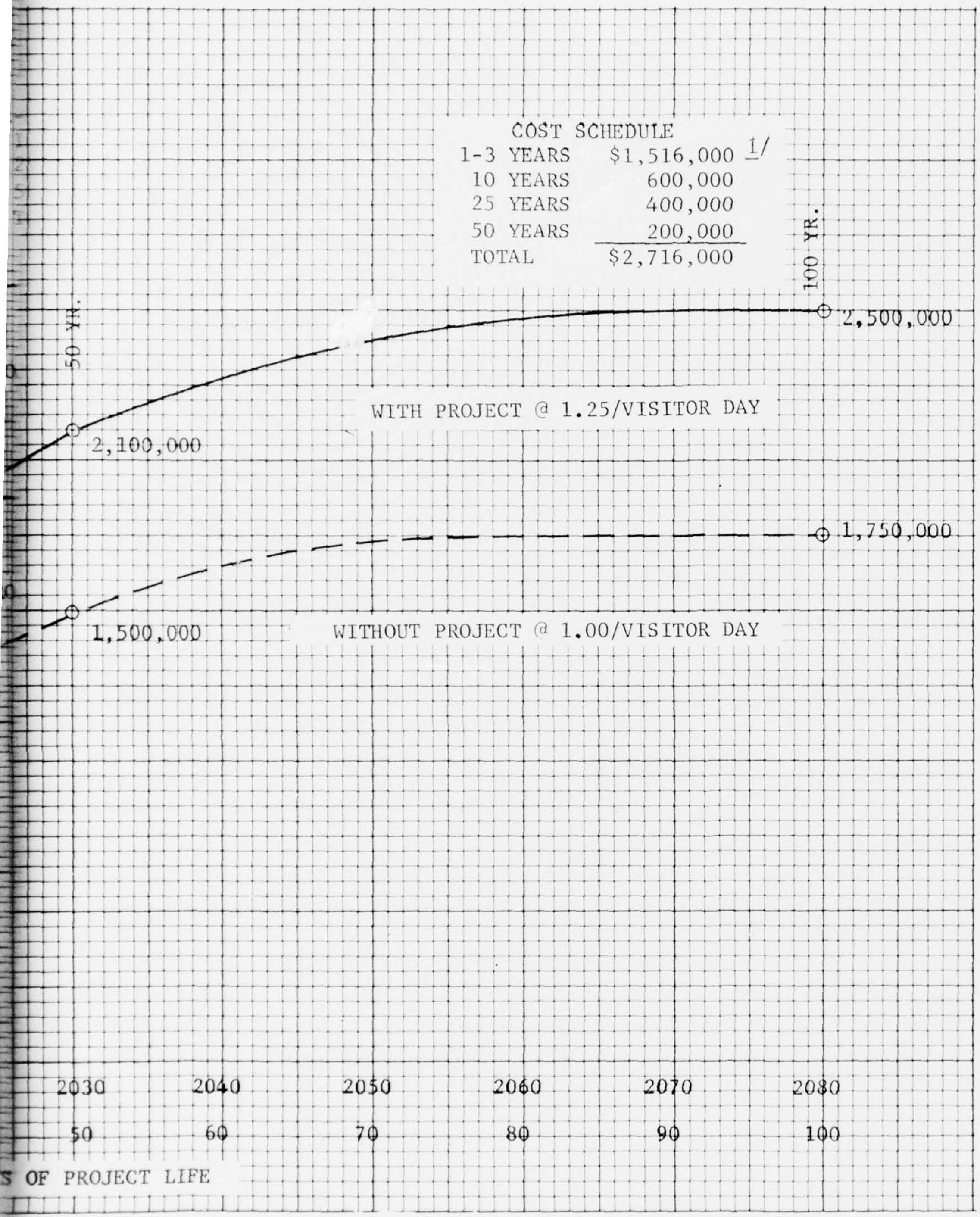
FUTURE COST OF RECREATION FACILITIES

Unit	Unit cost	No. of units	Cost
Access roads	\$40,000/mile	1	\$ 40,000
Fishermen access & dock	L.S.	L.S.	25,000
Picnic units	1,000/each	150	150,000
Swimming beach	L.S.	L.S.	60,000
Trail development	L.S.	L.S.	25,000
Comfort stations	30,000/each	3	90,000
Parking areas	4.00/yd^2	10,000	40,000
Landscaping & tree planting	L.S.	L.S.	65,000
Site grading & improvement	L.S.	L.S.	30,000
Subtotal			\$ 525,000
Contingencies			105,000
Direct cost			\$ 630,000
Engineering & design			95,000
Supervision & administration			75,000
TOTAL COST			\$ 800,000



1/ Includes land cost

DOWNSTREAM FROM DAYS CREEK DAM
(EXCLUDING ROSEBURG)



COST SCHEDULE

1-3 YEARS	$1,516,000 1/
10 YEARS	600,000
25 YEARS	400,000
50 YEARS	200,000
TOTAL	$2,716,000

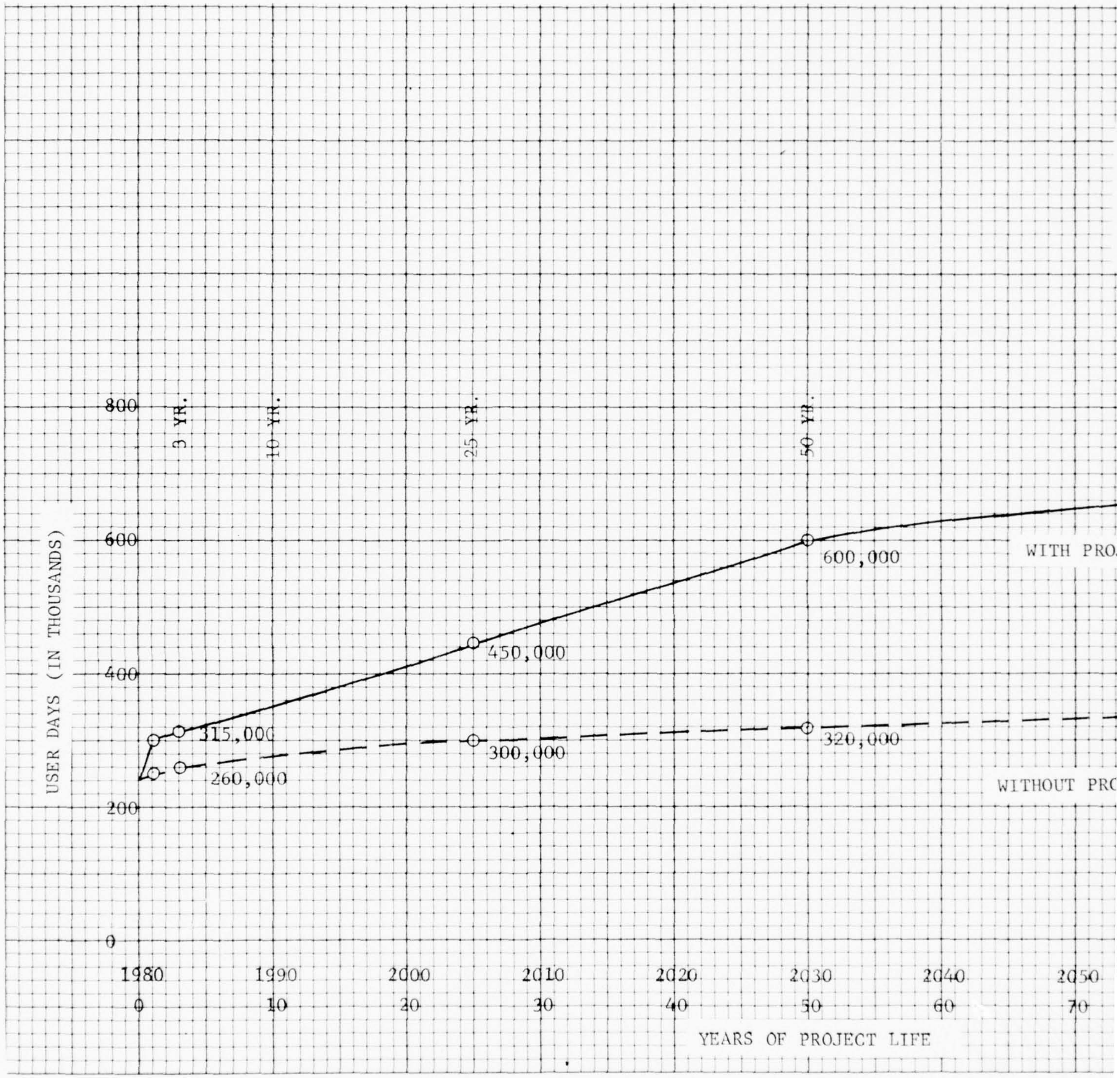
M FROM DAYS CREEK DAM
DING ROSEBURG)

Umpqua River and Tributaries, Oregon
Umpqua and South Umpqua Rivers

DOWNSTREAM FROM DAYS CREEK DAM
PRELIMINARY PUBLIC USE PROJECTIONS
(EXCLUDING ROSEBURG)

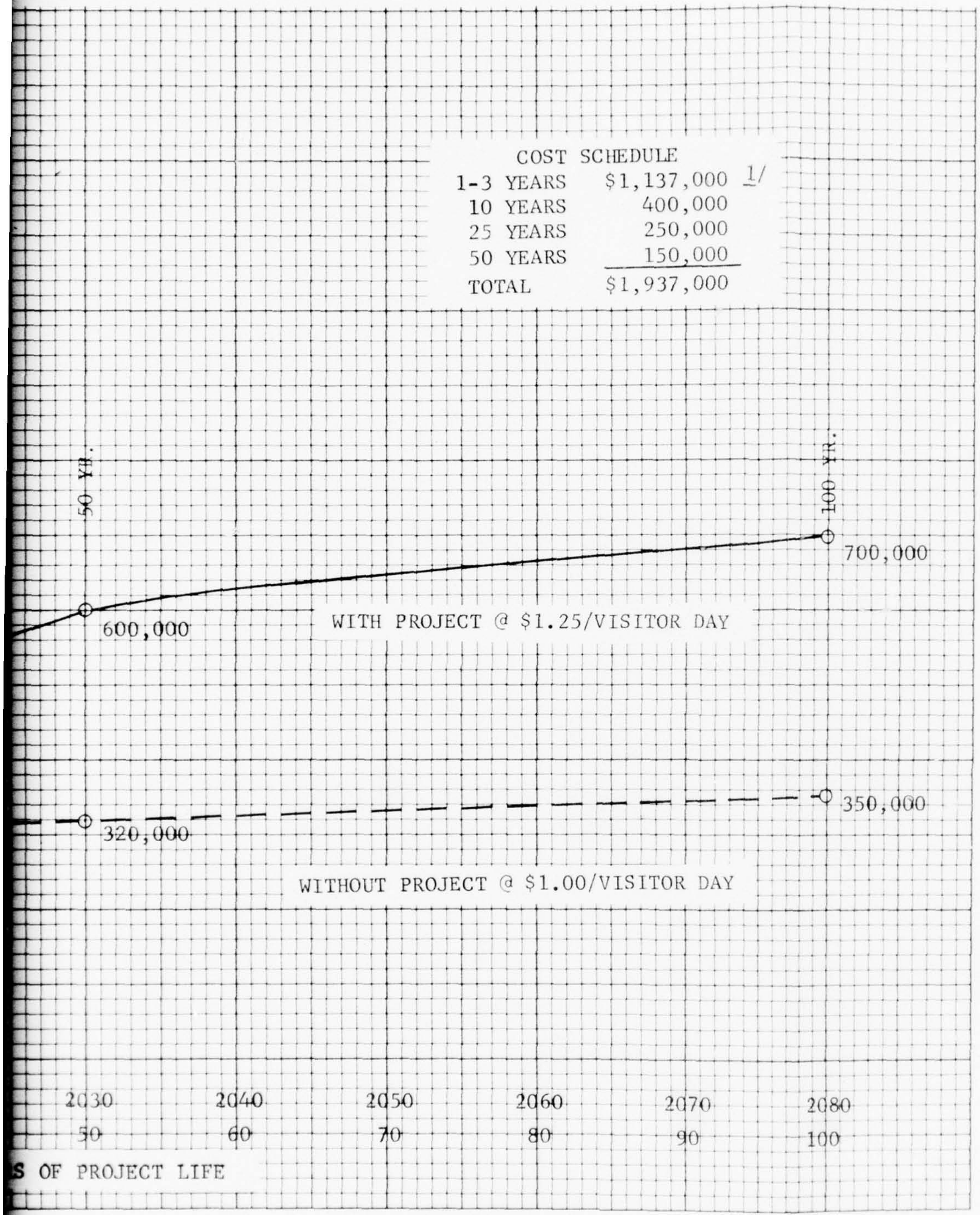
U.S.Army Engineer District, Portland
Recreation Planning Section

CHART 4



1/ Includes land cost

CITY OF ROSEBURG
Preliminary Public Use Projections



COST SCHEDULE

1-3 YEARS	$1,137,000 1/
10 YEARS	400,000
25 YEARS	250,000
50 YEARS	150,000
TOTAL	$1,937,000

Y OF ROSEBURG
ublic Use Projections

Umpqua River and Tributaries, Oregon
South Umpqua River

DOWNSTREAM FROM DAYS CREEK DAM
PRELIMINARY PUBLIC USE PROJECTIONS
CITY OF ROSEBURG

U.S.Army Engineer District, Portland
Recreation Planning Section

CHART 5

SECTION V - RECREATION ALTERNATIVES

22. FIRST LEVEL ALTERNATIVES

As discussed in the main report, there is no other site for a dam which would do less damage to the environment and still accomplish the project purposes.

23. SECOND LEVEL ALTERNATIVES

Specific recreation alternatives as described in Supplement 1 to Senate Document 97, 87th Congress, 2nd Session, are those which would provide ". . . equivalent services which would be precluded if recreation were developed as a project purpose. Relevant recreation alternatives are those that: (1) are economically justified and would most likely be utilized in the absence of recreation as a project purpose; (2) serve essentially the same service area as the project; and (3) provide recreation opportunities reasonably equivalent to those of the project. Alternatives may consist of either a single purpose recreation project or unit, a combination of projects and units, or a recreation purpose in a multiple-purpose project. Such alternatives are not limited to reservoir projects and may involve providing access to natural water bodies, river, and related land resources having recreation development potential." There are no recreation alternatives that would meet the criteria of Supplement 1 to Senate Document 97 and provide equivalent services. The Rogue River Basin water resources projects (Lost Creek, Elk Creek and Applegate Lakes) would provide some opportunity for recreation use; however, driving distances from the primary market use area (Douglas County) would curtail the opportunity and demand on the Rogue projects would become too great if not compensated for in the Umpqua Basin. The most reasonable recreation alternative to Days Creek multipurpose project would be a single purpose recreation reservoir at the same location. Even though such a single purpose project is not economically justified and not likely to be developed in the absence of recreation as a project purpose, it constitutes the best alternative providing equivalent benefits for use in cost allocation.

TABLE VII
ECONOMIC DATA SUMMARY

LAKE	PLAN I	PLAN II	PLAN III	PLAN Ia	PLAN IIa
Initial Development Cost	2,250,000	2,300,000	1,350,000	1,250,000	1,500,000
Land Acquisition Cost	171,000	159,000	125,000	171,000	171,000
Interest During Construction	260,000	264,000	159,000	153,000	180,000
Future Development Cost (Present Worth Future)	2,750,000 (900,000)	2,800,000 (917,000)	2,250,000 (630,000)	1,250,000 (454,000)	1,500,000 (542,000)
Investment Cost	3,581,000	3,640,000	2,264,000	2,028,000	2,393,000
Annual Costs:					
Interest & Amortization	193,500	196,700	122,300	109,600	129,300
Operation, Maint. & Replacement	160,600	165,300	91,600	81,900	101,900
Annual Cost	354,100	362,000	213,900	191,500	231,200
Annual Benefit	533,000	557,000	360,000	170,000	207,000
DOWNSTREAM					
Initial Development Cost	2,110,000	2,110,000	2,110,000	2,110,000	2,110,000
Land Acquisition Cost	543,000	543,000	543,000	543,000	543,000
Interest During Construction	285,000	285,000	285,000	285,000	285,000
Future Development Cost (Present Worth Future)	2,145,000 (793,000)	2,145,000 (793,000)	2,145,000 (793,000)	2,145,000 (793,000)	2,145,000 (793,000)
Investment Cost	3,731,000	3,731,000	3,731,000	3,731,000	3,731,000
Annual Costs:					
Interest & Amortization	201,600	201,600	201,600	201,600	201,600
Operation, Maint.,& Replacement	179,000	179,000	179,000	179,000	179,000
Annual Cost	380,600	380,600	380,600	380,600	380,600
Annual Benefit	776,000	776,000	776,000	405,000	510,000
TOTAL ANNUAL COST	734,700	742,600	594,500	572,100	611,800
TOTAL ANNUAL BENEFIT	1,309,000	1,335,000	1,136,000	575,000	717,000

SECTION VI - ENVIRONMENTAL CONSIDERATIONS

24. THE PRESENT ENVIRONMENTAL SETTING

a. Physiography. - The South Umpqua River drainage lies in three distinct physiographic divisions with considerable contrast in topography, geology, and soils. Those divisions are: the Western Cascades, the Klamath Mountains, and the Coast Range. The Western Cascades, composed of pyroclastics, volcanic sediments, and lava flows, feature narrow stream valleys separated by sharp ridges, with valleys becoming wider and slopes more subdued toward the west; weathering is deep and intense, and swelling volcanic clay is common. The Klamath Mountains are characterized by rugged topography, steep slopes, narrow ridges, and deep canyons; weathering is varied according to rock type and intensity of fracturing. The Coast Range is lower and less rugged than the Cascades or Klamaths; weathering is intense and deep. Only a small portion of the South Umpqua River drainage is in the Coast Range. In its lowermost 70 miles from Tiller to its mouth, the South Umpqua drains narrow valley lands interspersed among the foothills of the three mountainous areas. South and North Umpqua Rivers join to form Umpqua River.

b. Runoff and precipitation. - South Umpqua River drains 1,762 square miles in southern Douglas County, Oregon. The North Umpqua drains about 1,347 square miles in the eastern part of the county. Differences of runoff between North and South Umpqua Rivers are: (1) lower summer flow in the South Umpqua - at times as little as one-seventh that of the North Umpqua; (2) the North Umpqua has slightly more annual runoff; and (3) flood runoff in North Umpqua River is greater per square mile of drainage area for a given frequency of flooding.

c. Precipitation over the headwater area in the South Umpqua drainage averages about 56 inches annually with an average runoff of about 30 inches, or 53 percent. In contrast, the headwaters area of the North Umpqua drainage has an average annual precipitation of approximately 60 inches and an average annual runoff of about 43 inches, or 71 percent. Thus, considerably more of the incoming precipitation runs off in the North Umpqua drainage than in the South Umpqua and accounts, in large part, for the greater summer flows in the latter stream.

d. Vegetation. - The South Umpqua River drainage area contains a wide variety of vegetative cover. Trees indigenous to the area include sugar pine, Douglas fir, white fir, ponderosa pine, Jeffrey pine, white and black oak, California live oak, chinquapin, madrone, alder, and maple. Those species are found throughout the area at various elevations. Of special note is the residency of Jeffrey pine and California live oak, which identifies the area as the beginning of a transition from the Pacific Northwest to the Pacific Southwest vegetation zones. Undercover includes manzanita, vine maple, salal, ferns, grasses, legumes, and mosses. Orchard trees, various ornamental plants, and grasses introduced for farming are located throughout the valley floors.

e. Fish and wildlife. - South Umpqua River supports both resident and anadromous fish, which are an integral part of the Umpqua River fishery. Salmon, shad, and striped bass are important sport and commercial fish in Oregon. Salmon are significant nationally and internationally in the offshore commercial fishery. The estimated sport and commercial catch of chinook and coho salmon originating in the Umpqua River system relative to Oregon as a whole is shown below.

