UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
4012 Federal Building, Salt Lake City, Utah 84138

July 13, 1973

E.L. Noble, Forest Service
Ray Lanier, Economic Research Service

Attached is a copy of Appendix III, "Irrigation Water Management", Sevier River Basin, Utah. Would you please make any comments or suggestions you feel are appropriate by July 25, 1973.

The Irrigation System Maps included cover Sub-basin A only. The balance of the river system maps will be included in the published report.

Sincerely,

Harold Brown, for
A.W. Hamelstrom
State Conservationist

Attachment

cc: w/attachment
John Schmidt (7)
Dan Lawrence
Paul Tilker, SCS, Portland (2)
Dee Hansen, State Engineer (4)
Max Keetch
Dave Wilson
David Crandall
Carl Carpenter
Ted Arnow (2)

Copies sent to Stanley Green, Bruce Whited, and Roger Walker by copy of this letter.

APPENDIX III

IRRIGATION WATER MANAGEMENT

SEVIER RIVER BASIN, UTAH

United States Department of Agriculture

Economic Research Service • Forest Service • Soil Conservation Service

March 1973

IRRIGATION WATER MANAGEMENT

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IRRIGATION WATER MANAGEMENT

CHAPTER I

I N T R O D U C T I O N

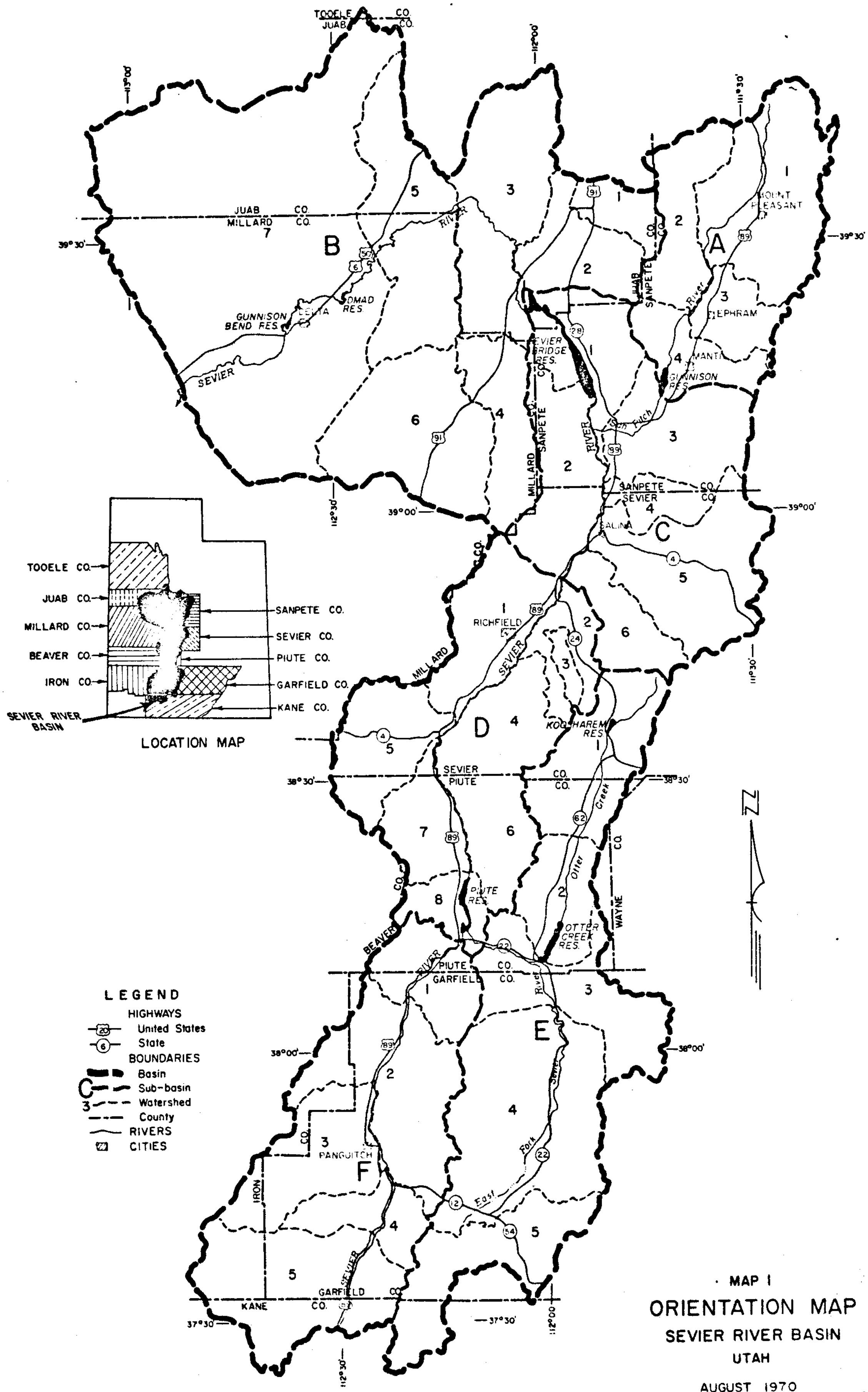
SCOPE OF REPORT

This appendix presents basic data collected and evaluated during the investigation of the Sevier River Basin relative to the management of irrigation water. For related information, other appendices and the Summary Report should be consulted.

The study of the Sevier River Basin was reconnaissance in nature, therefore, most of water management phases were investigated only to the detail required to meet the objectives of the Plan of Work. As the study progressed, it became apparent more detail was needed in some areas of consideration. Also, the desires of the sponsors indicated additional work in other areas would be of value.

Water rights along the Sevier River are described in general terms only to acquaint the reader with the complexity of the system. No attempt has been made to justify their existance or propose changes.

Topographic resurveys of the major reservoirs are discussed in detail. These were made for two purposes; to determine the amount of sediment deposition and update the area-capacity tables for management. Analysis of the reservoirs is discussed in Appendix IV, "Water Budget Analysis".



MAP 1

ORIENTATION MAP

SEVIER RIVER BASIN

UTAH

AUGUST 1970

SCALE IN MILES

Detailed maps of the irrigation systems are included along with a brief discussion of the irrigation companies and groups. This includes diversion records and canal condition classification. Also included are data and analysis of root-zone supply-frequency studies and a treatise on the value of irrigation water.

The Sevier River system depends on return flows to maintain the established regimen. This is discussed briefly along with the factors that influence these flow patterns.

INVESTIGATION PROCEDURES

The study of the Sevier River Basin utilized secondary data for most of the analysis and evaluation. Some field work was necessary to supplement basic data but this was minimal.

Basic data on stream flows and ground water collected and published by the U. S. Geological Survey, Sevier River Commissioner reports showing records of diversions, irrigation company records and many other sources of data were used to evaluate and analyze the management patterns of irrigation water. In areas where records were unavailable, diversions were estimated through correlation procedures, knowledge of technicians and water users in the area, and judgment. In some cases, diversions were determined during analysis of water budgets.

Mapping of irrigation systems was on mosaics at a scale of 1 inch equals 2 miles using reconnaissance methods in the office and field. Distribution systems were mapped only as far as irrigation companies assumed responsibility for maintenance.

Topographic resurveys of four storage reservoirs, Otter Creek, Piute, and Sevier Bridge Reservoirs and an original survey of Gunnison Reservoir were made using third order survey criteria for field horizontal and vertical ground control. Plotting of contours was accomplished from low level aerial photography using Kelsh-plotter methods.

PHYSICAL SETTING

The Sevier River is one of the most completely consumed rivers in the United States. Less than 1 percent or 44,840 acre-feet of the total precipitation of 6.5 million acre-feet is not consumed within the Basin, and of this amount, only 13,690 acre-feet is discharged into Sevier Lake.

Total water consumption in the water-budget areas is 1,103,540 acre-feet annually with agricultural and related uses accounting for 99 percent. Water consumed on lands outside the water-budget area, including the mountain watersheds, totals 5,351,620 acre-feet annually.

Nonconsumptive uses of the surface-water resource are also important. Uses related to recreation include boating, fishing, and maintaining waterfowl habitat. Industrial use of water is small at present, but is increasing in importance. Some water is used to transport waste and sewage.

Lake and reservoir storage facilities are an important part of the water resource scheme. The storage capacity of all reservoirs above Piute Dam is 50,000 acre-feet more than the total undiverted average annual tributary inflow. This provides a management capacity adequate to store all runoff that occurs 7 out of 10 years and provides carryover storage for drier years. This does not preclude the need for additional storage as there are still areas where regulatory storage is needed to provide more stable flows for late summer use.

Present storage below Piute Dam is 306,960 acre-feet or 65,000 acre-feet more than the undiverted runoff. This will store the supply that could be expected 4 out of 10 years. Here again, some local irrigation companies need additional storage to regulate their supply.

The Sevier River is characterized by a series of ground water reservoirs along the river, each separated from the ones upstream and downstream by a relatively impermeable underground geologic dam. According to groundwater studies by the U. S. Geological Survey, these groundwater reservoirs in the Sevier River Basin contain over 5,470,000 acre-feet in the upper 200 feet of the alluvial fill. These reservoirs are filled by water from the river channel as it traverses the valley, deep percolation from irrigation, from precipitation, and from tributary inflow entering the valley as ground water.

When the reservoir is full, it spills over the relatively impermeable groundwater barrier and contributes to the downstream flow of the river. As the soil profile become saturated, waterlogging of land occurs thus enabling high-water-using vegetation to grow.

Conversely, as the supply of water declines or when large volumes are pumped from the aquifers, the water table is lowered, drying up wet areas with a subsequent decrease in consumptive use. When this happens, water which normally drains to the river as return flow percolates downward to refill the groundwater reservoir and reduces the river outflow.

The groundwater basin in Watershed B-7 reacts similarly except there are no distinct boundaries and the water is moving across the watershed in a west to southwesterly direction.

Interaction of diversions and return flow is illustrated by the Richfield area. Return flow to Sevier River between the Sevier and Sigurd gages follows the same pattern as diversions in Watershed D-1 through D-5 except the peak return flow lags peak diversions about 5 months and low return flow lags low diversions about 7 months (Figure 1). Calculated average return flow along this reach for the 1945-54 period is 75,980 acre-feet annaully. Recorded inflow for March through September for this same period between the Richfield gage and the Sigurd gage is 29,100 acre-feet. This curve is flatter, indicating a more stabilized return flow. It averages about 4,160 acre-feet per month or 67 c.f.s. for the seven months. The other groundwater basins react in a similar manner.

Return flows are important in the regimen of the Sevier River. Water-budget analysis shows that 50 percent of the total tributary inflow and river diversions reappear as surface water for rediversion downstream. Many irrigation companies, particularly in the lower Sevier and Sanpete Valleys and Mills area, depend on return flow for their diversion supply. Groundwater movement is continuous but with less short-term fluctuation than surface-water flows.

Transwatershed groundwater flow is more important along the lower reaches of the river. The entire outflow from Watershed B-4 is groundwater movement through a system of en echelon faults in the Flagstaff limestone to Molten and Blue Springs on the Sevier River. More than 80 percent of the outflow from Watershed B-1 is groundwater flow into Watershed B-2. Annual groundwater outflows from Watershed B-5 and B-6 into Watershed B-7 are 28,420 and 20,800 acre-feet, respectively.

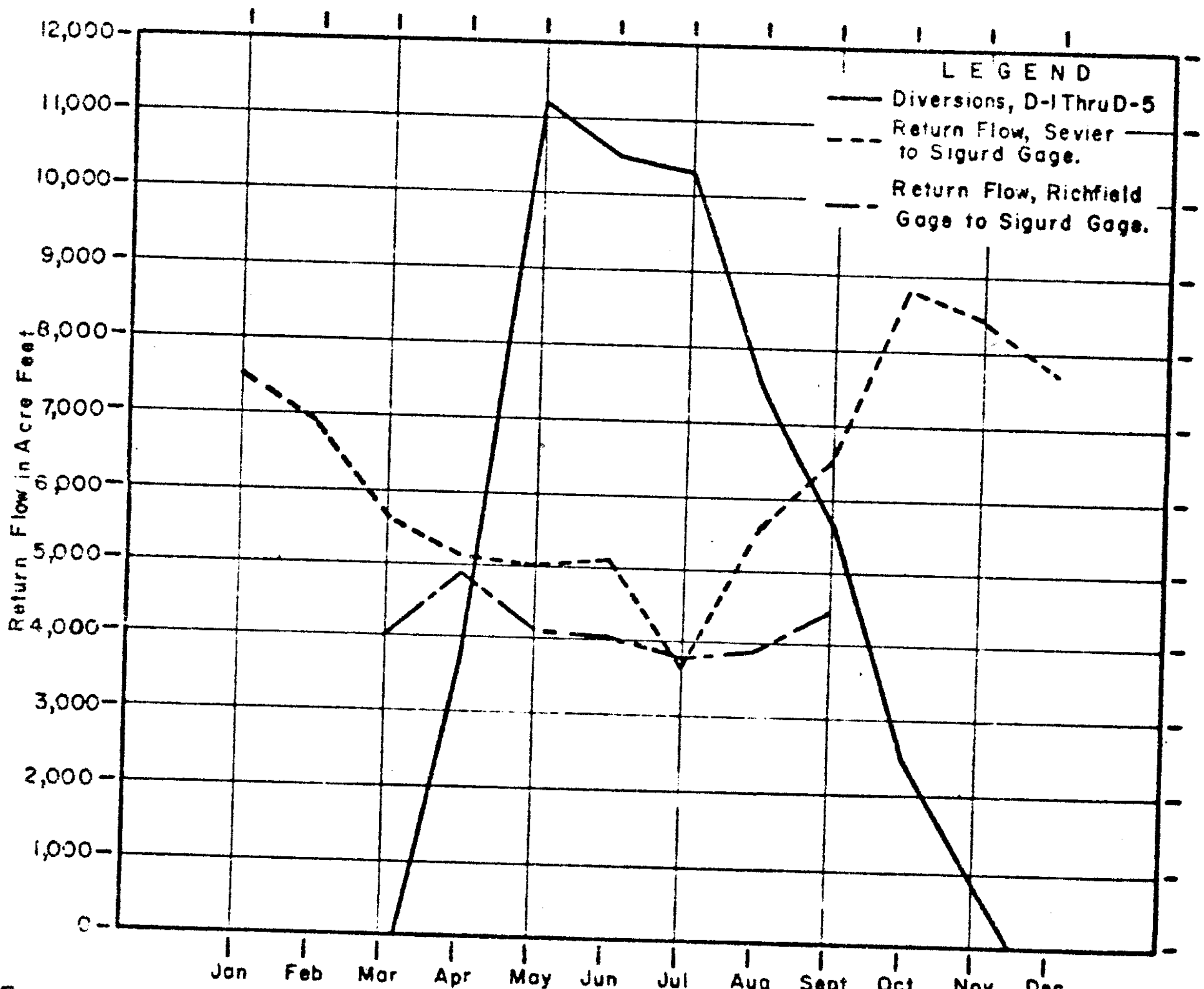


Figure 1: Relationship between direct diversion and return river flow, Sevier to Sigurd. 1945—1954 Average

CHAPTER II

WATER RIGHTS

This chapter briefly describes the events leading to the Cox Decree which adjudicates the water rights now in existence that are used to administer and manage the water resources of the Sevier River system. A brief summary of the rights as adjudicated by the Cox Decree concludes the chapter.

ADJUDICATION OF THE SEVIER RIVER

Several settlements along the Sevier River and its tributaries had been established by the early 1860's. Toward the turn of the century, several other communities had been settled, all of which were dependent upon the water resources of the Sevier River system for domestic use, livestock use, and irrigation. Due to the low demand on the water resources in the early days, there was plenty of water throughout the system for all of these uses. During this period of time, there was no regulation of the use of water in the river system, and any irrigation company or individual could divert all the water needed to satisfy his demands. In the late 1880's, there was a series of dry years, which soon indicated the need for some method of adjudicating the various rights on the lower Sevier River system.

In 1899, the Desert Irrigation Company and Leamington Irrigation Company filed suit in the District Court of Millard county to adjudicate the water of the Sevier River below Vermillion Dam in Sevier county. The case came before Judge E. V. Higgins in May, 1900. The decree issued by Judge Higgins adjudicated all the rights of the river system below the Vermillion Dam and provided that when these rights could not be satisfied in full, the water should be prorated in direct proportion to these adjudicated rights. The decree also provided for a river commissioner to distribute the water between the users. This decree became known as the Higgins Decree.

In 1902, the Desert Irrigation Company decided to build a reservoir near the Sevier Bridge and store winter and spring runoff from the Sevier River. This was prior to establishment of the Office of State Engineer and so no filing was necessary to construct this reservoir.

The Office of State Engineer was created by the Utah State Legislature in 1903. One of his duties was to regulate the use of water between appropriators on river systems throughout the state. He appointed two river commissioners on the Sevier River system, one to regulate the water from the headwaters to Vermillion Dam in Sevier county, and the other to regulate the water from Vermillion Dam to the lower end of the river.

Otter Creek Reservoir Company filed an application in 1905 to divert 400 cfs from the Sevier River in what is now called Piute Reservoir. This application was assigned to the State Land Board in 1908. Construction of the reservoir was completed in early 1913.

The water rights along the Sevier River proper from Vermillion Dam to the headwaters were adjudicated in 1906 by Judge C. W. Morse. This was instigated by the case of Richfield Irrigation Company et al, vs. Circleville Irrigation Company, et al. This decree later became known as the Morse Decree.

The rights along the Sevier River system were now adjudicated under two decrees, the Marsh Decree on the upper Sevier River to Vermillion Dam, and the Higgins Decree from Vermillion Dam along the Sevier River to its terminus. Neither of the decrees adjudicated the rights of any of the tributaries to the Sevier River or the rights between Sevier Bridge Reservoir and Piute Reservoir.

Richlands Irrigation Company requested adjudication of its rights on the lower Sevier River system in 1916. Prior to the time this could be done, the State Engineer, J. M. Bacon, instigated an adjudication of all the water rights along the Sevier River system. This action was completed in early 1926 and is commonly known as Bacon's Bible. However, prior to the time that this final determination was completed, the water users along the Sevier River and its tributaries had filed claims regarding their water rights in the Fifth Judicial District Court at Fillmore.

In the spring of 1926, determination of the rights under the Hawley filing for Sevier Bridge Reservoir was brought to trial before Judge Elias Hansen in the Fourth Judicial District. The decision awarded the owners of Sevier Bridge Reservoir a first priority of

89,280 acre-feet of water. The time and expense already expended for this one determination indicated a more expediate means was needed to settle allegations on the remaining 700-800 rights along the river system.

As a result, two committees were appointed, one to work out differences between claimed rights on the upper Sevier River system, and another committee to do the same thing on the lower Sevier River system. In addition, committees were appointed to work out differences between claimed rights involving Piute Reservoir and Sevier Bridge Reservoir. The outcome awarded Piute Reservoir and Sevier Bridge Reservoir owners first priority of 89,280 acre-feet, Piute Company owners the next 40,000 acre-feet, Sevier Bridge Reservoir the next 13,200 acre-feet, and any water available above these amounts would be divided 75 percent to Sevier Bridge Reservoir and 25 percent to Piute Reservoir. Under this situation, if there was sufficient water, both reservoirs were to be filled at exactly the same time.

The committees working up the claimed rights on the upper and lower Sevier River, with minor modifications, followed the Higgins Decree and Morse Decree except for one difference. Under the Morse Decree, A to L users in Sevier county were awarded year-round rights to use of the water. The above users, with the exception of Monroe South Bend Irrigation Company and Vermillion Irrigation Company, gave up their winter rights from October 1 through April 1 in exchange for the right to store water in Piute Reservoir. If there was insufficient capacity to store this water in Piute Reservoir, these users would be limited to 9,000 acre-feet of storage. This storage was available without cost.

The two committees, one assigned to the upper river and one to the lower river, had no involvement in each other's work. The only time the two committees worked directly together was to determine that the direct flow rights above Vermillion Dam were superior to those below Vermillion Dam. In addition it was determined that any water going over Vermillion Dam at any time of the year was available for storage to be divided between Piute Reservoir and Sevier Bridge Reservoir. If water was stored in Piute Reservoir above its share, it was to be delivered to Sevier Bridge Reservoir without allowance for any loss.

SUMMARY OF WATER RIGHTS

The summary of water rights as adjudicated by the Cox Decree was prepared by Carl H. Carpenter, Engineer, Central Utah Conservancy District.

C O X   D E C R E E   1936

Chapter I - Zone A

Page	Section A - Sevier River main stem (Morse Decree)	Date	cfs
2	Section A - Sevier Co. Primary rights		
"	(a) Richfield Irrigation Canal Co.	4-9/30	85.90
"	(b) Annabella Irrigation Canal Co.	4-9/30	30.40
"	(c) Elsinore Canal Co.	4-9/30	18.92
"	(d) Brooklyn Canal Co.	4-9/30	29.77
3	(e) Monroe Irrigation Co.	4-9/30	47.90
"	(f) Isaacson Ditch users	4-9/30	2.80
"	(g) Wells Irrigation Co.	4-9/30	10.90
"	(h) Joseph Irrigation Co.	4-9/30	25.90
"	(i) Union Central Life Ins. Co. (Mills Ditch)	4-9/30	1.33
"	(j) Elsinore Bench Irrigation Co. (Sevier Valley Canal)	4/1-11/25	2.00
"	(k) Sevier Valley Canal Co.	4/1-10/15	3.14
	Sevier Valley Canal Co.	4/1-4/30	50.00
	Sevier Valley Canal Co.	10/1-10/15	60.00
6	Monroe South Bend Canal Co.	4/16-10/15	1.25
	Monroe South Bend Canal Co.	10/16-3/31	37.00
	Monroe South Bend Canal Co.	4/1-4/30	30.00
7	Section A - Sevier County Secondary rights		
7	(1) Sevier Valley Canal Co.	5/1-10/1	68.00
5	Annabella Irrigation and Canal Co.	10/1-10/31	3.00
"	Annabella Irrigation and Canal Co.	11/1-11/20	15.00
"	Annabella Irrigation and Canal Co.	3/16-3/30	15.00
"	Sevier Valley Canal Co. 20 percent of flow of Sevier River between the two Kingston gages and Annabella Dam not to exceed 63.14	10/16-11/25	
"	U&I Sugar Co. (Richfield Canal) (Beet season)		10.00
5 & 6	Vermillion Irrigation Co. All river gain between Annabella Dam and Vermillion Dam not to exceed 37.80 cfs.	1/1-12/31	
4 & 5	Storage of a to 1 rights in Piute Reservoir		
6	Miller and Viele (Wells canal)	4/15-10/15	50.00 AF
7	Section A - Sevier County Third Class rights		
"	Monroe So. Bend Canal Co. Provided 37.00 from 10/16-3/31 and 30 cfs from 4/1-4/30 are primary rights against a to 1 users.	all year	41.50
7	Gain in flow of Sevier River between the two Kingston gages and Piute Dam; up to 22 cfs is alloted to Section A users April to Sept. 30. Not to be taken from storage rights. Prorated with Barnston Spr. if 22 cfs not available.		

Page			
	Section A - Sevier County Third Class rights (Cont'd)		
4	a to 1 rights may be stored in Piute Reservoir in lieu of allowing winter flow to be stored in Sevier Bridge Reservoir.		
	Section B - Piute County Primary Rights		
8	Circleville Irrigation Co. - Loss Creek Irrigation Co., Whittaker, Parker, Horton, etc.	4/1-11/15 11/15-4/1	91.25 30.00
	Section B - Piute County Second Class rights		
8	Circleville Irrigation Co. - Loss Creek Irrigation Co., etc.	4/1-11/15	32.50
	Section B - Piute Co. Third Class rights		
8	Circleville Irrigation Co., et al (same as above)	4/1-11/15	28.61
	Cannon and Dobson	4/1-11/15	1.39
	Whittakers and Dobson	4/1-11/15	0.50
	Drainage Water		
8	Allens and Christensen (Kingston Canal)		5.05
9	**Section C - Garfield County Primary rights**		
"	Ira Hatch (E. Hatch Ditch)	3/15-11/15	3.67
"	Hatch Town Corp. (from Mammoth Creek and South Fork Sevier River)	3/15-11/15	11.12
"	Wilsons	3/15-11/15	3.71
"	Showalters	3/15-11/15	1.45
"	Riggs	3/15-11/15	.82
"	Barton and Henrie	3/15-11/15	2.47
"	Long Canal Co.	3/15-11/15	27.21
"	East Bench Irrigation Co.	3/15-11/15	8.65
"	East Panguitch Irrigation Co.	3/15-11/15	23.74
"	Yardley	3/15-11/15	1.24
"	Panguitch Land and Irrigation Co.	3/15-11/15	2.02
"	Barton, LaFevre, Tebbs Ditch Co.	3/15-11/15	10.65
"	McEwan Ditch Co.	3/15-11/15	16.10
"	Bear Creek Irrigation Co.	3/15-11/15	5.00
10	J.L. Heap (From South Fork Sevier and Marshall and Veater Sloughs)	3/15-11/15	1.00
"	State of Utah (From South Fork Sevier and Marshall and Veater Sloughs)	3/15-11/15	2.00
"	Dalleys (From South Fork Sevier and Marshall and Veater Sloughs)	3/15-11/15	1.50
"	Daltons (From South Fork Sevier River)	3/15-11/15	2.50

Section C - Garfield County Primary rights (Cont'd)

Page			
10	To all above named parties (Panguitch Land and Irrigation Co. 6.00 and all others 44.00 cfs)	11/15-3/15	50.00

Section C - Garfield County Secondary rights

"	Hatch Town Corp.	3/15-11/15	4.94
"	Ira Hatch	3/15-11/15	.62
"	Barton and Henrie	3/15-11/15	1.24
"	Long Canal Co.	3/15-11/15	4.94
"	East Bench Irrigation Co.	3/15-11/15	4.95
"	East Panguitch Irrigation Co.	3/15-11/15	2.47
"	Veater and Page	3/15-11/15	.84

Section C - Garfield County Third Class rights

10	Hatch Town Corp.	3/15-11/15	0.82
"	Ira Hatch	3/15-11/15	5.36
"	Showalters	3/15-11/15	2.06
"	Riggs	3/15-11/15	0.41
11	Long Canal Co.	3/15-11/15	7.41
"	East Bench Irrigation Co.	3/15-11/15	1.24
"	East Panguitch Irrigation Co.	3/15-11/15	1.00
"	McEwan Ditch Co.	3/15-11/15	5.68
"	Barton, Tebbs and Houston Canal Co.	3/15-11/15	5.07
"	Bear Creek Irrigation Co.	3/15-11/15	2.50
"	Marshall Ditch users	3/15-11/15	5.95

Section D - Garfield County Fourth Class rights

11	Panguitch Land and Irrigation Co. Sufficient waters of South Fork Sevier River to fill its reservoir. (Hatch Town Dam)		

Section D - South Fork Sevier River and tributaries Primary rights

13	Junction Irrigation Co. and Sevier Valley Canal Co. All waters of Mitchell Slough 16.00 cfs. Anything less than 16.00 cfs comes from South Fork Sevier River. Sevier Valley Canal Co. gets 6.00 cfs.		
"	Sevier Valley Canal Co. 4.00 cfs from Panguitch State Canal under change application a-567. Sevier Valley Canal gets 4.5 cfs of Mitchell Slough water and 3 cfs of Panguitch State Canal water at headgate. Other 2.5 cfs remains in river.		
14	Junction Middle Ditch Irrigation Co. (Sevier River)	all year	3.99

Section D - Sevier River Main Stem and tributaries Primary rights

Page			
14	Piute Reservoir and Irrigation Co. (from Sevier River)	all year	0.84
"	Piute Reservoir and Irrigation Co. (Price Spring)	all year	1.78
"	Forrest King. All of Durkee and Willow Springs		
15	Piute Reservoir and Irrigation Co. Three-fourths flow in Barnson Springs (12 cfs) during entire year. Stored in Piute Res.		
"	Nielson and Howes (From Sevier River)	all year	3.00
"	Anderson, Black, et al (From Sevier River)	all year	1.00
"	Anderson, Black, et al (From Sevier River)	4/15-7/1	.50
"	Bullion Creek Irrigation Co. (Bullion Creek) (Elsie Taylor gets 1.489 cfs)	all year	10.05
"	Federal Land Bank (Beaver Creek)	all year	1.00
"	Tate (Beaver Creek)	all year	.25
"	F. Murray (Beaver Creek)	all year	.90
"	L. Murray (Beaver Creek)	all year	.60
16	McCarty (Beaver Creek)	all year	1.00
"	M. Murray (Beaver Creek)	all year	1.00
"	Olson (Beaver Creek)	all year	3.00
"	W. Ogden (Beaver Creek)	all year	2.25

