UMPQUA RIVER BASIN

Water Resources Board
July 1958

UMPQUA RIVER BASIN

STATE WATER RESOURCES BOARD

JULY, 1958

Cover Picture

NORTH UMPQUA RIVER
AT EAGLE ROCK

Price $1.50

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INTRODUCTION

On December 16, 1955, the State Water Resources Board of Oregon authorized a study of the water resources and water resource problems of the Umpqua River Drainage Basin. This action by the Board was in conformity with ORS 536.300 (1) which states that:

> "The board shall proceed as rapidly as possible to study: existing water resources of this state; means and methods of conserving and augmenting such water resources; existing and contemplated needs and uses of water for domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife, and fish life uses and for pollution abatement, all of which are declared to be beneficial uses, and all other related subjects, including drainage and reclamation."

Having completed this study and recognizing the need for immediate action in certain phases of the coordinated, integrated water resources program of the State, the Board proposes to adopt an integrated, coordinated program for the Umpqua River Drainage Basin. This action will be in conformity with ORS 536.300 (2) which states:

> "Based upon said studies and after an opportunity to be heard has been given to all other state agencies which may be concerned, the board shall progressively formulate an integrated, coordinated program for the use and control of all the water resources of this state and issue statements thereof."

Three basic techniques were utilized to obtain the data upon which the Board's program was based. They were: (1) a review of all reports and data available in current literature, both published and unpublished, relative to the water resources of Douglas County and items directly affected by water resources and water resource development; (2) limited field reconnaissance work, the magnitude of which was dictated by monetary considerations and the size of the Board's staff; (3) a formal hearing held in Roseburg, Oregon, on October 15 and 16, 1956, of which all other state agencies were duly notified and given an opportunity to

present engineering data, information, and evidence relative to their water resource problems and the proposed solutions of such problems.

The following report presents in summary form the major items considered by the Board in its adoption of an integrated, coordinated program of the use and control of the water resources of the Umpqua River Basin.

PURPOSE AND AUTHORITY

The purpose of this report and the actions indicated herein, is to implement the water resources policy of the State of Oregon, as prescribed in ORS 536.300. The Legislative Assembly recognizes and declares in ORS 536.220 (1) that:

"*(a) The maintenance of the present level of the economic and general welfare of the people of this state and the future growth and development of this state for the increased economic and general welfare of the people thereof are in large part dependent upon a proper utilization and control of the water resources of this state, and such use and control is therefore a matter of greatest concern and highest priority.*

"*(b) A proper utilization and control of the water resources of this state can be achieved only through a coordinated, integrated state water resources policy, through plans and programs for the development of such water resources and through other activities designed to encourage, promote and secure the maximum beneficial use and control of such water resources, all carried out by a single state agency.*

"*(c) The economic and general welfare of the people of this state have been seriously impaired and are in danger of further impairment by the exercise of some single-purpose power or influence over the water resources of this state or portions thereof by each of a large number of public authorities, and by an equally large number of legislative declarations by statute of single-purpose policies with regard to such water resources, resulting in friction and duplication of activity among such public authorities, in*

confusion as to what is primary and what is secondary beneficial use or control of such water resources and in a consequent failure to utilize and control such water resources for multiple purposes for the maximum beneficial use and control possible and necessary."

The authority for the report, the study on which it is based, and the actions effected are specifically delegated to the State Water Resources Board in ORS 536.300 (1) and (2) which state:

"(1) The board shall proceed as rapidly as possible to study: existing water resources of this state; means and methods of conserving and augmenting such water resources; existing and contemplated needs and uses of water for domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife, and fish life uses and for pollution abatement, all of which are declared to be beneficial uses, and all other related subjects, including drainage and reclamation.

"(2) Based upon said studies and after an opportunity to be heard has been given to all other state agencies which may be concerned, the board shall progressively formulate an integrated, coordinated program for the use and control of all the water resources of this state and issue statements thereof."

Within the limits of existing data and knowledge, the study has taken into full consideration the following declarations of policy under ORS 536.310:

"(1) Existing rights, established duties of water, and relative priorities concerning the use of the waters of this state and the laws governing the same are to be protected and preserved subject to the principle that all of the waters within this state belong to the public for use by the people for beneficial purposes without waste;

"(2) It is in the public interest that integration and coordination of uses of water and augmentation of existing supplies for all beneficial purposes be achieved for the maximum economic development thereof for the benefit of the state as a whole;

"(3) *That adequate and safe supplies be preserved and protected for human consumption, while conserving maximum supplies for other beneficial uses;*

"(4) *Multiple-purpose impoundment structures are to be preferred over single-purpose structures; upstream impoundments are to be preferred over downstream impoundments. The fishery resource of this state is an important economic and recreational asset. In the planning and construction of impoundment structures and milldams and other artificial obstructions, due regard shall be given to means and methods for its protection;*

"(5) *Competitive exploitation of water resources of this state for single-purpose uses is to be discouraged when other feasible uses are in the general public interest;*

"(6) *In considering the benefits to be derived from drainage, consideration shall also be given to possible harmful effects upon groundwater supplies and protection of wildlife;*

"(7) *The maintenance of minimum perennial stream flows sufficient to support aquatic life and to minimize pollution shall be fostered and encouraged if existing rights and priorities under existing laws will permit;*

"(8) *Watershed development policies shall be favored, whenever possible, for the preservation of balanced multiple uses, and project construction and planning with those ends in view shall be encouraged;*

"(9) *Due regard shall be given in the planning and development of water recreation facilities to safeguard against pollution;*

"(10) *It is of paramount importance in all cooperative programs that the principle of the sovereignty of this state over all the waters within the state be protected and preserved, and such cooperation by the board shall be designed so as to reinforce and strengthen state control;*

"(11) *Local development of watershed conservation, when consistent with sound engineering and economic principles, is to be promoted and encouraged; and*

"(12) *When proposed uses of water are in mutually exclusive conflict or when available supplies of water are insufficient for all who desire to use them, preference shall be given to human consumption purposes over all other uses and for livestock consumption, over any other use, and thereafter other beneficial purposes in such order as may be in the public interest consistent with the principles of this Act under the existing circumstances."*

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GENERAL CONCLUSIONS

1. *There is enough water on an annual-yield basis in the Umpqua system to supply all needs; existing and contemplated with the exception of utilization of water to minimize pollution.*

2. *Serious dislocations exist in terms of distribution of the resource with regard to physical location and with respect to availability at time of need.*

3. *Resources would not be sufficient in the summer months of critically low flow years to supply future consumptive and nonconsumptive demands if continued reliance is on existing patterns of stream flow.*

4. *Flows in recent years have generally been above critical flow levels and the impact of accrued rights to use water has not been fully recognized. Streams whose flows are popularly considered to be adequate for all needs would be at marginal levels under present depletion potentials during a critical flow year.*

5. *Depletion potentials on some streams, due to existing consumptive rights, are such that the simultaneous use of any major portion of the existing rights could result in flows approaching zero levels, above areas of major need, during critical flow periods.*

6. *Many streams of the system do not provide enough flow for nonconsumptive needs of the present in periods of relatively low, but not critical, flow.*

7. *In some areas, unavailability of stable supplies of suitable water for industrial uses and pollution abatement is a serious deterrent to the development of potential industries based on the utilization of other natural resources; this will continue if reliance is placed on existing patterns of stream flow.*

8. *Unavailability of stable supplies of water in the future will restrict the agricultural potential of the Basin.*

9. *Full development of the fisheries potentials of the Basin cannot be achieved without physical improvement of low flows.*

10. *All phases of water use will benefit if actual low flow levels are increased.*

11. A critical flow year would result in conflict, or at least a difficult management problem under present patterns of flow, in applying existing legal rights to the use of water on many streams.

12. Future appropriations of water will require full-time watermasters for many streams of the system.

13. Establishment of restrictions on further appropriations could prevent an increase in depletion potential on some streams. This would aid in maintaining higher minimums where streams are not now appropriated beyond their natural capacity at critical periods. For streams seasonally overappropriated, such actions would have limited practical effect until additional flows became available from return flows of future upstream developments or from storage.

14. Certain major sections and numerous minor streams and creeks are by the nature of their topography, location, availability, ownership, or economic potential, available only for limited resource uses.

15. Major quantitative future uses of water in the Umpqua system will be for irrigation, industry, power, fish life, wildlife, and recreation.

16. The flood control problem is the item of major interest and economic importance to the general public of this river system.

17. The probable recurrence frequencies of floods of 1955 magnitude vary for different streams in the Basin. Generally frequencies are higher than those thought representative after the 1950 floods.

18. Increased development is continuing to take place in the 1955 flood plain.

19. Major flood control potential is greatly limited because of the restrictive physiography of the Basin and its effect on project feasibility.

20. Major control of floods will require storage, although local protective works may reduce damage.

21. Major augmentation of the resource in periods of need must come from the storage of surplus winter runoff.

22. *The Basin has substantial potential for the development of hydroelectric energy.*

23. *Drainage and reclamation of drained lands are not major problems at present, nor are they expected to grow to significant proportions in the future if wise planning is exercised.*

24. *Physical potentials for water control are restricted and single-purpose development of available possibilities should not be permitted to limit multi-purpose development.*

25. *An essential requirement in the determination of the most complete program of use and control of the waters of the Umpqua River Basin is the development of criteria that will establish the levels of desirable base flows for fish life, wildlife, recreation, and pollution abatement.*

    These criteria, which would establish the position of desirable base flows relative to other uses, have not been made available to the Board by interested parties.

    It is, therefore, essential that the Board initiate independent studies in an attempt to define and establish the needed criteria.

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CHAPTER I

THE BASIN

The Umpqua River Drainage Basin, an area of approximately 4560 square miles, lies in the southwestern section of Oregon. The boundaries of the Basin are nearly coincidental with the boundaries of Douglas County. The Basin is bounded on the north by the Siuslaw and Willamette River Basins; on the east by the Deschutes and Klamath River Basins; on the south by the Rogue River Basin; and on the west by the Coos-Coquille River Basin and the Pacific Ocean. The Basin boundary is approximately 407 miles in length.

The Umpqua River, which is classified as a Pacific slope stream, discharges directly into the Pacific Ocean near the City of Reedsport. The approximate length of the river is 211 miles from its mouth to its headwaters in the High Cascades, via its main stem and the North Umpqua River. The North Umpqua River to Diamond Lake is approximately 106 miles long. The South Umpqua River to the headwaters of Castle Rock Creek on the Rogue-Umpqua divide is about 104 miles in length.

The Umpqua River Basin is the eleventh largest drainage basin in the State of Oregon.

Of the total length of the river and its tributaries, less than 40 miles is navigable from the mouth by anything other than small craft. The head of navigation, on the main stem, is at river mile 25 downstream from the community of Scottsburg. The lower section of Smith River is navigable by shallow draft vessels for a short distance.

Stream gradients in the system vary greatly. Lake Creek, the major headwater tributary of the North Umpqua River, has an average stream gradient of 86 feet per mile. Lake Creek heads in Diamond Lake. The North Umpqua River from Bradley Creek at an elevation of 4270 feet to Boulder creek at an elevation of 1620 feet, mean sea level, has an average gradient of 83 feet per mile. In this section, there is one almost vertical drop of 150 feet, Bradley Falls (Lemolo), and one drop of 300 feet in one mile, Ireland Falls (Toketee). From Boulder Creek, at mile 68 on the North Umpqua River, to the mouth of the North Umpqua River, the average gradient is approximately 19 feet per mile.

The gradient of the main stem from its confluence with the South Umpqua River to Elk Creek, at Elkton, is about 4½ feet per mile. From Elk Creek to tidewater at Scottsburg, the drop to mean sea level is about 80 feet.

The South Umpqua has a relatively flat gradient from its mouth to its confluence with Cow Creek, slope approximately 6 feet per mile. From its confluence with Cow Creek to its confluence with Elk Creek, the South Umpqua River has an average gradient of 13½ feet per mile increasing to a slope of 42½ feet per mile (average) for the next 24 miles to the mouth of Castle Rock Creek. Cow Creek, the main tributary of the South Umpqua River, has an average gradient of 23 feet per mile from its mouth to the confluence of Dismal Creek in its headwaters.

The climatology of the Basin is characteristic of Western Oregon. Temperatures are generally mild but vary between areas, to a noticeable extent, as elevations vary. The coastal slope seldom experiences freezing temperatures nor do the coastal mountains, except in the higher elevations. Summer temperatures are mild and fairly dry. The Central Valley section is more variable in temperature with recorded values ranging from a minimum of -6°F. to a maximum of 109°F. The average growing season approximates 190 days per year. Summer temperatures run higher than the coastal areas. The temperatures and temperature ranges of the eastern portion of the Basin vary with elevation.

Topographically, the Basin is composed of three definable segments: (1) The Coastal Range; (2) The Central Valley; and (3) The Cascades. The Coastal Range comprises the western segment of the Basin and is basically a low mountain range made up of sedimentary deposits, largely shales, sandstones and conglomerates. The Coast Range has a maximum height of approximately 3000 feet, msl.

The Central Valley section is that section of the Basin lying near the confluence of the North and South Umpqua Rivers. The area comprising this valley section extends down the main stem approximately 12 miles; up the South Umpqua River to its confluence with Cow Creek, including Lookingglass and Flournoy valleys; up the North Umpqua River and Sutherlin Creek to Camas Swale; and up Calapooya Creek to Hinkle Creek. Other valley lands, mostly shoestring in character, are widely scattered about the Basin along the tributaries.

The Cascades section of the Umpqua Basin covers the entire eastern portion of the drainage. Beginning in the foothills east of the valley section, the terrain steepens rapidly to the rugged country of the High Cascades where elevations reach 9000 feet, msl. The Cascades are of volcanic origin and include volcanic adesites, tuffs, breccias, lava flows, and pumice formations.

The southern boundary of the Basin is formed by hills falling, for the most part, in the Klamath-Siskiyou geologic province. These mountains are granite, metamorphosed sediments, and volcanics of an older period than the Coast Range, Western Cascades, or High Cascades.

Eighty-eight percent of the land area of Douglas County is classified as forest land. Of the 2,876,000 acres making up this percentage, about 2,773,000 acres, nearly 85 percent of the Basin total, has commercial potential. Eighty-nine thousand of this is reserved for other purposes.

Agricultural lands in the Basin are estimated at 487,000 acres, approximately 367,000 acres of non-crop pasture lands and 120,000 acres of cropland.

Mineral assets of the Umpqua Basin are difficult to inventory. A variety of mineral deposits exist in the Basin but qualitative and quantitative values have not been fully determined. Mercury and nickel are presently mined and processed in the drainage area of the Umpqua River. Deposits of gold, silver, zinc, chromite, copper, sulphur, coal, and limestone are potentials.

The precipitation pattern of the Basin is characterized by wet winters and dry summers. Rainfall patterns over the watershed are mainly the result of orographic barriers. Magnitude of rainfall is further influenced by seasonal variations in the Northwest's general circulation system. Annual rainfalls vary from 30-110 inches depending on the location. Generally, the coastal mountains vary from 50-110 inches; the Central Valley from 25-50 inches; and the Cascades from 50-75 inches. Variations in the Cascades and coastal mountains follow the elevation trends.

The Basin discharges an estimated average annual yield at its mouth of 6,700,000 acre-feet with estimated extremes of 12,000,000 acre-feet maximum and 2,750,000 acre-feet minimum. The most downstream point

where records of basin flows and yields have been kept, near Elkton at river mile 53, has the following measured yield values: (1) mean 5.4 million acre feet; (2) minimum 2.2 million acre-feet; and (3) maximum 9.8 million acre-feet. This represents the yield from about 77 percent of the entire Umpqua watershed. In terms of mean annual runoff (5,048,700 acre-feet), about 81 percent of the total yield occurs between November 1 and May 1. The South Umpqua sub-basin above Brockway represents about 44.6 percent of the area above the Elkton gage, but contributes, on the average, only 36 percent of the mean annual yield. The North Umpqua sub-basin above Rock Creek represents 25 percent of the area above the Elkton gage, but contributes 35.8 percent of the mean annual yield. Legal consumptive rights to use water in the system approach a volume of 400,000 acre-feet per year. About 80 percent of the right to use water is during the period, May 1 to September 1, when less than 20 percent of the yearly supply is available. The ungaged portion of the Basin, about 877 square miles is subject to more than the average precititation of the measured section of the drainage area.

These basic elements, land, minerals, and water coupled with manpower, comprise the basis of past and potential Basin development.

TABLE 1

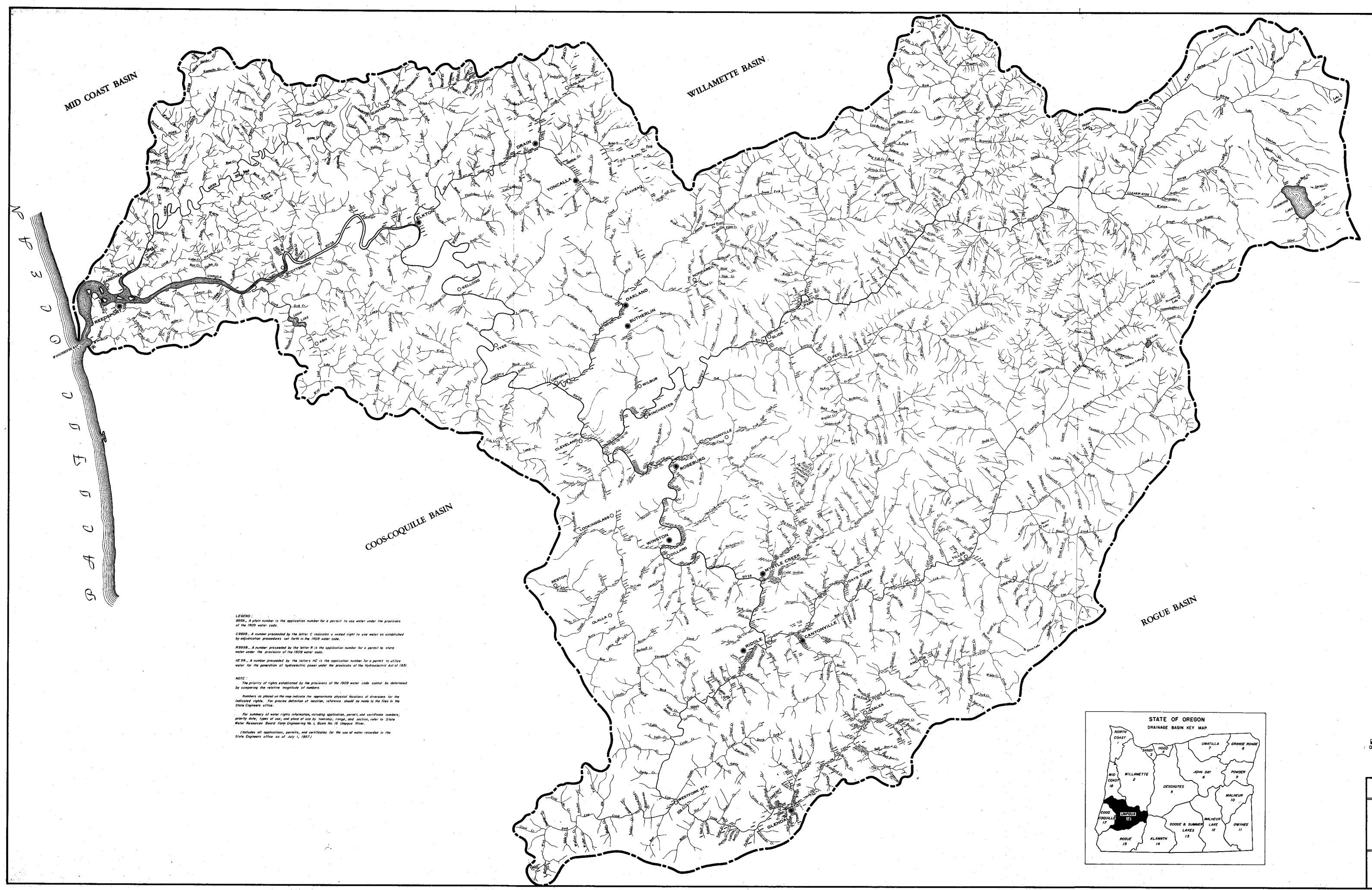
OREGON DRAINAGE BASINS
(Ranked by Area)

RANK	BASIN	AREA (Sq. Miles)
1	WILLAMETTE	11,741
2	DESCHUTES	10,821
3	MALHEUR LAKE	9,085
4	GOOSE & SUMMER LAKE	8,708
5	JOHN DAY	8,408
6	OWYHEE	6,455
7	ROGUE	5,108
8	GRANDE RONDE	5,095
9	MALHEUR	5,063
10	UMATILLA	4,565
11	UMPQUA	4,560
12	KLAMATH	3,792
13	POWDER	3,480
14	NORTH COAST	2,865
15	MID COAST	2,439
16	COOS-COQUILLE	2,299
17	HOOD	1,015
18	SANDY	575

TABLE 2

POPULATION DISTRIBUTION
DOUGLAS COUNTY

	1950	1958	Percent of Change
County	54,549	62,880	+15.3
Lower Umpqua			
Reedsport	2,288	3,450	+50.8
Elkton	201	200	- 0.5
Drain	1,150	1,440	+25.2
Yoncalla	626	700	+11.8
Oakland	829	970	+17.0
Sutherlin	2,230	2,700	+21.1
North Umpqua			
South Umpqua			
Roseburg	8,390	12,200	+45.4
Riddle	634	1,000	+57.7
Canyonville	861	1,010	+17.3
Glendale	871	1,000	+14.8
Myrtle Creek	1,781	2,250	+26.3
Winston	---	2,450	---



LEGEND :

8999.. A plain number is the application number for a permit to use water under the provisions of the 1909 water code.

C9999.. A number preceded by the letter C indicates a vested right to use water as established by adjudication proceedures set forth in the 1909 water code.

R9999.. A number preceded by the letter R is the application number for a permit to store water under the provisions of the 1909 water code.

HE 99.. A number preceded by the letters HE is the application number for a permit to utilize water for the generation of hydroelectric power under the provisions of the Hydroelectric Act of 1931.

NOTE

The priority of rights established by the provisions of the 1909 water code cannot be determined by comparing the relative magnitude of numbers.

Numbers as plotted on the map indicate the approximate physical locations of diversions for the indicated rights. For precise definition of location, reference should be made to the files in the State Engineers office.

For summary of water rights information, including application, permit, and certificate numbers; priority date; types of use, and place of use by township, range, and section, refer to State Water Resources Board Form Engineering No. 1, Basin No. 16 Umpqua River.

(Includes all applications, permits, and certificates for the use of water recorded in the State Engineers office as of July 1, 1957.)

STATE OF OREGON
DRAINAGE BASIN KEY MAP

FIGURE 1

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN WATER RIGHTS

Drawn	date 11/11/57	File No.	16
Checked	date 11/11/57		301
Revised	date		
Redrawn	date		
Approved	date		

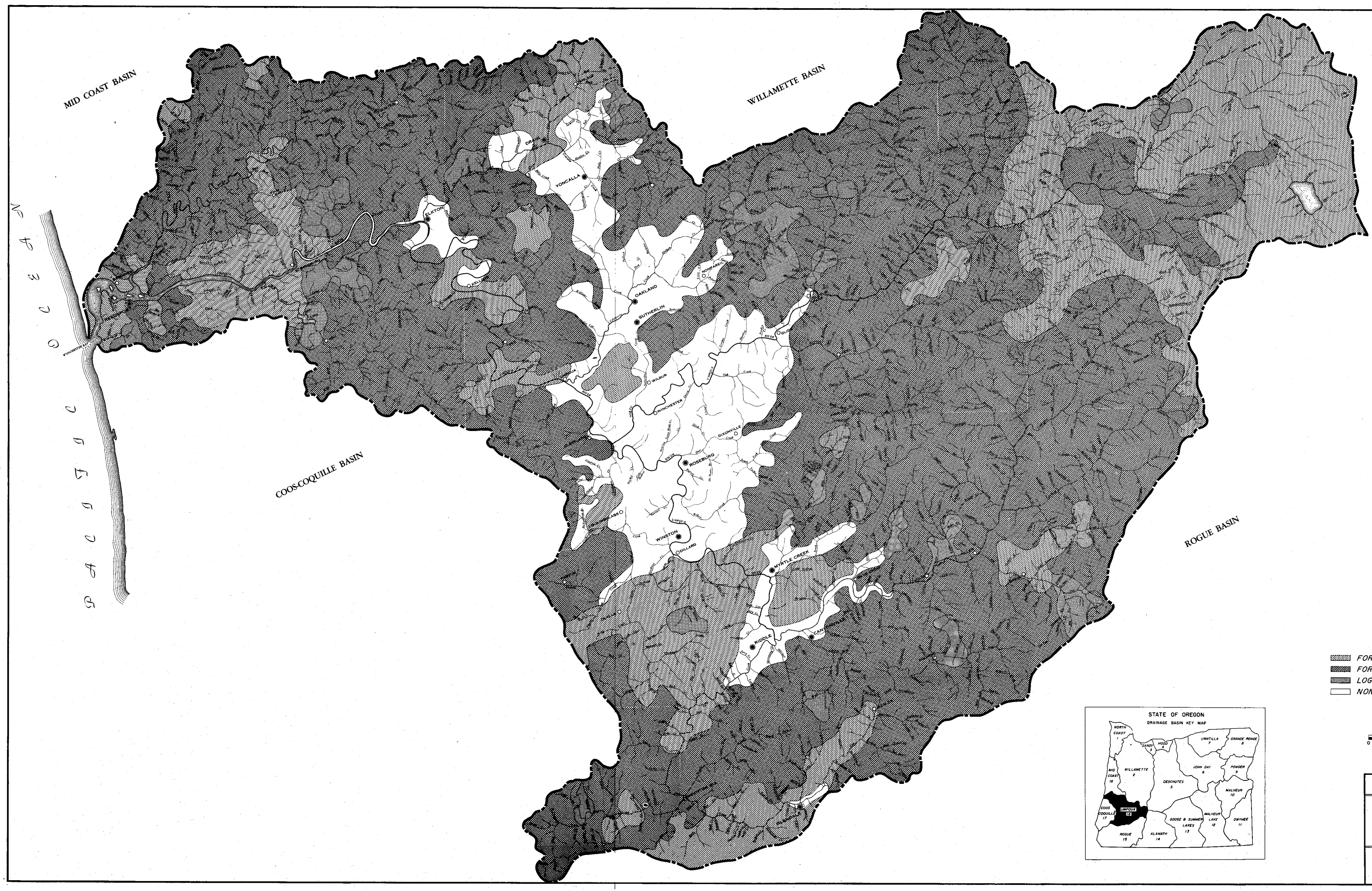


FIGURE 2

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN TIMBER RESOURCES

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Checked	date	16
Revised TIMBER RESOURCES ADDED	date	8
Redrawn	date	
Approved	date	

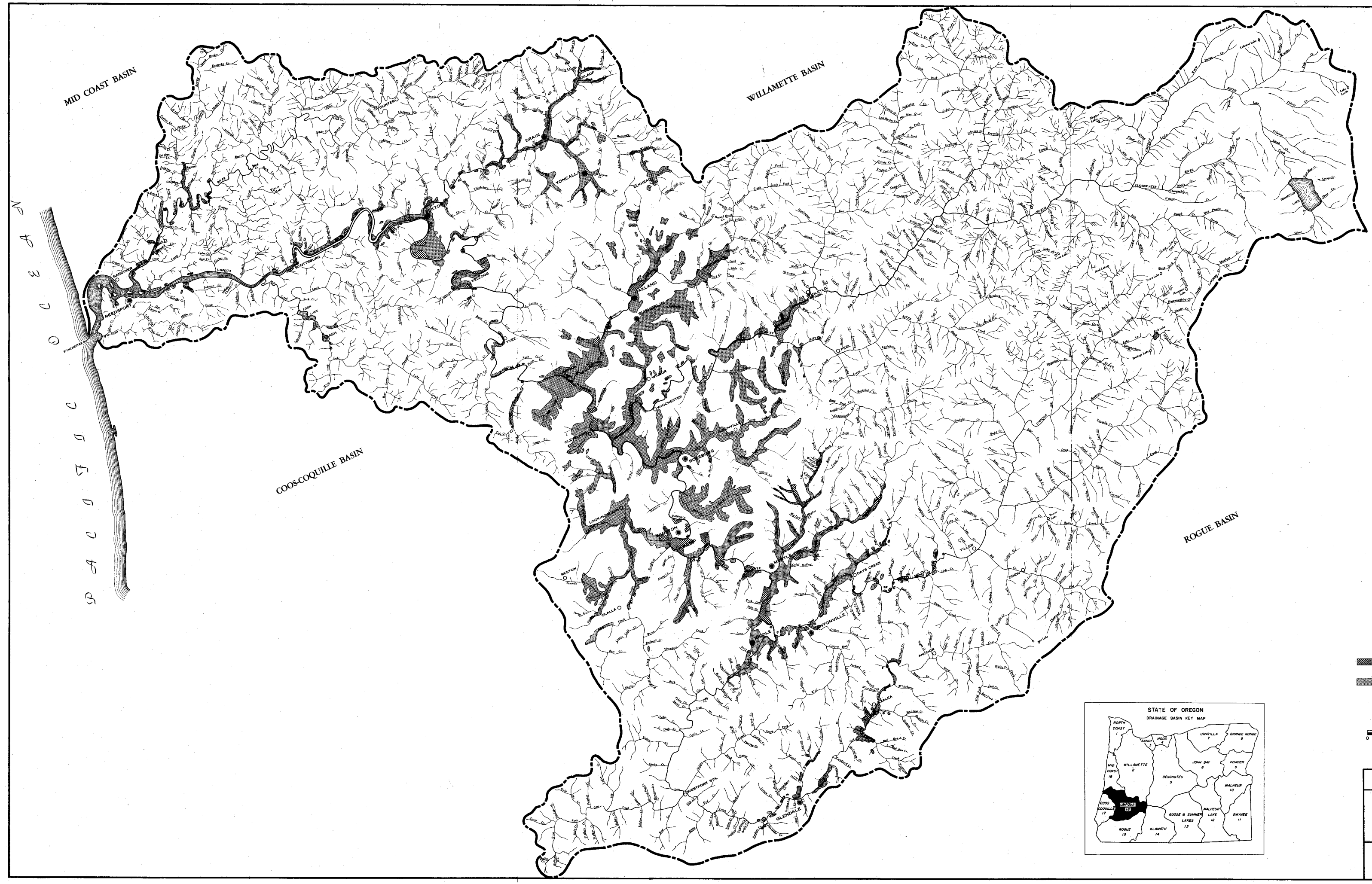

FIGURE 3

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN IRRIGATION LANDS

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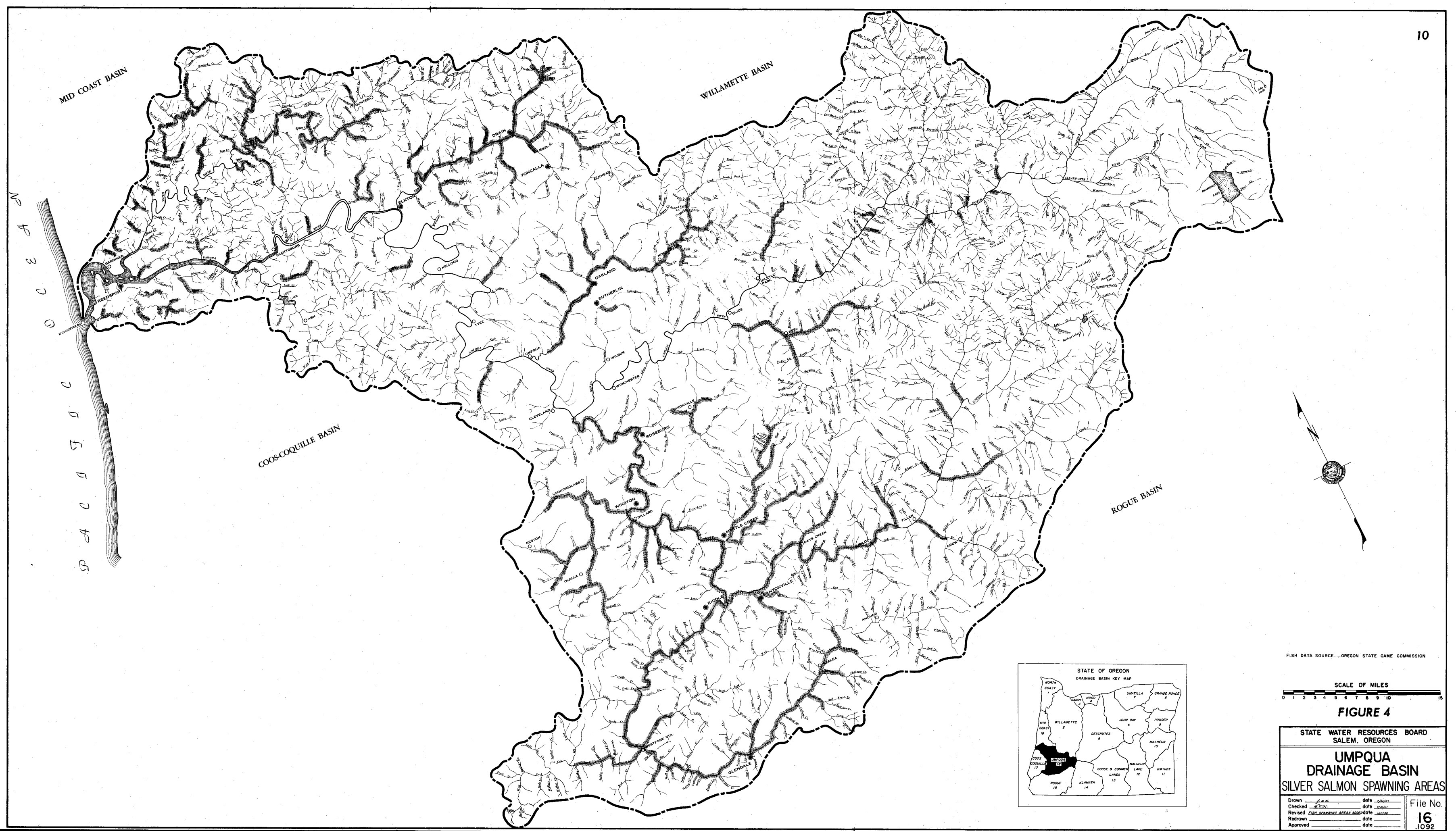
Checked	date	16
Revised	date	.1031
Redrawn IRRIGATION LANDS ADDED	date	
Approved	date	



FISH DATA SOURCE.....OREGON STATE GAME COMMISSION

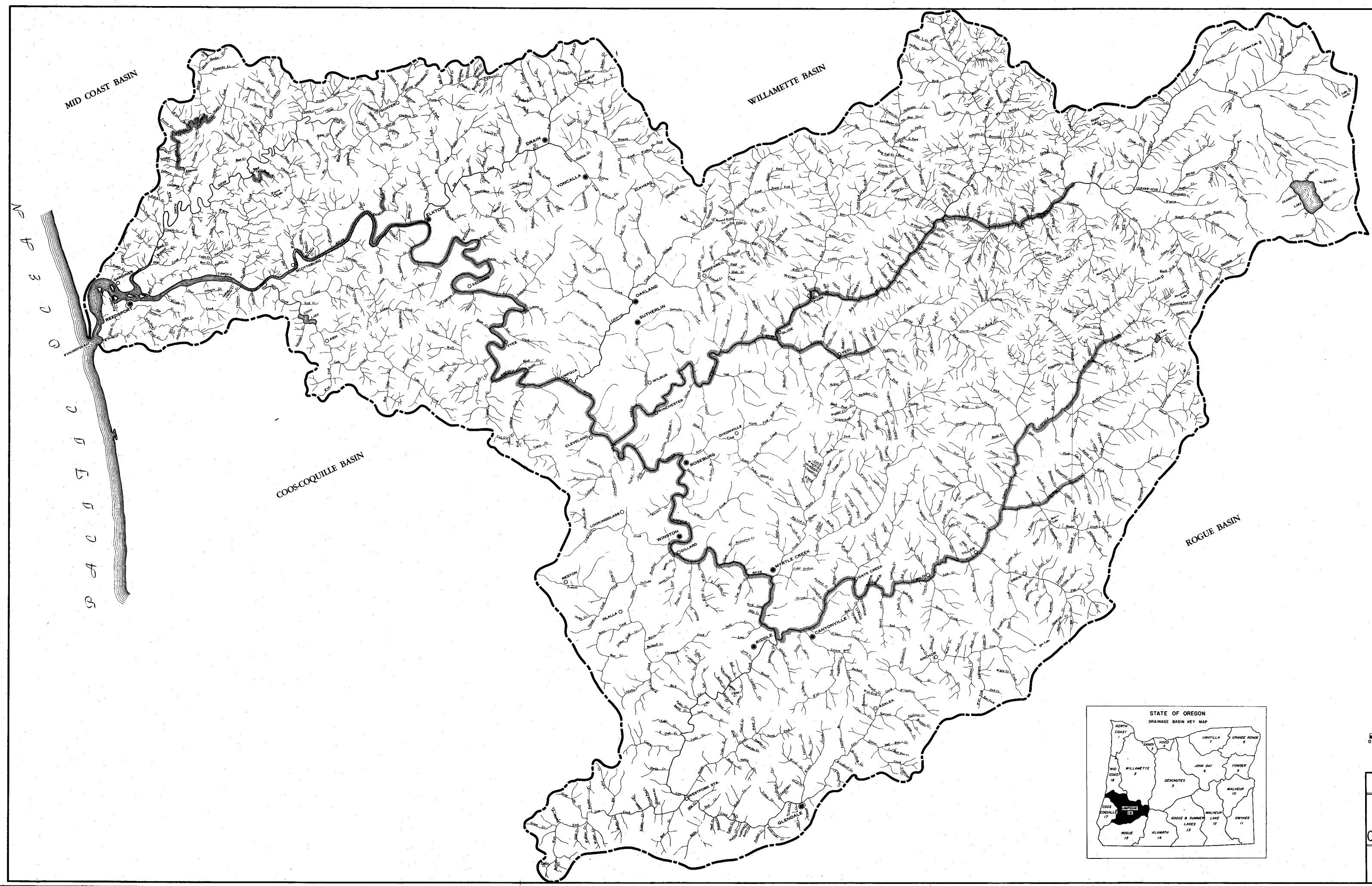
SCALE OF MILES
0 1 2 3 4 5 6 7 8 9 10 15

FIGURE 4

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN
SILVER SALMON SPAWNING AREAS

Drawn	date	File No.
Checked	date	16
Revised FISH SPAWNING AREAS ADDED	date	.1092
Redrawn	date	
Approved	date	



STATE OF OREGON
DRAINAGE BASIN KEY MAP

FISH DATA SOURCE — OREGON STATE GAME COMMISSION

SCALE OF MILES
0 1 2 3 4 5 6 7 8 9 10 15

FIGURE 5

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN
CHINOOK SALMON SPAWNING AREAS

Drawn	date 1/1/65	File No.
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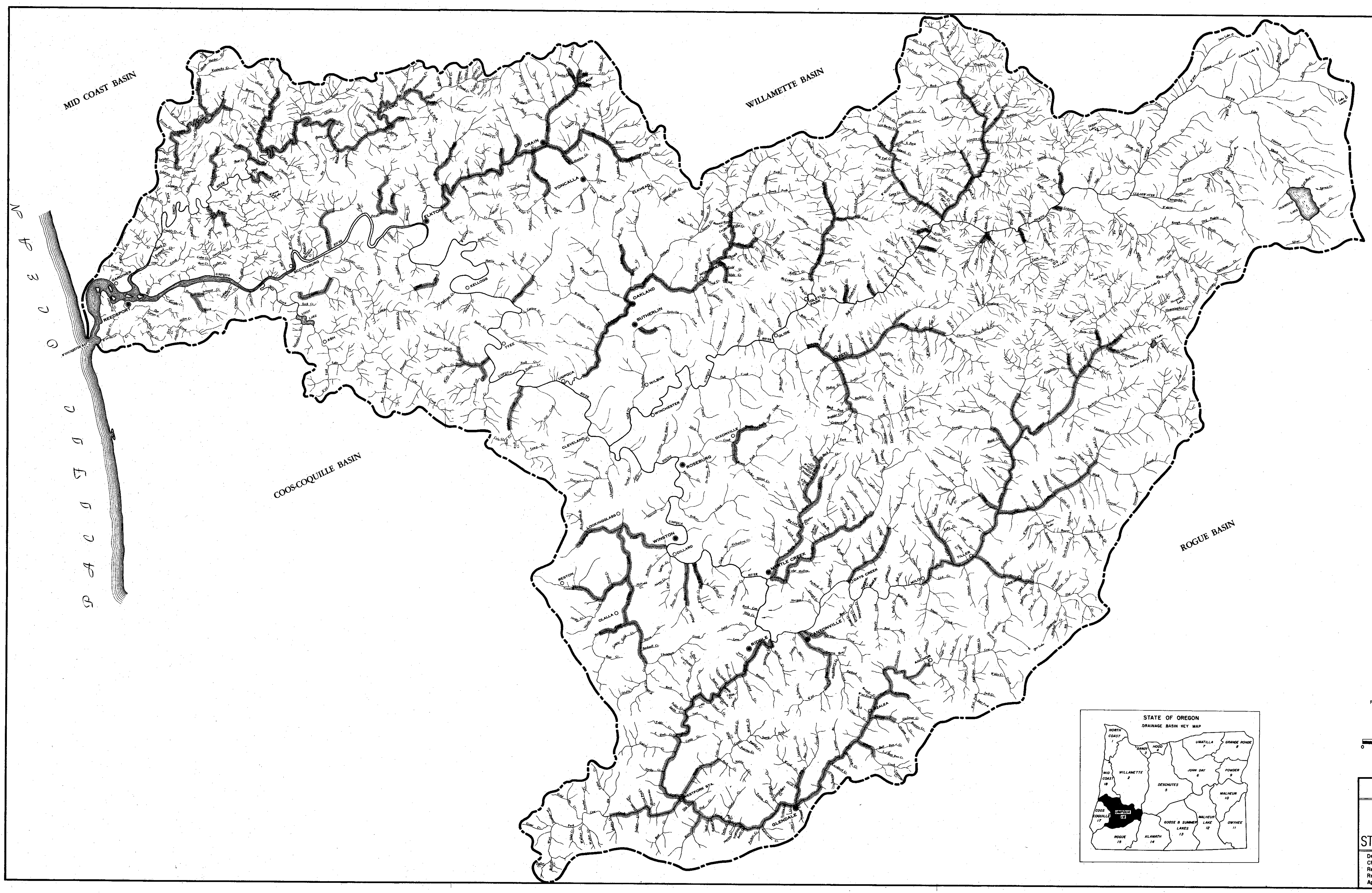
Redrawn	date	
Approved	date	



FISH DATA SOURCE.....OREGON STATE GAME COMMISSION

SCALE OF MILES

0 1 2 3 4 5 6 7 8 9 10 15

FIGURE 6

STATE WATER RESOURCES BOARD
SALEM, OREGON

UMPQUA DRAINAGE BASIN

STEELHEAD TROUT SPAWN'G AREA

Drawn	date	File No.
Checked	date	16
Revised FISH SPAWNING AREAS ADDED	date	.1092
Redrawn	date	
Approved	date	

CHAPTER II

WATER AND THE BASIN ECONOMY

Water is one of the most vital assets in the economy of the Umpqua River Basin. Nearly every major economic endeavor in Douglas County is dependent upon water for either its existence or its successful operation.

The economy of the Umpqua River watershed is dominated by its natural resource base activities; all of which require water as the catalyst for successful accomplishment.

Excluding manpower, the natural assets of the Umpqua River system are land (soil), minerals, and water. Water and land provide trees - the greatest single contribution to the existing economy of the Basin. Water and land provide for the growth of food - the economic activity second in importance to the Basin. Water, land (topography), and trees form the nucleus of an item of major economic importance in the Basin - recreation.

Water is also essential to the fisheries resources of the Basin which provide both recreational and commercial activity through game and offshore troll fisheries whose basic existence stems from the waters of the Umpqua River and its tributaries. Other beneficial uses of water; domestic, municipal, industrial, power development, and pollution abatement, result from the efforts of the Basin's populace to utilize the key assets of the Umpqua system to develop and expand their standard of living.

Minerals, which are not necessarily dependent upon water for their existence, do frequently require water to transform them into a developable economic asset for the Basin.

PRESENT BASIN ECONOMY

Forest Products

The major economic activity in the Umpqua River Basin (Douglas County) at the present is in the lumber and wood products industries. The greatest percentage of activity is concentrated in the primary timber operations which include logging, sawmilling, and plywood manufacturing. Very little of the covered employment in Douglas County is in secondary wood remanufacture operations.

Indicative of the economic status of timber operations in the Umpqua Basin is the comparison of employment in the lumber and wood products industries to the total employment in the Basin. The percent of lumber and wood products employment in Douglas County to total employment in 1955, as covered by the Unemployment Compensation Commission, ranges from 63.6 percent during the first quarter downwards to a low of 60.2 percent in the fourth quarter. By the fourth quarter of 1957 the percentage had dropped to 54.3. Average employment in Douglas County for 1955 ranged from a low of 8,400 jobs for a quarter to a high of 10,625 jobs for a similar period. For 1957, the average employment for the maximum and minimum quarters was 8,802, and 6,539, respectively.

Quarterly payrolls in Douglas County varied from 10 to 14 million dollars in the lumber and wood products industries in 1955. In 1957, quarterly payrolls ranged from 8 to 11 million dollars. For the maximum quarter of 1957, the payrolls for the lumber and wood products industries of the county represented about 62 percent of the total covered payroll. The minimum quarterly payroll was 56 percent of the total.

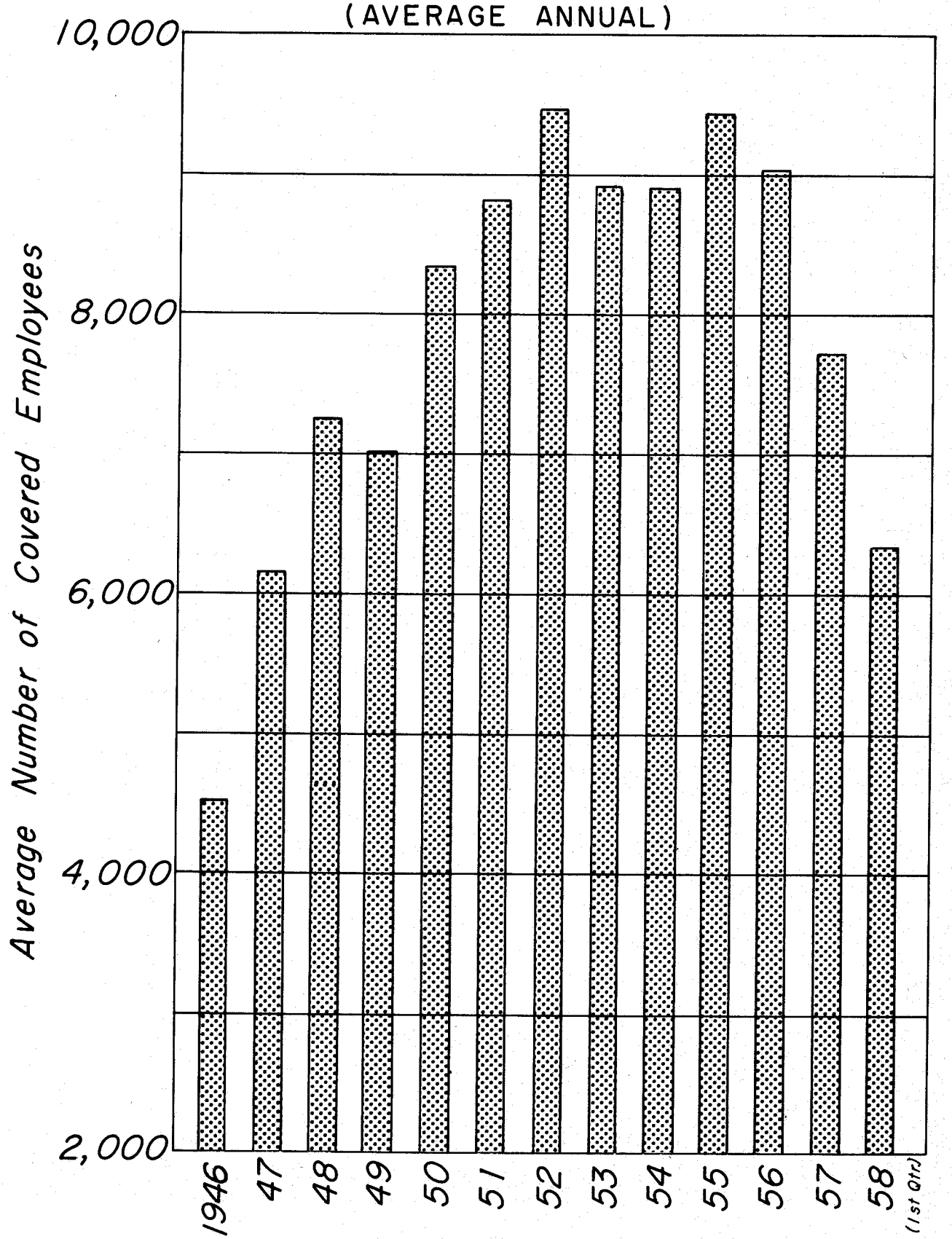
The foregoing figures indicate the decline in level of employment in the primary lumber and wood products field during an economic setback for the nation. This trend is illustrated by Figure No. 7 , which shows the average number of covered employees for each year for the period 1946 through 1957. The chart shows clearly the growth in lumber and wood products industries in Douglas County following the completion of World War II, climbing steadily to 1952 when the average employment level for any one year reached a maximum. After maintaining a reasonably level pattern of employment from 1952 to 1956, job opportunities began to decline, dropping to their present status. In addition to being subject to immediate effects from general economic cycles, primary timber operations of a field nature are subject to seasonal variations due to weather and miscellaneous other causes. The effect of seasonal variations on employment and basin economy can be obtained from Figure 8 which shows the average monthly covered employment in the lumber and wood products industry for the ten-year period 1948-1957.

Although the timber operations of Douglas County are the greatest individual contributor to the Basin's economy, they also represent the source of the Basin's major economic problem which is the maintenance of uniform employment.

COVERED EMPLOYMENT

LUMBER & WOOD PRODUCTS INDUSTRY

DOUGLAS COUNTY
(AVERAGE ANNUAL)



NOTE: Employees covered by Oregon State Unemployment Compensation Commission. Less than 2,000 in years prior to 1946.