Fishery	Total Oregon catch		Umpqua contribution		Percent of total
	Nos.	lbs.	Nos.	lbs.	
Commercial troll:					
Chinook	118,200	1,300,000	5,200	57,200	4.4
Coho	1,166,700	10,500,000	84,000	756,000	7.9
Ocean sport:					
Chinook	40,000		1,000		2.5
Coho	225,000		16,000		7.1

Important sport fish found in the system include winter steelhead, summer steelhead, cutthroat trout, rainbow trout, brown bullhead, American shad, striped bass, white sturgeon, and smelt. Nongame fish include redside shiner, dace, sucker, Oregon chub, stickleback, squaw fish, cottid, and lamprey. Anadromous fish spawning runs using South Umpqua River are estimated to be 1,000 spring chinook salmon, 650 fall chinook salmon, and 5,750 coho salmon; 2,500 winter steelhead; 2,000 searun cutthroat trout; and 3,000 shad. The progeny of those fish provide an average of 151,000 pounds of salmon and 3,400 pounds of shad annually to the commercial fishery in the Pacific Ocean and Umpqua River, and an average annual sport fishery of 78,200 angler-days in the Pacific Ocean and Umpqua River. South Umpqua River provides only about one-half as many anadromous fish to the Umpqua River fishery as does its sister stream, North Umpqua River. Of the resident game fish, cutthroat trout are the most abundant naturally; that species generally inhabits the headwater areas which are not used by anadromous fish. Rainbow trout are sparsely distributed throughout the system; natural trout production is supplemented, by stocking of about 25,000 legal-size rainbow trout annually, by the Oregon State Game Commission. It is estimated that sport fishing activity for resident trout is about 3,500 angler-days, most of which occurs upstream from the town of Tiller.

f. The South Umpqua area contains numerous wildlife species. Black-tailed deer and Roosevelt elk are common, while white-tailed deer, bear, and cougar are relatively scarce. Upland game, especially valley quail, ruffed grouse, mourning dove, band-tailed pigeon, silver-gray squirrel, and rabbit, also are present. Waterfowl numbers are limited, but mallard and wood duck use the area for nesting. Principal fur animals are beaver, mink, otter, and bobcat; others include muskrat, ring-tailed cat, striped and spotted skunks, coyote, red and gray foxes, raccoon, weasel, porcupine, and opossum. Numerous songbirds, reptiles, and other nongame animals are found throughout the area.

g. Water quality. - Temperature is a severe water quality problem in the South Umpqua drainage. Temperatures in South Umpqua River at Winston during July and August average 75° F., well above the maximum temperatures recommended for anadromous fish. Maximums have reached 94° F. and minimums of 60° F. for the same period. During January, the average is 42° F. with maximum and minimum temperatures reading 55° F. and 32° F., respectively. The most severe problem in South Umpqua River occurs where it passes through the Roseburg area. Table VIII shows the ranges of dissolved oxygen, biochemical oxygen demand, temperature, and bacterial concentration.

TABLE VIII

WATER QUALITY SUMMARY, UMPQUA RIVER BASIN [1]

Stream	DO mg/l	BOD_5 mg/l	Temperature, °F.	Coliform bacteria MPN/100/ml
Umpqua	8.6 - 9.7	1.1 - 2.2	82 - 51	400 - 2,000
South Umpqua	6.2 - 12.1	0.0 - 2.5	94 - 51	10 - 13,000
Cow Creek	7.3 - 9.5	0.8 - 1.22	85 - 55	10 - 800

[1] Water Supply and Quality Control Study, Umpqua River Basin, Oregon, September 1966, by USDI, FWPCA.

h. Industrial wastes are generated primarily from wood-products industries with some wastes from small food-processing operations. Most pollutants from wood-products industry are log-pond overflows. The major source of agricultural waste is from irrigation return flow carrying dissolved nutrients. The entire question of whether or not irrigation return flows significantly reduce the quality of streams is at present under study by the Bureau of Reclamation. As yet, no firm conclusions have been found. The 1970 report of Federal Water Quality Administration states that the major source of agricultural waste water in the South Umpqua River is from irrigation return flow. Although relatively few acres are irrigated, the impact on South Umpqua River dissolved oxygen levels from this source is significant. The irrigated lands in the Umpqua River Basin for the most part are located in narrow strips along the river. The mode of water application is almost entirely sprinkler irrigation; therefore, most of the return flows are subsurface and are able to enter the water prism of the river without aeration. The rates of irrigation returns are based on application rates that reflect reasonable and efficient irrigation practices. The report further states that additional control of agricultural wastes will be needed in the future to meet water quality standards if the Days Creek project is not constructed. Two alternatives were considered in the determination of benefits for control of agricultural wastes: A single-purpose reservoir for flow augmentation and the collection and treatment of irrigation return flows.

i. Recreation. - Recreation use of the Umpqua Basin is substantial. Other than fishing and hunting, recreational use includes boating, water-contact sports, picnicking, and camping. In contrast, use of the South Umpqua and its shorelines is much less intense. Early in the recreation season, so long as adequate flows are still available, picnicking, swimming, and hiking are popular pursuits at the several parks on the lower South Umpqua. During summer low-flow periods, the stream is neither esthetically appealing nor necessarily safe for swimming; the combination of low flows, high temperatures, profuse algal growth, and floating solids seriously inhibits the recreational potential of the stream.

j. Development and utilization. -

(1) Flood plain development. - The Umpqua standard project flood plain encompasses approximately 44,550 acres of land. Encroachment upon the flood plain is extensive. Cultivated lands have been extended into once-brushy timbered areas, and many agricultural lands have been shifted to higher economic uses. A study of the flood plain in 1965 indicated the following balance of uses:

Land use	Percentages
Brush, barren, and woodlands	9.4
Pasture	47.6
Cropland	22.3
Orchard	5.6
Farm sites	1.7
Urban	13.4
	100.0

The estimated value of properties included in the standard project flood plains of the South Umpqua and Umpqua Rivers, adjusted to 1971 values, is:

Location	Area subject to inundation (acres)	Value of damageable properties
Umpqua River (approximately 112 river miles)	22,465	$118,522,000
South Umpqua River from confluence with North Umpqua to Days Creek site (approximately 60 river miles)	22,085	311,817,000
Total	44,550	$430,339,000

(2) The area inundated in the 1964-65 flood, between the mouth of Umpqua River and the Days Creek damsite on South Umpqua River, was about 22,880 acres (excluding Reedsport). During that flood, lands and improvements in that area sustained damages of $17,182,000. At 1971 prices and 1985 development levels, damages from the 1964-65 flood would total about $38.7 million, excluding the reduction in damages provided by a Corps of Engineers levee project at Reedsport completed in 1970. The flood peak (265,000 c.f.s. at the Elkton gage) had an exceedence frequency of once in about 85 years. More than half the damage occurred in the central valley portion of the Umpqua Basin, which includes the towns of Elkton, Winston, Dillard, Myrtle Creek, and Canyonville and the city of Roseburg.

(3) Existing water resource development. - The only Federal water resource developments on South Umpqua River are two minor local flood control projects constructed by the Corps of Engineers in 1951, at Melrose and Conn Ford. At Melrose, the channel was cleared and 900 feet of revetments were emplaced. At Conn Ford, the channel was cleared and a gravel bar removed. Cost of the work at the two locations was $44,000. The Melrose area works have since been destroyed by floodwaters and no longer exist. Several water supply sources have been developed by the smaller communities in the area drained by South Umpqua River. In addition, private water resource developments include diversions for irrigation and industrial uses from South Umpqua River and its tributaries.

25. THE PROPOSED DAYS CREEK PROJECT AREA

The environmental setting in the proposed project area is discussed in the following subparagraphs:

a. Physiographic features. - The proposed Days Creek project area, in the Klamath Mountain physiographic division, is underlain by upturned metamorphic rock and related granitic intrusives. Some rock types in the area, particularly serpentine, have been intensively sheared, resulting in very weak rock conditions, and slides occur. The damsite area itself has a steep left abutment; a 1,200-foot-wide, gently sloping valley floor; and a moderately sloping right abutment; the channel of South Umpqua River at this locality is about 100 feet wide and is entrenched in bedrock.

b. Vegetation. - The valley floor in the proposed project area has been considerably altered by man. Small wood lots along the river contain alder, maple, pine, fir, and oak. The remaining lands are covered by grasses and legumes, utilized as pastureland. The steeper hillsides have been partially cleared of merchantable timber but still contain significant stands of Douglas fir, white fir, sugar pine, ponderosa pine, Jeffrey pine, white and black oak, chinquapin, and madrone.

c. Fish and wildlife. -

(1) Fish. - The proposed project area supports most of those same fish identified as being in South Umpqua River (paragraph 24e). Recent studies show that an estimated 1,250 coho salmon, 100 spring chinook salmon, 1,000 steelhead, and 1,000 cutthroat trout spawn annually in that part of South Umpqua River and tributaries proposed for inundation by the reservoir project.

(2) Wildlife. - Black-tailed deer, waterfowl, and several upland-game species inhabit the proposed project area. No endangered species of animals are known to depend on this stretch of the river and valley for survival. The northern bald eagle, golden eagle, and American osprey are among the protected species which use the project area.

d. Recreation. - Present recreational usage of the proposed project area is estimated to be about 4,000 recreation-days annually. General recreation use includes picnicking in Carl Hill Memorial Wayside, and hiking or sightseeing in undeveloped areas. General public access to the river for recreational use is somewhat restricted by private property. General recreation use of the proposed project area is expected to reach about 15,000 recreation-days annually in 100 years if the project is not developed.

e. Water quality. - Water quality in South Umpqua River in the proposed project area and upstream is considerably better than that of the lower river. Temperatures in the stream average 68° F. during July and August, and 62° F. in September, as compared to 75° F. for July and August at Winston. Maximum temperature exceeds 80° F. at the Tiller gaging station, however, at the upstream end of the project area.

f. Development and utilization. - Lands in the proposed project area are categorized into the following general uses:

Use	Acreage
Irrigated farm	800
Pasture	420
Orchard	45
Wooded (private)	5,215
Wooded (Government)	975
Building and special purpose	145
	7,600
Project lands for wildlife habitat (not located)	1,200
Total	8,800

Several types of structures are located on proposed project lands. A major development is a private church school which has a residency of about 400 students. Also there are 24 farmsteads, 80 residences, seven commercial properties, a public school, a church, a boy scout building, a log-scaling facility, and a forest-ranger station.

g. Archeology. - The archeological significance of the proposed project area has not been totally identified. The report, "A Report on the Archeological Potential of Three Proposed Reservoirs in the South Umpqua Drainage, Oregon," dated February 4, 1966, by Thomas M. Newman and Daniel J. Scheans, was prepared through coordination with the National Park Service, U.S. Department of Interior. That report is shown in appendix J. The survey located seven archeological sites which would be inundated by the project, and thus no longer available for future scientific investigation. All seven sites are important, and three are of particular significance -- two sites attributed to the historic Umpqua Indians and one buried site which may yield remains of considerable antiquity.

h. Mining. - According to Bureau of Mines, USDI, there are two mines or prospects located within the reservoir site. The Days Creek Chromite deposit is located in the center of section 22, T. 30 S., R. 4 W. The ore appears to be low grade; however, one sample assayed 45.84 percent Cr_2O_3. The Gold Cut Mine, also known as the Pennel Mine, consists of 160 patented acres located in the NE1/4, section 27, T. 30 S., R. 2 W. Assays taken across a 12-inch vein ranged from trace to 0.08 ounce gold per ton and traces of silver. The State of Oregon Department of Geology and Mineral Industries identifies two mineral occurrences which should be mentioned. There is one chromite occurrence in the south part of section 15 that probably will be in the area of road relocation and a proposed recreation area about one-fourth mile east of the north abutment of the dam. The production from this occurrence, which is listed in Bulletin 52 as the Rainy Day Mine in the Tiller-Drew area, is estimated at 20 tons with unknown reserves. There is also a manganese occurrence in the Dothan formation in section 19, T. 30 S., R. 3 W. This occurrence is called the Sitting Duck Manganese occurrence. Neither of these represents significant mineral values.

26. ALTERNATIVE PLANS OF DEVELOPMENT

a. General. - In the following discussion, the alternatives to the proposed Days Creek project are described in detail, and the reasons for not selecting them are given. Justification for selecting the Days Creek site is discussed in the main report. Ten alternative plans of development, ranging from single- to multiple-purpose in scope, were investigated; those include no action, flood-plain zoning, flood-plain evacuation, levee protection, a dam similar to Days Creek at another location, a different-size dam at Days Creek, dry-reservoir operation at Days Creek, concrete instead of embankment dam at Days Creek, small headwater storage sites in various combinations, and a water-supply storage project.

b. No action. -

(1) This alternative would be to take no action in response to the area's water and related land resources problems. Approximately $130 million, which includes construction, interest, and land transfer costs to implement the recommended plan, would then not be spent by the Federal Government. A choice of whether or not to construct a dam at the Days Creek site would remain available to future generations. No lands would be inundated by a project, the extent of flooding downstream would remain unchanged, and the proposed project area could continue to be used for timber growing, logging, and such farming as would be appropriate.

(2) Leaving things as they are also would mean retaining present fish and wildlife populations and habitat, and foregoing new fisheries in South Umpqua River (summer steelhead and fall chinook salmon) as well as an increased return of anadromous fish presently using the stream. Prospective benefits from flood control, irrigation, fish habitat enhancement, and improved water quality would not be realized. Reservoir-oriented recreation opportunities, which would be provided by the project, would be foregone, while streamside recreation would remain, but on a lesser scale than would be provided under the recommended plan.

(3) The no-action alternative was not selected because it would not be responsive to human and some environmental needs in the basin.

c. Flood-plain zoning. - Flood plain land-use regulation, through zoning and building codes, would not effect a reduction in the present level of flood damages. Neither would it provide service to any other of the present or projected water-resource needs of the area. While its effect would be beneficial, as a basic measure for prevention of future increases and possibly some reduction of present flood damage, its adoption would not provide needed water-conservation benefits. Accordingly, it has been considered as an essential complement to the flood control aspect of multiple-purpose storage. The impact of zoning would be to limit or preclude damage-prone development in areas that are subject to frequent flooding. An analysis of the effectiveness of flood plain land-use regulation in reducing damage showed that a vigorous program to eliminate all population growth and economic development within the 100-year flood plain after 1985 would reduce average annual flood damages by only 13 percent. Some flood-plain evacuation would result from continued implementation of properly planned flood-plain zoning. That evacuation would be complementary to the proposed project. Also, with the planned flood-plain zoning, flood insurance would become available. Insurance would not affect flood levels, or the damages suffered by flood plain occupants, but it would reduce the potential financial burden on the flood plain users.

d. Flood-plain evacuation. - Evacuation of areas subject to flood overflow would be a potential nonstructural solution to the flood problem. It would involve removal of all damage-prone, manmade improvements from parts of, or even entire, communities such as Tiller, Canyonville, Winston, Dillard, Myrtle Creek, Roseburg, Melrose, and Garden Valley. It would be necessary to relocate residents and improvements to areas outside the flood plain and purchase all or a large part of the properties involved. Following the relocation, the evacuated land would have to be retained in public ownership or strictly zoned to prevent renewed development from taking place.

e. Levee protection. - Levees, channel improvements, and related works could protect local areas from flood damages. Those measures would have great utility where damageable property is concentrated, or where reservoir storage for flood control could not be provided or would not be fully effective. All local flood-protection works have the disadvantage of disrupting, to a degree, the natural stream and riparian environments. Potential levees investigated in this study have been found impractical or economically infeasible, because the work required would be excessive in terms of the acreage and values which could be protected; at Roseburg, for example, some structures which should be protected would have to be removed to provide room to construct a levee. Channel stabilization works to prevent meandering have been considered in detail for several locations, but have been found to be lacking in individual economic feasibility. Further, levee construction at selected locations would not offer a solution to the water-conservation needs of the basin, to the very important need for water quality improvement, or to flood control needs of the remainder of the basin.

f. Similar dam, another location. - With this alternative, adverse environmental effects could be expected to be comparable to those for Days Creek. However, there appears to be only one other site for construction of a dam of similar size, on South Umpqua River or any other tributary thereto, that would provide similar protection to the lower river; that other site, at Tiller, is discussed below. Other locations on the river in the vicinity of the proposed project were carefully studied; development at those locations would provide less benefits and require larger expenditures than for the Days Creek site.

(1) The principal alternative is the Tiller site, at the upstream end of the Days Creek project area. It has excellent development potential, so far as the damsite is concerned. The site is in an area of sound rock, apparently suitable to development of a concrete gravity or perhaps even an arch dam. It is suitable for a project with total storage capacity of at least 750,000 acre-feet. Immediately upstream from the damsite, the canyon widens into a topographically excellent storage basin. However, almost all of the reservoir area is in a geologic division where soils are unstable. Graphic evidence of extensive slide activity exists. In the most recent slide, on Dompier Creek immediately upstream from the damsite, more than 40 million cubic yards of earth slid from at and above the potential full-pool level elevation to elevations below any flood control pool level for the Tiller site. Thus, pool-level fluctuations inherent in flood control operation could be expected to cause additional slides. Because the problems posed by existing and potential aggravated slide conditions, both in the reservoir area and in the uplands where roads would be relocated, and because of the real probability of reservoir turbidity, as a consequence of slides, the Tiller site was abandoned in favor of development at the proposed Days Creek site.