Section D - Sevier River main stem and tributaries Second Class rights

16	Federal Land Bank (Beaver Creek)	all year	.65
"	F. Murray (Beaver Creek)	all year	.45
"	L. Murray (Beaver Creek)	all year	.31
"	McCarty (Beaver Creek)	all year	.515
"	M. Murray (Beaver Creek)	all year	.515
"	Olson (Beaver Creek)	all year	1.55
"	J.M. Wright (Deer Creek)	all year	.50
17	Bullion Creek Irrigation Co. (Bullion Cr.)	all year	7.10

Section D - Sevier River main stem and tributaries Fifth Class rights

17	Bullion Creek Irrigation Co. (Bullion Cr.)	whenever available	15.60

Section D - East Fork Sevier River and its tributaries Primary rights

Antimony Creek

11	C.L. King, Jr. (King Ditch)	3/1-11/1	1.64
"	Carpenter, Riddle, Black, et al (Bench Canal)	3/1-11/1	2.56
"	Bench Irrigation Co.	11/1-3/1	1.00
"	Bench Irrigation Co.	3/1-11/1	5.21
"	Bench Irrigation Co.	11/1-3/1	2.00

Section D - East Fork Sevier River and its tributaries
Primary rights (Cont'd)

Page			
	East Fork Sevier River		
12	Lora V. Gleave (Gleave Ditch)	3/1-11/1	.60
"	C.W. Wymore (Steele Ditch)	3/1-11/1	.13
"	R.B. Gleave	all year	.50
"	A.M. Hunter	all year	1.00
"	Alma Savage	3/1-7/15	.33
"	Coyote and East Fork Irrigation Co.	all year	1.00
"	Coyote and East Fork Irrigation Co.	3/1-11/1	8.50
"	Coyote and East Fork Irrigation Co.	4/1-12/1	1.25
"	Coyote and East Fork Irrigation Co.	11/1-3/1	2.50
"	Clover Flat Irrigation Co.	3/1-11/1	1.04
"	Clover Flat Irrigation Co.	5/1-7/15	6.90
"	Clover Flat Irrigation Co.	10/15-12/1	7.59
"	Clover Flat Irrigation Co.	4/1-12/1	1.00
"	Clover Flat Irrigation Co.	4/1-7/15	1.14
"	Smoot, King, et al	3/1-11/1	1.08
"	Langford, Hunter, et al	3/1-11/1	.28
"	Wiley, Allen, et al	3/1-11/1	1.44
"	Wiley (Wiley Ditch)	5/1-10/15	.50
"	Savage	4/1-12/1	.45
"	Spencer	10/1-11/15	2.00
"	Otter Creek Reservoir Co.	5/1-7/15	4.30
"	Otter Creek Reservoir Co.	10/15-12/1	1.05
"	Otter Creek Reservoir Co.	11/1-3/1	20.00
13	Otter Creek Reservoir Co.	4/1-8/1	.75
"	Otter Creek Reservoir Co.	8/1-10/1	.50
14	Piute Reservoir and Irrigation Co. (East Fork Sevier River)	1/1-6/1	3.00
"	Piute Reservoir and Irrigation Co. (East Fork Sevier River)	6/1-12/31	1.66
	Second Class rights		
16	J.K. Anderson (East Fork Sevier River)	all year	.17
	Fourth Class rights		
17	Coyote and East Fork Irrigation Co. (East Fork Sevier River)	all year	3.50
"	C.L. King, Jr. (Antimony Creek)	all year	.80
"	Langford, Hunter, et al (East Fork Sevier River)	all year	.40
"	Smoot, King, et al (East Fork Sevier River)	all year	.65
"	Lora Gleave (East Fork Sevier River)	all year	.75

Section D - East Fork Sevier River and its tributaries
Primary rights (Cont'd)

Page	Fourth Class rights - Cont'd.		
17	Whittaker & Wiley (East Fork Sevier River)	all year	.75
"	Clover Flat Irrigation Company (East Fork Sevier River)	all year	3.75
"	Carpenter, Riddle, Black, et al (Antimony Creek)	all year	1.40
"	Bench Irrigation Company (East Fork Sevier River)	all year	2.00
	Section E - South Fork Sevier River and Tributaries		
18	Henrie Slough - Ira Hatch	3/15-11/15	1.00
"	Asay Springs - James Yardley	3/15-11/15	2.00
"	Castle & Minnie Creeks spring areas - Yardley, et al	all year	entire flow
"	Spring area Section 25, T37S, R6W, - J.A. Little	all year	entire flow
"	Mammoth Creek - Hatch Town Corp.	all year	.50
"	Pole Canyon & Don's Spring - Geo. Dodds	all year	entire flow
"	Burrows Wash - W. R. Riggs	all year	entire flow
"	Hatch Springs - Tenia Marshall	all year	entire flow
"	Proctor Canyon Creek - H. L. Henrie	all year	1.00
"	Proctor Canyon Creek - Proctors, et al (2nd class)	all year	.75
"	Proctor Canyon Creek Remaining flow to be divided 50-50	all year	
19	Unnamed Spring in Proctor Canyon - H. L. Henrie	all year	entire flow
"	Unnamed Spring Section 22, T36S, R5W - Proctors, et al	all year	entire flow
"	Unnamed Spring Section 25 T36S, R5W - State of Utah	all year	entire flow
"	Clark Springs - J. C. Clark	all year	entire flow
"	Hillsdale Canyon Creek - Wilson, et al	all year	entire flow
"	Rock Canyon Creek - Evans	3/15-11/15	.50
"	Red Canyon Creek - Fed. Land Bank	3/15-11/15	3.21
"	Water Cress Spring - Fed. Land Bank	all year	entire flow
"	Casto Spring - Allen	3/15-11/15	1.97
"	Sandy Creek - Houston	3/15-11/15	2.34
"	North Fork Sanford Creek - Davenport 3/5 of all waters	3/15-11/15	

Section E - South Fork Sevier River and
Tributaries (Cont'd)

Page			
19	North Fork Sanford Creek - Johnson 2/5 of all waters	3/15-11/15	
"	South Fork Sanford Creek - Dodds	3/15-11/15	2.50
"	LaFevre Creek, Hollyoak Spring, Navajo Spring, Bear Creek (All from Bear Creek)	4/1-10/15	1.93
"	Bear Creek - Tophams	entire year	3.34
20	Bear Creek - LaFevre	3/15-11/15	1.00
"	Bear Creek - Fed. Land Bank	3/15-11/15	3.00
"	North Spring Creek, Rock Quarry Spring, Big Swamp Spring (tributaries to Bear Creek) Tophams	entire year	1.50
"	West Spring - Tophams	entire year	0.50

Panguitch Creek & tributaries (See page 8, also this index)

Section C (Second Class Right)

10	West Panguitch Irrigation & Res. Co. from Castle Creek and to be stored in Panguitch Lake Res.	entire year	4.97

Section E

20 (a)	Butler Creek - W. H. Tebbs	5/1-10/1	1.25
" (b)	Bunker Creek - Leight	5/1-10/1	.88
"	Deer Creek & Blue Spring - Leight	5/1-10/1	7.13
" (c)	Blue Spring - Miller Bros.	5/1-10/1	1.25
" (d)	Blue Spring - Houston	5/1-10/1	0.80
"	Parowan or Fish Creek - Houston	5/1-10/1	1.57
" (e)	Parowan or Fish Creek - Marsden	5/1-10/1	0.87
"	Springs in Sec 31 T35S, R7W - Marsden	5/1-10/1	0.30
" (f)	Parowan or Fish Creek - Tebbs	5/1-10/1	1.57
	Ipson Creek - Tebbs	5/1-10/1	1.50
" (g)	Spring in Section 9 T36S, R7W - Owens	5/1-10/1	1.29
20 (g)	Willow Spring - Owens	all year	entire flow
"	Haycock Creek - Owens	all year	0.48
21	Spring area Section 34 & 35 T35S, R7W - Owens	5/1-10/1	1.46
21 (h)	Butler Creek - Tebbs	5/1-10/1	3.20
" (i)	Panguitch Creek - Shakespeare	3/15-10/15	0.30
" (j)	Panguitch Creek - Henderson	3/15-10/15	0.25
"	All waters of Panguitch Creek and its tributaries after above rights a to j have been satisfied to West Panguitch Irrigation & Res. Company		
"	Castle Creek - West Panguitch Irrigation & Res. Company in Panguitch Lake Res.		

Panguitch Creek & Tributaries (Cont'd)

Page			
21	Threemile Creek - Panguitch City	all year	2.00
"	Threemile Creek - W. H. Tebbs	all year	3.00
"	Threemile Creek - Flows above 5 cfs as follows: R. DeLong 5/35, E. Allen 10/35, Panguitch City 8/35, Tebbs 12/35		
22	Tebbs Spring - Susan Tebbs	all year	entire flow
"	Birch Creek (South of Circleville) - Simpkins	all year	entire flow
"	Wade Canyon & Cottonwood Creek - Town of Circleville	all year	entire flow
"	Loss Creek - Whittaker Bros.	all year	entire flow

Section E. East Fork Sevier River & Tributaries

22	Sweetwater Creek - St. of Utah	all year	1.125
"	Sweetwater Creek - Town of Widstoe	all year	1.375
"	Spring - Quince Kimball (Widstoe)	all year	entire flow
"	Ranch Creek, Birch Creek, Horse Creek - Horse Creek Irrigation Company	all year	entire flow
"	Cottonwood (Needle Rock) Creek - King, et al	all year	1/2 flow
"	Cottonwood (Needle Rock) Creek - Sylvester	all year	1/4 flow
"	Cottonwood (Needle Rock) Creek - Lester Spencer	all year	1/4 flow
"	Center or Crystal Creek - Lambson	all year	1/3 flow
"	Center or Crystal Creek - W. Gleave	all year	1/3 flow
"	Center or Crystal Creek - R. Gleave	all year	1/3 flow
23	Gleave Spring - Lora Gleave	all year	entire flow
"	Pine Creek - Wiley	all year	entire flow
"	Poison Creek & Sheep Creek - Day	all year	1.00
"	Clear or Clark Spring - Hall	all year	entire flow
"	Forest Creek - Hall All waters up to 1/2 cfs	all year	1/2
"	Pole Creek - Rowan All waters up to 1/3 cfs	all year	1/3
"	Hunter Spring - Hunter All waters	entire year	
"	Spring Section 4, T31S, R2W - Hunter All waters	entire year	
24	East Fork Sevier River - Tropic & East Fork Irrigation Company	4/1-6/1	20.00
"	East Fork Sevier River - Tropic & East Fork Irrigation Company	6/1-10/15	15.00
	East Fork Sevier R. - Tropic & E. Fork Irr. Co.	6/1-10/15	540 AF Storage

Section E. East Fork Sevier River & Tributaries

Page			
30	Otter Creek and E. Fork Sevier River Otter Creek Reservoir Company Sufficient waters of said two streams to fill its reservoir to a capacity of 52,590 AF after primary, 2nd class, 3rd class rights in sections A, B, C, & D have been filled, and fourth class rights in section D are supplied in full.		
"	East Fork Sevier River - 1/3 of flow April 1 - May 31		
	East Fork Sevier River - 1/2 of flow May 31 - June 30		
"	East Fork Sevier River - 2/3 of flow June 30 - Sept. 30		
"	East Fork Sevier River - Kingston Irrigation Company	9/30-12/1	5.00
"	East Fork Sevier River - Kingston Irrigation Company	12/1-Beg. Irr. season	2.00
31	Otter Creek Reservoir storage - Kingston Irrigation Company	Beg. Irr. seas.-9/30	21.08
"	Otter Creek Reservoir storage - C. Magleby	Beg. Irr. seas.-9/30	1.50
"	Otter Creek Reservoir storage - L. Jones	Beg. Irr. seas.- 9/30	1.00
"	Otter Creek Reservoir storage - Jones Bros.	Beg. Irr. seas.-9/30	.25
"	Otter Creek Reservoir storage - M. Magleby	Beg. Irr. seas.-9/30	.25
"	Otter Creek Reservoir storage - Piute Reservoir & Irrigation Company	Beg. Irr. seas.-9/30	.92
"	Otter Creek Reservoir storage - Monroe South Bend Irrigation Company	Beg. Irr. seas.-9/30	10.00

Section E - Otter Creek & Tributaries

23	South Fork Little Lost Creek - Mumford	entire year	all waters
"	North Fork Booby Hole Creek - Mumford	11/1-4/10	all waters
"	Little Lost Creek - Mumford	6/30-27 - 10/1-3/31	all waters
"	Otter Creek at mouth of Daniels Canyon - As follows: Whittaker 15/100, McMillan 16/100, Peterson 25/100, Burr 2/100, Fed. Reserve Bank 15/100. Use entire year.	entire year	7/10 flow
24	Also from 7/10 flow as follows: Lipsey 11/100, Dastrup Bros. 13/100, Burr 3/100. Lipsey and Dastrup use entire year. Burr use April 1 - November 1 Burr shall have right to 1.00 cfs November 1 - November 17 and domestic and stock rights all year.		

Section E - Otter Creek & tributaries (Cont'd)

Page			
24	Booby Hole Creek - Federal Reserve Bank storage in Booby Hole Reservoir and to use during the irrigation season		3.00 for
"	Booby Hole Creek - Secondary right - McMillan		1.00
25	Battle Creek (Burr Creek) - Burrville Irrigation Company	all year	7.00
"	Prater Creek - Fairbanks	all year	2.00
"	Otter Creek - Koosharem Irrigation Company - 2/10 flow at Daniels Canyon mouth and enough flow below Koosharem Reservoir to aggregate 2/10 flow of Otter Creek	entire year	18.00
"	Otter Creek - Meridian Ditch Company - 1/10 flow of creek at mouth of Daniels Canyon	4/15-6/15	10.00
"	Otter Creek - Meridian Ditch Company - 1/10 flow of creek at mouth of Daniels Canyon	6/15-4/15	6.00
"	Koosharem Creek - Rosebud Irrigation Company	all year	1.50
"	Koosharem Creek - Koosharem Irrigation Company remaining flow	all year	
"	Otter Creek - Koosharem Irrigation Company 2,088 AF Storage in Koosharem Reservoir		
"	Little & Mill Creeks - Anderson	all year	0.58
"	Otter Creek - Peterson	all year	.72
"	Milk House Spring - Peterson	all year	entire flow
"	Otter Creek - Peterson & DeLange	4/1-6/15	.50
"	Cedar Grove Spring - Sorenson	all year	entire flow
26	Otter Creek - Brown Bros.	all year	.42
"	Otter Creek - J. P. Sorensen	4/1-6/15	.20
"	Otter Creek - G. & W. Brown	all year	1.00
"	Otter Creek - Sorensen & Brown	all year	.50
26	Otter Creek - Sorensen, W. Brown, A. Brown	all year	1.25
"	Brown Spring - Koosharem Town	all year	entire flow
"	Petersen Spring - Petersen	all year	entire flow
"	School Section or Koosharem Springs - Richenbach & Hatch Bros.	all year	entire flow
"	Richenbach wells - Jos. Richenback	all year	entire flow
"	Otter Creek - Various users	4/1-6/1	32.00
27	Otter Creek - Various users	6/1-6/15	16.00
"	Otter Creek - Various users	6/15-11/15	15.00
"	Otter Creek - George Bagley	all year	1.00
"	Otter Creek - Magleby's	all year	6.65
"	Otter Creek - C. Magleby	4/1-6/1	3.35
"	Otter Creek - Magleby's	6/1-4/1	2.78

Section E - Otter Creek & tributaries (Cont'd)

Page			
27	Otter Creek - A. Magleby	6/1-4/1	1.39
28	Greenwich Creek - Various users - Class I	all year	entire flow
"	Greenwich Creek - Fed. Land Bank - Class III	entire flow all year	5.00
"	Beaver or Box Cr. - Beaver Cr. Irr. & Res. Co.	4/15-6/15	18.00
"	Beaver or Box Cr. - Beaver Cr. Irr. & Res. Co.	6/15-4/15	12.00
"	Beaver or Box Cr. - Beaver Cr. Irr. & Res. Co.	Right to fill two reservoirs	
"	Otter Creek - Jolley, et al 1/3 of flow at head of ditches after above rights are satisfied up to 22 cfs.		
"	Otter Creek - Otter Creek Reservoir Company - entire flow - after all above rights are satisfied subject to pro rata with the following:		
	When flow exceeds 9 cfs - N. Michlea	0.10 cfs	
	When flow exceeds 9 cfs - H. Wilcock	.33	
	Return flow from Jolley's - H. Wilcock	All	
	Small flows in creek - Brinkerhoff	1.00	
30	Pete's Spring No. 1 - Bridges	all year	entire flow
"	Pete's Spring No. 2 - Wilcock	all year	entire flow
"	Pole Canyon Spring Creek - Brindley	all year	entire flow

Section E - Sevier River main stem & tributaries

31	City Creek - City Creek Irrigation & Reservoir Company, et al	all year	entire flow
"	Saw Mill Spring - Town of Junction	all year	entire flow
"	Manning Creek - Sevy, et al	3/15-6/15	21.00
"	Manning Creek - Sevy, et al	6/15-11/15	8.50
35	Manning Creek - Sevy, et al	Barney Lake Storage	172 AF
31	Tenmile Creek - Howes, et al	all year	4.00
32	Gold & Cottonwood Creeks - Various users	all year	entire flow
"	Dry & Tibadeau Creeks - Various users	all year	entire flow
"	Taylor Pond - Sevier Valley Canal Company Entire flow up to 4 cfs 4/1 - 11/25		
"	Sevier River & East Fork Sevier River - Sevier Valley Roller Mills Company - Power rights.		
37	Barney & Anderson Canyons - J. W. Sylvester	all year	entire flow

Section E - Sevier River main stem & Tributaries (Cont'd)

Page	Clear Creek & Tributaries		
33	Fish Creek - Annie Laurie Cons. Gold Mines - All waters from tunnels all year		
"	Lammersdorf Spring, Gold Springs, Sevier Springs, and tunnels and underground works - Annie Laurie Cons. Gold Mines - All flow entire year		
"	Clear Creek - Annie Laurie Cons. Gold Mines		10.00 power
"	Shingle Creek - G. Bradbury	all year	.57
"	Mill Creek - J. Marchant	all year	1.735
"	Dry Creek - R. Olcott	all year	1.14
"	Mill Creek - R. Olcott	all year	0.015
34	Clear Creek primary right - Various users including Clear Creek Irrigation Company for entire year		10.26
"	Clear Creek Secondary right - Clear Creek Irrigation Company	all year	1.00
"	Holland or Snyder Spring - Annie Laurie Cons. Gold Mines	all year	entire flow
"	North Creek - C. W. Hawley	4/15-10/15	2.52
"	Birch Creek - C. B. Hawley	4/15-10/15	2.00
"	Magpie Creek - C. B. Hawley	4/15-10/15	entire flow
"	Three Creek L. Morrey	4/15-10/15	0.74
"	Three Creek Reservoir - Sevier Valley Canal Company		1,000 AF
"	Three Creek Spring, Birch Creek, Charlesworth Creek, Dry Creek - Sevier Valley Canal Company		
"	Grass Creek - W. & A. Gray	4/15-10/15	1.00
35	Grass Creek - W. Olson	4/15-10/15	0.50
37	Spring - J. A. Hunt (Skinner Spring)	all year	entire flow
"	Riley Spring - O. R. Myers	all year	entire flow

	Monroe Creek - Primary rights		
35	Monroe City	entire year	8.45
"	Ferd Erickson	entire year	.10
"	S. Thornton	entire year	.20
"	South Monroe Water System	entire year	.25
"	Secondary rights	entire year	5.5
36	Class II	entire year	16.0
"	Class III	entire year	11.0
"	Class IV	entire year	4.0
37	Dry Creek - Dry Creek Irrigation Company	all year	entire flow

Section E - Sevier River main stem & tributaries (Cont'd)

Page			
37	Birch Springs - Union Central Life Ins. Co.	all year	entire flow
"	Unnamed Spring - Jensen & Hunt	all year	entire flow
"	Unnamed Spring - Fed. Land Bank	all year	entire flow
"	Birch Spring No. 3 - J. H. Skougaard	all year	entire flow
"	Cottonwood Springs - Bohman	all year	entire flow
"	Jericho Wells - Brooklyn Canal Company	entire year	1.50

General

17 & 18 Second Class rights in Section B, C, & D are subordinated to primary and 2nd class in Section A. (Sevier Valley)

Third class rights in section B & C are subordinated to third class in section A. (Sevier Valley)

Second class rights in section C are subordinated to primary rights in section B. (Circle Valley)

30 Otter Creek Reservoir Company - Sufficient waters of Otter Creek and East Fork Sevier River to fill its reservoir to a capacity of 52,590 AF after primary, 2nd class, and third class rights in sections A, B, C, and D have been filled, and fourth class rights in Section D.

38 Sevier River - Jumbo Plaster & Cement Company - 150 cfs - Year round for power Appl. no. 1725 Certif. 163

Chapter 2 - Zone A-Independent Rights

Page	South Fork Sevier River & tributaries		Date	cfs
38	Mammoth Creek - Heber C. Jensen	1898	5/1-10/1	0.09 - 0.14
"	Tommy Creek - Heber C. Jensen	1888	5/1-10/1	0.72 - 1.07
"	Proctor Canyon Creek - L.L. Porter	1903	5/1-10/1	0.04 - 0.07
39	Panguitch Creek - below last diversion - J. H. Clark Seepage flow below diversion			
"	Mitchell Springs - O.C. & John Snow	1881	5/1-10/15	1.5 cfs
	to be diverted from Sevier River into Monroe South Bend Canal			
	East Fork Sevier River & tributaries			
39	Spring Creek - Art. Whittaker	1888	5/1-10/15	2.56 -
	Diverted into Vater Ditches, Steel or Jensen Ditches			3.83
"	Pine or Deep Creek - Richfield Comm. & Savings Bank	1876	5/1-9/30	8.00
"	Unnamed Creek - Mrs. L.V. Gleave	1890 Gleave Ditch	5/1-10/15	0.13 - 0.20
"	Unnamed Spring - Clover Flat Irrigation Company	1879	5/1-10/15	0.11 - 0.16
	Otter Creek & tributaries			
40	Box Creek - George A. Bagley	1893 No. Canal	5/1-10/15	0.71 - 1.06
	Sevier River Main Stem & tributaries			
40	Sevier River - Curtis E. Pitts	1879	4/15-10/15 pumped	45.0 AF 60.0 AF
"	Acton Spring tributary to Bullion Creek - Sam L. Page	1902	4/15-10/15	0.25 - 0.38
"	Big Spring tributary to Bullion Creek - Town of Marysvale	1880	year round	0.50
"	Durkee Spring - W. E. Fincher	1880	4/15-10/15	0.12 - 0.18
"	Deer Creek - Aluminum Potash Co.	1897	4/15-10/15	0.06 - 0.09
"	Deer Creek - Pittsburgh - Utah Potash Co.	1897	4/1 -11/30	0.20
41	Shingle Creek tributary to Clear Creek - U.S. Forest Service	1886	4/15-10/15	0.07 - 0.10
"	Fish & Picnic Creek (Clear Creek) - Telluride Power Co.	1901	year round power	27.00

Sevier River Main Stem & tributaries (Cont'd)

Page				
41	Joe Lott & Mill Creek (Clear Creek) - U.S. Forest Service	1892	4/15-10/15	0.60 - 0.90
	(This right is secondary to John Marchant right in same source)			
"	Clear Creek - R.W. Levie	1886	4/15-10/15 (Levie Ditch)	0.10 - 0.14
"	Water Canyon Creek - Parley Anderson	1898	4/15-10/15 (Anderson Ditch)	0.62 - 0.93
"	Sevier River - Willard Utley	1880	4/15-10/1	15.00AF 20.00AF

Sevier River main stem & tributaries

42	Sevier River - J. H. Levie	1890	4/15-10/1	10.00AF 15.00AF
"	Sevier River - P. P. Leavitt	1885	4/1-10/15	60.00AF 80.00AF
"	Sevier River - B. D. Darger	1890	4/1-10/15 (Wells Ditch)	45.00AF 60.00AF

Chapter 3 Zone A - Applications

	Sevier River main stem and tributaries	Date	cfs
P. 43	Bullion Cr. - J.E. Dennis A-968 7/2/06 (South Bench Canal) Cert. 134-8	4/15-6/30	2.40
"	Monroe Cr. - J.H. Erickson & H.N. Hayes A-1002 Cert. 162 8/7/06 Bertleson Canal	4/1-7/1	18.00
"	Monroe Cr. - St. of Utah A-1002 Cert. 162 8/7/06 Bertelson Canal	4/1-7/1	2.00
"	Monroe Cr. - Union Central Life Ins. A-2653 Cert. 166 8/21/06 Bertelson Canal	4/15-6/15	1.00
"	Monroe Cr. - Parley Magleby A-2653 Cert. 166 8/21/06 Bertelson Canal	4/15-6/15	6.00
"	Monroe Cr. St. of Utah A-2653 Cert. 166 5/21/06 Bertelson Canal	4/15-6/15	3.00
43 & 44	Bullion Cr. - Bully Boy Mines Corp.		
	(a) A-3496 Cert. 169 9/12/10 for power	all year	10.00
	(b) A-8337 Cert. 1353 10/15/19 for power	all year	10.00
	(c) A-3646 Cert. 170 11/30/10 for mining	all year	1.00
44	Corner Spr. - Lydia Asay A-4275 Cert. 243 9/30/11	3/1-10/20	0.076
"	Monroe Cr. - N.J. Bates A-2972 Cert. 298 2/15/10 Bertelson Canal	4/15-6/15	5.00
"	Red Butte Sprs. - Annabella Town A-3044 Cert. 299 8/5/10	all year	1.00
45	Little Rock Spr.-Mill Cr.-USFS A-5443 Cert. 387 9/8/13	all year	0.008
"	Bullion Cr.-Swenning Anderson A-4590 Cert. 410 4/4/12 (into So. Bench Canal)	4/1-7/1	0.83
"	Gillan Spr.-Mineral Products Corp.		
	(a) A-6488 Cert. 485 10/2/15 for mining	all year	0.08
	(b) A-6215 Cert. 457 5/13/15 for domestic	all year	0.02
46	Bullion Cr.-A. Hardy A-4199 Cert. 480 8/25/13 (into Foisey Ditch)	5/1-7/1	0.17
"	Beaver Cr. Spr.-F. Murray A-4537 Cert. 526 3/6/12	all year	0.03
48	Norton Cr.-W.L. Camp A-5696 Cert. 767 4/13/14	all year	0.20
"	Cottonwood Cr.-Wm Rosequist A-4565 Cert. 839 3/20/12	5/1-7/15	0.58
"	Three Mi. Spr. (Cottonwood Cr.)-Deer Trail Mining Co. A-6885 Cert. 877 8/9/16 for mining	all year	0.25
50	Unnamed Spr.-Central Water Works Co. A-2595 Cert. 1373 7/26/09	all year	Entire flow
52	Riley Spr. (Clear Cr.) Joseph & Cove Highland Irr. Co. A-5847 Cert. 1825 7/21/14	3/1-10/31	8.00
"	Deer Cr.-Pittsburgh Potash Co. A-7244 Cert. pending (for mining)	all year	2.00

	South Fork Sevier R. & tributaries	Date	cfs
45	Lime Kiln Wash - O. Orten A-4202 Cert. 469 8/13/14 0.13/14	3/15-10/1	0.31
46	Lime Kiln Wash - Owen's A-2456 Cert. 537 7/14/09	5/1-10/31	1.50

South Fork Sevier R. & tributaries (cont.)