File: 16.801

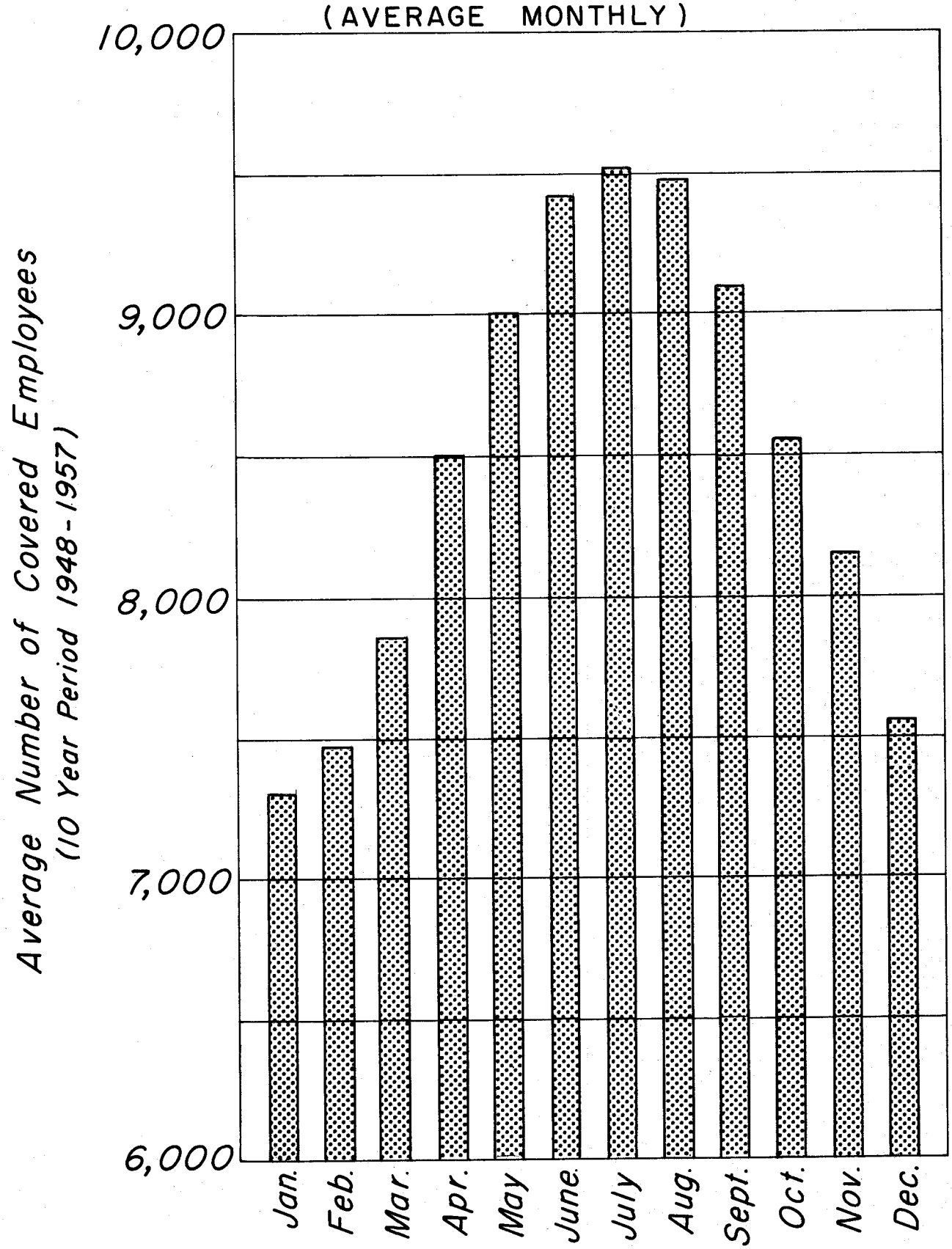
FIGURE 7

COVERED EMPLOYMENT

LUMBER & WOOD PRODUCTS INDUSTRY

DOUGLAS COUNTY

(AVERAGE MONTHLY)



NOTE: Employees covered by Oregon State Unemployment Compensation Commission.

File: 16.801

FIGURE 8

Agriculture

The economic activity, second in importance in the Umpqua River Basin, is agriculture. In 1956 farm products for the Drainage Basin had a gross value of approximately 7 million dollars.

The 1954 Census of Agriculture reported the value of farm products sold at $5,924,102 for 1954, about $9,000 less than the value reported for 1949. In view of the discussion in the previous section pointing out the predominant place of lumber and wood products in the Basin economy, it is significant that nearly $1,242,000 of the total value of agriculture, or farm products, was for farm wood-lot products. This exceeded the value of wood products from farm operations for 1949 by about 40 percent.

The 1954 census showed a downward trend in the number of farms in Douglas County with 2,651 farms in 1950 being reduced to 2,155 farms in 1954. Coincidental with this downward trend in number of farms was a decrease in farm acreage of approximately 35,000 acres during the same period. In terms of value per acre, the trend was upward during the same period with an increase in value of approximately $24.00 per acre on the average.

A significant factor in the agricultural economy of any area is the status of irrigated lands. In Douglas County irrigated acreage was reported as 3,798 acres in 1949 increasing to 10,798 acres reported in 1954. Of the 6,911 acres of irrigated cropland harvested in Douglas County, as reported in the 1954 census, 4,315 acres were devoted to the primary production of hay. The balance was distributed among a variety of products including corn, grain, small grains, annual legumes, and other miscellaneous crops. There were 3,880 acres devoted to irrigated pasture land. Irrigated pasture in Douglas County showed a gain of better than 50 percent from 1949 to 1954 showing the strong influence of livestock production on the agricultural economy of the Basin.

Most of the land in Douglas County suitable for agricultural production is now being utilized for that purpose. Major expansion of the agricultural economy of the Basin will have to come from increased utilization of presently-available land. This will mean reliance on irrigation development for fullest utilization of the agricultural potentials of the Basin.

Mining and Mineral Industries

The third identifiable item in the economy of Douglas County is its mining and mineral industry development. In1954 the gross income in the Umpqua Basin for mining and allied operations was slightly in excess of $2,000,000. The covered payrolls of the Unemployment Compensation Commission for 1957 show mining employment to vary from 161 to 192. Approximately 55 percent of the mining during this period was in the metal mining field and the balance, 45 percent, in the nonmetalic mining and quarrying field. Quarterly payrolls for mining in the Umpqua Basin range from $228,000 for the first quarter of 1957 to approximately $296,000 for the third quarter. Distribution of quarterly payrolls between metal mining and nonmetalic and quarrying operations maintain approximately the same percentage of distribution as employment.

Covered mining employment represents less than two percent of the total covered employment in Douglas County.

The primary metals industries have become a significant factor in the economy of Douglas County. Primary metals manufacture, plus stone, glass, and clay industries, had only 30 covered employees in April of 1954. By June of that year the number of employees had climbed to 136, largely because of the opening of the nickel processing operations near Riddle. Third quarter payrolls for 1954 in this area of operation, totaled approximately $83,000. By 1957, employment in the primary metal industries had increased to an average of about 440, excluding stone, clay and glass products. Quarterly payrolls for the first three quarters of 1957 ranged from 600 to 660 thousand dollars. The substantial increase in employment and payrolls in this basic field is a result of the operation of the Hanna Nickel Company at Riddle.

The Hanna Nickel operation was constructed under a federal loan of 24.8 million dollars advanced by the Defense Minerals Procurement Agency for the construction of smelter facilities. This loan is to be liquidated by June 10, 1962. Defense requirements for nickel supplies made it desirable for the federal government to develop domestic sources of this valuable defense material. If the process utilized by the Hanna Company permits production of nickel at a cost competitive with that of other sources, this operation will provide a stable item in the Umpqua Basin's economy, even in times when needs are not based solely on defense requirements.

Recreation, Fish Life, and Wildlife

Recreation, fish life (both sports and commercial), and wildlife are recognized as providing the Umpqua Basin with substantial economic and social benefits. Unfortunately, it is difficult to define by normal economic yardsticks the contributions of these items to the Basin economy.

Contributions of recreation to economy are generally dealt with by referring to the contribution of tourists and citizens of the state on a statewide basis. Of the 141 million dollars brought into the state by tourists in 1955 and the 70 million dollars spent on outdoor recreation by citizens of Oregon, the portion contributing to the economy of Douglas County is unknown. One of the primary needs for the Umpqua Basin is realistic and unbiased evaluation of the place of recreation in the existing economy of this area. One isolated instance illustrating the value of recreation is the contribution of the Salmon Harbor installation at Winchester Bay near the mouth of the Umpqua River. According to the Supervisor of Parks for Douglas County, this installation boosted the economy of Douglas County by an estimated one and one-half million dollars in 1956. One of the greatest items in the relative economic value of recreational units, is the adequacy of water facilities. 1/

The fisheries resource of the Umpqua Basin contributes to the economy from two points of view: first, the game fishery, and second, the commercial fishery. The commercial fishery consists of several segments: the salmon fishery; the commercial shad fishery; and the clam catch. The Fish Commission of the State of Oregon estimates the wholesale commercial fishing values of the Umpqua Basin resources at $365,000 a year for the offshore salmon troll fishery which approximates three-quarters of a million pounds annually; $130,000 a year for the half-million pound shad fishery; and approximately $30,000 annually for the twenty to thirty thousand pounds of clams harvested each year in the estuary of the Umpqua River. These resources constitute a wholesale commercial value accruing to the fisheries resource of, at a minimum, $525,000 each year.

1/ Reference - comments of C. B. Collins, Douglas County Parks Department; (transcript Umpqua Basin Hearing, 1956, State Water Resources Board)

The economic value of the game fishery of the Umpqua Basin is more difficult to define. Data submitted by the Oregon Game Commission to the State Water Resources Board at its Umpqua Basin hearing, October 15 and 16, 1956, gives a rough base for the estimation of the economic status of the game fishery in the Umpqua system. In their testimony, the Game Commission indicated that approximately 75,000 angler trips were made in the 1955 season in connection with anadromous fishery game activities. In additon to this, an estimated 20 to 25 thousand man days were utilized in the trout fishery. For purposes of simplification, it is assumed that the 25 thousand man days represents an equivalent number of angler trips.

Testimony introduced at the Board's hearing indicated that the game fishing effort in the Umpqua system in 1955 resulted in a catch including 700 river-caught spring chinook, 800 river-caught fall chinook 7,000 chinook from Winchester Bay, 4,000 silver salmon from the river and 8,200 from the bay, 370 summer steelhead, 6,500 winter steelhead, and approximately 2,500 sea-run cutthroat trout. The catch of resident trout was not established.

For the purpose of establishing order of magnitude values for the economic contribution of the game fishing, two values can be considered: first, the value to the Basin by virtue of the average expenditure for an angler trip; and secondly, the value of fish caught as a food.

The Crosley "National Survey of Fishing and Hunting" indicates the value of an average angler trip at $8.15. Assuming the value of an angler trip at this level for the indicated number of angler trips, the economic benefit would be on the order of $615,000 for the anadromous fishery and $200,000 for the resident trout fishery.

The Fish Commission of the State of Oregon submitted data indicating that the wholesale value of salmon as meat approximates 50 cents per pound. If this figure is applied to the 30,000 plus fish caught in the game fishery, with an estimated total weight of 250,000 pounds, meat value would amount to an additional $125,000. Not all of this value could be assigned to the economic gain of the Umpqua River Basin.

Very little data on the contribution of wildlife to the economy of Douglas County is available. The Game Commission has submitted data indicating that the deer hunting activities in Douglas County contribute over half a million dollars to the channels of trade. This figure was obtained by applying Washington State College study figures, developing the average expenditure per big game hunter, to the 7,890 deer hunters active in the Umpqua Basin in 1955. Supplementing the economic contribution of game hunter expenditure is the estimated value of the meat of the 3,147 deer killed during the 1955 season. The 346,000 pounds of venison at 25 cents a pound results in a meat value of approximately $84,000.

The limited data available on recreation, fish life, and wildlife does not provide an adequate basis for determining the contribution of these activities to the economy of Douglas County. Figures at the best are rough approximations and subject to some very broad qualifying assumptions. The figures indicated do not express to any degree the social values inherent in these three activities.

Power Development

Another significant item in the economy of Douglas County is the availability of relatively inexpensive hydroelectric power from the water resources of the North Umpqua River. The economic value of power development in the Umpqua Basin, although not specifically defined, is actually a real economic asset. If the hydroelectric potentials and developments of the North Umpqua were not available, power supplies would have to come from some alternative source. If that alternative source were thermal generated power, either gas, coal, or oil-fired, costs to the power consumers of the Basin would be substantially higher. The estimated average annual generating capacity from existing installations in the Umpqua Basin amounts to approximately 900 million kilowatt hours. The saving of one mill per kilowatt hour of energy generated over alternative sources would represent a saving of over 900 thousand dollars to the power consumers utilizing energy from the North Umpqua River.

FUTURE BASIN ECONOMY

Forest Products

The dominant position of timber in the present economy of the Umpqua River Basin is fully established. There is, at this time, no evidence to indicate that timber will be replaced in the future as the dominant influence in the economy of the Umpqua Basin. Studies by agencies interested in the conservation and utilization of forest products indicate that demands for wood will increase at least twofold in the next fifty years. In the period 1949 to 1953, the annual cut exceeded the estimated annual regrowth capacity of the forest lands of Douglas County which is placed at something less than three-quarters of a billion board feet. If operations within the sustained annual yield capacities are the basis for primary timber operations of logging, sawmilling, and plywood production for the Umpqua Basin in the future, no major economic growth can be expected to stem from these activities.

On the basis of existing practices, Douglas County could be expected to supply a lesser percentage of the demand in the future than it is presently supplying for existing requirements. Douglas County could, however, supply a greater share of the wood and fiber needed in the future if fuller utilization of its wood resources was accomplished. Forest Service figures indicate overall waste, from logging through the primary manufacturing processes, of approximately fifty percent of the timber cut in the Basin. Full utilization of wasted wood would mean revenue from 750 million board feet of timber, rather than 375 million board feet which would be realized from the sustained yield cut under existing utilization practices.

In the "Summary of Findings" of the publication entitled, "Economic and Industrial Survey of the Inland Umpqua Basin, with Particular Emphasis on Forest Resources and Their Utilization", published by the Roseburg, Myrtle Creek, and Riddle Chambers of Commerce, are several findings which point out very effectively the possibilities of increasing the contribution of lumber and wood products to the economy of the inland Umpqua Basin. They are as follows:

"1. Discourage the entrance of any new primary wood-using establishments except for a pulpmill.

" 2. *Encourage the establishment of a pulpmill at or near Winchester.*

" 3. *Encourage the entrance of several new secondary wood-using establishments which will increase the number of manhours required for every thousand board feet of raw material consumed and reduce labor seasonality.*

" 4. *Encourage the establishment of plants designed to utilize waste and low grade material.*

(a) *Extraction of wax, tannin, and dihydroquercetin from bark.*

(b) *Production of soft and hardboards or paper products from sawmill slabs, edgings, trims, and logging wastes in the form of limbs, stumps, cull trees, decay tree, etc.*

(c) *Production of consolidated hard and softboards from sawdust and shavings.*

(d) *Production of wood-sugar molasses from wood wastes which can be sold as cattle, swine, and poultry feed or can be fermented to produce ethyl alcohol.*

" 5. *Encourage the entrance of sawmills or plants to produce cut-stock for manufactured wood products from the native hardwoods.*

" 6. *Do anything possible to increase the dry kiln facilities for the area in the form of new kilns for present primary industries or building of separate plants to perform custom kiln drying.*

" 7. *Do anything possible to increase the number of access roads in areas now void in order to fit into the long range, sustained yield management plan for the area.*

" 8. *Cutting should be accelerated in the old growth stands within limits of the sustained yield capacity."*

All of these recommendations offer possibility for improvement in economic stability and gain for the Inland Umpqua Basin.

Since the issuance of the Chamber report in 1951, additional investigation work has been directed towards the potentials of pulp mill installation in the Basin. There are real potentials for the development of kraft pulp and paper processing operations in the Umpqua River Basin. Studies conducted by Sandwell & Company for the Oregon Development Commission indicate that the development of a pulp and paper operation with a daily capacity of 300 tons is economically feasible at this time. This installation could be supplied with raw materials from available residue from existing mills in the Basin. Wood salvage potentials indicate an ultimate pulping capacity for the Umpqua Drainage Basin ranging from 900 to 1,000 tons per day.

The Sandwell Report of 1958 indicates the process most likely to be developed in the Umpqua River Basin will be a sulphate (kraft) pulp and paper operation (unbleached). Economic considerations dictate an initial installation of 300 tons per day (100,000 tons per year). Manufacturing capacity would probably be distributed between kraft liner board and unbleached kraft paper in approximately equal amounts.

Estimated capital cost for the installation of kraft pulp and paper mills of modern design and integrated character is figured at $100,000 per ton of production per day. This would result in a capital cost for an initial installation of 30 million dollars.

The product value from an operation of this character is estimated at approximately 14 million dollars annually for a full capacity, 340-day-per-year operation. The product value is based on a fifty-fifty distribution of production between unbleached paper at a $155 net mill price and liner board at $115 net mill price.

Important physical features connected with the operation would be wood consumption, estimated at 200,000 cords per annum, water consumption, 2.8 cfs (diversion - 9½ cfs), and power consumption, 28 million kilowatt hours annually. A basic consideration in the contribution of a pulp and paper operation to the economic structure of the Umpqua Basin would be the level of employment that it would provide. Employment resulting from a facility of this kind would consist of two categories: (1) direct mill

employment; and (2) service employment in the community resulting from the creation of basic employment at the mill. Average industry figures for direct labor in pulp and paper operations of the type under consideration approximate five manhours per ton of production. Assuming a man year equivalent to 2,000 hours, 100,000 tons of production annually would provide for 250 employees on a direct-labor basis. By comparison, employment connected with Willamette Valley pulp and paper operations, although varied in nature, have a unit value of approximately 1.7 people per ton of production. This figure is probably high for a modern integrated pulp and paper operation. One specific example available in Oregon has a unit employment level of about one person per ton of capacity. Upon this basis the initial production of 300 tons in the Umpqua Basin would provide a direct mill employment for approximately 300 people, 50 of which would be in administrative and supervisory functions. Jobs created in the service and professional fields by virtue of the direct mill employment would contribute substantially to the Basin economy. One index, commonly used, estimates 74 jobs of the service and professional type for every 100 new industrial-base jobs created. Total employment resulting from the initial facility, would approximate 500 people.

The capital investment of 30 to 35 million dollars in a pulp and paper operation would result in the broadening of the taxable assets of the county and the redistribution of tax payments for property owners within the taxing district. Values for goods and services, other than wood, can be viewed only in light of present experiences in the Willamette Basin. Freight costs in the Willamette approximate seven dollars per ton of output; material purchased twenty dollars per ton of output; and utilities six and one-half dollars per ton of output. These goods and services would represent an expenditure in excess of three million dollars annually if the unit values were approximately the same for installations in the Umpqua Basin. The foregoing values indicate in a rough way the possible contributions of a pulp and paper operation to the economy of the county.

Sufficient water resources exist on the North Umpqua and main stem of the Umpqua to provide adequate water for processing operations with a high degree of reliability. Major problems connected with the installation of pulp and paper processing facilities revolve around air and water pollution. Minimum flows in the system at points where potential development sites exist are not sufficient to provide dilution for untreated effluents from conventional kraft mills. Stringent controls will be required to guarantee

that mill effluents do not produce deleterious effects on water to be used for other beneficial uses in the Basin.

The value for chips is projected by Sandwell & Company to be approximately seven dollars per ton bone dry for Douglas Fir and $13.75 per ton bone dry for selected species such as White Fir.

Agriculture

It has been pointed out previously that about 120,000 acres of the 495,000 acres of agricultural land in Douglas County is physically susceptible to irrigation but only about 60,000 of this amount appears to be economical for irrigation development in the foreseeable future. Land suitable for irrigation development is largely under agricultural crop and pasture land production at the present time. Growth in the agricultural economy of the Basin must come through increased production from the present crop and pasture land. The expansion of agriculture at the expense of depleting timber lands, does not present an economic gain in the overall picture. Although an immediate large scale expansion of irrigation in Douglas County does not appear to be economically feasible now, in the long run, the expansion of the agricultural base by increased irrigation will result in advantages to all segments of the county's economy. In addition to the bolstering of the crop economy of Douglas County, full utilization of irrigation potential would substantially increase the livestock production and the gross income from this agricultural activity.

It is anticipated that the expansion of irrigation in the county would result in an increased tax base because of the higher values of land under irrigation; it would result in increased markets for retail sales and manufacturing; and it could result, in time, in the development of food processing industries with their attendant connected growth.

In its presentation to the Board at the Umpqua Basin hearing, the agricultural subcommittee of the Douglas County Water Resources Advisory Committee made the following statement pertinent to advantages of irrigation, "Irrigation has greatly increased production per acre and gross income per acre. Well developed and well managed pastures under irrigation have produced 500 to 700 pounds of meat per acre, in productive capacity equal to ten or more acres of the best grazing lands. Irrigation permits growing a wider variety of crops, particularly specialty crops of

high value per acre. A good example is snap beans for canneries with an average of $1,200 gross income per acre and the same land in alfalfa without irrigation grossing $75 to $100 per acre.

Full development of irrigation in the Umpqua Basin might well triple the present annual gross agricultural income of six to seven million dollars. It is recognized that full development is not economical or possible immediately and gradual development over a number of years is necessary and desirable."

Evaluation techniques for predicting the contribution to river basin economy of agricultural expansion through proposed irrigation development have not developed to the point of general acceptance by all responsible analysts.

Case history studies of the economic impact of specific developments on area economics have been made but possibilities for comparison of conclusions have been restricted because of basic differences in the methodologies of analysis. Three studies which have comparability show indirect income in the affected trading area equal to 120-127 percent of net income from the agricultural development.

The necessary criteria and procedures for determining advance long-term net benefits stemming for irrigation development have not yet been perfected. Prediction of development contributions are realistically judgment decisions made with short term immediate foreseeable values in mind.

More specific data on the future of irrigation in the Umpqua Basin economy will be available when the Bureau of Reclamation completes feasibility studies now under way on projects proposed for this watershed.

Mining and Mineral Industries

Mining and mineral industries are a phase of the Basin's economic picture that can be fairly well defined in terms of their present activity and worth, but which are difficult to establish in terms of future potentials. The Basin does have mineral and mineral industries development potential but this potential is not fully definable from presently-known data.

Recreation, Fish Life, and Wildlife

Recreation offers great potential for contribution to the economy of Douglas County. Unfortunately specific data, evaluating criteria, and evaluating techniques are not available for projecting the future position and contribution of recreation to the economy of the Umpqua River system.

Determination of the future values of wildlife face the same difficulty as the evaluation of recreation in the Basin's economy.

In presenting a basis for the place of fish life in the future growth of the Umpqua Basin, particularly with regard to game fisheries, the Game Commission of Oregon projects that some 180,000 angler trips for sea-run fishes will be made in 1980 and that figure will increase to more than 400,000 trips by the year 2005. The Commission also anticipates the effort expended in the pursuit of resident fish to increase in a parallel fashion. Applying the value of an average angler trip as suggested in the Crosley Report, $8.15, the value to the Basin of the anadromous game fishery would be in excess of three million dollars annually not including the food value of these fish. Assuming the same ratio of values between angler trips for resident fish and contribution to the present economy and further assuming the same ratio between angler trips and pounds of fish caught, the value of the fisheries resource from a game standpoint is projected to more than four million dollars by the year 2005, based on 1957 values. This very rough value for the economic potential of the future game fishery is predicated on the assumption that the anadromous fisheries and resident fisheries resources will be maintained at such a level as to provide inducement for the contemplated fishing pressure.

In connection with the maintenance of sufficient resources to induce game fishing activity, some preliminary evaluations have been made by the Game Commission towards the contribution which might be made to the economy of the Basin by improvement in streamflows in areas substantially below their potential level of development. The evaluations were done in connection with determining fisheries benefits that might accrue to the Galesville project on Cow Creek, the Olalla project on Olalla Creek, and the Hinkle project on Calapooya Creek. The estimated benefits that would accrue to the Basin in both the offshore troll fishery and the game fishery are estimated at $800,000 annually. The capital cost, exclusive of storage, required to provide maximum protection of existing fisheries resources and realization

of maximum potentials, would approach $280,000. Annual operating costs, also exclusive of storage operations, are estimated at less than $40,000. To accomplish these benefits, Commission personnel indicate that 70 cubic feet per second of water must be made specifically available for use of the fisheries resources in the 62 miles of stream involved. If such economic benefits can be derived from the improvement of the stream conditions for 62 miles of stream length in the Umpqua system, the potentials for benefits stemming from this type of water utilization are tremendous. Of considerable significance is the fact that the benefits derived from utilization of water for the maintenance of minimum streamflows for the fisheries resources of Cow Creek may exceed the benefits which could be ascribed to the project at the Galesville location from any other individual use of water. If these benefit values, as preliminary as they may be, can be realized, enhancement of the fishery resources of the Umpqua system may be the most compelling reason for water resource development in the Basin.

Power Development

The 1957 report of the Federal Power Commission indicates that the total hydro generating potential of Douglas County approximates 3,500,000,000 kilowatt hours annually. Preliminary examinations indicate that some 882,000,000 of the remaining 2,600,000,000 kilowatt hours of annual potential are economically feasible in the foreseeable future. Some indication of the value of potential power development to the Basin can be obtained by examining the estimated cost of thermal power operating on modern efficient coal fired steam plants within fifteen miles of major load centers as the alternative source of power for the region by 1975. The cost of such power is about $18 per kilowatt annually for dependable capacity and slightly in excess of 3.3 mills per kilowatt hour of usable energy. Figures on dependable capacity for potential projects in the Umpqua system are not readily available but the annual energy values exceed two and one-half million dollars by themselves. The remaining power potentials of the Umpqua system constitute reserve assets for possible future utilization for benefit of the Basin's economy.

Other Water Uses

Domestic, municipal, and pollution abatement uses of water are factors in the Basin's economy that derive from growth and development and do not basically contribute to that growth and development to the extent of items previously considered. This does not diminish their importance but rather indicates that they are the result rather than the cause of the economy that might

develop in the future in the Basin. If requirements for these uses cannot be met by the available water resources, then they impose a restriction on expansion and development.

Value of Water in the Future Economy

It is impossible to place a fixed or even relatively fixed economic value on water of itself. The most reliable measure of its economic value is the value of goods and services that can be created or accomplished by its use or control, balanced against the cost of accomplishment. The benefits, economic or physical, that have accrued or could accrue from the use of the Umpqua River's waters for the development of the Basin's natural resource potentials, have been outlined in this chapter in broad terms. The examination of maximum potentials provides the base to which specific proposals can be compared as an initial test of maximum beneficial use of the Basin's water resources.

Flood Control in the Basin's Economy

Throughout the known history of the Umpqua Basin, floods of significant proportions have occurred. The most recent of consequence was the winter flood of 1955 which resulted in measurable damages in the Basin of over two million dollars. Figures are not available but damages in the South Umpqua watershed could have been substantially greater if the flood in that area had been the maximum basin flood which occurred in 1861.

As the Basin develops; as its low-lying lands become more intensively utilized, both from an urban and agricultural point of view; and as the industrial growth of the county increases, it can be anticipated that the damage potentials of floods of the magnitude of 1955 will increase significantly. Factors involved in basin expansion are too varied to attempt to establish any value of flood control prevention on the projected development basis.

Detailed analyses will be available for examination and evaluation upon completion of studies now under way by the Corps of Engineers.

CHAPTER III

WATER PROBLEMS IN THE BASIN

GENERAL

The study made by the Board of the Umpqua River Basin indicates that the water resources of the Umpqua system are sufficient for all foreseeable needs, present and future, in terms of total quantity, excepting the treatment of major industrial wastes by straight dilution.

Although the quantitative amounts of the resource taken on an overall basis are adequate, the studies of the Board and the evaluations of state, local, and federal agencies, and interested parties show conclusively that serious maldistributions exist in terms of resource availability, with respect to physical location and time. Unregulated resources of the Umpqua system will in general be inadequate for future needs during the low flow months of July, August, and September. There will be years where these dislocations would extend into the months of October, November, and even into the early part of December.

Need for water, for both consumptive and nonconsumptive uses, has expanded manyfold since 1931, the year of the lowest runoff (approximately 2.2 million acre feet). The average yield for the period 1929-1931 for the Umpqua system measured at Elkton was less than three million acre feet. Since 1944, there has not been an annual yield under 4.3 million acre feet. Recurrence of a low yield cycle such as 1929-1931 would result in a critical resource situation.

Broadly stated, the problem in the Umpqua Drainage Basin is to:

A. Provide water of suitable quality where and when needed for all consumptive and nonconsumptive beneficial uses.

B. Regulate the uncontrolled waters of the system to prevent, or at least mitigate, the potential for loss of life or property due to floods.

TYPES OF WATER PROBLEMS

The water problems of the Umpqua system follow these categories:

(1) Problems of quantity.

(2) Problems of quality.

(3) Problems of control.

(4) Problems of conflict.

PROBLEMS OF WATER QUANTITY

In the broadest sense, both items A and B can be included in this category of water problems. Flood control, however, is excluded from this phase and considered under the item of control. Thus, quantity problems discussed here are those related to the need for enough water at a given time and place to supply beneficial uses - consumptive and nonconsumptive.

Domestic

Domestic supplies are household and minor irrigation uses by individuals not served by municipalities or other public corporations. The sources of domestic supplies in the Umpqua Basin are: (1) surface supplies from rivers and springs; and (2) wells.

The established legal rights to appropriate surface water for domestic use, including springs, total less than 20 cubic feet per second for the entire Basin as of July, 1958. Legal rights to appropriate ground water are not established at this time. Rough field reconnaissance indicates that the use of ground water for domestic supplies is limited, and will be limited in the future due to the undependable nature of these supplies with respect to quality and quantity.

Legally established domestic water rights rely primarily on surface waters of the Umpqua system. Domestic permittees utilizing flows of the main stem of the Umpqua or the North Umpqua, have no problems insofar as quantity is concerned. Those individuals relying on tributaries of the South Umpqua have problems of adequate

supply during low flow periods.

Municipal

The problems of municipalities and public corporations serving the people of this river system are similar to those of the domestic appropriator but are quantitatively of greater magnitude. Those public corporations relying on the North Umpqua proper and the main stem do not have any serious supply problems at present nor should there be any in the foreseeable future, since sufficient amounts of the resource are available to provide for anticipated municipal requirements.

Municipalities located in the South Umpqua system and, to a lesser extent, on Elk and Calapooya Creeks are in a less desirable position. Supplies in the last few years have just barely been adequate from surface sources and those communities dependent upon ground water supply have been in difficulty. Typical is Tri-City whose individual wells either dry up or have greatly reduced supplies from July through November. Upon occasion, people in this area must haul water. The community has contracted to have specific engineering studies made to solve their problems.

The community of Myrtle Creek has filed on 10 cfs from the South Umpqua for future requirements but in critical supply years, such as 1931, upstream rights to water would exceed the unregulated stream potential at Myrtle Creek. Glendale, Riddle, Canyonville, and other communities have an analogous problem.

It is particularly important to remember that the summer flows of the Umpqua system have generally been good during the period of major growth dating from the end of World War II. The lowest flow of record at the Brockway gage on the South Umpqua since 1945, was 63 cfs, or 75 percent greater than the minimum of record August 12-13, 1926. In the seven years from October 1, 1946, to October 1, 1953, the flow at the Brockway gage dropped below 100 cfs in less than 110 days. Of these, 58 occurred in the months of August and September, 1951, the year of lowest flow since 1945 (63 cfs). Urban expansion in the South Umpqua area could be severely restricted if adequate supplies for municipal purposes are not made available during periods of low summer flow.

TABLE 3

MUNICIPAL WATER SUPPLY DATA - UMPQUA RIVER BASIN

Community	1950 Population	Certified 1958 Population	Source of Water Supply	Legal Diversion Right (cfs)	Use Restrictions	Treatment
Canyonville	861	1,010	O'Shea Creek	1.00	Irrig.	Chlor.
Coos Bay	-	-	North Umpqua (out of basin-use)	100.00	-	-
Drain	1,150	1,440	Bear Creek	4.00	None	Chlor.
Elkton	201	200	Springs, Umpqua River	0.50	None	Chlor.
Gardiner		400 +	Stream at Fisher's Cove	-	0.10 mgd	Chlor.
Glide		100 +	Little River	0.10	Pump Cap.	Chlor.
Glendale	871	1,000	Section Cr., Mill Cr., Springs, & Cow Cr.	1.82	None	Chlor.
Myrtle Creek	1,781	2,250	Harrison-Young Branch of N. Myrtle Cr.	7.17	None	Chlor.
Oakland	829	970	Calapooya Creek & Wells	2.00	None	Chlor.
Reedsport	2,288	3,450	Clear Lake (out of basin)	25.00	None	Chlor.
Riddle	634	1,000	Judd Cr., Unnamed Cr. of S. Umpqua, Wilson Cr. & Cow Cr.	2.75	None	Chlor.
Roberts Cr. Water District *		4,000 +	Cooper Cr. of Roberts Cr. & S. Umpqua River	1.22	None	Chlor., Filter, & Coagu.
Roseburg	8,390	12,200	North Umpqua River	25.00	None	Chlor.
Scottsburg	120	120 +	Creek	-	-	Chlor.
Sutherlin	2,230	2,700	Calapooya Creek	3.00	Irrig.	Chlor., Filter & Coagu.
Winston		2,450	South Umpqua River	2.57	-	-
Yoncalla	626	700	Adams Cr. & Wilson Cr.	1.50	Irrig.	Chlor. & Filter
	19,981	33,990				

* Serves Winston-Dillard

\+ Estimated 1956 Population

Irrigation

Future expansion of the agricultural economy of the Basin will be greatly inhibited if availability of water is not increased during periods of low streamflow. Preliminary studies by the Bureau of Reclamation indicate that some 120,000 acres of land in the Basin are irrigable and approximately 60,000 acres appear to have potential from an engineering and economic point of view. To improve the gross agricultural values of the Basin, increased productivity on existing agricultural lands must be achieved by the application of an efficient irrigation economy. The studies of the Board show conclusively that an increase in water requirements by expanded irrigation would be, in many areas, far in excess of stream capability during periods of critically low flows if based on present regimen. The exceptions would be the areas served by the North Umpqua and the Umpqua main stem. Major improvement in the agricultural economy will require the capture of waste waters of winter and spring runoff and their application to beneficial, consumptive use during the periods of low flow.

There is a real need for the completion of economic studies by the Bureau of Reclamation relative to the economic feasibility of developments tentatively proposed in their Special Report on the Umpqua River Basin, dated June, 1956. The funds invested in this report by the Federal Government, Douglas County, and the State of Oregon will not have attained their full purpose until the economic aspects have been evaluated. Completion of the Corps of Engineers studies are also essential to the development of a comprehensive program of water resource development for this river system.

Power Development

The estimated physical power potential of the Umpqua system is about 25 percent developed. A substantial portion of that remaining does not appear to be economically feasible in the foreseeable future. This is particularly applicable to sites in the South Umpqua portion of the Basin. Some of the possibilities examined as far back as the late 1920's are ruled out by urban development which would be destroyed by the construction of originally proposed projects. A few possibilities remain. Tiller on the South Umpqua, where power, as a facet of multi-purpose development, might be practical and desirable, is one.

TABLE 4

LIST OF EXISTING HYDROELECTRIC POWER PROJECTS

Name of Owner	Name of Plant	River	Installed Capacity KW	Av. Annual Generation 1,000 KWH	Gross Head Ft.
The Calif.-Ore. Power Co.	Winchester	N. Umpqua	500	3,900	14
The Calif.-Ore. Power Co.	Soda Springs	N. Umpqua	11,000	55,000	114
The Calif.-Ore. Power Co.	Slide Creek	N. Umpqua	18,000	94,000	179
The Calif.-Ore. Power Co.	Toketee Falls	N. Umpqua	42,550	220,000	448
The Calif.-Ore. Power Co.	Fish Creek	N. Umpqua	11,000	68,000	1,032
The Calif.-Ore. Power Co.	Clearwater 1	N. Umpqua	15,000	54,000	651
The Calif.-Ore. Power Co.	Clearwater 2	N. Umpqua	26,000	88,000	760
The Calif.-Ore. Power Co.	Lemolo 1	N. Umpqua	29,000	120,000	750
The Calif.-Ore. Power Co.	Lemolo 2	N. Umpqua	33,000	162,000	721
			186,050	864,900	

Source: Hydroelectric Power Resources of the United States Developed & dated 1957 by Federal Power Commission, Washington, D. C.

The North Umpqua has undeveloped sites of considerable power potential. Undeveloped power potential for the North Umpqua totals at least 180,000 kilowatts capacity, almost the equivalent of the existing California-Oregon Power Company development above Toketee Falls on this same stream. Future possibilities of a limited nature exist elsewhere in the Umpqua system.

The main stem of the Umpqua has potential for power development. Federal Power Commission figures indicate the possibility of an installed capacity of approximately 130,000 kilowatts. With proper storage facilities, this figure could be revised upward possibly to a range of 200,000-220,000 kilowatts.

TABLE 5

LIST OF POTENTIAL POWER PROJECTS

Name of Project or Site	River	Installed Capacity KW	Av. Annual Generation 1,000 KWH	Gross Head Ft.
LOWER UMPQUA				
12 RB No. 3	Smith	3,000	13,000	130
12 RB No. 1	Smith	5,400	23,600	320
Loon Lake Diversion	Mill Creek	6,500	55,900	385
Scottsburg	Umpqua	38,100	290,000	100
Kelleys Smith Ferry	Umpqua	30,800	236,000	85
Kellogg	Umpqua	23,500	196,000	70
Wolf Creek	Umpqua	37,000	298,000	145
NORTH UMPQUA				
Winchester	N. Umpqua	13,400	89,000	80
Oak Creek	N. Umpqua	11,300	86,500	70
Horseshoe Bend	N. Umpqua	14,000	98,300	90
Glide	N. Umpqua	9,000	62,200	60
Rock Creek	N. Umpqua	51,000	263,000	221
Boundary	N. Umpqua	44,000	216,000	187
Steamboat	N. Umpqua	16,300	113,000	190
Copeland Diversion	N. Umpqua	24,300	175,000	290
Lake Creek No. 3	Lake Creek	3,600	9,800	325
Lake Creek No. 1	Lake Creek	5,000	13,000	480
SOUTH UMPQUA				
Roseburg	S. Umpqua	3,000	22,000	50
Dillard	S. Umpqua	3,600	26,000	60
Ruckles	S. Umpqua	2,800	21,000	50
Myrtle Creek	S. Umpqua	3,900	28,000	70
Riddle Diversion	S. Umpqua	5,800	44,000	125
Days Creek	S. Umpqua	4,900	24,100	100
Perdue	S. Umpqua	4,600	20,800	100
Coffee Creek	S. Umpqua	3,100	20,000	80
Tiller Diversion	S. Umpqua	6,200	39,800	160
Deadman Creek	S. Umpqua	3,100	21,000	175
		377,000	2,514,000	

Source: Hydroelectric Power Resources of the United States Developed & Undeveloped, dated 1957 by Federal Power Commission, Washington, D. C.

Improvements in the flow patterns of the streams of the system by at-site or upstream storage would offer increased power production in many cases. Development of the various sites differs so widely in character that generalizations are improper. Specific studies, both engineering and economic, will be required to fully assess the individual project potentials.

Power supplies within the Basin are adequate for the immediate future. Water quantity can be considered only a problem insofar as the amount available controls the economics of a specific operation and thus to some extent controls the cost of the power production. Adequate supplies can be considered available as long as undeveloped sites remain from which power can be produced at a marketable cost. Use of the waters of the Umpqua system for power generation entails difficulties of another nature, as will be pointed out later.

Industrial

Two problems exist relative to industrial use. The first is the full time availability of water for processing purposes. Under present conditions, insufficient water is available during periods of low flow.

The second quantitative problem is that of dilution water for industrial pollution abatement processes. This is a quantitative problem arising from the effects of industrial waste on the qualitative standards of the surface and ground waters of the state. The adverse environmental and esthetic effects of waste discharge can be mitigated by sufficient quantities of dilution water, but this technique is not basically a solution to the problem--it is generally a temporary expedient brought on by economic pressure or convenience.

A major problem facing Douglas County is the stabilization of its economic base. Since a great portion of the wealth of Douglas County comes from its timber resource, fullest possible utilization is absolutely essential to the long range growth and welfare of the area. At the present time, authorities estimate up to 50 percent of the natural resource of wood harvested within the County each year is wasted. This is in large part due to the fact that secondary utilization of wood materials is practically nonexistent in this area. To utilize this wasted natural resource, secondary wood processing operations, as typified by the pulp and paper industry, are needed within the County. This is predicated

on the assumption that maximum benefit to the County from its own natural resource production would accrue only with the maximum amount of in-County processing.

The establishment of pulp and paper operations in this river system poses a significant problem with respect to the deleterious effects of their wastes on stream environment. Establishment of industrial operations of this type in interior Douglas County will require stringent treatment standards for industrial waste products. This can readily be understood when it is realized that wastes from kraft plants, limited to adequate control of toxic components, would require 100 percent regulation of the yield of the minimum year, 1931, on the South Umpqua to satisfy the requirement of a 200-ton unbleached kraft pulping operation. Such control is economically impractical. Economical operations of pulp and paper installations require, in general, continuous year-round production ruling out restrictions of output during periods of low stream-flow, therefore, four alternatives present themselves: (1) a solution of the industrial wood waste problems by the utilization of suitable treatment techniques; (2) restriction of large waste producing operations to coastal areas where ocean discharge could be acceptable under controlled conditions; (3) abandonment of pollution abatement standards; and (4) exclude industry by a refusal to allocate water for its operational needs. Possibilities (3) and (4) are unacceptable because of their totally negative nature.

Item (2) has the inherent disadvantage that it would divorce the major population center from a primary employment center. The possibilities of secondary wood utilization operations in the lower river are good, but utilization of all the wood available for operations at this point would be unacceptable to many people. Only one solution is totally and permanently acceptable for the Umpqua Basin--the development and use of satisfactory waste treatment techniques. This is a basic responsibility of both industry and the State of Oregon.

Mining

Mining operations in the Umpqua system are, to a large extent, located in the headwaters of the small tributaries and are, insofar as quantity is concerned, an individual problem. Existing rights for this use are often in excess of natural stream flows during summer months.

Operational difficulties and the nature of the permits issued by the State Engineer's office limit many operations to certain periods of the year. There are, however, some unrestricted rights of substantial size (as high as 30 cfs).

Actual use for mining is relatively small at present. Expansion of operations would be faced with a water availability problem during low flow periods.

Mining operations have little effect on downstream quantities available for other purposes, but can have serious qualitative effects as a result of uncontrolled operations.

Recreation

The needs for sufficient quantities of water for recreational uses are of great importance to the Umpqua Basin. Most of the income from outdoor recreation that comes into the County stems from some phase of recreation allied with water. The game fishing of the Umpqua is one of the important recreation values of the Basin. The relationship of fisheries resources to quantity of water (desirable base flows) is discussed in the section on Fish Life Uses.

Recreation requirements for water in the form of minimum flows extend beyond fishing. Approximately 50 percent of the out-of-state visitors coming to Oregon are from California. The Oregon State Parks Division of the Highway Department says, "It is an accepted fact that many want to see a country which offers them a change from their own dry surroundings. They want to see water and enjoy the many types of recreation that water provides."

Developments receiving greatest use in or near the Umpqua Basin are Diamond Lake, Crater Lake National Park, and the areas along the major streams. The greatest expenditures for recreation development have generally been where suitable water facilities are available during the recreation season. If the appeal, and thus the economic value, of these developments is to be continued, the maintenance of adequate water facilities is mandatory. The maintenance of satisfactory facilities requires water of suitable quality and sufficient quantity for the purpose needed. Minimum requirements vary with use, but the higher the standards at a given spot the greater the potential.

TABLE 6

MAJOR OUTDOOR RECREATION FACILITIES

DOUGLAS COUNTY

Improved Parks	Acreage
Fair Oaks	3.37
Mack Brown	3.37
Anna Drain	1.70
Winchester Bay (Salmon Harbor)	90.00
Dave Busenbark	28.60
Richard G. Barker Memorial	10.00
Singleton	3.50
Ziolkouski Beach	4.50
Winston-Dillard	7.25
Barton	27.30
Canyonville	12.00
North Myrtle	19.00
Gardiner Dock	0.25
Smith Springs	10.00
V. T. Jackson	3.00
Stearns	3.50
Cable Crossing	0.50
Lone Rock Wayside	0.50
Winchester River Access	2.00
Hestness Landing	1.09
Angler's Acres	1.50
Total Improved	232.93

Other County Parks	Acreage
Britt Nichols	123.25
James Wood	1.90
Ada	14.00
Otter Slough	30.00
Hedden	0.50
Steamboat Falls	15.41
Sparrow	14.00
Whistler's Bend	160.00
N. Umpqua Recreation Lands	428.00
Total Other	787.06

Recreational Roads	
Cleveland Rapids Road	1.50
Lawson's Bar Road	3.00

Recreational Reserve Lands owned or controlled -- approximately 2,000 acres.

FOREST SERVICE

National Forest Park Areas

12 camp and recreation areas totaling 85 acres, of which three of the most popular are:

Name	Location
Tahkenitch	7 mi. N. Reedsport
Diamond Lake	20 mi. N. Crater Lake
Carter Lake	9 mi. S. Florence

2 Winter Sports Areas
2 Resorts and Dude Ranches
1 Organized Camp
70 Summer Homes

1 Reservoir
3 Dedicated Areas
200 Miles of Roadside, Trailside, and Water Front

TABLE 6

MAJOR OUTDOOR RECREATION FACILITIES - CONTINUED

STATE OF OREGON

State Parks

Name	Location	Acreage
Bolon Island	City of Reedsport	11.41
Umpqua Lighthouse	5 mi. S. Reedsport	2,747.40
Umpqua Wayside	9 mi. E. Reedsport	31.22
Elk Creek Tunnel	3 mi. E. Elkton	200.00
Hutchinson	10 mi. S. E. Elkton	6.00
Pass Creek	5 mi. S. Cottage Grove	15.00
Umpqua-Myrtle Preserve	11 mi. E. Scottsburg	4.85
Susan Creek	29 mi. N. E. Roseburg	78.96
Roseburg	City of Roseburg	16.34
Canyon Creek *	3 mi. S. Canyonville	80.00
Stage Coach	18 mi. S. Canyonville	80.00
Camas Mountain	3 mi. E. Camas Valley	160.00
Total State Parks		3,431.18

Roadside Rest Areas

Umpqua River	13 mi. E. Reedsport	0.50
Cabin Creek	2 mi. N. Oakland	2.00
Cow Creek	24 mi. S. Myrtle Creek	5.00
Canyon Creek	3.6 mi. S. Canyonville	1.50
Packard Creek	5.7 mi. S. Canyonville	3.00
Total Roadside Rest Areas		12.00

* Includes Canyon Creek Roadside Rest Area

Historic Sites-Markers

Scottsburg	Site of Lowertown; wiped out in flood of 1861.
Canyon Creek	Route of Hudson Bay travelers to California.
Mile 28.17	Between Elkton and Scottsburg.

Minimum stream flows for recreation fall into two categories: (1) protection of desired minimums of streams whose natural low flows and depletion potential do not, at present, threaten the maintenance of the desirable physical minimums; and (2) creation of base program flows by the development of storage.

The main stem of the Umpqua, and the North Umpqua, plus some of its upstream tributaries, fall in the first class. Where the use of the resource for recreation is sufficiently valuable when compared to other beneficial uses, the Board can establish minimum perennial or desirable base flows by allocating such quantities of the unappropriated flow as are required.

Most other streams of the Basin fall into the second class. These are the streams with limited recreation development but which have real potential if suitable water could be made available. The South Umpqua and its tributaries are in this class. The answer is to provide storage when and if such storage becomes economically or physically feasible. To guarantee that storage facilities will be available when required, as needed for optimum water use, partial development of the limited number of sites in the system cannot be tolerated.

Fish Life

The major problem of a quantitative nature relative to the use of water resources of the Umpqua Basin for fish life uses lies in the physical accomplishment of base flows below which stream levels will never fall except in extremely unusual conditions not previously experienced.

The State Game Commission of Oregon has testified in a hearing before the Board at Roseburg, Oregon, in the fall of 1956 that sources of past information give fairly reliable evidence of anadromous fish populations of the Umpqua Basin in the days of early white settlers approaching 825,000 fish for anadromous species. They indicate that fish populations for these early periods had runs of the following approximate magnitudes: 25,000 spring chinook, 40,000 fall chinook, 350,000 silver salmon, 12,500 summer steelhead, and 150,000 winter steelhead. In contrast to these populations, the estimated fish population of this same system in 1955 was about 181,000 or roughly 22 percent of the population that is believed to have existed in early days.

Representatives of the State Game Commission have stated that proper management could restore the anadromous populations of the Umpqua system close to the 800,000 population level. To achieve this fisheries management objective, the Game Commission has determined that certain minimum streamflows are desirable and that their importance for the production of fish and fish food cannot be overemphasized. This poses a quantitative water problem of substantial magnitude.

In its study of the Umpqua system, the Board has compared actual flow data information with the values considered desirable by the Game Commission, and these comparisons show that minimum flows have occurred in the past, in some instances frequently, which are less than the desirable base flow levels. The most critical flow levels occurred in the early 1930's when the consumptive uses of water were small in comparison with the potential for consumptive use as expressed by existing legal water rights.

To evaluate, roughly, the potential of the main streams of the system to meet minimum desirable flows for the fisheries resources, comparisons were made between mean monthly flows of record and the desirable minimum flows for fish. These comparisons were made only to see what water would have been available under past circumstances to satisfy these requirements.

The low flow frequency curves, Figure 9, illustrate the situation. For the main stem and the North Umpqua, the occurrence of a month with a mean flow less than that desired for fish, 600 cfs, was an infrequent item.

For the South Umpqua and Cow Creek, the recurrence frequency of mean monthly flows of 100 and 20 cfs, respectively, is about every third and second year showing the futility of relying on existing stream regimen for desirable minimum flows for fish. Realistic accomplishment of desirable flows for the major portions of the South Umpqua watershed must come from a resource augmentation and conservation program not just resource conservation as represented by the commitment of all remaining unappropriated low flow water to the beneficial use of fish life.