(2) Another alternative site studied was the Galesville site on Cow Creek, a tributary to South Umpqua River. That site has substantial capability for reducing flood damages. However, it was found that the annual water yield of Cow Creek would not be sufficient to permit dependable filling of storage space adequate to serve conservation needs, either for irrigation or to effect enough flow augmentation for water temperature and quality control. For that reason, economic justification would be marginal at present. The adverse environmental impacts related to construction at Galesville would be similar to but less than those for Days Creek, because of the smaller size of reservoir.

g. Different-size dam. - Economic and environmental study of different dam sizes at the Days Creek site showed that a significant degree of service to all chosen project purposes, sufficient to provide economic justification, would be obtained with the recommended size. A smaller dam and pool would not result in proportional reduction in adverse impacts, would fall short of meeting basin needs by more than a proportional amount, and would provide considerably less benefits. A larger project would require more land and river, and have greater total impact on the environment. Also, there would be a reduction in net benefits with a higher dam and larger pool.

h. Dry reservoir operation. - Under this alternative, water would not be stored at the Days Creek site except during a flood. There would be a lower project cost because costs for reservoir area clearing, road relocation, recreation developments, and a fish hatchery would be greatly reduced or entirely eliminated. Wildlife impact might be reduced relative to the proposed reservoir since habitat loss would be temporary, although sedimentation of lower areas and deposition of a fine coating of silt over the remainder of the area as a consequence of flood control operations might render the habitat useless. Anadromous fish would be able to pass upstream through the project. There is, however, a high probability that during flood storage, spawning gravels would be adversely affected by siltation and that spawn would be destroyed. Adverse impacts on people in the project area would be similar since they would have to relocate. The only major benefit for such an alternative would be from flood control; seasonal use could be made of lands in the pool area but some of the production potential would be lost. The water conservation needs of the area would not be satisfied. A detailed economic study of this alternative was not made, because it would not meet the critical need for water quality improvement and increased summer water supply.

i. Different construction materials. - Construction of a concrete dam, instead of the proposed embankment dam, at the Days Creek site was studied. The concrete structure would be different in appearance but would serve the same purposes and have impacts on the environment much the same as those for an embankment dam, except for lesser quantities of borrow. However, geologic conditions of the site are better suited for construction of an embankment dam, and a concrete dam would cost about one-fourth more than an embankment dam. Since there would be no appreciable advantage gained by providing a concrete dam, the additional cost was not considered justifiable.

j. Headwater storage sites. - Various combinations of six small sites on headwater streams tributary to the South Umpqua River were investigated. All of the possible combinations lacked the capability to solve the basin's water-resource problems, and the associated costs would exceed benefits by a considerable margin. In addition, adverse environmental effects would be at least as great and probably greater, in total, than for the proposed project.

k. Water-supply storage project. - A major need in the region is to provide additional and dependably available water supply for irrigation and for municipal and industrial uses. Surface water is the only reliable source for additional water because ground water generally is lacking. Under natural conditions, streamflows in South Umpqua River and its tributaries are insufficient to satisfy the irrigation and municipal and industrial water supply needs during the summer months. Existing consumptive water rights total about 265 c.f.s., which is more than the available natural flow during some summers. A storage alternative, operating for those summer-use purposes and foregoing flood control storage, would be a practical means of providing the needed additional low-water-season water supply. The stored water should be at a higher elevation than the areas of use, to permit economical gravity flow to recipients. The alternative of using natural flows available in North

Umpqua River as a potential source for water supply also has been studied. Utilization of that source is being made at this time by the city of Roseburg. North Umpqua River has a sustained flow of good quality water, even during the dry season. Major irrigation diversions, however, plus diversions for municipal and industrial use, would not be possible without adverse effects on total flow, fish habitat, and esthetics. Also, long pipelines and pumping would be required to convey water from North Umpqua River to points of greatest need upstream along South Umpqua River, and that alternative would be considerably more expensive than providing water supply from the multipurpose Days Creek project.

l. The proposed Days Creek project. - The Days Creek project was chosen in favor of the various alternatives enumerated above. That project is described in the main report. It would be constructed and operated to meet major portions of existing and projected needs for flood control, irrigation, municipal and industrial water supply, recreation, water quality control, and fish habitat enhancement. It would have a benefit-to-cost ratio, at 5-3/8 percent interest and over a 100-year economic analysis period, of 1.4 to 1. The following paragraph describes the environmental setting with the project.

27. THE ENVIRONMENTAL SETTING WITH THE PROPOSED PROJECT

a. General. - The proposed Days Creek project would considerably modify the landscape in the project area, and change the streamflow regimen of South Umpqua River. Fish and wildlife habitats and recreational opportunities would change correspondingly. Those and other impacts of project construction are discussed in the following subparagraphs.

b. Physiography. -

(1) A major physiographic impact would be the flooding of the valley upstream from the dam, including 16 miles of South Umpqua River and 14 miles of tributary streams. The total 30 miles of free-flowing stream that would be lost compares to a total of 250 miles of similar river in the South Umpqua drainage. The impoundment created by the dam would have a surface acreage of 4,270 acres. During winter months, when the lake would be drawn down to elevation 948, m.s.l., 1,430 acres of reservoir land would be exposed. During critical water years, when carryover storage would be withdrawn to meet downstream needs, exposed reservoir land could amount to as much as 2,660 acres. At whatever levels below full pool the reservoir might be, exposed land could be the source of some turbidity during periods of heavy rain and surface runoff. At such times, inflow to the reservoir also would be turbid; those conditions are common to all such projects, and are not indicative, per se, of potential for long-term turbidity.

(2) Another major physiographic impact would be the removal of more than 680,000 cubic yards of overburden and rock from the embankment and quarry areas, and the excavation and placement of 7.5 million cubic

yards of material at the damsite to form the embankment. The esthetic impacts of that work would be major. The method of construction for the work would be selected to minimize adverse impacts, and provision for major restoration would be included in the work contracts. Any excavation outside the reservoir would be repaired by revegetation, during and after construction, to minimize environmental impacts. Rock and gravel quarries in the reservoir area would be inundated by the lake upon completion of the project.

c. Atmosphere. -

(1) During construction of the project, earth-moving machines would produce air pollution from their internal combustion engines and put dust into the air as they operate.

(2) Evaporation from the lake would amount to about 8,780 acre-feet of water per year. That evaporation would take place mostly during the summer months. No change is expected to occur to the hot, dry summer weather of the region because of that evaporation.

d. Water. -

(1) During construction, machinery working in and around water areas and gravel-washing operations would be potential sources of water turbidity and subsequent sedimentation in the river. Because of the impact on fish spawning from potential sedimentation, contracts for all phases of work would stipulate that contractors abide by all local and Federal water quality control standards; they would be required to provide assurance of that compliance. Close coordination with fishery agencies would be maintained during planning and construction to schedule work in the river during times of least potential impact to fish life.

(2) The ground-water table in the hillsides immediately around the project would be raised by filling of the reservoir. This is not expected to have any significant impact on the area.

(3) Algal blooms or other related problems are not expected to increase with the project. It is believed that, through low-flow augmentation and temperature control, existing algal problems in South Umpqua River would be decreased. With increased irrigation, there might be an increase in polluted return flow; the Bureau of Reclamation is currently studying that problem to quantify its impact.

(4) As for any other reservoir impounding runoff from the Coast Range, there is some possibility that a reservoir turbidity problem could develop. At the present time, however, significant turbidity exists at only one of 11 multiple-purpose storage projects in Willamette River Basin, to the north of the Umpqua; some aspects of the turbidity problem experienced at that project are year-round.

(5) Storage space in the reservoir would be allocated as follows for an average year:

Storage purpose		Storage space in acre-feet
Exclusive flood control		15,000
Multiple-use:		260,000
Irrigation	15,000	
M & I water	3,000	
Environmental enhancement 1/	242,000	
Carryover, multiple-use		130,000
Inactive		70,000
Dead		5,000
Total storage		480,000

1/ For water quality control, fishery enhancement, and downstream recreation.

During dry years, more than the above-referenced 260,000 acre-feet of stored water would be required to maintain fishery-enhancement flows and meet irrigation and M&I water supply needs. The additional water required would be drawn from the carryover storage.

(6) The reduction of flood stages downstream, by the Days Creek Lake project, would be a significant environmental impact. The following tabulation shows the stage reductions for two key locations on South Umpqua and Umpqua Rivers during floods of 5-, 10-, 25-, 50-, 100-, and 200-year average recurrence probability.

Recurrence probability in years	Stage data in feet					
	South Umpqua R. at Brockway			Umpqua River near Elkton		
	Unregulated	Regulated	Reduction	Unregulated	Regulated	Reduction
Bankfull	21.0	21.0	0.0	25.0	25.0	0.0
5	24.7	21.0	3.7	34.2	32.4	1.8
10	27.7	21.0	6.7	39.0	36.1	2.9
25	31.7	21.0	10.7	46.3	42.8	3.5
50	34.4	21.8	12.6	49.0	45.0	4.0
100	37.2	23.5	13.7	52.6	48.5	4.1
200	40.0	24.8	15.2	56.5	51.7	4.8

As noted in the above tabulation, high runoffs of South Umpqua River would be confined to bankfull stage at Brockway for 25-year and all lesser floods.

(7) Augmentation of low summer flows from the damsite to the mouth of Umpqua River would be another significant environmental impact of the Days Creek project. The project would improve water quality in South Umpqua River through temperature control and low-flow augmentation. Reduction of water temperature downstream, through release of cool water, would provide water of about 55° F. at the project and 70° F. or less at the mouth of South Umpqua River, about 60 river miles downstream. Depending on prevailing conditions, the temperature could be reduced to a lower level as might be desired for fish-habitat enhancement. Flow augmentation for fishery enhancement is planned to maintain flows suitable for anadromous and resident game fish in South Umpqua River from Days Creek to the confluence with North Umpqua River during the entire low-water season. Water released from storage for flow augmentation would not be removed from South Umpqua or Umpqua Rivers. Enhancement of recreational opportunities would occur along the entire river reach, but more especially along South Umpqua River. Enhancement of fisheries and water quality would result in South Umpqua River. The augmented low-water flow during August and September at the Brockway gage on South Umpqua River would be 3 or more times the natural minimum flow, based on 40 years of streamflow record. In one-half of those years, the augmented flow would have been 7 or more times the natural minimum flow. The natural and augmented flows from June through November are shown in the following tabulation; flow augmentation would not be provided during the other months.

Month	Natural flow (c.f.s.)	Augmented flow (c.f.s.)
June	474	750
July	139	950
August	70	950
September	69	800
October	186	650
November	313	550

e. Vegetation. - Trees, brush, and other major vegetation would be removed from the dam and reservoir construction areas during clearing operations. Except as required for road and utility relocations, and development of recreation areas, other project lands would not be cleared. Reseeding of cut slopes, and similar activities, would reduce the long-term impact of such work. Material from clearing which has commercial value would be salvaged. All other material would be disposed of by practices acceptable at the time and in compliance with all State and local environmental standards. It is probable that disposal would be by burning, burying, and chipping. Burning would create air pollution but would be the most economical. Burying as a disposal method is being used to a limited extent at other project. Depending upon the success and experience at those projects, it may be used at Days Creek. Chipping as a method of disposal would be encouraged but the material must be transported out of the reservoir area. There are limitations with chipping especially when large stumps are involved. Also, the material if placed too thick on the forest floor inhibits vegetative growth. All clearing operations would be scheduled at the latest possible date in advance of project completion in order that soil erosion which would result from cleared areas would be minimized.

f. Fish and wildlife. -

(1) Fish. - Anadromous-fish spawning area would be lost in the reservoir reach. The impact would be compensated for by hatchery production and by provision of fish passage. Adult salmon would be transported over the dam to permit continued use of the upstream spawning area. The overall anadromous fish resource would be enhanced due to increased flow, reduced water temperatures, and utilization of the reservoir for rearing juvenile chinook salmon. The following tabulation shows, by species, expected increased return to the South Umpqua system annually resulting from project operation, as estimated by the Fish Commission of Oregon.

Spring chinook	3,300
Fall chinook	6,900
Coho	660
Summer steelhead	3,100
Winter steelhead	1,300

Rearing of spring chinook salmon in the reservoir would provide an additional 10,300 returning adults of that species in addition to the amounts tabulated above.

(2) Improved fish habitat in South Umpqua River, augmented by hatchery production, is expected to result in substantial fisheries for fall chinook and summer steelhead, species not now present in South Umpqua River. Establishment of any new fishery is difficult and not always successful, but the figures given in the above table are based on the best information available to the Federal and State fishery agencies.

(3) The reservoir also would provide a substantial fishery for resident trout. The Oregon State Game Commission estimates that, by stocking at a rate of 50 fish per pound and 3 pounds per acre, 78,000 angler-days of fishing would be created annually.

(4) Several facilities would be provided at the project to permit efficient management of the fishery. Both the spillway and the stilling basin for the outlet works would be designed utilizing the latest standards and criteria available at time of construction to minimize or eliminate nitrogen supersaturation problems. For the downstream passage of fish, a movable collector (fish horn) would be installed at a suitable location to pass fish from the lake into a flexible hose to a conduit through the dam, and out into the channel of South Umpqua River; the fish horn would be movable through all operating levels of the reservoir, and

would be designed to attract fish within 5 feet of the reservoir surface. By utilizing multilevel ports for releasing water, release temperatures of 55° F. or less could be maintained at the project and 70° F. or less at the mouth of South Umpqua River.

(5) An existing fish hatchery, yet to be selected, would be enlarged, or a new hatchery would be constructed to provide compensation for loss of spawning and rearing areas resulting from project implementation; about 20 acres of land would be required for that purpose. Salmon now spawning within the reservoir area, and all steelhead and cutthroat now spawning upstream from the proposed damsite, would be compensated for with hatchery production. Individual fish of those species would be trapped and spawned, and the smolts planted downstream from the dam to maintain the present fishery. Trapped salmon in excess of hatchery needs would be transplanted upstream from the reservoir to spawn naturally.

(6) Wildlife. - The project would reduce available wildlife habitat by about 4,300 acres. The Oregon Game Commission estimates such habitat loss would result in an estimated reduction of 2,200 deer hunter-days annually, 600 hunter-days for upland game, and 150 hunter-days for nongame. The same habitat that would be lost to deer and upland game also is used by a variety of other terrestrial animals such as small fur-bearers, songbirds, and other nongame birds, reptiles, amphibians, insects, and other invertebrates. The reservoir would favor some species such as waterfowl within those broad groupings, but most of the forms present in the area to be inundated would be either eliminated or forced to compete in similar habitat types that remain elsewhere. In the noninundated part of the project area, which encompasses 4,500 acres, changes in land-use patterns probably would alter the balance of wildlife species to some extent. To compensate for the wildlife habitat to be inundated by the project, 1,200 acres would be acquired and set aside upstream from the reservoir, and managed specifically for wildlife use.

g. Recreation. -

(1) Recreation on the lake and the river downstream, as well as adjacent lands, would be developed and managed for public use. Douglas County Parks Department has expressed interest in developing the recreational potential of both the lake and the river downstream from the dam. The city of Roseburg also has expressed interest in developing recreation facilities on riverside land now in city ownership.

(2) Inundation of 30 miles of natural-flowing South Umpqua and tributaries and their shorelines would result in the loss of present recreational opportunities in the project area (presently 4,000 recreation days annually and expected to increase to 15,000 days in 100 years). Compared with use on North Umpqua River or Rogue River, the adjacent streams of comparable size, that use is very low. The reservoir and shoreline improvements resulting from the proposed Days Creek project would encourage an estimated 285,000 annual recreation-days during the

initial project period (third year), increasing to 554,000 recreation-days annually in 50 years and 775,000 in 100 years. Facilities to be constructed include 150 camp units, 120 picnic units, roads, boat-launching ramps, hiking trails, sewage-disposal facilities, and parking area. Future development, for the increasing use, would include the following additions: 150 camp units, boat-launching ramps, 270 picnic units, roads, trails, sewage-disposal facilities, and parking. The opportunity to boat and water-ski is not now available in the area; thus, the lake would provide for greater diversity of recreational experience. Downstream from the dam, to the confluence with the North Umpqua, annual recreation use is expected to increase to 895,000 recreation-days annually by the end of the third year of project operation because of improved water quality and augmented low summer flows; expected annual recreation use, without the project, for the same period is 740,000 recreation-days. Facilities to accommodate increased recreation use downstream would include five boat-access sites, 500 picnic units, 150 camping units, trails, parking, and sanitary facilities. Additional facilities in the city of Roseburg also are planned. The number of people using the Umpqua River is not expected to increase because of the improved water quality and augmented flows, but there would be an improvement in the recreational experience for those users.

h. Esthetics. -

(1) During reservoir clearing operations, the land in the project area would be denuded of all vegetation. That action would temporarily create an unsightly scene as well as a potential for erosion and silting problems. Those adverse potentials would be minimized by scheduling clearing operations for the reservoir as late as possible during project construction, thus avoiding surface drainage directly into the river over an extended period.

(2) Increased summer flow resulting from operation of the project, in addition to improving the quality of the water downstream, would enhance the esthetic quality of the river.

(3) Another impact on the environment would be the scars on the landscape from road construction. They would be unavoidable, even with present plans to minimize destruction of scenic resources, restore vegetative cover, and provide the essential services in a manner compatible with public use and enjoyment of the area.

(4) A scenic impact on the area would be the magnitude of the embankment dam. That structure, with its rock face, would be alien to the natural character of the site. The large lake created would be scenic during May through July but, because of drawdown, the area would be less attractive during the period August through April. The table below shows the drawdown, below full conservation pool, that would be expected to occur during an average water year:

Month	Drawdown (in feet)
May	0
June	0
July	5
August	19
September	35
October	52

(5) Esthetic measures in the vicinity of Days Creek damsite are included in the proposed plan. During and after construction, grading and landscaping to blend the features with the natural terrain would be accomplished. Borrow, quarry, and spoil areas would be chosen so as to detract as little as possible from the natural setting. Where spoil and borrow areas would be visible, they would be either screened with vegetation or graded and landscaped to blend with the character of the surrounding areas. Temporary haul roads would be located with care and would be obliterated, landscaped, or revegetated after completion of the project, when need would no longer exist for them. Contractors' work areas would be selected so as to create minimal disturbance, and would be restored after use. Permanent roads would be located to make use of scenic vistas, retain an unspoiled lake shoreline, and preserve the scenic beauty. Roadway cuts and fill slopes would be seeded and landscaped. At the dam, treatment would include selective shrub and tree planting, and use of indigenous building materials to present a harmonious relationship between manmade features and the surrounding lands. In all cases, the emphasis would be to preserve the natural scenic beauty wherever possible, and to rehabilitate only where altering the landscape would be unavoidable.

i. Geology. - The mineral resource in the project area generally has not been exploited. Project construction would utilize gravel, rock, and clay from the project area. After project construction and inundation, the mineral resource would not be physically destroyed, but it generally would not be available for use. Any mineral resources in the reservoir area, such as sand and gravel, that would not be needed for project purposes could be removed before project completion and inundation.

j. Historical and social. -

(1) The project will not affect any existing or potential units of the National Park system or sites presently eligible for registration as national historic or natural landmarks. No sites listed in the National Register of Historic Places or being considered for nomination to the Register are involved.