46	Coyote Lake - Dalley A-4111 Cert. 618 12/23/16	1/11-12/31	40.00 AF
47	Mahogany Sprs. - Dalleys A-4829 Cert. 619 12/23/16	3/1-11/15	0.025
"	Sanford Cr. - Heywood A-4047 Cert. 636 7/13/11	4/15-9/15	2.5
"	Shakespeare Hollow (Panguitch Cr.) - USFS A-4999 Cert. 640 6/9/13	4/1-8/1	1.04
"	Johnson Can. Cr. (Proctor Can. Cr.) - Geo. Wilson A-4507 Cert. 718 5/10/16	5/1-10/1	0.09
"	Johnson Can. Cr. M.W. Bigelow A-4633 Cert. 719 4/22/12	4/15-11/15	0.51
48	Little Pine Cr. (Circleville Can.) J.R. Norton A-4927 Cert. 721 11/24/12 (conveyed to Birch Creek)	3/1-10/1	0.27
"	Panguitch Cr. - Telluride Power Co. A-6783 Cert. 850 5/29/16 for power	all year	10.00
49	Pine, Wildcat and Cherry Creeks - Crosby Estate A-4104 Cert. 1138 7/10/11 (into Crosby Canal)	4/1-9/15	3.50
50	Headquarters Slough - A.M. Hatch A-4241 Cert. 1204 9/15/11 (into Hatch Ditch No. 1)	4/1-11/30	1.00
"	Broad Sprs. - Lamoreux Estate A-2408-A-484 Cert. 1415 11/17/14	3/1-10/25	1.25
51	Hawkin Spr. - Dalleys and Dog Valley Res.		
	(a) A-4229 Cert. 1591 9/11/11	3/1-10/31	0.50
	(b) A-4597 Cert. 1590 4/6/12 To be diverted from Eckard Can. Cr. or Brady Cr. into Dog Valley Res.	3/1-11/1	180 AF

East Fork Sevier R. & tributaries

44	E. Fk. Sevier R. - Elder & Ackerman A-2836 Cert. 350 11/26/09 (into Henderson Canal)	4/1-12/31	7.5
45	Cottonwood Cr. -USFS A-4997 Cert. 384 1/9/13	4/1-11/1	0.50
46	Pine Cr. - Pine Lake & Clay Cr. Irr. Co. A-1184 Cert. 486 8/12/07 (into Cameron, Kimball, Pine Cr. or Christensen Ditches)	all year	7.41
"	Dave's Hollow Slough - USFS A-4998 Cert. 639 1/9/13	4/1-10/31	0.34
48	E. Fk. Sevier R. & Spr. Cr. - Art Whittaker A-4569 Cert. 840 3/21/12 (into Veater Ditch #1)	4/1-11/30	2/43
49	E. Fk. Sevier R. - W.F. Holt		
	(a) A-5958 Cert. 1010 12/28/14 Zabriski Ditches	3/1-12/31	3.60
	(b) A-3938 Cert. 1200 7/17/20 Kimball ditch	year round	1.50
"	Shingle Mill Swale - R. C. Syrett A-7802 Cert. 1023 7/15/18 48.9 AF in Shakespeare Reservoir used 4/1 - 10/1		
"	Branch Creek Springs - W. W. Sylvester A-3404-B Cert. 1152 7/16/10	3/1 - 12/1	1.00
"	Sweetwater Creek - Cereal Farm & Livestock Co. A-6064 Cert. 1182 2/19/15	4/1 - 10/31	4.00

East Fork Sevier R. & Tributaries (Cont'd)

Page			
50	Antimony Creek - Bench Irr. Co. A-2452 Cert. 1295 4/8/21 Bench Canal	3/1-11/15	11.34
51	Pine Cr. - Lake View Res. & Canal Co. A-4914 Cert. 1467 6/9/13 Pine Lake Res. Storage Used 5/1-9/30	11/1-3/30	477 AF
"	Hunts Cr. - R. Mancom A-3147 Cert. 1474 9/5/25 & Tom Best Spr.	3/15-11/30	3.32
"	E. Fk. Sevier R. - W. F. Holt A-9181 Cert. 1592 11/4/22	year round power	50.00
"	Pacer Lake Sprs. - A. Cleave A-6539 Cert. 1598 11/3/15 & Mud Lake Sprs.	5/1-10/15	2.00
52	Deer Creek - J. R. Jolley A-3610 Cert. 1673 11/17/10	3/15-11/15	3.00
"	Branch & Shurtz Creeks - Hoffmans A-3404-A & A-525 Cert 1716 7/16/10		
	Branch Cr.	3/1-12/1	3.00
	Shurtz Cr.	3/1-12/1	1.00
"	Shingle Mill Swale - O. Zabriske A-9531 Cert. 1717 6/16/24 (Dipping Vat Spr.)	4/1-10/31	0.05
"	Langford Spr. - J.W. Young, Jr. A-6753 Cert. 1867 5/11/16	3/1-10/15	0.41
53	E. Fork Sevier R. - Taylor, et al A-5044 Certif. pending, into Henderson Canal	4/1-11/30	7.00
"	Branch & Shurtz Creeks - Mrs. F. Robinson A-3404 Certif. pending	3/1-12/1	0.50

Otter Creek & tributaries

45	Booby Hole Cr. - N. McMillan A-426 Cert. 442 8/10/05 200 AF to be stored in Booby Hole Res. Used June 1 - Aug. 31		
46	Otter Cr. - Magleby's A-4875 Cert. 475 9/30/12 or Box Cr.	4/1-7/1	3.65
50	Otter Cr. - Koosharem Irr. Co. A-5154 Cert. 1318 4/12/13 Koosharem Res. storage	10/15-3/15 used 3/15-10/15	1,770 AF
"	Box Cr. - Beaver Cr. Irr. & Res. Co. A-5222 Cert. 1403 3/14/22 Box Cr. Res	year round storage	339 AF used 4/1 - 10/15

Zone B

Chapter 4 - Tributaries to Sevier River Vermillion Dam to Redmond

Page	Source - Owner	Priority	Period	cfs
53	Glenwood Sprs. - Glenwood Irr. Co. 4.00 cfs 10/16 - 3/31 Claim No. 407	1871	4/1-10/15	entire flow
"	Parcell Cr. - Glenwood Irr. Co.	1871	4/1-10/15	1.00
54	Parcell Cr. - Glenwood Irr. Co.	1871	4/1-10/15	0.17
"	Water Cress Sprs. - Oliver Anderson, et al	1886	3/15-11/1	2.00
"	Indian Cr. - Abe Hanson	1880	all year	entire flow
"	Richfield Spr. - Richfield City	1865	all year	entire flow
"	Cottonwood Cr. - Richfield City	1865	4/18 to end of irr season	2.00
"	Cottonwood Cr. - Richfield Cottonwood Irr. Co.	1865	entire flow after Richfield City's 2.00 cfs	
67	Cottonwood Cr. - Colby, et al 1897 supplemental to lands served by Richfield Cott. Irrigation Co.			
54	Spring Hill Springs - Spring Hill Irr. Co.	1880		23.01
"	Spring Hill Springs - F. J. Heppler 1890 0.01 cfs Domestic			1.88
55	Spring Hill Springs - Avery Irr. Co.	1880		12.60
	(See page 55 & 56 for full explanation of Spring Hill Springs)			
56	Fish Pond Spr's - F. Rigby, et al	1880	4/1-10/15	8.52
"	Fish Pond Spr's - H. Peterson, et al	1880	4/1-10/15	7.38
57	Brimhall Spr. - J. A. Jorgensen	1894	Domestic	0.01
"	Brimhall Spr. - J. A. Jorgensen	1894	5/1-11/30	0.13
"	Glenwood Spr. - Utah Fish & Game Commission	1924	year round fishery	1.00
"	Glenwood Spr. - Telluride Power Co.	1911	year round power gen.	5.78
"	Glenwood Spr. - C. R. Christensen	1880	year round power gen.	entire flow
"	Cove River - Cove R. Irr. Co.	1871	4/1-10/15	10.00
"	Cove River - Venice Pumping Co.	1871	4/1-10/15	3.00
58	Herrins Hole Spr. Venice Pumping Co.	1871	4/1-10/15	3.00
"	Sloughs T235 R2W - Union Central Life Ins.	1890	4/1-10/15	1.40 - 2.11
"	Sloughs T235 R2W - Union Central Life Ins.	1890	Domestic	0.01
"	Kings Meadow Creek - Revere Land & Stock Co.			
"	(a) 1895 0.05 cfs - 0.08 cfs 4/1-10/15			
"	(b) 1895 0.74 - 1.11 cfs 4/1-10/15			
"	(c) 1895 0.01 cfs year round			
"	Kings Meadow Cr. - G. W. Nebeker, Jr.			
"	(a) 1870 2.11 - 3.16 cfs 4/1-10/15			
"	(b) 1870 0.01 cfs all year			

Chapter 4 - Tributaries to Sevier River Vermillion Dam to Redmond (Cont'd)

Page				
"	South Cedar Ridge Cr. - Cedar Ridge Irr. Co.			
	1894 Entire flow March 1 - Nov 1		Domestic	0.10
59	North Cedar Ridge Cr. - Cedar Ridge Irr. Co.			
	1894 Entire flow Mar 1 - Nov 1		Domestic	0.10
"	South Cedar Ridge Cr. - Cedar Ridge Irr. Co. 1909 Entire flow			
	after above rights are filled.		3/1-11/30	
"	Red Canyon Spr. - A.O. Rasmussen	1917	4/1-10/15	0.60
"	Aurora Spr. - Aurora Town Crop.	1918	all year	0.066
"	Amos Cr. - E. Herbert	1920	4/1-10/1	0.63
"	Denmark Wash Spr. - J. Christensen	1912	all year	2.00
60	Lost Creek - Lost Cr. Irr. Co.	1890		
	(a) Storage of 1,000 AF in Brian and Rex Reservoirs 3/15-10/15			
62	(b) 1890 17.34 to 26.00 cfs 3/15-10/15			
63	(c) 1890 2.00 cfs Domestic			
	(See details on Lost Cr. on p. 60 thru 63. See p. 23 of Cox Decree for Little Lost Creek.)			
60	Lost Cr. - Allen Searle	1883	8/1-10/15	1.84 - 2.76
"	Lost Cr. & Dry Cr. - F. E. Nielson	1880	5/1-6/15	high water right
"	Unnamed Spr. - J. A. Scorup	1880	4/1-10/15	0.67 - 1.00
67	Sevier River - Jumbo Plaster & Cement Co.	1911	150.0 cfs	power
	Salina Creek & tributaries			
63	Yogo Cr. - Manti Livestock Co.	1878	6/15-12/1	half of entire flow
"	Niotche Cr. - Manti Livestock Co.	1878	4/1-10/15	5.98 - 8.97
"	Yogo & Niotche Creeks - Manti Livestock Co.	1878	11/1-6/1	hlf. of both stream
"	Gates Creek - Freece & Larson			
"	Gates Creek (a) 1880 Sufficient to irrigate		4/1-10/15	173.3 Ac.
"	Gates Creek (b) 1880 Supplemental supply		4/1-10/15	173.3 Ac.
"	Gates Creek (c) 1880 Storage of 150.0 AF in Gates Res.		4/1-10/15	
"	Gates Creek (d) 1880 0.50 cfs for domestic			
64	Gates Creek - Wilkinson Estate 1885		4/1-10/15	1.39 - 2.08
"	Gooseberry Cr. - A.N. Casto Storage of 19.20 AF in 5 reservoirs for use July 1 - Sept. 30 Stored Dec. 1 - Mar. 1 (1915)			
"	Gooseberry Cr. - A.N. Casto Storage of 100.0 AF in Farnsworth Res. stored Oct. 1 - July 1 Used July 1 - Oct. 15 (1885)			
65	Salina Creek - Skootempaugh Res. & Irr. Co. - 1894 & 1912			
	500.0 AF Skootempaugh Res. Used 6/1-9/15			
	Reservoir may fill once each year.			

Salina Creek & tributaries (Cont'd)

Page	
65	Salina Cr. - W. H. Brown 12/10/13 10.00 cfs year round (Brown Ditch)
"	Salina Cr. - Salina Cr. Irr. Co. 1863
"	(a) 0.60 - 0.90 cfs 3/15-10/15 Mill Ditch
"	(b) 46.3 - 55.56 cfs 3/15-10/15 Trunk Canal
"	(c) 1.88 - 2.83 cfs 4/1-10/15 Murphy Ditch
66	(d) 5 cfs year round domestic
"	(e) 220 AF in Niotch Res. 6/1-10/1 Stored 10/1-7/1
	Salina Cr. Irr. Co. rights are subject to Manti Livestock Co. rights
"	Gooseberry Cr. - J. O. Ivie 1880 0.01 cfs year round domestic
"	Salina Cr. - T. W. Simpers 1875
"	Salina Cr.
	(a) 0.04 - 0.06 cfs 4/1-10/15
67	(b) 0.42 - 0.63 4/1-10/15 (from unnamed springs)
"	(c) 0.02 cfs year round domestic
"	Salina Cr. - L. A. Lawyer 1922 20.00 cfs A-9042 Power gen.
"	Gooseberry Cr. - Gooseberry Cr. Irr. Co. 1880
"	(a) 17.72 cfs - 26.58 cfs 4/1-10/15 Seven ditches
69	(b) Supplemental 4/1-10/15
"	(c) Supplemental 4/1-10/15
"	Gooseberry Cr. - J. O. Ivie 0.01 cfs Domestic 1880

Redmond Lake

Page	
66	Redmond Lake - Redmond Irr. Co. 1875
"	(a) 15.00 cfs 3/15-11/1 Storage in Redmond Lake all year
"	(b) 0.40 cfs All year from Redmond Town Springs
197	Redmond Sp. Cr. - Westview Irr. Co. 1.5 cfs 4/1-10/15

Zone B - Chapter 5

Sevier River & its tributaries below Vermillion Dam & above Sev. Br. Res. Dam

Page			
183	Willow Creek - Willow Cr. Irr. Co. 1870 (a) 45 cfs 3/1-11/15 Upper Canal (b) 45 cfs 3/1-11/15 Lower Canal Storage - Willow Cr. Res. 851.6 AF Storage period 5/1-10/5 Use period 6/15-8/15 2 cfs domestic all year		
"	Fayette Spring - Fayette Irr. Co. 1861	all year	7.00
184	Jap Valley - Mellor estate - 4/3/11 A-3879 Cert. 516 20 AF from Dry Lake to be stored all year & used 3/1-12/1		
"	Hell's Kitchen Can. & Timber Can. Creeks - Flat Can. Irr. Co. 1875		
	(a) Hell's Kitchen Can.	3/1-10/15	8.00 - 18.00
	Timber Can.	3/1-10/15	8.00 - 18.00
	(b) 2.00 cfs all year for domestic		

Sanpitch River & tributaries above Gunnison Res. Dam (Johnson Decree)

70-71	North Fork Sanpitch R. - A.E. McIntosh Priority 1876-1898 12.49 cfs to be diverted into 7 ditches	4/1-10/15	
"	Spring tributary to N. Fk. Sanpitch R. - A. E. McIntosh	all year	0.01
"	No. Fk. Sanpitch R. - S.O. Nielson - Priority 1876-78	4/1-10/15	4.93
"	No. Fk. Sanpitch R. - J.H. Seeley 1898	4/1-7/1	1.01
"	No. Fk. Sanpitch R. - Fed. Land Bank 1900	4/1-7/1	0.55
"	So. Fk. Sanpitch R. - S. D. Bills 1882	4/1-10/15	0.33
"	So. Fk. Sanpitch R. - G.A. Wheeler & B. Tucker 1885	4/1-10/15	0.86
72	So. Fk. Sanpitch R. - G.A. Wheeler & B. Tucker 1885 Storage period 4/1-7/1 Use period 8/1-8/31	Storage right for 4.00 AF	
"	So. Fk. Sanptich R. - W. Jensen 1893	4/1-10/15	0.18
"	So. Fk. Mrs. C. Mower 1890	4/1-10/15	0.21
"	Lone Pine Creek - Lone Pine Irr. Co. 1875	4/1-10/15	1.14
"	Springs - Spr. Branch Irr. Co. 1870	4/1-10/15	0.56
73	Springs - Spr. Branch Irr. Co. 1870	10/15-4/1	0.56
"	Stewart Spr. - P.R. Stewart 1890	all year	0.19
"	Unnamed Spr. - C.L. Stewart	all year	0.05
"	Sanpitch River - W. E. Mower 1890	4/1-10/15	0.04
"	Sanpitch River - Niels Hansen 1890	4/1-10/15	0.17
"	Crooked Cr. & Stewart Sprs. - Crooked Cr. Irr. Co. 1882	4/1-10/15	2.86

Sanpitch River & tributaries above Gunnison Res. Dam (Johnson Decree) (Cont'd)

Page			
73	Crooked Cr. & Stewart Sprs. - Crooked Cr. Irr. Co. 1882	10/15-4/1	1.00
"	Dry Creek - Dry Cr. Irr. Co., et al - 1871	4/1-10/15	9.00
75	Dry Creek - Dry Cr. Irr. Co., et al - 1871	10/15-4/1	2.00
"	Sanpitch R. - J. W. Christensen 4/5/24	power right	4.00
"	Sanpitch R. - J. L. Mower 1880	4/1-10/15	0.24 - 0.11
"	Sanpitch R. - Sheep Ditch Co., 1897	4/1-10/15	4.50
"	Sanpitch R. - Sheep Ditch Co. 1897	all year	2.50
"	Indian Spr. Hollow - L. Poulson 6/29/14	A-5803 Cert. 769	0.30
76	Sanpitch R. - Mower Ditch Co. 1893	4/1-10/15	5.00 - 2.20
"	Sanptich R. - Mower Ditch Co. 1893	10/15-4/1	1.00
"	Sanpitch R. - A. Anderson 1876	4/1-10/15	0.23 - 0.10
"	Oak Creek - Sanpete Oak Cr. Irr. Co. 1883	4/1-10/15	24.50 - 10.70
77	Oak Creek - Sanpete Oak Cr. Irr. Co. 1883	10/15-4/1	3.00
"	Oak Creek - C. L. Mower 1883	4/1-10/15	0.45 - 0.20
"	Spr. Branch Slough - D. A. Clement 1890	4/1-10/15	0.42
"	Spr. Branch Slough - Meadow Irr. Co. 1883	4/1-10/15	2.88 - 1.27
"	Spr. Branch Slough - Meadow Irr. Co. 1883	10/15-4/1	1.00
"	Spring area - C. W. Fowles 1870	4/1-10/15	0.20
"	Spring area - J. H. Mower 1892	4/1-10/15	0.51
"	Spring area - J. H. Mower 1892	10/15-4/1	0.01
78	Fairview City Springs - Fairview City 1859	all year	1.00
"	Spring area - Sanpete County Poor Farm 1897	all year	0.03
"	Cottonwood Creek - Gooseberry & Cottonwood Irr. Co. 1882-1897 39.15 cfs into several ditches 4/1-10/15 1.50 cfs 10/15 - 4/1 for domestic & stock		
79	Cottonwood Creek - Fairview Cottonwood Irr. Co. 1858	4/1-10/15	19.27 - 9.64
		all year dom. & stk.	2.00
"	Spring area - J. L. Bench 1885	all year	0.14
"	Lower Mud Spr. - A. B. Cox 2/18/16	4/1-11/1 A-6623 Cert. 951	0.11
80	Unnamed Spring - P. Sundwall 1865	4/1-10/15	0.46 - 0.20
"	Unnamed Spring - E. Cheney 1858	4/1-10/15	0.2
"	Old Mill Race - E. Cheney 1858	4/1-10/15	0.41 - 0.18

Sanpitch River & tributaries above Gunnison Res. Dam (Cont'd)

Page			
80	Spring Creek - M.J. Howell 1865	4/1-10/15	0.20 - 0.09
"	Cottonwood Wash - M.J. Howell 1865	4/1-10/15	0.23 - 0.10
"	Spring Branch Slough - J.A. & U. Larsen 1865	4/1-10/15	0.31 - 0.14
81	Spring Branch Slough - E. Cheney 1858	4/1-10/15	0.04
"	Sanpitch River - J. Oborn 1878	4/1-10/15	0.11 - 0.05
"	Sanpitch River - J. Oborn 1887		18.00 power
"	Spring Cr. Sloughs - North & South Slough Irr. Co. 1880	4/1-10/15	0.55
82	Drains - D. Sanders - Entire flow of certain drains		
"	Spr. Cr. Slough - South Slough Irr. Co. 1878	4/1-10/15	0.67
"	Spr. Cr. Slough - L. C. Larsen 1869	4/1-10/15	1.02
83	Lower Spr. Cr. - Miner-Turpin Ditch Co. 1865	4/1-10/15	1.58
"	Spring Cr. Canyon - Spring Canyon Irr. Co. 1880 - 1895	4/1-10/15	9.78 - 4.28
84	Archie's Hollow - F. C. Jensen 6/1/16 A-6786 Cert. 933	4/1-10/15	0.71
" 86	Birch Creek - Birch Cr. Irr. Co. & Mt. Pleasant Birch Cr. Irr. Co. 1850-70 Entire flow all year. When flow recedes to 28.06 cfs one-half to each Co. Diverted into 8 ditches		
"	Spring area - A. U. Miner 1865	4/1-10/15 all year	0.66 0.10
"	Spring area - J. M. Burns 1882	4/1-10/15 all year	0.20 0.10
87	Spring area - C. Turpin 1874	all year	0.08
"	Spring area - G. P. Peterson 1870	4/1-10/15	0.10
"	McArthur Spring - E. McArthur 1990	4/1-10/15	0.17
"	McArthur Spring - E. McArthur 1990	10/15-4/1	0.07
"	E. Rasmussen Slough - E. Rasmussen 1880	4/1-10/15	0.25
"	E. Rasmussen Slough - E. Rasmussen 1880	10/15-4/1	0.10
"	Meiling Spr. - L.A. Seely 1875	4/1-10/15	0.33
88	Meiling Spr. - L.A. Seely 1875	10/15-4/1	0.10
"	Madsen & Willow Slough - A.O. Madsen 1860	4/1-10/15	0.33
"	R. Brown Spr. - R. Brown 1881	4/1-10/15	0.25
"	R. Brown Spr. - R. Brown 1881	10/15-4/1	0.10
"	White Spr. - F. D. White 1870	4/1-10/15	0.07
"	Sanpitch R. - L.A. Peterson 1876	4/1-10/15	0.43 - 0.19
88-89	North Creek - North Cr. Irr. Co. 1878-86	4/1-10/15	30.00 - 13.10
90	North Creek - W.D. Candland 2/4/03	4/1-10/15	2.90
"	North Creek - W.D. Candland 2/4/03	4/1-10/15	2.10

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd.

Page			
90	North Creek - North Cr. Irr. Co. 1862	4/1-10/15	22.95-10.03
"	North Creek - North Cr. Irr. Co. 1862	10/15-4/1	5.00
91	North Creek - R. Brown 1881	4/1-10/15	1.97-0.86
"	North Creek - P.A. Allred 1878	5/1-7/20	0.71-0.31
"	North Creek - P.A. Allred 1878	5/1-7/20	1.10-0.48
"	North Creek - E. L. Brandon 1878	5/1-7/20	1.79-0.78
"	Waldemar Spr. - E. T. Waldemar 1890	4/1-10/15	0.50
"	Waldemar Spr. - E. T. Waldemar 1890	10/15-4/1	0.10
"	Mule Cr. Spr. - J.F. Christensen 1885	all year	0.10
"	Barton Sprs. - City of Mt. Pleasant 1860	all year	1.04
"	Coal Fork Spr. - City of Mt. Pleasant 1859	all year	0.50
92	Pleasant Cr. -- City of Mt. Pleasant 12/16/12 A-4967 Cert. 842	14.00 cfs for power	
"	Pleasant Cr. -- City of Mt. Pleasant 1859	4/1-10/15	13.60-7.78
"	Pleasant Cr. - Pleasant Cr. Irr. Co. 1859	4/1-10/15	31.20-15.60
93	Pleasant Cr. - Pleasant Cr. Irr. Co. 1910	4/1-10/15	5.00
"	Pleasant Cr. - Pleasant Cr. Irr. Co. 1859	10/15-4/1	4.00
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co. 1878	4/1-10/15	1.83-0.92
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co. 1885	4/1-10/15	1.26-0.63
94	Pleasant Cr. - A. C. Candland 12/4/09 A-2867 Cert. 1078	4/1-7/1	0.50
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co. 1878	4/1-10/1	11.22-5.61
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co. 1885	4/1-10/1	14.90-7.46
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co. 1910	4/1-10/1	5.00
"	Pleasant Cr. - Pleasant Cr. Highland Irr. Co.	5/1-7/15	35.00
95	Pleasant Cr. - A-3318 6/20/10 Cert. 199		
"	Pleasant Cr. - A-3590 11/10/10 Cert. 353		
"	Pleasant Cr. - A-3591 11/10/10 Cert. 200		
"	Pleasant Cr. - A-3642 11/28/19 Cert. 201		
"	Pleasant Cr. - Mt. Pleasant Mill & Power Co. 1870	all year	7.00
"	K. & L. Barton Spring - K. & L. Barton 1871	4/1-10/15	0.15-0.10
"	K. & L. Barton Spr. - K. & L. Barton 1871	10/15-4/1	0.10

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd.