The frequency levels indicated are probably conservative because they include early water years not influenced by depletion of water through

UMPQUA RIVER BASIN

LOW FLOW FREQUENCY CURVES

(MINIMUM MONTH)

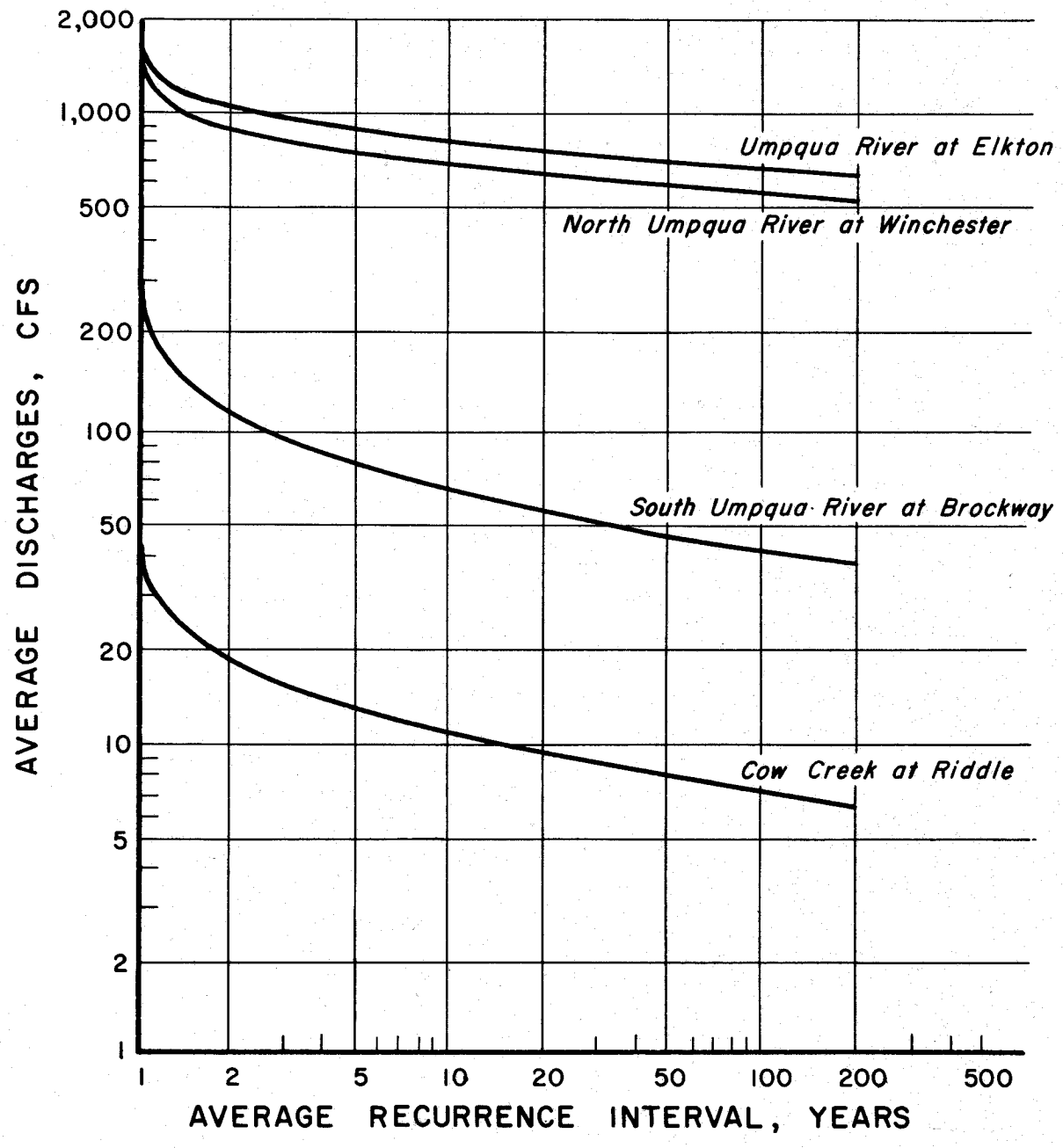


FIGURE 9

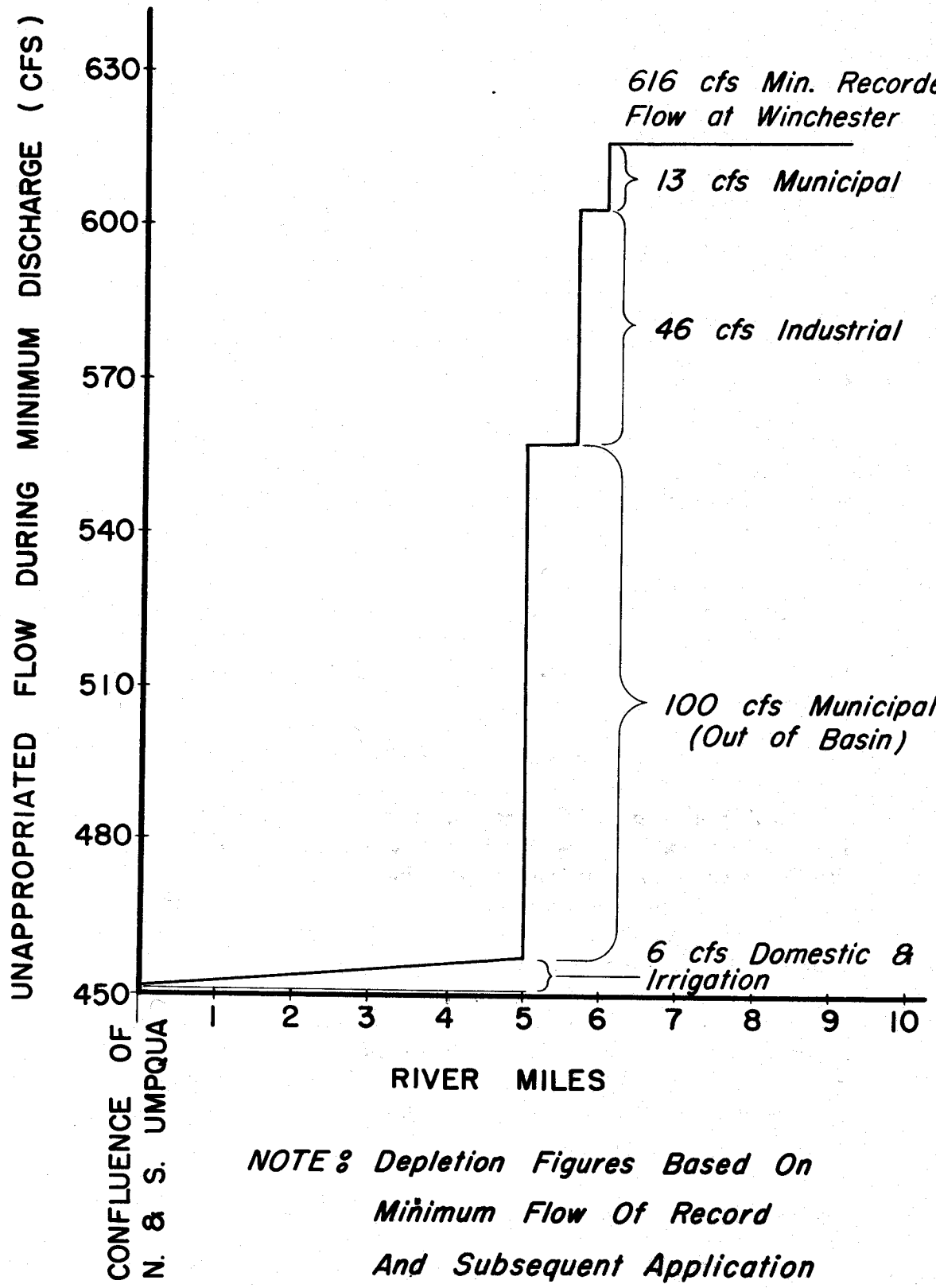
appropriation to beneficial use. These same water years, if repeated now, would most likely show smaller observed flows resulting in a lowering of the plotted curves.

Not reflected in the Umpqua and North Umpqua curves is a large water right, 100 cfs, which, though on the books, has never been exercised. If this right were exercised to a major degree, it could have substantial effects on the magnitude of low flows.

The expansion of legal rights to use water consumptively has intensified the problem of providing desirable base flows. In many areas the potential exists legally for the complete depletion of stream flows, and in the lower areas of the South Umpqua Basin, legal rights are such that in almost all areas flows would be depleted in dry years below that considered desirable. To illustrate this problem, the specific example of the North Umpqua River between Winchester Dam and the river mouth, a distance of 6½ miles, is considered. If the minimum flow of record (1926) of 616 second feet (average daily) should again occur at the Winchester Dam, the full exercise of consumptive legal rights between Winchester and the mouth of the river would result in the depletion of the flow below the value considered by the Game Commission to be the minimum desirable. Legal rights are such that the flow at the mouth would be reduced to 450 cfs, or 150 cfs less than the recommended value of 600 cfs for the mouth of the North Umpqua (Fig. 10). It is, of course, unrealistic to assume that full utilization of all consumptive water rights will occur simultaneously. However, the margin between the low flow of record and the desired base flow is so small, 16 second feet, that a coincidental use of more than 8 percent of the legal consumptive rights would lower the stream's flow below the desirable level. This potential would become even more critical in light of the estimated future needs of this particular section of the stream, since the additional requirements for consumptive use would represent an additional depletion potential of at least 60 cfs exclusive of major industrial expansion. The concurrence of a high use period, a low flow, and a run of anadromous salmonoids has relatively low probability, but the potential does exist.

This example illustrates the problem of water quantity as it relates to the fisheries resource in the case of the North Umpqua and some of its tributaries where, presently, sufficient water flows during some periods of critical supply in the rest of the Basin. Protection of the fish populations

DEPLETION POTENTIAL
NORTH UMPQUA RIVER
(WINCHESTER TO MOUTH)



NOTE: Depletion Figures Based On Minimum Flow Of Record And Subsequent Application Rights.

FIGURE 10

could be achieved by restricting future applications for the appropriation of water for consumptive use or for out-of-basin diversion. Such action would prevent the expansion of depletion potential and would serve to maintain the base flows of the stream at the highest possible level consistent with existing runoff conditions.

Throughout the Umpqua River system, and particularly in the basin of the South Umpqua, such an action would have an effect of prolonging the desirable base flows, but would not fully preclude the possibility of flows dropping below the desired level, or, for certain periods, even achieving a point of zero flow. The problems on streams of this type can be solved by only one technique, and that is by making water physically available when needed, to provide the desired base flows. The major sources of water are the winter and spring flows which would have to be stored for later discharge.

Because of the topography of the Umpqua River Basin, supplying water for minimum flows from storage reservoirs conflicts with the fisheries management program itself. Suitable sites for the impoundment of water, from an engineering and economic point of view, are not located in the steep rugged areas above the limits of salmonoid migrations. In some instances, the only sites which would be economically feasible from the most liberal point of view, lie well downstream of the upper migration limits. The desire to preserve as much spawning area in the stream system as possible is sometimes, and in fact frequently in the Umpqua Basin, in direct conflict with the need to provide water in suitable quantities and of a suitable quality to obtain the desirable base program flows whose primary justification is the protection of the fisheries resource, recreation, wildlife, and pollution abatement. It is impossible to evaluate the loss of spawning area against the anticipated gains from increased minimum flows until a specific project location has been selected. If minimum flows are necessary for increased fish propagation, then in the Umpqua system some spawning area must be relinquished in order to provide the water for downstream fisheries needs during low flow periods. The establishment of relative values requires careful analysis.

In some cases, it will be necessary to provide fish passage and handling facilities at dam sites which will still make it possible to utilize the upper reaches of the stream. However, there are instances in which economic feasibility of the project will not allow extensive fish passage

or handling facilities. Here the relative gain from desired flow over loss of spawning ground, must be evaluated and weighed in the final decision as to the merits of the project.

One of the biggest deterrents to the accomplishment of this fisheries resource management program is, and has been, the failure to provide funds to include in multi-purpose water resource projects facilities for the improvement, as opposed to maintenance, of the fisheries resource. If fish life is a valuable resource of the Umpqua Basin, and it is generally agreed that this is the case, then it seems reasonable that funds should be spent for its improvement as well as the expenditure of funds to maintain the status quo or something less.

Wildlife

The quantitative problems of water for wildlife uses are similar in character to those of fish life. An adequate and dependable supply of water is needed for the maintenance of bird and animal life. Here again, desirable base flows would be of substantial benefit. It is desirable with wildlife, as with the fisheries resource, to maintain control of the resource as high in the watershed as is economically feasible. The State Game Commission takes the position that the number of animals any given water supply can support is limited by the distance that the animal will willingly travel to reach it. If necessity requires animals or birds to travel further for water than they are willing, a reduction in bird and game potential can be anticipated. The storage of waste winter runoff waters in reservoirs, and their subsequent discharge into streams during periods of low flow, would have beneficial effect, in general, on wildlife.

Pollution Abatement

From a quantitative point of view, water for pollution abatement purposes involves the problem of dilution of industrial, municipal, domestic, mining, and agricultural wastes. Stated simply, sufficient water must be available in any stream to receive the waste products discharged into it, from whatever source, and so dilute those wastes that they will have no deleterious effect on any downstream beneficial uses of water.

The problem of industrial waste as related to the pulp and paper industry of Oregon has been discussed under the heading, "Water for Industrial Uses", primarily because of the large quantitative values involved in the potential industries that seem most possible of development in the

Basin. This is a potential problem, since there are no major sources of industrial waste pollution in the Umpqua Basin at this time. The Sanitary and Engineering Division of the State Board of Health in the Roseburg hearing of the State Water Resources Board in 1956 stated, "Thus far, most of the pollution caused by industry has been in connection with log pond overflows and the discharge of wood waste and other debris." Studies of the staff of the Division of Sanitation and Engineering indicate that oxygen demands of log pond discharges can be extremely high and can cause a serious pollution problem when discharged into small streams. This problem would be extremely acute during summer periods when streamflows are low. A magnitude of the potential for difficulty can be readily understood upon noting that the oxygen demand from a log pond, containing 50 acre-feet of water, would be equivalent to the raw sewage for one day from 100,000 persons, or more than the present population of Douglas County.

The domestic and municipal waste pollution problem of the Umpqua system is not of serious magnitude at this time, largely due to the active efforts of the Sanitary Authority and the program for municipal disposal facilities in the Basin. The quantities required for the dilution of future municipal and domestic wastes are, in comparison to potential industrial needs, relatively small.

PROBLEMS OF WATER QUALITY

It is convenient to divide water quality problems into two main groups: (1) problems relative to groundwater supplies, and (2) problems relative to surface water supplies. In the "Water Quality Inventory Study" conducted in 1955-1956 by the Experiment Station at Oregon State College for the State Water Resources Board, no information was found relative to the quality of water from underground sources in the Umpqua system.

Information on the quality of surface water supplies in the Umpqua Basin was also extremely limited. Prior to June 1, 1956, only 28 spot samples were available for analysis for the waters of this system. In addition, there were two points in the Basin where daily records had been kept for some period of time. At one of these points (the Rock Creek Hatchery in the North Umpqua system) the only test made was for temperature. These temperature data extended from 1943 to 1956. The other instance of daily samples was for the purpose of boiler water analysis taken in the vicinity of the town of Elkton on the main stem of the Umpqua.

TABLE 7

SEWAGE TREATMENT PLANTS

Name	Year Constructed	Treatment Units	Design Pop.	Pop. Served
Drain	Under Construction	ScCmFtDCmEgBo	2,000	
Glendale	1930	Cs	500	800
Glendale	1957	Sc(CmDpCm)FthEgcBo	1,000	
Milo	1956	CiFthCpEh	450	300
Myrtle Creek	1952	ScCmFthCmEgDcpBo	3,000	2,000
N. Roseburg	1951	ScCmFt2hCmEgDfhBo	4,000	5,400
Riddle	1952	ShCmFthCmEgcDcpBo	2,000	1,000
Roseburg	1940	ShCmFtrCmEgDchBo	6,000	9,000
Roseburg	Under Construction	ScCmFtDCmEgBo	20,000	
Sutherlin	1956	ShGhCmFtrCmEgDchBo	3,500	2,500
Sutherlin Hsg	1953	CsEgc	350	350
Winston	1953	CsFsEh	175	150
Winston	1957	ScCmFthCmEgcDam	3,500	

Treatment Abbreviations

Bo	Open sludge beds	Egc	Gas chlorination, separate contact tank
Ci	Imhoff tank	Eh	By hypochlorite
Cs	Septic tank	Fs	Intermittent sand filters
Cm	Mechanically equipped tank	Fth	High rate or capacity filter
Cp	Plain hopper bottom tank	Ft2h	Two stage high capacity filter
Dch	Digester, fixed cover, heated	Ftr	Standard rate filter with rotary distributor
Dcp	Digester, fixed cover, unheated	Gh	Hand cleaned grit chamber
Dfh	Digester, floating cover, heated	Sc	With shredder or grinder, comminutor
Dp	Unheated	Sh	Hand cleaned bar rack
Eg	By chlorine gas		

Source: Oregon State Sanitary Authority

Because several other areas of the State also lacked data, the State Water Resources Board extended its water quality acquisition program to include a restricted field sampling program of a voluntary nature. This program was started during the summer of 1956 and was continued through the spring of 1957. Within the Umpqua Basin, an additional 52 spot samples were obtained. Sampling was distributed over the Basin as widely as possible. Daily samples were also taken at the outfall of the Roseburg sewage treatment plant. This data, plus information previously held by the City of Roseburg for the same location, gave coverage for a period from August 16, 1954, to April 30, 1957. Daily samples were taken in the Yoncalla area, but the tests for water quality here were limited to turbidity and chloride. These data indicate that the general quality of the surface waters of this system is quite high. Most problems relative to quality result from operations that take place in the Basin on an intermittent basis and with no consistency as to geographical distribution.

It is convenient in discussing qualitative aspects to consider three categories relative to water characteristics. These are: (1) physical, (2) chemical, and (3) biological characteristics. In the Umpqua system, present problems of water quality center about the physical characteristics of the supply. Future problems will include aspects of physical, chemical, and biological characteristics, if anticipated industrial, commercial, and urban development occurs. General problems relating to the various characteristics of water are:

(1) Physical Characteristics

Siltation

Turbidity caused by silt is the most immediate quality problem falling under the category of a physical characteristic. The heavy silt loads carried by the streams of the Basin after intense or protracted rainfalls result from certain land use practices and have been a matter of considerable public attention in the Basin.

The sources of silt are the logging operations, which are widespread; intermittent construction activities; sand and gravel operations; certain agricultural practices; and the erosive actions of natural forces. Sufficient data is not available to present a clear picture of the relative amounts of sediment occurring in the streams of this Basin from the various sources. The Douglas County Water Resources Survey sediment measuring program collects samples

at specified stations throughout the Basin with the purpose of developing the variation in silt loadings and the relative effect of logging operations, as well as industrial, construction, and agricultural practices on this particular phase of water quality. The sampling program for the Basin utilizes 12 sampling points, and data is available extending from February 1956, to the present. Figure 11 included in this report gives comparative values for two typical stations in the Basin. The first, on the North Umpqua at Winchester, where suspended solids vary from zero parts per million to a maximum of 220 parts per million; the second, Cow Creek at Riddle, where suspended solids sampling show variations from zero parts per million to 784 parts per million. These values do not represent the maximums that have occurred. One spot sample taken in the 1951-1952 water year was 6850 parts per million with the October-May average running about 550 parts per million. Siltation poses the following problems which are given a general qualification :

Domestic

Problems inherent with domestic supplies where siltation occurs are offensive taste, odor, and appearance. Domestic supply systems generally lack treatment facilities and difficulties with laundering and the operation of household equipment are experienced. This is primarily an individual problem.

Municipal

When heavy silt loads occur in raw water supplies of municipalities, filtration systems are frequently unable to supply the demand placed upon them. This is in part due to the reduction in output because of the necessity of frequent backwashing of filtering equipment to maintain a constant quality standard. Since the backwashing procedure, in most cases, utilizes water already treated, more frequent backwashes cut down on the amount available for public consumption. Difficulties of this type have been experienced in the Basin. Sutherlin is an example.

Operational difficulties related to the maintenance of equipment result from siltation. Water works appurtenances require more frequent cleaning and are also subject, where there are abrasive constituents, to wear and more frequent replacement.

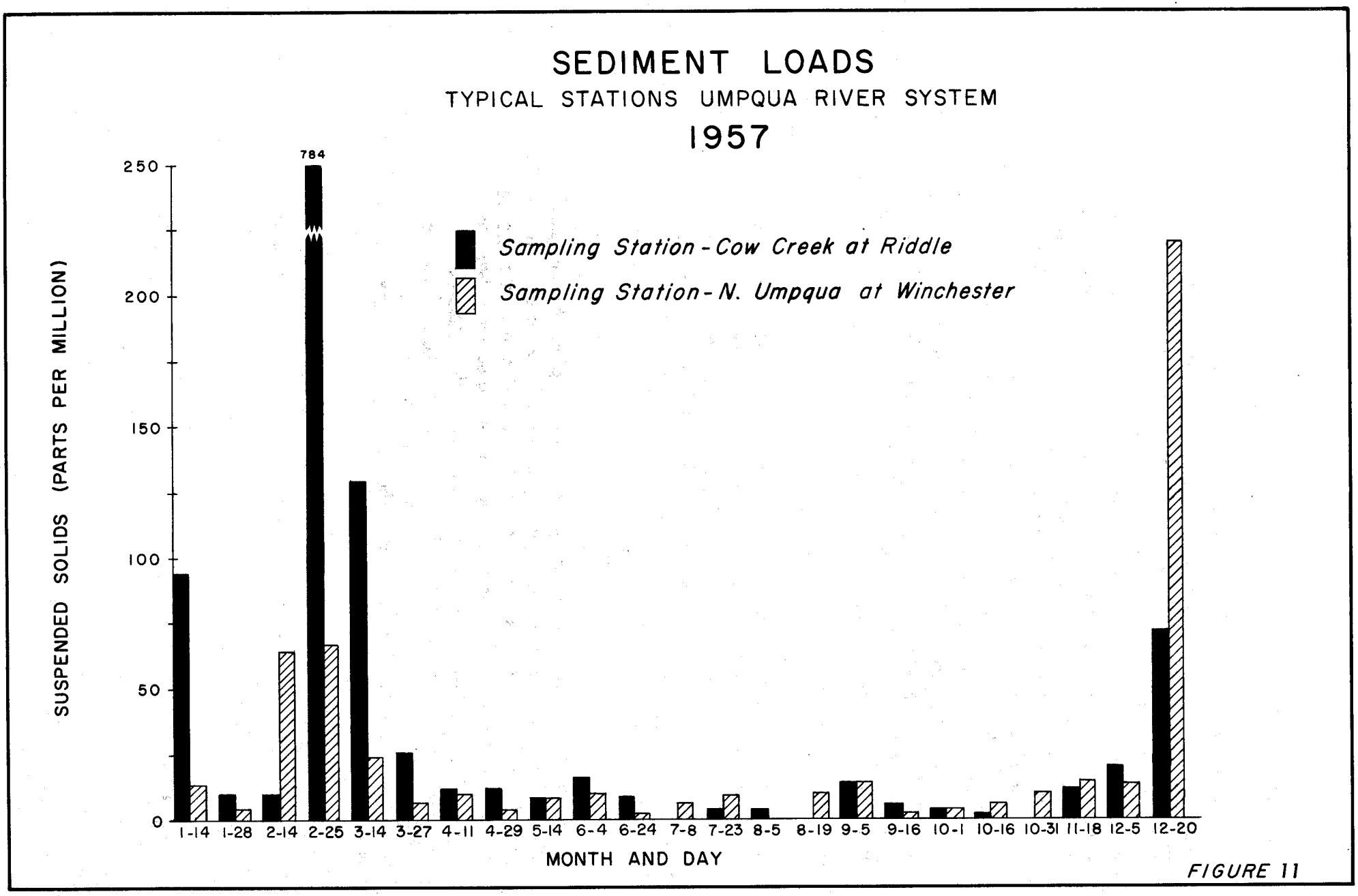

SEDIMENT LOADS
TYPICAL STATIONS UMPQUA RIVER SYSTEM
1957
784
250
200
150
100
50
0
SUSPENDED SOLIDS (PARTS PER MILLION)
Sampling Station - Cow Creek at Riddle
Sampling Station - N. Umpqua at Winchester
1-14 1-28 2-14 2-25 3-14 3-27 4-11 4-29 5-14 6-4 6-24 7-8 7-23 8-5 8-19 9-5 9-16 10-1 10-16 10-31 11-18 12-5 12-20
MONTH AND DAY

FIGURE 11

Irrigation

The major problem of siltation, as it relates to agriculture, involves the deposition of material upon agricultural lands subject to flooding. The characteristics and volume of the silt takes the inundated land out of production for the current agricultural season and sometimes for substantially longer periods. Areas in the South Umpqua have experienced this problem.

Problems are minor for water used for irrigation and may be treated as difficulties of an individual nature.

Power Development

The effects of siltation on the hydroelectric power developments of the Umpqua system are of no significance under present or anticipated circumstances. Problems are mainly maintenance problems due to the effect of silt on the operation of facilities and mechanical appurtenances.

Industrial

Qualitative problems of industrial use of water vary widely and depend on the specific type of operation involved. Where an industry has its own source of raw water, it must make provisions for treatment facilities if the quality of the raw water is not such that it is adaptable to the processes employed. Where filtration and other types of equipment are required to maintain a uniformly high quality of water, then siltation poses the same operating problems as a municipal operation.

No evidence has been submitted to the Board in its studies that would indicate that this is a major problem at the present time.

Mining

The Board's investigations uncovered no information that would indicate siltation as a major problem in the use of the resource for mining purposes.

Recreation

A stream made turbid from an excessive silt load loses its

attractiveness for swimming, water skiing, boating, picknicking, and other pleasure uses. All other items being equal, i. e. safety, convenience, amount of water, surface area, and degree of congestion, a clear supply is more sought after than murky or turbid waters.

Present problems related to silt and recreation involve man-created difficulties. Typical are the unregulated activities of construction, logging, or sand and gravel operations which are generally active during the recreation season.

One of the major problems, the effect of silt on game fishing, is pointed out in the section on Fish Life.

Wildlife

No detailed information on this subject was developed in the Board's investigations, other than the aspect of unpotability of water as a result of excessive siltation.

Fish Life

Fisheries biologists point out several adverse effects of silt on the fisheries resource.

First is the destruction of eggs in the spawning grounds. Silt deposited over the spawning beds change the environment for the eggs and many do not mature. Siltation can change the environment of the stream resulting in destruction of food sources for young fish.

Siltation has been a distinct problem in reducing the success of sport fishermen by creating roily water. Reference to this is made in the "Annual Report of the Game Commission, Fisheries Division, 1955."

Pollution Abatement

Additional organic loading is often experienced during periods of heavy siltation, since many of the operations contributing to heavy silt loads dislodge the surface organic materials and discharge them into the stream. This organic material depletes the dissolved oxygen level. The oxygen depletion reduces the downstream dilution potential of the stream

for receiving wastes from other sources. No specific values are available on this item for the Umpqua system.

Temperature

One of the most important physical characteristics of a water supply is its temperature. There is not sufficient data available to establish with any degree of accuracy the variations in water temperature throughout the Umpqua system.

Present problems in the Umpqua system are relatively limited and primarily concern the problems of pollution abatement and protection of the fisheries resource. Problems of temperature related to the various uses are as follows:

Domestic & Municipal

The temperature problems of domestic and municipal water involve consumer preferences for palatability.

No material evidence was developed during the Board's investigation that indicated any present problem of a major nature related to temperatures in municipal operations. Expansion of commercial or industrial activities in the Basin may make this an item of importance.

Irrigation

Data regarding the temperature factor in agricultural applications of water in the Basin is limited.

There are no major water temperature problems related to agriculture presently or are any contemplated in the foreseeable future.

Power Development

No problems were identified with this use.

Industrial

Water temperatures are an important item in industrial processing operations. It is difficult to find an industrial process that does not have

some type of temperature control or some temperature limitations in its operational sequences. Obtaining water for cooling purposes is one of the big problems of many industries. The pulp and paper industry is among these. According to the National Council for Stream Improvement of the Pulp, Paper, and Paperboard Industry, a kraft (sulfate) pulping operation requires approximately 20,000 gallons of water per ton of pulp. About one-third of this amount is presumably for cooling. Another one-third is for paper machine overflow. The subject of cooling water for pulp and paper operations is a complex one involving many factors including scale problems, corrosion, organic growth, and others.

Temperature of water discharged from pulp and paper or other industrial operations may be an important factor in the water resource picture of the Umpqua Basin during low periods if full utilization of the timber resources is achieved in the future.

Mining

There are no temperature problems insofar as present mining uses of the waters of the Umpqua River system are concerned.

Recreation

There are two facets of the effect of temperature on recreational uses of water. The first is the effect of temperature on the game fisheries resource of the system. This item will be discussed under the heading of Fish Life.

The second facet is the esthetic aspect of water used for recreational purposes. If the temperature of the waters of the stream is raised too high, it may result in adverse odor, color, or general appearance characteristic which would make the stream undesirable for recreation purposes.

This particular problem is of some consequence in the South Umpqua system at the present time during periods of low flow. Here adverse conditions are experienced when flows drop to such levels that stagnant pools exist in portions of the stream's length. Such conditions can only be rectified by the achievement of base program flows which provide sufficient flows at a suitable temperature.

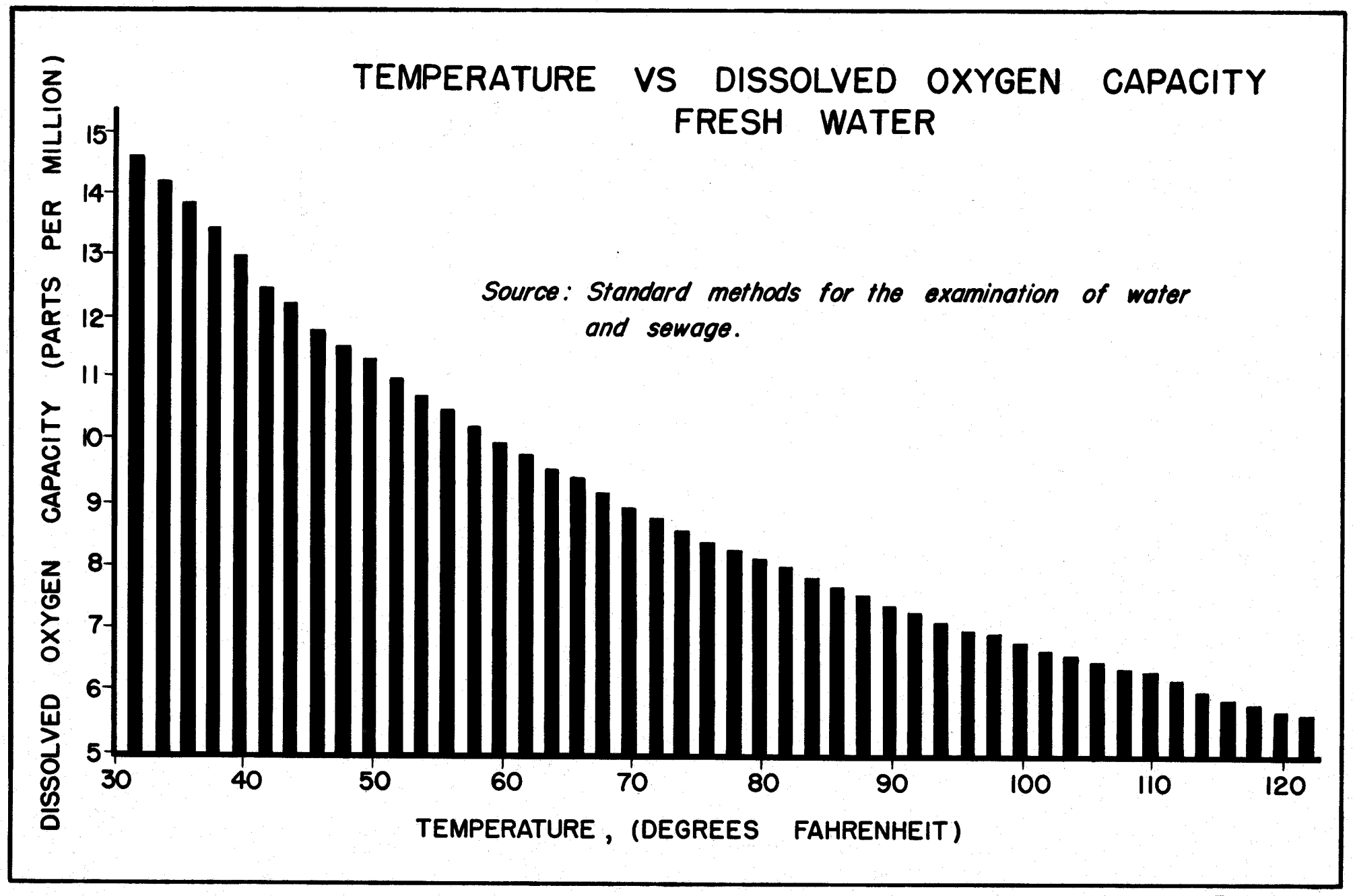

TEMPERATURE VS DISSOLVED OXYGEN CAPACITY
FRESH WATER
Source: Standard methods for the examination of water and sewage.
DISSOLVED OXYGEN CAPACITY (PARTS PER MILLION)
15
14
13
12
11
10
9
8
7
6
5
30
40
50
60
70
80
90
100
110
120
TEMPERATURE, (DEGREES FAHRENHEIT)

FIGURE 12

Fish Life

Anadromous species and the resident trout populations which comprise the basic game and commercial fisheries resource of the system are dependent upon satisfactory water temperatures for their survival and propagation. Maximum spawning success for these species depends on cool, well aerated water whose temperature variation lies with a relatively restricted range. Fish biologists indicate that temperatures for the anadromous species should not exceed the low 60 degree Fahrenheit range. At higher temperatures the fish become less resistant to disease and other adverse factors in their environment. Their tolerance to temperature is influenced by physical, chemical, and biological factors, including the condition of the fish, the concentration of fish, and the volume of water available in their habitat.

As temperatures rise, the ability of that water to retain its dissolved oxygen is lessened. Figure No. 12 indicates the decrease of oxygen-holding capacity of water with a rise in temperature. Dissolved oxygen content less than 5 parts per million would have an adverse effect on the anadromous species of the Umpqua system as well as the resident trout population.

The fisheries resource of the South Umpqua River depends to a substantial degree on the utilization of resting holes. If a low yield year such as 1931 should again occur, the effects on the fisheries resource of this segment of the system could be catastrophic. Low flows under such a condition, plus consumptive uses which have developed since 1931, could result in flows close to zero in the lower portions of the stream system. Some fish would undoubtedly survive in the resting pools of the upper areas, but the possibilities of major losses are quite real. The only solution for the low flow-high temperature problem of this area is to provide water of suitable temperature to improve the minimum flow of the stream.

Wildlife

No specific data was developed in the Board's investigations relative to the effects of temperature on the use of the resource for wildlife purposes.

Pollution Abatement

Temperature is an important item in the use of the resource for pollution abatement purposes. The problem specifically is the effect of temperature on the stream's capacity to receive and reduce pollution elements to their stable condition without reducing the dissolved oxygen content of the water below the level considered necessary for other resource uses. Existing problems are limited in scope and localized in character.

(2) Chemical Characteristics

There are at present no major problems in the Umpqua system which can be attributed to the chemical characteristics of the water.

(3) Biological Characteristics

The investigations of the Board did not uncover any significant problems related to biological characteristics that presently exist in the Umpqua system. Such problems as do prevail are of localized nature and relate generally to the problem of maintaining public health. Restriction on swimming in the lower sections of the South Umpqua during periods of low flow is one of the localized problems. The presence of pathogenic bacteria or viruses which are water-borne and result in disease, or the presence of algae or other organisms in water which create either disease, taste, color, or undesirable odors are problems against which continuous safeguards are maintained by county officials and the State Sanitary Authority.

Physical and chemical characteristics and changes in these characteristics brought about by pollution and other factors result in a biological problem relative to the fish life resource of the Basin. In addition to the factors which result in direct kill of fish, there are items which affect the flora and fauna of the stream system upon which the anadromous and resident fish populations are dependent for their food supplies and favorable environment.

No evidence has come to the Board that would indicate major problems relative to bacteriological characteristics exist for the other beneficial uses of water.

PROBLEMS OF WATER CONTROL

There is one dominant problem with regard to control of the resource in the Umpqua River system. The problem is the control of the serious floods to which this Basin is frequently subjected. No other item in the water resource use and control field has received as much attention from the general population of the Umpqua River Basin. It has been the item of dominant interest to all the groups in this area, including the Water Resources Advisory Committee of Douglas County. Floods within the system are such that they affect much of the population of Douglas County and have serious effects on practically all phases of the Basin's economy. Difficulties resulting from intense floods are: the ever-present danger of the loss of human life when people are trapped in their homes or in dangerous locations by the rapidly rising waters which characterize the floods of the Umpqua system, particularly the South Umpqua; the destruction of agricultural, industrial, commercial, and residential establishments and their contents either by inundation or the driving force of the flood waters; the ruin of agricultural lands by the deposition of the heavy silt loads carried by the streams at flood stage and/or the adverse effects of debris which is either deposited on the land or dragged across the land resulting in an increase in erosion and general damage; the erosion of river banks and agricultural land by the high water stages; the disruption of trasportation within the Basin due to loss of roads, bridges, and the blocking of transportation routes; the damages to the economy of the area resulting from shutdown in operations due to inundation of industrial operations; the destruction of drainage and irrigation appurtenances and facilities; damages to the railroads of the Basin; and numerous other items.

History of Floods

The Umpqua River has a long history of violent floods dating back to the year 1861 when the tragic destruction of the community of Scottsburg occurred on the Lower Umpqua River. Since that time there have been eighteen years of record wherein the flood stage at Elkton has been at or above the thirty-foot gage height which is assumed as the measure of a flood on the Umpqua system. The maximum measured discharge for a flood at Elkton was 218,000 cfs. This was the peak flow recorded during the flood of December, 1955. The records of the U. S. Geological Survey indicate that this is the approximate peak flow experienced during the flood of 1861. There is some evidence, however, that the flood discharge of 1861 may have been substantially higher. The four highest

TABLE 8

MAXIMUM DISCHARGES OF MAJOR FLOODS AT ELKTON AND BROCKWAY SINCE 1890

YEAR OF FLOOD	UMPQUA RIVER AT ELKTON		S. UMPQUA R. AT BROCKWAY	
	Discharge cfs	Feet above bankfull	Discharge cfs	Feet above bankfull
February, 1890	No Data	---	130,000	12.1
January, 1907	Incomplete Record		71,000	5.0
February, 1927	185,000	16.0	101,000	10.2
December, 1942	186,000	16.1	70,000	7.5
December, 1945	179,000	15.1	67,700	7.2
January, 1948	154,000	12.8	71,400	8.0
October, 1950	108,000	19.2	102,000	11.4
November, 1953	195,000	17.4	81,800	8.0
January, 1953	199,000	18.0	89,200	9.4
Dec. 22, 1955	218,000 *	20.6	91,300	10.5
Dec. 26, 1955	178,000	15.0	85,300	9.3

* Assumed to equal the historical flood of 1861.

Note:	Discharge at bankfull, cfs	Stage at bankfull, feet
Elkton	86,000	25.0
Brockway	45,400	21.0

flood values for the Umpqua River at Elkton have occurred since the year 1950. In order of magnitude starting with the year of highest peak flow, they are: (1) 1955; (2) 1950; (3) 1953; and (4) 1953. The two floods for the year 1953 did not occur during the same flood season. The highest magnitude (3) occurred in January of 1953 in the 1952-53 water year, and the flood of fourth magnitude occurred in November of 1953 which would be the 1953-54 water year. Flood patterns of 1953 and 1955 were unique. Both these years experienced double flood peaks where the major peaks occurred several days apart. On the South Umpqua River at the gaging station near Brockway, the period of record dating (intermittently) from 1890 shows ten years in which the flows exceeded a flood stage height of 25 feet which is generally considered the flood level at this location. In the case of the South Umpqua, the floods of greatest magnitude have

not been concentrated in the period of record covering the past six or seven years. The flood peak of 1950 was the second highest of record and the December 22nd flood peak of 1955 was the fourth highest peak of record. The December 26th peak of 1955 which followed roughly four days after the first peak was the sixth highest flood peak of record on the South Umpqua system.

Economic Impacts

Some idea of the damages occurring from the floods of the Umpqua system can be obtained from Table 9. The table summarizes damages for the flood of December, 1955. Appraised values of property exposed in the Umpqua Basin during the 1955 flood exceeded that of the Rogue River by nearly eight and one-half million dollars. 1/ In addition, the Umpqua Basin has a greater number of acres of field, truck, and special croplands, as well as orchard and small fruit lands subject to difficulties by virtue of being in the flood plain. In relation to field, truck, and special crops, Umpqua River lands in the limits of the 1955 flood exceed those of the Rogue River by some 1,000 acres, and orchard and small fruit lands for the Umpqua exceeded those of the Rogue River by slightly more than 1,000 acres.

TABLE 9

FLOOD DAMAGES
OF DECEMBER, 1955 1/

Type	Direct	Indirect	Total
Agricultural	$ 668,520	$ 5,220	$ 673,740
Residential	233,690	320,180	553,870
Industrial	256,280	195,250	451,530
Commercial	68,020	40,890	108,910
Railroad & Utilities			171,610
Highway & Roads			132,940
Schools & other Public			18,500
Flood Control Structures & Navigation Facilities			24,000
Public Aid & Relief			8,040
Total Private	$1,953,080		
Total Public	190,060		
GRAND TOTAL			$2,143,140

1/ "Report on Floods of December, 1955", Portland, Oregon, District Corps of Engineers, U. S. Army, October, 1956.

Methods of Flood Control

There are two common techniques available by which the flood damages of the Umpqua Basin may be lessened. (1) by the utilization of revetments, levees, and limited local protective works; and (2) reduction of peak flows by utilization of major upstream impoundments. In general, existing local protective works were inadequate during the peak flood stage for those areas in the general vicinity of Roseburg. Investigations by the Corps of Engineers are now under way to establish the need for and merits of additional local protective facilities within the Umpqua River system.

At the present time, no major storage facilities exist in the Umpqua system above the zones subject to extensive flood damage. An investigation of the potentials for flood control reservoirs in the Umpqua system was initiated in 1956 by the Corps of Engineers, but funds were not available to complete this investigation. Requests are presently being made to Congress for the necessary funds to complete this investigation, and if such funds are forthcoming as anticipated, the final analysis of the problem should be available late in 1959. In order to facilitate the development of a coordinated, integrated program for the Umpqua River Basin, the Board was required to make a preliminary evaluation of the flood control problem in the Basin. Discussions were held with various individuals in the Corps of Engineers to obtain as much information as is presently available regarding the flood problems in this area. In addition, the staff of the Board made limited studies designed to point up the specific problems. Some very serious deterrents appear evident in attempting to develop a program for flood control in the Umpqua River Basin by means of storage reservoirs.

Problems in Flood Control Storage

The problems of establishing sufficient impoundments in the Umpqua system to regulate the floods fall into three main categories: (1) physical, (2) economic, and (3) financial.

Because of the particular characteristics of the Basin's physical structure, suitable sites for the impoundment of flood waters are limited. The basic requisites of a flood control reservoir are structural feasibility for impoundment works and reservoir capacity. There are many structural sites for dams in the Umpqua system, but because of the steep gradients and narrow canyons, large structures would be required to develop the storage

needed for major regulation of floods. There are sites within the lower section of the South Umpqua River above Roseburg which are suitable from a physical point of view for the construction of major flood control operations, but the very creation of these structures and reservoirs would inundate the most highly developed and valuable land of the river system. To a great extent this land is the basis for the need of control.

Another physical problem is the character of runoff patterns creating the floods. One flood control site is the Tiller site on the South Umpqua River some 27 miles above its confluence with Cow Creek. This storage site would not result in the control of the runoff of the Cow Creek, Lookingglass, Elk, Days, and Myrtle Creek watersheds. Would the Tiller site exercise sufficient physical control to provide protection to the lower areas under the circumstances that existed during the second peak of the 1955 storm? Preliminary evaluations of the second peak runoff indicate that most of the water for this portion of the storm came from sections of the Basin which would not be regulated by construction of the Tiller site. It will be necessary to evaluate the pinch-off ability of the Tiller site on the South Umpqua as related to the volume of water available from the balance of the Basin before any positive conclusions can be reached as to the effectiveness of this site on the floods in the lower valley.

Another site exists on the South Umpqua approximately 12 miles above its confluence with Cow Creek. This is known as the Days Creek site. The location is below Elk Creek and would subject that stream to control. Because of existing developments in the reservoir area, it may prove difficult to justify economically a development at this location.

Damages from the 1955 flood and from the 1950 flood occurred throughout the entire Basin, ranging from damages on Cow Creek, Lower Myrtle Creek, Lookingglass, Deer Creek, Calapooya Creek, and Elk Creek to difficulties along the main stem of the River and the South Umpqua. This means that a full flood control program, attempting to reduce to the minimum damages to all areas in the Basin, would require widespread development and a great number of structures. Control of flood damages on Calapooya Creek would require storage above the community of Oakland, which storage would be of no value to Deer Creek, Lookingglass, or areas of the Umpqua Basin upstream from the confluence of Calapooya Creek and the main stem of the Umpqua River. The same analogy applies to problems on Cow Creek wherein the storage in the headwater

areas would alleviate the flood problem for Glendale and Riddle, and to a very limited extent on the South Umpqua, but would have no measurable value towards reducing damages on Lookingglass, Deer Creek, or Calapooya Creek. This widespread distribution of damages along the main River and its tributaries will make it difficult to find economically justified storage.

Under present national practices for flood control justification, the basic economic concept is that the benefits gained must exceed the costs of the development required to achieve the desired flood control. The damages prevented by the flood control development facilities must exceed over the life of the project the cost of amortization, interest on the money borrowed for construction, the depreciation of the structure, and any other costs appertaining thereto. Preliminary indications are that it will be impossible to justify economically the development of major storage anywhere in the Umpqua system for flood control purposes alone. It will be necessary, therefore, to develop facilities for multiple-purpose uses so that all economic benefits that might accrue to a water resource development project can be combined. Frequently, one of the largest economic values of water resource development is the production of hydroelectric power, but the potential for economic justification assistance from this source is limited on the South Umpqua system, due to the character of the stream patterns of this Basin. Some power benefits may accrue at the Tiller location but benefits other than flood control and power will have to be available at this location to make a project feasible.

The final information regarding the economic feasibility of proposed flood control developments in this system will not be available until the Corps of Engineers has completed its flood investigation sometime in late 1959.

The financial problem of the development of flood protective works in the Umpqua Basin centers around the early procurement of the funds necessary for the construction of flood control facilities. At the present time, the funds for water resource development facilities must come from either the local governmental units, private enterprise, or federal agencies. There are no funds available nor any methods of obtaining funds for the development of water resource projects, either flood control or others, through the medium of the state government. To date, the financial resources of local governments are very restricted in comparison to the large

expenditures required for major control of the floods of the rivers of Western Oregon, and the prospect of major development through county, municipal, or other local government is highly unlikely. In the case of private enterprise, such flood control benefits as do derive from water resource development are incidental to some other phase of water resource use and control and cannot be considered a major possibility in the solution of the flood control problems of the Umpqua River Basin.

Finances necessary to develop the flood control required for the Umpqua River system will, under existing and foreseeable circumstances, have to come from the federal government through one of the agencies delegated responsibilities in this connection. The primary responsibility for flood control works has been assigned to the Corps of Engineers by the Congress of the United States. The Corps also includes benefits from navigation, power, irrigation, and pollution abatement where they are available. Flood control responsibilities have been also assigned to the Soil Conservation Service of the Department of Agriculture, in connection with its long-range program of soil conservation and watershed management. The Bureau of Reclamation, Department of the Interior, also makes funds available for flood control purposes as one phase of its multi-purpose water resource development projects, although its basic responsibility lies in the field of reclamation.

To obtain funds for flood control works through any of the federal agencies, certain specific steps must be followed, and in the final analysis, all agencies are required to set forth the economic practicality of a project by the methods outlined by the Bureau of the Budget. The Corps of Engineers is the organization most likely to develop the flood control aspects of a water resource use and control of the Umpqua River system, either through its own initiative or as an advisor to the Bureau of Reclamation in setting forth the economic benefits of the flood control feature of the various Bureau projects proposed. The presently outlined preliminary plans of the Bureau of Reclamation in the Umpqua River Basin do not offer any major potential for flood alleviation in the most critically effected areas of this river system.

It appears that any major physical solution to the flood control problem cannot be anticipated within the immediate future.

CONFLICTS

Conflicts do exist in the Umpqua River system between various beneficial uses of water and between beneficial uses and control of the resource. In practically every section of the Basin, exclusive of the main stem and the North Umpqua River, data collected by the Board indicates conclusively that there is conflict between consumptive uses of the resource. This is in large part due to the fact that summer season flows are not large enough to satisfy all consumptive demands. Even though all consumptive rights or uses may not be exercised simultaneously, certainly conflict will exist in critical periods in an area where the legal right to consume water exceeds the natural capacity of the stream. There is not sufficient water in main sections of the streams of the Umpqua system during the periods of low summer flow to satisfy quantitatively the demands for domestic, municipal, irrigation and industrial uses which are the primary consumptive uses of the resource.

If full, or even a high percentage of the consumptive requirements of the system are utilized under normal low flow conditions, the effect on the nonconsumptive uses of the resource would be severe. Depletion of the streams by such consumptive uses would result in a streamflow far below the value required to maintain adequate recreation facilities, water for fish life uses, and water for the satisfaction of pollution abatement requirements.

In addition to the consumptive versus nonconsumptive problem, a specific area of conflict exists in the Umpqua Basin between nonconsumptive uses of water. The problems are: (1) the conflict between the anadromous fisheries resource and the nonconsumptive use of water for power. Actually, the problem here is not a conflict of use as much as it is a conflict due to the physical barriers to fish passage created by the construction of dams or diversion structures for hydroelectric power developments. The problems that exist involve the passage of both upstream and downstream migrants. Although it cannot be said that all interests are fully satisfied, the passage of upstream migrants past structures of relatively low height with small fluctuations in forebay levels have at least been accepted. Considerable controversy exists, however, with regard to structures whose forebay levels vary substantially in elevation. The major source of controversy is still the problem of passage of downstream migrants. Several devices or techniques to fulfill this requirement are now being investigated, particularly the so-called skimmer device being tested at the Pelton project on the

Deschutes River and at Brownlee on the Snake River, plus investigations of electrical barriers which are proposed to divert the downstream migrants into passageways which would take them around a particular facility. These devices or methods are in the investigation or development stages. Although claims have been made as to their effectiveness, full evaluation cannot be made until they have been put into full operation. The locations of conflict between hydroelectric developments, which are essentially nonconsumptive, and the fisheries resource lie along the main stem of the Umpqua and the North Umpqua. Of the remaining hydroelectric potential in the Umpqua River system, approximately 80 percent lies along the main stem and the North Umpqua.

It should be noted that the construction of any water resource facility involving an impoundment structure or barrier across the stream constitutes a physical impediment to the passage of anadromous fish and must be provided with fish passage facilities where it is determined that the resource must be conserved.

The construction of major flood control storage facilities within the Umpqua system would provide exactly the same problems as hydroelectric development. It should be recognized, however, that there are potentials for planning and design where the interests of the fisheries resource and the development of impoundment structures might be compatible. Any control feature of a water resource development involving structures across the paths of anadromous fish runs would constitute a problem. On the other hand, the construction of control facilities should not be a major problem with regard to consumptive uses of water because any control that can be affected in the Umpqua Basin could improve the status of water with regard to quantity in any reach of the Basin downstream from that particular control device. Control structures will have little effect on upstream consumptive uses that exist at present. Certain dislocations may occur in reservoir areas because of inundation or the development of control facilities, but these will be localized in nature.