(2) No studies have been made of the social and cultural conditions in the vicinity of the project. Based on a count of houses from the air and the assumption that there are 3.2 persons per house or farmstead, it is estimated that about 330 people now reside on lands to be

acquired for the project. Also, about 400 students reside at Milo Academy in the project area. Those 330 residents would be displaced only when comparable, decent, safe, and sanitary replacement housing is available, and would be given relocation advisory assistance, moving and related expenses, and replacement housing payment or rental assistance payments. The Milo Academy students would be transferred by the Seventh Day Adventist Church, owner of the academy.

(3) Local school programs also would be affected by additional enrollment from construction-crew families. Federal impact payments to local school districts would minimize the effect of increases in operating costs. The Tiller public elementary schook, which is in the project area, has a 1971-72 enrollment of 62 students. About 35 of those students reside in the project area and would be relocated. The rest of the students would either be transported to another existing school (Days Creek), or a new school at some other location would be provided. Details regarding school mitigation would be worked out during preconstruction planning with the local school district.

(4) People living near the project, or in a community such as Days Creek or Canyonville, would experience an impact from increased tourist and recreational use of the area generated by the project. That impact may be beneficial to those individuals who rely on tourism for economic gain, but it would be adverse to many more people who desire a rural atmosphere without the disruption of large numbers of tourists, sightseers, or recreationists.

(5) Community services would require expansion for the expected construction workers and their families. As a long-term impact, the recreationists attracted to the region because of the lake would extend that service demand. One could expect, for example, that nearby communities such as Days Creek, Canyonville, and Roseburg would expand existing facilities--restaurants, motels, service stations, mobile trailer camps, and sporting-goods shops--and perhaps add facilities which provide water-ski and boating supplies. The economic impact in that regard could be very important to the people of the region.

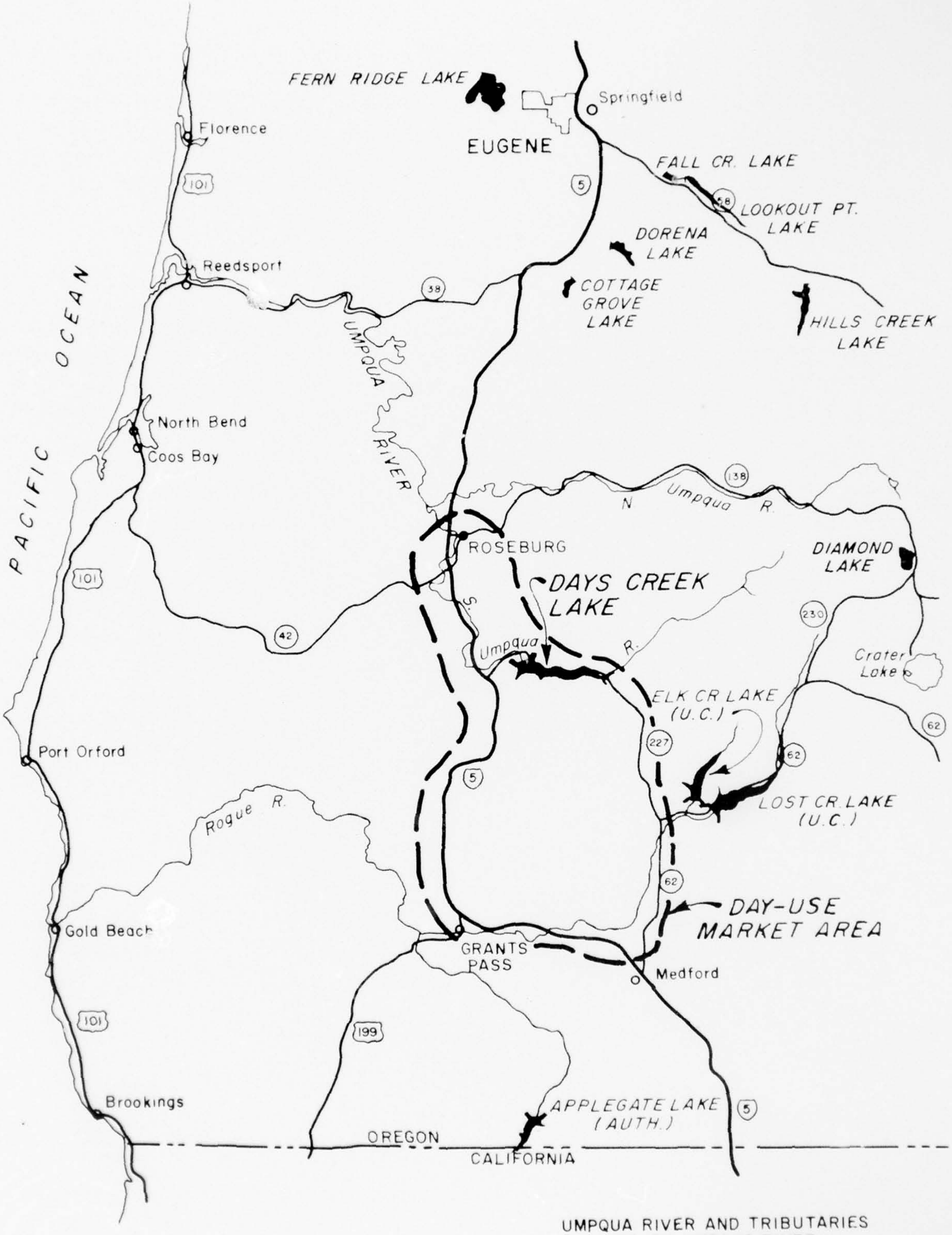
(6) The project would induce development adjacent to the project lands and throughout the local area. Problems stemming from such things as inappropriate or mutually detracting land uses, inadequate provision for sewage treatment, and encroachment on hazardous flood plains are likely to result unless the State and local governments guide and control the induced development.

k. Downstream. -

(1) To prevent erosion damages to the channel and banks of South Umpqua River during flood-evacuation periods, the proposed plan provides for up to 17,000 linear feet of channel stabilization work, at various locations, with the locations to be determined on the basis of experience

after the project is placed in operation. If that channel stabilization work proves to be necessary, it would reduce riparian habitat, effect esthetic change because of riprapped shoreline, and reduce erosion and potential turbidity. During construction, depending on location, shoreline turbidity could result. Specific design features and method of construction for the stabilization work would be based on latest acceptable environmental practices. The plans for the work would be coordinated with all interested agencies. The work would be scheduled during periods of least potential adverse impact to fishery.

(2) The project will provide flood plain protection which could affect flood plain development. The impact of that protection might be an influx of people and businesses to the area to be protected. In past years the trend associated with newly constructed projects has been for new downstream development to advance farther and farther riverward until there are large concentrations of damageable properties inside the area of unacceptable risk. Flood plain regulation based on the 100-year floodway, and the floodway fringe-zoning concept, should encourage nondamageable uses of the flood plain, to insure that the expected flood control benefits of the project are realized. Local government would be responsible for implementing regulations and is pursuing such a program at this time. The main report includes the following recommendation: Construction of the project is recommended provided that "An appropriate non-Federal agency take the necessary action by means of land-use regulation, to (1) prevent encroachment on the waterway needed for passage of regulated flood peaks, and (2) to protect spawning gravel areas satisfactory to state and Federal fishery agencies." Douglas County has given written assurances, also included in that report, that such actions will be taken.



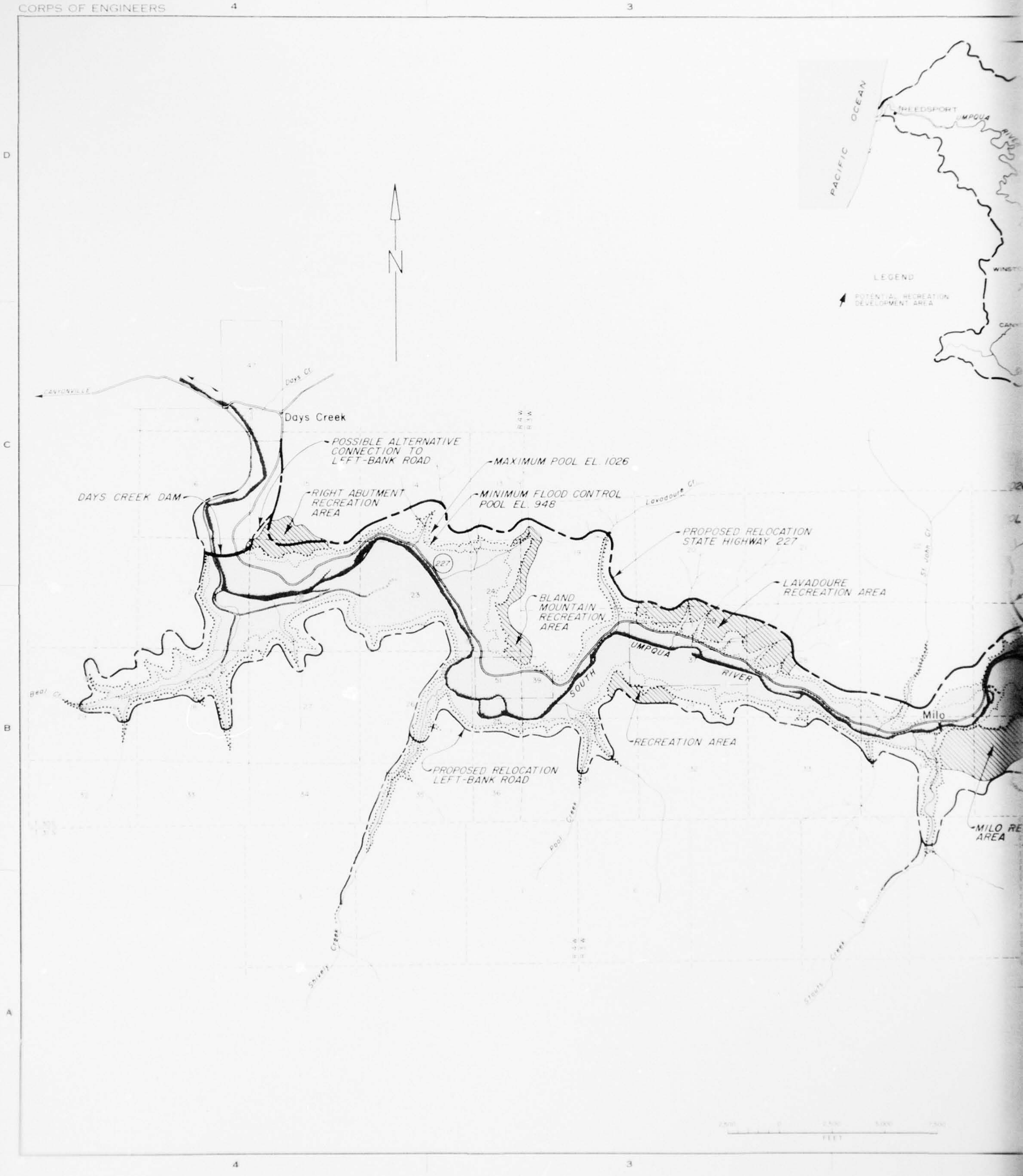
UMPQUA RIVER AND TRIBUTARIES
SOUTH UMPQUA RIVER
DAYS CREEK LAKE

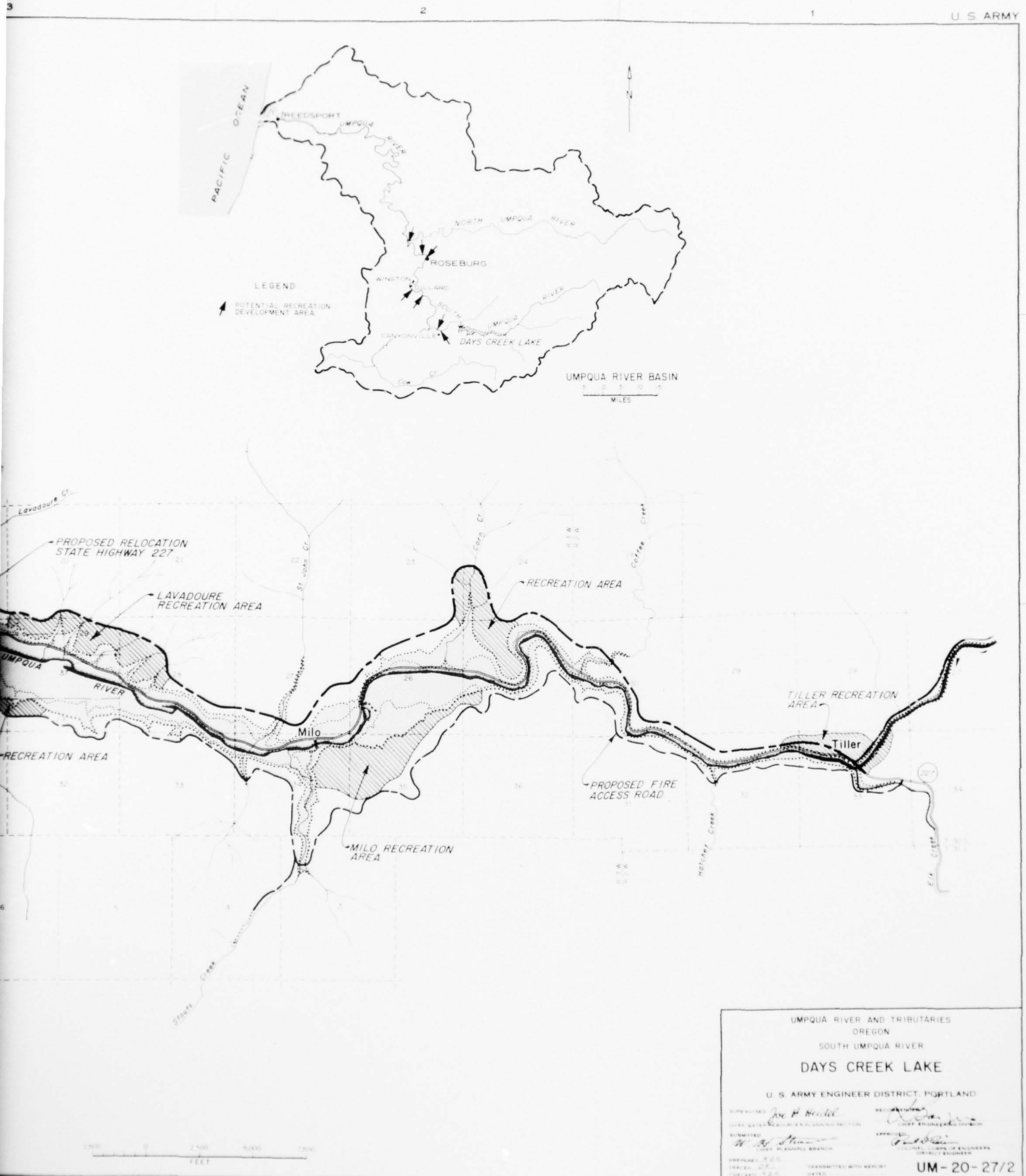
DAY-USE MARKET AREA

0 5 10 20 30

ONE INCH EQUALS
APPROXIMATELY 19.3 MILES

PLATE I


CORPS OF ENGINEERS
4
3
D
C
B
A
N
PACIFIC OCEAN
REEDSPORT
UMPQUA
RIVER
WINST
CANY
LEGEND
POTENTIAL RECREATION DEVELOPMENT AREA
CANYONVILLE
Days Cr.
Days Creek
POSSIBLE ALTERNATIVE CONNECTION TO LEFT-BANK ROAD
DAYS CREEK DAM
RIGHT ABUTMENT RECREATION AREA
MAXIMUM POOL EL. 1026
MINIMUM FLOOD CONTROL POOL EL. 948
Lavadoure Cr.
227
PROPOSED RELOCATION STATE HIGHWAY 227
LAVADOURE RECREATION AREA
BLAND MOUNTAIN RECREATION AREA
St. John Cr.
Beal Cr.
SOUTH
UMPQUA
RIVER
Milo
RECREATION AREA
PROPOSED RELOCATION LEFT-BANK ROAD
MILO RE
AREA
Pool Creek
Shively Creek
Stouts Creek
2500 0 2500 5000 7500
FEET



UMPQUA RIVER AND TRIBUTARIES
OREGON
SOUTH UMPQUA RIVER

DAYS CREEK LAKE

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SUPERVISED Joe H Heidel
CHIEF, WATER RESOURCES PLANNING SECTION

RECOMMENDED
CHIEF, ENGINEERING DIVISION

SUBMITTED
CHIEF, PLANNING BRANCH

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

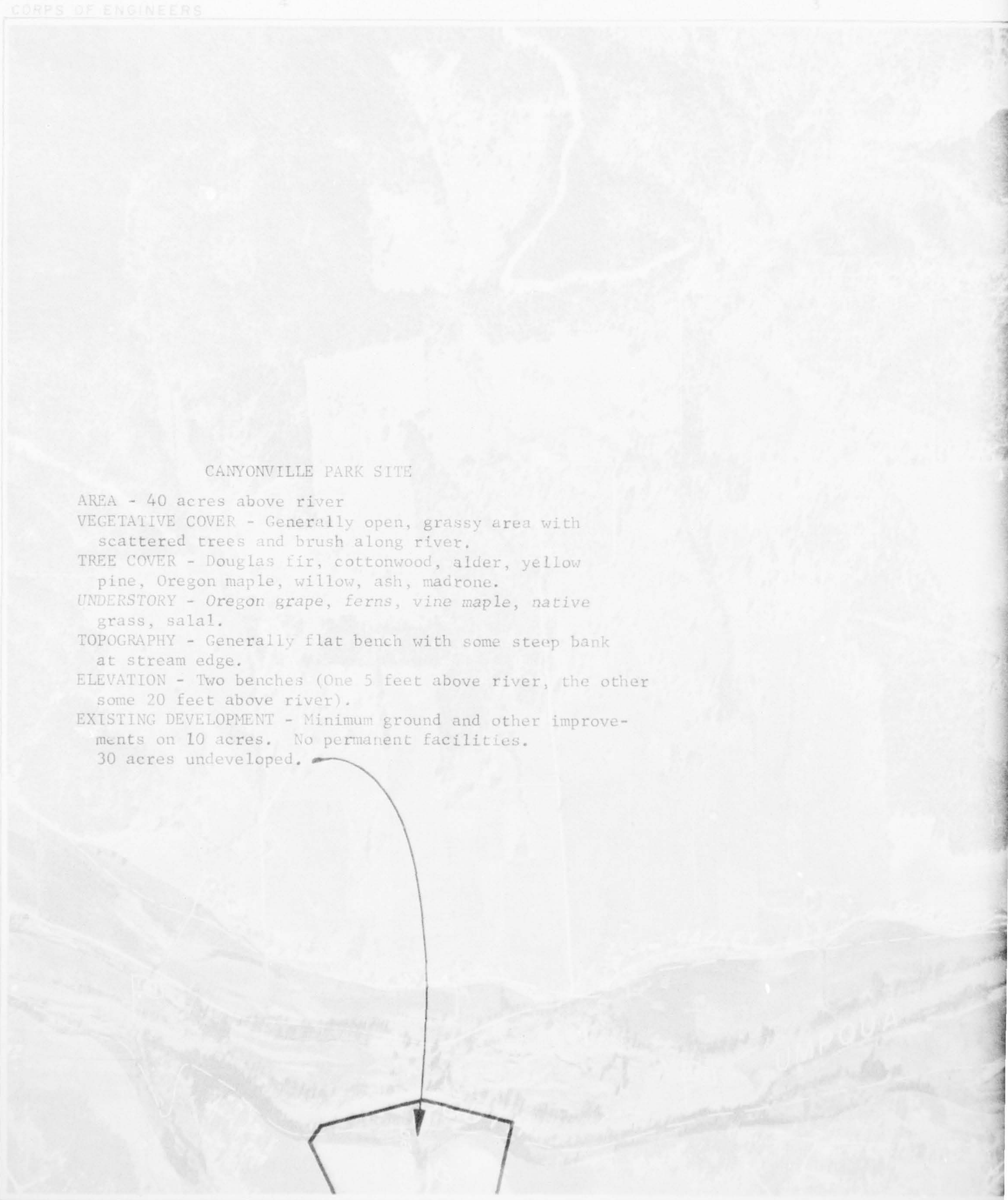
PREPARED
TRACED
CHECKED

TRANSMITTED WITH REPORT
DATED

UM-20-27/2

PLATE 2

2



CANYONVILLE PARK SITE

AREA - 40 acres above river

VEGETATIVE COVER - Generally open, grassy area with scattered trees and brush along river.