Page			
96	Olsen Spr. - W. Olsen 1875	all year	0.10
"	S. A. Barton Spr. - S.A. Barton 1868	4/1-10/15	0.20
"	S. A. Barton Spr. - S.A. Barton 1868	10/15-4/1	0.10
"	Wm. Olsen Spr. - N. A. Nielson 1875	4/1-10/15	0.67
"	Wm. Olsen Spr. - N. A. Nielson 1875	10/15-4/1	0.15
"	Slough - C. C. Nielson 1888	4/1-10/15	0.20
"	Slough - C. C. Nielson 1888	10/15-4/1	0.10
97	Barton Spr. - E.K. Barton 1871	4/1-10/15	0.13
		10/15-4/1	0.10
"	Barton Slough - G. G. Madsen 1893	4/1-10/15	0.20
		10/15/4/1	0.10
"	Barton Slough - C. W. Sorensen 1893	4/1-10/15	0.31
		10/15-4/1	0.10
183	Spring - A. Jensen	all year	0.50
97	Spring No. 1 - W.G. Wagstaff 1864	all year	0.05
"	Spring No. 2 - W. G. Wagstaff 1864	all year	0.05
98	Erickson Slough - J. Olsen estate, et al 1876	4/1-10/15	1.38
"	Erickson Slough - J. Olsen estate, et al 1876	10/15-4/1	0.20
"	North & South Streams - J. K. Madsen, et al 1876	4/1-10/15	1.33
99	North & South Streams - J. K. Madsen, et al 1876	10/15-4/1	0.20
"	North & South Streams - J. K. Madsen, et al 1876	3/1-11/30	supple-mental
"	Olsen New & Old Spr. - S.M. Olsen estate 1881	4/1-10/15	0.33
"	Olsen New & Old Spr. - S.M. Olsen estate 1881	10/15-4/1	0.20
"	Olsen New & Old Spr. Water may be stored in Olsen Res.		5.0 AF
"	Hebe Ivie Spr. - J.K. Madsen 1890	all year	0.16
100	Oldham Spr. - J. H. Seely & Sons 1883	all year	0.37
"	Upper & Lower Lake Sprs. J.H. Seeley & Sons Water may be stored Upper & Lower Lake Reservoirs	all year	10 AF
"	Poulson Sprs. - A. H. Poulson 1878	all year	0.03
100-103	<u>Twin Cr. & Cedar Creek</u>		
	First Class - Twin Creek Irr. Co. 1859 From Twin Cr. & ½ flow of Cedar Cr.	4/1-10/15	29.36
	Cedar Cr. Irr. Co. 1859 6.09 cfs from ½ flow of Cedar Cr.		
	<u>Second Class</u> - Cedar Cr. High Water Irr. Co. 1895 0.105 cfs from Cedar Cr.	4/1-10/15	
	<u>Third Class</u> - Poulson - Peterson - Hasler 1909 1.00 cfs from Twin Cr. 5/15-7/15		
	<u>Fourth Class</u> - Cedar Cr. Highwater Irr. Co. 1895 0.048 cfs from Cedar Cr. 4/1-10/15		
	<u>Fifth Class</u> - Twin Cr. Irr. Co., Cedar Cr. Irr. Co., Poulson, et al, Cedar Cr. Highwater Irr. Co. 46.127 cfs		
	<u>Sixth Class</u> - J. Monson, et al 1903	5/1-7/15 Cedar Cr.	6.00

Sanpitch River & tributaries above Gunnison Res. Dam cont'd

Page			
101-103	Seventh Class - Poulson, et al	5/15-7/15	6.00
	Eighth Class - Cedar Cr. Highwater Irr. Co.	4/1-10/15	27.50
	Domestic & Stk. Twin Cr. Irr. Co. 10 cfs from Twin Cr. & ½ flow of Cedar Cr. Cedar Cr. Irr. Co. 3 cfs from ½ flow of Cedar Cr. 10/15-4/1		
101-103	Cedar Cr. - Aiken, et al 1878 4.00 cfs All year when flow exceeds 12.18 cfs		
104-111	Sanpitch River - Johnson Decree of 7/17/01 Ten classes of water specified. Moroni Irr. Co. Moroni - Mt. Pleasant Irr. Co. McArthur - Frandsen Ditch Co. Brady Ditch Co. Sanpitch Fairview City Ditch Co. West Milburn Irr. Co. East Milburn Irr. Co. Meadow Ditch Co. Graveyard Ditch Co. Moroni City Corp. Various other individual and company users. Any flow above the tenth class is awarded Moroni Irr. Co.		
111-112	Twin & Cedar Creeks - P.Y. Jensen 1859	4/1-10/15	0.43-0.19
"	Twin & Cedar Creeks - J.C. Jordan, et al 1859	4/1-10/15	1.29-0.56
"	Twin & Cedar Creeks - L.L. Peterson 1859	4/1-10/15	0.43-0.19
"	Twin & Cedar Creeks - J. Poulson 1859	4/1-10/15	0.29-0.18
"	Twin & Cedar Creeks - L.K. Barton 1859	4/1-10/15	0.29-0.13
"	Twin & Cedar Creeks - L.K. Barton 1859	10/15-4/1	0.07
"	Twin & Cedar Creeks - A. Coates 1860	4/1-10/15	2.03-0.89
"	Twin & Cedar Creeks - A. Coates 1890	4/1-10/15	0.91-0.40
"	Twin & Cedar Creeks - A. Coates 1860	10/15-4/1	0.30
113	Twin Cr. - A. H. Poulson 1871	4/1-10/15	1.09-0.48
"	Twin Cr. - A. H. Poulson 1871	10/15-4/1	0.10
"	Twin Cr. - H. Hasler 1859	4/1-10/15	0.14-0.06
"	Twin Cr. - L.K. Barton 1874	4/1-10/15	0.95
"	Twin Cr. - L.K. Barton 1874	10/15-4/1	0.20
"	Twin Cr. - L.K. Barton 1878 Storage in Ole Hansen Res. 10/1-5/1 Used 4/1-10/1		

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd

Page	Source - Owner, Priority	Period	Amount
113	Cedar Cr. - M.R. Anderson 1912 A-1316 Cert. 362	5/1-7/1	1.70
"	Johanson Spr. No. 1 - J. Johanson 1875	4/1-10/15	0.80
114	Johanson Spr. No. 1 - J. Johanson 1875	10/15-4/1	0.25
"	Johanson Spr. No. 2 - J. Johanson 1875	4/1-10/15	0.25
"	Peterson Slough - J.&J. Johanson 1878	4/1-10/15	0.64
"	Peterson Slough - J.&J. Johanson 1878	10/15-4/1	0.20
"	Johanson Slough - Big Ditch Irr. Co. 1877	4/1-10/15	1.00
"	Johanson Slough - Big Ditch Irr. Co. 1877	10/15-4/1	0.20
115	Little Ditch Spr. - Little Ditch Co. 1877	4/1-10/15	0.25
"	Little Ditch Spr. - Little Ditch Co. 1877	10/15-4/1	0.10
"	Cedar Cr. Slough - J. Peel 1881	4/1-10/15	0.77
"	Cedar Cr. Slough - J. Peel 1881	10/15-4/1	0.10
"	Cedar Cr. Slough - A. Peel 1881	4/1-10/15	0.11
"	Cedar Cr. Slough - A. Peel 1881	10/15-4/1	0.10
116	Cedar Cr. Slough - Cedar Cr. Slough Irr. Co. 1870	4/1-10/15	1.75
"	Cedar Cr. Slough - Cedar Cr. Slough Irr. Co. 1870	10/15-4/1	0.25
"	Snake Sprs. - Snake Sprs. Irr. Co. 1860	4/1-10/15	3.54
117	Snake Sprs. - Snake Sprs. Irr. Co. 1860	10/15-4/1	0.50
"	Bottom Slough - J. Larsen 1880	4/1-10/15	0.38
"	Jorgenson Slough - J. Larsen 1880	4/1-10/15	-
"	South Slough - J. Larsen 1880	4/1-10/15	0.83
"	Erickson Slough - J. Larsen 1880	4/1-10/15	-
"	North Slough - J. Larsen 1880	4/1-10/15	-
"	Snake Sprs. - J. Larsen 1880	4/1-10/15	-
118	- - J. Larsen 1880 1.00 cfs 10/15-4/1 from all above		
"	Matson Sprs. - N. P. Nielson, et al 1878	4/1-10/15	0.57
"	Matson Sprs. - N. P. Nielson, et al 1878	10/15-4/1	0.10
"	Larson Corral Spr. - N. P. Nielson 1878	all year	0.10
"	Sanpitch River - Rock Dam Irr. Co. 1874	3/1-11/15	41.57-18.17
119		11/15-3/1	5.00
"	Gamit Canyon - F.D. Smyth 1880	4/1-10/15	3.26-1.43
"	Big Springs - F.D. Smyth 1880	10/15-4/1	0.50
119-120	Big Springs - Big Springs Power Co. 1902	all year	13.00
	Power generation A-598 Storage 3 AF each 24 hrs. Priority 1921 Period of storage 12/1-3/20 A-8730 Cert. 3024		
120	Big Springs - F. L. Hansen 1885	all year	0.02
120-122	Big Springs, Log Canyon, Big Hollow, Pole Canyon, Maple Canyon-South Branch, Crooked Cr. - South Branch, Squaw Springs - South Branch, Birch Creek - Fountain Green Irr. Co. 1861	3/15-11/15	44.00
	Storage of 255.00 AF 1861 Storage period 11/15-3/15 Use period 3/15-11/15 Stored in Seven Cedar Hills Reservoirs		

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd

Page			
122	Big Springs - Fountain Green City 1861	all year	1.00
"	Tidd Creek - J. S. Ottosen, et al 1860	3/1-11/15	entire flow
122-123	Moroni Pole Can. - J. Lund, et al 1870	3/1-10/15	12.18-5.33
123	Bailey Spr. - P. Bailey 1893	all year	0.02
123-124	Lauritz Tunnel Spr. - L. Taylor, et al 1876	all year	0.10
124	Lauritz Tunnel Spr. - L. Taylor, et al 1876	2/15-10/15	0.54
"	Maple Canyon - L. Taylor, et al 1876	2/15-10/15	12.41-5.17
125	Maple Canyon - Freedom Irr. & Waterworks Co. 1871	all year	
"	Currant Canyon - L. Taylor, et al and Freedom Irr. & W.W. Co. 1871	2/15-10/15	10.00-4.38
		10/15-2/15	0.12
126	Silver Cr. - Johnson & Prestwich 1876	all year	2.10-1.05
"	Silver Cr. - Johnson & Prestwich 1876	all year	4.64-2.32
"	Prestwich Spr. - Wm. Prestwich 1875	4/1-10/15	1.00
"	Blue Hill Spr. - Blue Hill Spr. Land & Grazing Co. 12/31/10 A-3699 Cert. 205	all year	0.0087
"	Spring - Moroni Land & Grazing Co. 8/8/16 A-6882 Cert. 852	all year	0.035
127	Silver Cr. - N. L. Eliason 1870	4/1-10/15	2.50-1.00
"	Silver Cr. - Silver Cr. Irr. Co. 1870	4/1-10/15	9.42-5.90
"	Silver Cr. - Silver Cr. Res. Co. 1898 1,480 AF storage in Wales Res. 10/15-4/1 Used 4/1-10/15		
"	Silver Cr. - Silver Cr. Irr. Co. 1898	10/15-4/1	1.0
"	North Spr. - Wales Irr. Co. 1858	3/1-11/15	0.54-0.24
"	North, Middle & South Sprs. Wales Irr. Co. 1858	3/1-11/15	3.80-1.66
128	New Wales Canyon Cr. - Wales Irr. Co. 1858	3/1-11/15	20.64-9.04
"	Limekiln Spr. - Wales Irr. Co. & Wales Town 1858	all year	0.18
"	Pete's Canyon Cr. - Wales Irr. Co. 1858	3/1-11/15	5.79-2.54
"	Pete's Canyon Cr. - Wales Irr. Co. 1858	11/15-3/1	2.00
"	Pete's Canyon Cr. - T. J. Edmunds 1858	3/1-11/15	2.82-1.23

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd

Page			
129	Pete's Canyon Cr. - T. J. Edmunds 1858	11/15-3/1	0.50
"	Lamb's Spr. - A.A. Lamb 1870	all year	0.21
129-130	Sanpitch River - West Point Irr. Co. 1875		
	(a) 30.50 cfs not to exceed 9,200 AF	3/1-12/1	
	(b) 3.00 cfs	12/1-3/1	
"	Pro-ration between West Pt. Irr. Co. & Bagnall Ditch Co.		
130	Sanpitch River - Island Irr. Co. (Bagnall Ditch Co.) 1875		
	(a) 65.00 cfs not to exceed 19,095 AF	2/24-12/1	
	(b) 4.00 cfs	12/1-2/24	
130-132	Class A & B rights		
132	Sanpitch River - J. W. Christensen 1882	2/24-12/1	10.00 not to exceed 2,260 AF
133-134	Sanpitch River - H. E. Peterson 1882 for various periods. Total not to exceed 3,360 AF Must notify Gunnison Irr. Co. & Highland Irr. Co. when irr. commences.	3/1-12/1	125
134	Freeman Allred Spr. - F. Allred 1890	4/1-10/15	0.36
"	Freeman Allred Spr. - F. Allred 1890	10/15-4/1	0.20
"	Spring - H. Jensen 1900	all year	0.10
"	Oak Creek - Spring City Corp. 4/5/12 A-1009 Cert 290 5.00 cfs all year for power		
134-135	Oak Creek - Spring City Roller Mill Co. 1870	all year for power	6.00
135	Oak Creek - Agreement with Horseshoe Irr. Co.		
135-136	Oak Cr. & Canal Cr. - Horseshoe Irr. Co.		
	(a) 66.24 cfs 1853	4/1-10/15	
	(b) 1.48 cfs 1870	4/1-10/15	
	(c) 6.72 cfs 1878	4/1-10/15	
	(d) 20.26 cfs 1880	4/1-10/15	
	Six diversions form Oak Cr.		
	Ten diversions from Canal Cr.		
	One diversion from Spring area		
	(e) 1.00 cfs 1853	all year	
	(f) 4.00 cfs 1853	10/15-4/1	
137	Canal Cr. - J. Johnson 1860	4/1-10/15	2.10
"	Canal Cr. - J. Johnson 1860	10/15-4/1	0.25
"	Canal Cr. - Chester Res. Ditch Co.		
	(a) 11.84 cfs 1870	4/1-10/15	
	(b) 6.92 cfs 1878	4/1-10/15	
	(c) 33.21 cfs 1899	3/1-4/1	
	(d) Storage in four reservoirs of 545.00 AF	1883	
	Storage all year. Used 4/1-10/15		
138	Spring - A. Olsen 1/15/16 A-5707 Cert. 534 1/12 cfs all year		
"	Bill Allred, Johnson & Pigeon Canyons - Armstrong-Olsen, et al 1854	4/1-10/15	14.42
		10/15-4/1	3.00

Sanpitch River & tributaries above Gunnison Res. Dam, cont'd

Page			
138	Excell Cr. - Dave Christensen 1870	3/1-11/15	10.43-4.58
139	Excell Cr. - Dave Christensen 1870	11/15-3/1	2.00
"	Dry Canyon Cr. - J. O. Larsen, et al 1876	3/1-11/15	3.08-1.35
"	Dry Canyon Cr. - J. O. Larsen, et al 1876	11/15-3/1	2.00
"	Big Spring - Ephraim City Corp. 1854	all year	1.6
"	Big Spring - Ephraim City Corp. 1/28/28	all year for power	3.00
140	Cottonwood & New Canyons - Ephraim City Corp. 7/8/11	all year for power	7.53
"	Birch Spr. - F. C. Anderson 1893	4/1-10/15	0.15
140-141	Ephraim Cottonwood Cr. - Ephraim Irr. Co. 1854		
	(a) 218.81 - 95.73 cfs	3/15-10/15	thirteen ditches
	(b) 5.00 cfs	10/15-3/15	
	(c) Storage 25.77 AF in three reservoirs 11/30-3/15 Used 3/15-10/15 (1) 5.26 AF (2) New Can. Res. 15.5 AF (3) White Point Res. 5.01 AF		
	(d) 0.04 cfs 1880	4/1-10/15	
141-142	Willow Cr. - Ephraim Willow Cr. Irr. Co. 1861		
	(a) ½ flow of Willow Cr. not to exceed 46.50 cfs 4/1-10/15 in six ditches		
	(b) 2.00 cfs 1861 10/15-4/1		
142-143	Willow Cr. - Manti Willow Cr. Irr. Co. 1861		
	(a) ½ flow of Willow Cr. not to exceed 46.50 cfs	4/1-10/15	
	(b) 2.00 cfs 10/15-4/1		
143-144	Maple Can. Creek - H. Maylett 1860	4/1-10/15	0.63-0.28
144	Maple Can. Creek - H. Maylett 1860	10/15-4/1	0.15
"	Maple Can. Creek - F. Maylett 1860	4/1-10/15	0.76-0.33
"	Maple Can. Creek - F. Maylett 1860	10/15-4/1	0.15
"	Spring - D. Olsen & Sons A-2687 Cert. 956 9/13/09	all year	0.0033
144-146	Manti Creek, Funks Canyon, Sulphur Spr. & unnamed springs Manti City Corp. 1849	all year	
	(a) 0.134 cfs Municipal		
	(b) 7.00 cfs Power		
146	Manti Creek - A.P. Madsen 1869	all year	7.00 cfs for power
146	Manti Creek - Manti Roller Mill Co. 1852	all year	6.00 cfs for power

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Manti Creek, Funks Canyon, Sulphur Spr. & unnamed springs (Cont'd)

Page			
147-165	<u>Manti Creek</u> - Various water users		
147-159	First Class - 95.002 cfs 1850	4/1-10/15	
159	Second Class - 5.00 cfs 1852	4/1-10/15	
160	Third Class - 5.00 cfs 1856	4/1-10/15	
"	Fourth Class - Storage for first class users Used 6/15-10/15	4/1-6/20	
	(1) Burnt Hill Res. 40 AF 1860		
	(2) Cottonwood Res. 44.16 AF 1860		
	(3) Patten Res. 42.7 AF 1860		
	(4) Yearns Res. 1,502 AF 1860		
	(5) Loggers Fk. Res. 75 AF 1889		
	(6) Trout Lake 5 AF 1889		
161	Fifth Class - 33.00 cfs 1861	4/1-10/15	
"	Sixth Class - 7.00 cfs 1865	4/1-10/15	
"	Seventh Class 3.00 cfs 1868	4/1-10/15	
"	Eighth Class - 9.467 cfs 1872	4/1-10/15	
"	Ninth Class - 21.25 cfs 1875	4/1-10/15	
162	Tenth Class - 19.283 cfs 1880	4/1-10/15	
163	Eleventh Class - 5.00 cfs 1885	4/1-10/15	
"	Twelfth Class - 5.00 cfs 1890	4/1-10/15	
"	Thirteenth Class - 5.00 cfs 1892	4/1-10/15	
"	Fourteenth Class - 25.00 cfs 1888	4/1-10/15	
"	Fifteenth Class - 7.00 cfs 1849	10/15-4/1	
164-165	Water is diverted into 33 ditches		
165	Crystal Springs - W.G. Ehlert 1870	4/1-10/15	0.75
"	Crystal Springs - W.G. Ehlert 1870	all year for power	0.75
"	<u>Sanpitch River</u> - J. K. Olsen, et al 1878 Not to exceed 6,215 AF	2/24-12/1	17.00
178	<u>Sanpitch River</u> - T. J. Edmunds Not to exceed 630 AF	3/1-12/1	2.00
179-183	<u>Sanpitch River</u> - J. Thompson, et al 1859 from 10 diversion points	15,527.2 AF all year	

Chapter 5 - Zone B

Sanpitch River & tributaries below Gunnison Res. Dam

Page

176 Gunnison Irr. Co. 1860 priority

(a) 145 cfs 4/1-6/15
111.54 6/15-10/1
27,84 10/1-11/1
To be diverted into Larson Ditch, City Canal, Lee Ditch, Old Field Canal.

(b) 1.00 cfs Morrison Tunnel trib. to Sixmile Cr. All year

(c) 2.1518 cfs 4/1-11/1 Ninemile Cr. and part of award in (a) above

(d) Storage of 20,264.2 AF to be stored year round & used 4/1-11/1 Stored in Gunnison Res. and supplied from Sixmile Cr. & Sanpitch River

(e) Storage of 32 AF to be stored year round & used 4/1-11/1 Stored in Deep Lake & Shingle Mill Reservoirs, 240 & 8.0 AF respectively

(f) 2.5 cfs 4/1-11/1 & 10 cfs 11/1-4/1 for Dam & stock. The Gunnison Irr. Co. is entitled to the first right to sources hereinafter named to satisfy (a) above as follows:

(1) Waters of the Sanpitch River above Gunnison Res. Dam.
(2) One-half natural flow of Sixmile Cr.
(3) 2.1518 cfs of Ninemile Cr.
(4) 58% of natural flow of Twelvemile Cr.

177 Unnamed Wash - Lewis Larson 1/26/15 A-6043 Cert. 1712

(a) 5.00 cfs 4/1-11/15
(b) 500 AF Storage year round in Larson Res.

178	Sanpitch River - C. P. Peterson 1862	4/1-10/15	0.75
"	Sanpitch River - J. Christensen 1864	4/1-10/15	1.25
"	Sanpitch River - W. H. Gribble 1864	4/1-10/15	1.25

(Subject to only those of the Gunnison Irr. Co.)

Chapter 5-Zone B

Sanpitch River & tributaries - Sixmile Creek & Ninemile Creek

Appropriator	Decree Page	Priority Date	Amount	Use	Canal	Use Period	Remarks
(1) Gunnison Irr. Co.	177	1860	1/2 natural flow	Irr.	Four Canals	4/1-11/1	Larson, City, Lee, Old Field Canals
Gunnison Irr. Co.	169	1860	0.98 cfs	Irr.	Gunnison R. Feeder	4/1-10/15	(Natural flow can be stored in Gunnison Res.)
Gunnison Irr. Co.	176	1860	1.00 cfs	Irr.	Gunnison R. Feeder	1/1-12/31	Morrison Mine Tunnel
Gunnison Irr. Co.	176	1860	2.1518 cfs	Irr.	Ninemile Cr.	4/1-11/1	Ninemile Creek
(3) No. Sixmile Irr. Co.	167	1880	42.5 cfs from 25%	Irr.	Sixmile & Funks Lake ditches	4/1-10/15	
No. Sixmile Irr. Co.	168	1880	3 cfs from 25%	Dom.& stk.	Sixmile & Funks Lake ditches	10/15-4/1	
No. Sixmile Irr. Co.	168	1880	0.5 cfs	Dom.& stk.	Sixmile & Funks Lake ditches	1/1-12/31	Morrison Mine Tunnel
(4) Sterling Irr. Co.	168	1880	42.5 cfs from 25%	Irr.	Upper & So. Ditches	4/1-10/15	Morrison Mine Tunnel
Sterling Irr. Co.	168	1872	100 AF	Irr.	Upper & So. Ditches	6/1-9/15	Parley's, Skidway & Birch Cr. Res. (Subject to all other rights)
Sterling Irr. Co.	168	1872	3 cfs from 25%	Dom.& stk.	Upper & So. Ditches	10/15-4/1	
(5) Manti Irr. & Res. Co.	168	1899	1,541.19 AF	Irr.	Funks Lake	4/1-11/1	Subject to rights of Gunnison, No. Sixmile, & Sterling Irr. Co's.
Manti Irr. & Res. Co.	169	1880	All excess over 2 cfs	Irr.	Funks Lake	1/1-12/31	
(2) J. Ross Thompson	169	1880	1.50 cfs	Irr.	Three ditches	4/1-10/15	Subject to Gunnison Irr. Co. rights.
(6) Highland Canal Co.	166	1896	85.62 cfs	Irr.	Highland Canal	4/1-6/15	To be satisfied from Twelvemile Cr. Sanpitch R., Ninemile Cr., Sixmile Cr. or other sources
Highland Canal Co.	166	1896	40.00 cfs	Irr.	Highland Canal	6/15-10/15	

Sanpitch River & tributaries - Sixmile Creek & Ninemile Creek (Cont'd)

Appropriator	Decree Page	Priority Date	Amount	Use	Canal	Use Period	Remarks
Highland Canal Co.	167	1896	10.00 cfs	Dom.& stk.	Highland Canal	10/15-4/1	(Sixmile Cr. diversion is subject to all those listed above and equal to Manti Irr. & R. Co. right.
(7) Telluride Power Co.	169	1909	20 cfs	Power	Power ditch	1/1-12/31	Appl. 2382 Cert. 131-8 Non-consumptive.
Andrew Funk	169	1880	0.50 cfs	Irr.	Cove Cr. Spr. into Upper ditch	4/1-10/15	Subject to rights of Sterling Town
Andrew Funk	170	1880	0.50 cfs	Dom.& stk.	Cove Cr. Spr. into Upper ditch	10/15-4/1	
Town of Sterling	170	-	100%	M&I	Pipeline	1/1-12/31	Sterling municipal supply Upper Spr. in Cove Hollow
G. A. Funk	170	1880	0.12 cfs	Irr.	Whiskey Spr. ditch	6/1-11/30	Whiskey Spring
Mrs. Mary C. Funk	170	1880	0.37 cfs	Irr.	Funk Spr. ditch	4/1-10/15	Funk Spring
Gunnison City	170	1870	0.705 cfs	M&I	Pipeline	1/1-12/31	Peacock Spr. Gunnison municipal supply
David Olsen	170-171	1875	0.50 cfs	Irr.	Olsen Ditch	4/1-10/15	Ninemile Cr.
Hyrum Christensen	171	1877	0.45 cfs	Irr.	Spr. Ditch	4/1-10/15	Little Ninemile Spr.
Hyrum Christensen	171	1877	0.45 cfs	Dom.	Spr. Ditch	10/15-4/1	Little Ninemile Spr.

Sanpitch River & tributaries - Twelvemile Creek

Appropriator	Decree Page	Priority Date	Amount	Use	Canal	Use Period	Remarks
(2) Mayfield Irr. Co.	177	1871	150 cfs from 42%	Irr.	Eight ditches	4/1-10/15	Subject to rights of Gunnison Irr. Co.
(4) Mayfield Irr. Co.	172	-	50 cfs	Irr.	Eight ditches	4/1-10/15	Secondary right subject to rights of Newfield Canal Co. Reduced to 3 cfs 5/1-6/20
Mayfield Irr. Co.	172	1884	250 AF	Irr.	Eight ditches	7/1-10/1	Bear Hole Res. 150 AF Town Res. 100 AF
Mayfield Irr. Co.	172	1871	5 cfs	M&I	Eight ditches	10/15-4/1	
(5) Twin Lakes Res. Co.	172	1882	2 cfs	Suppl. Irr.	Eight ditches	7/1-10/1	
Twin Lakes Res. Co.	173	1882	315 AF	Suppl. Irr.	Eight ditches	7/1-9/1	Twin Lake Res. 175 AF, Dry Hole Res. 125 AF, Newfield Res. 15 AF, Suppl. supply to lands owned by Twin Lakes Res. Co. stockholders under Mayfield Irr. Co.
Hyrum Olsen & H.C. Bogh	174	1890	0.04 cfs	Irr.	Spring	4/1-10/15	Unnamed spring in SE Cor Sec. 20, T19S, R1E
Hyrum Olsen & H.C. Bogh	174	1890	0.04	Stock	Spring	10/15-4/1	
Centerfield Municipal Corporation	174	1881	1 cfs	M&I	Spring	1/1-12/31	Sorenson Spr.
(1A) Elmer A. Poulson	174	1881	0.56 cfs	Irr.	North Ditch Spanish Stream	4/1-10/15	Spanish Stream is return flow from Arapien Valley
Elmer A. Poulson	174	1866	0.50 cfs	Irr.	South Ditch	4/1-10/15	From Twelvemile Cr.
Elmer A. Poulson	174	1866	0.50 cfs	Dom.& stk.	South Ditch	10/15-4/1	From Twelvemile Cr.
A. J. Bjerregaard	174	1881	2.62 cfs	Irr.	North Ditch Spanish Stream	4/1-10/15	Spanish Stream

Sanpitch River & tributaries - Twelvemile Creek (Cont'd)

	Appropriator	Decree Page	Priority Date	Amount	Use	Canal	Use period	Remarks
	A. J. Bjerregaard	174	1881	0.25 cfs	Dom & stk	North Ditch Spanish Stream	10/15-4/1	Spanish Stream
	Walter Wilkinson	175	1881	1.66 cfs	Irr.	North Ditch Spanish Stream	4/1-10/15	Spanish Stream
	Walter Wilkinson	175	1881	0.25 cfs	Dom.& stk	North Ditch Spanish Stream	10/15-4/1	Spanish Stream
	R. S. Yardley	175	1881	0.77 cfs	Irr.	Spring Ditch	4/1-10/15	Three springs in SE¼ SW¼ 18 & Four springs in NW¼ Sec. 19, T19S, R2E
	R. S. Yardley	175	1881	0.25 cfs	Dom.& stk.	Spring Ditch	10/15-4/1	Three springs in SE¼ SW¼ 18 & Four springs in NW¼ Sec. 19, T19S, R2E
(6)	Orson Wilkinson	175	1886	0.50 cfs	Irr.	South Ditch	4/1-10/15	From Twelvemile Cr.
	Orson Wilkinson	175	1881	0.56 cfs	Suppl. Irr.	North Ditch	4/1-10/15	Spanish Stream
(3)	NewField Canal Co.	175	1878	32 cfs	Irr.	Newfield Canal	5/1-6/20	Irrigate 2,179 acres. Rights are secondary to first priority right of Mayfield Irr. Co.
(1)	Gunnison Irr. Co.	176	1860	58% of total	Irr.	Four canals	4/1-11/1	Larson, City, Lee, & Old Field Canals
	Gunnison Irr. Co.	177	1860	320 AF	Suppl. Irr.	Four canals	4/1-11/1	Deep Lake Res. 240 AF, Shingle Mill Res. 80 AF
	Gunnison Irr. Co.	177	1860	2.5 cfs	Dom.& stk.	Four canals	4/1-11/1	
	Gunnison Irr. Co.	177	1860	10 cfs	Dom.& stk.	Four canals	11/1-4/1	
(7)	Highland Canal Co.	166	1896	85.62 cfs	Irr.	Highland Canal	4/1-6/15	To be satisfied from 58 decreed to Gunnison Irr. Sanpitch R., Sixmile Cr. Ninemile Cr., or other sources.
	Highland Canal Co.	166	1896	40.00 cfs	Irr.	Highland Canal	6/15-10/15	
	Highland Canal Co.	167	1896	10 cfs	Dom.& stk.	Highland Canal	10/15-4/1	Also subject to right of Gunnison-Fayette Canal Co.

Sanpitch River & tributaries - Twelvemile Creek (Cont'd)

Appropriator	Decree Page	Priority Date	Amount	Use	Canal	Use Period	Remarks
Ferd Rosenlund	171	1880	1 cfs	Irr.	Rosenlund No. 1 Ditch	4/1-10/15	Order Canyon Cr.
Ferd Rosenlund	171	1880	Entire flow	Irr.	Rosenlund No. 2 Ditch	4/1-10/15	Olsen Canyon Spr.
Ferd Rosenlund	171	1880	1 cfs	Dom.	Rosenlund No. 2 Ditch	10/15-4/1	Olsen Canyon Spr.