SUMMARY OF PROBLEMS

The problems of the Umpqua River, as reviewed by the Board, involve no unknown concepts. In essence, the needs are for the conservation, augmentation, and control of the water resources of the Umpqua River system to provide for existing and contemplated needs and uses of water for all purposes, consumptive and nonconsumptive, and for flood control. The

most important need in the Umpqua Basin's program is the capture and control of the waste waters of winter runoff and the augmentation of summer supplies by the release and application of such captured waters to beneficial use during the periods of low water resource availability. A complementary item to the capture of winter runoffs for beneficial uses is the control of peak flows which create a widespread flood hazard.

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CHAPTER IV

CRITERIA - SUB-BASIN ANALYSIS

For convenience and clarity, the Umpqua River Basin was divided into sub-basins for study and evaluation. This is desirable because of the wide variation in the character and problems of the streams of this system. Differences can be illustrated by the comparison of the hydrologic characteristics of the three main divisions of the Umpqua system, the main stem, the North Umpqua, and the South Umpqua. These streams experience their heaviest runoff during periods of heavy precipitation and their lightest runoff during the dry months, a characteristic applicable to all streams west of the Cascade Mountains. The major difference between the North and the South Umpqua lies in the extent of the variations from the mean flow of the maximum and minimum values for each stream. The flow patterns of these two tributaries are of major influence on main stem hydrology.

The North Umpqua sub-basin has approximately 20 percent of its land area lying above an elevation of 5,000 feet. This portion of the sub-basin has a heavy snowfall and the snowpack resulting constitutes a storage reservoir for the water resource. In addition, the geological structures of large areas of the Upper North Umpqua watershed are highly porous and also act as a natural reservoir for the storage of water. The character of the flow pattern of the North Umpqua River is affected by these two natural regulatory features. The South Umpqua River, on the other hand, with a small portion of its basin, about three percent, above 5,000 feet, and its limited porous geological structures, has little natural storage. It is a "flashy" stream whose runoff follows the immediate pattern of precipitation quite closely.

The main stem of the Umpqua River reflects, on a modified basis, the characteristics of the dominant hydrologic features of the North and South Umpqua, its two major tributaries.

The main stem is benefited during the summer months by the sustained flow patterns of the North Umpqua. The major portion of flow during summer months of critical supply years originates in the North Umpqua sub-basin. There are five years for which records are available covering the Elkton (main stem), Winchester (North Umpqua), and Brockway (South Umpqua) stream gages. For the average of the two

low flow months of these years, the mean flow of the North Umpqua was 87 percent of the mean flow at Elkton while the South Umpqua was 10.5 percent. During the most critical month of these five years, the matching values were 95 percent and 8 percent. The unresolved variance from a total of 100 percent reflects use and/or inflow in the intervening section of the river.

While both branches contribute to flood peaks at Elkton, the percentage contribution is materially different. During the first peak of the 1955 flood, the North Umpqua peak flow was 42.5 percent of the peak flow at Elkton and the South Umpqua peak flow was 41.5 percent. For the second peak, the values were 29.2 percent and 47.6 percent, respectively. The peak values of flow for the North and South Umpqua stations are not necessarily directly additive in contribution to Elkton maximum values because of varying travel times for the respective peaks. The travel times are close enough to make the indicated figures serve as good order of magnitude values.

The natural hydrographic divisions of the Basin dictated the division into three segments utilized in the analysis.

The specific sub-basin evaluations of Chapter V set forth the characteristics of the individual streams within the limits of available information.

The analysis of present needs for the water resource is based on a study of existing water rights within the various sub-basins. An analysis based on known water rights does not present the full picture in all cases. It is known that there are numerous cases of water use for which legal rights have not yet been determined. Funds and personnel limitations did not allow a physical field survey of existing needs.

For purposes of the sub-basin evaluations, the following values were used for determining the percentage of diverted water consumptively used by the various beneficial uses: domestic, 0.75; municipal, 0.50; irrigation, 0.66; power, 0.0; industrial, 0.5; mining, 0.0; recreation, 0.0; wildlife, negligible and assumed, 0.0; fish life, 0.0; and pollution abatement, 0.0. These factors are utilized on a reconnaissance basis. It is recognized that these factors are approximations, but they probably represent a conservative approach.

Data available was insufficient to adequately determine the future requirements for all beneficial uses of water. Fortunately, the studies of the Bureau of Reclamation made it possible to estimate with some degree of accuracy the total potential for the major consumptive use of water, which is irrigation. The following reconnaissance standards were adopted as a means of estimating future needs and are utilized throughout the sub-basin presentations, unless otherwise indicated:

(1) Future domestic needs - this value will be determined by taking the known water rights in a given area for domestic use and multiplying the total of these rights by the ratio of nonirrigated, but irrigable, lands in the Basin divided by twice the present irrigated land. This is based on the assumption that the expansion of irrigation within the Basin will allow the support of greater concentration of rural family units. Since the overall existing and contemplated requirements for domestic use are small in relation to the total requirements, use attributed to this factor will be minor;

(2) Future municipal use - projections for this use will be based on the present municipal water rights times a factor of 2.8 (which represents the projected population of Douglas County, 1975, divided by the 1950 population) times a factor of 1.4 (this represents the estimated per capita increase in the use of water between the present and 1975);

(3) Projected irrigation requirements are based on the report of the Bureau of Reclamation for the Umpqua River Basin published in 1956. Consumptive values are based on the use of 2½ acre-feet of water per year per acre of land irrigated. Diversion values for the computation of instantaneous flows are based on a value of 1/80 cubic feet per second per acre of land irrigated. In order to avoid the ridiculously high flows that would be necessary in some stream channels if all diversions were exercised simultaneously, a diversity factor of 2.0 is utilized; 1/

1/ Diversity factor - the ratio of total diversion rights to the sum of rights to divert that are exercised simultaneously under the maximum diversion condition.

(4) Projected power availability - potentials are based on the report of the Federal Power Commission published in 1957, and although there are areas in the Basin where additional federal power site withdrawals exist, these are ignored if the sites are not specifically listed in the FPC 1957 report;

(5) Projected industrial needs - where data is lacking for specific analysis in a basin, existing rights to use water for industrial purposes will be multiplied by the factor 2.8. This is based on the assumption that light industrial growth will parallel municipal growth and calculation of these two needs should be consistent;

(6) Projected mining needs - values for future uses for this purpose will be individually set forth where there is justification. There will be no attempt to project existing mining on the basis of any factor;

(7) Recreation, wildlife, fish life uses - for the purposes of this report, it has been assumed that the values for "Desirable Minimum Stream Flows for Fishery Management" presented by the State Game Commission at the October 15 & 16, 1956, hearing of the Board in Roseburg, will also provide adequate water for recreation and wildlife. The adoption of this assumption is necessitated by the fact that no specific flow values were submitted to the Board as being necessary or desirable for these purposes.

(8) Projected needs for pollution abatement - for the purpose of this report, normal pollution loads are assumed to have a population equivalent to 2.5 times the actual urban population of the sub-basin. Major industrial loads will be treated individually where identifiable. Each population unit is assumed to have a demand loading of 0.2 pounds of 5-day biochemical oxygen demand per day. It is further assumed that overall reduction of 5-day B.O.D. by treatment should be 85 percent of the total pollution loading. Required flows are based on the need for the 1 cfs of flow per 30 pounds of 5-day B.O.D. discharge to the stream daily.

It should be further pointed out that these total water needs are rough values designed to determine the general magnitude of potential needs.

CHAPTER V

SUB-BASIN INVENTORIES

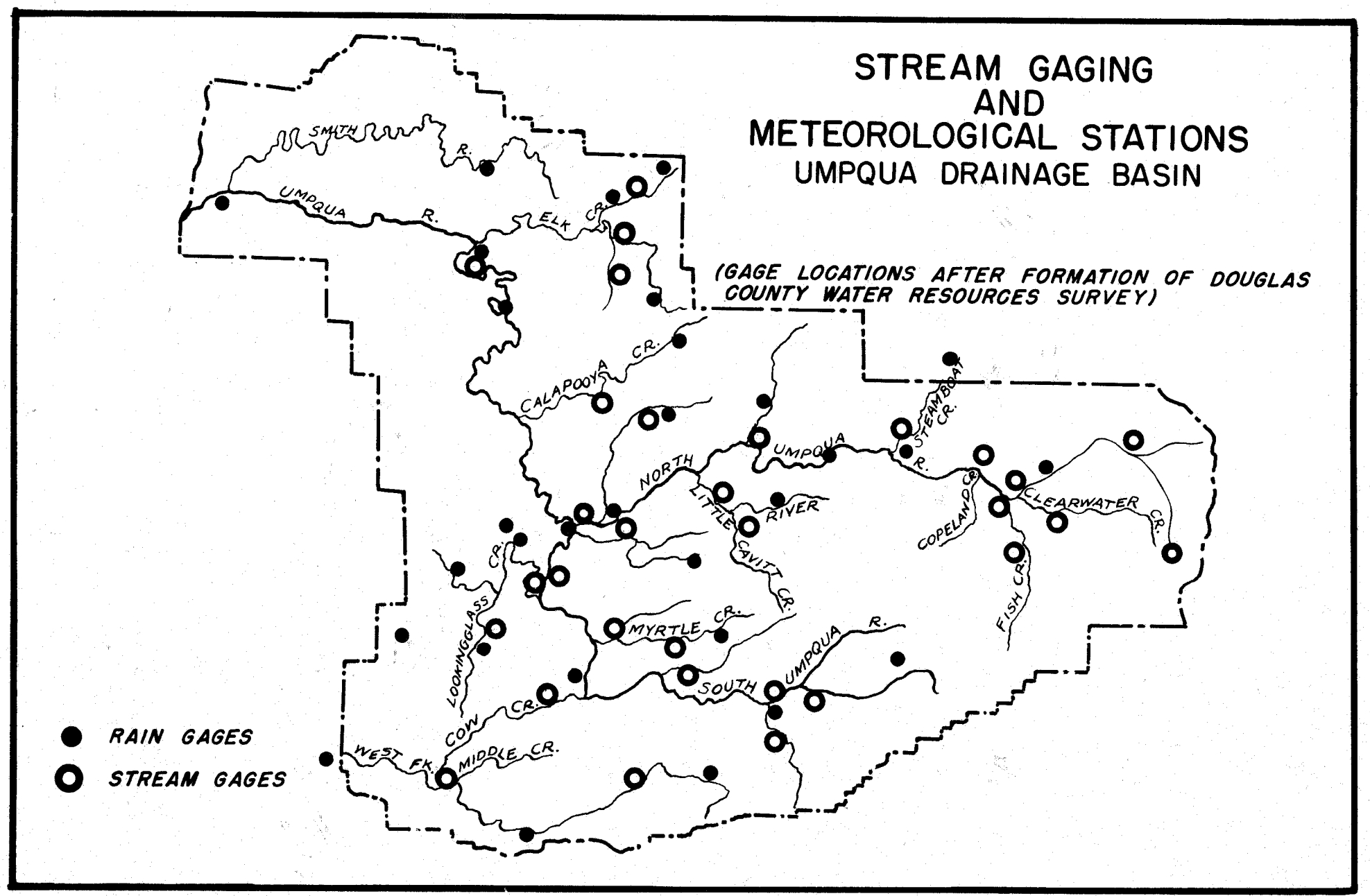

STREAM GAGING
AND
METEOROLOGICAL STATIONS
UMPQUA DRAINAGE BASIN
(GAGE LOCATIONS AFTER FORMATION OF DOUGLAS COUNTY WATER RESOURCES SURVEY)
SMITH R.
UMPQUA R.
ELK CR.
CALAPOOYA CR.
NORTH UMPQUA R.
STEAMBOAT CR.
LITTLE RIVER
CAVITT CR.
COPELAND CR.
CLEARWATER CR.
FISH CR.
LOOKINGGLASS CR.
MYRTLE CR.
SOUTH UMPQUA R.
COW CR.
WEST FK. MIDDLE CR.
RAIN GAGES
STREAM GAGES

FIGURE 13

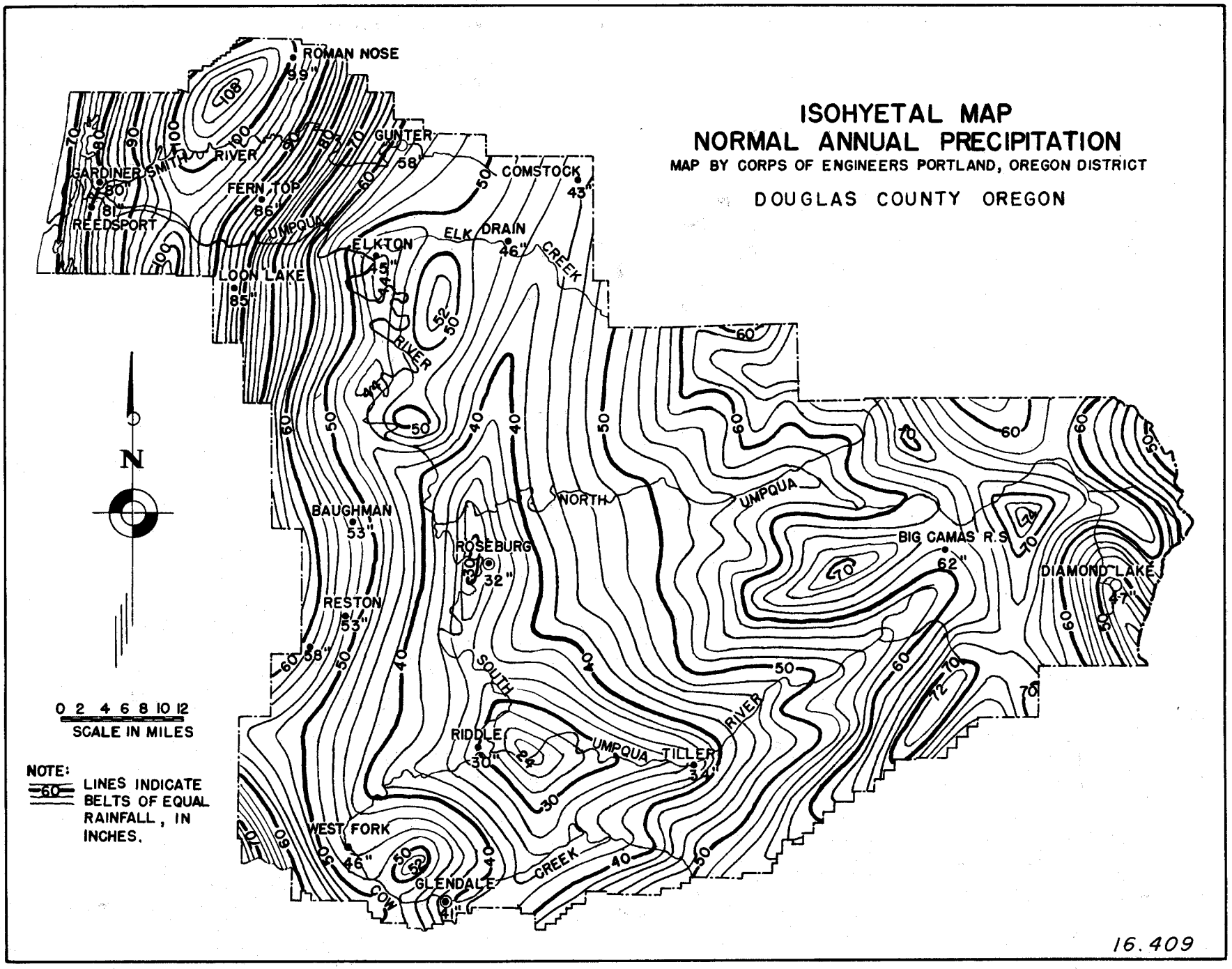

ISOHYETAL MAP
NORMAL ANNUAL PRECIPITATION
MAP BY CORPS OF ENGINEERS PORTLAND, OREGON DISTRICT
DOUGLAS COUNTY OREGON
ROMAN NOSE
39"
GUNTER
58"
COMSTOCK
43"
GARDINER
80"
81"
REEDSPORT
FERN TOP
86"
UMPQUA
RIVER
ELK DRAIN
46"
ELKTON
45"
LOON LAKE
85"
CREEK
RIVER
N
BAUGHMAN
53"
ROSEBURG
32"
NORTH
UMPQUA
BIG CAMAS R.S.
62"
DIAMOND LAKE
47"
RESTON
53"
58"
SOUTH
UMPQUA
RIVER
RIDDLE
30"
UMPQUA TILLER
34"
WEST FORK
46"
COW
CREEK
GLENDALE
41"
0 2 4 6 8 10 12
SCALE IN MILES
NOTE:
60 LINES INDICATE BELTS OF EQUAL RAINFALL, IN INCHES.
16.409

FIGURE 14

TABLE 10

UMPQUA SUB-BASIN AREAS

Sub-basin	Drainage Area Sq. Mi.	Total Sq. Mi.
LOWER UMPQUA RIVER		
Smith River	347	
Mill Creek	135	
Elk Creek	290	
Calapooya Creek	247	
Miscellaneous Streams	471	
		1,490
NORTH UMPQUA RIVER		
Little River	206	
Rock Creek	93	
Steamboat Creek	220	
Copeland Creek	34	
Fish Creek	82	
Clearwater River	70	
Miscellaneous Streams	603	
		1,308
SOUTH UMPQUA RIVER		
Deer Creek	63	
Roberts Creek	24	
Lookingglass Creek	160	
Myrtle Creek	117	
Cow Creek	397	
West Fork Cow Creek	87	
Canyon Creek	37	
Elk Creek	80	
Jackson Creek	155	
Miscellaneous Streams	642	
		1,762
GRAND TOTAL UMPQUA RIVER BASIN		4,560

TABLE 11

INDEX OF SURFACE WATER RECORDS
TO SEPTEMBER 30, 1955

Gaging Station	Drainage Area Sq. Mi.	Period of Time
SOUTH UMPQUA RIVER at Tiller	449	1910-11;1939-
Elk Creek near Drew	54	1954-
Cow Creek near Azalea	78	1926-
Cow Creek at Glendale	--	1926-32.
W. Fork Cow Cr. near Glendale	84	1955-
Cow Creek near Riddle	456	1954-
Cow Creek at Riddle	485	1911-12;1926-32.
N. Myrtle Cr. near Myrtle Creek	54	1955-
Lookingglass Creek at Brockway	158	1955-
South Umpqua River near Brockway	1,670	1905-12;1923-26;1942-
NORTH UMPQUA RIVER:		
Lake Creek at Diamond Lake	55	1922-25;1926-53.
Lemolo Res. near Toketee Falls	170	1954-
North Umpqua River below Lemolo Reservoir near Toketee Falls	170	1927-
North Umpqua R. above Clearwater R.	258	1948-54.
Clearwater River above Trap Creek, near Toketee Falls	42	1927-
Clearwater River at mouth, near Toketee Falls	77	1947-54.
North Umpqua River at (near) Toketee Falls (Hoaglin)	339	1908-9;1914-17;1924-48.
Fish Creek at Big Camas ranger station, near Toketee Falls	69	1947-
North Umpqua River above Copeland Creek, near Toketee Falls	475	1949-
North Umpqua River near Hoaglin	856	1911-12;1914-16.
North Umpqua River above Rock Cr., near Glide	886	1924-45.
Little River at Peel	177	1954-
North Umpqua River near Glide	1,210	1915-20;1921-22;1927-38.
North Umpqua River near Oakcreek	1,275	1905-8;1913-15.
North Umpqua River at Winchester	1,344	1908-13;1923-29;1954-
Calapooya Creek near Sutherlin	87	1912-13;1922.
Luse Canal near Sutherlin	--	1912-13
UMPQUA RIVER near Elkton	3,683	1905-
Elk Creek near Yoncalla	3,738	1950-
Elk Creek near Drain	104	1955-
Elk Creek at Drain	168	1950-
Mill Creek near Ash	81	1907-12;1915-17.

Note: Extracted from U.S.G.S. Circ. 394. (Revised 1957)

TABLE 12

COMPARISON
ELKTON, WINCHESTER AND BROCKWAY 1/
YIELDS

Water Year	Gaging Station	Yield in Acre-feet	Percent of Basin Yield
1909-10	Elkton	5,530,000	
	Brockway	1,930,000	34.9
	Winchester	2,860,000	51.7
	Balance	740,000	13.4
1910-11	Elkton	4,640,000	
	Brockway	1,490,000	32.1
	Winchester	2,270,000	48.9
	Balance	880,000	19.0
1923-24	Elkton	2,870,000	
	Brockway	761,000	26.5
	Winchester	1,570,000	54.7
	Balance	539,000	18.8
1924-25	Elkton	6,960,000	
	Brockway	2,190,000	31.5
	Winchester	3,030,000	43.5
	Balance	1,740,000	25.0
1925-26	Elkton	2,920,000	
	Brockway	897,000	30.7
	Winchester	1,440,000	49.3
	Balance	583,000	20.0

1/ Drainage areas below Winchester gage on North Umpqua and below Brockway gage on South Umpqua.

TABLE 13

MAXIMUM-MINIMUM DISCHARGES

Stream	Gaging Station	Location Sec.	Twp.	R.	Maximum cfs	Minimum cfs	Years of Record
Mill Creek	Ash	2	23S	10W	10,000 (11-23-09)	1.5 (9-13-10)	7
Umpqua River	Elkton	8	23S	7W	218,000 (12-22-55)	640 (7-18-26)	50
North Umpqua R.	Winchester	25	26S	6W	100,000 (11-23-09)	616 (8-17-26)	13
Sutherlin Creek	Sutherlin	16	25S	5W	1,250 (12-26-55)	---	1
North Umpqua R.	Glide	13	26S	4W	90,000 (12-22-55)	552 (8-27-31)	17
Little River	Peel	8	27S	3W	15,800 (12-22-55)	---	2
Cavitt Creek	Peel	14	27S	3W	4,910 (12-26-55)	---	1
Rock Creek	Glide	1	26S	3W	12,300 (12-22-55)	---	1
North Umpqua R.	Rock Creek	12	26S	3W	68,000 (12-22-55)	521 (10-16-31)	21
Steamboat Creek	Glide	31	25S	1E	26,900 (12-22-55)	---	1
North Umpqua R.	Copeland	23	26S	2E	20,600 (12-22-55)	684 (11-23-52)	8
Fish Creek	Big Camas	10	27S	3E	7,650 (12-22-55)	36 (11-27-52)	8
Clearwater R.	Mouth	36	26S	3E	1,380 (1-18-53)	192 (11-19-52)	7
Clearwater R.	Trap Creek	1	27S	4E	487 (10-29-50)	91 (11-4-32)	30
North Umpqua R.	Toketee Falls	35	26S	3E	5,080 (12-31-42)	475 (12-12-31)	28
North Umpqua R.	Clearwater	25	26S	3E	3,680 (1-18-53)	470 (11-22-49)	6
North Umpqua R.	Lemolo	13	26S	5E	1,190 (6-9-33)	206 (12-9-31)	28
Lake Creek	Diamond Lake	30	27S	6E	336 (1-1-43)	0 (8-25-31)	30

TABLE 13

MAXIMUM-MINIMUM DISCHARGES (continued)

Stream	Gaging Station	Location Sec.	Twp.	R.	Maximum cfs	Minimum cfs	Years of Record
Deer Creek	Roseburg	16	27S	5W	6,800 (12-26-55)	---	1
South Umpqua R.	Brockway	15	28S	6W	102,000 (9-29-50)	36 (8-12-26)	23
Lookingglass Cr.	Brockway	20	28S	6W	34,000 (12-26-55)	---	1
N. Myrtle Cr.	Myrtle Creek	23	29S	5W	2,950 (12-26-55)	---	1
S. Myrtle Cr.	Myrtle Creek	20	29S	4W	2,100 (12-26-55)	---	1
Cow Creek	Riddle	24	30S	6W	38,300 (12-26-55)	7 (8-11-26)	8
W. Fork Cow Cr.	Glendale	11	32S	8W	10,600 (12-21-55)	---	1
Cow Creek	Azalea	4	32S	4W	5,920 (10-29-50)	4 (9-26-31)	31
Days Creek	Days Creek	10	30S	4W	2,500 (12-21-55)	---	1
Elk Creek	Drew	14	31S	2W	7,500 (12-21-55)	0.9 (9-6-55)	1
South Umpqua R.	Tiller	33	30S	2W	37,400 (10-29-50)	20 (9-3-11)	17
Jackson Creek	Tiller	21	30S	1W	10,600 (12-22-55)	---	1

Note: ( ) indicates year when maximum or minimum occurred.

TABLE 14

INDEX OF PRECIPITATION RECORDS

Stream	Station Name	Location Sec.	Twp.	R.	Years of Record
Smith River	Gunter	36	20S	7W	* 1940-
Elk Creek	Elkhead	28	23S	4W	1955-
	Curtin	20	21S	4W	1955-
	Drain	4	22S	5W	* 1902-
Main Umpqua R.	Elkton 4S	32	22S	7W	1950-
	Kellogg	20	23S	7W	1956-
	Reedsport	3	22S	12W	* 1937-
Calapooya Creek	Sutherlin 2ENE	15	25S	5W	1957-
	Sutherlin Camp	21	24S	3W	1955-
North Umpqua R.	Toketee Falls	32	26S	3E	1953-
	Upper Steamboat	20	24S	2E	1956-
	Steamboat	32	25½S	1E	1955-
	Little River	3	27S	2W	1955-
	Idleyld-Rock Cr.	36	25S	3W	1955-
	Winchester	25	26S	6W	1950-
Deer Creek	Dixonville 3SE	5	28S	4W	1958-
South Umpqua R.	Tiller-Coyote	34	29S	1E	1955-
	Tiller	33	30S	2W	* 1936-
	Roseburg	12	27S	6W	1878-
	Riddle 2NNE	12	30S	6W	* 1899-
Lookingglass Cr.	Upper Olallie	5	30S	7W	1956-
	Reston	14	28S	8W	* 1909-
	Flournoy Valley	29	27S	7W	1955-
Myrtle Creek	South Myrtle	16	29S	3W	1955-
Cow Creek	Devils Flat	3	32S	3W	1955-
	Glendale	28	32S	6W	* 1904-
	Marial-West Fork	11	32S	10W	1955-

Note: * Incomplete for some years of record.

TABLE 15

SUMMARY OF WATER RIGHTS IN CUBIC FEET PER SECOND

AS OF JANUARY 1, 1958

Sub-basin	Consumptive Rights							Nonconsumptive Rights			Totals
	Dom.	Camp	Stock	Irrig.	Pond	Munic.	Indust.	Power	Mining	Fish	
LOWER UMPQUA R.											
Smith R.	0.32			0.71				300.00			301.03
Mill Cr.	0.23			1.54		15.00					16.77
Elk Cr.	0.84		0.01	24.76	3.75	5.50	2.81	2.62			40.29
Calapooya Cr.	0.14	0.76	0.05	25.83	2.00	5.00					33.78
Misc. Streams	3.70	0.08	0.02	31.73	2.28	1.00	49.17	0.18			88.16
TOTAL	5.23	0.84	0.08	84.57	8.03	26.50	51.98	302.80			480.03
	Total Consumptive 177.23							Total Nonconsumptive 302.80			
NORTH UMPQUA R.											
Misc. Streams	2.30	1.25	0.03	29.88	6.38	112.00	46.46	3575.65	0.15	61.08	3835.18
	Total Consumptive 198.30							Total Nonconsumptive 3636.88			
SOUTH UMPQUA R.											
Deer Cr.	0.23			4.85	5.96			10.18			21.22
Roberts Cr.	0.04			0.39		0.55					0.98
Lookingglass Cr.	0.11			16.06	0.40			5.17	23.00		44.74
Myrtle Cr.	0.75		0.02	19.80	2.81	1.00	0.67	10.00	14.57		49.62
Cow Cr.	2.94	0.02	0.17	54.67	10.15	4.52	33.14	8.25	262.13	0.17	376.16
Misc. Streams	7.17	____	0.02	77.75	11.09	8.12	1.53	0.07	____	____	105.75
TOTAL	11.24	0.02	0.21	173.52	30.41	14.19	35.34	33.67	299.70	0.17	598.47
	Total Consumptive 264.93							Total Nonconsumptive 333.54			

TABLE 16

FEDERALLY OWNED LAND BY OWNER CLASSIFICATION

Sub-basin	National Forest Land Acres	O & C Acres	Public Domain Acres	O & C in Controversy Acres	Coos Bay Wagon Rd. Acres	Total Sq. Mi.	Percent of Sub-basin
LOWER UMPQUA RIVER							
Smith River	65,920	20,960	1,280			137	39.0
Mill Creek	7,360					12	9.0
Elk Creek		39,360	828			63	22.0
Calapooya Creek		10,880	320			17	7.0
Misc. Streams	18,880	40,960	3,840		128	100	21.0
NORTH UMPQUA RIVER							
Little River	65,280	12,480	960	22,400		158	77.0
Rock Creek	2,080	17,920	640			32	34.0
Steamboat Creek	107,520	5,120		17,280		203	93.0
Copeland Creek	22,400					34	100.0
Fish Creek	52,200					82	100.0
Clearwater River	45,100					70	100.0
Misc. Streams	219,520	18,560	1,280	8,600		389	64.0
SOUTH UMPQUA RIVER							
Deer Creek		2,880	320			5	8.0
Roberts Creek		448	64			1	0.4
Lookingglass Creek		18,880	2,880		6,560	44	28.0
Myrtle Creek	11,520	18,240	1,280			49	42.0
Cow Creek	52,480	32,960	2,688	640		138	35.0
W. Fork Cow Creek	4,092	768				8	9.0
Canyon Creek	11,520	4,480	320			30	80.0
Elk Creek	34,240	6,400		7,680		76	94.0
Jackson Creek	83,840	4,160	256	10,880		155	100.0
Misc. Streams	145,280	52,160	4,672	29,120		361	56.0
TOTAL UMPQUA BASIN						2,164	47.0

SOUTH UMPQUA SUB-BASIN

GENERAL DATA

Location

The South Umpqua sub-basin comprises the entire southern section of the Umpqua River Basin and Douglas County. It includes all the lands within the Basin south of the sixth standard parallel, plus the drainage area of Deer Creek, and the lower 15 miles of the South Umpqua River which cover ranges 4W, 5W, and 6W of township 27S. Practically the entire drainage area of the South Umpqua falls within the political boundaries of Douglas County. The major tributaries of the South Umpqua River are Myrtle Creek (North and South), Cow Creek and its tributary (West Fork), Elk Creek, Jackson Creek, and that area above Jackson Creek known as the upper South Umpqua.

Size

The South Umpqua River drains an area of approximately 1762 square miles. Its length is approximately 114 miles from its confluence with the North Umpqua to the head of Falcon Creek on the summit between the South Umpqua and the Rogue River. Its principle tributary, Cow Creek, is approximately 69 miles long. Cow Creek has a drainage area of 397 square miles.

Topographic Characteristics

The lower section of the South Umpqua (below its confluence with Cow Creek) contains the major portion of the developable lands of the South Umpqua Basin. In the Melrose Valley, near the confluence of the North and South Umpqua Rivers, lie the most extensive and fertile agricultural lands in the Umpqua Basin. The width of the valley in this general area approaches three miles. Other areas suitable for cultivation are the Edenbower area immediately below Roseburg, the area near Winston, and limited lands downstream from the mouth of Cow Creek and the South Umpqua. Shoestring valleys suitable to very limited development exist intermittently along other portions of the lower South Umpqua and its tributaries, Deer Creek and Myrtle Creek. A relatively large area with potential for irrigation lies in the Lookingglass Valley southeast of Roseburg. With the general exception of the areas

indicated, the South Umpqua sub-basin is rugged and suitable primarily to the production of timber and limited grazing of livestock.

Elevations vary from 460 feet mean sea level at the mouth of the South Umpqua to 8,000 feet msl in the upper reaches of the South Umpqua at the Umpqua-Rogue Divide. Less than three percent of the sub-basin lies at elevations above 5,000 feet msl. The entire watershed of the South Umpqua above Myrtle Creek is covered with large stands of timber.

Geologic Characteristics

The South Umpqua sub-basin has within its confines three physiographic provinces. The section downstream of Dillard falls within the Coast Range whose rock formations are shales, conglomerates, and sandstones. Above Dillard and including all of Cow Creek and the South Umpqua to Tiller is an area identified as the Klamath-Siskiyou Range. The formations of this province are granite, metamorphized sediments and volcanics of the cretaceous and earlier periods. The balance of the watershed falls in the Western Cascade province, with the exception of the headwaters which originate in the High Cascades.

Meteorologic & Hydrologic Characteristics

Generally speaking, temperatures within the sub-basin are mild, the only exception being the headwaters areas in the High Cascades. Because of the relatively mild temperatures partially due to low elevations, the major portion of precipitation in this sub-basin occurs in the form of rain. Snowpacks are limited and runoff generally follows the rainfall patterns closely. Since the major portion of the drainage area falls within geological provinces that do not contain the porous formations characteristic of the Upper North Umpqua, ground water storage for natural stream regulation is practically nonexistent. Precipitation within the drainage area ranges from an average of about 30 inches per year in the vicinity of Roseburg and the Lookingglass Valley to as high as 90 inches in the headwaters of the West Fork of Cow Creek, and 70 inches in the headwaters of Jackson Creek. Specific precipitation data for the sub-basin is extremely limited. Records have been kept at Roseburg since 1878, and one station was operated for a short period of time at Reston (1909-1917). At Riddle, near the confluence of the South Umpqua and Cow Creek, a weather station has been in operation since 1899. These records show the general character of precipitation patterns for the western portion of the sub-basin (at the lower levels), but are not sufficient to provide reliable

information for the analysis of runoff patterns of the major portion of the drainage area.

Stream gaging records for the South Umpqua River date back to 1905 when a gage was established near Brockway. Unfortunately, the record of this gage, which is the measure of yield for the entire sub-basin, is intermittent in character. Gaging records are available for the upper section of Cow Creek above Azalea dating back to 1926, but these cover a small portion of the total drainage area of Cow Creek and do not describe the status of the lower section. At Tiller, on the South Umpqua, records are somewhat limited, but allow an approximation of distribution within the sub-basin. Records for this area do not compare with those available for the North Umpqua as a base for establishing the amount and distribution of resource.

Land Ownership

The west boundary of the Umpqua National Forest intersects the South Umpqua at its confluence with Jackson Creek, and the entire drainage area of the South Umpqua above this point and Jackson Creek falls within the limits of the Umpqua National Forest. Below this point (downstream) substantial areas of land are held by the Bureau of Land Management. In general, BLM lands are held in a checkerboard pattern and cannot be given a precise definition. Land ownership can be summarized by stating that 49 percent of all the lands in South Umpqua watershed are owned or managed by the Federal Government.

Federal power withdrawal sites are located immediately above Roseburg on the main stem of the South Umpqua, Roberts Creek, at the confluence of the South Umpqua and Myrtle Creek, three sites on North and South Myrtle Creek, five sites on Cow Creek, one site on Canyon Creek, four sites on the South Umpqua between Canyonville and Stout Creek, and a blanket from Hatchet Creek to a point one mile above Boulder Creek on the South Umpqua, plus an isolated location on Elk Creek just downstream of Drew.

Transportation Facilities

The lower sections of the South Umpqua and Cow Creek are served by the Southern Pacific Railroad. The section from Roseburg through Dillard, Myrtle Creek, Canyonville, and Azalea is served by State Highway connecting with U. S. 99 at Canyonville. The Lookingglass Valley and lower Cow

Creek up to Crawford Creek are served by county roads and miscellaneous logging access roads which reach into the east slope of the Coast Range. The area downstream from Roseburg is served by the Reedsport-Roseburg highway (State 225) and a network of county roads.

Transportation facilities in the watershed above Tiller are restricted to a state road paralleling the South Umpqua River and various Forest Service and miscellaneous logging access roads in the upper watershed.

Economy

The present economy of this section of the sub-basin has three facets: (1) timber, (2) limited agricultural and livestock development, and (3) industrial development which is primarily mining and processing based on the Hanna nickel plant at Riddle. The communities of Azalea, Glendale, Canyonville, Days Creek and Tiller depend primarily upon timber as the basis for their existence, with some support from agriculture. Riddle and Myrtle Creek depend on timber operations and the existence of the nickel processing operations at Riddle for their economy. Roseburg itself is the center for many primary timber processing operations, as well as the basic wholesale and retail distribution center for the entire Umpqua River Basin. Its economy is stabilized by the agricultural developments of the Melrose and Garden Valley areas. These sections provide a wide diversity of crops, fruits, nuts, berries, alfalfa and many row-type crops.

Population

Most of the population of Douglas County is concentrated in the vicinity of Roseburg.

AMOUNT AND DISTRIBUTION OF RESOURCE

Precipitation

As indicated previously, precipitation information is limited and has not been utilized to any material degree in the analysis of the amount and distribution of the water resource. It has been used where possible as a check in conjunction with the stream gaging information.

Stream Gaging

The record of the gaging station at Brockway on the South Umpqua River reflects the conditions of yield and instantaneous flow that have existed in the past for this drainage area. Annual yields from the watershed

have been as low as 0.8 million acre-feet and as high as 3 million acre-feet. Instantaneous flow values range from peak discharges of 100,000 cubic feet per second for short periods during floods to as low as 36 cfs in late summer (August 12-13, 1926). Flows recorded at the Brockway gage in years of normal runoff are frequently below 300 cfs for 3 or 4 months of the year.

Resource Distribution

The South Umpqua sub-basin, which represents 46 percent of the drainage area above the Elkton gage, contributes from 23 to 47 percent of the yield. The South Umpqua River above Tiller, which represents 12 percent of the entire Umpqua Basin, contributes from 11 to 16 percent of the total Umpqua Basin runoff and Cow Creek at Azalea, about 2 percent of the total area, very seldom contributes more than 1.50 to 1.75 percent of the total runoff.

The relative contributions made by West Fork Cow Creek have never been measured, yet this stream with headwaters in the Coast Range has extremely high flows during certain periods of the year. The contribution of North and South Myrtle Creek, which represents a drainage area of 117 square miles is larger than West Fork, has just recently been gaged, and its contribution to yield and flow patterns is not established. The same situation exists for Elk, Lookingglass, Deer, and Olalla Creeks. Until sufficient records are obtained through Douglas County's program, a full hydrologic analysis is of restricted value.

AMOUNT AND DISTRIBUTION OF RESOURCE UNDER APPROPRIATION

The pattern of distribution of water rights within the South Umpqua sub-basin is extremely complex. One simplified method of illustrating the effects of both consumptive and nonconsumptive water rights on a specific section of the stream is by means of the depletion diagram Figure 20. By means of such a diagram, the depletion potential above a specific point can be analyzed. For example, Figure 20 indicates that the total diversion potential of the South Umpqua River is more than 570 cfs. The chart also indicates that approximately 240 cfs of this total is water which can be taken from the stream for consumptive purposes. To supplement a depletion diagram for the South Umpqua River, similar diagrams for each of its tributaries are required. The Figure shows that 48 percent of the consumptive rights to use water in the South Umpqua sub-basin occurs

downstream of the confluence of the South Umpqua River and Cow Creek. The depletion potential on the South Umpqua River above mile 42, at the confluence of Cow Creek and the South Umpqua River, is about 31 cfs. This depletion potential is nearly equal to the observed stream flow at the Brockway gage (approximately mile 22) for the critical flow of record (36 cfs). The diagram also indicates the distribution of water rights by the magnitude of the ordinate represented by each incoming tributary. For example, Cow Creek which joins the South Umpqua River at mile 41, represents the largest tributary use of water for consumptive purposes. Diversions for consumptive use total approximately 88 cfs, or roughly one-third of the total diversion potential for consumptive use of water in the South Umpqua sub-basin. For an evaluation of the distribution of rights on Cow Creek itself, reference would be made to a specific depletion diagram for this stream. Figure 20 also indicates that most nonconsumptive diversion rights also occur on Cow Creek.

Total water rights, consumptive and nonconsumptive, for the South Umpqua sub-basin represent approximately thirteen percent of the total known legal rights to use water in the Basin. This would tend to indicate that the problem on the South Umpqua River was less critical than in other areas of the Basin. This is incorrect because the major proportion of the water rights legally established within the Umpqua Basin are for nonconsumptive purposes; nearly 82 percent are for the purpose of hydroelectric power generation. In analyzing the consumptive uses of water, the true status of the South Umpqua River becomes apparent. One-third of the consumptive rights to use water for the entire Umpqua system are located in the South Umpqua sub-basin. Better than 28 percent of the total consumptive rights within the Umpqua Basin are located on Cow Creek and the South Umpqua River and its tributaries below Canyonville.

EXTENT OF THE BOARD'S JURISDICTION

Many portions of the South Umpqua sub-basin have been appropriated above the capacity of the stream to deliver during periods of critically low flow. For this reason, the Board's jurisdiction is limited largely to flows that occur during the high runoff periods of December, January, February, and March. On the South Umpqua River above its confluence with Cow Creek, the Board has undefined jurisdiction. Major jurisdiction would be in the upper portion of the sub-basin. All the watershed above the confluence of the South Umpqua River and Jackson Creek lies within the Umpqua National Forest. To establish the extent of the Board's jurisdiction in any specific

location would require a study of existing rights in relation to available resources. The status of the distribution of the resource has not been sufficiently established to make the necessary comparisons.

EXISTING AND FUTURE NEEDS FOR THE RESOURCE

Existing and future water needs for the South Umpqua sub-basin encompass both consumptive and nonconsumptive beneficial uses of water. Because the interrelationships between resource availability and the point of application to beneficial use are so complex in the South Umpqua watershed, the discussion following is directed to overall sub-basin analysis. Specifics are discussed where they can be identified.

There is a serious need for an improvement of water supplies during the critical flow months in order to satisfy both consumptive and nonconsumptive requirements of the present, as well as future. Water supplies are so undependable during summer months that the situation will act as a serious deterrent to expansion of beneficial use during the immediately foreseeable future. Total needs for full development would exceed, by a substantial degree, the amount of water available during the summer months in an average year. In fact, on a straight time-flow relationship, there is not sufficient water during periods of need to provide for the potential requirements of irrigation alone. When the water needs of industrial development, municipal requirements, and other consumptive beneficial uses are superimposed upon irrigation, fish life, and other major needs, the situation existing in the South Umpqua becomes critical.

On the basis of evidence available, it appears that the potential for conflict in the immediate future, and in terms of foreseeable needs, is far more critical than is generally supposed.

Domestic

The existing requirements for domestic use, as defined by rights of record, total approximately 11.24 cubic feet per second for the entire South Umpqua sub-basin. The largest domestic requirement is in the Cow Creek watershed with a total value of 3.00 cfs. Myrtle Creek follows with 1.00 cfs, Lookingglass Creek with 0.21 cfs, and Deer Creek with 0.23 cfs. The balance of the 11.24 cfs is made up of miscellaneous domestic requirements along the main stem and other tributaries.

It is difficult to estimate what future domestic requirements might be for a large portion of existing domestic rights in the South Umpqua are in areas which may ultimately be served by municipal water supplies. A maximum figure for ultimate domestic requirement is estimated at 25 cfs.

Municipal

Present municipal requirements in the South Umpqua sub-basin total 14 cfs. These rights do not reflect the demands of the City of Roseburg which receives its supply from the North Umpqua River. It is anticipated that there will be an immediate change in this value as some of the communities in the South Umpqua are considering making application for additional water supplies.

Utilizing the criteria outlined in Chapter IV, it is estimated that probable municipal requirements for 1975 will approach 55 cfs.

Irrigation

Present rights to divert water for irrigation purposes in the South Umpqua sub-basin total approximately 175 cfs. This is between 25 and 30 percent of the foreseeable potential.

Assuming that the presently-irrigated lands of the South Umpqua sub-basin are adequately irrigated, the future irrigation requirements for the area during the months of June, July, and August, would total approximately 70,000 acre-feet. Supplies, based on the average flow of all years of record for the same irrigation period, June, July, and August, approximate a yield of 42,000 acre-feet. Future potentials that can be identified are the Deer Creek drainage with a 10 cfs requirement in terms of diversion rights; Lookingglass Creek drainage, 118 cfs; Myrtle Creek drainage, 75 cfs; and Cow Creek drainage, 102 cfs. These values represent possible total rights as related to legal applications but should not be construed to be additive in terms of stream withdrawal or depletion potential.

Power Development

Rights of record for power development in the South Umpqua sub-basin total 34 cfs. These rights represent a composite of several individual developments which are not utilized for the sale of power to the public.

Expansion of the present type of power development in the South Umpqua sub-basin is not anticipated in the future. Power development may prove to be practical as a part of the comprehensive development of sites being investigated by the Corps of Engineers and the Bureau of Reclamation. Precise definition of the amounts of water involved will be dependent upon the outcome of economic analyses presently under way by the investigating agencies. It is anticipated that these rights will be confined to the main stem of the South Umpqua River.

Industrial

Present utilization of water for industrial purposes total about 35 cfs for the entire sub-basin. The Cow Creek watershed has rights totaling almost 90 percent of this figure.

Future industrial needs in this sub-basin are difficult to predict. This is due to the fact that the water supply situation has advanced to the point where availability of water determines the extent of industrial growth. Requirements for a pulp and paper operation to serve the wood products potentials of the Umpqua system are excluded on the basis that such development is most likely to occur where main stem or North Umpqua water can be used. Future industrial requirements are estimated at 80 cfs.

Mining

Present rights to utilize South Umpqua waters for mining purposes total 300 cfs. There are 262 cfs of existing mining rights concentrated on Cow Creek and its tributaries. The status of rights on Cow Creek is well established since this sub-basin has been adjudicated by the State Engineer. Some of the mining permits are subject to limitations with regard to period of use. A substantial portion of these rights are not being utilized at the present time.

Although the point of application to beneficial use may change with discovery of additonal mineral resources, it is anticipated that the total use of water for these purposes will not expand materially under foreseeable conditions.

Fish Life, Wildlife, and Recreation

Existing and future needs for these three purposes will be assumed

to be met by the requirements for desirable minimum flows set by the Fish and Game Commission in their statement to the Water Resources Board, the Umpqua River Hearing. The key control is the Brockway gage with a basic flow for fish life of 100 cfs. The increase of 40 cfs at this location, over the previous figure of 60 cfs presented to the Water Resources Advisory Committee, was not accompanied by any criteria or standards defining the need for this change. The requirements for the fisheries resources of the South Umpqua River are in direct conflict with consumptive requirements, primarily for irrigation development. The maintenance of a minimum flow of 100 cfs at the Brockway gage constitutes a commitment of 18,000 acre-feet of water during the irrigation season. This would represent the water needed, including transmission and other losses, during June, July, and August for the irrigation of better than 7,000 acres.

Pollution Abatement

In recent years, during low flow periods, the quality of the water in the lower limits of the South Umpqua River has deteriorated to a level that makes swimming inadvisable. This has generally occurred when flows at the Brockway gage have dropped below 100 cfs. This condition will be alleviated to some extent by the completion of facilities presently planned for the treatment of wastes discharged into the South Umpqua.

In the future, expanding population and industrial growth will require a higher degree of treatment for wastes whose residuals will eventually be discharged into the South Umpqua. It is impossible to predict at this stage what the relationships between total treatment, efficiency of treatment, and enhancement of streamflows will have to be to meet requirements of the future.

Flood Control

The status of flood control needs in the South Umpqua sub-basin are illustrated by the damages resulting from the 1955 flood. Of the $2,143,140 total damages, $1,487,150 occurred in the South Umpqua sub-basin. Approximately 50 percent of the flood damages in the 1955 flood occurred in the section of the South Umpqua between Cow Creek and the confluence with the North Umpqua River. Damages on Cow Creek, Myrtle Creek and Deer Creek were not included in this percentage.

Utilizing the flood hydrograph - South Umpqua River near Brockway - Figure 22, a general measure of the flood control problems of the lower

South Umpqua can be identified. In this figure is found the volume of water occurring during the flood period which contributed to flows above bankfull stage at Brockway. The total volume involved approximates 150,000 acre-feet. Assuming a flood of this magnitude, and inability to discharge water between flood peaks, storage effective at Brockway would be required in this amount. Actually this does not represent the total picture in the sub-basin since storage on the main stem controlling to this level would not prevent flood damages on tributary streams. The determination of the best location for flood control storage to maximize the benefits accruing to flood control is complex and will not be available until the studies of the Corps of Engineers are completed in 1959.

Problems will intensify if development in the flood plain continues without the development of adequate control measures.

METHODS OF RESOURCE DEVELOPMENT

The major method of satisfying all the potential needs of the South Umpqua Basin and providing for the regulation of flow necessary to limit flood damage is storage. The South Umpqua sub-basin is deficient in storage sites which have the appearance of physical feasibility and economic practicality.

Storage Possibilities

The storage possibilities and their problems for the South Umpqua River are set off by areas as follows:

Deer Creek

The major possibility for storage on Deer Creek is a reservoir located immediately above the community of Dixonville. A dam across the valley approximately a quarter of a mile above the confluence of the North and South Forks would store a maximum of 100,000 acre-feet for a 160-foot structure. Development at this point would inundate some of the best agricultural land in the Deer Creek watershed. This is land which is presently quite fully developed. The development of storage at this location would probably inundate and take out of production more and better quality agricultural land than could be reclaimed by the use of the water from this watershed for irrigation purposes. In addition, the annual yield potential of the watershed above this site would not be sufficient to fill a

a reservoir of this capacity each year.

The only value of storage of this section of Deer Creek would be for the purposes of alleviating flood damages in lower Deer Creek and particularly within the confines of the City of Roseburg. It is doubtful that the cost of construction of a flood control structure at this point could be balanced by the benefits derived. There is some potential for small development in the upper section of the South Fork of Deer Creek, but storage capacities here would be of an order of magnitude which cannot be determined from the topographic sheets available for present studies.

Myrtle Creek

Storage potential examined on the Myrtle Creek, including both North and South Myrtle Creek, would amount to a maximum of 100,000 acre-feet. This would include sites on the South Myrtle Creek at its confluence with School Hollow and on North Myrtle Creek in the section of the stream between the confluence of Myrtle Creek and Slide Creek and the confluence of Myrtle Creek and Lee Creek. Water stored in either one of these sites would be available for industrial use in the community of Myrtle Creek. It could be used for pollution abatement purposes, or it could be utilized for limited agricultural development below either of the proposed sites.

The construction of these reservoirs would represent a substantial measure of flood control for the community of Myrtle Creek, but it is very unlikely that the economic benefits derived could even begin to pay for the costs of structures of the size required.

The primary disadvantage of these developments is the fact that the creation of the storage reservoirs would necessitate inundation of lands which are presently being utilized for agricultural purposes and represent a fairly high degree of development.

In both cases, the entire normal yield of the area would probably be required to fill the reservoirs each year, although specific information to substantiate this assumption is not available.

Construction of the reservoirs would also require about six miles of road relocation in a very difficult terrain on North Myrtle Creek, and approximately seven or eight miles on South Myrtle Creek. It does not appear that development of either of these sites will be economically feasible within the foreseeable future.