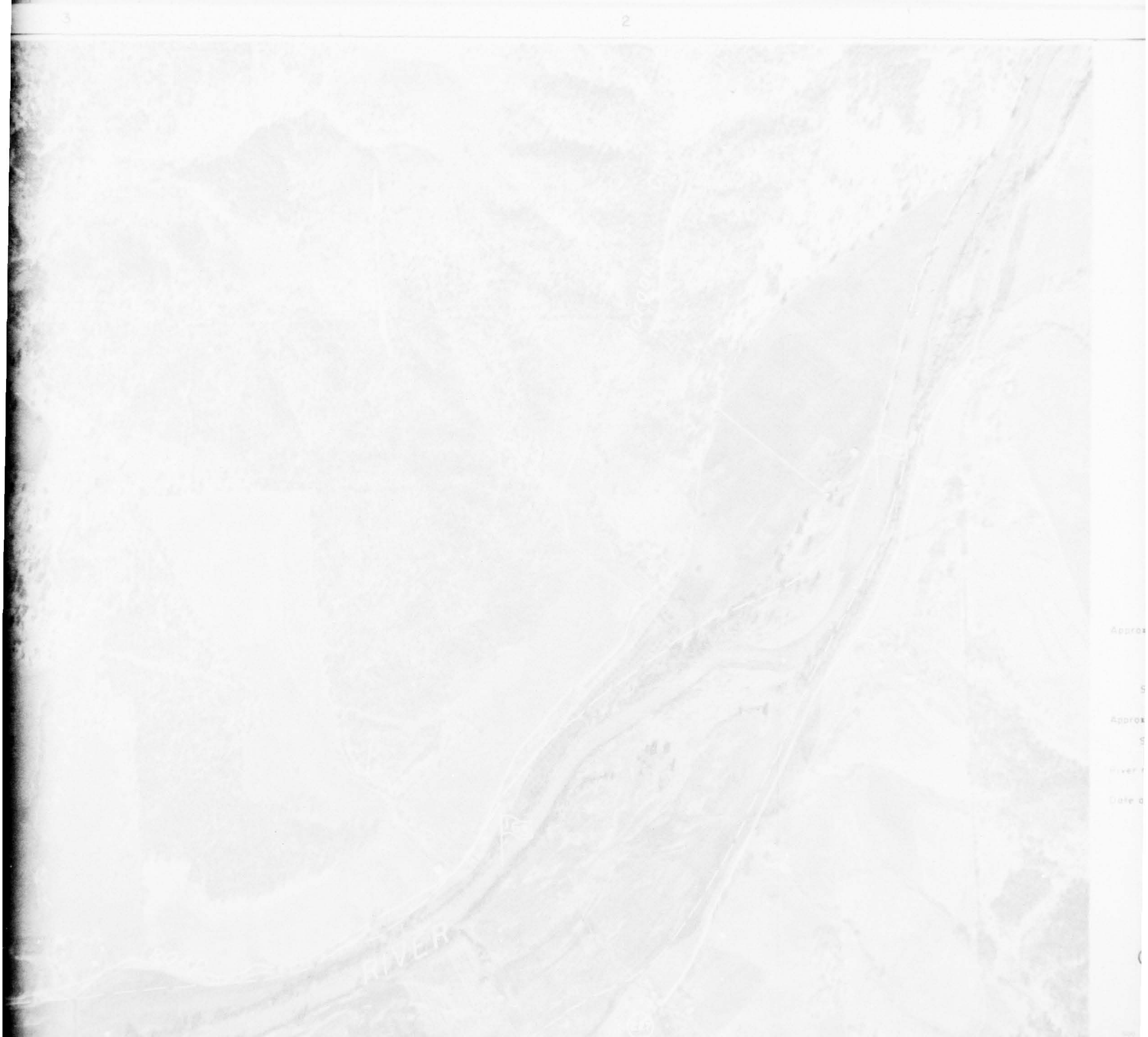
TREE COVER - Douglas fir, cottonwood, alder, yellow pine, Oregon maple, willow, ash, madrone.

UNDERSTORY - Oregon grape, ferns, vine maple, native grass, salal.

TOPOGRAPHY - Generally flat bench with some steep bank at stream edge.

ELEVATION - Two benches (One 5 feet above river, the other some 20 feet above river).

EXISTING DEVELOPMENT - Minimum ground and other improvements on 10 acres. No permanent facilities. 30 acres undeveloped.



2

LEGEND

Approximate area inundated by flood of December 1964

Stage 25.72 feet and discharge 60,200 c.f.s. at Tiller

Approximate limits of 1955 flood

Stage 20.85 feet and discharge 33,300 c.f.s. at Tiller

River miles from 1926 U.S.G.S. Survey 103

Date of photograph 2 March 1965

CANYONVILLE PARK SITE

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

SHEET NO. 27

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

3

AREA - 40 acres ab
VEGETATIVE COVER -
introduced plant
numerous fruit t
TREE COVER - Dougl
maple, willow, a
Domestics: frui
UNDERSTORY - Nativ
TOPOGRAPHY - Gener
bank at river.
ELEVATION - Two le
river, an island
EXISTING DEVELOPME
highly developed
paved roads & pa
proposed for acq

STANTON PARK SITE

AREA - 40 acres above river.

VEGETATIVE COVER - General open grass area with native and introduced plant materials. Some brush along river and numerous fruit trees

TREE COVER - Douglas fir, cottonwood, alder, yellow pine, maple, willow, ash, madrone;

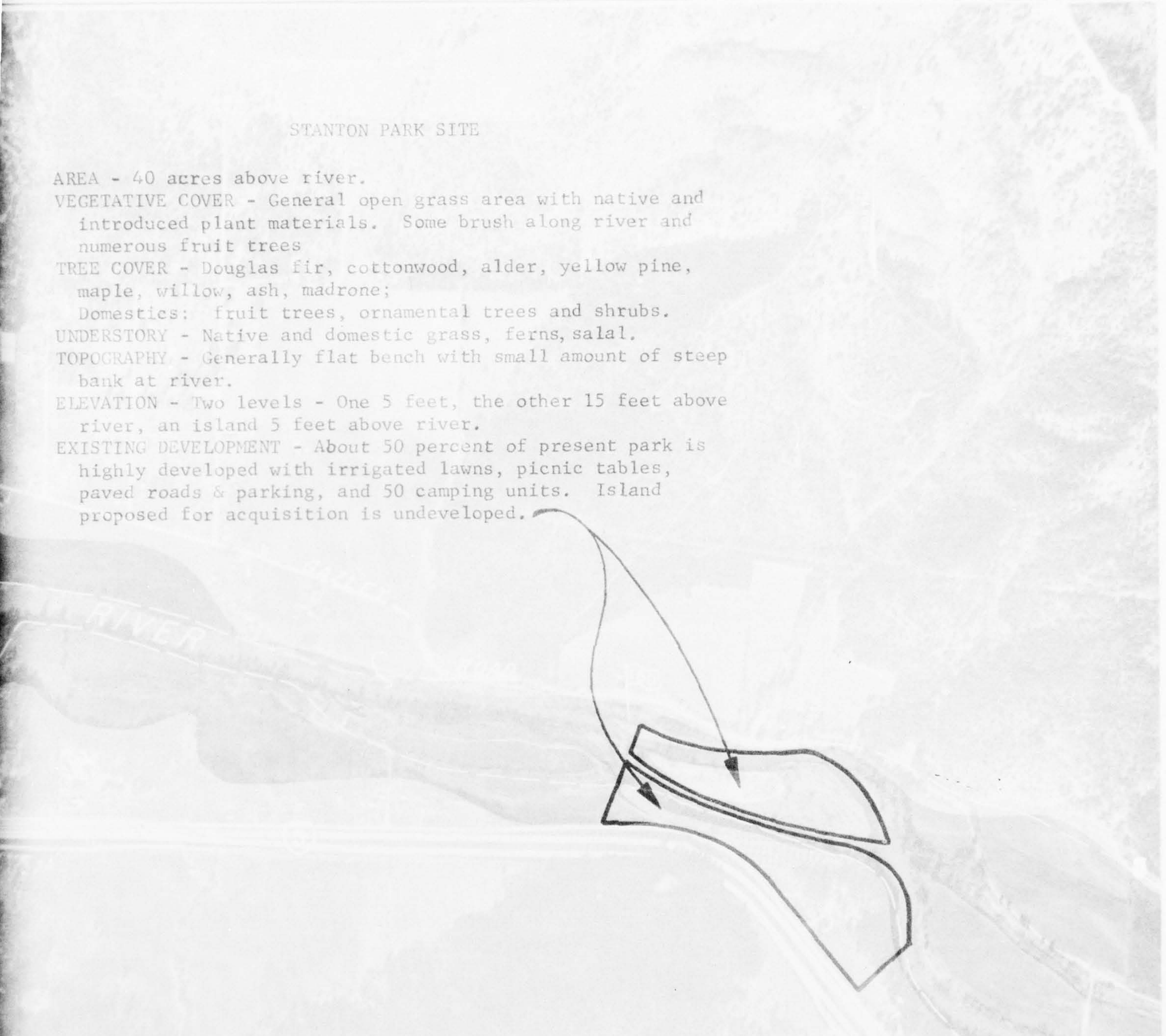
Domestics: fruit trees, ornamental trees and shrubs.

UNDERSTORY - Native and domestic grass, ferns, salal.

TOPOGRAPHY - Generally flat bench with small amount of steep bank at river.

ELEVATION - Two levels - One 5 feet, the other 15 feet above river, an island 5 feet above river.

EXISTING DEVELOPMENT - About 50 percent of present park is highly developed with irrigated lawns, picnic tables, paved roads & parking, and 50 camping units. Island proposed for acquisition is undeveloped.



SITE

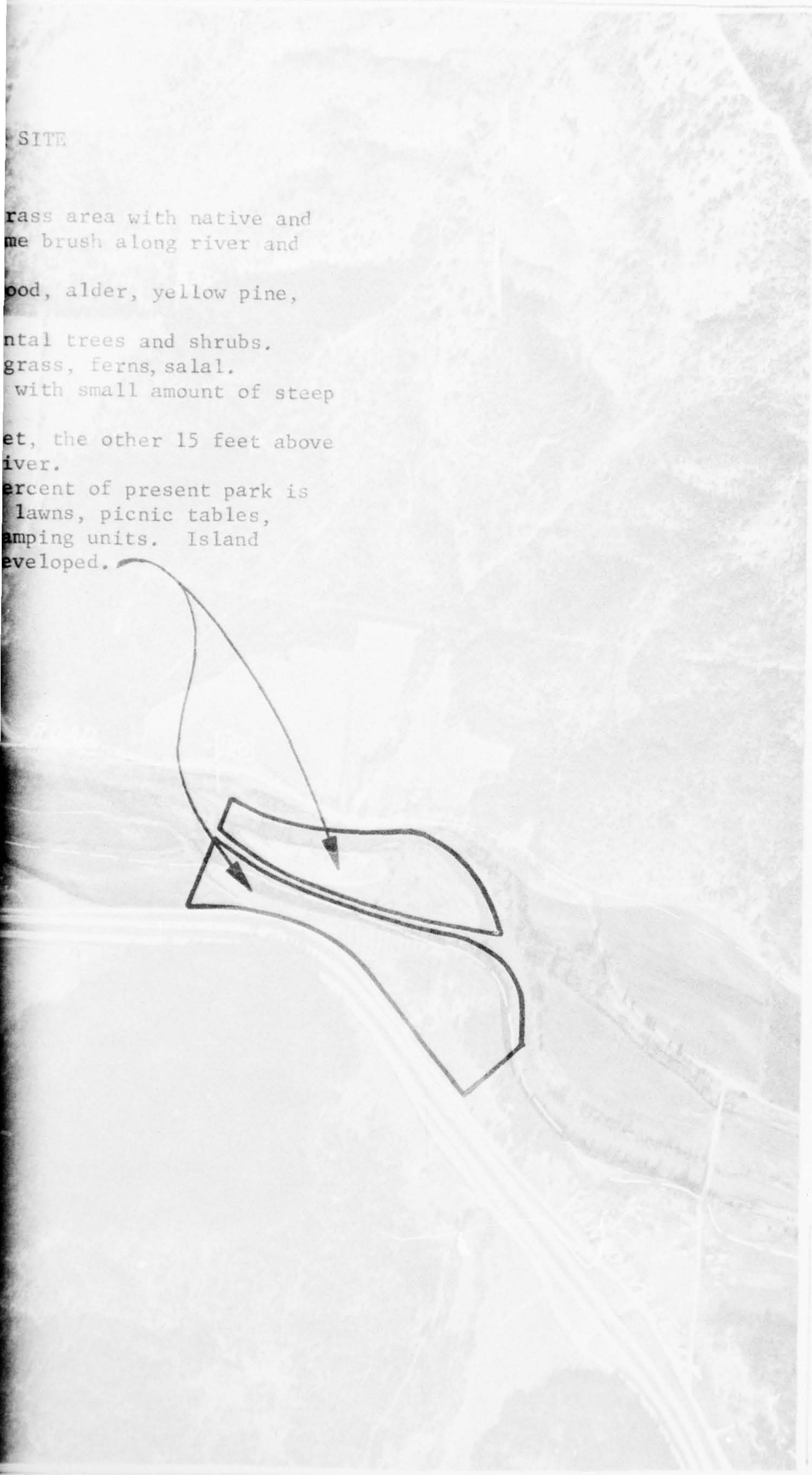
rass area with native and
me brush along river and

ood, alder, yellow pine,

ntal trees and shrubs.
grass, ferns, salal.
with small amount of steep

et, the other 15 feet above
iver.
ercent of present park is
lawns, picnic tables,
amping units. Island
eveloped.

U. S. ARMY



LEGEND

Approximate area inundated by flood of December 1964

Stage 25.72 feet and discharge 60,200 c.f.s. at Tiller

Approximate limits of 1955 flood

Stage 20.85 feet and discharge 33,300 cfs at Tiller

River miles from 1926 U.S.G.S. Survey 103

Date of photograph 2 March 1965

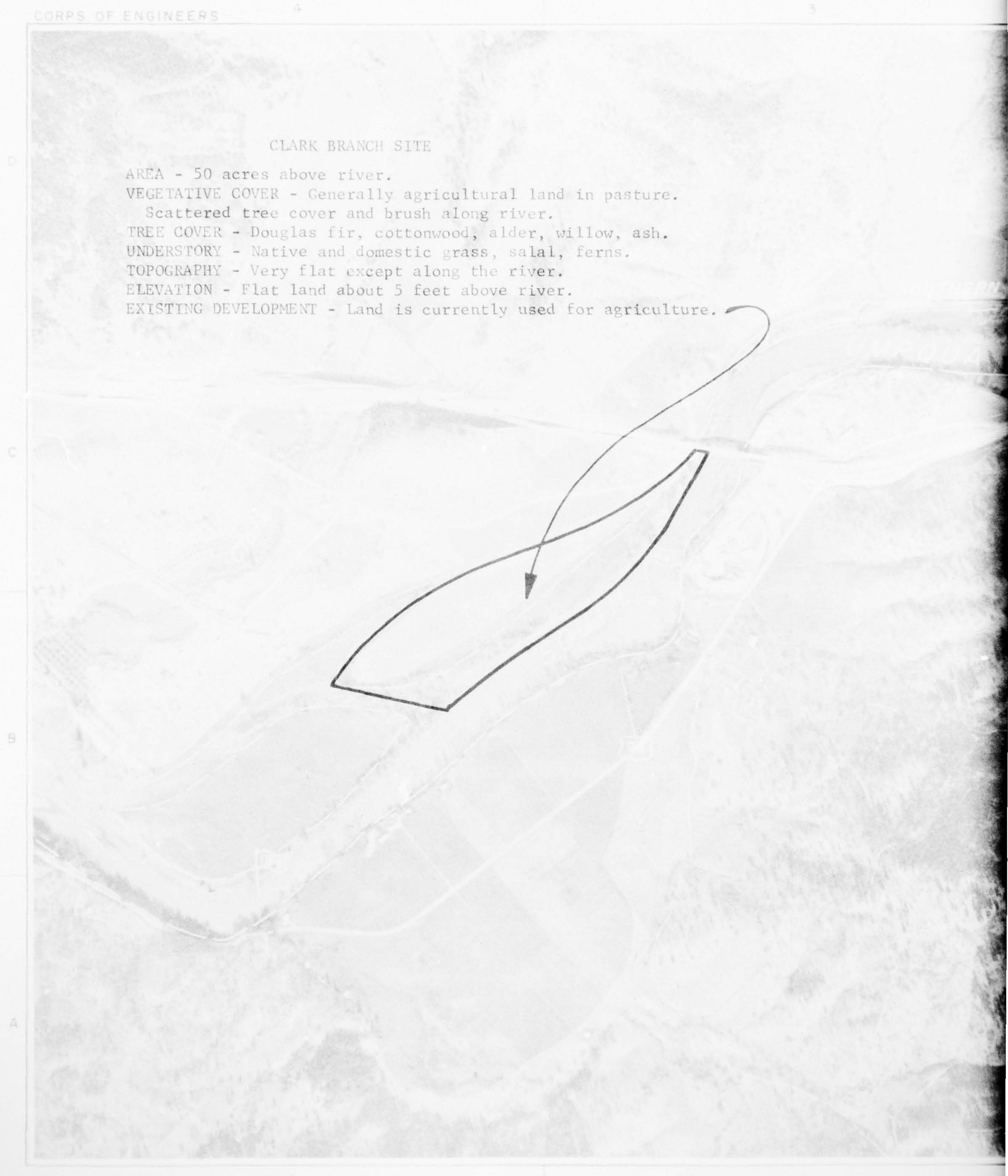
STANTON PARK SITE

SCALE IN FEET

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PLATE 4



CLARK BRANCH SITE

AREA - 50 acres above river.
VEGETATIVE COVER - Generally agricultural land in pasture. Scattered tree cover and brush along river.
TREE COVER - Douglas fir, cottonwood, alder, willow, ash.
UNDERSTORY - Native and domestic grass, salal, ferns.
TOPOGRAPHY - Very flat except along the river.
ELEVATION - Flat land about 5 feet above river.
EXISTING DEVELOPMENT - Land is currently used for agriculture.