Chapter 6 - Zone B

Sanpitch River below Gunnison Res. Dam

Page			
198-199	Gunnison Fayette Canal Co. - 40 cfs 3/1-10/1 after all above rights have been satisfied.		
197	Class AA right to Gunnison-Fayette Canal Co.	3/1-10/15	1.5

Sevier River-main stem below Vermillion Dam (Higgins Decree)

Primary Rights

193	Rockyford Canal Co. - 16,000 AF) Willow Bend Irr. Co. - 8,000 AF) Waters of Sevier R. yielded between Vermillion Dam & Rockyford Dam. Apr. 1 - 10/15 Can be stored in Rockyford Res. during March not to exceed 2,000 AF		
195	Class A		
"	Gunnison-Fayette Canal Co.	3/1-10/15	16.5
"	R.P. Dyreng & W. J. Wintch	3/1-10/15	6.0
"	J. W. Nielsen	3/1-10/15	0.8
"	Fritch Loan & Trust	3/1-10/15	3.2
"	Dover Irr. Co.	3/1-10/15	45.0[2]
"	Dover Irr. Co.	3/1-10/1	12.1[1]
"	Wellington Irr. Co. (Sev. Br. Res. Owners)	3/1-10/1	20.4
196	Central Utah Water Co. (p. 190)	3/1-10/1	12.4
"	Sam McIntyre Inv. Co.	3/1-10/1	22.0
"	Leamington Irr. Co.	3/1-10/1	23.6
"	Abraham Irr. Co., 1874 (p. 190)	3/1-10/1	59.0
"	Deseret Irr. Co., 1874 (p. 190)	3/1-10/1	74.0

" 1/ 6.3 cfs to be delivered to Central Utah Water Co.
5.8 cfs to Nicholson Seed Farms

2/ 23.7 cfs to Westview Irr. Co. in Westview Canal
1.2 cfs to be delivered to J.W. Nielson in Gunnison-Fayette Canal
20.1 cfs to be delivered in Dover Canal

Secondary Rights

"	Class B		
"	Abraham Irr. Co., 1874	3/1-10/1	5.0
"	Deseret Irr. Co. 1874	3/1-10/1	10.7
"	Class C		
"	Central Utah Water Co.	3/1-10/1	12.5

Sevier River-main stem below Vermillion Dam (Higgins Decree) (Cont'd)

Page			
196	Class D		
"	Abraham Irr. Co. 1890 priority	4/1-7/1	4,285.6 AF
197	Deseret Irr. Co. 1890 priority	4/1-7/1	5,714.4 AF
"	Class E		
"	Central Utah Water Co.	3/1-10/1	5.8
"	Class F		
"	Westview Irr. Co.	3/1-10/15	28.6
"	Gunnison-Fayette Canal Co.	3/1-10/15	14.3
"	R.P. Dyreng & W.J. Wintch	3/1-10/15	1.0
"	Central Utah Water Co.	3/1-10/1	4.3
"	Abraham Irr. Co. (1890)	3/1-10/1	9.0

Sevier R. & tributaries between Vermillion & Gunnison Bend Dams

197	Class AA rights		
"	1. Redmond Cr. Spr. - Westview Irr. Co.	4/1-10/15	1.5
"	2. Sanpitch River - Gunnison-Fayette Canal Co.	3/1-10/15	1.4
	(To be diverted from the yield of the Sanpitch R. below intersection of the river with the canal.)		
"	3. Ryan Meadow Spr. - St. of Utah	4/1-10/15	1.0
"	4. Ryan Meadow Spr. - Howard Roberts	4/1-10/15	0.7
"	Ryan Meadow Spr. - Archie Mellor	4/1-10/15	0.7
"	5. Sevier River - Central Utah Water Co. (Erickson right in Higgins Decree)	3/1-10/1	3.3
"	6. Sevier River - Nicholson Seed Farms	3/1-10/1	1.4
198	(Roberts right in Higgins Decree)		
	Well Rights		
"	A. Dover Dam Wells		
	1.0 cfs Westview Irr. Co.	4/1-10/15	
	Max of 3.0 cfs Gunnison Valley Land & Livestock Co.	4/1-10/1	
"	B. Kearns Ranch Wells		
	2.0 cfs Gunnison Valley Land & Livestock Co.	4/1-10/1	
"	C. Spaulding Livingston Wells		
	Not to exceed 15 cfs, Abraham Irr. Co.	4/1-10/1	
"	Sanpitch River		
	Maximum of 40 cfs of Sanpitch River to Gunnison-Fayette Canal Co. after all prior Sanpitch River rights have been satisfied.	3/1-10/1	

Sevier River main stem below Sevier Br. Res.

Page	
190	Deseret Irr. Co.) Abraham Irr. Co.) Have primary right of direct diversions Central Utah Water Co.) beginning March 1
193	Abraham Irr. Co. (Secondary right) A-1176 Cert. 78-8 1/8/07 3/1-7/1
190	Storage in Gunnison Bend Res. Deseret Irr. Co.) Abraham Irr. Co.) Entitled to store entire capacity during non-irr. season up to a max. of 10,000 AF which may arise below Sev. Br. Res. Dam. Also high flows between 4/1-6/30 not to exceed 10,000 AF and after prior rights are satisfied.
191	A-1367-A A-1367 - Al A-4562 5/10/07 5/10/07 3/19/12 Yield of river below Sevier Br. Res. Dam to be divided up among 5 companies as follows: 4/1-10/1

Melville Irr. Co.	11.8%	
Deseret Irr. Co.	18.9%	
Delta Canal Co.	30.7%	
Central Utah Water Co.	35.4%	
Abraham Irr. Co.	3.2%	
Central Utah Water Co.	100%	10/1-4/1

191-192 Four Party Contract

	Filing No. 1367-A (5/10/07)	Filing No. 4562 (3/19/12)
Central Utah Water Co.	51.1%	35.4%
Melville Irr. Co.	17.0%	11.8%
Deseret Irr. Co.	27.3%	18.9%
Abraham Irr. Co.	4.6%	3.2%
Delta Canal Co.		30.7%

199 Exchange Users

Apr. 16 - Oct. 10

200 Fall Water

"	Westview Irr. Co.	10/16-11/15 30
"	Gunnison-Fayette Canal Co.	10/16-11/15 30
"	Dover Irr. Co.	10/16-11/15 30

Sevier River below Gunnison Bend Res.

225 First 6.666 cfs 3/1-11/1

N. Rogers 2 cfs
J. Dewsnup 1.333
Conk, et al 3.333

Sevier River below Gunnison Bend Res. (Cont'd)

Page			
226	Next 8.84 cfs All year N. Rogers, et al		
226-229	Other uses		
	Sevier R. tributaries below Sevier Br. Res. Dam		
204	Molten & Blue Springs - Rathje & Graue	3/15-10/15	1,000 AF
"	Molten & Blue Springs - Rathje & Graue	10/15-3/15	0.75
"	Pigeon Creek - Levan Irr. Co. 1784 - 40.80 cfs (1865)		
"	Chicken Cr. - Levan Irr. Co. 1875 - 42.88 (1865)		
"	Chicken Cr. - Metal Grip Plaster Co.	all year for power	6.25
205	Springs trib. to Chicken Cr. - Levan City	all year	350 gpm
"	Skinner Spr's. - H. R. Francom	all year	0.07
"	Deep Can. Cr. - Mangleson, et al - 2.22-5.17	4/1-10/15	(1880)
"	Deep Can. Cr. - Mangleson, et al - 1.00 cfs domestic 10/15-4/1		
"	Spring area - T. A. Powell	4/1-10/15 10/15-4/1	0.47 0.1
"	Spring area - T. A. Powell	4/1-10/15 10/15-4/1	2.50 0.1
206	Little Salt Cr. - Schofield, et al	4/1-10/15	45.50
"	Little Salt Cr. - Schofield, et al domestic	10/1-4/1	2.00
"	Skinner or Mud Spr's. - A.Z. Bonhan A-984 6/9/11	all year	0.022
"	Chriss Canyon - Chase's 1885	4/1-10/15	31.70
207	Chriss Canyon - Chase's Domestic	10/15-4/1	1.5
"	Chicken Creek - Juab Lake Irr. Co.	4/1-10/15	2,400 AF
	Also the right to store 2,000 AF in Chicken Cr. Res. 10/15-6/15, period of use 4/1-10/15 (1900) Domestic use for Town of Mills All year		
"	Chase & Foote Sprs. - Juab Devel. Co. 1891	4/1-10/15	5
208	Chase & Foote Sprs. - Juab Devel.. 1891	10/15-4/1	1
"	Round Valley Cr. - 1.37 - 1.83 cfs (1860) Scipio Irr. Co.	4/1-10/15	
"	Round Valley Cr. - 60.45 - 80.60 cfs (1860) Scipio Irr. Co.	4/1-10/15	
"	Round Valley Cr. - Scipio Lake Res. storage, 6,586 AF, to be stored 9/1-7/1 and used 4/1-10/15		
"	Springs - Town of Scipio (1860)	all year	0.66
208-209	Sweetwater Spr. - J. Bastian - 12/10/17 Cert 1256	all year	0.00111
"	Unnamed Spr. - E. Brown 4/27/20 Cert. 1242	all year	0.0088
209	Oak Cr. Can. - F. Hatch 9/20/15 Cert. 1101	4/1-10/1	0.81

Sevier R. tributaries below Sevier Br. Res. Dam (Cont'd)

Page			
209	Syphon Spr. - F. Hatch 5/22/16 Cert. 1014	3/1-10/31	3
"	Springs - H. Hassell 1880	4/1-10/15	0.57
210	Cherry Creek - McIntyre Inv. Co.	4/1-10/15	0.64
"	Devil Cr. - McIntyre Inv. Co.	4/1-10/15	0.43
"	Tanner Cr. - P. Mayer 10/15/06 Cert. 52-B	all year	147.92 AF
"	Fool Cr. - Fool Cr. Irr. Co. 1872	4/1-10/15	14,84
"	Fool Cr. - Fool Cr. Irr. Co.	10/15-4/1	1
"	Fool Cr. - Leamington & Fool Cr. Pipeline Co.	all year	0.50
229	Oak Cr. - Oak Cr. Irr. Co. Primary Right 1870 Remainder to Andersons, et al	all year	55.40
211	Pole Can. Sprs. - Nielsons 1890	4/1-10/15	0.25
"	Dry Creek - Oak City Pipe Water Co. Cert. 303 1/13/11 (Municipal supply for Oak City)	all year	0.038

Pavant Valley

"	Giles, Whiskey & Duggins Creeks - Stephensons 1876	4/1-10/15	2.71
212	Giles, Whiskey & Duggins Creeks - Stephensons 3/13/12 Cert. 128	all year	4.00
"	Platinum Spr. - S. Stephenson 7/26/12 Cert 791	all year	5.24
"	Eightmile Cr. - Eight Mile Cr. Irr. Co. 1880	3/1-6/1	11.93
213	Eightmile Cr. - Eight Mile Cr. Irr. Co. 1880	3/1-6/1	1.60
"	W. Fk. Eightmile Cr. - Greenwood & Ray 2/28/10 Cert. 505	all year	3
"	W. Fk. Eightmile Cr. - Greenwood & Ray 2/28/10 Cert. 506	all year	10
"	Church Spr. - Stevens, et al 1860	4/1-10/15	entire flow
214	Church Spr. - Stevens, et al 1860	10/15-4/1	entire flow
"	Pioneer & Wild Goose Creeks - Holdem Irr. Co. 1858		32.22
"	Pioneer & Wild Goose Creeks - Holdem Irr. Co. Domestic		3
"	Springs - Holdem Irr. Co. Supplemental Supply		
"	Oak or Adobe Spr's. - W. Paul 1870	year round	0.05
215	Oak or Adobe Spr's. - W. Paul 1858	4/1-10/15	0.16
"	Maple Hollow - Bennett's 1880	4/1-10/15	0.87
"	Unnamed Spr's. - W. Bennett 1900	4/1-10/15	0.01
216	Quaking Aspen Spr. - McKee, et al 1900	all year	1
"	Johnson Can. Cr. - Hunter's 1886	3/1-7/15	1.13
"	Hunter Spr. - Hunter's	4/1-10/15	0.10
217	Chalk Cr. - Fillmore City 14½/25 of 24.5 cfs or less		
"	Chalk Cr. - Fillmore Irr. Co. 10½/25 of 24.5 cfs or less		
218	(Other information on Chalk Cr.)		
219	Pine Creek - Robison est. 29 cfs 1855		
"	Pine Creek - Robison est. 1.25 cfs 12/14/09 Cert. 1069	7/15-10/13	

Pavant Valley (Cont'd)

Page			
219	Maple Hollow - Anderson 1860	Irr. season	0.60
"	Maple Hollow - Anderson 1860	Non-irr. season	0.20
"	Maple Hollow - Robison 1860	Irr. season	0.60
"	Triangle Can. Cr. - Warner 4/28/10 Cert. 216	3/1-6/30	0.397
220	Unnamed Spr. - R. Stott 10/7/19 A-8321	all year	1.0
"	Meadow Cr. & Walker Can. - Meadow Irr. Co. 1850		50.41
"	Meadow Cr. & Walker Can. - Meadow Irr. Co. Domestic & stk.		
"	Dry Cr. - Meadow Irr. Co. 1850	Suppl. supply	6
221	Spring seep - Bushnell 2/2/16 Cert 1038	all year	0.011
"	Corn Cr. - Corn Cr. Irr. Co. 1880	Irr. season	89
222	Corn Cr. - Corn Cr. Irr. Co. 1880 (Kanosh Town supply)	Non-irr. season	6
"	Big Cottonwood Cr. - Christensen, et al 1880	Irr. season	17.20
"	Big Cottonwood Cr. - Christensen, et al 1880	Non-irr. season	0.50
"	Cottonwood Cr. - F. Barney 4/27/12 Cert. 1542	7/10-3/10	0.049
"	Little Cottonwood Cr. - Penny, et al 1890	Irr. season	4
"	Cottonwood Cr. - Mortensen 1890	4/1-10/15	0.50
		10/15-4/1	0.50
"	Oak Spr. - Mortensen 1890	4/1-10/15	0.50
		10/15-4/1	0.50
"	Oak Spr. & Little Cottonwood Cr. - Kanosh Indian Band of Ute Tribe Entire flow. Cert. 11277		
224	Brush & Wine Hollow Crs. - Holt's 1894	Irr. season	0.85
"	Dewal Spr. Basin - F. Christensen 4/13/14 Cert. 433	all year	0.25
"	Dewal Spr's. - F. Christensen 2/21/14 Cert. 445	all year	1/70
"	Spring Hollow - Ahlstrom 1888	all year	0.06
"	Unnamed Spr's. - W. Penney	all year	entire flow
225	Dry Wash - Black, et al 1900	4/1-10/15	6.70

Page				
185-190	Piute & Sevier Br. Reservoirs			
185	Piute Res. & Irr. Co.			
	A-296	400 cfs	3/14/05	
	A-1534	500 cfs & 200,000 AF	8/16/07	
	A-1624	300 cfs	10/21/07	
185-191	Sevier Bridge Reservoir Company			
	Abraham Irr. Co.			
	Deseret Irr. Co.			
	Delta Canal Co.			
	Central Utah Water Co.			
	Mellville Irr. Co.			
	Sevier Br. Res. Hawley Filing	8/26/02	1,500 cfs	104,000AF
186	First Priority			
	Sevier Bridge Res.	89,280 AF		
"	Second Priority			
	Piute Res.	40,000 AF		
"	Third Priority			
	Sevier Bridge Res.	24,000		
	Piute Res.	8,000		
"	Fourth Priority			
	Sevier Bridge Res.	13,720		
"	Fifth Priority			
	Sevier Bridge Res.	56,250		
	Piute Res.	18,750		
"	Sixth Priority			
	Sevier Bridge Res.	85% of remaining flow		
	Piute	15% of remaining flow		
190	Holdover storage privileges			

Allocated Storage in Sevier Br. Res.

Page		
192-193	Less than 104,000 AF in Sevier Br. Res.	
	Delta Canal Co.	50%
	Deseret Irr. Co.	16 2/3%
	Melville Irr. Co.	28 1/3%
	Central Utah Water Co.	5%
	Abraham Irr. Co.	0%
193	Storage in excess of 104,000 AF	
	Delta Canal Co.	17%
	Deseret Irr. Co.	20.55%
	Abraham Irr. Co.	5.45%
	Central Utah Water Co.	57%
	Melville Irr. Co.	0%
200	Wellington Irr. Co. from Sevier Br. Res. (Decreed to owners of Sev. Br. Res.) 4,000 AF or 25 cfs 4/15-10/1	

Allocated Storage in Sevier Br. Res. (Cont'd)

Page

200 Leamington Irr. Co. & McIntyre Inv. Co. - from Sevier Br. Res.

Rights as set forth above.	3/1-4/15	
90% of rights	4/16-10/1	

201 Exchange Users Storage Amounts in Sevier Br. Res.

202 Allocation in Sev. Br. Res. on July 1 each year. When storage = 129,280

Central Utah Water Co.	First 3,000 AF
Central Utah Water Co.	35.3%
Delta Canal Co.	30.7%
Deseret Irr. Co.	18.9%
Melville Irr. Co.	11.9%
Abraham Irr. Co.	3.2%

Same percent when storage exceeds 129,280 AF except Central Utah Water Co. does not get first 3,000 AF.

203 Exchange storage with Gunnisom Bend Res. owners.

" Losses in Sevier Br. Res.

204 Gain between Gunnison and Juab gages. 3/1-10/1 20 cfs

CHAPTER III

RESERVOIR MANAGEMENT

Management of the surface water storage reservoirs on the Sevier River system varies considerably. Accurate and detailed records are available for many facilities while others are operated without benefit of records on inflow, stage-capacity or releases.

This chapter presents data gathered and evaluated that is not published in other available references. Also included is information on four reservoir surveys performed during this investigation.

RESERVOIR SURVEYS

On October 3, 1960 at a meeting of the Joint Board of Directors of the Consolidated Sevier Bridge Reservoir Company and Piute Reservoir and Irrigation Company with Federal and state representatives, the directors of the reservoir companies voted to resurvey these two facilities with assistance from the U. S. Soil Conservation Service and the State of Utah. On October 5, 1960, Otter Creek Reservoir Company voted to resurvey this reservoir. During September, 1964, Gunnison Irrigation Company decided to contract for an original survey of Gunnison Reservoir.

These four surveys were performed using field surveys for ground control and aerial photography and Kelsh-plotter methods to determine topographic configurations. Engineering work was completed by the U. S. Soil Conservation Service. The irrigation companies furnished man-power assistance, equipment and finances. The State of Utah provided financial and advisory assistance. Release rate rating curves and technical assistance for installation of a stage staff gage at Gunnison Reservoir were provided by the U. S. Geological Survey.

Horizontal and vertical ground control was established using third-order survey criteria. Bench marks established during previous reservoir surveys and those established by the U. S. Coast and Geodetic Survey were tied into the survey network. Relationship of the reservoir surveys and the land net surveys was determined by locating and tying in section corners established by the Bureau of Land Management.

Aerial photography contracts were awarded to Continental Engineers, Inc. of Denver, Colorado for Otter Creek, Piute, and Sevier Bridge Reservoirs and H. G. Chickering, Jr. of Eugene, Oregon for Gunnison Reservoir. Low-level aerial photography at a scale of 1:5,000 was specified with sufficient coverage to meet the needs of topographic mapping by Kelsh Plotter at a scale of 1 inch equals 200 feet with 2-foot contour intervals.

Following is the procedure used to determine the area-capacity table after topographic plotting was completed:

1. The area between each contour was cut out and filed in separate envelopes.
2. One square mile of ozalid paper was cut out and weighed to determine the weight conversion factor. To adjust for humidity changes, this sample area was weighed four times

during the entire process with the time of weighing recorded to make the necessary conversion factor adjustments to the area weights.

3. Each area between contours was weighed separately and recorded.

4. The weights were recorded and converted to determine the values shown in the area-capacity table.

The area-capacity tables for the four reservoirs are given in Tables 1, 2, 3, and 4.

Total job cost for Otter Creek, Piute, and Sevier Bridge Reservoirs is $23,223.53. This is $1.45 per surface acre.

TABLE 1.--Area-capacity, Otter Creek Reservoir, Sevier River Basin, Utah

Contour	Area at contours	Volume between contours	Capacity of reservoir at contour
	Acres	Acre-feet	Acre-feet
-00.4			
00	39.1	11	11
02	313.8	353	364
04	510.6	824	1,188
06	707.3	1,218	2,406
08	869.2	1,577	3,983
10	1,037.3	1,907	5,889
12	1,231.8	2,269	8,158
14	1,330.7	2,563	10,721
16	1,421.9	2,753	13,473
18	1,520.5	2,942	16,416
20	1,632.3	3,153	19,569
22	1,743.8	3,376	22,945
24	1,841.6	3,585	26,530
26	1,945.7	3,787	30,317
28	2,056.8	4,003	34,320
30	2,175.1	4,232	38,552
32	2,295.8	4,471	43,023
34	2,410.6	4,706	47,729
36	2,522.6	4,933	52,662
38	2,646.4	5,169	57,831
40	2,768.3	5,414	63,246

TABLE 2.--Area-capacity, Piute Reservoir, Sevier River Basin, Utah

Contour	Area at contours	Volume between contours	Capacity of reservoir at contour
	Acres	Acre-feet	Acre-feet
9.2	0		
18	7.0	31	31
20	54.6	62	92
22	129.0	184	276
24	237.5	366	642
26	360.0	597	1,240
28	436.6	797	2,036
30	517.8	954	2,991
32	612.4	1,130	4,121
34	736.2	1,349	5,469
36	860.4	1,597	7,066
38	982.8	1,843	8,909
40	1,091.9	2,075	10,984
42	1,138.7	2,231	13,215
44	1,190.8	2,330	15,544
46	1,274.5	2,465	18,009
48	1,341.1	2,616	20,625
50	1,418.9	2,760	23,385
52	1,483.2	2,902	26,287
54	1,542.6	3,026	29,313
56	1,607.3	3,150	32,463
58	1,673.0	3,280	35,743
60	1,735.5	3,408	39,152
62	1,788.0	3,523	42,675
64	1,846.4	3,634	46,310
66	1,911.0	3,757	50,067
68	1,990.2	3,901	53,968
70	2,073.5	4,064	58,032
72	2,183.9	4,257	62,289
74	2,377.4	4,561	66,850
76	2,598.4	4,976	71,826

TABLE 3.--Area-capacity, Sevier Bridge Reservoir, Sevier River Basin, Utah

Contour	Area at contours	Volume between contours	Capacity of reservoir at contour
	Acres	Acre-feet	Acre-feet
07.8			
08	.5		
10	21.4	22	22
12	262.2	284	306
14	498.0	760	1,066
16	655.0	1,153	2,219
18	818.9	1,474	3,693
20	934.8	1,754	5,446
22	1,028.2	1,963	7,409
24	1,158.1	2,186	9,596
26	1,292.5	2,451	12,046
28	1,453.6	2,746	14,793
30	1,622.5	3,076	17,869
32	1,746.7	3,369	21,238
34	1,838.5	3,585	24,823
36	1,924.5	3,763	28,586
38	2,045.5	3,970	32,556
40	2,182.5	4,228	36,784
42	2,293.0	4,476	41,260
44	2,432.9	4,726	45,986
46	2,554.7	4,988	50,973
48	2,664.8	5,219	56,193
50	2,780.2	5,445	61,638
52	2,915.7	5,696	67,334
54	3,028.6	5,944	73,278
56	3,151.4	6,180	79,458
58	3,275.9	6,427	85,885
60	3,608.4	6,884	92,769
62	4,268.0	7,876	100,646
64	4,904.3	9,172	109,818
66	5,682.2	10,587	120,405
68	6,473.9	12,156	132,561
70	7,191.0	13,665	146,226
72	7,911.1	15,102	161,328
74	8,547.9	16,459	177,787
76	9,316.8	17,865	195,652
78	10,135.9	19,453	215,104
80	10,905.2	21,041	236,145

TABLE 4.--Area-capacity, Gunnison Reservoir, Sevier River Basin, Utah

Contour	Area at contours Acres	Volume between contours Acre-feet	Capacity of reservoir at contour Acre-feet
5,366.2	286.7		0
		580	
5,368	358.2		580
		779	
5,370	419.6		1,360
		914	
5,372	494.9		2,274
		1,077	
5,374	586.3		3,351
		1,262	
5,376	679.3		4,613
		1,466	
5,378	787.2		6,079
		1,672	
5,380	884.4		7,751
		1,856	
5,382	971.7		9,607
		2,031	
5,384	1,059.2		11,638
		2,203	
5,386	1,141.2		13,841
		2,360	
5,388	1,218.7		16,201
		2,509	
5,390	1,289.1		18,710
		2,637	
5,392	1,347.4		21,347
		2,770	
5,394	1,420.3		24,118

Note: Dead storage is not included.

STORAGE AND RELEASE PATTERNS

Water budgets were prepared for nearly all the storage reservoirs within the water-budget areas. In addition, a budget was prepared for Tropic Reservoir in Watershed E-5. Sufficient data were available to determine inflow-use-outflow relationships for some reservoirs while very little data were available in other cases. However, synthetic data could be computed for the 30-year base period average with the water-budget procedures used and described in Appendix IV, "Water Budget Analysis".

The average storage contents, monthly change in storage and accumulated change in storage was computed for those reservoirs with sufficient measured data or where data could be computed. These are shown in Figures 2, 3, and 4.

The shape of the curves indicate the relationship of water supply patterns, volume of storage, and use demands. Reservoirs with most of the annual supply coming during spring snowmelt, with small capacities, and with relatively high release demands are indicated by curves with sharp breaks and steep slopes. The larger reservoirs, especially those with hold-over capacity, have flatter curves with less drastic fluctuations. Some curves indicate more than one filling and releasing cycle during the year. They indicate a spring runoff supply and an upstream return flow supply later in the year. More than one peak release period will develop these cycles.

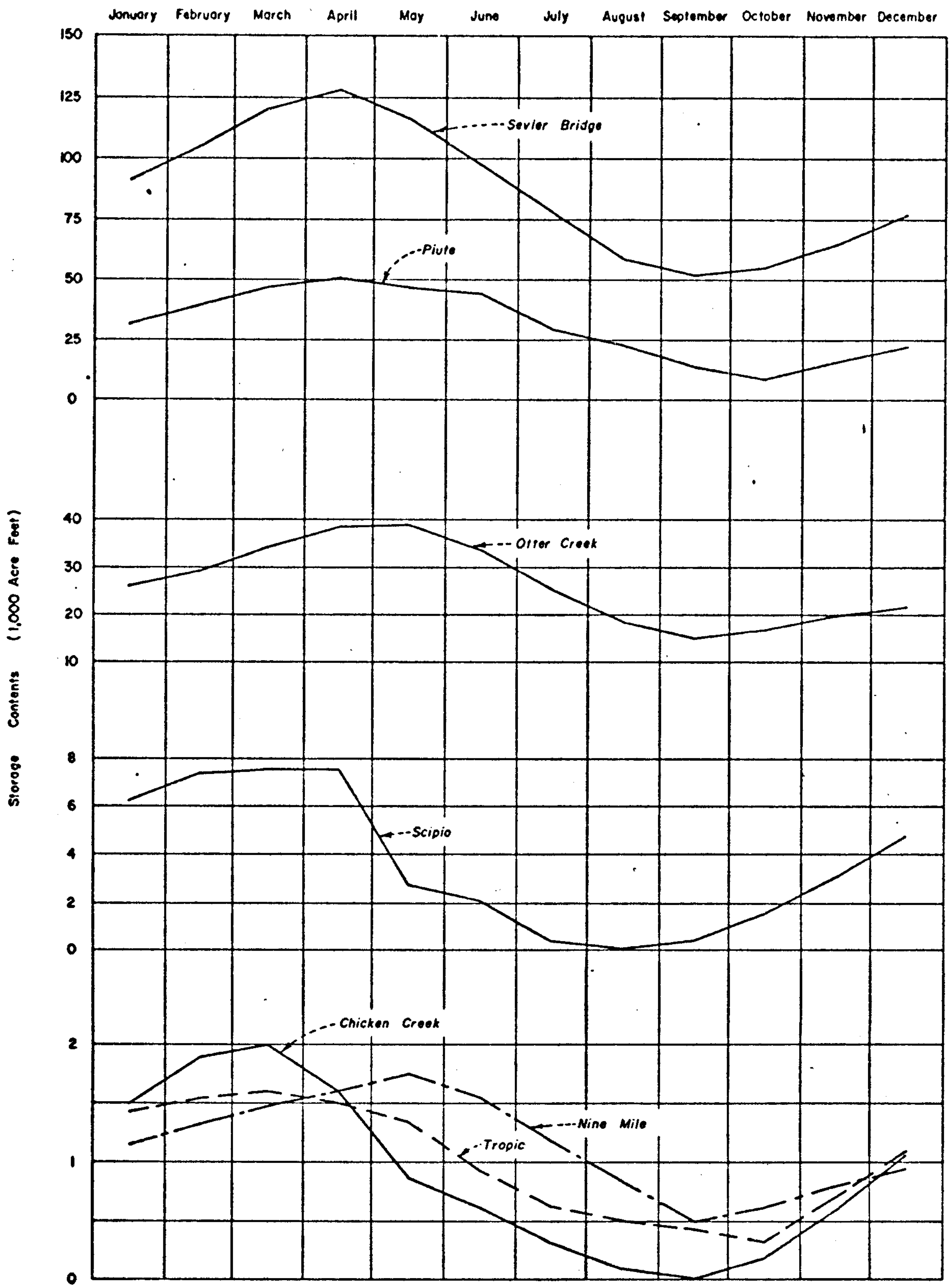


Figure 2.