Lookingglass-Olalla Creek

Two possibilities exist for major storage in this particular sub-basin. First is a site on Lookingglass Creek in section 32, township 27S, range 7W just below the junction of Lookingglass Creek and Flournoy Creek. A 240-foot structure at this point would store a maximum of 150,000 acre-feet. The development of a reservoir in this position would inundate Flournoy Valley which is fairly extensively developed and the benefits to be derived from such a project are unestablished. Since the total annual yield to this reservoir would be substantially less than the capacity indicated, development of this particular site is not deemed feasible.

The second possibility in this sub-basin is the Olalla site investigated by the Bureau of Reclamation in its 1955 Evaluation Report. A damsite exists on Olalla Creek in the section of the stream between its confluence with Berry Creek and the intersection with the south boundary of section 8, township 29S, range 7W. Preliminary investigations by the Bureau of Reclamation indicate that the storage of approximately 15,000 acre-feet at this location would provide for the irrigation of all lands servicable from this project. Field reconnaissance indicates that a substantially larger reservoir might be physically feasible. Total capacity for a 240-foot structure in this stretch of the stream would amount to 115,000 acre-feet as a maximum. Data on yield available at the reservoir location is not fully established at this time. Although maximum development would represent substantial storage, this reservoir would control only fifteen percent of the sub-basin runoff. Under this circumstance, a large percentage of this sub-basin would continue to contribute to the flood problems of the Roseburg area.

There does not appear to be any power potential at the Olalla site that would represent a substantial contribution to the benefits accruing to a project at this point. Preliminary evaluations indicate that benefits to the project from power would not be sufficient to justify the power installations alone.

Flood control benefits would accrue to the Olalla project. In addition to the benefits of capacity usable for flood control and irrigation, additional capacity serving flood control and the maintenance of minimum flows seems highly desirable and of major economic significance. Minimum flow may result in material benefits to the project.

The primary enhancement from minimum flows in Olalla and

Lookingglass Creeks will accrue to the fisheries resource. With a firm minimum water supply of 25 cfs discharging at the project, enhancement would mean approximately 2000 more silver salmon spawning; 2000 additional silver salmon for the off-shore troll fishery; 1000 steelhead; slightly increased trout angling in Olalla and Lookingglass Creeks, by a few hundred angler days; and reservoir trout angling effort of approximately 3000 angler trips annually.

When the physical fisheries enhancements are translated into angler expenditures and commercial profits, the annual economic benefits accruing to the maintenance of a minimum flow becomes significant, equalling or exceeding the benefits from flood control.

Development of the Olalla site would cut off spawning areas in upper Olalla and Berry Creeks. Passage facilities or artificial spawning channels, egg-taking, hatching facilities, and rearing ponds would be necessary to prevent or mitigate losses from project construction. The capital cost of facilities to maintain, above reservoir, fisheries resources would be approximately equal to the benefits from two years of project operation and operating costs would approach 15 percent of the capital cost of the facilities.

Enhancement figures were qualified by the Game Commission because flow studies indicated water to maintain the 25 cfs minimum would be available in only seven of ten years. The assumption that enhancements would be proportional to the seven to ten ratio is, in their minds, questionable. The primary difficulty stems from the fact that flow data on Olalla Creek is based on correlation studies with a limited amount of actual stream measurement.

Enhancements are predicated on adequate protective measures including screening of diversions and protection of fish from other adverse features resulting from project construction and development.

Development at this site would necessitate the relocation of several miles of county road serving the headwater areas of this sub-basin. The relocation of farms and other existing facilities would be limited.

This particular site appears to have real potential from a physical and economic point of view.

Cow Creek

The total physical site capacity for the Cow Creek watershed amounts to some 800,000 acre-feet based on the limited knowledge available; however, only a small portion of this storage appears feasible from an economic point of view. The most practical appearing development is the so-called Galesville site located on Cow Creek below its confluence with McGinnis Creek. At this point, a 130-foot structure could store a maximum of 55,000 acre-feet. This is about one-half the amount of yield to this site during an average year. Development of this project could supply irrigation water for the entire sub-basin with sufficient surplus water to provide for the desired base flows set forth in the requests of the Oregon Game Commission. Sufficient capacity would be available to provide water for all uses except the dilution of pulp and paper operation effluents.

The contribution of this site to flood control would be limited to the protection of property and lives in the upper Cow Creek area and would have limited effect on the flood problems of the lower Cow Creek region and negligible effect on the South Umpqua River.

Any storage project constructed in the upper limits of the Cow Creek area which provides flows for release to the benefit of the fisheries resource during low flow periods will provide substantial benefits. Specific comments have been received from the Oregon State Game Commission outlining benefits that might accrue to the construction of the Galesville project. Storage at the Galesville project or any of the projects previously studied upstream from that location, McGinnis Creek, Meadows, or Dismal, that would provide for a minimum regulated flow of 25 cubic feet per second in Cow Creek would result in substantial fisheries benefits. These benefits would accrue from increases in salmon spawning areas, salmon and steelhead rearing areas, survival and escapement during what would normally be low flow periods, increased trout fishing where supplemental waters are available, and increased trout fishing made possible by the construction of the reservoir.

A relatively small amount of spawning gravel would be eliminated by the construction of a project in this area and provisions to accomodate approximately 300 silver salmon and 300 winter steelhead by artificial spawning channels, holding ponds, and egg-taking and hatching facilities would reduce loss to the existing fisheries resource to a negligible level. Costs are low in view of the large benefits that would accrue to this project. from an increase of 9000 silver salmon spawners; 9000 silver salmon to ocean

troll fisheries; 4300 steelhead; increase of 3000-4000 angler trips per year for downstream fishing and approximately 3000 fishing trips annually to the impoundment.

It would be essential that all diversion structures and channels be adequately protected to maintain a maximum enhancement of the fisheries resource at all locations downstream of the project.

If the benefits, indicated on a preliminary basis, are developed and accepted as being the benefits that would accrue to the fisheries resource from this project, it is quite possible that these benefits may be the factor which provides the greatest increment of benefits to the project from a multi-purpose water use basis.

Relocations within the project area would be at a minimum and are confined to limited farm relocation problems and relocation of existing unsurfaced county roads serving the headwater areas of Cow Creek.

South Umpqua above Canyonville

The total storage potential on the South Umpqua River above Canyonville exceeds 500,000 acre-feet. About 210,000 acre-feet is concentrated in the area between Canyonville and Milo. Development of the major portion of this storage does not seem practical because of the extensive relocation of highways and the inundation of valuable agricultural lands, particularly in the section between Milo and Canyonville. Storage for flood control purposes could be developed at the so-called Days Creek site, but the economic potentials of this particular site are doubtful. Possibilities of storage for flood control purposes in this area are being studied by the Corps of Engineers in its Umpqua Basin Flood Control Study, but specific data will not be available until the completion of this investigation.

The Bureau of Reclamation has made preliminary reconnaissance investigations on the potentials of the Tiller site which is located above the community of Tiller and just below the confluence of the South Umpqua River and Jackson Creek. Preliminary studies by the Bureau indicate that a structure approximately 190 feet high with a crest length of approximately 620 feet would have a capacity of 54,000 acre-feet and would serve 28,000 acres of irrigable land in the South Umpqua sub-basin below Tiller. The Bureau indicates that the geological setting is favorable and that additional capacity could be provided for other desired uses. Reconnaissance studies of the

Board indicate that structures up to 350-400 feet in height are a possibility. Storage would range upward to a quarter of a million acre-feet. Size of structure and reservoir capacity will be determined by detailed cost benefit studies.

Evaluations are presently underway to determine the benefits or detriments that would accrue to the construction of the Tiller project in connection with the fisheries resource. Preliminary figures indicate that benefits will probably not exceed the cost associated with loss or mitigation of loss for the fisheries resource. Should the final analysis prove benefits to be in excess of costs, they will probably not be sufficiently greater to constitute an important item in economic justification of the project. If this proves to be the case, the major benefits accruing to the Tiller project will have to come from irrigation, flood control, and possibly power.

The primary relocation problem connected with the construction of the Tiller project would be the relocation of roads serving the upper South Umpqua sub-basin and the Umpqua National Forest lands. Final economic evaluation of the Tiller site will not be available until the investigations of the Corps of Engineers and the Bureau of Reclamation are completed.

There are no major storage sites available on the South Umpqua River above the mouth of Jackson Creek. There is a small site available on Jackson Creek, but its maximum capacity would be about 19,000 acre-feet and would require a 150-foot structure to develop this storage. Economic justification is unlikely.

There is a limited possibility for storage development on Elk Creek, a tributary of the South Umpqua River, whose confluence with the main stem is just below the community of Tiller. A structural site exists on Elk Creek just above its confluence with Drew Creek and the construction of a 250-foot structure at this point would result in a maximum storage development of 60,000 acre-feet. In addition to inundating the community of Drew and the agricultural development in the reservoir site, relocation of several miles of State Highway 42 would be required. The Bureau indicates that comparative cost studies indicate storage at the Elk Creek site would be less economical than that at Tiller.

In order to satisfy existing and future needs of the South Umpqua sub-basin, it will be necessary to investigate every possible storage site

which might ultimately prove physically and financially sound. The benefits to be derived from any storage development would be: stabilized stream flow for fish, recreation and pollution abatement; water for consumptive use by industries and municipalities; irrigation use; power and flood control.

SOUTH UMPQUA

FIGURE 15

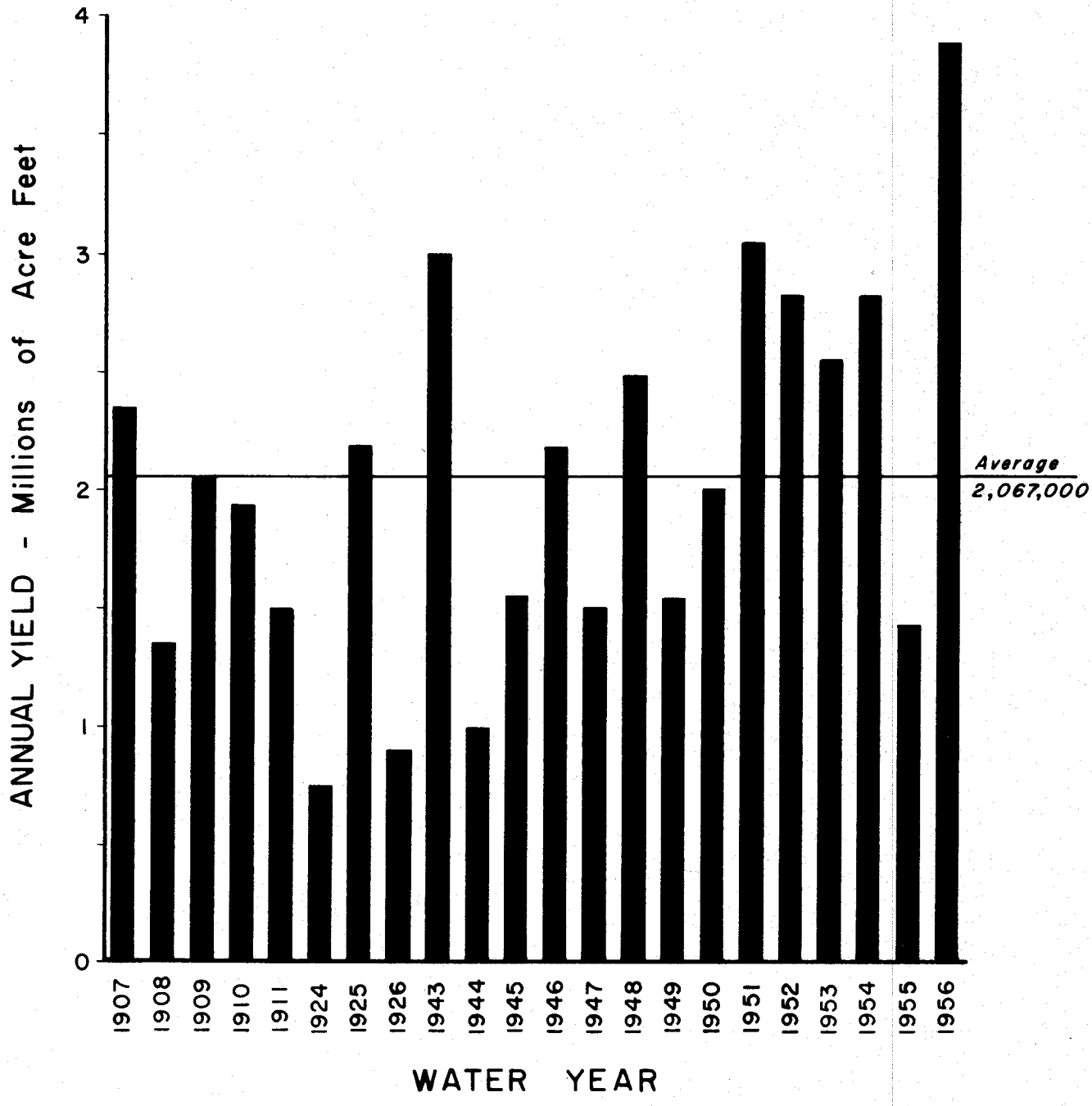
UMPQUA RIVER BASIN

YIELD DIAGRAM

ANNUAL YIELD
OF

SOUTH UMPQUA RIVER NEAR BROCKWAY

Drainage Area 1,640 Sq. Mi.



Note: Records incomplete for years not shown.

Drawn: Dec., 1957
File No. 16.220
FIGURE 16

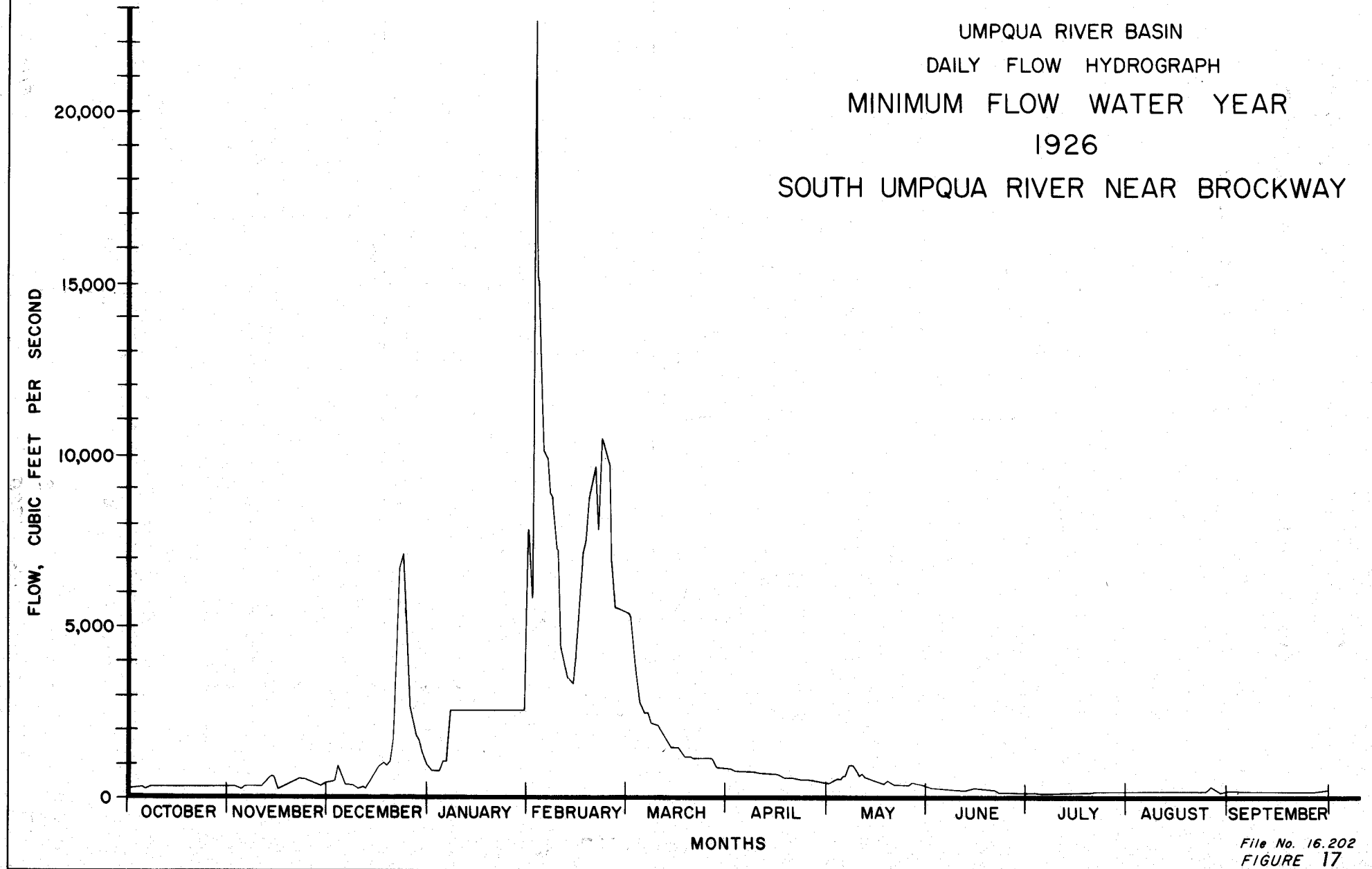
UMPQUA RIVER BASIN

DAILY FLOW HYDROGRAPH

MINIMUM FLOW WATER YEAR

1926

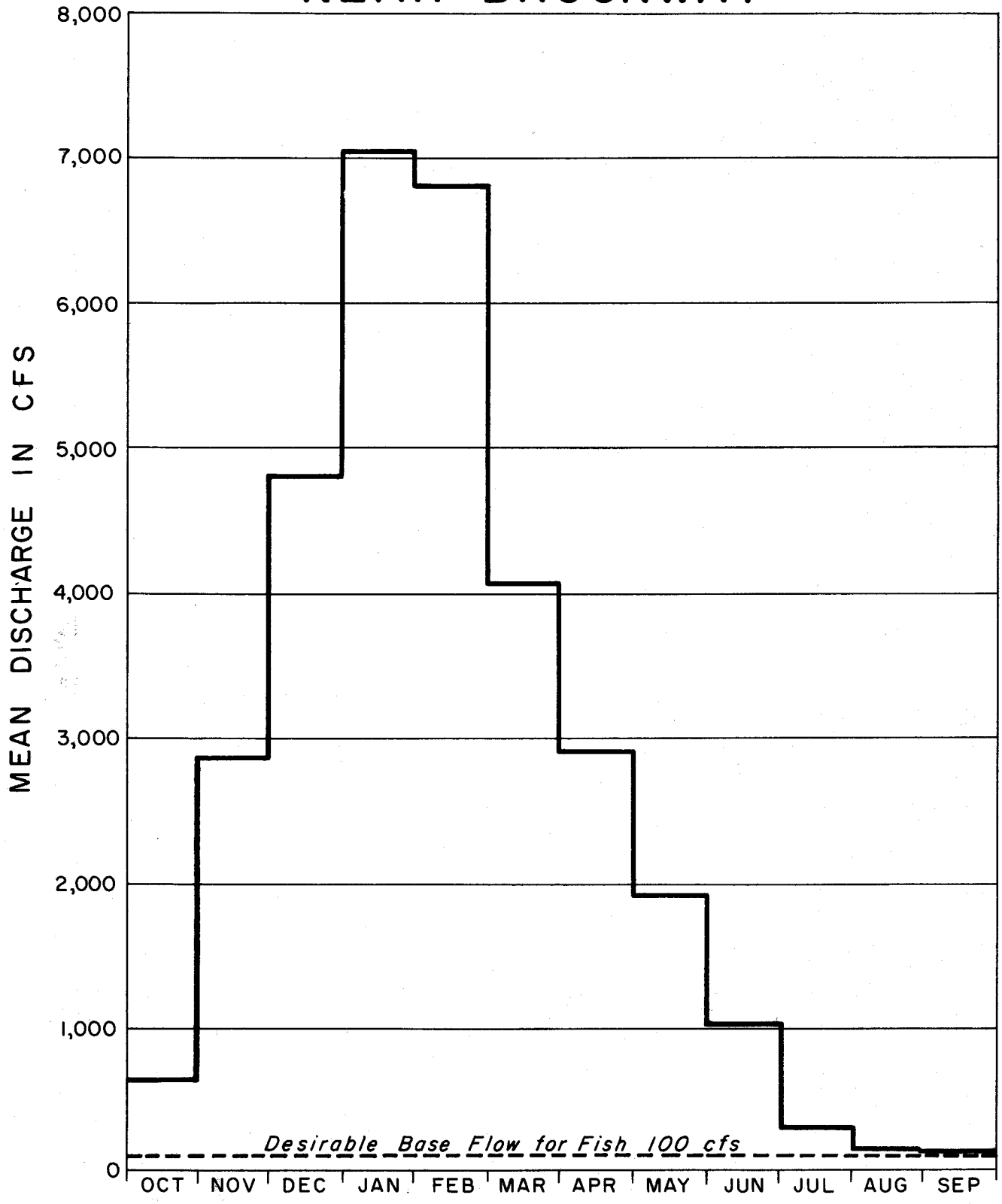
SOUTH UMPQUA RIVER NEAR BROCKWAY



File No. 16.202

FIGURE 17

UMPQUA RIVER BASIN
MEAN MONTHLY HYDROGRAPH
SOUTH UMPQUA RIVER NEAR BROCKWAY



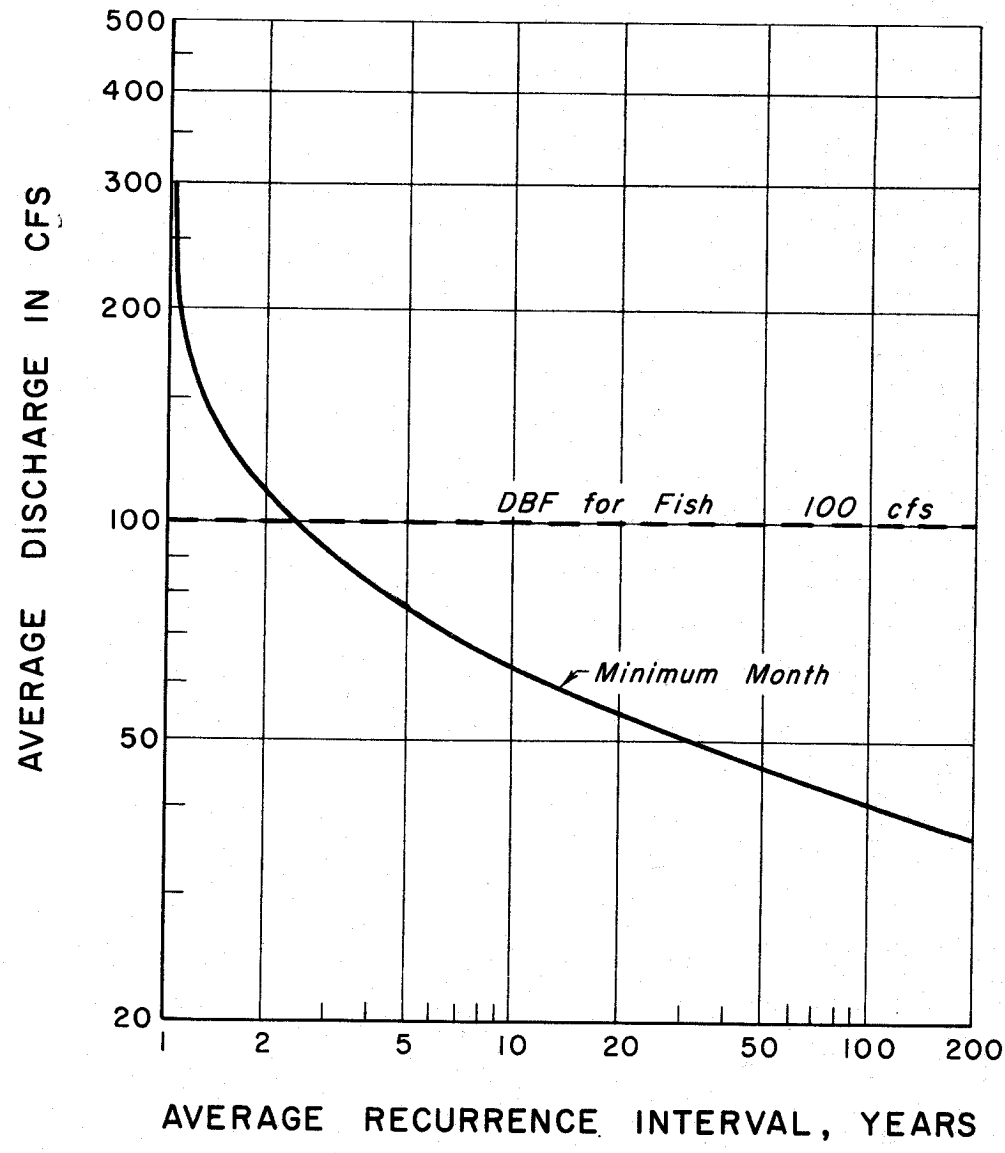
YEARS OF RECORD 1906 - 1912
1924 - 1926
1942 - 1955

File : 16.202
FIGURE 18

UMPQUA RIVER BASIN

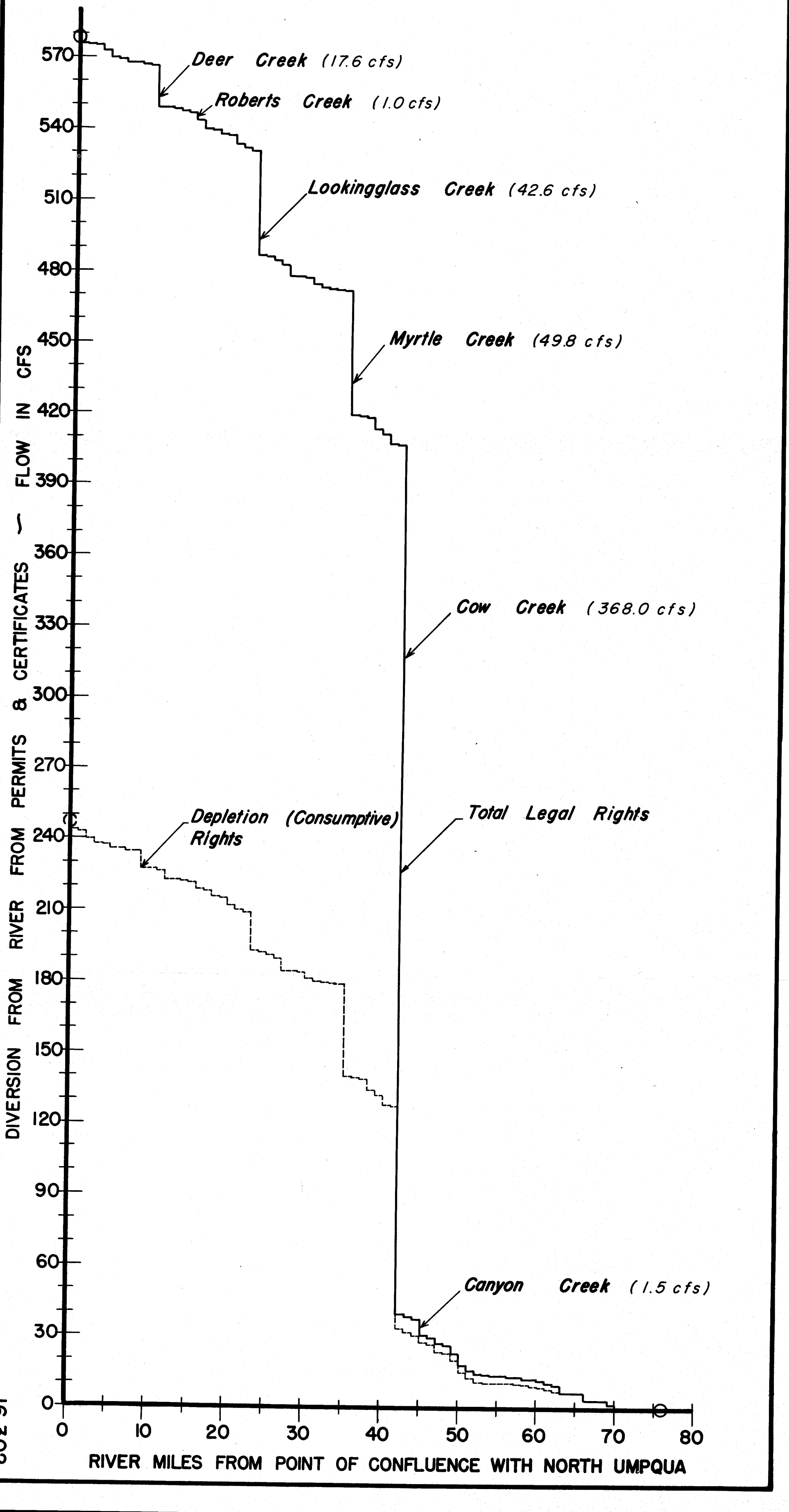
SOUTH UMPQUA AT BROCKWAY

LOW FLOW FREQUENCY CURVE
AND
DESIRABLE BASE FLOW FOR FISH



Drawn: Jan., 1958
File No. 16.203
FIGURE 19

DEPLETION RIGHTS VS RIVER MILES ON SOUTH UMPQUA & TRIBUTARIES



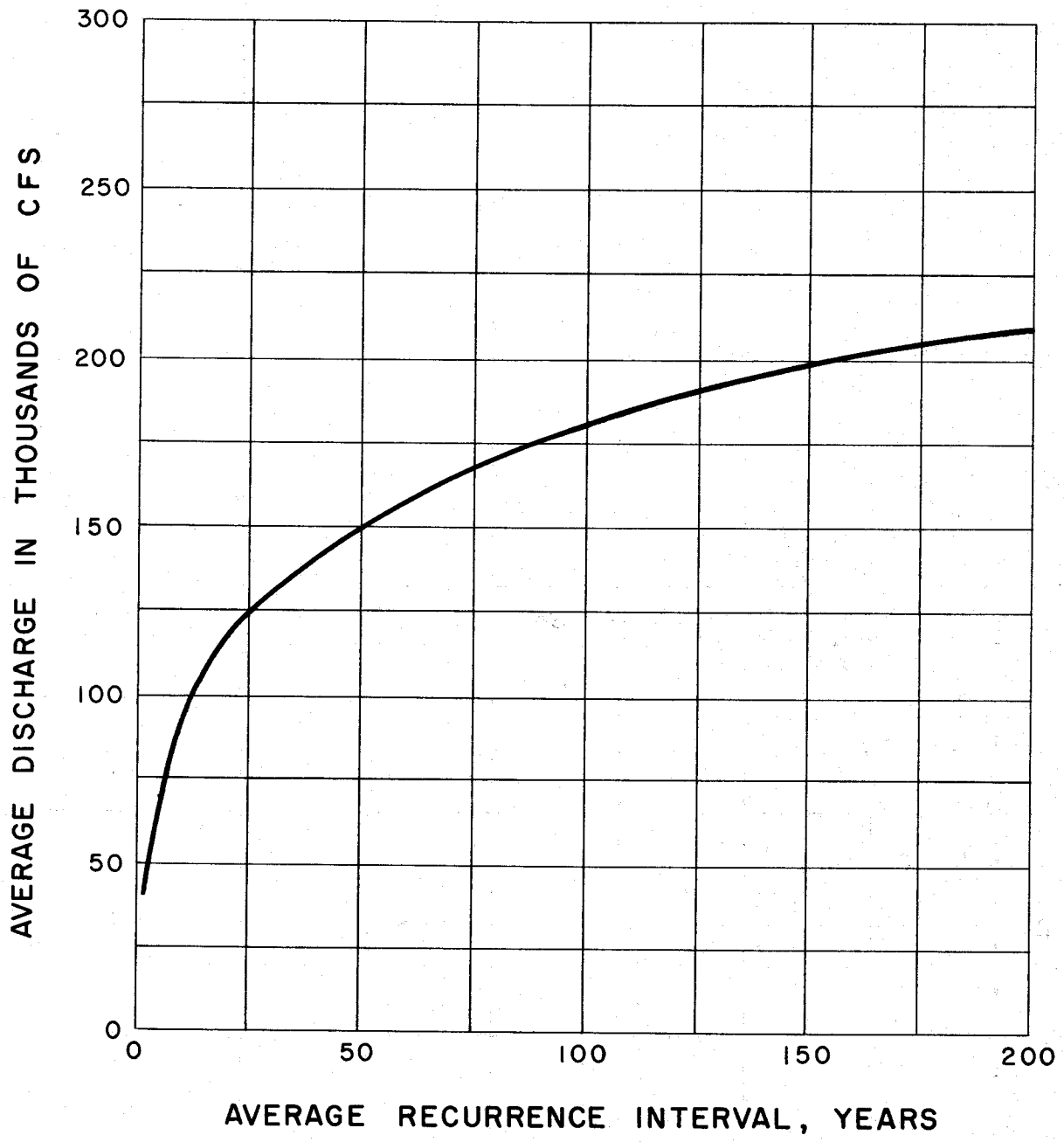
16.302

FIGURE 20

UMPQUA RIVER BASIN

SOUTH UMPQUA RIVER NEAR BROCKWAY

FLOOD FREQUENCY CURVE



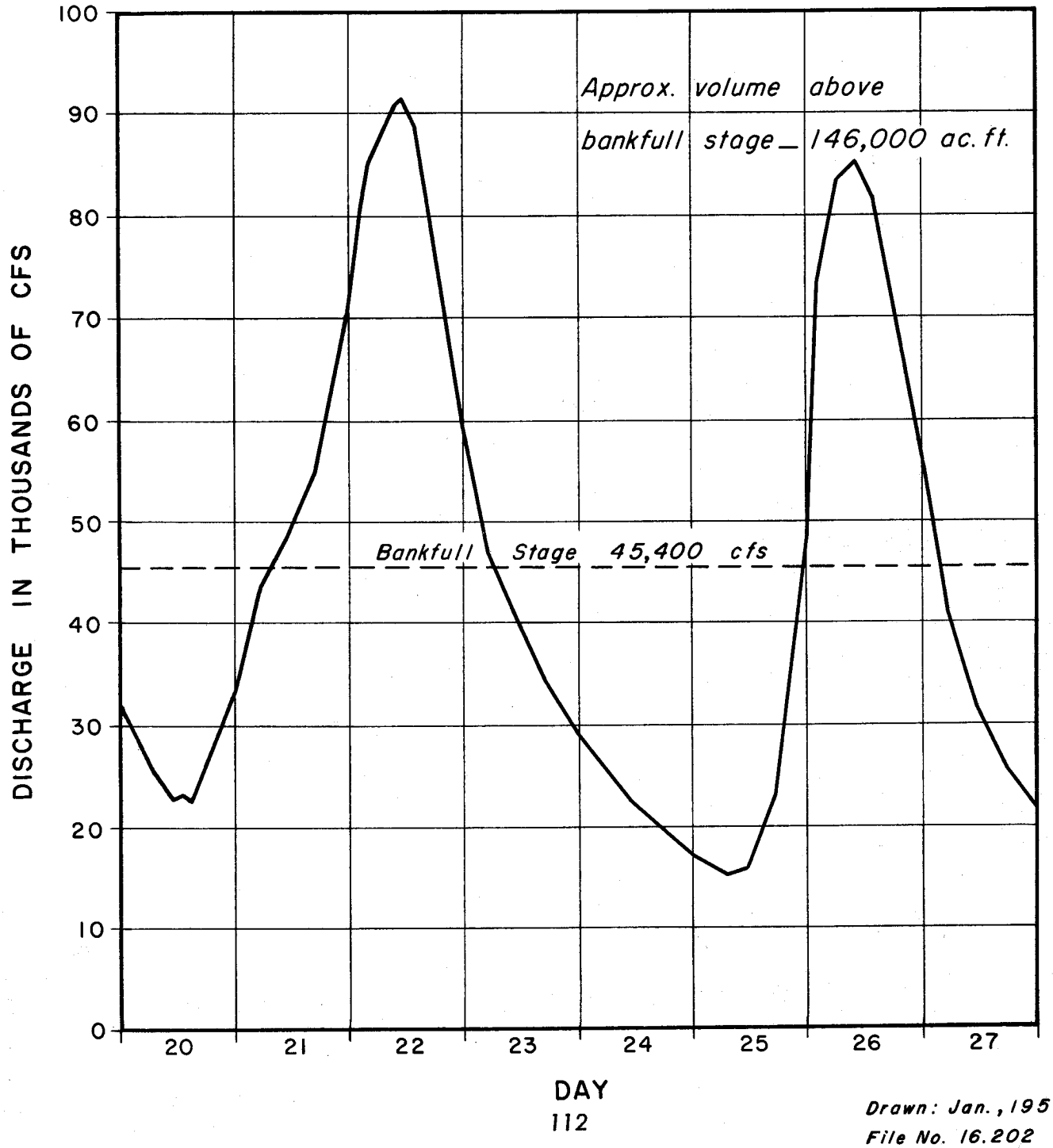
Drawn: Dec., 1957
File No. 16.203
FIGURE 21

UMPQUA RIVER BASIN

FLOOD HYDROGRAPH

SOUTH UMPQUA RIVER NEAR BROCKWAY

DECEMBER 1955



Drawn: Jan., 1958
File No. 16.202
FIGURE 22

SOUTH UMPQUA

MINERAL DEPOSITS

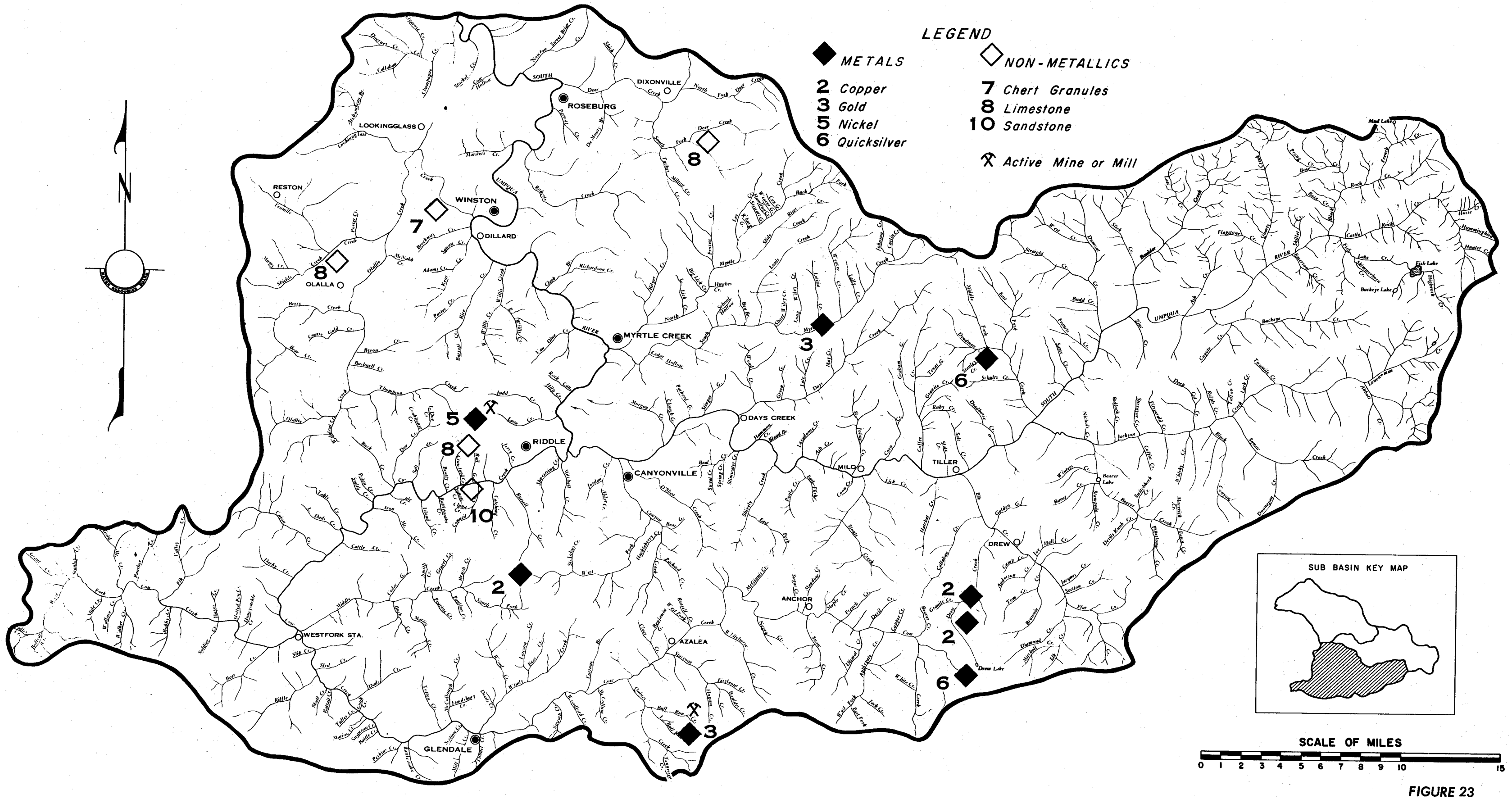


FIGURE 23

TABLE 17

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

SOUTH UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
South Umpqua River	100	Winston bridge gage
" " "	60	Tiller
Deer Creek	3	mouth
Lookingglass Creek	5	mouth
Tenmile Creek	3	mouth
Olalla Creek	3	mouth
Rice Creek	2	mouth
Willis Creek	2	mouth
Myrtle Creek	15	mouth
North Myrtle Cr.	8	above South Myrtle Cr.
" " "	4	above Slide Creek
Slide Creek	2	mouth
South Myrtle Creek	8	above North Myrtle Cr.
" " "	4	above Letitia Creek
Cow Creek	20	at Riddle
" "	12	Glendale
" "	10	4 mi. east of Azalea
" "	8	above Applegate Creek
West Fork Cow Cr.	8	mouth
Middle Creek	4	mouth
Windy Creek	2	mouth
Quines Creek	2	mouth
Starveout Creek	2	mouth
Applegate Creek	2	mouth
Canyon Creek	5	mouth
" "	2	above West Fork
West Fork Canyon Cr.	3	mouth
Days Creek	5	mouth
Coffee Creek	3	mouth
Elk Creek	5	mouth
Jackson Creek	30	mouth
Beaver Creek	8	mouth
Deadman Creek	3	mouth
Dumont Creek	3	mouth
Boulder Creek	5	mouth

TABLE 17 (Continued)

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

SOUTH UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
South Umpqua River		
Buckeye Creek	5	mouth
Quartz Creek	5	mouth
Black Rock Creek	10	mouth
Castle Rock Creek	15	mouth
Fish Lake Creek	5	mouth

* As requested by the Oregon State Game Commission.

NORTH UMPQUA SUB-BASIN

GENERAL DATA

Location

The North Umpqua sub-basin covers the north central, and northeastern portions of the Umpqua Basin. The major tributaries within this area are Little River, Rock, Canton, Steamboat, Copeland, Fish, Clearwater, and Lake Creeks.

Size

The North Umpqua River has a drainage area of approximately 1,308 square miles. It joins the South Umpqua River forming the main stem at River mile 105. The total length of the North Umpqua River to its headwaters in Diamond Lake is approximately 100 miles.

Topographic Characteristics

The entire sub-basin is extremely rugged, characterized by precipitous slopes and steep stream gradients. The greater majority of the terrain is covered by dense forest; primarily of Douglas Fir, other species occurring in lesser percentages. Very little land is available for agricultural, industrial, or urban development above the community of Glide. From Glide to the confluence of the North and South Umpqua Rivers, there are sections of land along the river suitable for agricultural and limited industrial growth. The area with the greatest potential for development lies in that section of the river below mile 6. Nowhere within the sub-basin are there lands suitable for development that lie more than a mile from the banks of the river, with the exception of the area below mile 6 where development sites lie as far away as Sutherlin and the Camas Swale areas. Elevation within this sub-basin varies from 460 feet, mean sea level, at the mouth of the river, to more than 9,000 feet in the peaks of the Cascade Range.

Geologic Characteristics

The geological province known as the Western Cascades, which encompasses practically all the drainage area below the mouth of Fish Creek, has a rock formation described as "volcanic andesites". The area above the mouth of Fish Creek in the High Cascades consists of andesites, basalts, tuffs, and other volcanic formations. The porous volcanic structures of the upper North Umpqua River provide the groundwater storage which is a

primary factor in its relatively uniform stream flow pattern.

Meteorologic & Hydrologic Characteristics

Summer temperatures within this sub-basin are mild. Summer precipitation is relatively light. During winter seasons, temperatures are generally below freezing at elevations above 5,000 feet and precipitation is relatively heavy. Precipitation ranges from 60 to 80 inches throughout the sub-basin in a normal year. The snowpacks which result from the large portion of the sub-basin above 5,000 feet elevation (20 percent) further contribute to the uniform runoff.

Stream gaging records for the North Umpqua River date back as far as 1908. Coverage in terms of location and time is probably better than for any other area within the Umpqua Basin.

Precipitation information within the sub-basin is so meager as to be without major value in hydrological analysis.

Land Ownership

Eight miles above the confluence of Rock Creek and the North Umpqua River at mile 41.5, the boundary line of the Umpqua National Forest intersects the North Umpqua River. More than 73 percent of the sub-basin above this point lies within the Umpqua National Forest boundary. When O & C lands are considered with National Forests, 74 percent of the total North Umpqua sub-basin is in federal ownership.

Nearly the entire length of the North Umpqua River and its tributaries above, not including Rock Creek, are covered by federal power withdrawal sites. The exact boundary of these sites have not been investigated.

Transportation Facilities

Transportation facilities in the area are limited to the road from Roseburg to Glide paralleling the North Umpqua River up to the California-Oregon Power Company's project in the vicinity of Toketee Falls. This road continues on over the High Cascades, connecting with roads to Diamond Lake and Crescent Lake. A well-built logging road extends from this road up Steamboat Creek and over the divide into the Willamette River Basin. The area is served by other logging access and Forest Service roads of an unimproved nature. In general, these roads follow the streams quite closely. There are no rail facilities above mile 6 in this sub-basin.

Economy

That portion of the sub-basin above the community of Glide is presently, and can be considered for the foreseeable future, a cropland for the timber which will support the timber economy of Douglas County. No other development potential of any magnitude exists above Glide, with the exception of recreation. Between the communities of Winchester and Glide, there are agricultural lands lying adjacent to the river banks. Practically all of the suitable land in this section is being utilized. Less than 16 percent has been developed to its full agricultural capabilities, according to information from the Bureau of Reclamation. Along Sutherlin Creek, a tributary of the North Umpqua River at river mile 4.5, there is considerable potential for development of irrigated lands. The Sutherlin Creek area offers the greatest potential for industrial site development because of the transportation facilities provided by U. S. Highway 99, Southern Pacific Railroad, and the county road network in this area. This area also offers a substantial labor pool from the community of Roseburg.

Development of the North Umpqua sub-basin can be thought of in two basic sections; one, above Glide where the entire sub-basin will be dedicated to permanent timber cropland, and two, that area below Glide which has potential for agricultural, industrial and urban growth.

Population

About 98 percent of the population of this sub-basin is concentrated at or below the community of Glide. The only permanent population above Glide are isolated units in the area of lower Rock Creek and operation and maintenance personnel attached to the California-Oregon Power Company hydroelectric developments in the vicinity of Toketee Falls.

AMOUNT AND DISTRIBUTION OF RESOURCE

Compared with other sections of the Umpqua Basin, data for the determination of yield and runoff patterns for the upper North Umpqua River are very good.

Precipitation

There are no precipitation records for this sub-basin that would be of much value in determining either runoff or yield patterns. The most extensive data would be from the meteorological station established at Winchester which has been in operation less than seven years.

Stream Gaging

Coverage of this sub-basin by stream gaging is good. Although intermittent, the records at Winchester provide an opportunity to establish the pattern of runoff for the entire sub-basin as well as finite values for sub-basin yield. Additional stations at Oak Creek, Glide, Rock Creek, Toketee Falls, Copeland Creek, Lake Creek, and other points make it possible to establish with some degree of accuracy the distribution of the waters of this sub-basin in terms of location and time. The minimum daily flow recorded for this sub-basin (measured at Winchester) was 616 cfs in August, 1926. The maximum discharge for the sub-basin recorded at the same point in November, 1909, was 100,000 cfs.

Minimum yield of record for the sub-basin amounted to slightly less than one and one-half million acre-feet in the water year 1926. The maximum yield was recorded in the water year 1956 and it amounted to slightly more than four million acre-feet.

Resource Distribution

Sufficient information is available to show the approximate patterns of yield and flow within the North Umpqua sub-basin. Reference to the percent yields of the various sub-basins within the Umpqua River system will show that for the available periods of record, the yield for the North Umpqua River above Winchester is about 50 percent of the normal total yield at the Elkton gage. If note is taken of the readings of the gage near Glide, it will be found that 60 percent of the total yield at the Elkton gage in 1931, the low yield year of record, originated above this point, an area representing only 33 percent of the total drainage basin above the Elkton gage.

AMOUNT AND DISTRIBUTION OF RESOURCE UNDER APPROPRIATION

For purposes of discussion, it is convenient to divide the North Umpqua sub-basin into three sections. First is the section between the mouth of the North Umpqua River and the mouth of Rock Creek in which practically all of the consumptive water rights are included. Second is the section between the mouth of Rock Creek and Toketee Falls. Appropriations of water within this section including Canton and Steamboat Creeks, are extremely small totaling less than one cubic foot per second. The third is the section above Toketee Falls wherein the water rights are large in magnitude, due to the nonconsumptive use of water in the

hydroelectric developments of the California-Oregon Power Company.

For practical purposes, all the consumptive use in the North Umpqua sub-basin occurs between the mouth of the North Umpqua and River Mile 34. In terms of instantaneous flow, this would amount to 191 cfs. Volumetrically, this would amount to consumptive use in the amount of 140,000 acre-feet per year. Consumptive uses in the other two sections of the sub-basin are too small to merit attention in a reconnaissance investigation.

Although not an established legal right, the California-Oregon Power Company's claim to a vested right at the Winchester dam would probably be sustained by an adjudication proceeding. The only factor presently unknown would be its priority status with regard to minor irrigation uses practiced above Winchester in years prior to the formulation and adoption of the 1909 Water Code. It is assumed that consumptive rights above this point would be negligible. Any program developed for that section of the North Umpqua sub-basin above Winchester would be subject to the limitations imposed by this claimed right of 705 cfs. If valid, this right practically guarantees a legal but not actual minimum flow at Winchester dam of 705 cfs.

There exists at the present time two filings on water for municipal and industrial purposes whose diversions would be located downstream of the Winchester dam. One of these, the filing by the City of Coos Bay, proposes a diversion of 100 cfs from the North Umpqua River which would be diverted out of the Umpqua River Basin by means of pipelines and tunnels. The application states that this water will be used for municipal purposes and industrial supply for pulp and paper processing.