Approximat

Stage

Stage

Approximat

Stage

Stage

River miles

Date of pho

CL

500

FI

SHEE

U.

U.S. ARMY

Approximate area inundated by [illegible]

Stage 34.5 feet and discharge 105,000 c.f.s. [illegible]

Stage 25.7 feet and discharge 63,000 c.f.s. [illegible]

Approximate limits of 1955 flood

Stage 31.5 feet and discharge 41,300 c.f.s. [illegible]

Stage 20.9 feet and discharge 33,300 c.f.s. [illegible]

River miles from 1909 U.S.G.S. Survey 104

Date of photograph 2 March 1966

CLARK BRANCH PARK SITE

SCALE IN FEET

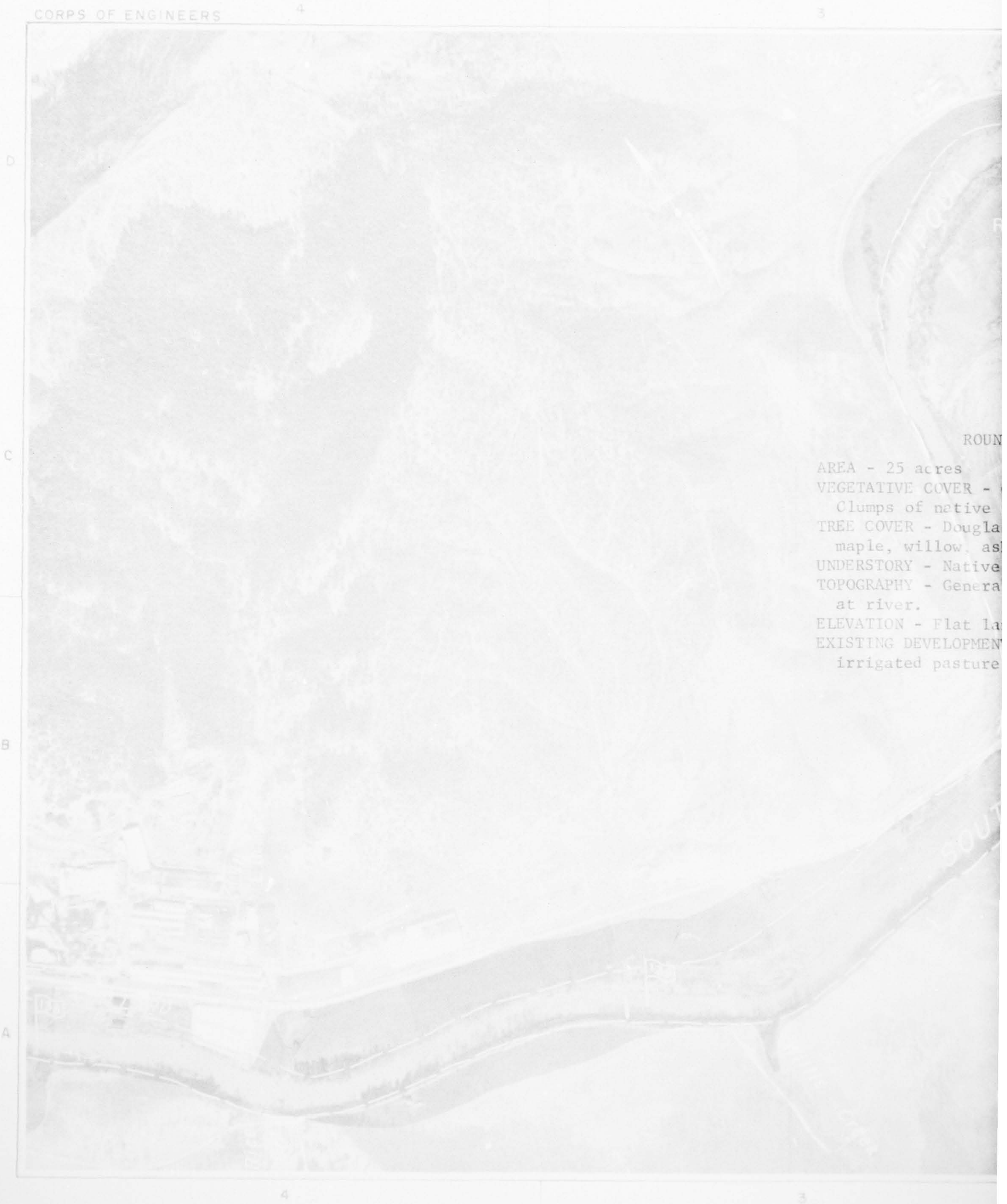
500 0 500 1000 1500 2000

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

SHEET NO. 19

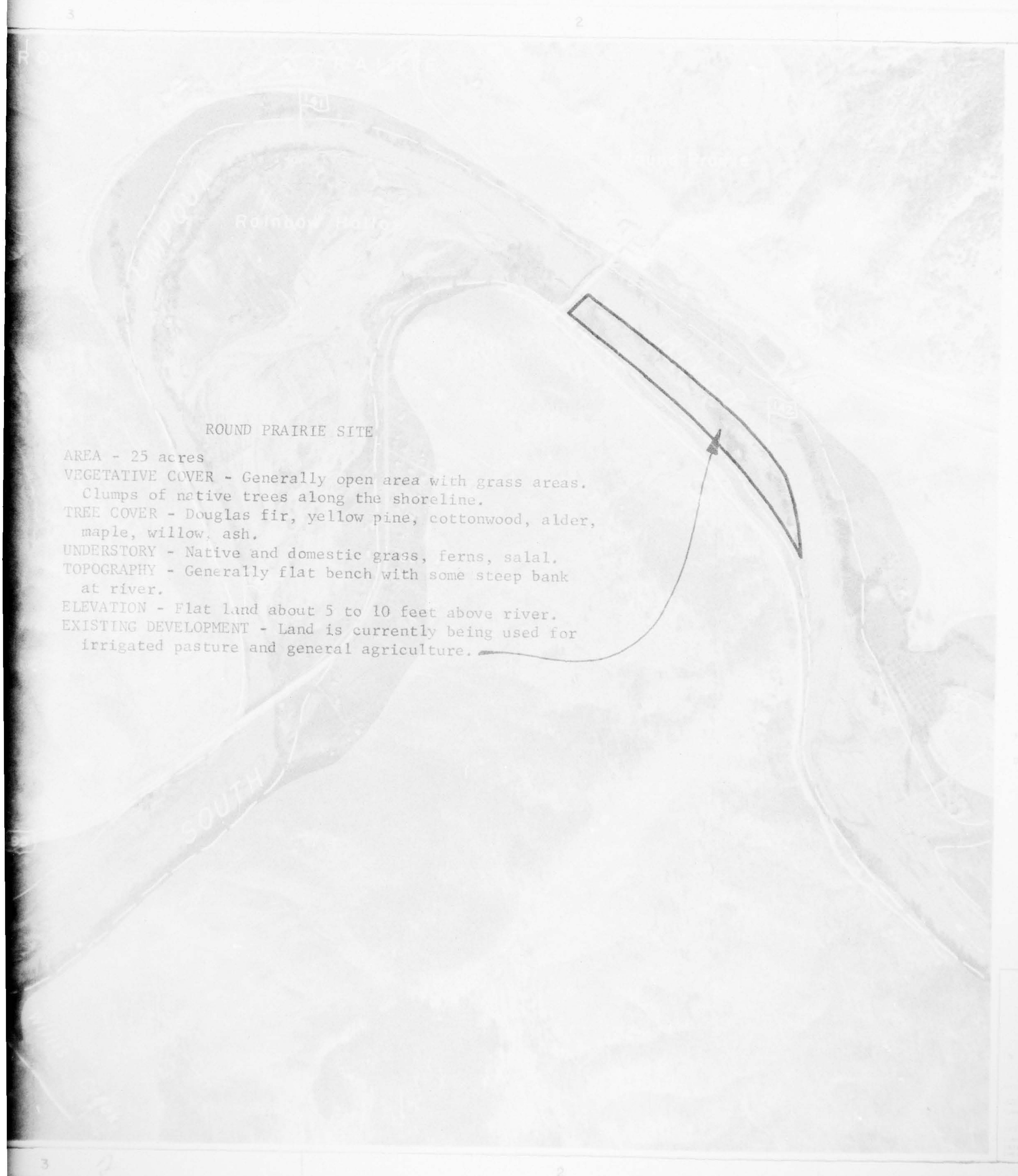
U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PLATE 5



ROUN

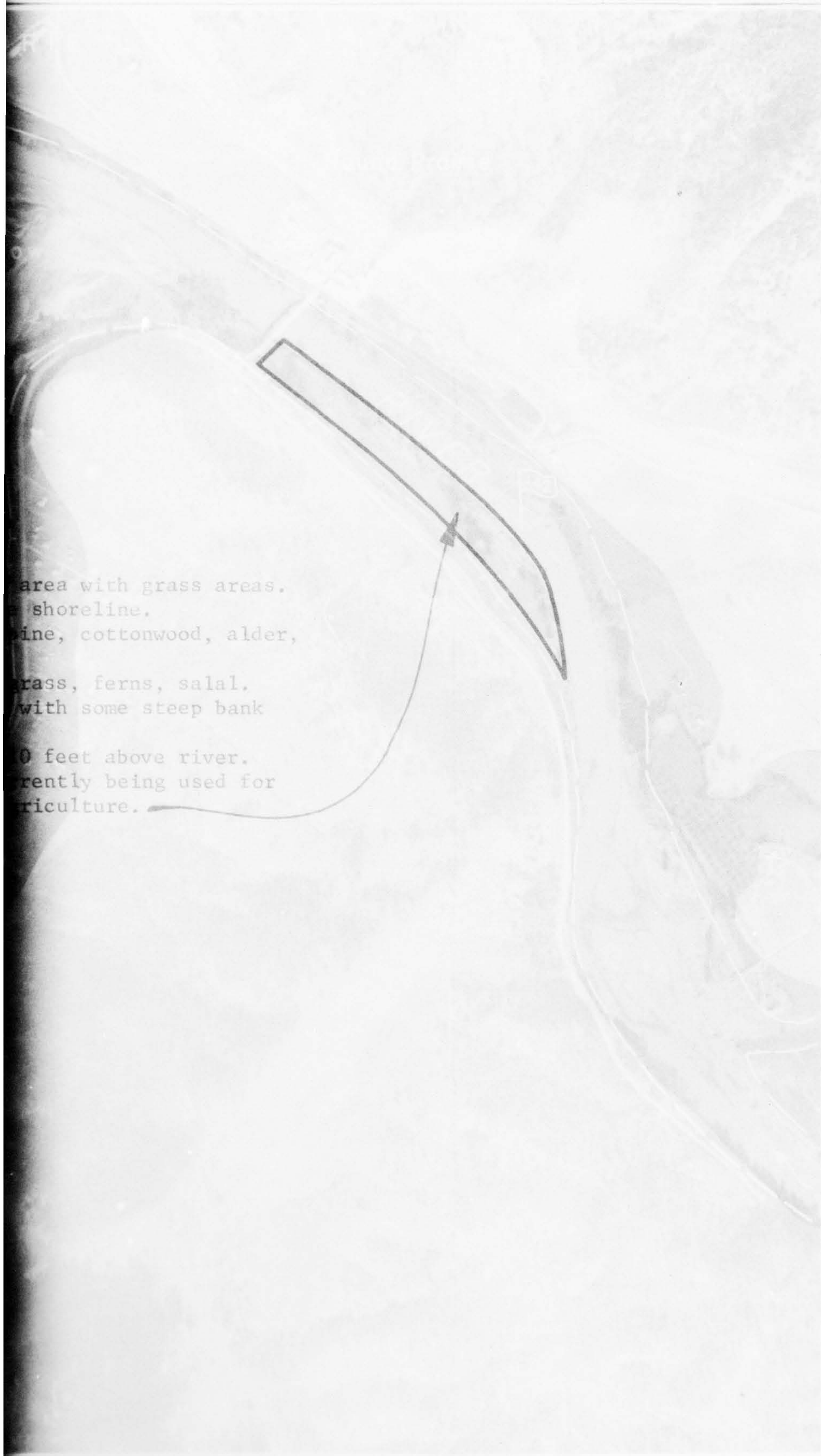
AREA - 25 acres
VEGETATIVE COVER -
Clumps of native
TREE COVER - Dougla
maple, willow, as
UNDERSTORY - Native
TOPOGRAPHY - Genera
at river.
ELEVATION - Flat la
EXISTING DEVELOPMEN
irrigated pasture



ROUND PRAIRIE SITE

AREA - 25 acres
VEGETATIVE COVER - Generally open area with grass areas. Clumps of native trees along the shoreline.
TREE COVER - Douglas fir, yellow pine, cottonwood, alder, maple, willow, ash.
UNDERSTORY - Native and domestic grass, ferns, salal.
TOPOGRAPHY - Generally flat bench with some steep bank at river.
ELEVATION - Flat land about 5 to 10 feet above river.
EXISTING DEVELOPMENT - Land is currently being used for irrigated pasture and general agriculture.

U. S. ARMY



LEGEND

Approximate area inundated by flood of December 1964

Stage 34.3 feet and discharge 105,000 c.f.s. at Winston

Stage 25.7 feet and discharge 60,000 c.f.s. at Tiller

Approximate limits of 1955 flood

Stage 31.5 feet and discharge 91,300 c.f.s. at Winston

Stage 20.9 feet and discharge 33,300 c.f.s. at Tiller

River miles from 1926 U.S.G.S. Survey

Date of photograph 2 March 1961

ROUND PRAIRIE PARK SITE

SCALE IN FEET

500 0 500 1000 1500 2000

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

AD-A043 962 ARMY ENGINEER DISTRICT PORTLAND OREG F/G 8/6
REVIEW REPORT ON UMPQUA RIVER AND TRIBUTARIES, OREGON, SOUTH UM--ETC(U)
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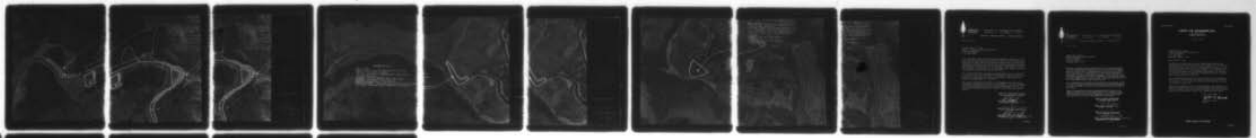