Average Reservoir Storage Contents
Sevier River Basin Utah

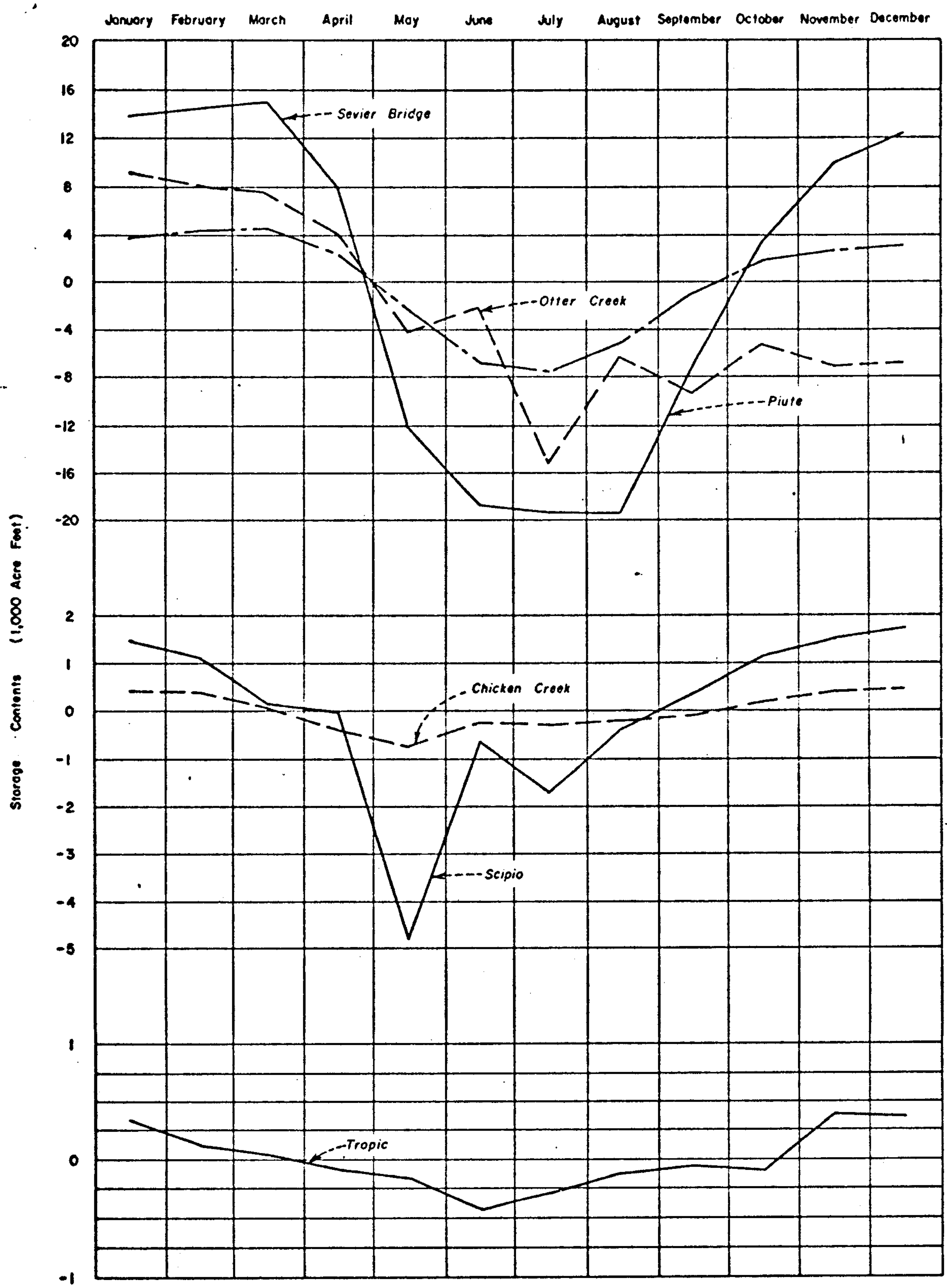


Figure 3 : Monthly Change In Reservoir Storage
Sevier River Basin Utah

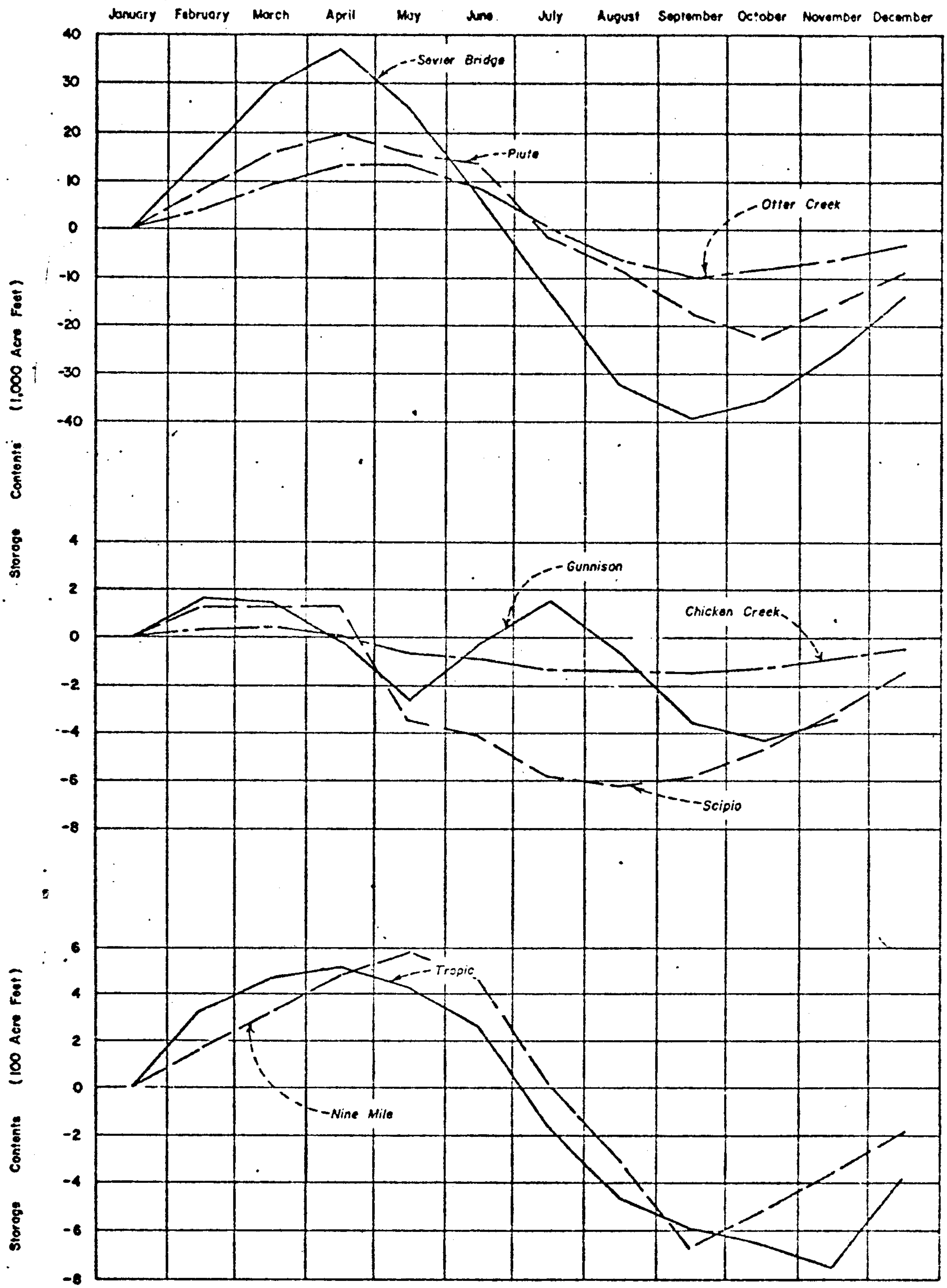


Figure 4

Accumulated Change In Reservoir Storage
Sevier River Basin Utah

CHAPTER IV

IRRIGATION WATER DISTRIBUTION

The water resources of the Sevier River drainage are distributed according to the Cox Decree. The complexities and problems of distribution are many and will not be discussed here. It is doubtful if all the intricacies associated with the distribution and use of the Sevier River system is or can be completely understood by any one person.

DIVERSIONS

Most of the diversions from the Sevier River mainstem are measured and recorded. Diversions from tributary streams are often not measured on a continuous basis and frequently not at all. If an irrigation company or group had rights to the entire flow of a stream, there was no need for measuring these flows.

During preparation of water budgets, estimates were made of tributary inflow and diversion from these flows. Generally, no attempt was made to determine the volume of diversion from individual drainages. The volumes of tributary diversions are shown in Appendix IV, "Water Budget Analysis".

The following map, "Average Annual Stream Flow and Depletions" indicates the 1931-60 base period diversion from the Sevier River mainstem. It also shows the average streamflow volume at gaging stations for the same period.

DISTRIBUTION SYSTEMS

The distribution systems mapped show only the canal systems operated and maintained by the respective irrigation systems. The areas served by each system are delineated on the maps and the approximate acreage is given in the narrative. Other information is given where available and should not be considered as complete. The reader is referred to the Cox Decree, river commissioner reports, water master records, and other primary sources for detailed data.

Subbasin A

Subbasin A comprises all of the Sanpitch River drainage above Gunnison Reservoir. This reservoir and the lands served are included in Subbasin C.

1. Roy Tanner Ditch

This system diverts about 100 acre feet of water annually from the headwaters of Sanpitch River in Sanpitch Canyon. From there it is conveyed to Indianola which is located out of the Sevier River Basin.

2. Graham Ranch System

This system diverts surface water flows immediately below the Tanner ditch, serving about 90 acres near the mouth of Sanpitch Canyon through about 3 miles of canal. The water supply is primarily from snowmelt and regulatory storage would benefit the system.

3. Milburn Irrigation Company

The Milburn Irrigation Company system diverts water from South Sanpitch Canyon and serves about 310 acres east of the river. Approximately

2.5 miles of earth main canal now delivers the allotted water. A pipeline or concrete canal to convey 2-3 c.f.s. from the mouth of the canyon to the irrigated land would alleviate the heavy seepage losses.

4. Long Ditch

This 3.5-mile long canal system diverts from the Sanpitch River and serves about 240 acres west of the river near Milburn. A diversion structure is needed along with canal lining.

5. Lone Pine Irrrigation Company

This company has a diversion right to 1.14 c.f.s. of irrigation water from April 1 to October 15 to be supplied from Lone Pine Canyon. It serves about 20 acres. A concrete lined ditch or pipeline to control seepage losses from the canyon mouth to the farming area near the river would be beneficial.

6. Crooked Creek Irrigation Company

This company diverts water from Crooked Creek and Stewart Springs to irrigate about 55 acres near the mouth of the canyon. The diversion right is 2.86 c.f.s. (1 c.f.s. to 40 acres duty) and to 1.25 c.f.s. (1 c.f.s. to 60 acres duty) from April 1 to October 15, and a stockwater right for 1 c.f.s. during the non-irrigation season. The main canal is about one mile long.

7. Wheeler Springs

The water from Wheeler Springs is used to irrigate about 40 acres northwest of Milburn.

8. East Milburn Irrigation Company

This company diverts from the east side of the river and serves about 160 acres in the Milburn area with 2 miles of main canal. Construction of a concrete ditch and small regulating reservoir is needed.

9. Milburn Meadow Ditch Irrigation Company

This company shares a diversion structure with East Milburn Irrigation Company and serves about 155 acres west of the river. Concrete lining of the 1.5-mile main canal and sharing the construction and use of a small regulating reservoir with the East Milburn Irrigation Company would make more beneficial use of the water supply.

10. Dry Fork Irrigation Company

This company serves about 250 acres in the Milburn area. They have a right to all the waters of Dry Creek during the irrigation season from April 1 to October 15, and to 2.0 c.f.s. stockwater during the non-irrigation season. The company maintains about 4 miles of canal.

An old mine tunnel near the mouth of the canyon formerly contributed water, and should be cleaned and protected against further cave-ins. Some springs in this area need cleaning and further development. The possibility of a well to supplement the waters of Dry Fork exists near the mouth of the canyon. A pipeline and/or concrete canal would reduce seepage losses across the alluvial fan to the farming area.

11. Brady Ditch Company

This company maintains about 3.5 miles of canal to serve about 230 acres near Fairview. They need a new diversion structure and concrete canal lining or pipeline.

They have a diversion right for 10.33 c.f.s. of irrigation water, April 1 through October 15.

12. Mower Ditch Company

Water is diverted from the east side of Sanpitch River and is used to irrigate about 80 acres of cropland north of Fairview. They have a right to use 5 c.f.s. when water duty is 1.0 c.f.s. to 40 acres and 2.20 c.f.s. when the water duty is 1.0 c.f.s. to 60 acres. Period of use is from April 1 to October 15. They have a 1.0 c.f.s. stockwater right during the non-irrigation season. Concrete lining for the delivery canal (about 6,350 feet) and related measuring and control devices are needed.

13. Sheep Ditch Company

This system is located west of Fairview and serves about 80 acres immediately above that served by the Brady Ditch. The canal is about 4.3 miles long. The company has a right to 4.5 c.f.s. from April 1 to October 15 and to 2.5 c.f.s. January 1 to December 31. It may be possible to combine the delivery ditches of these two companies to reduce maintenance and seepage losses. Because of the length of delivery canal in relation to the irrigated acreage served, a careful economic study should precede any lining program.

14. Oak Creek Irrigation Company

This company diverts water from Oak Creek and serves approximately 1,000 acres north of Fairview. They have a right to 24.5 c.f.s. based on 1 c.f.s. to 40 acres duty and to 10.7 c.f.s. based on a 1 c.f.s. to 60 acres duty. Use period is April 1 to October 15. They have a stockwater right for 3 c.f.s. from October 15 to April 1. The company maintains about 4.5 miles of main canal. The system needs an extensive reorganization and improvement program.

15. Graveyard Ditch Irrigation Company

Water is diverted from the west side of the river and serves 85 acres west of Fairview. They have a right to 2.2 c.f.s. from April 1 to October 15. The main canal is about 2 miles long. The system needs a diversion structure and 1.5 miles of concrete-lined ditch with related measuring and control structures.

16. Meadow Irrigation Company

The company diverts water from Spring Branch and irrigates 60 acres between Fairview City and the Sanpitch River. The Cox Decree lists water-rights as follows: 2.88 c.f.s. (1 c.f.s. to 40 acres duty); 1.27 c.f.s. (1 c.f.s. to 60 acres duty) and an additional 17/80 c.f.s., with 1.0 c.f.s. stockwater. Period of use is April 1 to October 15 for irrigation water and October 15 to April 1 for stockwater. Lining the 4,400 feet of main canal and installing related control structures is needed.

17. Fairview City Ditch Irrigation Company

Water is diverted from the Sanpitch River to irrigate 190 acres immediately west of Fairview. They have a 2.2 c.f.s. right from April 1 to October 15. The company is short of water and needs to improve the delivery system. They could drill an irrigation well and develop and install more canal lining.

18. Gooseberry-Cottonwood Irrigation Company

This company serves about 1,355 acres near the mouth of Fairview Canyon including areas within Fairview City. The Fairview-Cottonwood Irrigation Company is now incorporated with the above company.

The Cox Decree lists the combined water right in Cottonwood Creek as 58.42 c.f.s., when a water duty of 1 c.f.s. to 40 acres applies and 26.78 c.f.s., when a water duty of 1 c.f.s. to 60 acres applies. Period of use is from April 1 to October 15. A stockwater right of 1.5 c.f.s. from October 15 to April 1 and of 2.0 c.f.s. January 1 to December 31 is listed. The company also owns a right in Fairview Lakes which entitles them to 2,200 acre feet although the average amount stored is about 1,500 acre feet. The Fairview Lakes system is a transmountain diversion.

The distribution system needs reorganization. The primary problems are seepage loss and water control. A flood-control structure incorporating streamflow regulation would be helpful. There is an immediate need to construct three diversion structures and install 11.5 miles of canal lining with related measuring and control structures.

19. Spring Canyon Irrigation Company

Water is diverted from Spring Creek and used to irrigate about 110 acres. The main canal is about 2.5 miles long. They have a right to 9.78 c.f.s. from April 1 to October 15. The company has constructed 2,000 feet of pipeline and need an additional 5,600 feet of concrete lined canal.

20. Miner-Turpin Ditch Company

This company diverts water from lower Spring Creek and serves about 210 acres southwest of Fairview. Their water right is for 1.58 c.f.s. from April 1 through October 15. Canal lining with appurtenant control structures is needed.

21. Moroni-Mount Pleasant (M&M) Irrigation Company

This system consists of one canal which diverts water from Sanpitch River northwest of Mount Pleasant and conveys it to a point about mid-way between Moroni and Fountain Green. The canal is about 21 miles long and serves about 1,835 acres. The water right listed in the Cox Decree is based on the Johnson Decree. This constitutes a first class irrigation right to 8.59 c.f.s. a sixth class irrigation right of 25 c.f.s. and a stockwater right of 4 c.f.s. The period of use is March 1 to December 1 for irrigation and December 1 to March 1 for stockwater.

Much of the main canal is constructed on steep hillsides and seepage losses are high. Canal lining and a regulating reservoir would alleviate most of the problems.

22 and 23. Birch Creek-Fairview and Birch Creek-Mt. Pleasant Irrigation Companies

These two companies serve 350 acres and 945 acres respectively. Each owns one-half the flow of Birch Creek for the entire year. An Artesian well located in the upper watershed flows about 1.25 c.f.s. which is co-mingled with the natural streamflow and distributed accordingly.

These systems suffer a high seepage loss and need extensive system improvements including canal lining and a flood channel.

24. North Creek Irrigation Company

This company serves about 1,295 acres northeast of Mount Pleasant. The company is entitled to divert 58.52 c.f.s. from North Creek when water duty is 1 c.f.s. to 40 acres and to 25.56 c.f.s. when duty is 60 acres per c.f.s. A subsequent right gives an additional 5 c.f.s. They own stockwater rights for 6.5 c.f.s. Period of use for irrigation water is from April 1 to October 15, although the Allred Right is from May 1 to July 20. Stockwater use is from October 15 to April 1.

There is a current need for 68,000 feet of canal lining to alleviate seepage losses and improve water management.

25. McArthur-Frandsen Irrigation Company

The company diverts water from the Sanpitch River northwest of Mt. Pleasant and serves about 290 acres west of the river. The company water right is: first class, 6.3 c.f.s.; third class, 0.1 c.f.s.; fifth class, 0.04 c.f.s. An additional 5.31 c.f.s. right is subject to all preceeding rights (10 classes). The company also has a 2 c.f.s. stockwater right. Period of use is April 1 to October 15 for irrigation and October 15 to April 1 for stockwater. The system needs reorganization and other measures to better control water distribution, prevent seepage losses, and prevent flood damage. One-third of the water distributed is not owned as corporate shares and presents management difficulties. The company should consider a concrete canal lining program for their 4.6-mile system.

Pleasant Creek

The water supplied from Pleasant Creek includes that delivered by two transmountain diversions. Distribution is made through four companies or systems with the exception of one individual right. A single water master serves all systems on the creek.

26. Pleasant Creek Irrigation Company

The Pleasant Creek Irrigation Company serves about 1,715 acres of cropland and non-rotated pastures in the vicinity of Mt. Pleasant. The main canal is approximately 17.5 miles long. Some of this land is also served by Pleasant Creek-Highland Irrigation Company. Water is also supplied from the Canalland Ditch, which is shared with Mount Pleasant City. Water supplies are inadequate during some years. A system reorganization and canal lining is needed.

27. Pleasant Creek-Highland Irrigation Company

This company serves about 995 acres near the mouth of Pleasant Creek. Some of the area is also served by Coal Fork Irrigation Company and Pleasant Creek Irrigation Company. The main canal is approximately 10.5 miles long. This company is often short of water as its rights are subject to 44.8 c.f.s. in prior rights. Most of the distribution system crosses permeable soils so seepage losses are high.

28. Coal Fork Irrigation Company

Irrigation water is delivered through Coal Fork Ditch, a trans-mountain diversion, into Pleasant Creek at an average annual volume of about 260 acre feet. A 10 percent transmission loss is deducted at the diversion from Pleasant Creek. Lands served are located on the Seeley-Proctor Ditch of Pleasant Creek-Highland Irrigation Company. The efficiency of the pick-up canal on the eastern slope of the mountain would be improved by installation of 8-inch perforated CMP.

29. Moroni Irrigation Company

This company serves about 3,190 acres near Moroni. The Cox Decree lists a first class right of 39 3/80 c.f.s. to be used from March 15 to November 15. A 4 c.f.s. stockwater right extends from October 15 to April 1. The company operates three main canals; City Ditch, Canal Ditch, and Spring Ditch. The first two divert water from the Sanpitch

River and Spring Ditch diverts water from springs and return flow from the lower end of Cedar Creek drainage. The present system is about 29 miles in length. The system needs canal lining with appurtenant regulating and measuring devices and a regulating reservoir. Development of wells could provide an additional 8 c.f.s.

Twin and Cedar Creeks

Three companies own and distribute the waters of Twin and Cedar Creeks. Supplemental water is provided by three transmountain diversions with an annual average of about 865 acre feet. The efficiency of these diversions could be improved by installing perforated CMP in the feeder canals.

30. Twin Creek Tunnel

This transmountain diversion delivers about 225 acre feet into Twin Creek. The water right is individually owned but serves land under the Twin Creek Irrigation Company system.

31. Cedar Creek Tunnel and Black Canyon Ditch

These transmountain diversions deliver water into Cedar Creek. They are individually owned and supplement water supplies to these individuals under the Cedar Creek Irrigation Company. The annual diversions average 356 acre feet through the Cedar Creek Tunnel and feeder system and 284 acre feet through the Black Canyon Ditch.

32. Twin Creek Irrigation Company

About 1,585 acres south and southeast of Mt. Pleasant are served by the 24-mile main canal. Seepage tests indicate a moderate water loss through one reach but other sections exceed this rate. Timing and related control structures would alleviate a late summer water shortage.

A regulatory reservoir could provide flood and sediment storage and possibly long-term storage of part of an October 15 to April 1 stock-water right.

33. Cedar Creek Irrigation Company

This company serves about 840 acres located between Mount Pleasant and Spring City. Regulatory and flood control structures and lining to reduce the high seepage loss in the distribution system would reduce the current water shortages. A reservoir site located on the Jensen farm near the mouth of Cedar Creek could be used to store a part of their 3 c.f.s. October 15 to April 1 stockwater right. Preliminary studies indicate a cost in excess of $300 per acre foot for a reservoir having about 250 acre feet of storage.

34. Cedar Creek Highwater Irrigation Company

This company serves lands which are also served by the Twin Creek and Cedar Creek Irrigation Companies. Many of the improvements made by them will also profit this company.

35. Cedar and Twin Creek Sloughs

This area, located southwest of Mt. Pleasant, is served by small companies and individual systems. It is supplied with water from Cedar and Twin Creek Sloughs and by springs which are abundant in the area. Much of the area is sub-irrigated by drainage water from lands above. The area comprises about 1,100 acres, most of which is irrigated non-rotation cropland.

36. Big Ditch Irrigation Company

This company takes water from Johansen Slough, which is 2 miles southwest of Mt. Pleasant, and irrigates about 60 acres of land southeast of Moroni. They have a 1.0 c.f.s. irrigation right from April 1 to October 15 and a 0.2 c.f.s. stockwater right from October 15 to April 1. Current improvements needed include 1,200 feet of concrete pipeline, 9,000 feet of concrete ditch, and a small regulatory storage reservoir.

37. Rock Dam Irrigation Company

This company through two diversions on the Sanpitch River, serves about 745 acres south of Moroni. The Cox Decree lists a 41.57 c.f.s. right at a 1 c.f.s. to 40 acres duty and an 18.17 c.f.s. right at a 1 c.f.s. to 60 acres duty. Use period is March 1 to November 15. Also listed is a 5.0 c.f.s. stockwater right from November 15 to March 1. The river diversions are supplemented by water pumped from two wells.

38. Oak Creek and Canal Creek

Two companies distribute the water of these creeks. The water is comingled with other water rights held by the companies.

39. Horseshoe Irrigation Company

This company serves about 3,820 acres in the Spring City area. In addition to Oak and Canal Creeks, water is also supplied from two transmountain diversions: the Spring City Tunnel and the Reeder Ditch. The company owns a reservoir site with a right to 500 acre feet of regulatory storage. If built, this would be used primarily to regulate water from the Spring City Tunnel. The company is short of water during late summer, primarily through seepage loss and lack of water control structures. Peak runoff from snowmelt and summer floods carry heavy sediment loads with corresponding problems.

40. Chester Irrigation Company

This company serves about 480 acres of rotation cropland and surplus water is used on an additional 700 acres of wet meadows. The existing main canal is approximately 9 miles in length. Except in wetter years, the company is short of water. Water is lost through seepage and use by non-beneficial plants. The company has been improving 5 ponds used to store water and need to develop them to the fullest extent.

41. Fountain Green Irrigation Company

Fountain Green Irrigation Company distributes water to irrigated land surrounding the city proper and southward for about four miles but Birch Creek, Big Hollow, Maple Canyon and Pole Canyon contribute to the supply. Most of the irrigation water distributed by the company originates at Big Springs. The company delivers water to 3,290 acres of irrigated land through 20.5 miles of main canal. About four miles of the canal system has been lined with concrete or concrete pipe. Water losses in unlined canal reaches are high while weeds and other vegetation hamper water deliveries.

42. Log Cabin Hollow - Government Canyon

This irrigated area served from these drainages totals approximately 60 acres situated northwest of Fountain Green. Irrigation water originates in both canyons but the supply is generally insufficient for crop needs. About one mile of canal conveys water to the irrigated crops.

43. Jerusalem Irrigation Company

This company distributes water to about 290 acres of irrigated land north of Freedom. A pipeline transports Moroni Pole Canyon water to the irrigated land where that supply is comingled with water from Maple Canyon. Relatively steep slopes are common in the irrigated area. The main delivery canal is about one mile in length.

44. Freedom Irrigation and Water Works Company

The Freedom Irrigation and Water Works Company consists of an irrigated area surrounding Freedom, totaling about 420 acres. Approximately 2.5 miles of canal system is used to deliver water to this irrigated land. Land is relatively steep, resulting in soil erosion during normal irrigation and cultivation practices.