EXTENT OF BOARD'S JURISDICTION

In the minimum year of record, the yield of the North Umpqua sub-basin was approximately 1,440,000 acre-feet of water. As pointed out, consumptive uses amount to approximately 140,000 acre-feet leaving 1,300,000 acre-feet of which that portion running off when the flow was above 700 second feet, would be under the jurisdiction of the Board, both on a nonconsumptive and consumptive basis.

The broad generalization of the preceding paragraph is not sufficient to fully describe the extent of the Board's jurisdiction. To do this, it is necessary to study the individual sections.

That area above mile 63 (the site of the COPCO "Soda Springs Plant") has its status fairly well defined. The Board would have consumptive jurisdiction only when flows exceeded 1,600 cubic feet per second at Soda Springs project. This would confine the Board's jurisdiction to the months of January, February, March and April during a normal year, and to an even more restricted period in critical years. The waters over which the Board's jurisdiction might extend are strictly the flood or freshet flows.

The second section is from mile 33, one mile below the mouth of Rock Creek to mile 63. Total rights, consumptive and nonconsumptive, for this section are less than 1.0 cfs including the Canton, Steamboat, and Copeland Creeks. The Board's jurisdiction here is limited only by downstream rights. Using the 705 cfs figure for Winchester, minimum flow plus consumptive rights between Winchester and mile 34 (13.3 cfs), the Board's jurisdiction over consumptive use is limited to flows over 720 cfs. This is based on the assumption that the 705 cfs nonconsumptive right at Winchester will satisfy all known rights downstream from that point.

Analysis of section three, from Winchester to the mouth of the North Umpqua River, is more complex. Assuming 705 cfs at Winchester as a starting point, and further assuming the real possibility of zero flow at the mouth of the South Umpqua River, we find that the flow from the North Umpqua River must provide water for all existing rights on the main stem of the Umpqua River. Total consumptive rights on the main stem are 76 cfs. Consumptive rights from the mouth of the North Umpqua River to Winchester total 152 cfs. On this basis, the Board has consumptive jurisdiction for flows exceeding 228 cfs immediately below the Winchester dam.

EXISTING AND FUTURE NEEDS FOR THE RESOURCE

The anticipated needs of the North Umpqua sub-basin would represent an annual volumetric requirement of 726,000 acre-feet. In most of the sub-basin presentations given, the requirements shown have consisted of needs within the physical boundaries of the sub-basin. This circumstance does not hold in the case of the North Umpqua. It is anticipated that a portion of the needs for sub-basin resources lie outside of the physical boundaries of this

sub-basin. Specific instances will be indentified under particular use.

Domestic

As the fringe area adjacent to the Roseburg metropolitan area increases, there will be an additional demand for domestic water to satisfy this type of development. In addition, there will be a growth in rural domestic use as lands within the sub-basin are brought under irrigation. The formula indicated in the criteria has been utilized in establishing this value but there has been no attempt to try to predict domestic requirements for fringe areas. When demands for domestic water in fringe areas becomes sufficiently large to present a problem, the private utilities supplying municipal water for the City of Roseburg will probably find it physically possible and profitable to supply these needs by an extension of their system.

Municipal

At the present time the legal right to use water for municipal purposes within the sub-basin boundaries is quite small. However, two very important circumstances exist. First, the Oregon Water Corporation, which supplies the City of Roseburg, has rights to the use of 12 cfs from the North Umpqua River. This water is diverted from a pool at Winchester dam. Practically the entire output of the COPCO unit at Winchester, 500 kilowatts, is utilized in pumping this water. In effect, this is an out-of-basin diversion. The Oregon Water Corporation has also filed on an additional 13 cfs to supplement its present right and provide for future growth. Mr. A. Andrews, manager for the Oregon Water Corporation in Roseburg, indicates that the company is now using, during periods of maximum demand, almost all of the 12 cfs right.

The second item of considerable interest relative to municipal supplies from the North Umpqua River, is the filing presently held by the City of Coos Bay. This is the filing which makes application for a right to divert 100 cfs from the North Umpqua River immediately below Winchester dam. The application on file in the State Engineer's office covering this action indicates that this water will be used for municipal and industrial purposes, specifically pulp and paper processing. The diversion of this amount of water from the North Umpqua River during periods of minimum flow (616 cfs) at Winchester dam would, when existing consumptive rights from that point to the river mouth are considered, result in the flow of less than 500 cfs at the mouth of the North Umpqua.

Projecting existing municipal requirements to the future by use of the formula indicated in the "Criteria - Sub-basin Analysis", would be erroneous in the case of the North Umpqua. To present a more realistic analysis, the 100 cfs filing has been eliminated from the formula calculations, and future requirements are predicated on extension of the future municipal needs of the City of Roseburg, plus the Coos Bay filing. These would be represented by a flow of 146 cfs.

Irrigation

Based on the Bureau of Reclamation figures, maximum possible irrigation diversion requirements would amount to 113 cfs, annual use in terms of acre-feet per year, 24,000 acre-feet. This figure, which covers somewhat more than 9,000 acres (not including the upper areas of Sutherlin Creek which has been combined into the requirements for the Calapooya area). A possibility for interchange exists in this instance. If storage possibilities on the Calapooya Creek do not prove to be feasible, the lands of Sutherlin Creek could be irrigated by pumping water from the North Umpqua River up Sutherlin Creek to the Camas Swale area. This could be accomplished by means of a ten-mile pipeline.

Power Development

Needs for power within the sub-basin would be relatively small. However, in light of transmission techniques, a problem of power potential of a stream and needs for power within the sub-basin of that stream cannot be necessarily coordinated. Although the possibilities for power use within the sub-basin are limited to potential industrial development in the Winchester area, the needs for power throughout the entire Umpqua Basin will grow tremendously as the economy of the Basin and the state expands. Of the total lands considered irrigable in Douglas County, some 63,000 acres would fall in the category of feasible, insofar as development is concerned. Nearly all of this land will be irrigated by sprinkler methods. Obviously, this would require substantial amounts of electrical energy just to provide power to the pumps necessary for these operations. For full development, a conservative figure for power needs covering this purpose is 15,000 kilowatts generating capacity, assuming again an 0.5 diversity factor in regard to irrigation. If there is an expansion of the timber economy of the Roseburg area by virtue of a pulp and paper plant, additional power will be required for this purpose. Other than Mill Creek and Smith River, the North Umpqua River offers the only feasible development of hydroelectric energy within Douglas County. A list of the sites existing on the North

Umpqua River at the present time is given in Table 4. The installed capacity of these units, all of which are operated by the California-Oregon Power Company, is 186,050 kilowatts with an average annual generation of 864,900,000 kilowatt hours per year. This is apparently sufficient to supply all of the requirements within this area for the immediate future. It should be pointed out that COPCO's output is supplemented by power supplied through the Bonneville Power Administration at the Douglas County REA and the Hanna Corporation nickel processing operation which utilizes low cost power for reduction of its basic ores.

Table 5, shows the undeveloped hydroelectric power sites still available on the North Umpqua River. These are Oak Creek, installed capacity 11,300 kilowatts; Horseshoe Bend, 14,000 kilowatts; Glide, 9,000 kilowatts; Rock Creek, 51,000 kilowatts; Boundary, 44,000 kilowatts; Steamboat, 16,300 kilowatts; Copeland Diversion, 24,300 kilowatts. Such large structures would be required in case of the Oak Creek, Horseshoe Bend, and Glide projects in relation to their power outputs that their development in the foreseeable future appears unlikely. The Rock Creek and Boundary sites offer potential for fair amounts of power, but as outlined in Water Supply Paper 636-F of the U. S. Geological Survey, these would be run-of-river operations.

If the power requirements of the Umpqua River Basin expand beyond the capabilities of the existing facilities, it would appear that the feasible source of hydroelectric power from within the Basin would be the developable sites on the North Umpqua River and possibly the Tiller site on the South Umpqua River.

Industrial

Industrial rights for the use of water in this sub-basin are negligible (actually less than 0.15 cfs). However, an application is on file in the State Engineer's office requesting the right to divert 46.42 cfs from the North Umpqua River.

One of the largest requirements for industrial water that would probably develop in this sub-basin is for process water in the pulp and paper industry. As indicated before, we have utilized a figure of 10 cfs per hundred tons per day of pulp as an average figure for the various types of pulp and paper processes. In terms of existing facilities and water resources, the Roseburg-Sutherlin-Oakland area or the Reedsport area offer the best

possibilities for pulp and paper plant sites. These are the only points in the Umpqua Basin which have suitable transportation facilities and adequate water for process use. This does not imply that either one of these locations may be satisfactory from the point of view of waste disposal.

Mining

Although there is a potential for expanded mining activities, particularly in the headwaters of Canton Creek and Rock Creek, this use is of a nonconsumptive nature and so small that it can be eliminated.

Fish Life, Wildlife, and Recreation

In reporting to the Water Resources Board on their requirements for desirable stream flows on the North Umpqua River, the Game Commission indicated the following desired flows: North Umpqua at the Southern Pacific Railroad bridge, 600 cfs; North Umpqua, one mile west of Glide, 600 cfs; North Umpqua, one-half mile above Rock Creek, 550 cfs; North Umpqua above Copeland Creek, 500 cfs.

If the minimum flows indicated could be maintained, they would probably fulfill the minimum requirements for recreation and wildlife, as well as fish life uses. Under the existing conditions of appropriation and filing, it is conceivable that the flow of 600 cfs could be maintained immediately downstream of Winchester dam, which is approximately one-fourth mile above the Southern Pacific Railroad bridge; however, it should be pointed out that this is the area in which the diversion right of 46.42 cfs for industrial purposes and 100 cfs for diversion to the Coos-Coquille Basin by the City of Coos Bay are located. Development and exercise of these filings would reduce the flow of the North Umpqua River to less than 500 cfs and the exercise of all potential rights below this section would reduce the flow at the mouth of the North Umpqua River to less than 450 cfs.

On this basis, it can be presumed that existing supplies below Winchester dam are not sufficient to provide for all needs, and the situation will become more critical as additional development takes place.

Pollution Abatement

Existing needs for pollution abatement in terms of dilution of present loads in the North Umpqua sub-basin indicate a need for a minimum of 6.0 cfs for this purpose, if it is assumed that the degree of treatment indicated in the "Criteria - Sub-basin Analysis" is fully established.

Pollution abatement requirements for the future are approximately 13 cfs. This is projected from existing requirements and does not take into account the construction of pulp and/or paper processing operations in this area. In the tentative standards set forth at the Roseburg hearing of October 15 and 16, 1956, the State Board of Health, through its Sanitary Engineering Division, advised that some authorities feel that a flow of approximately 500 cfs is required to dilute the waste from each hundred tons of pulp produced per day. This value is based on adequate control of toxic waste materials.

If such a standard were adopted, there would be extensive periods during the summer months when the flow in the North Umpqua River would limit pulp and paper capacity to about 200 tons per day. During critical flow years, the restriction would be even greater and untreated wastes from process capacities much above 100 tons could not be tolerated.

METHODS OF RESOURCE DEVELOPMENT

A reconnaissance study of the North Umpqua sub-basin was made from topographic maps covering that area of the sub-basin from River mile 30 to 63. Topographic maps available for that area above mile 63 were at 1/125,000 scale and unsuitable for analyzing storage capacities. It can be pointed out, however, that this area of the sub-basin (above mile 63) contains no major reservoir sites. Any impoundment structures would have to be located in the steep-walled canyons of the North Umpqua River and its tributaries, and while many structural sites are available, the amount of water that could be impounded in relation to the size and cost of the structure is so small that it rules out development for the basic purpose of providing regulation for flow. In developing the power potential of the area above mile 63, COPCO has utilized total storage of about 17,000 acre-feet, not all of which is active storage. Of this storage, 13,900 acre-feet are in the reservoir for Lemolo No. 1, located at the junction of Lake Creek and the North Umpqua River.

Storage Possibilities - North Umpqua

Between the community of Glide and mile 63, there are several possible storage sites and these are dealt with in Water Supply Paper 636-F, U. S. Geological Survey. Reservoir sites indicated in the report were all located on the main stem of the North Umpqua River and were

to be used to regulate streamflow for the purposes of producing hydroelectric power. In every case, these reservoirs would require impoundment structures approximately 200 feet or more in height, and the storage obtained would be relatively small in relation to the cost of the structure.

The Copeland site near the Illahe ranger station would require a dam 200 feet high to provide a storage capacity of 40,000 acre-feet.

The Steamboat site would require a dam 190 feet high. Storage capacity at this height would amount to 28,000 acre-feet. This site would be approximately two and one-half miles above the mouth of Steamboat Creek.

The Boundary site, one mile below Fall Creek just west of the National Forest line, would require a 225-foot structure to achieve a storage capacity of 79,000 acre-feet.

The Clark Ranch site, about four miles above the mouth of Rock Creek, would require a structure 110 feet high to achieve 24,000 acre-feet of storage.

The Rock Creek site, which is located about one mile above Rock Creek, would require a sixty-foot structure to obtain storage of 17,000 acre-feet.

The Horseshoe Bend site, located at mile 21.5 on the North Umpqua River near the mouth of Cooper Creek, would provide 28,000 acre-feet of storage. However, construction of this project would result in the dislocation of the heavily developed area in and immediately below the community of Glide and it would, therefore, appear that the possibilities of developing this site are limited.

The Oak Creek site, four miles downstream from Horseshoe Bend at the confluence of the North Umpqua River and Oak Creek, would have a storage of 22,000 acre-feet with a sixty-foot structure. Here, again, severe dislocations of existing facilities would take place, particularly of summer homes and farms located in this area.

Storage Possibilities - North Umpqua Tributaries

Quadrangle maps of the U. S. Geological Survey, available in late June, 1957, indicate limited possibilities for storage on tributaries of the North Umpqua River.

Rock Creek

Reconnaissance examinations indicate a possibility of storage on Rock Creek with a maximum potential of 110,000 acre-feet. Such development would require a reservoir approximately six miles long, extending from the intersection of the south boundary of section 30, township 25S, range 2W to above the confluence of Rock Creek and Herrington Creek in section 11, township 25S, range 2W.

Water from storage in this general area could be utilized for the improvement of minimum flow conditions in the lower section of the North Umpqua and the main stem of the Umpqua River. Such storage would add significant amounts to minimum flows during critical yield years.

Primary losses occasioned by storage on this tributary would be the effects on the anadromous fish runs of Rock Creek. This stream is a spawning area for silver salmon and steelhead trout. The upstream limits of the migration are far above the potential structural site. Substantial spawning areas lie above the potential dam site. In addition, the location of a reservoir in this area would require the relocation of some five miles of county road and would also inundate the present logging operation and mill plant in section 21, township 25S, range 2W. Potential for the development of this site is limited.

Steamboat Creek

Only one major storage possibility exists on Steamboat Creek and Canton Creek, its major tributary. The possibility lies in the structural site located in the vicinity of Black Gorge on Steamboat Creek, section 27, township 25S, range 1E. Maximum storage potential for this development would approximate 240,000 acre-feet and the reservoir would extend some five and one-half miles from Black Gorge to the confluence of Steamboat Creek and Big Bend Creek.

The benefits from this particular development have not been fully established, but would be similar to the benefits derived from storage on Rock Creek, although of lesser magnitude.

This development would also interfere with the steelhead runs that occur on Steamboat Creek and would be particularly adverse in light of the fisheries management program of the Oregon State Game Commission. The Game Commission for the past several years has closed Steamboat Creek and its tributaries to fishing in order to develop more fully the potential of this stream as a spawning area for steelhead. This development would also require extensive relocation of county roads in areas of extremely difficult terrain. Such a development would substantially alter the type of recreation presently available on this stretch of the river and would inundate Steamboat Falls.

Little River

Potential for storage exists on Little River. The major possibility, from a physical point of view, would be offered by a 300-foot-plus section storing a maximum of 280,000 acre-feet. If structurally and economically feasible, the site of the impoundment structure would be approximately one mile above the confluence of Little River and Cavitt Creek. Data on this development has become available only recently, and full analysis has not been completed. In general, the evaluations would be similar to those of Rock and Steamboat Creeks, none of which have had studies relative to their power potential.

Development in this area and at the Cavitt Creek site in section 34, township 27S, range 3W, with a capacity of 30,000 acre-feet, would both raise difficulties with respect to the anadromous fish runs. Chinook salmon, silver salmon, and steelhead trout all use this stream system as a spawning area. Development on Little River would also cause serious dislocations of suburban developments in the vicinity of Boundary Creek and Wolf Creek.

All the structures indicated in this section on Tributary Storage would probably be expensive in relation to the number of acre-feet of water stored and would not appear feasible in the immediate future. Full economic and structural feasibility would require detailed site investigations and analyses.

Gains from Storage

If economical storage could be developed on the North Umpqua River, a more stabilized stream flow would provide additional flows to meet the present unsatisfied requirements of nonconsumptive use for

fish life and additional water during low flow periods which could be utilized in dilution of domestic and industrial wastes.

Losses from Storage

Major loss from storage would probably be damage to anadromous fish runs. Although it might not properly be characterized as a loss, there would be a change in the recreation and scenic patterns of the river itself by the creation of slack waters behind impoundment structures.

NORTH UMPQUA

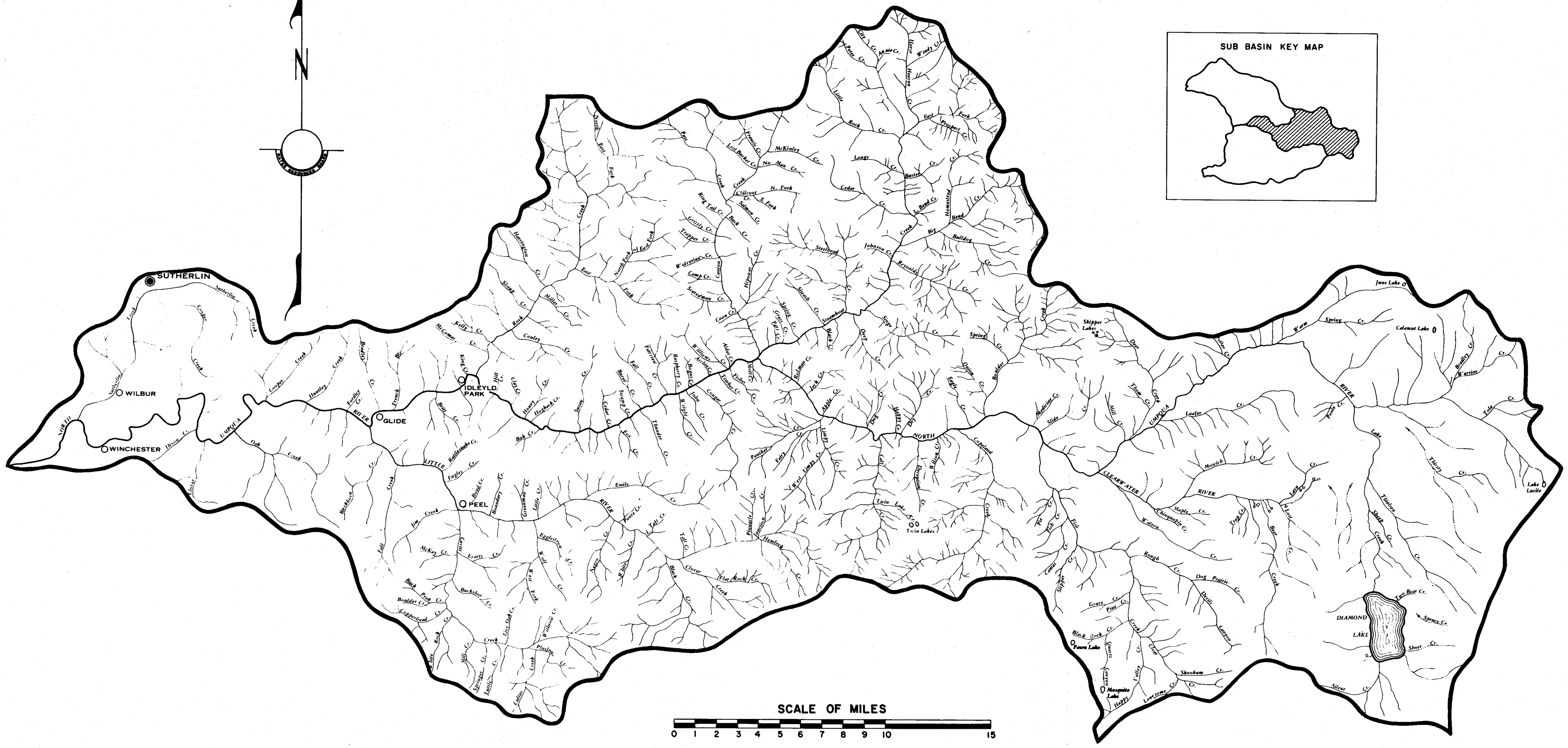
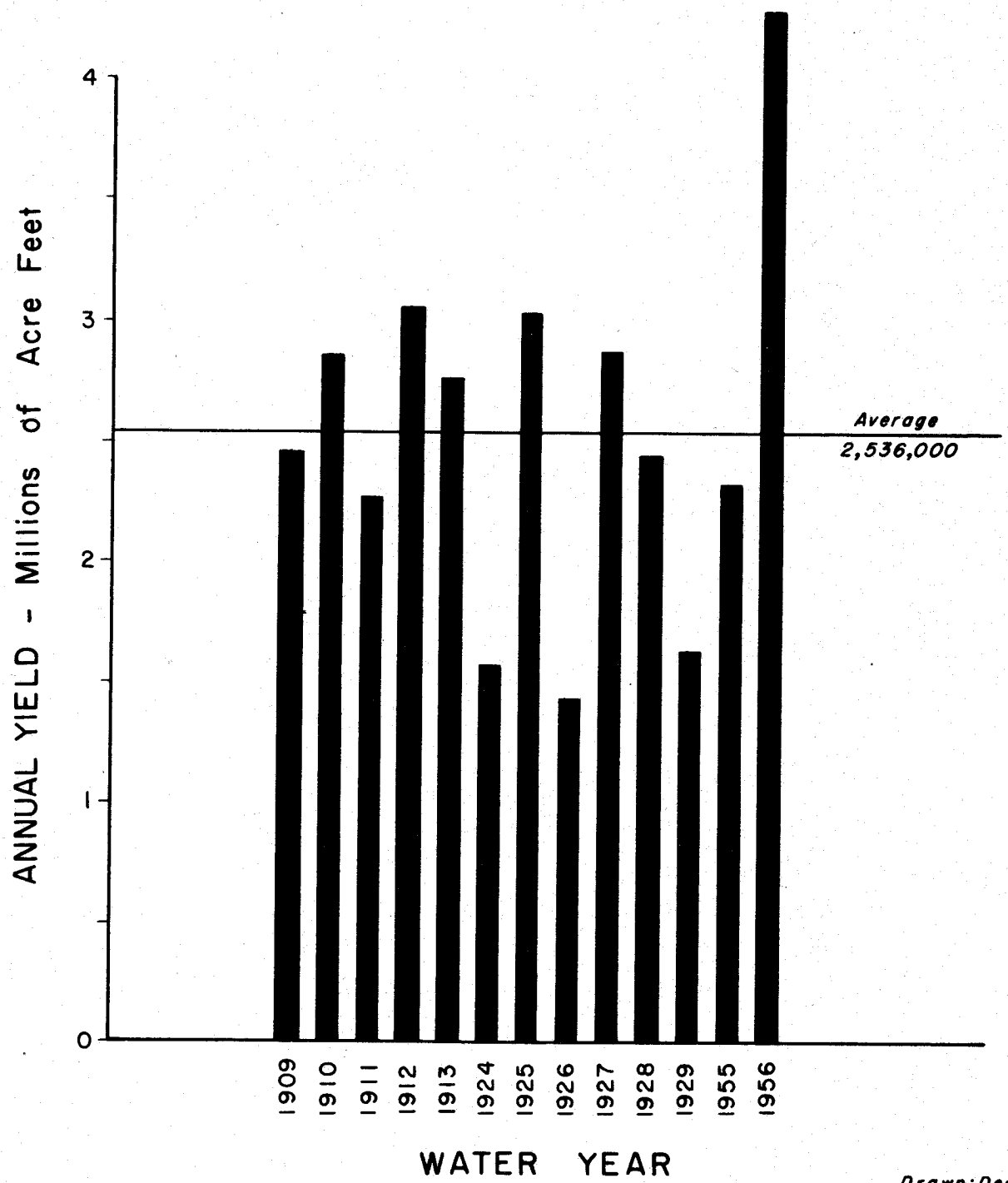


FIGURE 24

UMPQUA RIVER BASIN
YIELD DIAGRAM
ANNUAL YIELD
OF
NORTH UMPQUA RIVER
AT WINCHESTER

Drainage Area 1,350 Sq. Mi.



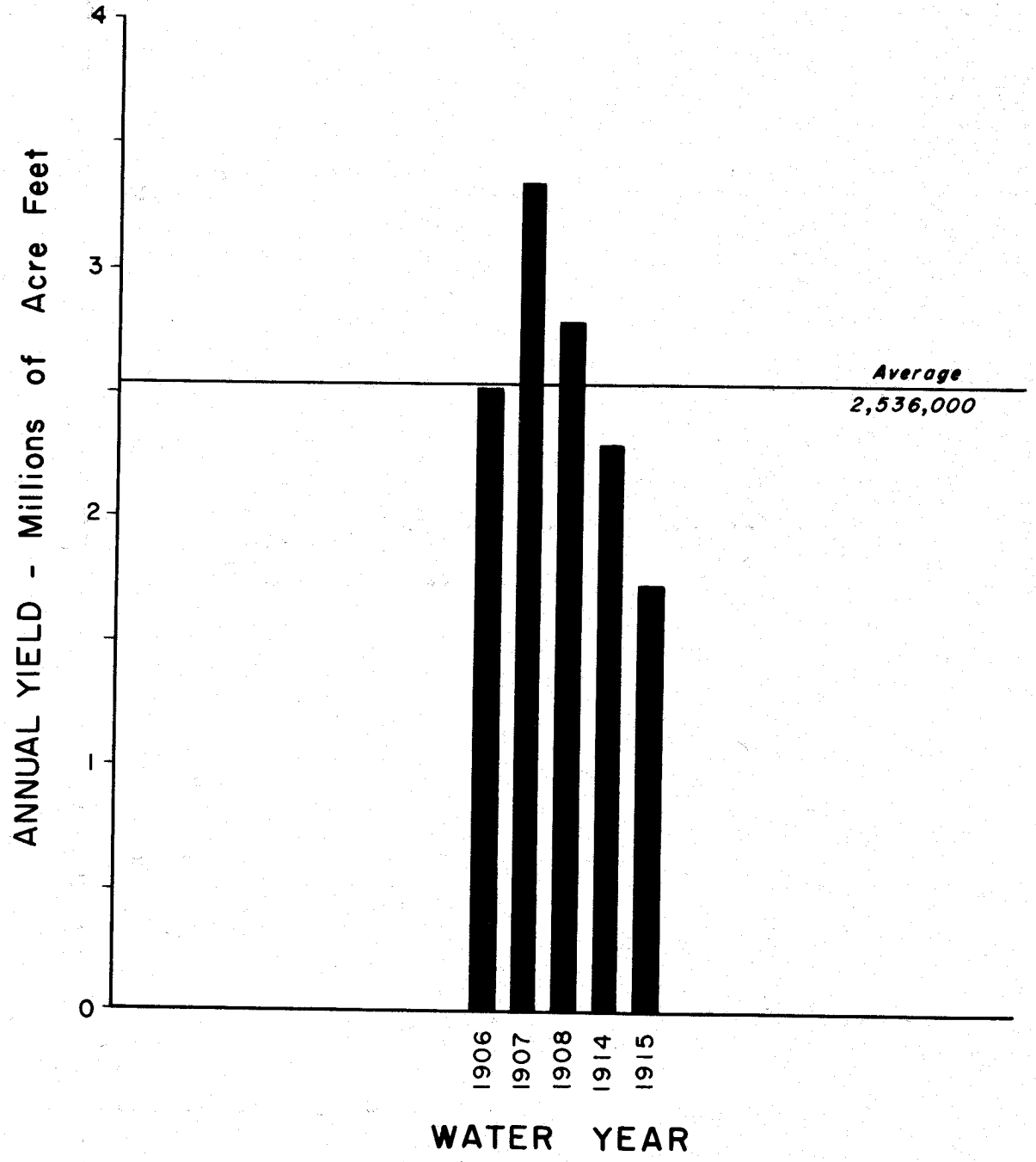
NOTE: Records Incomplete for years not shown.

Drawn: Dec., 1957
File No. 16.220

FIGURE 25

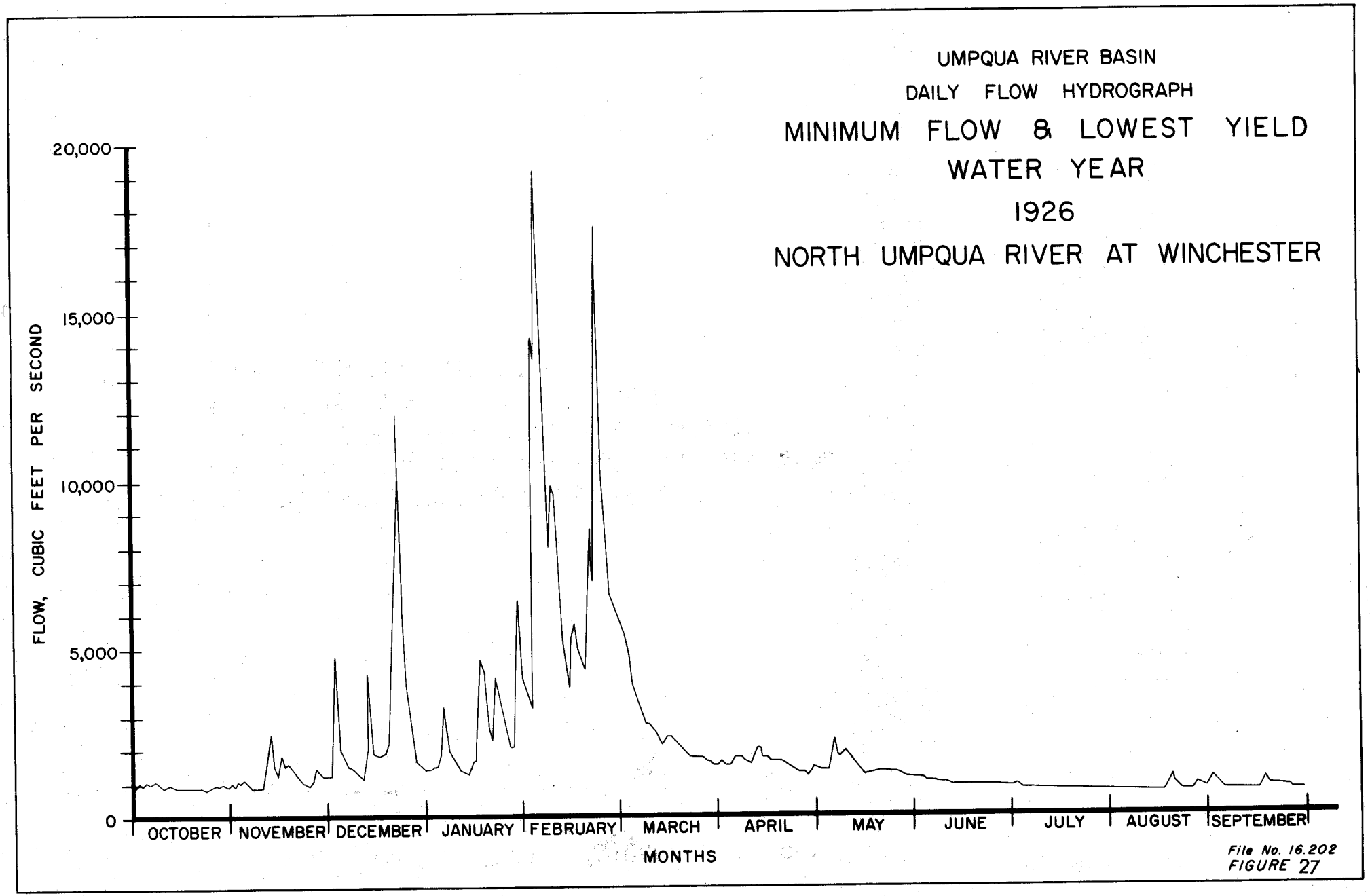
UMPQUA RIVER BASIN
YIELD DIAGRAM
ANNUAL YIELD
OF
NORTH UMPQUA RIVER
NEAR OAKCREEK

Drainage Area 1,276 Sq. Mi.



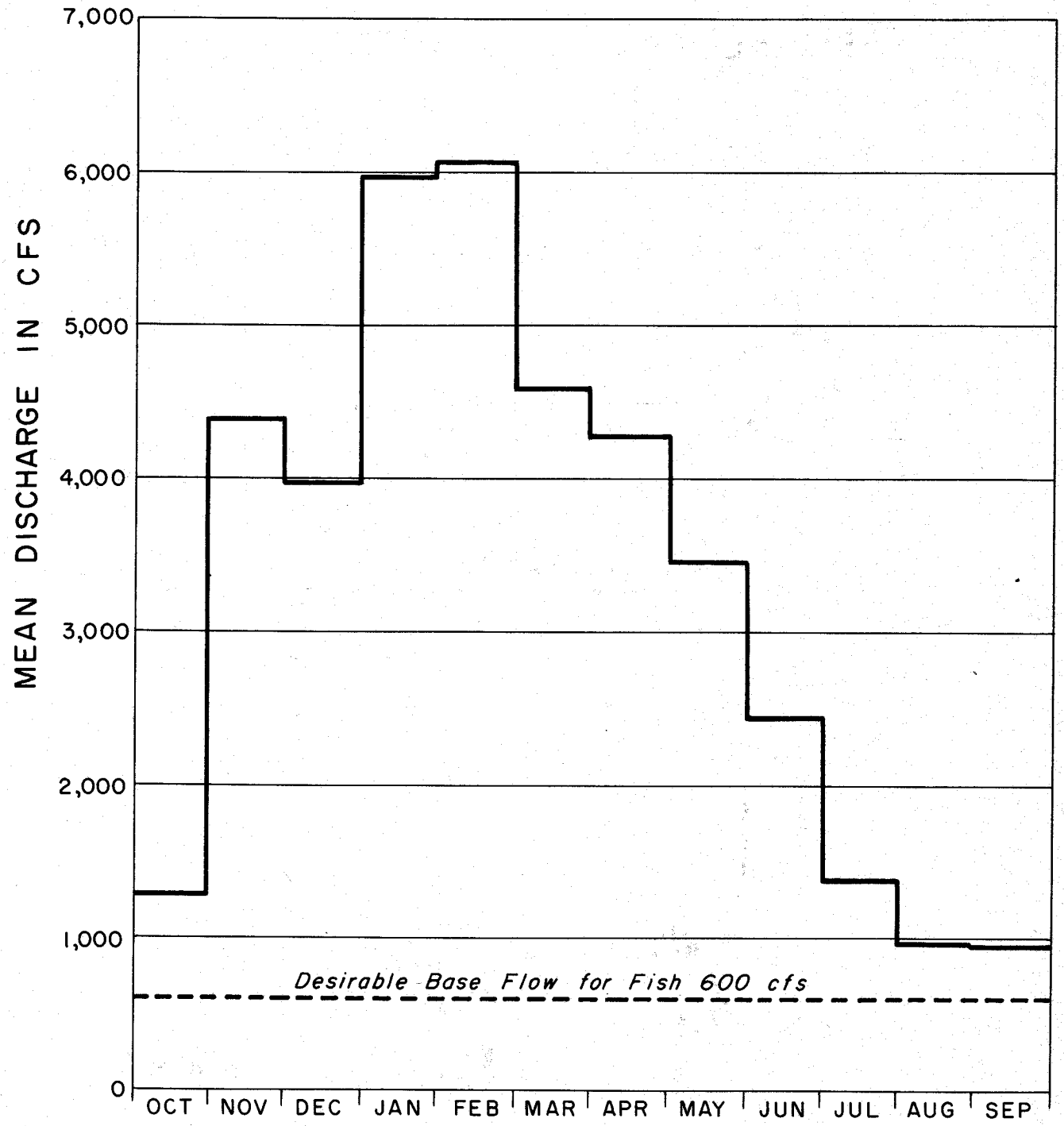
NOTE: Records incomplete for years not shown.

Drawn: Dec., 1957
File No. 16.220
FIGURE 26


UMPQUA RIVER BASIN
DAILY FLOW HYDROGRAPH
MINIMUM FLOW & LOWEST YIELD
WATER YEAR
1926
NORTH UMPQUA RIVER AT WINCHESTER
FLOW, CUBIC FEET PER SECOND
20,000
15,000
10,000
5,000
0
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
MONTHS
File No. 16.202
FIGURE 27

UMPQUA RIVER BASIN
MEAN MONTHLY HYDROGRAPH

NORTH UMPQUA RIVER AT WINCHESTER



YEARS OF RECORD 1909 - 1913
1924 - 1929
1955 -

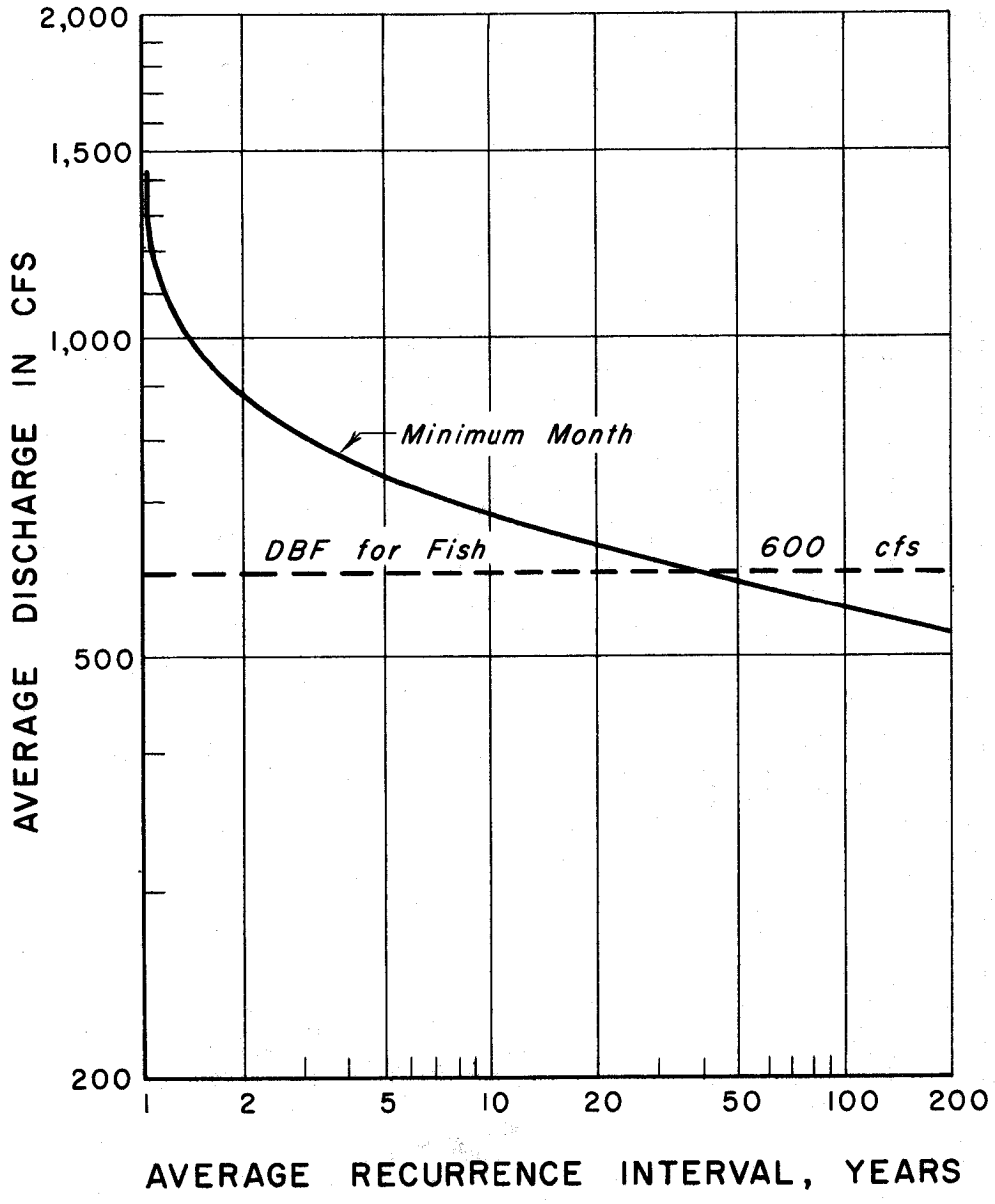
File : 16.202

FIGURE 28

UMPQUA RIVER BASIN

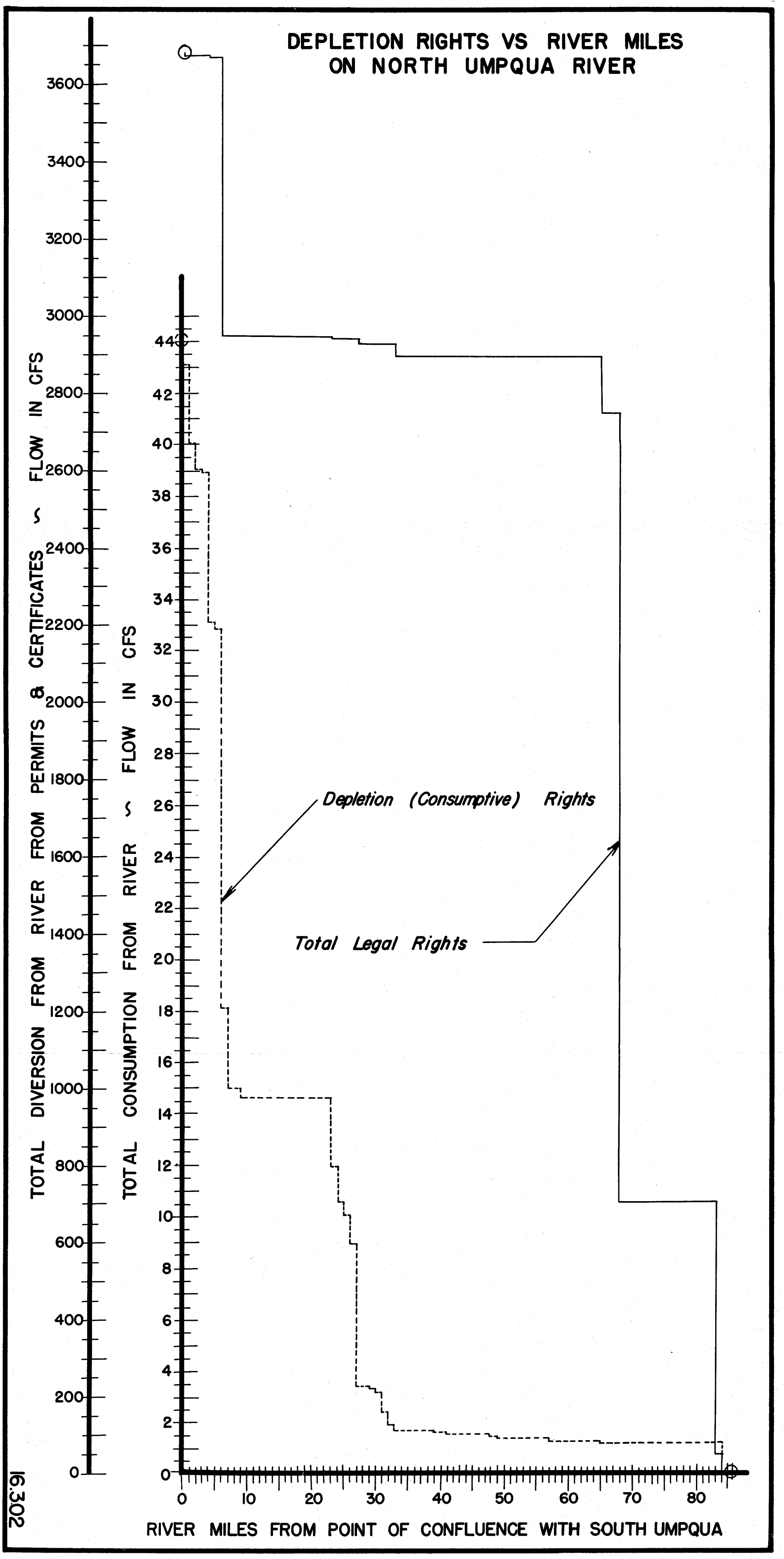
NORTH UMPQUA AT WINCHESTER

LOW FLOW FREQUENCY CURVE
AND
DESIRABLE BASE FLOW FOR FISH



Drawn: Jan., 1958
File No. 16.203
FIGURE 29

DEPLETION RIGHTS VS RIVER MILES ON NORTH UMPQUA RIVER



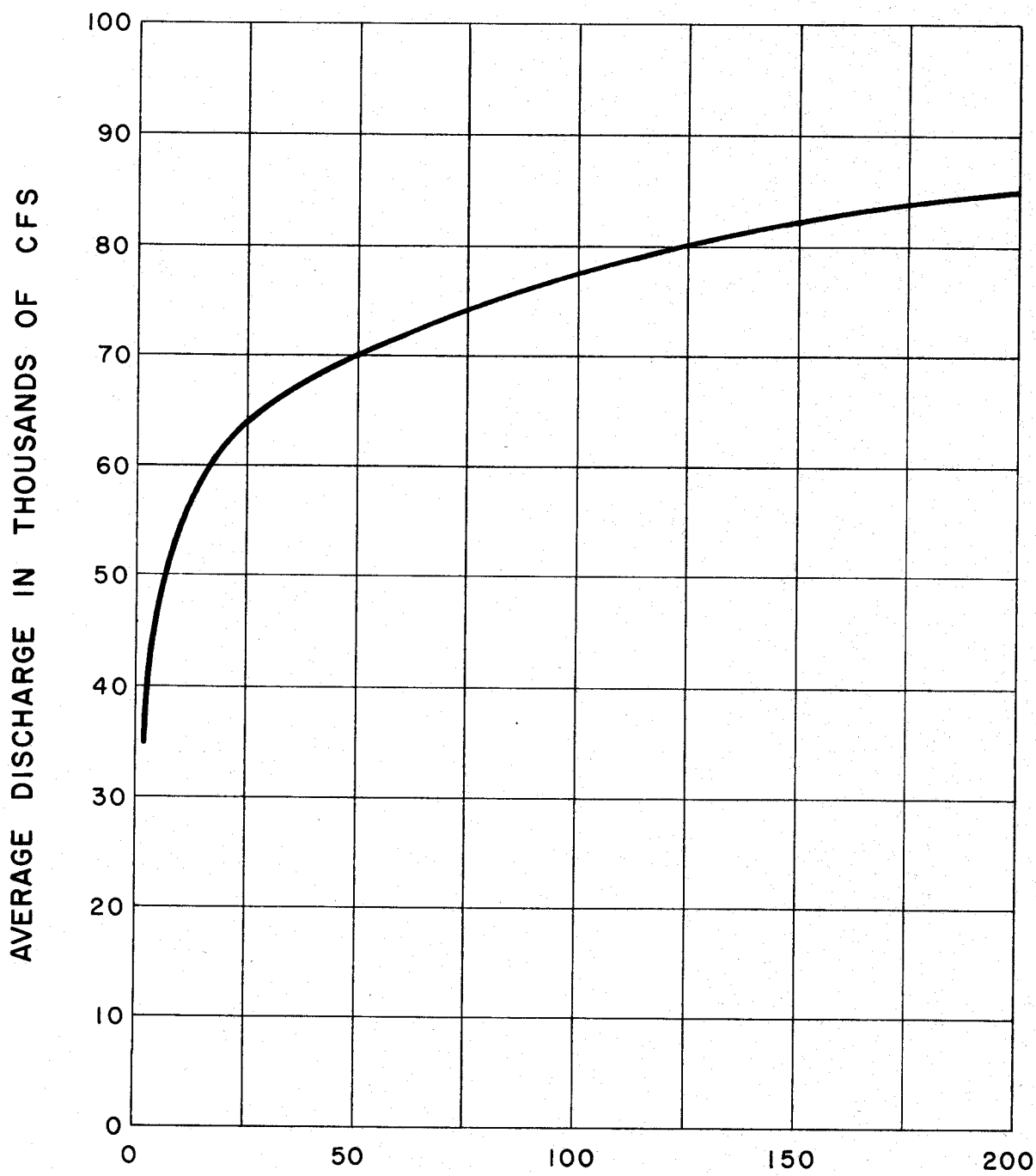
16.302

FIGURE 30

UMPQUA RIVER BASIN

NORTH UMPQUA RIVER NEAR GLIDE

FLOOD FREQUENCY CURVE



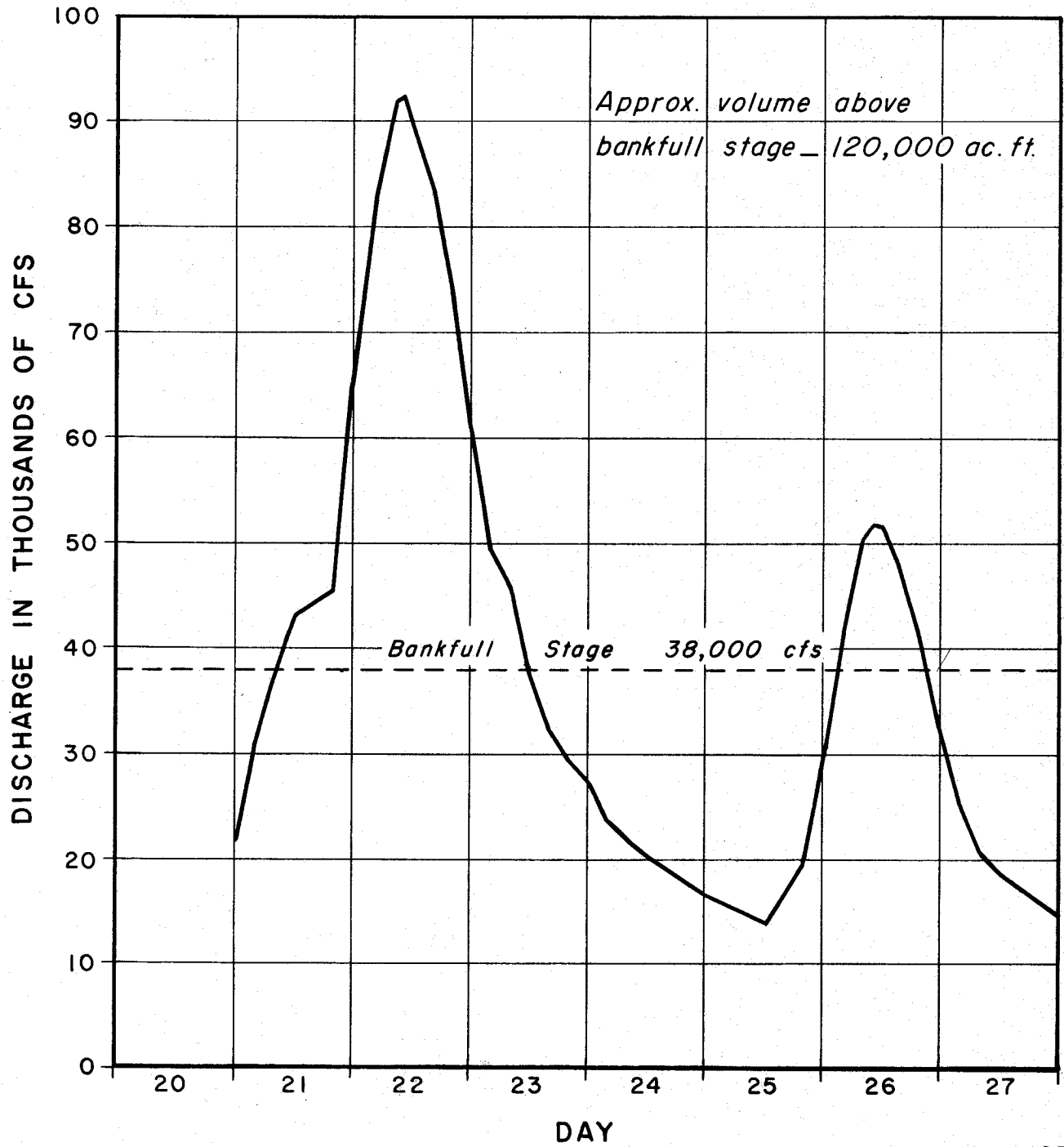
Drawn: Dec., 1957
File No. 16.203
FIGURE 31

UMPQUA RIVER BASIN

FLOOD HYDROGRAPH

NORTH UMPQUA RIVER AT WINCHESTER

DECEMBER 1955



Drawn: Jan., 1958

File No. 16.202

FIGURE 32

NORTH UMPQUA

MINERAL DEPOSITS

FIGURE 33

TABLE 18

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

NORTH UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
North Umpqua River	600	Winchester
" " "	600	below Little River
" " "	550	above Rock Creek
" " "	500	above Copeland Creek
Cooper Creek	3	mouth
Little River	35	mouth
" "	15	above Emile Creek
Cavitt Creek	15	mouth
Emile Creek	2	mouth
Rock Creek	30	mouth
" "	18	above East Fork
East Fork Rock Cr.	12	mouth
Honey Creek	2	mouth
Susan Creek	2	mouth
Cougar Creek	2	mouth
Williams Creek	2	mouth
Steamboat Creek	50	mouth
" "	40	above Canton Creek
Canton Creek	15	mouth
Limpy Creek	3	mouth
Calf Creek	7	mouth
Dry Creek	2	mouth
Copeland Creek	10	mouth
Boulder Creek	10	mouth
Fish Creek	25	above Camas Creek
Clearwater River	150	mouth
" "	75	above Trap Creek
Deer Creek	25	mouth
Lake Creek	5	below Diamond Lake

* As requested by the Oregon State Game Commission.