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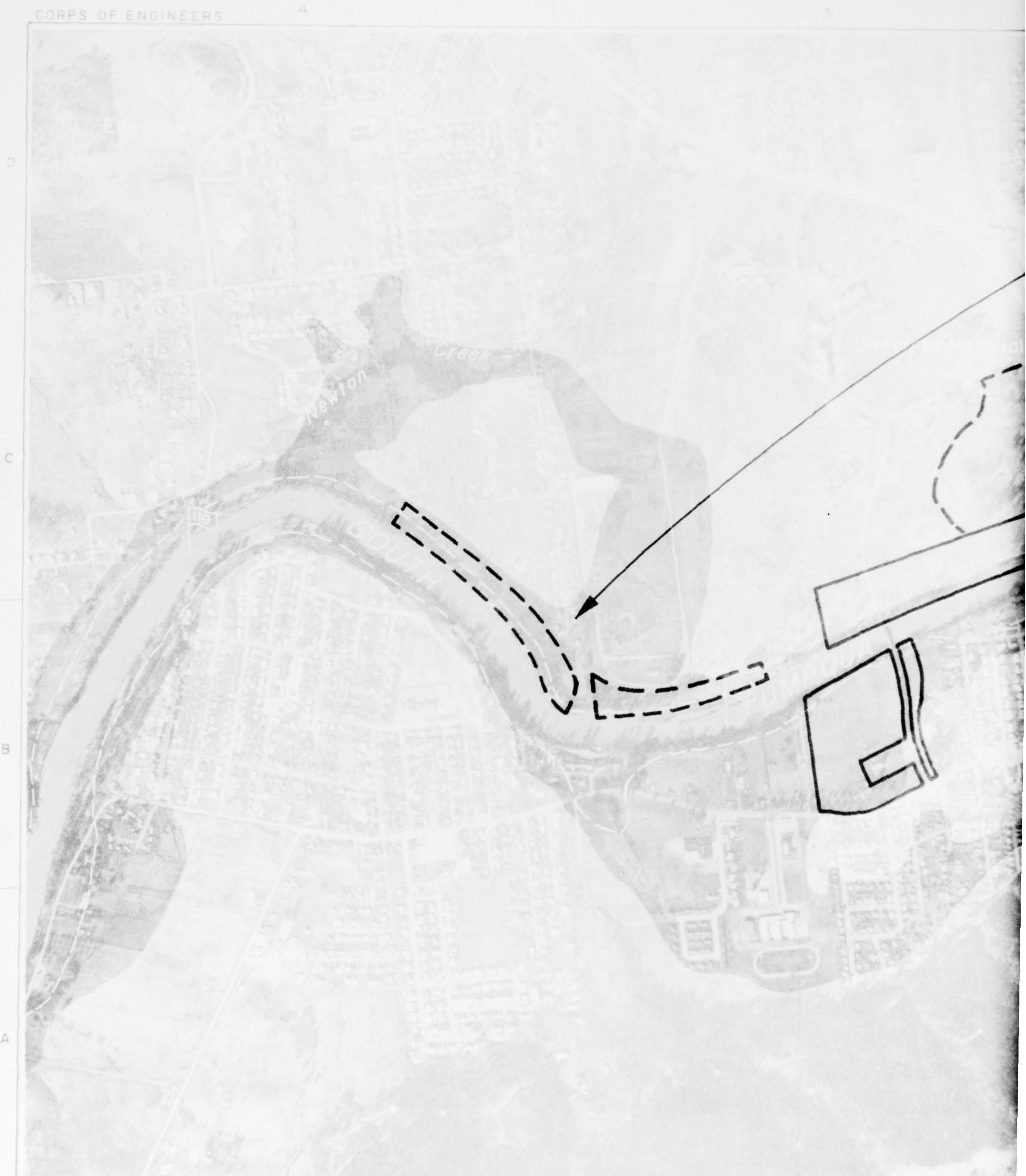
CORPS OF ENGINEERS
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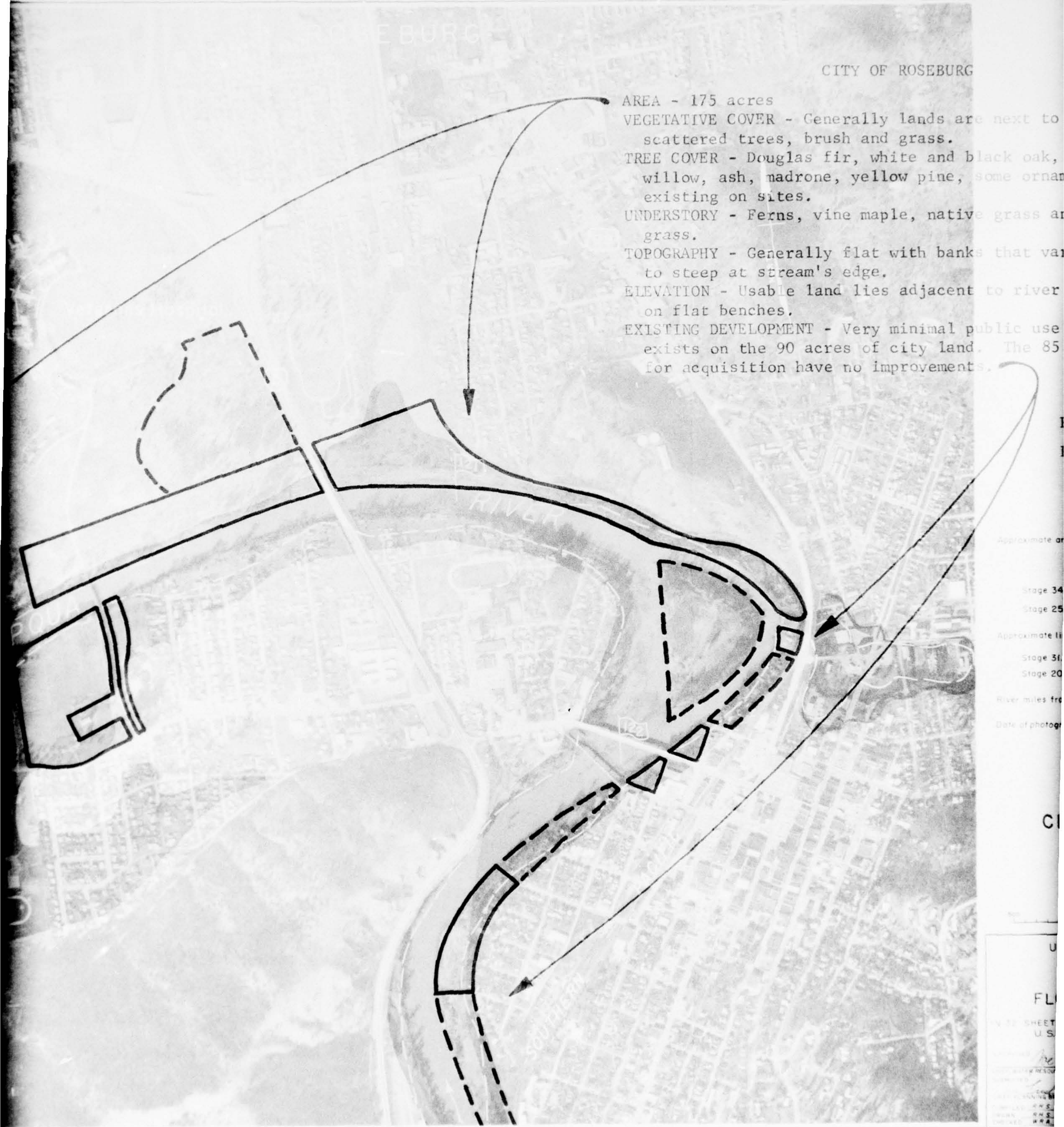


CITY OF ROSEBURG

AREA - 175 acres

VEGETATIVE COVER - Generally lands are next to scattered trees, brush and grass.

TREE COVER - Douglas fir, white and black oak, willow, ash, madrone, yellow pine, some ornam existing on sites.

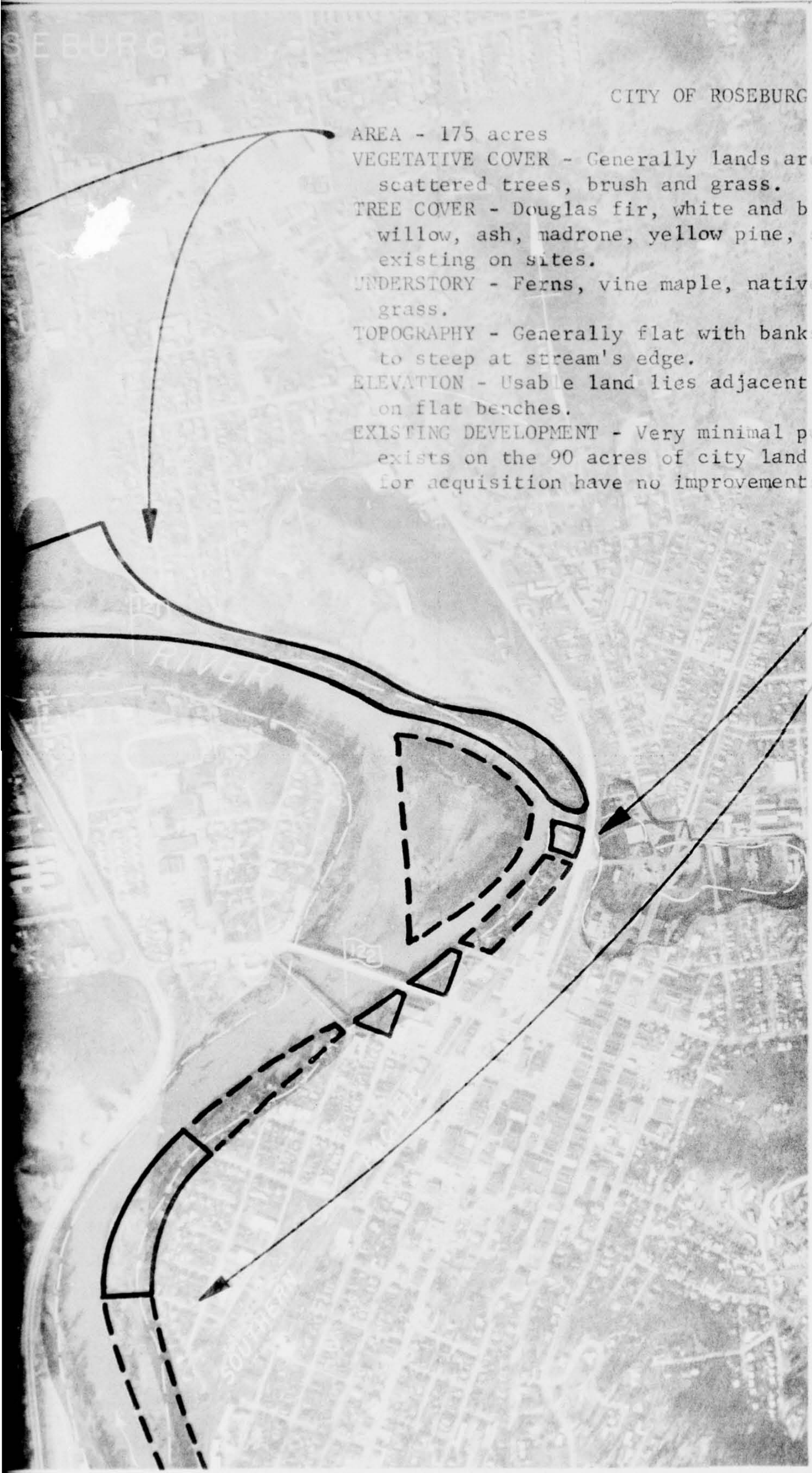
UNDERSTORY - Ferns, vine maple, native grass ar grass.

TOPOGRAPHY - Generally flat with banks that var to steep at stream's edge.

ELEVATION - Usable land lies adjacent to river on flat benches.

EXISTING DEVELOPMENT - Very minimal public use exists on the 90 acres of city land. The 85 for acquisition have no improvements.

U. S. ARMY



CITY OF ROSEBURG

AREA - 175 acres

VEGETATIVE COVER - Generally lands are next to river and have scattered trees, brush and grass.

TREE COVER - Douglas fir, white and black oak, cottonwood, willow, ash, madrone, yellow pine, some ornamental stock existing on sites.

UNDERSTORY - Ferns, vine maple, native grass and domestic grass.

TOPOGRAPHY - Generally flat with banks that vary from moderate to steep at stream's edge.

ELEVATION - Usable land lies adjacent to river and above river on flat benches.

EXISTING DEVELOPMENT - Very minimal public use development exists on the 90 acres of city land. The 85 acres proposed for acquisition have no improvements.

PRESENT ———

POTENTIAL — —

LEGEND

Approximate area inundated by flood of December 1964

Stage 34.3 feet and discharge 105,000 c.f.s. at Winston

Stage 25.7 feet and discharge 60,000 c.f.s. at Tiller

Approximate limits of 1955 flood

Stage 31.5 feet and discharge 91,300 c.f.s. at Winston

Stage 20.9 feet and discharge 33,300 c.f.s. at Tiller

River miles from 1926 U.S.G.S. Survey 103

Date of photograph 2 March 1965

CITY OF ROSEBURG PARK SITES

Rev. Aug. 1966

SCALE IN FEET

500 0 500 1000 1500 2000

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

IN 32 SHEETS SHEET NO. 13

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

CHIEF, ENGINEERING DIVISION

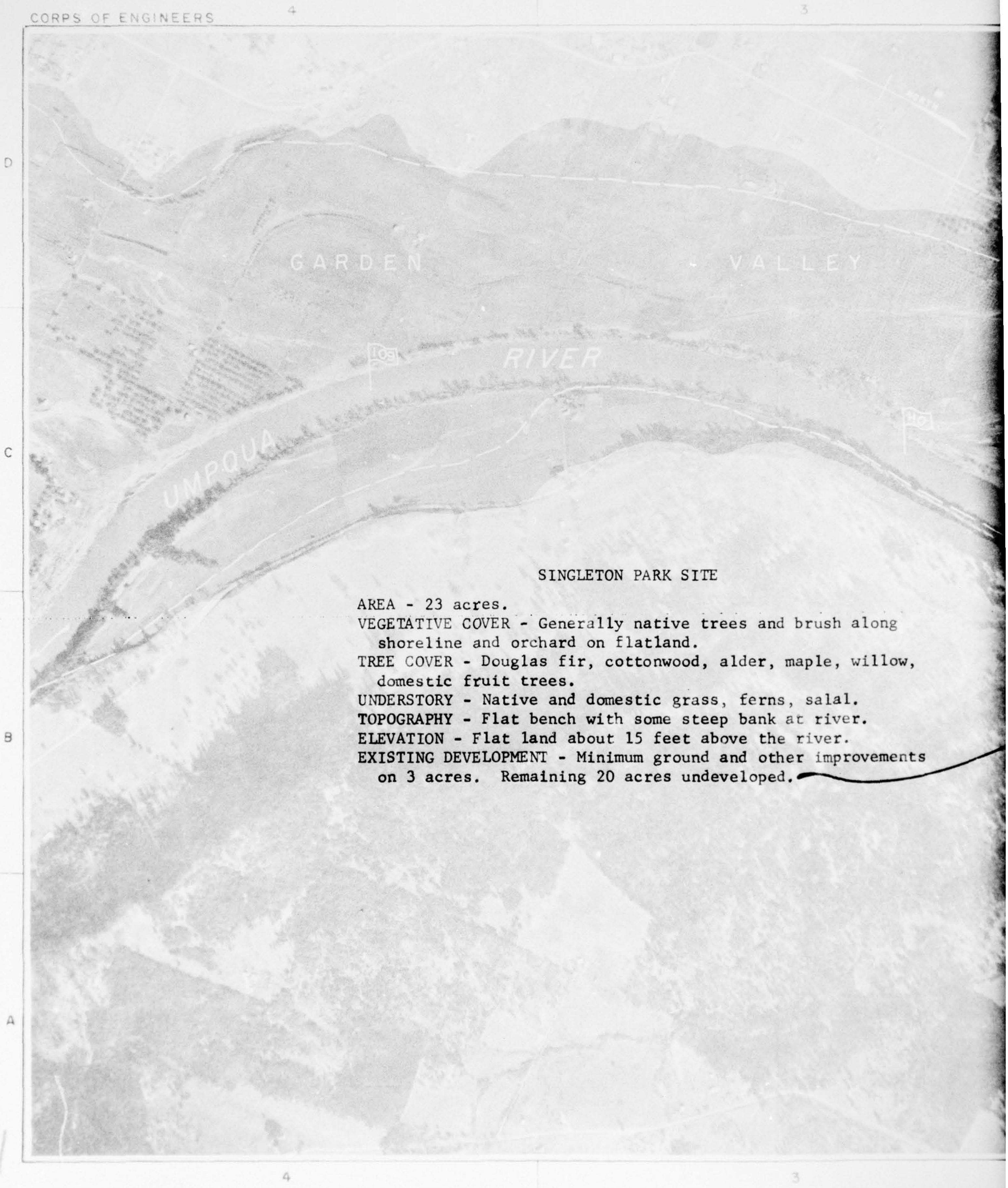
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

COMPILED
DRAWN
CHECKED

TRANSMITTED WITH REPORT DATED JANUARY 1966

3

PLATE 7



SINGLETON PARK SITE

AREA - 23 acres.
VEGETATIVE COVER - Generally native trees and brush along shoreline and orchard on flatland.
TREE COVER - Douglas fir, cottonwood, alder, maple, willow, domestic fruit trees.
UNDERSTORY - Native and domestic grass, ferns, salal.
TOPOGRAPHY - Flat bench with some steep bank at river.
ELEVATION - Flat land about 15 feet above the river.
EXISTING DEVELOPMENT - Minimum ground and other improvements on 3 acres. Remaining 20 acres undeveloped.

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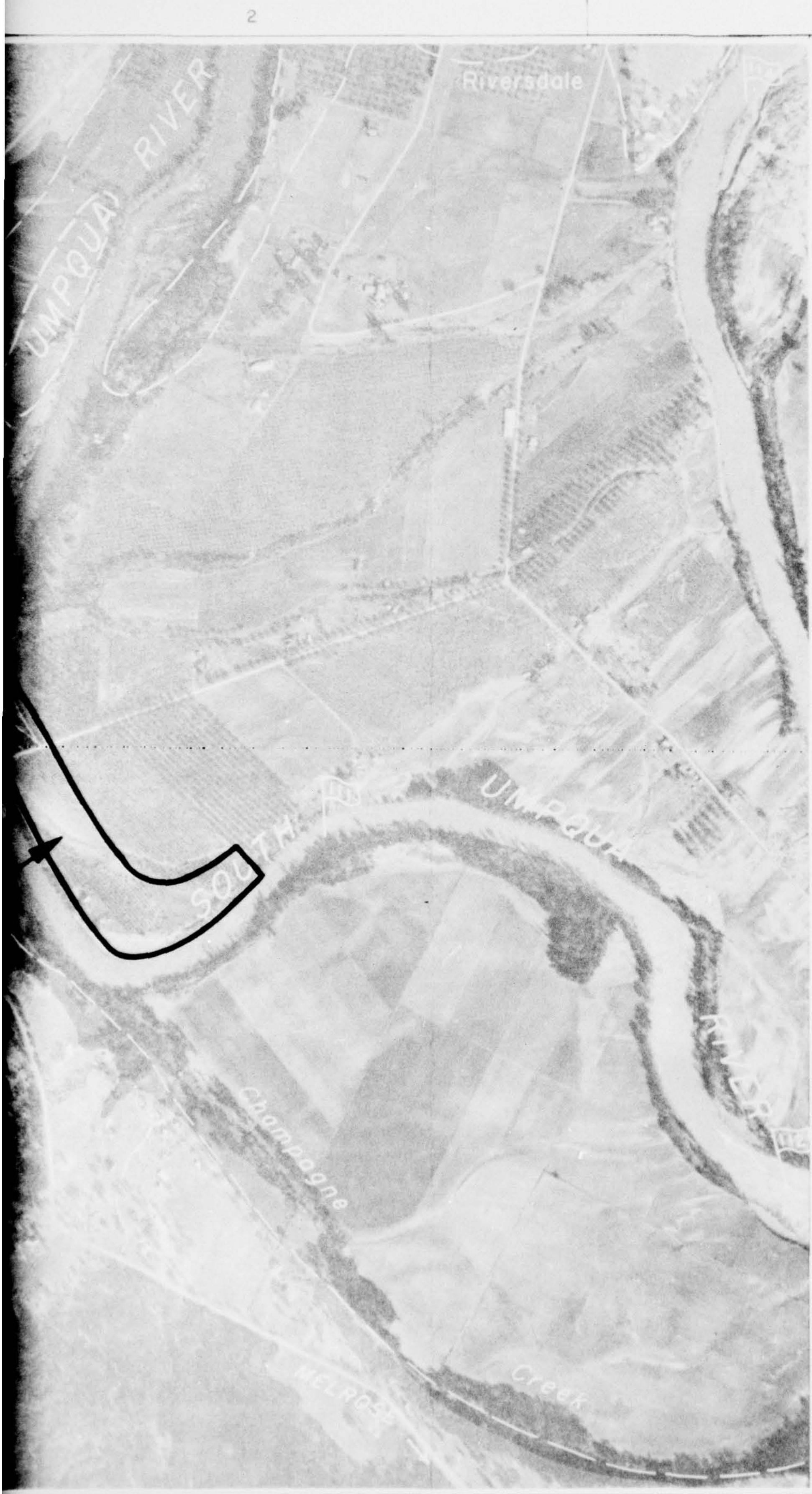
U. S. ARMY