45. Larsen Irrigation Company

Larsen Irrigation Company distributes water to about 495 acres of irrigated land north of Ephraim. The irrigated area is divided into three land parcels necessitating rather extensive delivery canals, with a combined total of 10 miles.

46. Ephraim Irrigation Company

This company distributes irrigation water to land bordering Ephraim and extending northward for about 5 miles. Approximately 5,350 acres are irrigated by an annual diversion of 12,600 acre feet. The main canal system totals 61 miles in length. Seepage tests conducted during the study period identified a loss of about 34 percent for 11 miles of canal and 38 percent in another reach of 38 miles. Many opportunities exist throughout the delivery system to reduce water losses.

47. Island Irrigation Company

Island Irrigation Company distributes water to 4,820 acres of irrigated land along the valley floor. Much of the crop consumptive use needs comes from groundwater supplies. About 29 miles of delivery canal convey irrigation water to users and about 1.2 miles have been lined.

48. West Point Irrigation Company

This irrigation company distributes water to lands about 830 acres of cropland on the west side of Sanpete Valley. Dual canals convey water for a distance of about 3 miles, beginning at the point of diversion. The main canal system is about 11 miles long. Water losses are high. Installation of modern facilities and lining critical canal sections would improve efficiency.

49. Silver Creek Irrigation Company

Silver Creek Irrigation Company distributes water to irrigated lands south of Wales on the west side of Sanpete Valley. The irrigated area totals 650 acres and is served by 8 miles of delivery canal. Part of the system has been lined with concrete.

50. Wales Irrigation Company

This small irrigation company distributes water to about 580 acres of irrigated land through approximately two miles of main canal. The water supply comes from Reese Spring, Wales, Canyon, and Peach Canyon. Generally irrigated crops are short of water. Two separate land parcels are supplied by the system, contributing to the inefficiency.

51. Sanpitch Pump Company

This irrigation company supplements direct flow from West Point Canal and Excell Canyon with wells. Soils are generally shallow and topography undulating as well as steep, resulting in serious erosion problems when irrigating with conventional furrow irrigation methods.

52. Sanpitch River Drainage District

This area has main canals on both the east and west side of the river. It also has a rather elaborate drainage system designed to lower water tables and dispose of excess surface water. A substantial part of the district is still inadequately drained, resulting in mostly wet pastures and wild hay lands. The irrigated area within the district amounts to 2,700 acres. About 10 miles of delivery canal convey water to these lands.

53. Ephraim-Willow Creek Irrigation Company

This company distributes water to a block of land of about 850 acres between Manti and Ephraim. The water supply originates in Ephraim Canyon and Willow Creek. The water supply is generally inadequate for crop needs. About 9 miles of main canal system conveys water to users.

54. Manti-Willow Creek Irrigation Company

The Manti-Willow Creek Irrigation Company distributes water to irrigated land between Willow Creek and Manti. The irrigated area consists of about 790 acres. Approximately 10 miles of main canal system is used to convey water to these lands. Seepage losses are high in many canal sections. There are opportunities to improve the system with lining. Some canal reaches generally parallel others and these could be consolidated if detailed investigation proved this feasible.

55. Manti Irrigation Company

This irrigation company distributes water to about 5,200 acres of irrigated land through 67 miles of conveyance system. Many reaches traverse gravelly soils, resulting in high water losses. The average annual water supply diverted into the system totals 4,170 acre feet. This supply generally is inadequate to meet irrigated crop needs.

56.. Braithwaite-Chapman Ditch

This small block of irrigated land lies approximately due west of Manti and is supplied water through a one-half mile extension of the canal serving Manti Irrigation Company lands. About 50 acres are included within this irrigated tract.

57. Prestwich Dich

This irrigated land lies west of Moroni and includes about 50 acres. Almost one mile of conveyance system serves this area.

58. Eleason Ditch

This irrigated land is situated west of Moroni and contains about 65 acres. The delivery system begins at a small spring and extends for about one and one-half miles. The water table is generally high, thereby encouraging permanent pasture and native hay land as the dominate crops.

59. North Six Mile Irrigation Company

Three ditches, the Allen Valley, Killpack, and Dennison distribute water to the company stockholders. They total 10.5 miles in length and serve 1,590 acres. The diversion structures are in good condition but the balance of the system is in poor condition. Seepage loses are high and control structures are inadequate to nonexistent. Some lands receive irrigation water deliveries through the Funk's Lake Canal operated by the Manti Irrigation and Reservoir Company.

About 500 feet of concrete pipe has been installed in the Dennison ditch. The balance of the system sould be upgraded.

Subbasin B

Subbasin B includes all the drainage of the Sevier River below Sevier Bridge Reservoir except Tintic Valley. This reservoir was included as part of Subbasin C although its use and management were evaluated separately so the downstream effects could be distinguished.

1. Levan Irrigation Company

The Levan Irrigation Company has a right to all the flow originating in Pigeon and Chicken Creeks. During the 1930's, a concrete lined canal was constructed in Pigeon Creek extending upstream approximately 4 miles from its mouth. Parallel concrete canals connect Pigeon and Chicken Creeks and enable users to combine flows, especially during low-flow periods. Construction of regulatory storage reservoirs would make more efficient use of the water supply.

This irrigation company serves approximately 4,550 acres of irrigated cropland through 32 miles of main canal and laterals. About one-half the canals have been lined and the balance should be lined. The average annual diversion is estimated at 5,800 acre feet.

2. Mills Irrigation Company

This company supplies water to approximately 790 acres of irrigated land through about 12 miles of canal system. Estimated average diversion to this irrigated land is 5,440 acre feet. The company has completed 3.25 miles of lining. The balance of the canal should be lined in the near future. Wetlands adjacent to the irrigated land could be included within the present system with minor enlargement if a water supply were available.

3. Lands irrigated by wells near Mills

Wells within the Mills area distribute water to approximately 2,650 acres of irrigated land. These wells are positioned within the irrigated acreage such that on-farm field ditches distribute water to the different irrigated fields.

4. Scipio Irrigation Company

This irrigation company distributes water to 3,280 acres of irrigated land in Round Valley through 8 miles of main canal and 11 miles of distribution laterals. The company has a right to all the flow of Ivy Creek. The average available water supply at Scipio Reservoir is at 9,650 acre feet.

The distribution system is in poor condition. The main diversion should be replaced and better control structures installed. There are approximately 8 miles of highly erosive canal. Storage closer to the irrigated area and sprinkler irrigation would alleviate a water-short condition.

5. Central Utah Canal

This sytem diverts water from the Sevier River near Leanington and distributes water to 6,150 acres of irrigated land between there and the McCormic-Greenwood area as well as to an undetermined number of irrigated acres of land around Flowell. The Flowell area is beyond the Basin boundary. The company has principally a high water right which limits their diversion supply. Available records indicate an average diversion of 29,390 acre feet of water. The main canal length within the Basin is about 39.50 miles, traversing coarse to medium textured soils. Total length is about 52 miles. Water losses are very high, especially through certain canal segments.

6. McIntyre Investment Company

The McIntyre Investment Company is a privately owned system diverting water out of the Sevier River near Leanington. The system distributes water to 740 acres of irrigated land from 8 miles of main canal. On-farm ditches situated at regular intervals distribute the water from the main canal to individual fields. Diversion records available show an average diversion of 3,420 acre feet to this system. The system is generally in good condition.

7. Leamington Irrigation Company

This irrigation system diverts water from the Sevier River east of Leamington. The present diversion is made of sand bags but it seems to function adequately. About 1,990 acres are irrigated under the system with an average diversion of 4,150 acre feet. The main canal is approximately 7 miles long. No lining has been completed on the system but improvements are needed.

8. Fool Creek Irrigation Company

This system distributes water to 1,340 acres of irrigated land through 7.75 miles of main canal. The company has installed 3.5 miles of pipeline up Fool Creek channel. A 2.5-mile length of concrete lined ditch joins the pipeline on the lower end. Available water supply diverted averages 5,690 acre feet annually.

The general system condition is good. Most of the canal system has been lined practically eliminating erosion and seepage losses. As the system was lined, headgates and checks were also modernized. These are generally adequate under the present system, but measuring devices are inadequate.

9. Oak Creek Irrigation Company

The Oak Creek Irrigation Company distributes water to 1,630 acres of irrigated land through 11.14 miles of main canal. The company has installed 6.64 miles of pipeline from the canyon mouth up stream. Approximately 1.3 miles of concrete lining has been completed within the farming area. Available water yield data adjusted to an average diversion indicate that the company diverts about 4,610 acre feet annually.

With the improvements installed over the years, the irrigation system is in good condition. Erosion and seepage problems in the distribution system have largely been corrected by lining. A few more headgates and measuring devices should be installed to assist in better distribution of water to users.

10. Holden Irrigation Company

This irrigation company distributes water to 1,120 acres of irrigated land through 7.25 miles of main canal. The company has lined 4 miles of the present system.

The system is in good condition. The main diversion is in good condition and seepage losses and erosion hazards have been largely eliminated with the existing canal lining. Measuring devices and headgates are lacking to achieve the best water distribution to individual users.

11. Delta Canal Company

This company delivers water to approximately 18,330 acres of irrigated land through eighteen miles of main canal and 32 miles of distribution laterals. About 1.1 miles of main canal has been lined but no lining has been completed on the laterals. The average diversion for this system is 37,000 acre feet. The canal system traverses lake bed deposits and experiences high seepage losses. The company should line the balance of the main canal.

Irrigation water is released from D.M.A.D. reservoir into the Delta-Melville canal. The diversion is relatively new and in good condition. Approximately 2 miles downstream, the flow is split according to their water rights into separate systems. This canal section has been lined. The company has installed many permanent type headgates and measuring devices. Some standardization of measuring devices would be desirable.

Canal users could benefit from a stable water supply. More irrigable land could be irrigated under this system if water were available.

12. Melville Irrigation Company

The Melville Irrigation Company delivers water to 13,360 acres of irrigated land through a delivery system of 35 miles of main canal and 28.5 miles of distribution laterals. Approximately 2 miles of main canal and 5 miles of distribution laterals have been lined. The company has diverted an average diversion of 27,440 acre feet of water.

The canal traverses lake deposits with a resulting high water loss. Standardization of measuring devices could aid in equalizing water distribution. The canal should be lined and modern headgates installed. Company water users would benefit substantially from a more stable water supply.

13. Desert Irrigation Company

This irrigation system distributes water to approximately 14,960 acres of irrigated land through 1.5 miles of main canal and 61.5 miles of distribution laterals. The company has lined about 0.75 mile of canal. Seepage losses are high on the unlined portion. During the period of record, the diversions have averaged 35,490 acre feet annually.

The general irrigation system is in good condition. The river diversion was installed about 6 years ago. The measuring devices and headgates are adequate for the present operation. Additional lining would benefit the delivery efficiency.

A stable water supply would greatly benefit this system. Additional water, if available, could be used beneficially by irrigable lands under the system.

14. Abraham Irrigation Company

This company distributes water to 10,870 acres of irrigated land through 26 miles of canal system. Approximately 12.1 miles has been lined. The system is unique in that the last canal outlet has a slightly higher elevation than the first outlet point. In affect a lake is developed from which each user can draw equally. Seepage and other water losses are equally shared under this system. The company has experienced good results with plastic lining and should line the entire canal.

Subbasin C

Subbasin C includes that area along the Sevier River, including tributaries, between the Sigurd gage below Rocky Ford Reservoir dam and Sevier Bridge Reservoir dam except the San Pitch river drainage above Gunnison Reservoir. This area is in Subbasin A. Gunnison Reservoir was evaluated as part of Subbasin C.

1. Aurora Irrigation Company

The Aurora Irrigation Company includes the Johnson Livestock Company Ditch, Rocky Ford-Willow Bend Canal, and Little Ditch.

The Rocky Ford-Willow Bend Canal is 14.5 miles long and delivers 21,440 acre feet of water annually to 2,920 acres of land on the west side of the river in addition to lands irrigated on the east side. Water is released from Rocky Ford Reservoir into the system. Seepage losses in the canal are high and water control structures are inadequate.

The Johnson Livestock Company Ditch is 2.75 miles long with 1.5 miles of lining. Water is diverted into this ditch from Rocky Ford-Willow Bend Canal and siphoned across the river to irrigate lands on the east side.

The Little Ditch is a branch of the Rocky Ford-Willow Bend Canal. It is 6.0 miles long with 0.25 miles of lining. About 310 acres of land are irrigated with an average of 1,360 acre feet annually. Seepage losses are high. The diversion structure is in good condition but the balance of the structures are inadequate.

2. <u>Lost Creek Irrigation Company</u>

This system consists of the Upper Ditch, Lower Ditch, and Amond-Foote Ditch. Water is diverted from Lost Creek. The system is in fair condition and needs improvements. Water is short during late season.

The Upper Ditch is 4.5 miles in length. Water is diverted from the Upper Ditch into the Lower Ditch and the Amond-Foote Ditch is a branch of the Lower Ditch. The total length of the canal system is about 10 miles and it delivers water to about 2,000 acres of irrigated land.

3. <u>Salina Irrigation Company</u>

The Salina Irrigation Company system diverts about 16,200 acre-feet from Salina Creek to irrigate about 2,800 acres of land. The distribution system totals about 30 miles in length and consists of the following ditches: Quarry Ditch, Salina City Ditch system, South Field and South Ditch, Murphy Ditch, and Skootumpah-Tipperary Ditch.

The system is in poor to fair condition. The diversion is in good condition. Seepage losses are high throughout the system except for 1.5 miles in the City Ditch system. Some water control structures are in good condition, some are in fair to poor condition, and are non-existant in some locations where they are needed. Most of the users are delivered water on turns.

One of the major problems is sediment diverted into the system. Salina Creek carries excessive amounts of sediment which is deposited on irrigated lands. This build-up requires considerable maintenance.

4. Redmond Irrigation Company

This company delivers water to 740 acres of irrigated land through a canal system 7.5 miles in length with 3.4 miles of lining. The system includes the Spring Ditch, Town Levee Ditch, Big Levee Ditch and South Ditch. Some water is delivered to the east side of the river crossing the West View Canal. The water supply is diverted from Redmond Lake which in turn is supplied by the Redmond Springs. The system is in good condition, however seepage losses are high in the unlined portion. The Spring Ditch is a cast-in-place underground conduit through the town of Redmond.

5. West View Irrigation Company

Water is diverted into the West View Canal from the Sevier River at a point just east of Redmond Lake. The structure is in good condition and very efficient in controlling and sluicing sediment. The canal is about 17 miles long with 15 miles of lining. Average annual diversion is about 7,220 acre-feet to irrigate 3,125 acres of land. The system is in good condition.

6. Willow Creek Irrigation Company

This company diverts water from Willow Creek near Axtell. Water is delivered to 1,165 acres of irrigated land through a conveyance system which includes 7 miles of main canal and 8.3 miles of laterals. Total diversion averages 5,630 acre-feet annually. The company maintains two diversion structures. Part of the irrigated area also receives water from the Gunnison Irrigation Company. Considerable water is lost in the lower reaches of Willow Creek because of the dense growth of phreatophytic vegetation. Seepage losses in the system are high.

7. Dover Irrigation Company

Dover Irrigation Company diverts water from the Sevier River west of Centerfield. The Peterson Ditch diverts from the Dover Canal about one mile below the diversion. Total length of the two canals is about 11.7 miles serving 2,785 acres of irrigated land. The average annual diversion is about 4,520 acre feet. The system is in good condition. Any seepage loss is compensated for by return flows from irrigated areas above the canals. Also, the canals traverse some wet areas.

8. Gunnison-Fayette Irrigation Company

This company diverts water from the Sevier River southwest of Centerfield. The main canal extends for 26.8 miles to serve an irrigated area of 3,985 acres. The annual diversion averages about 8,900 acre feet. The irrigated area stretches along the west side of the Sevier River with a maximum width of about one mile. The upper reach of the canal traverses a wet pasture area. The diversion structure is in good condition while the balance of the system structures is in fair condition. The seepage loss is high through most of the canal length.

9. Sterling Irrigation Company

Sterling Irrigation Company diverts water from the Six Mile Creek drainage, including Morrison Mine and diverts into several ditch systems. These include Cove Ditch, South Ditch, East Ditch, Middle Ditch, and North Ditch. There is an overflow diversion that returns excess water to Six Mile Creek, through the feeder ditch and into Gunnison Reservoir. Water is also diverted from the East Ditch into the Highland Exchange Ditch and into Nine Mile Reservoir. The above two reservoirs serve the Gunnison Irrigation Company.

The Sterling Irrigation Company system is _______ miles long and delivers water to ________ acres of irrigated land. The system is in fair condition. There is a need for improving the control structures although the diversion structures are adequate. Seepage losses are high except in the short length of the system with lining. Some sections of the system have an erosion problem.

10. Mayfield Irrigation Company

This company maintains three diversion structures to divert water from Twelve Mile Creek. These structures are all in good condition. The total system is 36.6 miles long and serves about 3,715 acres of irrigated land with an average annual diversion of about 6,500 acre feet, not including North Ridge and Mill Ditch systems. Seepage losses are high in all ditches except Spaniard Ditch where losses are low. Headgates and measuring devices are adequate throughout the system except Mayfield City Ditch, North Ridge Ditch system, and Mill Ditch. These systems serve nearly half the irrigated area. Consolidation of some of the canals would improve the total system efficiency considerably.

11. Gunnison Irrigation Company

Gunnison Irrigation Company diverts water from Six Mile Creek, Nine Mile Spring, Twelve Mile Creek and San Pitch River. Water is delivered to irrigated lands through an extensive distribution system that traverses several significant tributary drainages. Total length of the distribution system is 46.7 miles with over 14 miles of concrete lining. Seepage losses are high in the unlined areas. Condition of the system varies from poor to good. Consolidation of some of the distribution canals would improve the irrigation water distribution efficiency considerably.

12. Fayette Springs Irrigation Company

This system distributes water to 700 acres of irrigated land through 4 miles of canal, all of which is lined with concrete. The total supply is diverted from Fayette Springs and a pump well nearby. The diversion averages 1,800 acre feet annually. Each of the 17 water users diverts the entire flow on a turn basis. The system is in good condition.

13. Private Systems

Three small individual systems divert the entire flow of Hells Kitchen Canyon, Timber Canyon and Pierce Canyon. The irrigated areas and canal lengths are 40 acres, 0.75 miles; 210 acres, 1.5 miles; and 25 acres, 0.75 miles, respectively. Most of the runoff comes early, creating late season shortages. Regulatory storage is definitely needed. The seepage losses are high.

Subbasin D

Subbasin D includes all the drainage of the Sevier River below the Kingston streamflow gages on the East Fork and South Fork of Sevier River and above the Sigurd streamflow gage. The irrigation system maps for Subbasin D include the Circleville area although this is located in Subbasin F.

1. Junction Irrigation Company

This system serves 700 acres of irrigated land through a main canal 4.7 miles in length with 1.2 miles lined. The average annual diversion from Sevier River is 4,150 acre-feet.

The irrigation system is in fair to good condition. The river diversion structure is in fair condition. Seepage losses through the main canal are high. Measuring devices are adequate although a number of new headgates are needed. Moss accumulation in the system during the irrigation season causes a water delivery problem. This could be improved if the canal were lined.

2. Junction Middle Ditch Irrigation Company

This irrigation system distributes water to 700 acres of irrigated land through 3.25 miles of main canal. The average annual diversion is 1,644 acre feet all from the Sevier River. The irrigation system is in fair condition. Seepage losses are low. Measuring devices are not critical for efficient water distribution as each individual user maintains his own headgate.

3. City Creek Reservoir and Irrigation Company

The City Creek system distributes water to 310 acres of irrigated land with 5.25 miles of main canal. Approximately 2 miles has been lined. The average annual diversion is estimated at 4,150 acre feet from City Creek.

The irrigation system is in good condition. Seepage losses are high on the unlined portion of the system. Measuring devices and headgates are adequate. The erosion condition that has existed in the system has been mostly corrected through lining a section of the canal. Above the lined section, erosion is still a problem. Laterals diverting water from the main canal to individual users field ditches are on steep slopes. This situation creates an erosion problem to a limited degree. The optimum solution for this particular system is to convert to a gravity sprinkling system. It would be advisable for them to have reservoir storage as a means of supplementing late season water requirements.

4. Kingston Irrigation Company

The Zabriskie Ditch distributes water to approximately 120 acres of land through 2.2 miles of canal. No lining has been completed in the system and the main diversion is nearly new. Seepage test results show high losses indicating lining is needed. Measuring devices and headgates are adequate.

The Allen Ditch distributes water to 340 acres of irrigated land. The main canal is 3 miles long and about 0.5 mile of this has been lined. An average of 912 acre feet of water has been diverted into this system. The Allen Ditch and West Ditch use the same diversion structure which should be replaced. Seepage is moderate and measuring devices and headgates are adequate.

The West Ditch system distributes water to 790 acres of irrigated land. The average irrigation water diversion is 6,040 acre-feet annually. The earth canal system is approximately 4 miles long. The joint West Ditch and Allen Ditch diversion structure, as previously stated, is inadequate. Tests indicate seepage is moderate in the system. Measuring devices and headgates are adequate.

5. <u>Private Systems</u>

The Ten Mile system serves approximately 20 acres of irrigated land through 0.5 mile of main canal. The water supply is limited to high seasonal flows so system improvement becomes prohibitive. Seepage losses are high and slight erosion occurs in the system. Sediment originating upstream is a major problem.

The Henrie Brothers system distributes water to 180 acres of irrigated land through 3 miles of gravity pipeline system. The entire irrigated land is under sprinkler irrigation. The system is owned by one user.

The Nielson - Howes Ditch serves four principle land parcels totaling 160 acres of irrigated land. Approximately 3.3 miles of main canal is used to distribute water to these users. The system has been adequate for individual farmer use. Erosion is low within the system. Field observations suggest consolidating these four systems into two and eliminating one river diversion.

6. Cottonwood Irrigation Company

The Cottonwood Irrigation Company distributes water to 580 acres of irrigated land through 12.3 miles of main canal. This includes several branches to make up the main canal system. The system is in need of improvement. Under existing conditions, the diversion should be replaced, seepage losses should be reduced through lining, more measuring devices and headgates should be installed, and sediment problems should be corrected.

7. Bullion Creek Irrigation Company

The Bullion Irrigation Company distributes water to 1,110 acres of irrigated land through 11 miles of main canal. Water shortages are common during the late irrigation season. Reservoir storage facilities could improve this adverse situation. The distribution system is in fair condition. The two creek diversions are in poor condition and should be replaced. High seepage losses are incurred and measuring devices and headgates are inadequate to enable users to realize an equitable allocation of available water. There is no apparent erosion.

8. Beaver Creek Water Users

This system distributes water to 200 acres of irrigated land through 0.5 miles of main canal. None of the present system has been lined. The system is generally in good condition except for high seepage losses. Sufficient measuring devices and headgates are installed and the main diversion is in good condition. There is essentially no erosion.

9. Cove and Highland Irrigation Company

This irrigation system distributes water to 300 acres of irrigated cropland. The main canal is 4.25 miles in length and the average diversion is about 380 acre feet. This system needs a new diversion structure. Seepage losses are moderately high. An increase in the number of measuring devices in the main canal would help in allocating water to users although lateral headgates are adequate. The main problem in the system is the deposition of sand from the Sevier River in the main canal. Some type of sluice gate at the head of the canal would alleviate this problem.

10. Clear Creek Irrigation Company

This irrigation system distributes water to 310 acres of irrigated land through a main canal 2.5 miles in length. The average annual diversion is 3,510 acre feet. No lining has been installed. The main diversion structure is obsolete and should be replaced. Tests show that the canal system gains return flow as well as loses water through seepage. These tend to balance each other. There are very few measuring devices in the system but the headgates seem to be adequate. Erosion is not a serious problem.

11. Joseph Irrigation Company

This system distributes water to 1,460 acres of irrigated land through 5 miles of main canal. The annual diversion averages 5,810 acre feet from the Sevier River.

The overall system is in fair condition although tests indicate seepage is moderate to high. Several wiers have been installed on the main canal and there are adequate headgates to accurately release water as needed. Erosion is not a problem but sediment accumulation from the Sevier River is costly. Some means of sluicing this at the diversion should be considered.

12. Sevier Valley Canal Company and Piute Reservoir and Irrigation Company

The Sevier Valley - Piute Canal distributes water to irrigated lands in Subbasin D and Subbasin C. The irrigated land served by this canal in Subbasin D totals 9,600 acres and 3,500 acres in Subbasin C. The main canal is 53 miles long. The average diversion is 65,210 acre feet annually.

This irrigation system is in generally fair condition. Seepage tests indicate moderate losses occur throughout the system. Measuring devices and headgates have generally been adequate. However, a systematic replacement schedule should be instigated. There is considerable build up of sediment built-up at the head of the system. Some side washes also deposit sediment in the canal at points throughout its length.

13. Monroe South Bend Irrigation Company

The Monroe South Bend Irrigation Company served 2,490 acres of irrigated land through its 12 miles of main canal. No lining has been completed on the present distribution system. Diversion records indicate an average of 18,690 acre feet of water. The canal system is in good condition. There are seepage losses of 36 percent from the river diversion to other points of diversion along the canal. The main diversion is relatively new and measuring devices and headgates in the system are in good condition. There is sediment deposition in the system which originates in the Sevier River drainage.

14. Wells Irrigation Company

This irrigation system distributes water to 500 acres of irrigated land through 4 miles of main canal. There is an average diversion of 2,525 acre feet of water. Wells Ditch and Joseph Canal use the same diversion. This structure is adequate. Seepage losses are high in the system and measuring devices and headgates are fair. Replacement of obsolete gates and more measuring devices would facilitate water distribution. Sediment stemming from the Sevier River drainage is a problem to this system. A better method of eliminating this sediment would aid the local company in their general overhead costs. Reduced sediment accumulation on fields would remove the need for releveling practices.

15. Monroe Irrigation Company

The Monroe Canal distributes water to 2,700 acres of irrigated land through 8 miles of main canal. Monroe Canal has diverted an average of 11,590 acre feet of water. The system is in fair condition and the diversion structure is relatively new. Seepage losses on this canal were estimated to range between low and moderate. Headgates and measuring devices are adequate on this system. There is a sediment problem stemming from sediments originating upstream within the Sevier River drainage.

16. Brooklyn Irrigation Company

This canal system supplies water diverted from the Sevier River to 1,830 acres of irrigated land through 6.5 miles of unlined main canal. This system has diverted an average of 8,290 acre feet. Seepage losses are high and measuring devices and headgates range from poor to good. Sediment stemming from the quantity transported by the Sevier River is a problem to the system. A sluice gate at the head of the system to flush sediments back into the river would alleviate this problem.

17. Annabella Irrigation Company

This canal system distributes water to 2,050 acres of irrigated cropland and pastureland through 10.25 miles of main canal. None of this system has been lined. Through the Annabella area, individual users divert water directly from the main canal. The system is in fair condition. Seepage losses approach 30 percent in the main canal. Losses may be higher through some sections than others. Users would benefit substantially with better type measuring devices. Sediment from the Sevier River is a problem. A sluice gate or other means of eliminating sediment from the system would be advantageous to these users. Through the Annabella area, side drainages contribute sediment loads into the system. Some means of controlling this accumulation of sediment would be advisable.

18. Bertelson Water Users

Bertelson ditch distributes water from Bertelson Canyon to 410 acres of irrigated cropland. The present water right is essentially for high water. Also, any water in excess of Monroe City water right can be used by this system. During low flow periods, Monroe City gets all the water out of Bertelson Canyon. The main canal is 3.25 miles in length. The main diversion needs to be replaced. There are also high seepage losses within the system. No measuring boxes, except at the head of the canal, are installed to distribute flow among users. Headgates and other regulatory outlets are generally good. Flash floods cause problems to the system.

19. Bohman Water Users

The Bohman ditch distributes water to 200 acres of irrigated land through 5.25 miles of earth canal system.

The system is in poor condition. Bohman ditch diverts water from Bertelson Canyon and is subject to the same water right as the Bertelson Water Users. Seepage losses are high for the system. There are no measuring devices to equitably distribute water among users. Headgates on the system appear adequate for the use of the individual farmers. Erosion hazard is high since the system traverses down the alluvial fan. Canal lining would be a means of correcting associated erosion.