LOWER UMPQUA SUB-BASIN

GENERAL DATA

Location

The Lower Umpqua sub-basin is that section of the Umpqua system downstream from the confluence of the North and South Umpqua Rivers. This section frequently referred to as the main stem of the Umpqua River receives the entire discharge of the Umpqua River Drainage Basin. The sub-basin covers the northwestern portion of Douglas County. The major tributaries of the Lower Umpqua sub-basin are Smith River which discharges into the main stem at river mile 9.5; Mill Creek which discharges into the main stem at mile 22, approximately 12 river miles above Reedsport; Elk Creek discharging into the main stem at river mile 45; and Calapooya Creek which discharges into the upper portion of the main stem at river mile 96.

Size

The Umpqua Basin drains a total area of approximately 4560 square miles. Of this, 3070 square miles lie above the confluence of the North and South Umpqua Rivers. The Lower Umpqua sub-basin which includes within its boundaries the remaining 1490 square miles is approximately 105 miles in length. Four hundred and seventy-one square miles of the Lower Umpqua watershed consists of a large number of miscellaneous streams. The remaining thousand plus square miles are drained by the four major tributaries of the sub-basin.

The Smith River drainage covers approximately 346 square miles and has a total length of about 68 miles to its upper reaches in section 11, township 21S, range 5W, about six miles north and slightly west of the town of Drain. The major tributary of the Smith River is North Fork which discharges into Smith River proper at river mile 14.5. It is approximately 23 miles in length and drains an area of 60 square miles. The Smith River drains the western portion of the Lower Umpqua sub-basin lying north of the main stem of the Umpqua River.

Mill Creek drains an area of approximately 135 square miles. The length of Mill Creek is approximately 17 miles and terminates at the head of Lake Creek on the Umpqua-Coos River divide. Camp Creek, its main tributary, discharging into Mill Creek about 5.25 miles above its mouth,

has a drainage area of some 39 square miles and is also nearly 17 miles in length. Mill Creek drains the western portion of the Lower Umpqua sub-basin lying south of the main stem of the Umpqua River.

Elk Creek drains an area of approximately 290 square miles lying immediately east of the Smith River drainage and north and east of the main stem of the Umpqua River. Elk Creek is approximately 35 miles long and terminates in the Coast Fork of the Willamette-Umpqua River divide.

Calapooya Creek drains the area lying south of Elk Creek and east of the main stem of the Umpqua River. This watershed has a drainage area of 247 square miles and a length of approximately 35 miles. Its headwaters terminate in the Coast Fork of the Willamette-Umpqua River divide.

Topographic Characteristics

The major portion of the Lower Umpqua sub-basin is characterized by a fairly rugged terrain varying from the broken topography of the Coast Range to the rugged foothills of the Western Cascades. Lands suitable for development within this sub-basin are dispersed along the main stem of the Umpqua River and its four major tributaries. From Scottsburg, on the main stem, upstream to the vicinity of Coles Valley at the mouth of the Calapooya, the main stem of the Umpqua River is a rapidly moving stream cutting its way through the rugged Coast Range. In general, the Umpqua River is confined to a very narrow valley and potential for development is restricted to narrow bench lands. At various points, in the vicinity of Elkton, Kellogg, and Tyee, bench lands broaden out. Potential for limited irrigation development exists in these areas. Potentials for major municipal or urban expansion are limited. The narrow strips of fertile land that lie on benches adjacent to the main stem are susceptible of development on an individual irrigation enterprise basis. The terrain of the Lower Umpqua sub-basin downstream from Coles Valley and bordering the bench land is extremely rugged and varies in elevation from sea level to better than 1900 feet within four miles of the river.

The upper fifteen miles of the Lower Umpqua sub-basin contains some of the finest agricultural lands in the Umpqua River Basin. These lands are situated in the Coles and Garden Valley areas. At the present time, substantial agricultural development exists in the Garden Valley

area but both sections have additional potential for development under irrigated agriculture practices. The terrain on the west side of the main stem of the Umpqua River is extremely rugged rising sharply to the divide of the Coast Range. On the east side, the terrain varies from moderate rolling hills in the lower portions of the Calapooya Creek to extremely rugged terrain in the vicinity of Tyee Mountain. The potential for development along the main stem of the Umpqua River is restricted to the areas immediately adjacent to the river.

The topographic characteristics of the major tributaries of the Lower Umpqua sub-basin show the same general characteristics as the land along the main stem. The Smith River area is characterized by rough heavily wooded terrain typical of the Coastal Mountains. Arable land in the Smith River area is, as on the main stem, located on very narrow benches along the river. There are few areas suitable for agriculture, industrial or municipal development. Limited potential exists in the lower reaches of the Smith River but land here is not protected and is subject to flooding. Slopes increase sharply not far from the river banks and benches are seldom more than a few hundred feet in width. Elevations within the Smith River area vary from sea level to approximately 3000 feet.

Mill Creek is located entirely within the Coast Range. The terrain is rough and heavily wooded with level land restricted to narrow strips along the stream above Loon Lake. Reconnaissance surveys indicate that developable lands would not exceed 750 acres. Elevations within this watershed vary from a few feet above sea level at the mouth of the stream to approximately 1500 feet, mean sea level, at the headwaters of the West Fork of Lake Creek on the Umpcoos Ridge.

Elk Creek from stream mile 0 to 10 is rugged and development restricted. Much of the terrain is wooded. At stream mile 10 the stream expands into the Putnam Valley, an agricultural area extending almost to the community of Drain. Putnam Valley is approximately a mile across at its widest point. Several small tributaries with steep gradients and limited lengths - two to four miles - discharge into Elk Creek in this section. Putnam Valley narrows down to a canyon about three miles downstream from the community of Drain. A few hundred acres of level land lie at the junction of Pass and Elk Creeks, of which the town of Drain covers the major portion of this land.

Approximately two miles south of Drain, Yoncalla Creek joins Elk Creek. There are lands suitable for agriculture along Yoncalla Creek and in the area opening up into Pleasant Valley. In this area of the watershed, the hills are open and barren of timber except on the higher ridges. Other level lands are located in Scotts Valley on Elk Creek about six miles above the Elk-Yoncalla Creek junction, and bench lands along upper Elk and Pass Creeks. The upper areas of this watershed are in the rugged terrain of the Coast Fork of the Willamette divide and are heavily timbered.

Calapooya Creek drainage has lands suitable for irrigated agricultural development in its lower reaches. From its mouth to river mile 6, there is a valley approximately a mile to a mile and a half in width suitable for further irrigation development if water supplies become available. From mile 6 to the community of Oakland, the valley narrows, varying from one-half to three-quarters of a mile in width. Above Oakland, the terrain is generally more rugged as the Coast Fork of the Willamette divide is approached; timber growth becomes heavy.

The 1956 report on the Umpqua River by the Bureau of Reclamation points out land suitable for agricultural development upstream from Oakland along Bachelor Creek and the lower reaches of Oldham Creek. A substantial area is also located between river miles 18 and 25 along the main stem of the Calapooya River immediately downstream from the proposed Hinkle damsite.

Stream gradients increase sharply above mile 25 and are quite steep in the headwaters. Elevations within the Calapooya Creek watershed vary from 320 to 2552 feet msl in the lower reaches to 3200 feet msl in the headwaters.

Geologic Characteristics

The Lower Umpqua sub-basin falls within two geologic divisions. These are the physiographic provinces known as the Coast Range and the Western Cascades. The Coast Range province is characterized by rock formations which are shales, sandstones, and conglomerates of the Eocene Age. The Coast Range is mature, dissected and north-south trending. The Western Cascades province is characterized by rock formations generally classified as volcanic andesites. The line of demarcation between the two provinces is not sharply defined.

That portion of the sub-basin discharging directly into the main stem lies entirely within the Coast Range province. This is also true of the tributaries of Smith River and Mill Creek. The Elk Creek and Calapooya Creek watersheds fall within both provinces, the lower reaches in each case falling within the Coast Range and the headwaters terminating in the Coast Fork of the Willamette-Umpqua divide falling in the Western Cascades province.

Meteorologic & Hydrologic Characteristics

Temperatures within this area are mild. Major precipitation occurs in the form of rain, and snowpacks are limited to the highest elevations of the Coast Range. Because of these features, the stream runoff patterns of the tributaries follow the precipitation patterns quite closely.

Runoff characteristics of the Lower Umpqua River are affected by the combined characteristics of its two major tributaries, the North Umpqua and the South Umpqua Rivers. The resultant effect of this is to have a stream whose characteristics resemble those of the North Umpqua during the period of low flow, but whose high flow patterns are strongly influenced by the rapid runoff variations of the South Umpqua during periods of intense precipitation in the southern portion of the Umpqua River Basin.

This area experiences a wide range in precipitation, running as high as 120 inches annually in the upper elevations of the Coast Range, down to 30-35 inches annually in the area near the community of Umpqua. Precipitation records in Roseburg are somewhat characteristic of the upper 20 miles of the sub-basin. Incomplete precipitation data exists for Elkton and Reedsport dating back to 1836, but records of these stations cannot be considered representative of the very heavy rainfalls experienced in the higher elevations of the Coast Range.

Stream gaging records for the main stem of the Umpqua River have been maintained for the period 1903 to present. Records, however, for this period of time were available for only one station located on the main stem near the community of Elkton. This station records the runoff for approximately 3,680 square miles of the drainage area of the Umpqua system above this point. Data on the stream runoff of the major subbasins discharging into this section of the Umpqua River are indicated in their specific sections.

Smith River

Climate in this area is usually mild. Warm, but generally dry, summers result in low summer flows. Temperatures seldom reach freezing except at higher elevations; freezing periods are of short duration resulting in little snowpack to aid late spring and summer flows. Winter precipitation in the form of rain is heavy. Stream flow patterns follow precipitation patterns quite closely.

Streamflow data is limited and stream yields for this section are unmeasured. Precipitation varies from 50-110 inches over the Smith River watershed in a normal year. Precipitation data is inadequate and is poorly defined, since no precipitation station existed prior to 1940. Stations contiguous to the area, Canary on the Siuslaw and Umpqua near Reedsport, are not representative as they are in the lower coastal elevations of the Smith River watershed.

Mill Creek

The climate of this section is typical of Coast Range streams. Temperatures are generally mild, rarely reaching freezing levels except at the higher elevations. Winters are very wet, but mild, and summers are warm.

Most of the precipitation occurs as rain with some snow. No extensive snowpack is created; thus, streamflows are up during precipitation periods, and immediately thereafter flows drop rapidly as dry periods lengthen. Stream flows are very low in the late summer months, but rise rapidly for short periods of time when summer precipitation is experienced.

Streamflow records for the Mill Creek section are limited and precipitation values must be interpreted from Reedsport records or estimated from isohyetal charts whose values are but rough approximations of the precipitation patterns and quantities of the coastal region.

Elk Creek

Mild year around weather characterizes this section. Summer temperatures are higher than coastal areas, and precipitation is substantially less. Annual rainfall is generally uniform over the area and amounts to

approximately 50 inches. Stream runoffs are almost entirely related to rainfall. Snowpacks for storage are small and of short duration because of relatively low elevations (maximum 2400 feet msl).

Calapooya Creek

This section is characterized by generally mild weather conditions. Temperatures seldom reach freezing and when they do, do not remain long at this level. Summer temperatures are warm, with the average temperature for the month of August being approximately 70 degrees Fahrenheit.

Rainfall over this drainage area is generally uniform, varying from 50 to 56 inches in a normal year. Greater precipitation is experienced in the upper reaches of the Calapooya Creek watershed. As with the other lower region areas, precipitation occurs primarily in the form of rain and stream runoff is directly related to the precipitation pattern. Some storage in the headwaters from snow pack is available, but it is not sufficient to provide minimum needs during the summer months.

Land Ownership

Of the 471 square miles of drainage area of the Lower Umpqua sub-basin not included in the major tributaries, approximately 100 square miles is held in federal ownership. Of this, roughly 19,000 acres is in National Forest, 40,000 acres in O & C lands, 4,000 acres in public domain, and 128 acres in Coos Bay Wagon Road holdings. The balance of the land is held in private ownership.

Federal power withdrawal sites cover the following sections of the main stem of the Lower Umpqua River: from the vicinity of Scotts burg to a point roughly one-half mile above the mouth of Lutsinger Creek; a site between Stonybrook and Paradise Creek; an area in the vicinity of Beener Creek; a location immediately above the community of Elkton; and the major portion the the Lower Umpqua River from Heddin Creek, approximately three miles above Elkton, to the mouth of the Calapooya River at mile 85.

Smith River

Approximately 39 percent of the Smith River area is owned or

or controlled by the Forest Service and Bureau of Land Management. One and three-quarters sections are held by the State Land Board, and the balance is in private ownership.

Ninety percent of the North Fork of the Smith River watershed lies in National Forest lands. Federal power withdrawal sites are at and above Smith River Falls, and in the area near the confluence of the North Fork and the main stem of Smith River.

Mill Creek

Approximately nine percent of the Mill Creek area is owned by the State of Oregon through the State Forestry Department. These holdings lie primarily to the west of Mill Creek and cover most of the land between the community of Ash on the south, the Umpqua River on the north, Mill Creek on the east, and the Umpcoos Ridge on the west. The State Forestry Department also holds approximately two sections of land east of Mill Creek. Approximately four and one-half miles of Mill Creek, from its mouth to Loon Lake, is bounded by state land on both sides, while another one and one-half miles along the west shore of Loon Lake is abuting State land.

Federal ownership is confined to five square miles of land near the junction of Bear, Camp, and Lake Creeks, and eight square miles at the headwaters of Lake Creek. This land is National Forest land. The Bureau of Land Management has no holdings within this watershed.

The distribution of private and county ownership has not been investigated.

Mill Creek, from its mouth to a point approximately three miles above Loon Lake, has been designated as federal power withdrawal sites.

Elk Creek

Approximately 21 percent of the Elk Creek area is in O & C land, controlled by the Bureau of Land Management. Small isolated areas are classified as public domain with the balance of the area in private ownership. The federal Forest Service has no holdings in the Elk Creek area.

Federal power site withdrawals are limited to a site approximately two miles upstream of Elkton and a site near the junction of Elk and Yoncalla Creeks.

Calapooya Creek

Seven percent of the Calapooya Creek area is in O & C lands controlled by the Bureau of Land Management. With the exception of a very small portion of public domain, the balance of this area is in private ownership. There are no federal power withdrawal sites within the Calapooya Creek watershed.

Transportation Facilities

Reedsport near the mouth of the Umpqua River is served by the U. S. Coastal Highway 101 and the coastal branch of the Southern Pacific Railroad. The lower section of the main stem is served by State Highway 38, which runs parallel with the Lower Umpqua River from Reedsport to the community of Umpqua at the confluence of the Calapooya and the main stem. The Lower Umpqua River is paralleled for a greater portion of its length by a county road which is unsurfaced downstream of Millwood. This particular county road continues on from Umpqua to Cleveland, Melrose, and thence into Roseburg. State Highway 38 connects Elkton with U. S. Highway 99 through the community of Drain.

Smith River

Roads are the primary transportation facility of the Smith River area. A county road (surfaced to the vicinity of Bear Creek one and one-half miles above Smith River Falls) serves the lower area. An unsurfaced road (graded) branches off from the surfaced road at the junction of Smith River and the North Fork of the Smith River. This road runs about six or seven miles up the North Fork, then turns west and crosses over the divide into the Mid-Coast Basin. The county road continues from Bear Creek up the Smith River to Vincent Creek and upstream (south) on Vincent Creek and over the divide between Smith River and the Lower Umpqua River to Scottsburg. The upper Smith River downstream to Gunter is served by a non-surfaced, but graded road from old U. S. Highway 99. Other roads are under construction for forest access.

The Smith River is navigable to the North Fork, but only for very shallow draft vessels.

Mill Creek

A graded, but generally unsurfaced, road roughly following Mill Creek from the Lower Umpqua River to the vicinity of upper Lake Creek with a branch road up Camp Creek is the only transportation facility in the Mill Creek area. The Loon Lake road swings west over the Umpcoos Ridge and continues as an unimproved road to the Coos River.

Elk Creek

The Elk Creek area is served by two primary roads. The Umpqua Highway from Elkton to Drain, which parallels Elk Creek (State Highway 38); and the new U. S. Highway 99 running south from the Willamette-Umpqua Basin divide through Scotts Valley and Pleasant Valley to the divide between Yoncalla Creek and Cabin Creek, a tributary of Calapooya Creek. Old U. S. Highway 99 connects Drain and new U. S. Highway 99 and serves the Pass Creek area as well as Yoncalla Creek area. The county road network connects Scotts Valley, Shoestring Valley, and the Elkhead district with branches to London Springs on the Coast Fork of the Willamette River, Oakland, Sutherlin and communities to the south.

The Elk Creek area is served by the Southern Pacific Railroad by its line from Cottage Grove to Roseburg. This line also links Drain and Yoncalla.

Calapooya Creek

The lower reaches of the Calapooya Creek area are served by U. S. Highway 99 and by a county road network connecting Oakland, Sutherlin and the town of Umpqua. Transportation facilities at the headwaters are limited to logging roads and a logging railroad operated by the Weyerhauser Timber Company. The Southern Pacific Railroad connects Yoncalla, Oakland, Sutherlin and Roseburg.

Economy

The present economy of the Lower Umpqua River is composed of two primary divisions; first, timber, and second, agriculture and livestock development. As indicated previously, the upper 15 miles of this area contains the most fertile and productive agricultural lands in the Umpqua River Basin. Fruits, nuts, berries, alfalfa, and row-type crops are the products of this particular section.

The lower portion of this sub-basin, the Reedsport and Gardiner areas, are dependent primarily on the timber resource. In addition, the Reedsport area receives substantial economic benefits from the fisheries resource, both from a commercial and recreation standpoint. The development of the Winchester Bay project has been a substantial contributor to the economy of this area.

Smith River

The Smith River area's economy is based almost entirely on lumber. Agriculture, including dairy and livestock grazing, is limited. With the large holdings of the Forest Service and Bureau of Land Management, the future economy of the area will be based primarily on timber harvested on a sustained yield basis.

Mill Creek

The economy of the Mill Creek area is dependent on logging operations and limited agricultural development in the vicinity of Loon Lake and Lake Creek. There is no industrial, mining or power development in the Mill Creek area.

Loon Lake is used for recreation purposes, and the waters of Mill Creek, Lake Creek, and tributaries offer fishing for trout. Lower Mill Creek and lower Camp Creek offer potential for steelhead trout and silver salmon, but these items have had little effect on the economic development of the Mill Creek area. The impact of these items is felt more in the Reedsport section, since facilities within the Mill Creek area are limited.

Elk Creek

Elk Creek's economy is based on timber and agriculture. The timber economy would be strengthened by the development of secondary woods processing industries. At this time, growth in this direction would exclude the establishment of pulp and paper plants because of severe restrictions imposed by water resource deficiencies.

Potential exists for an irrigated agricultural growth, but water shortages in the summer months impose problems. Work by the Bureau of Reclamation indicates less than 15 percent of the land suitable for

irrigation is so treated. Much of this land would be suitable for irrigated pasture land, or cropland, if water were available.

Calapooya Creek

The economy of the Calapooya Creek area is based primarily on timber, supplemented by limited agriculture. The towns of Oakland and Sutherlin have experienced their growth almost entirely from the expansion of the timber economy. Because of the present difficulties in the saw timber and plywood industries, these areas are experiencing some serious economic problems. Need for secondary timber manufacturing to stabilize the economy of this area is apparent. Development of agricultural potential would also serve as a stabilizing influence and should provide opportunities for expansion of the Calapooya Creek's economy. Less than ten percent of the irrigable land is being irrigated at the present time.

Population

1958 estimates indicate approximately one-third of Douglas County's population is located in the Lower Umpqua sub-basin. The main concentrations of population are Reedsport, 3450; Sutherlin, 2700; and Drain, 1450. The communities of Elkton, Yoncalla and Oakland total about 1870 persons. From the confluence of Elk Creek and the main stem to Reedsport, the area is sparsely populated.

AMOUNT AND DISTRIBUTION OF RESOURCE

Lower Umpqua River

Precipitation

Available precipitation data is of limited value in establishing the amount and distribution of the resource.

Stream Gaging

The gaging station at Elkton on the Lower Umpqua River is the oldest station in the Umpqua Basin and the one with the longest period of continuous record. Annual yields from the watershed above this point have been in excess of 9 million acre-feet per year and as low as 2.2

million acre-feet per year. The Elkton gage represents 80 percent of the entire drainage area, but little information is available to determine the distribution of the 20 percent of the area represented by that section of the main stem and its tributaries below Elkton. Instantaneous flows, as measured at the Elkton gage, exhibit a range from 218,000 cfs at the peak of the 1955 flood to as low as 640 cfs on July 18, 1926.

Resource Distribution

Of the annual yield at the Elkton gage, from 75 to 85 percent is contributed by the watersheds of the North and South Umpqua Rivers. The balance is contributed by the major and minor tributaries contiguous to the main stem between Elkton and river mile 105. These figures are based on five years of record when the Elkton, Brockway, and Winchester gages were in simultaneous operation.

The distribution of the resource between minor tributaries of the main stem above and below Elkton is not known.

Smith River

Precipitation

The Gunter station is the only precipitation station within the Smith River area. Records of precipitation are incomplete with the month of December missing in all years. The nearest station, Drain in the Elk Creek watershed, has as much as 25 inches of rain in December alone. The annual rainfall at Gunter is estimated to vary between 48 and 100 inches per year.

Rough approximation can be made of the minimum watershed yield assuming a minimum annual rainfall of 48 inches in one year over the entire Smith River watershed, and a runoff factor of 0.65. Minimum annual yield on this basis approaches 600,000 acre-feet. Distribution of this yield as to area of origin has not been evaluated.

Stream Gaging

It is not possible to plot hydrographs to show stream flow patterns for the Smith River as there are only five flow measurements of record.

The five flow measurements are spot checks taken in August or September. The lowest flow was recorded on September 5, 1951, with a value of 9.13 cfs.

Resource Distribution

Data for the determination of yield and runoff distribution patterns for the Smith River is insufficient.

Mill Creek

Precipitation

Rainfall over the Mill Creek watershed varies from 50 to 90 inches in a normal year, according to isohyetal charts (rainfall contour maps) developed by the U. S. Corps of Engineers for the western portion of Oregon. There is no record of precipitation stations having been established within the Mill Creek watershed. Variations in rainfall over the area throughout a yearly period and averages in rainfalls can only be estimated. Prediction of dry cycle runoffs on the basis of precipitation for this area is impractical.

Stream Gaging

Some stream gaging has been done on Mill Creek near the community of Ash. The drainage area above the gaging station is 90 square miles, or 67 percent of the watershed.

The minimum instantaneous flow recorded in the eight years of record is 1.5 cfs in September of the 1909-1910 water year; the maximum flow was 10,000 cfs in November of the same water year. Annual average discharge in cfs per square mile varies from 40.04 cfs to 68.01 cfs per square mile.

The minimum yield of record occurred in the water year 1910-1911. Total runoff for this period was 192,000 acre-feet. The maximum runoff of record occurred in the water year 1915-16. Total runoff for this water year was 322,000 acre-feet. It is interesting to note that the water year 1915-16 was the ninth lowest yield year of 48 years of record at the Elkton gage; yield for the year was nearly 2 million acre-feet below the

48-year average. The 1910-11 water year was below the 48-year average at Elkton by approximately 600,000 acre-feet. No records exist for the comparison of the maximum year at Elkton, 1920-21, and the yield of that year on Mill Creek.

The amount of the resource in the Mill Creek watershed is taken as 192,000 acre-feet for a minimum year.

Resource Distribution

With only one gage, there is not sufficient information to establish the geographical distribution pattern of the resource.

Elk Creek

Precipitation

Precipitation varies from 28 to 64 inches per year at Drain, the only gaging station in the Elk Creek watershed. Rainfall is relatively uniform over the watershed, with slightly higher values in the headwaters and in the lower mountainous reaches. Records cover 49 years with a five-year gap in the period, 1936-41.

Stream Gaging

Stream flow records for Elk Creek are limited to one summer of record, July 1 to September 31, 1950, plus a few miscellaneous measurements. Gages were temporarily located on Elk Creek in Scotts Valley and on Elk Creek, 300 feet below its confluence with Pass Creek. Flows at the lower gage were often less than the upstream gage. In the period indicated, the maximum flow was 18 cfs (July 10th); by August 4, the flow was down to less than 5.0 cfs, decreasing to 1.3 cfs on September 9.

Resource Distribution

Distribution of the resource cannot be specifically established and total yield must be approximated from rainfall data. In a minimum year, Elk Creek watershed would approach 250,000 acre-feet of water as its yield.

Calapooya Creek

Precipitation

There are no precipitation records prior to 1955 in the Calapooya Creek watershed. A rain gage has been established by the Douglas County water survey at Sutherlin Camp in the upper reaches of the area, but data from this source will be of restricted value until a sufficient period of record has been established to indicate the precipitation patterns. Rainfall over the watershed is probably similar to the Elk Creek drainage, averaging between 28 and 64 inches per year.

Stream Gaging

There are no continuous stream gaging records for Calapooya Creek prior to 1955. Spot observations indicate that flows in Calapooya Creek have dropped to values of four to five cfs during the late summer months. The lowest measured value known is 8.0 cfs below the confluence of the Calapooya and Williams Creeks. In a minimum year, a yield of 210,000 acre-feet could be anticipated.

Resource Distribution

The distribution of this yield over the Calapooya Creek watershed is relatively uniform.

AMOUNT AND DISTRIBUTION OF RESOURCE UNDER APPROPRIATION

Lower Umpqua River

Total known legal rights to divert waters of the Umpqua system above its point of discharge into the Pacific Ocean total nearly 4,375 cfs. Of this total, approximately 548 cfs represents the known rights to the consumptive use of water. The known legal rights on the main stem of the Umpqua River below river mile 105 are quite small and amount to 29 cfs for irrigation purposes, and 47 cfs for industrial use (an application). The total depletion potential, assuming full consumptive use for the industrial application, would be 76 cfs. Total diversion rights for all areas tributary to the main stem below mile 105, including the other major sub-basins, total less than 125 cfs. Figure 39 illustrates the depletion pattern of this section of the sub-basin.

Smith River

Legal rights to the use of the waters of the Smith River were determined as of January 1, 1958.

These rights represent a legal entitlement to deplete the natural flow at a given time to the total extent of approximately one cubic foot per second at the most downstream right. Total volumetric right to the consumptive use of water would be approximately 400 acre-feet per year for domestic purposes and nearly 100 acre-feet per year for irrigation purposes.

The total of 500 acre-feet represents the known legal rights to the consumptive use of water in the Smith River watershed. To establish the total legal rights, an adjudication of the area would be necessary. Determination of actual use would require a field investigation.

Mill Creek

Known legal rights to the use of water in the Mill Creek watershed are quite small. Total volumetric consumptive rights amount to approximately 500 acre-feet per year.

Diversion rights in terms of instantaneous flow diversions total 1.8 cfs; 1.5 cfs of this value is for irrigation.

There has apparently been no problem of water supply within the Mill Creek watershed. As a consequence, this area has not been adjudicated and the full legal rights to the use of the resource are not known.

No field investigation has been held to determine actual use.

Elk Creek

Total volumetric consumptive rights for the Elk Creek watershed are about 12,000 acre-feet per year.

Diversion rights in terms of instantaneous flow amount to 39.29 cfs, with 24.76 cfs being diversions for irrigation. Only 2.4 cfs of the diversion rights are located below mile 10 (lower end of Putnam Valley). Above mile 10, rights are scattered over the entire stream network.

Elk Creek has not been adjudicated and total legal rights to the use of water are unknown.

Calapooya Creek

Total volumetric consumptive rights in the Calapooya Creek watershed are estimated at approximately 22,000 acre-feet per year, including the waters of Calapooya Creek that are diverted into Sutherlin Creek for municipal and other uses. Diversion rights in terms of instantaneous flow total 31 cfs; 26 cfs for irrigation. Most rights within the Calapooya Creek watershed are concentrated below river mile 15 and between river miles 18 and 21. Scattered rights exist on tributaries of the stream.

Calapooya Creek has not been adjudicated and total legal rights to the use of water are unknown.

EXTENT OF THE BOARD'S JURISDICTION

Lower Umpqua River

Total volumetric rights in the Umpqua Basin approximate 400,000 acre-feet per year, or about 18 percent of the Basin's resource available in the minimum year of record as measured at the Elkton gage. Under this condition, the Board would have jurisdiction over more than 1.8 million acre-feet of water during a year of minimum runoff. From a practical point of view, the Board would have jurisdiction over slightly more than 400 cfs, downstream of mile 105, under conditions of full depletion and a flow equal to the minimum flow of record.

Smith River

Based on a yield of 600,000 acre-feet per year and a known legal right to the volumetric use of 500 acre-feet per year, the Board has jurisdiction over nearly 600,000 acre-feet of water, limited geographically to some extent by existing nonconsumptive rights.

In addition to the consumptive rights indicated, there is a nonconsumptive right to the use of 300 cfs in the vicinity of Smith River Falls. This application was filed by the Lincoln County P. U. D. and has an effective filing date of February 19, 1954. All subsequent upstream rights and withdrawals, and any apportionment programs established by the Board

would be subject to the practical restrictions imposed by this filing. The filing is held by virtue of ORS 261.330.

Mill Creek

Within the limits of available data and neglecting legal rights which might exist by virtue of use prior to 1909, the Board has jurisdiction over approximately 190,000 acre-feet of water in a minimum yield year.

In terms of instantaneous flow, the Board has apparent jurisdiction over all flows below the junction of Lake Creek and Soup Creek. Jurisdiction varies above this point with the distribution of rights among several tributaries. Camp Creek has no rights of record and the Board is presumed to have full jurisdiction over this stream.

Elk Creek

Based on approximate yield values for Elk Creek and neglecting the effects of rights that might be established by adjudication, the Board would have quantitative jurisdiction over 240,000 acre-feet of water based on a minimum precipitation year of 24 inches.

In terms of instantaneous flow and period of jurisdiction, the Board's jurisdiction would exist only when flow values exceeded 39.29 cfs related to the mouth of Elk Creek. Jurisdiction would vary in relation to distribution of yield and rights to beneficial use.

Calapooya Creek

Based on approximate yield values for Calapooya Creek in a minimum year and neglecting the unknown rights to the use of water, it is estimated that the Board would have quantitative jurisdiction of approximately 190,000 acre-feet of water. The minimum year is assumed to be a precipitation year of 24 inches.

EXISTING AND FUTURE NEEDS FOR THE RESOURCE

Lower Umpqua River

Existing Needs

Based on annual yields, the resource is sufficient for all existing needs. On the basis of the low flow of record and the exercise of full depletion potential in the Basin above the main stem, summer flows would not be sufficient to provide for nonconsumptive uses. Specifically, the requirement of 600 cubic feet per second as a desired base flow for the use of fish life, wildlife, recreation, and pollution abatement could not be provided under the minimum flow of record condition.

Future Needs

Domestic

Future requirements for water in terms of domestic use should not exceed two to three cfs under anticipated development along the Lower Umpqua River.

Municipal

Projections for municipal use are based on the 1950 population in the sub-basin times a factor indicated in the sub-basin evaluation section. Projections for municipal needs in the future along the Lower Umpqua River are quite small and will probably not exceed 10 cfs.

Irrigation

Approximately 14,000 acres of land lying along the Lower Umpqua River is susceptible to irrigation. Quantitatively this would require about 35,000 acre-feet of the resource each year. The pattern of diversion for this use cannot be anticipated, since the development of these lands would be on an individual or piece-meal basis.

Industrial

The future requirements for industrial water on the Lower Umpqua River cannot be predicted at this time. It is anticipated that such industrial development as would occur would be in the vicinity of Reedsport or Scottsburg, or at the upper limits of the main stem in Garden Valley-Coles Valley area. These are the only two sections in the sub-basin that have adequate rail transportation and would, therefore, be acceptable for industrial development. At the present time, there is an application for water for industrial use near the community of Scottsburg in the amount of 47 cfs for the establishment of pulp and paper operation. To date, no specific action has been taken with regard to the utilization of this application.

Industrial requirements for pulp and paper operations in the vicinity of Reedsport could probably be satisfied under existing circumstances by municipal water available through Reedsport. Reedsport received its water supply from Clear Lake which is not within the confines of the Umpqua River Basin.

Mining

There is no evidence to indicate that there will be any future demands for water for mining.

Power Development

The Lower Umpqua sub-basin was surveyed by the U. S. Geological Survey in 1929-30, and their estimates indicate a power potential of approximately 137,000 horsepower for 90 percent of the time. This estimate is predicated on the construction of five dams, each of which would be run-of-river projects located on the Lower Umpqua River. In conjunction with this power development is the possibility of establishing navigation from Scottsburg to the Roseburg area. This possibility has been under investigation for a number of years and, to date, has not offered a sufficient economic potential for serious consideration. The development of power and navigation facilities on the Lower Umpqua River would constitute a problem with regard to the preservation of the anadromous fisheries resource. It would also constitute a change in the recreation pattern of the Lower Umpqua River.

Fish Life, Wildlife, and Recreation

Requirements for these purposes are set at a desired base program flow of 600 cfs, which is assumed to be sufficient for all three of these uses.

Pollution Abatement

No prediction for the requirements for pollution abatement can be made until the pattern of pulp and paper development with the watershed is set forth. The installation of a pulp and paper operation of 300-ton capacity in the area at the upper end of the Lower Umpqua River would require a flow of 1500 cfs if waste treatment is restricted only to toxic control.

The mean monthly flow at Elkton approximately halfway down the Lower Umpqua section has been below 1500 cfs in 152 months out of the 612 months for which there are records. It has been below 1000 cfs for 42 months. Mean monthly flows below 1500 cfs occurred the following times in the months indicated: October, 28 times; November, 6 times; December, 1 time; June, 4 times; July, 20 times; August, 46 times; and September, 47 times. Mean monthly flows below 1000 cfs occurred as follows: October, 7 times; November, 3 times; July, 5 times; August, 11 times; and September, 16 times.

These figures show that the assignment of all water to pollution abatement in these months would still not provide adequate dilution. When the requirements for other beneficial uses, needed and completed, are considered, flows available for dilution are further reduced.

Substantial treatment facilities will be required for pulp and paper operations established in the Lower Umpqua watershed.

Smith River

Existing Needs

No presentation was made at the hearing of October 15-16, 1956, at Roseburg setting forth any existing needs for the Smith River watershed. The Board has no evidence that the existing resource under its present

condition of distribution in amount and time is not sufficient to meet existing consumptive requirements. Requirements for minimum desirable base flows for the improvement of fish preservation and production cannot be met by existing stream flows during summer periods.

Future Needs

Domestic

Population in this area is not expected to show any substantial increase in the next 10 years for the following reasons:

1. Approximately 39 percent of the land is held in O & C or National Forest lands. It is assumed that these lands will be utilized as timber croplands for the indefinite future.

2. Transportation facilities are limited and will thus limit future growth of an urban or industrial character.

3. The total potential irrigable cropland totals about 1800 acres. Therefore, domestic farm consumption increases would be relatively small even with full employment.

4. Little population growth can be expected from natural resource exploitation of mineral deposits. In all, domestic requirements of a non-urban character should not exceed 3.0 cfs.

Municipal

The only foreseeable possibility for municipal development is the growth of a small community supported by the field operations of a pulp operation. Assuming the expansion of Gunter, or the development of a new community within the Smith River watershed to a population not to exceed 500, the municipal demand would be less than 1.0 cfs.

Irrigation

With 1800 acres of potentially irrigable land in the Smith River watershed, future use for this purpose can be expressed in terms of maximum potential need. Volumetrically, total future use would amount to

approximately 4500 acre-feet per year, about 45 times the present known legal right to use for this purpose. Assuming a diversion right of 1/80 cfs per acre, the flow demand could approximate 23 cfs if all areas were irrigated simultaneously.

Power Development

Potential power sites exist at Smith River Falls. One filing, by the Lincoln County P. U. D., is based on a theoretical production of 4400 horsepower. The methods of development would be based on a reconnaissance survey not yet submitted to the State Engineer. Preliminary examination of a map of the area indicates that generation of power would be subject, in general, to natural streamflow, since at-site storage would be relatively small. The filing is for 300 cfs and is a limiting factor on the Board's jurisdiction.

Industrial

There are limited potentials for industrial expansion within the watershed, although the development of storage and flow regulation might make available an industrial supply for the Gardiner area for a pulp and paper operation. For a 500 ton operation, 50 cfs would be an ample supply for process water. This requirement is based on a rough requirement of 10 cfs per 100 tons of production.

Fish Life, Wildlife, and Recreation

Needs as expressed by the Oregon State Game Commission and the Fish Commission of Oregon in their report to the State Water Resources Board, suggested a desirable minimum flow of 20 cfs below Smith River Falls and 10 cfs at Gunter. This stream was shown by the Game Commission as a spawning stream for chinook and silver salmon, as well as steelhead trout.

Wildlife needs have not yet been established, but it is assumed that they can be satisfied by the desirable minimum flow for fish.

The use of the resource of this stream for recreation other than fishing purposes is limited by the lack of facilities. Diversification of recreation types is needed. Satisfaction of fish use requirements would serve to satisfy recreational needs for water.

Flood Control

At the present time, the problem of flood control on the Smith River is of limited importance. No requests were made in the Board's public hearing at Roseburg regarding needs in this area for flood control measures. No study of flood magnitudes or potentials has been attempted due to lack of basic flow and runoff data.

The major problem at present is in connection with the maintenance and reconstruction levees built by the Corps of Engineers in the late 1930's.

Mill Creek

Existing Needs

The total availability of water and its distribution in terms of time and location appear to be sufficient for all present consumptive needs. Minimum desirable flows for fish propagation are not satisfied by existing natural flows during low flow periods.

Future Needs

Domestic

No material population growth can be anticipated within the Mill Creek watershed. Improved recreation facilities and growth, plus a small increase in rural population would not bring total potential domestic use over 1.5 cfs or approximately 110 acre-feet per year.

Municipal

There is no foreseeable requirements for use of the resource of this watershed for municipal use. Reedsport, the only municipality of any size in the Lower Umpqua area, has sufficient provisions for municipal water from sources outside of this watershed.

Irrigation

Evaluation studies made by the Bureau of Reclamation, and presented in their feasibility report of 1956 for the Umpqua Basin, indicate that the total irrigation potential of the Mill Creek watershed is approximately 750 acres, all located above Loon Lake. Volumetrically, this would require about 2000 acre-feet per year of the watershed's yield, about 1.2 percent of the yield of the low year of record.

Total diversion rights in terms of flow would amount to approximately 10 cfs. This flow is not available from unregulated flow at low flow periods, but could be supplied from storage.

Power Development

Investigations were made by the U. S. Geological Survey as early as 1924 for power development on Mill Creek. Federal Power Commission figures indicate a potential of 55,900,000 kilowatt hours average annual generation on an installed capacity of 6500 kilowatts operating on a gross head of 385 feet. This development would require maximum stream regulation consistent with available storage. Permit rights for storage and use would be based on a diversion right of approximately 200 cfs.

Industrial

No apparent future needs for this use.

Mining

No known needs.

Fish Life, Wildlife, and Recreation

During critical flow periods, streamflows are insufficient for the maximum propagation, preservation, and protection of resident trout and anadromous fish. The Oregon Game Commission desires a minimum flow of 12 cfs about one-half mile above the mouth of Mill Creek. This flow could be obtained by storage at Loon Lake and Lake Creek. The spawning area for steelhead trout and silver salmon is located in a four and

one-half mile section of Camp Creek beginning about one and one-half miles above its mouth. No improvement in Camp Creek flow conditions would be realized by storage available on Mill Creek at Loon Lake or above. Potential for improvement of Camp Creek flows exists near the confluence of Camp Creek and Little Camp Creek.

Pollution Abatement

There are no foreseeable needs except minor dilution of rural domestic waste and agricultural pollution.

Flood Control

No major problems.

Elk Creek

Existing Needs

Total resource is sufficient for all present needs, but severe dislocations exist during summer periods. Generally from June to October supplies will not meet requirements. Water at this time is insufficient for irrigation, domestic, municipal, fish, wildlife, recreation, and pollution abatement.

Future Needs

Domestic

Future domestic requirements in terms of instantaneous flow are estimated at approximately 5 cfs, volumetrically, 3650 acre-feet per year.

Municipal

Projections for municipal use are based on 1950 population of pertinent precincts in the Elk Creek watershed, times an appropriate factor. Municipal use is projected at 23.0 cfs for 1975. This figure assumes growth consistent with that anticipated as an overall county average. Volumetrically, this would amount to approximately 17,000 acre-feet per year.

Studies have been made by the community of Drain for the utilization of a municipal water development in the Bear-Bully Creeks watershed.

Irrigation

Total irrigable land in the watershed amounts to approximately 15,000 acres. Total volumetric requirement for ultimate development would approximate 37,500 acre-feet per year. Maximum possible diversion on the basis of 1/80 cfs would be 187 cfs. What might constitute a reasonable flow for the natural channels of this system has not been established. Examination of the maps of the area would indicate the need for a distribution system in addition to the normal stream channels.

According to the Bureau of Reclamation, principle use of irrigable lands would be for irrigated pasture.

Power Development

Although two federal power withdrawal sites exist in the watershed, their development is unlikely and of relatively little importance. In its 1957 publication, listing potential power sites of the Umpqua Basin, the Federal Power Commission does not give mention of any possibilities on Elk Creek.

Industrial

Water supply and potential waste treatment problems restrict industrial development within the Elk Creek watershed. It is assumed that future industrial demand will maintain about the same ratio to municipal requirements as now. Industrial requirements would amount to 15 cfs. This figure could be changed markedly by improvements in waste treatment which would allow the location of pulp and/or paper installations in areas where streams are unable to receive waste of present quantity and quality.

Mining

Needs are not established.

Pollution Abatement

Because of the low summer flows, any increase in waste loading for Elk Creek will have to be accompanied by suitable treatment facilities.

Fish Life, Wildlife, and Recreation

The Game Commission states that Elk Creek is a spawning stream for steelhead trout and silver salmon. With the exception of the section from mile 0 to 3, the upper reaches of the tributaries, and the section above Scotts Valley, the entire network is classed as a spawning area. They would like a flow of 10 cfs, 50 yards above the mouth of Elk Creek, and 5.0 cfs above the confluence of Elk and Pass Creeks. Shortages exist in terms of streamflow during summer months. This has been pointed out under the heading of "Amount and Distribution of Resources." Pass Creek and Yoncalla Creek, tributaries of the Elk Creek, which discharge into it above the community of Drain, have been known to be totally dry during the summer months, and development of agricultural lands in the Yoncalla area and in Pleasant Valley have been restricted.

Flood Control

Flood control problems are local in character and economic solution of these problems are not apparent at this time.

Calapooya Creek

Existing Needs

During the summer months existing streamflows are not sufficient to fill all requirements. Water is insufficient for irrigation, domestic, municipal, fish life, wildlife, recreation, and pollution abatement uses. The minimum flow required to satisfy present needs would approach 30 cfs. There are periods during summer months when this flow is not available.

Future Needs

Future needs on the basis of volume are estimated to be not in excess of 400 acre-feet per day, or a total yearly quantitative demand of approximately 146,000 acre-feet.

Domestic

Present domestic requirements in this watershed are relatively small, amounting to 0.2 cfs, and it is not anticipated that future requirements for domestic purposes will exceed 5 cfs, even with full agricultural development of this area.

Municipal

Projections for municipal use, based on the 1950 census for this area, indicates that requirements will approach 20 cfs for the year 1975. This figure is based on the assumption that growth patterns will follow those predicted by the Douglas County Planning Commission in its report titled, "Character of Douglas County," which was issued in 1955.

Irrigation

Total irrigable lands in the Calapooya Creek watershed amount to 20,000 acres. Total volumetric requirements for water to achieve ultimate development would amount to 50,000 acre-feet per year. On the basis of a diversity factor of 2.0 for irrigation use, flows of 125 cfs would supply maximum irrigation diversion requirement. The acreage indicated includes irrigable land located in the Sutherlin Creek area.

The Bureau of Reclamation points out in its report that a diversion canal once existed which transported water from Calapooya Creek to an irrigation project in Camas Swale near Sutherlin. This venture was a failure, due to a sagging farm economy, drouth, and increased logging operations. The Bureau further indicates that the principal use for future irrigation in the area would be for livestock production.

Power Development

There is no potential for hydroelectric power development within this watershed.

Industrial

Because of water deficiencies, development of secondary wood processing industry of major size in this watershed are unlikely unless the necessary water is supplied from storage or transported into the watershed from the North Umpqua or the Lower Umpqua Rivers. Assuming a possibility for small secondary wood processing growth, industrial needs are projected to be 2.0 cfs.

Mining

Future requirements are unknown.

Fish Life, Wildlife, and Recreation

The Game Commission indicates that the main stem of the Calapooya Creek from two miles above its mouth to its headwaters are spawning grounds for steelhead trout and silver salmon. The lower two or three miles of Hinkle, Gassy, Bachelor, and Oldham Creeks are also spawning areas for these species, as well as a four-mile section of Pollock, beginning two miles above its confluence with the Calapooya Creek. This flow could be accomplished for a period of 120 days if storage were available in the amount of 3,000 acre-feet.

Pollution Abatement

Requirements for the future are estimated to be 15 cfs, exclusive of pulp and paper or other major industrial wastes.

Flood Control

Flooding problems in the Calapooya watershed are largely local in nature and consist of erosion of stream banks and inundation and deposition of debris upon the farm lands of the watershed. Localized problems are experienced in Oakland, but would not appear to be of major importance to the purposes of this study. Any storage of flood water would, of course, alleviate this problem.

STATUS OF NEEDS TO AVAILABLE RESOURCE

Lower Umpqua River

With a total yield at the Elkton gage ranging from 2 to 9 million acre-feet annually and a total foreseeable basin consumptive need of approximately one-half million acre-feet per year, total resources are adequate.

During low flow periods, main stem resources can meet the requirement of present use for consumptive purposes and still maintain desirable minimum flows for nonconsumptive public uses. Utilization of legally established but, to date, unused rights would reduce flows below desirable

minimum levels upon occasion. Analysis of records shows that mean monthly flows below 1000 cfs have occurred in 42 out of 612 months of record with an average recurrence interval of approximately 14 months. The large volume required to meet minimum desirable flows for fish, a commitment of approximately 440,000 acre-feet annually, amounts to 20 percent of the total resource of the Lower Umpqua River in a minimum year.

During the low flow period of the year, flows would not be sufficient to receive large quantities of untreated, or inadequately treated, industrial or municipal wastes. Low flow conditions are much less critical on the Lower Umpqua River than on the major tributaries.

Smith River

Volumetrically, there is sufficient water in the Smith River watershed to supply all foreseeable watershed needs.

Status of available resource to needs, future and present, in terms of immediate demand, can only be assumed. The limited flow records at Smith River Falls and the limited precipitation records (four years, all incomplete) point to a typical coastal range stream summer flow pattern. Storage would be necessary to increase minimum flows during summer months.

Mill Creek

There is sufficient total resource to satisfy all the needs in the Mill Creek watershed. However, summer flows are inadequate to meet needs of the future. For fullest utilization of the resource, storage is required. By storage, at or above Loon Lake, flows can be controlled for power production; for critical flow improvements for fish life below Loon Lake; for pollution abatement below Loon Lake; for general recreation advantages of a more stabilized streamflow; and for irrigation water from reservoir supply for the limited remaining agricultural lands if such a project should be built.

Elk Creek

Foreseeable volumetric requirements of the Elk Creek watershed total less than 80,000 acre-feet annually. Total watershed resources amount to approximately 250,000 acre-feet in a minimum yield year.

Mean monthly flows during the late summer months are seldom adequate to meet consumptive and nonconsumptive requirements. Low flows, less than 10 cfs at the mouth of Elk Creek, are not uncommon. Fisheries requirements alone amount to 15 cfs. Desirable flows for all foreseeable needs should total close to 90 cfs with residual flows at the mouth of Elk Creek approaching 35 cfs.