LEGEND

Approximate area inundated by flood of December 1964

Stage 34.28 feet and discharge 105,000 c.f.s. at Winston

Stage 34.11 feet and discharge 111,000 c.f.s. at Winchester

Approximate limits of 1955 flood

Stage 31.55 feet and discharge 91,300 c.f.s. at Winston

Stage 29.14 feet and discharge 92,500 c.f.s. at Winchester

River miles from 1926 U.S.G.S. Survey 103

Date of photograph 2 March 1965

SINGLETON PARK SITE

Rev. Aug. 1966

SCALE IN FEET

500 0 500 1000 1500 2000

UMPQUA RIVER BASIN, OREGON
UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

IN 32 SHEETS SHEET NO. 10
U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

RECOMMENDED
CHIEF, WATER RESOURCES PLANNING SECTION
SUBMITTED
CHIEF, PLANNING BRANCH
RECOMMENDED
CHIEF, ENGINEERING DIVISION
APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

COMPILED RHS
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CHECKED WRA
TRANSMITTED WITH REPORT
DATED JANUARY 1966

PLATE 8

CORPS OF ENGINEERS

AREA
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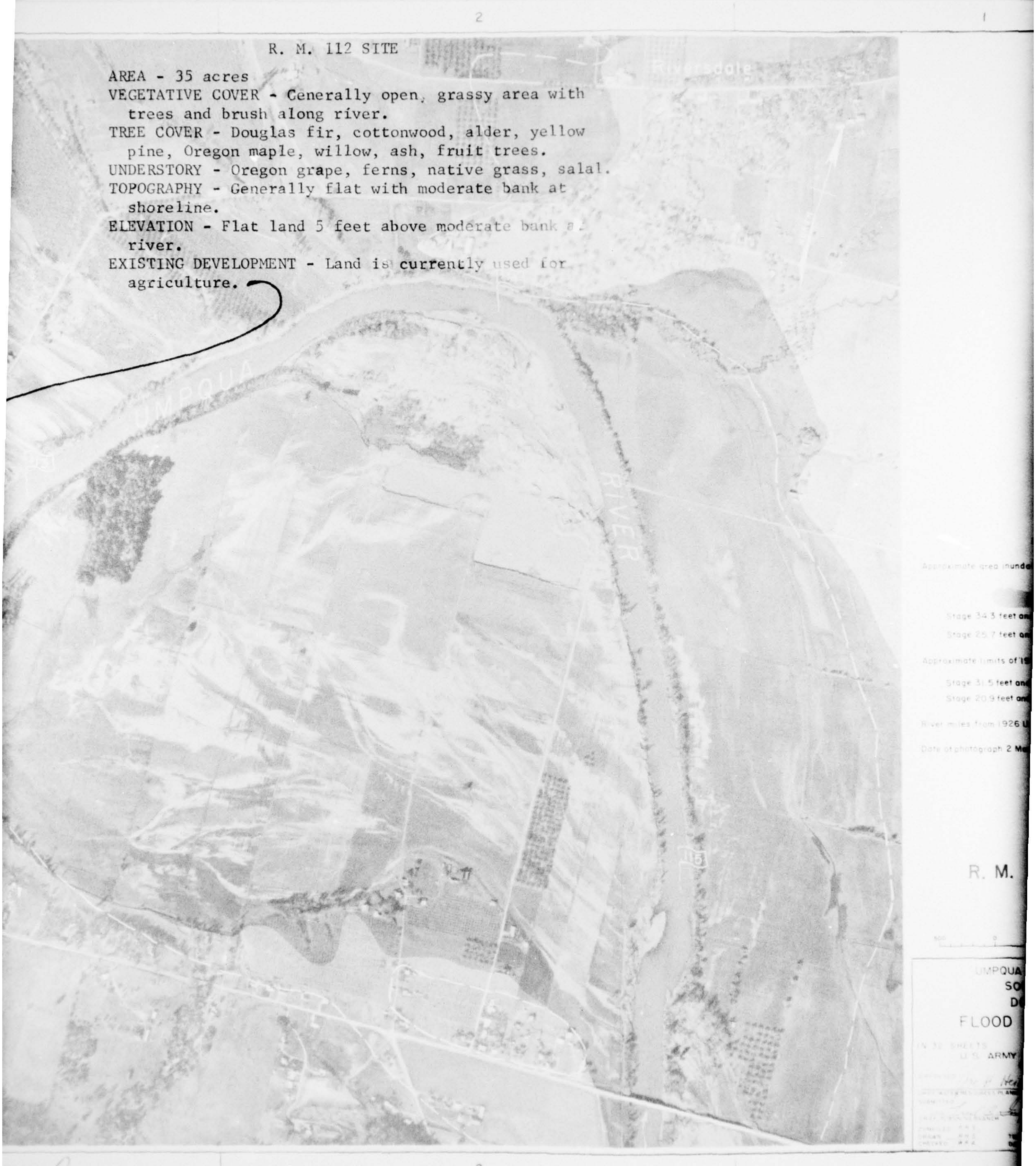
R. M. 112 SITE

AREA - 35 acres
VEGETATIVE COVER - Generally open, grassy area with trees and brush along river.
TREE COVER - Douglas fir, cottonwood, alder, yellow pine, Oregon maple, willow, ash, fruit trees.
UNDERSTORY - Oregon grape, ferns, native grass, salal.
TOPOGRAPHY - Generally flat with moderate bank at shoreline.
ELEVATION - Flat land 5 feet above moderate bank at river.
EXISTING DEVELOPMENT - Land is currently used for agriculture.



2

U. S. ARMY

112 SITE

erally open, grassy area with
g river.
ir, cottonwood, alder, yellow
willow, ash, fruit trees.
ape, ferns, native grass, salal.
flat with moderate bank at

5 feet above moderate bank at

Land is currently used for

LEGEND

Approximate area inundated by flood of December 1964

Stage 34.3 feet and discharge 105,000 c.f.s. at Winston

Stage 25.7 feet and discharge 60,000 c.f.s. at Tiller

Approximate limits of 1955 flood

Stage 31.5 feet and discharge 91,300 c.f.s. at Winston

Stage 20.9 feet and discharge 33,300 c.f.s. at Tiller

River miles from 1926 U.S.G.S. Survey 103

Date of photograph 2 March 1965

R. M. 112 PARK SITE

Rev. Aug. 1965

SCALE IN FEET
500 0 500 1000 1500 2000

UMPQUA RIVER BASIN, OREGON
SOUTH UMPQUA RIVER
DOUGLAS COUNTY
FLOOD PLAIN INFORMATION

IN 32 SHEETS SHEET NO. 11
U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

APPROVED
COLONEL, CORPS OF ENGINEERS
DISTRICT ENGINEER

DRAWN R.H.S.
CHECKED W.R.A.
TRANSMITTED WITH REPORT
DATED JANUARY 1966

PLATE 9

3

DOUGLAS COUNTY

BOARD OF COMMISSIONERS
STANFORD BUELL RAY E. DOERNER AL FLEGEL

COURTHOUSE . . . ROSEBURG, OREGON 97470 TELEPHONE 503/672-3311

July 19, 1971

Colonel Paul D. Triem
District Engineer, Portland District
Corps of Engineers
P. O. Box 2946

After consideration of the expected recreational resource to result from the proposed Days Creek Lake Project as discussed with personnel of your office, the Douglas County Board of County Commissioners intends to participate with other non-Federal agencies and the Corps of Engineers in the planning, development, and administration of that resource in compliance with Public Law 89-72 (the Federal Water Project Recreation Act).

It is understood that non-Federal participants will be required to bear not less than one-half the separable project costs allocated to recreation and to operate, maintain, and provide the necessary replacement of facilities.

The actual scheduling and scope of development and division of non-Federal responsibility will be determined by mutual agreement by the participants as project planning progresses, and will be contingent upon availability of funds to the respective participants.

BOARD OF COUNTY COMMISSIONERS
OF DOUGLAS COUNTY, OREGON

By Al Flegel
Al Flegel, Chairman

By Ray E Doerner
Ray E Doerner, Commissioner

By Stanford Buell
Stanford Buell, Commissioner

EXHIBIT 1

DOUGLAS COUNTY
BOARD OF COMMISSIONERS
STANFORD BUELL RAY E. DOERNER AL FLEGEL
COURTHOUSE . . . ROSEBURG, OREGON 97470 TELEPHONE 503/672-3311

July 27, 1971

Colonel Paul D. Triem
District Engineer, Portland District
Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

We expect the recreational resource of South Umpqua River downstream from the proposed Days Creek Lake project to be significantly improved because of that project. Understanding that that area of improvement will be proposed as an authorized part of the project, the Douglas County Board of County Commissioners intends to participate with other non-Federal agencies and the Corps of Engineers in the planning, development, and administration of that resource in compliance with Public Law 89-72 (the Federal Water Project Recreation Act)

It is understood that non-Federal participants will be required to bear not less than one-half the separable project costs allocated to recreation and to operate, maintain, and provide the necessary replacement of facilities.

The actual scheduling and scope of development and division of non-Federal responsibility will be determined by mutual agreement by the participants as project planning progresses, and will be contingent upon availability of funds to the respective participants.

BOARD OF COUNTY COMMISSIONERS
OF DOUGLAS COUNTY, OREGON

By Al Flegel
Al Flegel, Chairman

By Ray E. Doerner
Ray E. Doerner, Commissioner

By Stanford Buell
Stanford Buell, Commissioner

EXHIBIT 2

Office of the Mayor Phone 673-4457

CITY OF ROSEBURG
744 S. E. Rose Street
ROSEBURG, OREGON 97470

July 28, 1971

Colonel Paul D. Triem
District Engineer, Portland District
Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear Colonel Triem:

We expect the recreational resource of South Umpqua River downstream from the proposed Days Creek Lake project to be significantly improved because of that project. Understanding that area of improvement within the City will be proposed as an authorized part of the project, the City of Roseburg intends to participate with the Corps of Engineers in the planning, development, and administration of that resource in compliance with Public Law 89-72 (the Federal Water Project Recreation Act).

It is understood that non-Federal participants will be required to bear not less than one-half the separable project costs allocated to recreation, and to operate, maintain, and provide the necessary replacement of facilities.

The actual scheduling and scope of development, and division of non-Federal responsibility, will be determined by mutual agreement by the participants as project planning progresses, and will be contingent upon availability of funds to the respective participants.

Very truly yours,

Wm T. Evans

William T. Evans
Mayor

Timber Capital of the Nation

EXHIBIT 3

OREGON STATE
HIGHWAY DIVISION

HIGHWAY BUILDING • SALEM, OREGON • 97310

July 26, 1971

Colonel Paul D. Triem
District Engineer, Portland Dist.
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Colonel Triem:

After consideration of the expected recreational resource to result from the proposed Days Creek Lake project as discussed with personnel of your office, the State Parks and Recreation Division does not wish to participate in development and administration of that resource. We do, however, have an interest in the public's recreational enjoyment of the project. We would be willing to participate in the overall recreational and state highway planning, if it would be beneficial to you.

We appreciate the opportunity to review the proposal and the courtesy extended by your people during the joint investigation.

Attached for your information is our preliminary analysis of the Days Creek Reservoir recreation potentials and requirements.

Very truly yours,

R. L. Porter
State Highway Engineer

By David G Talbot
David G. Talbot
State Parks Superintendent

Attach.

EXHIBIT 4.1

Preliminary An sis of Recreation Potentials a Requirements

DAYS CREEK RESERVOIR, SOUTH UMPQUA RIVER, OREGON

June 28, 1971

The following comments were prepared by the Oregon State Parks and Recreation planning staff in response to the June 8, 1971 request of the Corps of Engineers for an early evaluation of the recreational resources of the project. They are based upon the June 8 data provided by the Corps of Engineers and a joint field inspection made of the area on June 15 by Recreation Planners Ira Moore and Bernard Bishop of the Corps of Engineers, Portland; Tom Keel, Director of the Douglas County Parks System; Keith Shone, Recreation Specialist of the Bureau of Outdoor Recreation; and Richard McCosh, Landscape Architect of the Oregon State Parks and Recreation office.

General Recreation Impact

The project would provide a large body of water in an area where it would be significant and favorable to recreational use. This use would be primarily by the residents of Douglas County and the tourists traveling on nearby Interstate Highway 5. The statewide recreation plan indicates a shortage of natural lakes and reservoirs in this area. Attractive existing lakes and proposed reservoirs within the surrounding counties of Jackson, Josephine, Coos, Klamath and Lane will reduce the extent of inter-county recreation demand upon the Day Creek Reservoir for recreational uses, unless an exceptional fishery is developed.

The existing section of the South Umpqua River which would be inundated is primarily of state recreation significance in relation to its effects on the anadromous fishery and the downstream recreation related to this resource. This stretch of river is also bordered by State Highway 227 for some 10 miles along which the highway shoulders provide easy fisherman access and there is some pleasure driving scenic interest. Only one small county park would be inundated, and the general overall scenic losses would be considerably less than in the upper South Umpqua River basin or the North Umpqua River areas in this vicinity of the state.

There are numerous state and county parks and recreational areas downstream which would be benefited by the protection afforded by flood control as well as the increased summer flows in the dry season.

EXHIBIT 4.2

Reservoir Recreation Sites and Shoreline Scenic Values

Information is limited at this time, since there is no indication of how shoreline recreation values might be affected by the relocation of State Highway 227, the need for material sources for the dam and roads, or the Bureau of Land Management's future logging program for the extensive O&C lands at the area. Water quality and fishery values are also undetermined.

There are several potential shoreline recreation sites available on the proposed reservoir where topography and vegetation could be favorable to public use as outlined by the Corps of Engineers' recreation planners.

Our review of the area indicates that the most favorable combination of shoreline topography and useful recreation areas overall would be possible under Plan 2 with a Conservation Pool level of 1022 feet in elevation, but there is some flexibility for good use at other levels at individual areas.

An excellent viewpoint opportunity appears to be available on the high ridge three miles upstream from the proposed dam and west of Lavadoure Creek. This point commands views in both directions above the lake for many miles in each direction. If the relocation of State Highway 227 occurs close to the north shore of the lake, more consideration might be given to the west slope of this ridge as a major recreation site with possible routing of the State Highway to the north and east of the point via Lavadoure Creek.

The Tiller site could be reduced in scope with primary consideration to day use access to both shorelines.

Recreation Use Estimates

Although the proposed lake would be comparative in size to Detroit Lake, an equivalent recreation use cannot be foreseen. Detroit Lake is located near the heavily populated lower Willamette Valley and along a major tourist highway which serves as an important recreational travel route to the Cascades and Eastern Oregon. It also has an extensive fishery attraction.

EXHIBIT 4.3

Our estimates of recreation use and demand at Days Creek would be closer to an initial day use of 125,000 and camping use of 25,000 annual visitors, with future growth entirely dependent upon the water quality, fishery, and recreational attractions which are made available.

Development Needs

Based on our attendance estimates and potential recreation use of the lake shore, there should be a minimum of 100 acres of reasonable grade topography for day use and 50 acres of nearly level area for camping use with appropriate adjoining recreation use lands.

Operation

The recreation areas of this reservoir could be most efficiently administered by Douglas County and the Bureau of Land Management who already have existing operations in the immediate vicinity. The usage of the area is anticipated to come primarily from the Douglas County population and the Interstate Highway traveler.

Summary

The Days Creek Reservoir offers a large body of water of potential recreation significance to the Roseburg, Douglas County area and in close proximity to tourist use of Interstate Highway 5.

The project recreation should be administered in connection with existing vital Douglas County, Bureau of Land Management, and Corps of Engineers interests in the area.

The State is not interested in participating under P.L. 89-72 on this project, but would have a continued interest in the overall project effects upon anadromous fishing, the appropriate relocation of State Highway 227, and giving assistance to recreation planning which leads to useful public recreation enjoyment of the reservoir itself.

RIM:aw

EXHIBIT 4.4

March 3, 1849

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
PACIFIC NORTHWEST REGION
1000 SECOND AVENUE
SEATTLE, WASHINGTON 98104

IN REPLY REFER TO:
D6427CNP

OCT 27 1971

Colonel Paul D. Triem
District Engineer
Portland District, Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear Colonel Triem:

Reference is made to your letter of October 6, 1971, requesting our review of your revised Recreation and Public Use Appendix, Days Creek Lake, of the Review Report on Umpqua River and Tributaries, Oregon, Interim Report, South Umpqua River. We are pleased to note that our review comments of August 11, 1971, have been incorporated into the revised report.

This office has participated in a joint field inspection of the project area and has met on several occasions with representatives of your planning staff to discuss recreation planning for the project. It is our view that the recreation potential of the Days Creek Project has been adequately evaluated and that the revised report sets forth a plan which, when implemented, will realize the recreation potential of the project. We note that the features of the plan pertaining to the downstream reaches of the South Umpqua River contain provision for the enhancement of urban recreation opportunities within the city of Roseburg and view this as very desirable.

The forecasts of recreation use for the reservoir and the downstream zone of project influence appear reasonable in comparison with attendance at existing, similar reservoir projects. We further note that the unit day value has been selected from the range of values provided in Supplement No. 1 to Senate Document 97 in computing recreation benefits and that the selection of the maximum unit value is justified.

Appendix XII (Recreation) of the Columbia-North Pacific Comprehensive Study indicates that the general area of western Oregon and Washington is deficient in outdoor recreation opportunities. The project area lies within subregion 10 of the Columbia-North Pacific Region which includes those portions of Oregon and Washington lying west of the

EXHIBIT 5.1

Cascades plus the Rogue and Umpqua river basins of southwestern Oregon. The recreation appendix indicates that, as a whole, most of the subregion outdoor recreation demand was being met at existing reservoirs in 1965. However, increased demand beyond 1965 will surpass the capability of the existing resources by 1980 and, by 2020, an imbalance between supply and demand is anticipated. The Days Creek Project will assist in meeting these needs.

In response to subsection 6(a) of the Federal Water Project Recreation Act, it is our judgment that the outdoor recreation aspects of the project are not in conflict with the approved Oregon Statewide Comprehensive Outdoor Recreation Plan currently on file in this office developed pursuant to subsection 5(d) of the Land and Water Conservation Fund Act of 1965 (78 Stat. 897).

We appreciate the opportunity to review your revised appendix.

Sincerely yours,

Maurice H. Lundy
Regional Director

E. E. Allen

E. E. Allen
Acting Regional Director

cc:
Mr. R. L. Porter

EXHIBIT 5.2