Calapooya Creek

The future needs of the Calapooya Creek watershed are estimated at a maximum of 400 acre-feet per day during the maximum demand period. Volumetrically, there is sufficient yield in the watershed to supply all needs. Distribution in terms of tributary yield and point of need are not compatible. Summer flows are insufficient to fulfill the needs for both consumptive and nonconsumptive uses.

METHODS OF RESOURCE DEVELOPMENT

Lower Umpqua River

Analysis of the main stem of the Lower Umpqua sub-basin indicates that any development along this section would have value primarily for power and navigation purposes. In general, projects in this section would provide no major flood control benefits, since they would all be located below the areas subjected to the greater percentage of the damage from the floods in the Umpqua Basin. Benefits that would accrue from the storage of water would be restricted to the lower sections of the river and would still require individual development and pumping from the channel. Major reservoir sites would flood out some of the most valuable and high developed agricultural areas of the Umpqua Basin.

For specific information relative to the power potentials of the main stem, reference is made to U. S. G. S. Water Supply Paper 636-F.

It does not appear that there is any economic potential for multipurpose water resource development of significance on the main stem of the Lower Umpqua River in the foreseeable future. Potentials for power development would probably be physically and economically feasible if evaluated from the point of view of single use of the resource. Before specific possibilities can be deemed acceptable, full evaluation of their

effect on the fisheries resource must be made.

There are areas within the Lower Umpqua sub-basin where watershed treatment and management would be physically desirable. Suitable criteria and data for determining cost and benefit are not available to evaluate the contribution of any resource augmentation or conservation program based on watershed management.

Smith River

For the foreseeable future, the primary key to development of water resource of the Smith River watershed is water management and regulation through storage.

Storage Possibilities

The total storage potential for the Smith River watershed is approximately 307,000 acre-feet and the yield of the watershed is approximately 600,000 acre-feet of water per year. Of the total storage, 77,000 acre-feet is on the North Fork of the Smith River, considered by the Oregon State Game Commission to be an excellent spawning stream for silver and chinook salmon and steelhead trout. The other 230,000 acre-feet of storage is concentrated in reservoir sites in the vicinity of the town of Gunter. Utilization of a potential damsite approximately three miles downstream from Gunter could develop any amount of storage up to the practical yield of the drainage area above the site which is estimated at 100,000 acre-feet per year. Active storage of only 60,000 acre-feet of water at this site would provide a sustained flow at Smith River Falls of 300 cfs for a period of 100 days.

The storage potentials indicated above are based on rough reconnaissance data and show the physical potential for impoundment as determined from the examination of topographic maps and very limited field observation.

Information has not been obtained on geology, detailed hydrology, or costs and benefits which are factors essential to the development of project specifics.

Other Methods

There are none that offer any material advantages at this time.

Mill Creek

There is little interest in water resource development within the Mill Creek drainage area. Present problems are insignificant with the exception of minimum flows for fish. Existing problems of consumptive nature are insignificant.

Storage Possibilities

A U. S. Geological Survey of a localized nature indicates that total storage potential for the area at Loon Lake is about 150,000 acre-feet; at the lower Lake Creek site, 50,000 acre-feet. This capacity for storage approaches the average annual yield of record for the watershed. Such storage, if developed, probably would provide full regulation of the watershed (above Loon Lake) yield in a year of average yield.

The reconnaissance investigations of the Board show potential for storage on Camp Creek, which is one of the primary tributaries of the Mill Creek watershed. In the vicinity of the confluence of Camp Creek and Little Camp Creek, potential exists for storage with a maximum capacity of some 40,000 acre-feet. Map reconnaissance indicates that structural sites may exist in township 23S, range 9W, section 12. No specific site evaluation has been made relative to structural possibilities or limitations. Storage of this capacity could provide for full regulation of the flow of the Camp Creek drainage above this point in a normal runoff year.

Other Methods

None

Elk Creek

Full development of the Elk Creek watershed is dependent upon the storage of water. Total storage potential amounts to 430,000 acre-feet. Substantial portions of this storage potential have been ruled out on the basis of reconnaissance investigations.

Storage Possibilities

Bully Creek, a tributary of Elk Creek, discharging into the main stem about two miles downstream from Drain, has a 80,000 acre-feet

site approximately two and one-half miles upstream from its mouth. However, based on precipitation records, the yield to this drainage area would not exceed 28,000 acre-feet.

A site exists on Elk Creek, approximately two miles above the community of Drain. This site has a potential storage capacity of 220,000 acre-feet, but the average yield to this reservoir would not exceed 115,000 acre-feet. In addition, the utilization of this site would inundate the entire Scotts Valley area and a two mile section of new U. S. Highway 99. Because of the very rugged topography adjacent to the highway, it would be necessary to relocate considerably more than the two miles which would be inundated by the construction of a structure at this point.

A structural site exists at the mouth of Scotts Valley with a storage potential of 100,000 acre-feet. Yield to this reservoir would amount to approximately 75,000 acre-feet. Here, too, the same section of U. S. Highway 99 would be inundated, but relocation problems would be somewhat decreased.

Reference has been made by interested parties to a potential site in the area known as Shoestring Valley. A reservoir in this area would have a potential storage capacity of 30,000 acre-feet, but the yield to this reservoir would not exceed 12,500 acre-feet in a year of normal precipitation. The physical formation of the area is such that a dam built to store what the watershed would normally yield would probably not be economical, as it would take an 80-foot structure to store a 12,500 acre-foot yield.

There is a potential site in the vicinity of the community of Elkhead. In this area a 160-foot dam could store 80,000 acre-feet of water, a volume far in excess of the amount of water available from this watershed in terms of yield. With an 80-foot structure in this same location, a reservoir could be developed whose potential would approximate 16,000 acre-feet of storage. The yield to this storage would be approximately 26,000 acre-feet.

If all storage that appears at all possible to develop were constructed, the total storage provided would amount to 105,000 acre-feet. This would probably be sufficient to provide for all needs since natural flows would generally take care of requirements during the winter months of the year and storage could be utilized for discharge at low flow periods. If studies

should indicate that the Scotts Valley site is not economical, then the total practical storage potential of this watershed would be 54,000 acre-feet, an amount insufficient to supply all future needs for the resource within this watershed.

Suggestions have been made that an inter-basin diversion from the Coast Fork of the Willamette River should be investigated. Reconnaissance investigations of this item indicate that there is not enough water available from the Coast Fork of the Willamette in the area of London Springs, which is the only logical point for inter-basin diversion, to justify the construction of a tunnel or pumping facility to transfer this water over the divide.

Other Methods

There are possibilities of utilizing some watershed management techniques in this watershed but the costs and benefits that would be attendent to such a program have not been established.

Calapooya Creek

The reconnaissance studies on storage potential for the Calapooya watershed indicate that potential does exist for storage development within the watershed. A number of possibilities were investigated in a preliminary sense, and a summary of the various possibilities and their limitations is indicated under the subsection entitled, "Storage Possibilities". As indicated previously, the range of storage potential at a given site is so large that an analysis based on maximum potential results in the development of storage capacities which are in a real sense quite impractical. This is particularly true in the Calapooya watershed where a specific site may offer possibilities for a structure anywhere from 80 to 320 feet in height with a storage potential varying from 27,000 acre-feet to 250,000 acre-feet. Practical limitations on the development of a specific site depend upon the purposes which must be fulfilled, the economics of the structure, the availability of water to fill the reservoir, and a number of other items which cannot fully be considered in the reconnaissance investigation. Individual sites examined on a reconnaissance basis for physical storage potential only follow :

Storage Possibilities

The Bureau of Reclamation has investigated a site located on Gassy Creek, a tributary of the main stem of Calapooya Creek. In its report, the Bureau indicates that the runoff would be inadequate to meet irrigation requirements and would require a feeder canal to take water from Calapooya Creek. The need for a diversion dam and feeder canal would make the cost per unit of storage quite high for this development. The total storage capacity of this site has not been fully determined. The primary disadvantage of the Gassy Creek site is the fact that it would offer no material flood control benefits since it is on a tributary stream and controls but a small portion of the watershed of the Calapooya Creek. Drainage area controlled by this site would approximate 10 square miles, or 6400 acres.

Possibilities of an impoundment structure immediately below the confluence of Oldham Creek and Calapooya Creek were investigated. A 160-foot dam in this general location would provide storage capacity somewhere in excess of 100,000 acre-feet. A structure at this point would control a drainage area of approximately 148 square miles, nearly 95,000 acres of the upper Calapooya watershed, including Bachelor Creek, Oldham Creek, and the main stem of the Calapooya Creek above Camas Swale. Precipitation levels for this watershed are such that the capacity of this reservoir could be supplied in most years.

Primary disadvantages of this site are that a long structure would be required because the valley at this point is relatively wide; the greater part of the reservoir area contains lands that are excellent for irrigation development; substantial relocation of county roads would be required; some dislocations would occur in the area of the community of Fair Oaks.

Limited possibilities for a reservoir exist on Oldham Creek in the southwest quarter of section 30, township 24S, range 4W. An 80-foot structure at this location would provide a maximum storage of 17,000 acre-feet. Since the width of the valley at this point would require a fairly long structure, it is doubtful that this development would be economically feasible.

Storage on the main stem of the Calapooya Creek below the community of Oakland is not feasible, since the available sites in this area

would inundate the very land presumed to benefit from such development.

The Coon Creek storage site, located on Coon Creek one mile above its confluence with the Calapooya at stream mile 6, has a potential of 40,000 acre-feet. The yield from its drainage area would not be more than 17,000 acre-feet in the normal year and less than 9,000 acre-feet in a minimum year. The only use for water stored at this site would be for irrigation in the valley below the community of Oakland.

On Williams Creek, whose confluence with Calapooya Creek is at river mile 8, there is a potential storage of 120,000 acre-feet. This site would inundate the area known as Green Valley if sufficient water were available to fill the reservoir. From a total drainage area of 10,000 acres, the normal yield would approximate 28,000 acre-feet per year and construction of a dam to utilize maximum site capacity would be impractical. Construction of an 80-foot dam one mile above the mouth of Williams Creek could provide for storage of 20,000 acre-feet of water, very nearly the total yield of this drainage area. This water could be utilized for irrigation of the valley lands downstream from Oakland. Because benefits other than irrigation are lacking, this site does not appear economically feasible.

The Hinkle site investigated by the Bureau of Reclamation which is located in section 29, township 24S, range 3W, is the most upstream reservoir site whose potential for storage is in excess of 10,000 acre-feet. Storage potentials at this location are substantially in excess of the 27,000 acre-feet indicated by the Bureau of Reclamation as being required to supply irrigation water for lands which could be served from this location. If a structure over 200 feet high should prove structurally sound and economically feasible at this location, storage would probably be on the order of 100,000 acre-feet or more.

The Corps of Engineers is also examining this site to determine its suitability for inclusion as an increment in the needed flood control plans for the Umpqua system. Preliminary indications are that flood control benefits will be limited. Total damages in the Calapooya Creek watershed were less than $31,000 during the 1955 flood. A flood of that significance every other year would provide damage benefits of less than $16,000 annually. Even including enhancement values, flood control benefits could hardly exceed $20,000 annually.

These benefits will have to be supplemented from other sources if a project at this location is to be economically feasible. Major foreseeable benefits are irrigation and enhancement of the fisheries resource. Because of their potential significance in the development of multi-purpose water resource projects in the Umpqua system, the fisheries potentials deserve specific comment.

The Oregon Game Commission, in preliminary evaluations, indicates enhancement to the extent of a silver salmon spawning population totaling about 3500 fish; and approximately equal commercial (ocean troll) catch; approximately 1000 winter steelhead; an increase of approximately 1500 angler days of trout fishing below the project; and the creation of additional trout fishing in the reservoir.

Figures are based on reasonably dependable water supply, adequate rearing and protection facilities. Rearing facilities would mitigate losses above the project by providing spawning, holding ponds, egg-taking and hatching facilities for approximately 300 silver salmon and 100 winter steelhead trout.

Gross benefits may approximate 50 percent of the irrigation benefits. Separable capital costs, charged to additional fish facilities, are estimated at less than one-half of one year's benefits. Operation and maintenance is pegged at approximately three percent of annual benefits.

Since power does not appear to be justified, irrigation and fish life may carry the economic burden for this potential development.

The primary problems connected with development of this site are the relocation of the Weyerhauser Timber Company logging railroad which runs directly through the reservoir area from the potential site nearly to the upper end of the reservoir. This development would also require the abandonment or relocation of the Weyerhauser switching yard housing, and office buildings which are located at the confluence of Coon Creek and Calapooya Creek in section 21, township 24S, range 3W.

Sufficient data was not available to determine accurately the yield capacity of the drainage area above the reservoir site. However,

it has been indicated by the Bureau of Reclamation that normal yields to this site will be in the neighborhood of 70,000 acre-feet per year.

Although further investigation is required for this drainage area, there is potential for water resource development that would alleviate, at least in part, existing problems and provide for future needs.

Other Methods

Watershed management is a possibility but data on its practicality as a major corrective device is unestablished.

LOWER UMPQUA

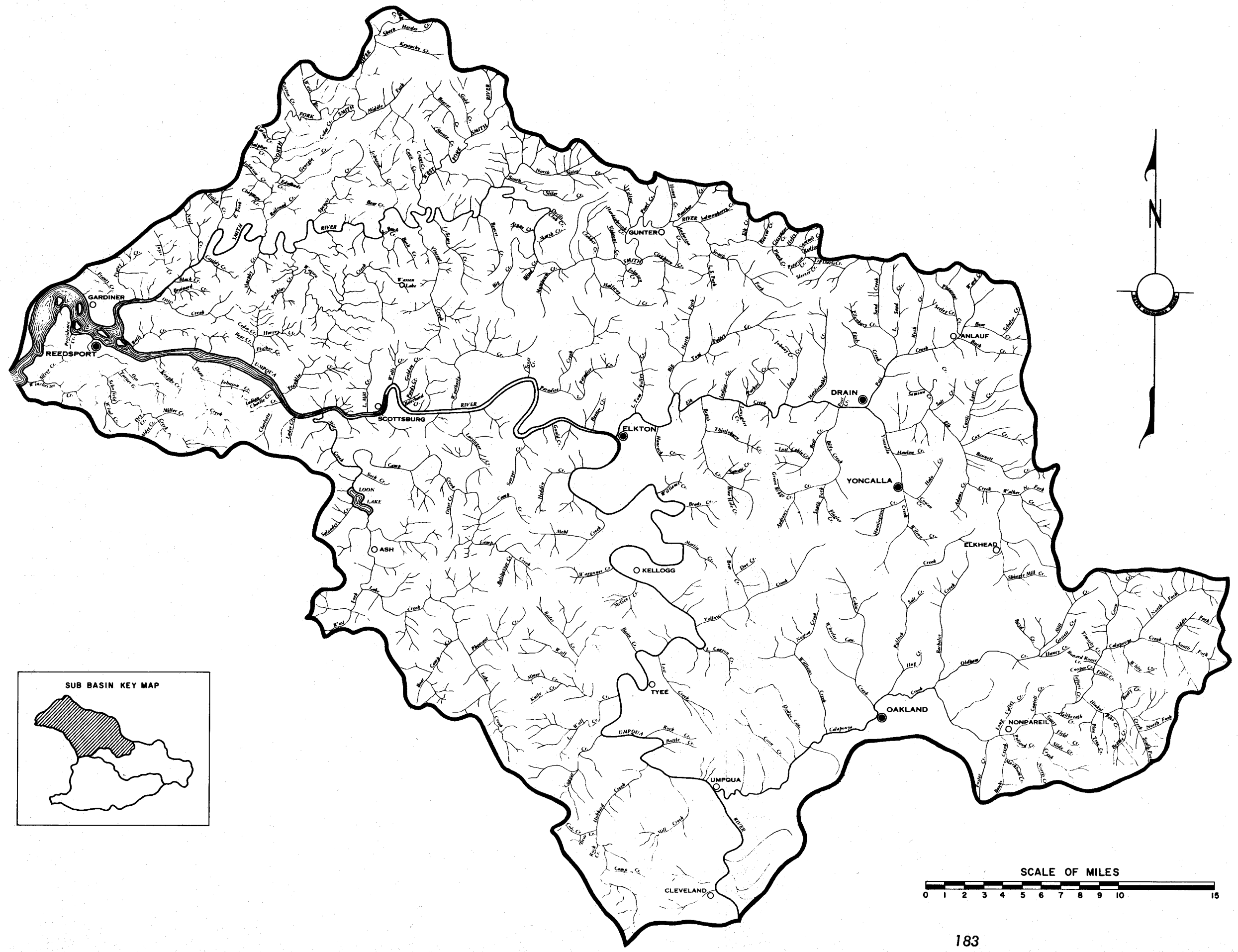
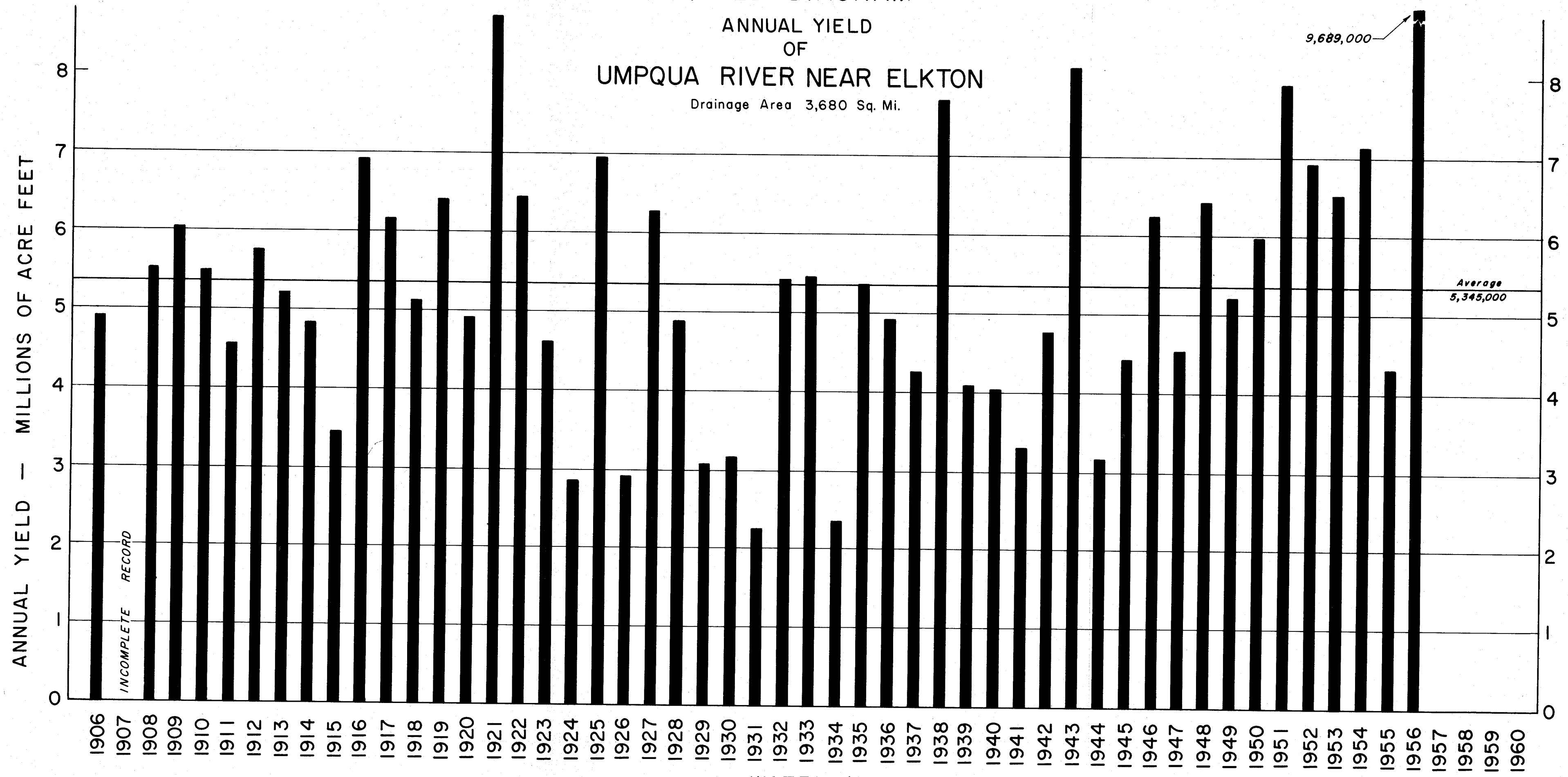


FIGURE 34

YIELD DIAGRAM

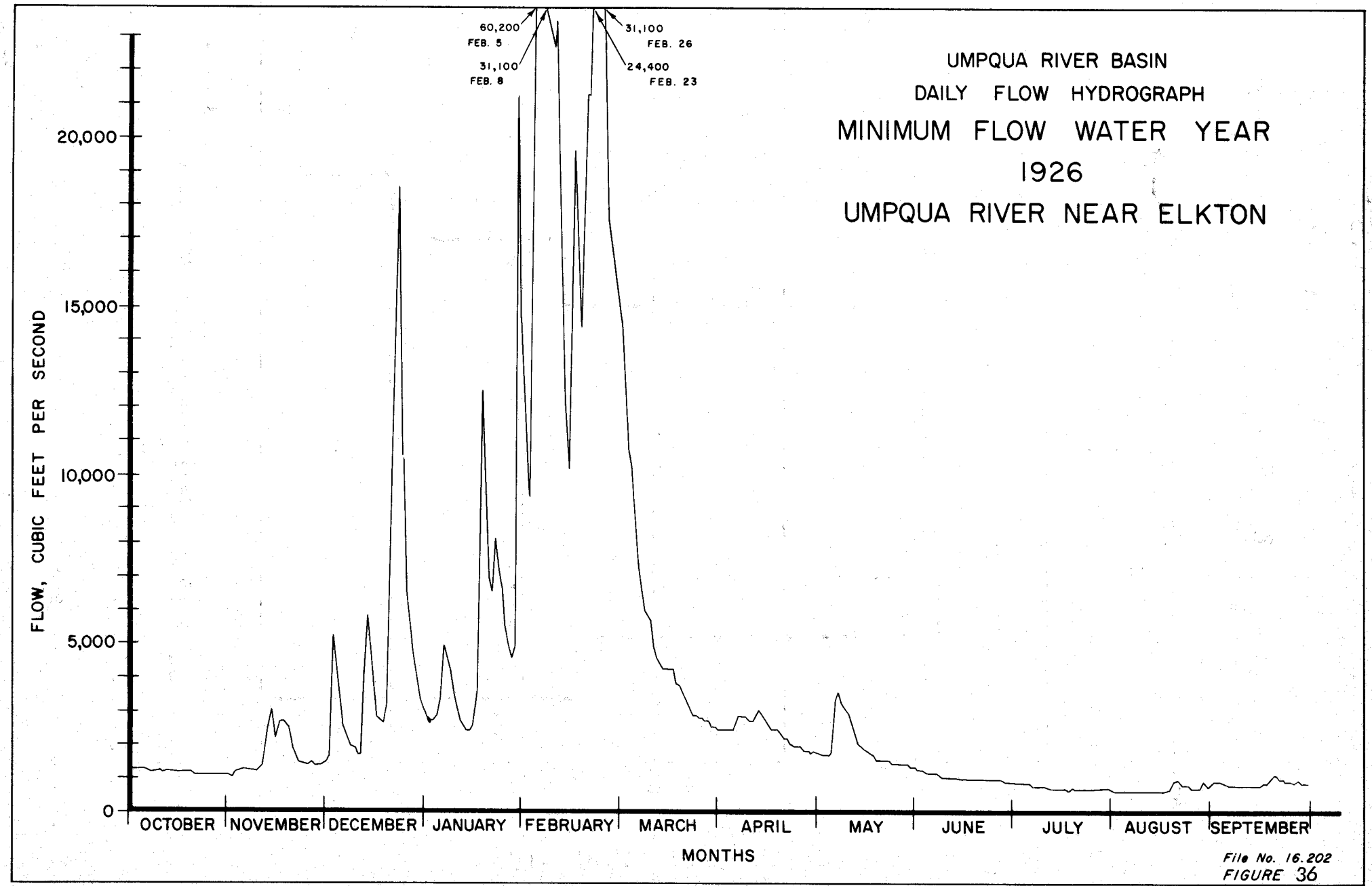
ANNUAL YIELD OF UMPQUA RIVER NEAR ELKTON

Drainage Area 3,680 Sq. Mi.



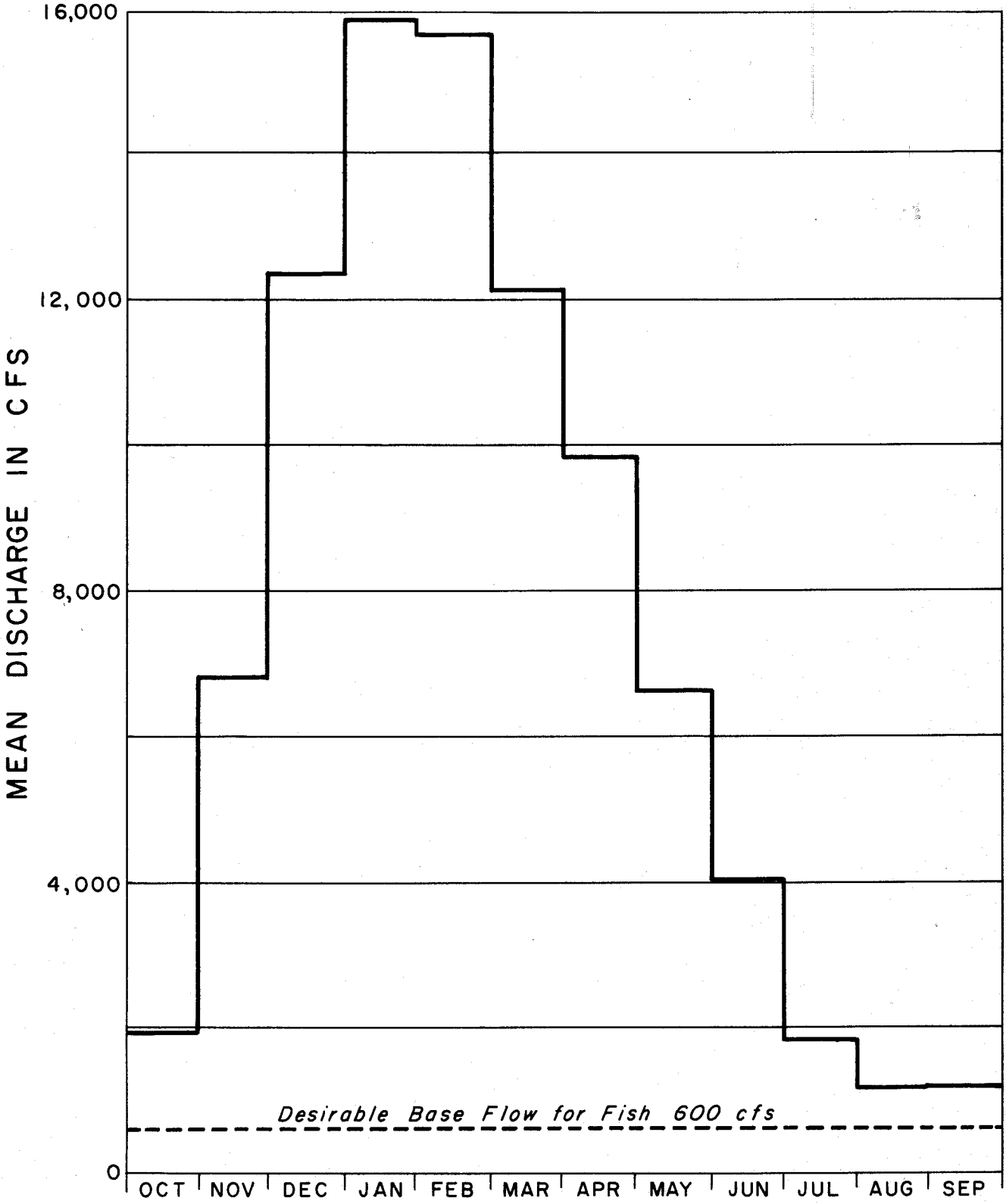
16.220

FIGURE 35



File No. 16.202
FIGURE 36

UMPQUA RIVER BASIN
MEAN MONTHLY HYDROGRAPH
UMPQUA RIVER AT ELKTON



YEARS OF RECORD 1906 - 1956

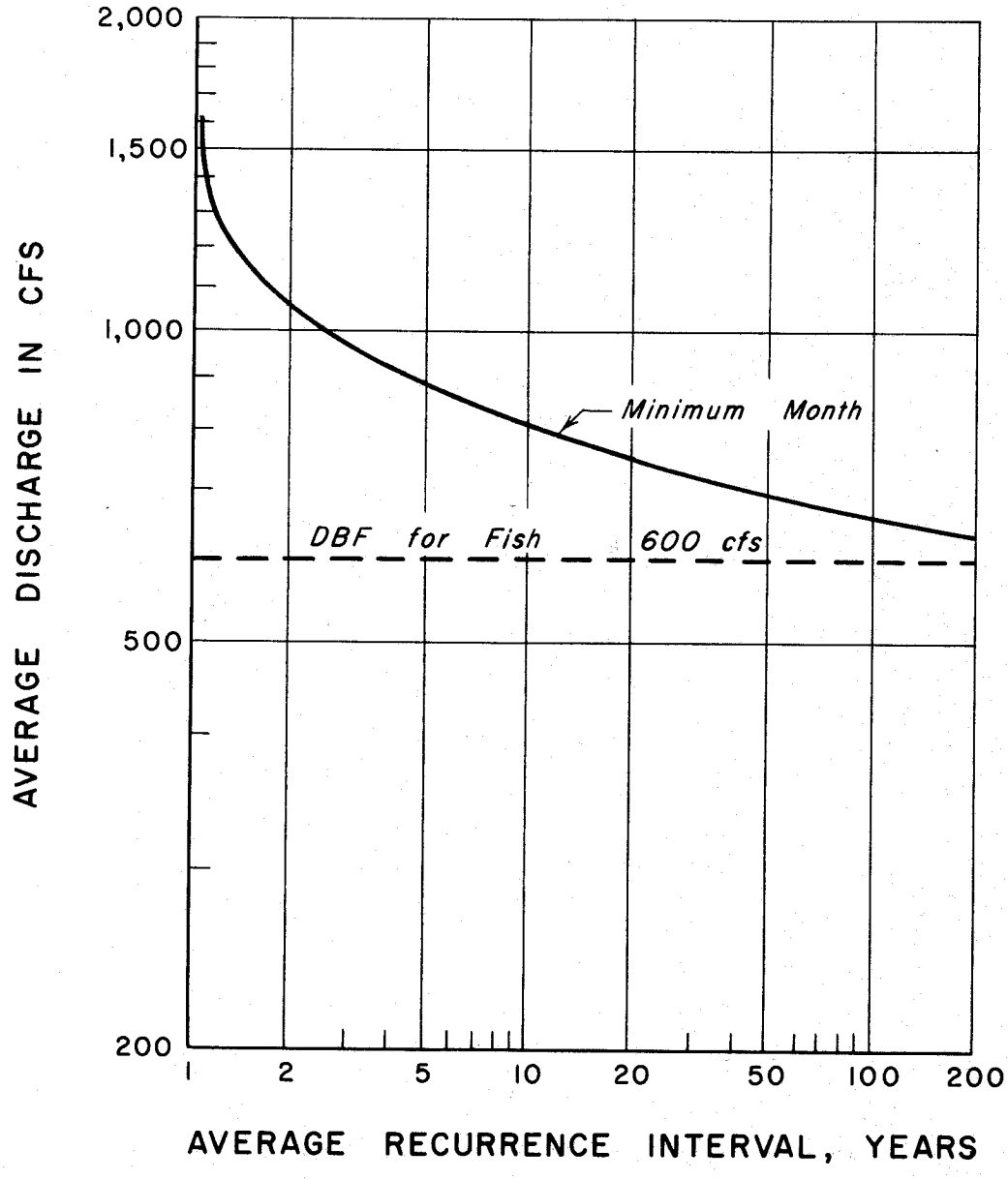
File: 16.202

FIGURE 37

UMPQUA RIVER BASIN

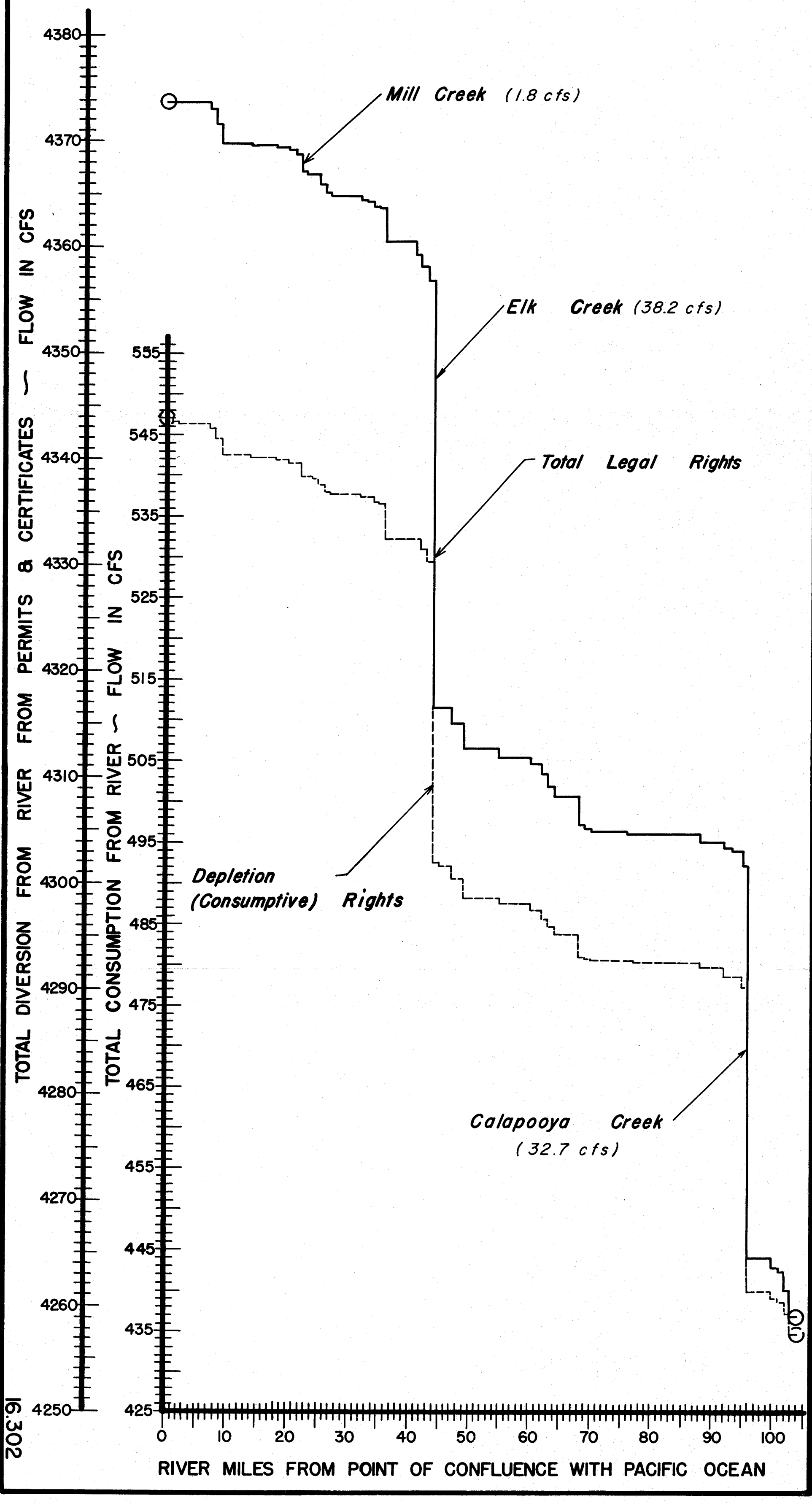
UMPQUA RIVER AT ELKTON

LOW FLOW FREQUENCY CURVE
AND
DESIRABLE BASE FLOW FOR FISH



Drawn: Jan., 1958
File No. 16.203
FIGURE 38

DEPLETION RIGHTS VS RIVER MILES ON UMPQUA RIVER & TRIBUTARIES



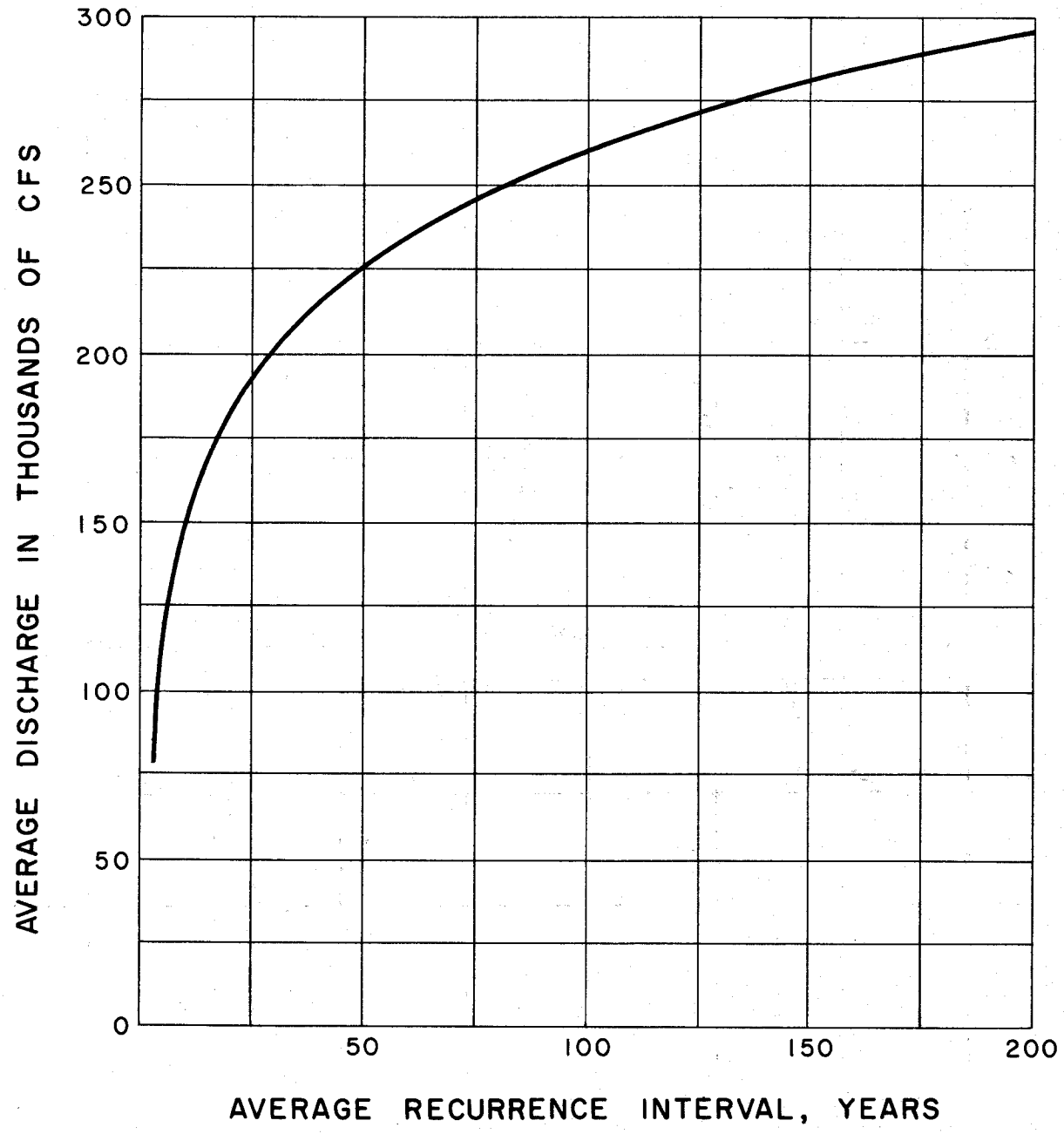
16.302

FIGURE 39

UMPQUA RIVER BASIN

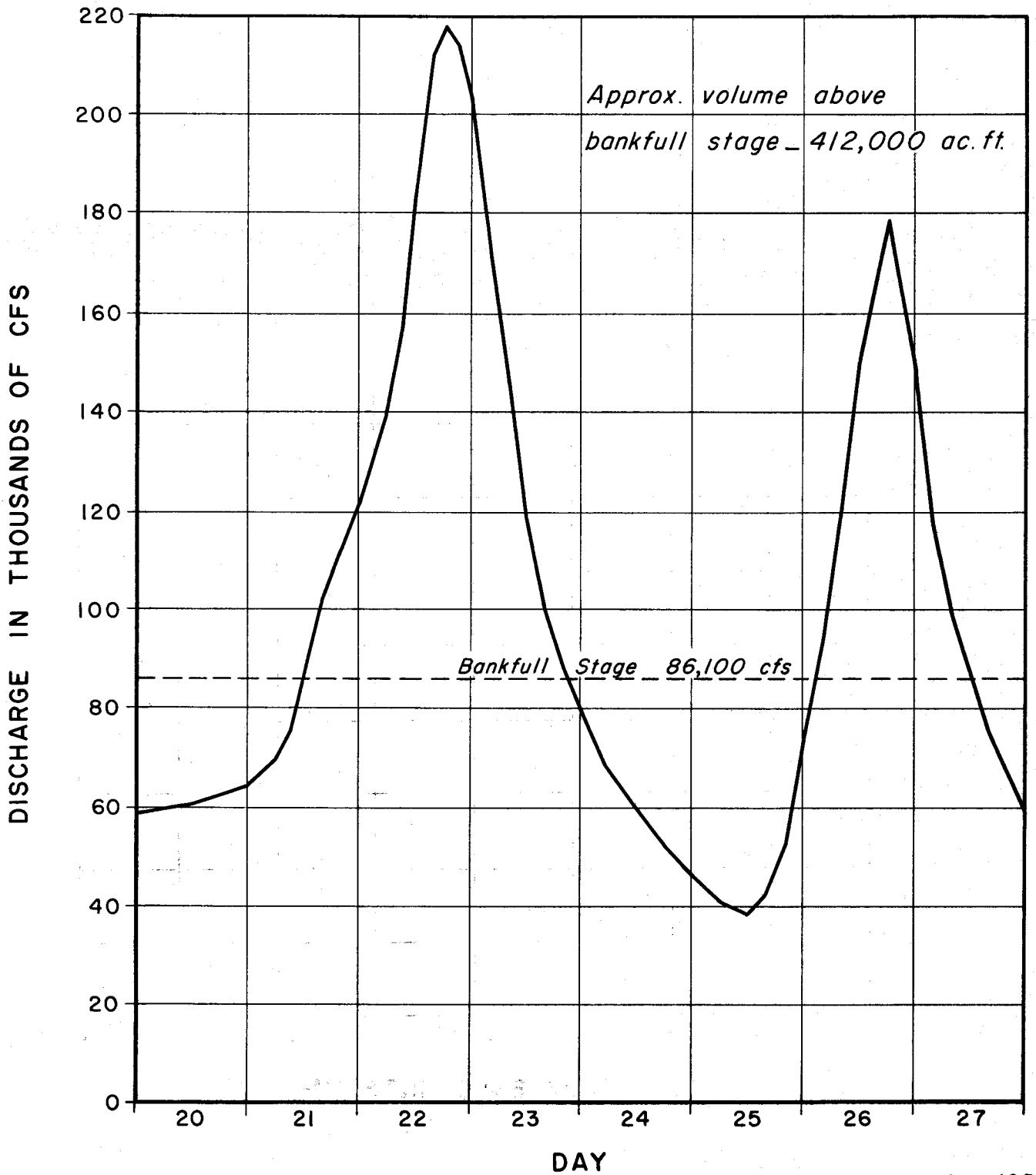
UMPQUA RIVER AT ELKTON

FLOOD FREQUENCY CURVE



Drawn: Dec., 1957
File No. 16.203
FIGURE 40

UMPQUA RIVER BASIN
FLOOD HYDROGRAPH
UMPQUA RIVER AT ELKTON
DECEMBER 1955



Drawn: Jan., 1958
File No. 16.202
FIGURE 41

LOWER UMPQUA

MINERAL DEPOSITS

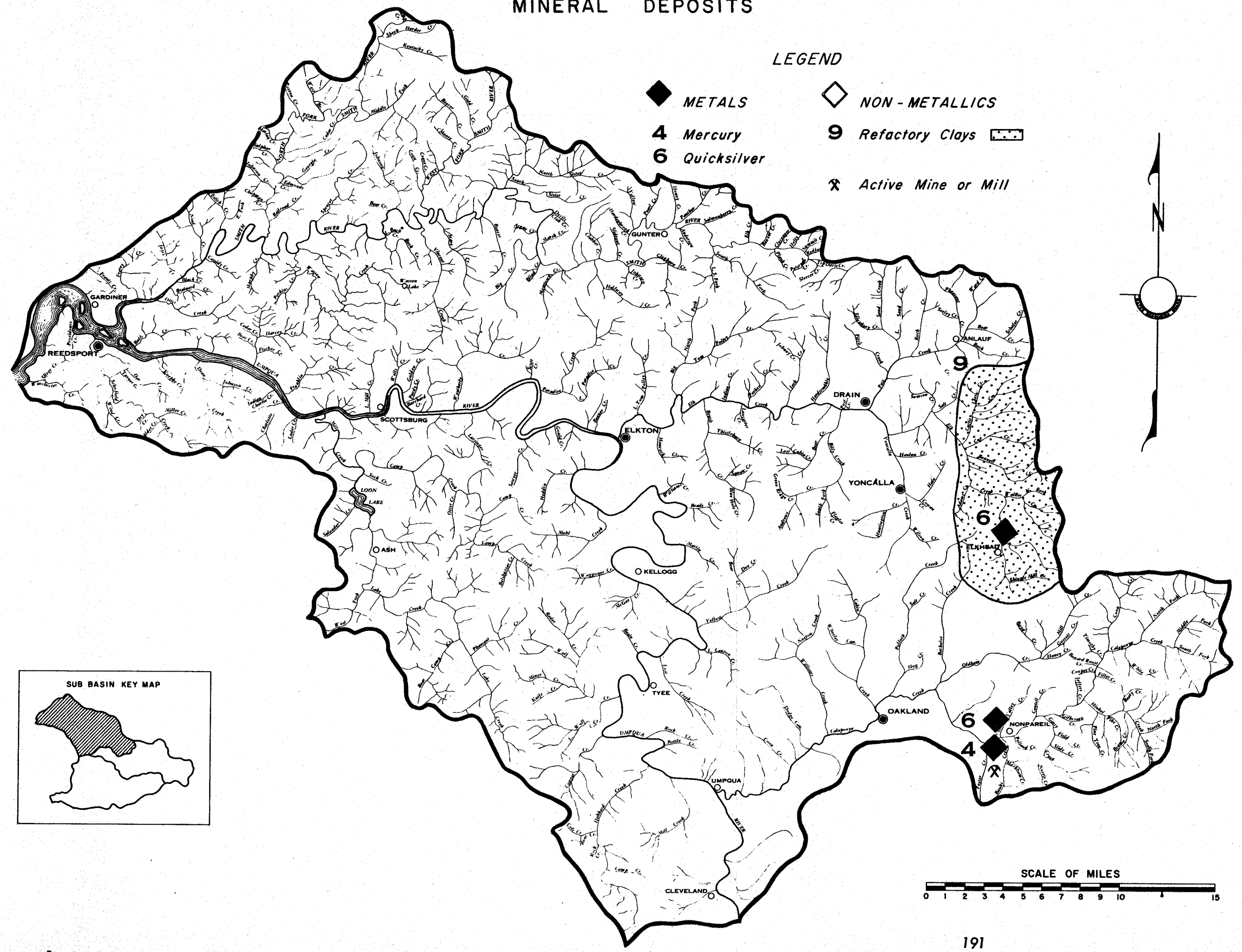


FIGURE 42

TABLE 19

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

LOWER UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
Main stem Umpqua River	600	4 mi. south of Elkton
Winchester Creek	2	head of tidewater
Schofield Creek	3	head of tidewater
Smith River	20	at falls
" "	10	Gunter
North Fork Smith R.	12	4 mi. above mouth
Wassen Creek	5	head of tidewater
Spencer Creek	3	mouth
West Fork Smith R.	5	mouth
Dean Creek	2	head of tidewater
Mill Creek	12	head of tidewater
Camp Creek	6	mouth
Lake Creek	6	mouth
Paradise Creek	5	mouth
Elk Creek	10	mouth
" "	5	above Pass Creek
Big Tom Folley Creek	3	mouth
Brush Creek	3	mouth
Hardscrabble Creek	3	mouth
Billy Creek	3	mouth
Pass Creek	3	mouth
Sand Creek	2	mouth
Yellow Creek	3	mouth
Wolf Creek	3	mouth
" "	2	above Little Wolf Cr.
Little Wolf Creek	2	mouth
Hubbard Creek	5	mouth
Calapooya Creek	12	mouth
" "	6	above Hinkle Creek
Cabin Creek	2	mouth
Pollock Creek	2	mouth
Oldham Creek	3	mouth
Hinkle Creek	3	mouth

* As requested by the Oregon State Game Commission.

APPENDIX

ABBREVIATIONS AND SYMBOLS

ac	acre
Approx.	Approximately
Av.	Average
BOD	biochemical oxygen demand
cfs	cubic feet per second
Chlor.	Chlorination
Circ.	Circular
Coagu.	Coagulation
COPCO	California-Oregon Power Company
Cr.	Creek
DBF	desirable base flow
Don.	Domestic
E.	East
Fig.	Figure
ft.	feet or foot
Indust.	Industry
Irrig.	Irrigation
KW	kilowatts
KWH	kilowatt hous
mi.	miles
min.	minimum
Misc.	Miscellaneous
msl	mean sea level
Mtn.	Mountain
Munic.	Municipal
N.	North
ORS	Oregon Revised Statutes
O & C	Oregon & California Revested Lands
Pop.	Population
R.	River
R.	range
Rd.	Road
S.	South
Sec.	section
Sq. Mi.	square miles
Twp.	Township
USGS	United States Geological Survey
W.	West
WSP	water supply papers

APPROXIMATE HYDRAULIC EQUIVALENTS

1 acre foot

= *a volume 1 acre in area and 1 foot in depth*
= *326,000 gallons*
= *43,560 cubic feet*
= *0.5 cubic feet per second for 1 day*

1 cubic foot per second

*falling 8.8 feet will produce 1 horsepower**
*falling 11.8 feet will produce 1 kilowatt**
= *7.5 gallons per second*
= *450 gallons per minute*
= *2.0 acre-feet per day*
= *650,000 gallons per day*

1 inch per day

= *0.04 cubic feet per second per acre*
= *27 cubic feet per second per square mile*
= *19 gallons per minute per acre*

1 inch per hour

= *1.0 cubic feet per second per acre*
= *640 cubic feet per second per square mile*
= *450 gallons per minute per acre*

1 million gallons per day

= *690 gallons per minute*
= *1.5 cubic feet per second*
= *3.0 acre-feet per day*

* *theoretical for water at standard conditions*

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