20. Monroe City Creek

Monroe City Creek system distributes water on 170 acres of irrigated land. The system is made up of 1.75 miles of main canal. The entire length has been lined.

The system is in good condition except the main diversion needs to be replaced. Bohman ditch, Bertelson ditch and Monroe City Creek systems use the same diversion structure. Measuring devices and headgates are adequate.

21. Elsinore Irrigation Company

This company serves approximately 1,120 acres of irrigated land through 8 miles of main canal. None of the canal system has been lined.

The system is in fair condition. There is a relatively new diversion to divert water from the Sevier River. Seepage losses are relatively high. Measuring devices and headgates are not adequate. Installation of more measuring devices and headgates would allow a better job of water distribution among users. Sediment originating in the Sevier River drainage is a problem.

A number of laterals is used to convey irrigation water from the main canal to individual farms. These are used periodically based on a turn procedure among users. As such, some laterals are without water for certain periods. When water is turned into these laterals again, it takes a considerable length of time for the soil profile to fill up with water before the allotted stream can reach the individual farmers irrigation system. A considerable water loss is incurred by this method. Some laterals have been lined. Local experience suggests consolidating a number of these laterals.

22. Richfield Canal Company

The Richfield canal distributes water to 10,190 acres of irrigated land under the system. The company has 19.5 miles of main canal, none of which is lined. Some laterals are used to distribute water among users. However, the major water supply is diverted into individual onlets directly into on-farm ditch systems. There is an average diversion of 22,390 acre feet of water.

The system is in fair condition. The river diversion structure should be replaced. Seepage losses have generally been high. Measuring devices and headgates are adequate, however, more of them could be installed to give a better distribution of water to users. Sediment accumulation from the Sevier River is distributed throughout the system and is a problem. Sediment and floodwater from side drainages, principally Flat Canyon and Cottonwood Creek, cause problems.

23. Spring Hill Irrigation Company

The Spring Hill ditch is located in a meadow area near Richfield and receives water from springs in that vicinity. The system serves approximately 20 acres through approximately 2 miles of main canal. None of this has been lined. The system diverts an average of 1,680 acre feet of water. This is more than ample to irrigate the area served. Part of this water is also distributed on wetlands in the area. The system could use a new diversion structure. Seepage losses are essentially low. There are no measuring devices and the few headgates are in poor condition.

24. Avery Irrigation Company

This system serves approximately 340 acres of irrigated land through 3.25 miles of main canal, none of which has been lined. They have diverted an average of 1,680 acre feet of water. The company receives its irrigation water from springs and seeps in the vicinity through a collector system. Water flow fluctuates a great deal. The canal is in a rather tight soil and seepage test results are varied. Wet areas contribute water so that lining is prohibited. There are no measuring devices and headgates are in poor condition.

25. <u>Cove River Irrigation Company</u>

This company serves approximately 580 acres of irrigated land. The main canal extends approximately 2 miles in length, none of which has been lined. The average diversion is 3,900 acre feet of water. This system diverts water from springs and seeps in the area. The diversion system is a ditch through the wet area which picks up surface water. The flow fluctuates a great deal during the irrigation season. Moss is a problem. Measuring devices and headgates are in poor condition to non-existent.

26. <u>Glenwood Irrigation Company</u>

This company diverts water from the Glenwood Spring. The two main laterals, the south and east ditch, serve approximately 620 acres of irrigated land through 7.75 miles of distribution system. None of this has been lined. An average of 795 acre feet of water has been diverted annually by this company. The system is in fair condition. The diversion is adequate but seepage losses are high.

27. <u>Venice Pump Company</u>

This system supplies water to approximately 400 acres of irrigated land, through 2.5 miles of main canal, all of which is lined.

The system is in excellent condition as practically all facilities are new and functioning as desired.

28. Vermillion Irrigation Company

The Vermillion canal extends through lower subbasin D into Subbasin C with irrigated land in both areas served by the system. Approximately 1,380 acres of irrigated land are served in Subbasin D and about 2,860 acres of land are irrigated in Subbasin C. The system includes 21 miles of main canal, nine miles in Subbasin D and twelve miles in Subbasin C. The company has diverted an average of 16,000 acre feet of water annually from the Sevier River. The company has a primary right to river inflow below last upstream diversion. The system is in fair condition. The diversion structure in the Sevier River channel is in fair condition. Seepage losses are moderate. Adequate measuring devices and headgates are lacking in the system, prohibiting a better distribution of water. Sediment deposition from floodwater originating in Cottonwood Canyon is a problem.

Moss and other vegetation are a problem. High water tables prohibit lining in the upper reaches of the canal.

29. Cottonwood Creek Irrigation Company

This system irrigates approximately 250 acres of land near the mouth of Cottonwood Canyon. The system has approximately 2 miles of main canal. The average diversion is estimated at 1,180 acre feet of water. The system is generally in poor condition. The main diversion is an earth dam across the stream. This is periodically washed out by flash floods during the summer. Springs in the canyon provide the base supply of water. There is a possibility of installing a pipeline and irrigating with a gravity sprinkling system. Control of floods would be required. There are essentially no measuring devices in the system. Headgates are poor to non-existent. There is both a sediment and erosion problem which should be corrected. Summer flash floods often raise havoc with the system.

30. Cedar Ridge Irrigation Company

This system distributes water to approximately 2,230 acres of irrigated land through 3.5 miles of main canal, all of it lined. The system is in fair condition. There are two diversions, one in South Cedar Ridge and one in North Cedar Ridge Canyon that are used to divert water into the system. One is in fair condition and the other should be replaced. Seepage losses have almost been eliminated. Measuring devices and headgates are good to adequate. Summer floods damage the system and deposit sediment in other canals below the canyon mouths and on irrigated lands.

Subbasin E

This subbasin includes all the drainage of the East Fork of the Sevier River above the Kingston stream measuring gage. It also includes the irrigated area around Tropic and Cannonville in the Paria River drainage. These latter areas receive water from the East Fork of the Sevier River through a transbasin diversion.

1. Burrville Irrigation Company

This company diverts water from Burr Creek and distributes it to about 210 acres of irrigated land through 3.5 miles of main canal, none of which is lined. The system is in generally good condition although seepage losses are high. Measuring devices and headgates are adequate. There is a problem of rocks sluffing into the system in several places.

2. Meridian Ditch Company

Water is diverted from Otter Creek into an earth canal 3.5 miles in length. The irrigated area includes about 250 acres. Overall, the system is in fair condition. Measuring devices and headgates are adequate although a new diversion structure is needed. Seepage losses are moderate.

3. Koosharem Irrigation Company

The Koosharem Irrigation Company delivers water to about 2,220 acres of irrigated land, primarily around Koosharem. The main canal is about 10 miles long and 6.3 miles are lined. Approximately one mile of lining through Burrville meadows should be replaced with pipe or other type lining to eliminate frost action breaking the open concrete lining. The diversion structure in Otter Creek is adequate as are the headgates. Measuring devices are needed. There are moderate seepage losses in the unlined section of main canal.

4. <u>Rosebud Irrigation Company</u>

This company diverts water from Koosharem Creek and delivers it to the irrigated area above the Koosharem canal through about 1.5 miles of pipeline. Much of the approximately 500 acres of irrigated area is in Koosharem town. The diversion structure is new. Overall, the system is in good condition.

5. <u>Greenwich Creek Water Users</u>

These water users divert Greenwich Creek into the Anderson ditch and Bagley ditch with lengths of 1.75 miles and 2.0 miles respectively. Lands irrigated below the Koosharem canal receive water from both systems. The total area irrigated is about 1,160 acres. There is need for a diversion structure, measuring devices, lining, and a general upgrading of the total system.

6. <u>Box Creek Irrigation Company</u>

Box Creek Irrigation Company irrigates about 2,375 acres through 5.0 miles of canal. Water is stored upstream, released as needed, and diverted into the North ditch and South ditch. Seepage losses are high. The diversions are adequate as are other related structures in the system.

7. <u>Angle Irrigation Company</u>

This system diverts water from Otter Creek into the West ditch and East ditch. These are 3.0 miles and 2.2 miles in length, respectively and together serve 900 acres of irrigated land. The diversion structure is new. Measuring devices are adequate but there is a need for new headgates. Seepage losses are high and there is erosion occurring in some reaches of the system.

8. <u>Private Systems Along Otter Creek</u>

Private systems above Koosharem Reservoir divert water to about 870 acres of irrigated land through 4.5 miles of system. The diversion functions properly but seepage in the canals is high. Other structures are adequate.

The Christensen Ditch diverts below Koosharem Reservoir and serves 45 acres of irrigated land with 0.5 mile of canal. Structures are adequate and seepage is low.

The Rickenbach Ditch diverts water from the School Section Springs through 4.25 miles of canal to serve 280 acres of irrigated land. The system is generally adequate although a regulatory reservoir would increase water use efficiency.

The Meadow Ditch diversion is inadequate. Water is delivered to about 490 acres through 2.0 miles of canal. The canal picks up water through the wet meadow areas.

The Magleby Ditch diversion in Otter Creek is relatively new. Irrigated land is also served by water from Box Creek Irrigation Company.

The Allen pipeline delivers water from a regulating reservoir which stores water from Pole Canyon and Spring Creek. The pipeline is 1.0 miles long and serves a sprinkler irrigation system covering 75 acres.

9. Tropic and East Fork Irrigation Company

The Tropic and East Fork Irrigation Company diverts water stored in Tropic Reservoir on the East Fork of the Sevier River. The canal is a transbasin diversion, serving 2,200 acres of irrigated land in the Paria River drainage. In addition, several small systems irrigate about 170 acres of the canal before it crosses the divide. The canal is 21.5 miles long. Slightly over 3 miles has been lined along the upper reaches. Losses are high in the system through seepage, inefficient distribution, erosion and sedimentation, and inadequate control structures.

The irrigated land is very scattered and requires excessive laterals which contribute to water loss. Erosion and the accompanying sedimentation in Water Canyon require wasting of water for sluicing. The time lapse between releasing water into the canal and delivery to the farm makes regulatory storage imperative.

The annual diversion averages 3,240 acre feet of water. Some additional water is diverted from North Creek and Bryce Creek. This diversion could be increased by enlarging Tropic Reservoir to regain storage lost through sediment deposition. Storage on North Creek would increase the useable supply from this source.

10. Clifton Irrigation Company

This system diverts water from Henderson Creek to serve about 120 acres through 3 miles of canal. The system is in poor condition. There is a need for all types of control structures. Seepage losses are high and erosion is a problem.

11. Cannonville Irrigation Company

This company diverts water from several sources in the upper Paria River drainage including return flows from the Tropic area. They irrigated about 380 acres with 4 miles of canal. The system is in poor condition and needs all types of structural measures installed.

Several small private systems below Cannonville use return flows from the above company and also divert water from Henrieville Creek. They are all in poor condition. Irrigated land totals 140 acres under 3 miles of canal.

12. Private Systems - Johns Valley to Antimony

There are several individual systems diverting water to irrigated land through this part of the East Fork of the Sevier River. These systems are one-owner and informal groups. System condition varies from good to poor. The following tabulation lists pertinent information about these systems.

System Drainage	Irrigated area (acres)	Canal length (miles)	System condition
Sweetwater	70	0.5	fair
Dry Hollow	75	0.4	fair
Horse Creek	370	2.3	good (sprinkler)
Birch Creek	175	1.3	good (sprinkler)
Cottonwood Cr.	510	5.5	poor (wild flooding)
Mitchell Cr.	75	0.9	fair
Center Creek	250	1.7	good (sprinkler)
Poison Creek	185	1.0	good (lining & sprinkler)

There are also several individuals who divert water directly from the river above Antimony in Black Canyon and one in Kingston

Canyon below Antimony. These are small irrigated areas with relatively inefficient systems.

13. Bench Irrigation Company

This company diverts water from Antimony Creek and serves 1,000 acres of irrigated land on Antimony Bench through 6.2 miles of canal. Seepages losses are high. The control structures are adequate and some lining has been installed.

14. Coyote and East Fork Irrigation Company

This system includes the Cod Key Ditch, Meadow Ditch, Wiley Ditch and Coyote and East Fork Canal. The system is 12.8 miles long and serves about 1,400 acres. Water is diverted directly from the Otter Creek Reservoir Feeder Canal and the East Fork of the Sevier River. The Bench Canal supplies some water to the system.

The river diversion is inadequate and should be replaced. Seepage losses vary from moderate to high. Control structures are needed, especially measuring devices. Some of the system has been lined.

15. Clover Flat Irrigation Company

This company diverts water directly from the river to irrigate mostly meadow land. Irrigation is mostly by wild flooding.

Subbasin F

Subbasin F includes all the drainage of the South Fork of the Sevier River above the Kingston measuring gage. The Junction Irrigation Company system, which diverts water in the Mitchell Slough area above the gage, is described in Subbasin D.

1. Hatch Irrigation Company

The West Ditch diverts water from Mammoth Creek above its confluence with the Sevier River. The annual diversion is about 3,790 acre feet to 1,460 acres via 9.2 miles of canal. The diversion structure is in fair condition, control structures are inadequate or lacking and seepage losses are high.

The East Ditch diverts from the river to 130 acres of irrigated land. The canal is 1.8 miles in length and delivers about 740 acre feet annually. The diversion structure should be improved and additional control structures should be installed. Seepage losses are high.

2. Hillsdale Water Users

This informal group diverts water from the Sevier River to about 550 acres on both sides of the river. The annual diversion averages about 1,800 acre feet. The diversion structure is relatively new. Seepage losses are moderate to high. Improved control structures are needed.

3. Private Systems - Hatch to Panguitch

There are several systems diverting water from the Sevier River and several tributary drainages in this area. Most of these systems are inefficient and facilities need considerable improvement. Most of these systems are susceptible to flash floods and related problems.

4. Long Canal Company and East Bench Irrigation Company

These two companies use a common diversion structure in the Sevier River. They also use the same canal for nearly the upper one-half of the system length. The canals then divide into the Pinch Ditch and East Bench canal. Total system length is about 15 miles to serve 3,100 acres of irrigated land. The average diversion is about 14,570 acre feet. The total system is in generally good condition except seepage losses are moderate to high. Some erosion occurs in the system and flash floods from side drainages cause some damage.

5. East Panguitch Irrigation Company

About 7,570 acre feet of water are diverted annually to irrigate 1,510 acres of irrigated land. The main canal is 4.8 miles long with losses of only about 20 percent. The system is in good condition. Sediment from the river is a problem and increases maintenance costs.

6. West Panguitch Irrigation Company

This company stores water in Panguitch Lake which is delivered to the South Ditch and West Panguitch Canal via Panguitch Creek. These canals total 14.3 miles in length and serve 4,290 acres of irrigated land. The annual diversion averages 17,600 acre feet. The system is in generally good condition although the diversion structure could be improved and repair work is needed on Panguitch Lake dam. Seepage loss is about 30 percent. Flash floods from side drainages often cause problems.

7. Barton, Tebbs, Le Fevre Ditch Company

The river diversion structure is owned jointly with the McEwen Ditch Company. The structure is relatively new. Improved operation and possibly some modification would improve its efficiency. Considerable sediment is diverted into both systems at present. This company diverts about 4,000 acre feet of water annually through 5.5 miles of canal to 630 acres of land. Nearly one-half of the canal has been lined. Water control structures in the canal are adequate and seepage in the unlined part is moderate.

8. McEwen Ditch Company

The McEwen Ditch Company diverts 5,950 acre feet annually at the McEwen Diversion (owned jointly with the Barton, Tebbs, LeFevre Ditch Company) for use on 1,520 acres of irrigated land. The canal is 11.8 miles long with concrete lining only a few hundred feet at the diversion. Seepage losses in the balance of the system are high. Sediment deposition in the canal is a problem, at the diversion as well as at points along the system where it intercepts flash floods from side drainages.

9. Bear Creek Irrigation Company

This system diverts from Bear Creek to irrigate 360 acres along the west side of the Sevier River. The average diversion is about 2,170 acre feet annually. The canal length is about 4.9 miles. A new diversion structure is needed. The balance of the structures are adequate. Seepage losses are moderate. Sediment is a problem.

10. Private Systems - Panguitch to Circleville

Several groups and individuals divert water along this reach of the Sevier River from the river itself and from tributaries. These include small unnamed systems west of Panguitch town, Three Mile Creek, Sandy Creek, Marshall Ditch, Perkins, Whittaker, Parker Ditch and Cannon-Dobson Ditch.

The Marshall Ditch in lower Panguitch Valley serves 410 acres with 4.5 miles of canal and diverts about 1,800 acre feet annually. The diversion in the Sevier River functions adequately. The balance of the system needs improvements.

The Cannon-Dobson Ditch in upper Circle Valley serves 80 acres through 1.7 mile long canal. Users divert about 510 acre feet annually. The diversion is rock-brush and needs periodic repairs or replacement. The seepage is high.

The Parker Ditch utilizes a similar type diversion with the same problems. It serves 90 acres of land through 1.4 miles of canal. Diversions average 350 acre feet annually. Seepage losses are high. Other structural components should be upgraded.

11. Loss Creek Irrigation Company

This company diverts about 4,290 acre feet of water annually from the Sevier River to irrigate 800 acres of land. The canal is 4.5 miles long with concrete lining for 3.5 miles. The system is in good condition. All structures are adequate, in good condition, and function satisfactorily.

12. Circleville Irrigation Company

This system includes the West Canal, Wiley Ditch, Dalton Ditch, Thompson Ditch, and Kingston Canal. Water is diverted from the Sevier River at three diversion points. The Kingston diversion structure is in good condition. The upper diversion dam (shared with Loss Creek Irrigation Company) is in good condition, the lower one, serving the balance of the ditch systems, should be replaced. The Kingston Canal on the east side of the river, serves 2,530 acres of irrigated land through 6.25 miles of canal of which 1.2 miles are lined. The balance of the system, which is west of the river, serves 2,990 acres of irrigated land through 14.25 miles of canal of which 2.0 miles has been lined. The average diversion is 14,680 acre feet annually. Control structures in the total system are adequate but a replacement schedule should be planned. Seepage losses are from moderate to high.

ROOT ZONE SUPPLY - FREQUENCY STUDIES

Crop root zone water supply deficiencies by watershed were determined from available data as a means of assessing possible watershed problems requiring project measures to improve present conditions. Presently irrigated acres were used as the base for determining water supply deficits and potential benefits following installation of proposed project measures. Present water supply for these base acres was determined from diversion records, wells and other sources as applicable.

A weighted potential consumptive use requirement was calculated for each subbasin and used as a measure of crop needs for each watershed within the subbasin unless cropping pattern differences made an adjustment necessary. Average precipitation was deducted from the potential consumptive use requirement each month during the crop growing season before water deficits were determined. Soil moisture storage was tabulated for the crop root zone in order to give reasonable credit for winter precipitation within limits of soil profile waterholding capacity. This accounting procedure, which continued through the crop growing season, was used to determine the water application limitation for soil moisture storage or potential consumptive use for any one month.

The overall irrigation efficiency from diversions to crop root zone has two parts; transportation efficiency and on-farm efficiency. Transportation efficiency describes the relationship between quantity of water diverted into the canals and distributed among the several laterals and the quantity of water available at the farm headgate. In short, this item identifies canal and lateral water losses. On-farm irrigation efficiencies are determined by measuring the effectiveness of field application as well as on-farm ditch losses. The losses incurred as irrigation water is applied to the fields stem from two conditions -- deep percolation and tail water. On-farm ditch losses occur from deep percolation and phreatophyte consumptive use as well as evaporation.

Ground water in some irrigated areas provided a substantial quantity of water for crop needs. Generally these sources were available for a limited time during the beginning of the growing season. This water supply was credited similar to monthly precipitation so that diversion requirements could be reduced by the ground water amount.

The evaluation resulted in several curves showing various relationships for each watershed. These curves show supply-frequency, supply-deficiency, deficiency-frequency, and deficiency-efficiency relationships. All of these curves were not prepared for every watershed.

Curve Development Procedures

Gaged diversions were used to determine water available for crop needs. These diversion points were generally along the Sevier River mainstem. Ungaged diversions, mostly on tributary streams, were sampled during the study period and correlated with comparable diversions with several years of record to derive this water supply. Once diversions were determined, the water supply, adjusted for losses, was ranked in descending order and plotted by probability of occurrence. This gives the supply-frequency relationship.

The supply-deficiency relationship was determined using water budget calculations with a range of water supply levels. The supply levels chosen were such that a deficiency occurred. If there is no loss to ground water, this relationship is a straight-line function. If a loss to ground water is calculated, the relationship is sometimes curvilinear. Data used was from the irrigated cropland section of the water budget for average conditions.

The supply associated with a given frequency and efficiency was determined from the supply-frequency curves. The deficiency associated with this supply was either calculated or taken from the curves and information developed in the supply-deficiency relationship. Curves of deficiency versus frequency were plotted on arithmetic paper corresponding to each of the specific supply-frequency curves plotted previously.

The area under a particular deficiency-frequency curve defines the average annual deficiency at the specified efficiency. At least three average annual deficiencies thus determined were plotted against their respective efficiency on arithmetic paper and a smooth line drawn through them to give the deficiency-efficiency curve.

Detailed Example - Watershed A-3, Ephraim Creek

The following paragraphs show the detailed procedures used to develop these relationships.

General Supply-Frequency Curve Field investigation indicated thirty percent of the gross flow of Ephraim Creek reaches the crop root zone. This value was converted to inches of supply for the 10,350 acres of irrigated rotation cropland. Annual precipitation was assumed to be the same as recorded at the Manti climatological station. These two supplies were combined, arrayed in descending order, and plotted by frequency to determine cropland supplies. The average value from the years of record available occurred at the 45 percent chance point. Figure 9 shows the frequency curves.

Specific Supply-Frequency Curve Specific Supply-Frequency curves were made for 30 percent, 40 percent, and 50 percent efficiencies. These curves are shown on Figure 9.

Supply-Deficiency Relationship Curve As the water budget indicates no loss to ground water due to an over-filled soil profile, the supply-deficit relationship is assumed to be a straight line function. A plot of the data appears on Figure 10.

Deficiency-Efficiency Curve Figure 11 shows the deficiency-frequency curve resulting from plotting the average annual deficit at efficiencies of 30 percent, 40 percent, and 50 percent against their respective efficiencies. Points indicated on the curve correspond to present watershed efficiency and increased efficiencies due to adding incremental project measures.

Deficiency-Frequency Curve Figure 12 shows the deficiency-frequency curves for efficiencies of 30 percent, 40 percent, and 50 percent. These different percentages identify changes in overall efficiencies stemming from land treatment and project measures. The tabulated data on the figure is the area under each respective curve and its corresponding deficit.

Use of the Analysis The deficiency-frequency curve was used to identify the present average annual deficit of 3,050 acre-feet. This curve was also used to estimate the reduction in deficiency expected from the following potential project measures: (1) Land leveling of 7,300 acres with an efficiency improvement of 1.2 percent (31.7 to 32.9 percent) resulting in a deficit reduction of 160 acre-feet per year; (2) on-farm ditch lining on 9,540 acres with an efficiency improvement to 36.8 percent and a deficit reduction of 590 acre-feet; and (3) canal lining of 75.3 miles with an efficiency improvement to 46.4 percent and a deficit reduction of 1,140 acre-feet.

The deficit-frequency curve was used to determine the number of wells and the deficit reduction expected. Wells in the Ephraim area may be expected to produce about 2 cfs during a 3 month irrigation season or 360 acre-feet per well. A deficit-frequency curve was plotted for a 46.4 percent efficiency as determined above. The 90 percent water supply level was selected for analysis. The deficit expected at this level is 5,000 acre-feet which is equal to the approximate capacity of 30 wells at 46.4 percent efficiency. The intercept on the frequency axis indicates the wells would only be needed 33 years out of 100 years. This information is used to estimate the life expectancy of pump, motors, and related equipment for determining well costs.

The area under the curve at a deficit level of 5,000 acre-feet is 2.51 square inches which indicates an annual deficit reduction of 1,004 acre-feet. Other levels of supply could be analyzed to determine the highest number of wells it may be practical to consider.

Summary of Results

A brief narrative is given for each deficiency-frequency analysis made. Following these narratives, Table 5 shows the irrigated cropland deficits by the present, 40 percent, and 50 percent efficiency. The deficits are tabulated by 20, 50, and 80 percent chance occurrence.

Watershed A-2 Analysis The General supply-frequency curve for Watershed A-3 was used along with the Watershed A-2 water budget. Supply-frequency curves were plotted for 30 percent, 40 percent, and 50 percent efficiencies. The total value of annual supply in inches, as tabulated in the water budget, was plotted at the 50 percent frequency. Deficit-frequency curves were plotted for efficiencies of 30 percent, 40 percent, and 42.7 percent (efficiency with land leveling and canal lining), and 50 percent. The effect of potential wells and a multiple use reservoir was evaluated. The deficiency-efficiency curve analysis investigated the effect of 5,700 acres of land leveling and 18.75 miles of canal lining. The effect of on-farming ditch lining was also evaluated to determine the extent this reduced cropland deficits.

Watershed A-3 Analysis See the preceeding detailed example.

Watershed A-4 Analysis The General supply-frequency curve for Watershed A-3 was used with the annual supply from the water budget to plot the specific supply-frequency curves for efficiencies of 30 percent, 40 percent, and 50 percent. The supply deficiency relationship was determined through results of water budget analysis as a loss to ground water as indicated for average conditions. Although this relationship was shown as a curve, the relative accuracy of the data and procedure would indicate it could be a straight line. Deficit-frequency curves were plotted for efficiencies of 30 percent, 40 percent, and 50 percent, as various land treatment and structural measure effects were evaluated. The deficit reducing effect of constructing wells was also evaluated.

The efficiency-deficiency curve shows 1,500 acre feet corresponding to the estimated present efficiency of 32.8 percent. Applying land leveling to 4,635 acres would raise the efficiency to 36.1 percent with a deficit reduction of 300 acre-feet. Canal lining of 23.6 miles was estimated to give an efficiency of 42.3 percent with a deficit reduction of 350 acre-feet annually.

Watershed B-1, B-2a and B-2b As annual diversion data was not available, diversions were estimated, using the water budgets for average diversions and a correlation with Salt Creek to estimate annual amounts. Levan climatological station data was used with the above to obtain the general frequency-supply curve for Watershed B-1. The slope of this curve was used for specific curves for Watersheds B-2a and B-2b. An additional specific supply-frequency curve for Watershed B-2b was shown for the condition resulting from pumping ground water of equal amounts each year corresponding to the average release from Chicken Creek Reservoir.

Deficit-frequency curves were plotted for each watershed for efficiencies of 30 percent, 40 percent, and 50 percent. An additional curve was plotted for each watershed for estimated efficiencies resulting from land leveling, sprinkler irrigation, ditch lining, and canal lining.

Deficiency-efficiency curves for these watersheds were plotted showing the effects of recently constructed measures and of potential measures.

Watershed B-4 The general supply-frequency curve was made using the Scipio climatological station precipitation data and annual diversion values taken from the water budget data for average conditions and correlating these with Chalk Creek gaging station records. Supply-frequency curves were plotted for efficiencies of 30 percent, 40 percent, and 50 percent. A supply-frequency curve was also plotted for project conditions which includes potential effects of land leveling, ditch and canal lining, water salvage, and a reservoir. Deficiency-frequency curves were plotted for each of the above conditions. The deficiency-efficiency curves were used to determine the effect of land leveling, ditch lining, and canal lining.

Watershed B-5 The general supply-frequency curve is based on Oak City climatological station data, diversion records of the lower Sevier River Water Commissioner, and estimated tributary diversions. Estimated diversions were correlated with Chalk Creek records. This curve appeared as two straight lines probably due to the effect of reservoir storage on the water supply.

Specific supply-frequency curves were plotted for efficiencies of 25, 30, 40, and 45 percent. Deficiency-frequency curves were plotted for each of the above efficiencies along with one for 48 percent efficiency stemming from land leveling, ditch lining, and canal lining. The effect of 18 wells in further reducing deficits was evaluated. The deficiency-efficiency curve indicates the effect of land leveling, ditch lining, and canal lining measures.

Watershed B-6 The general supply-frequency curve was made similar to the one for Watershed B-6 with records of the Fillmore climatological station being used. Supply-frequency curves were plotted for efficiencies of 30, 35, and 40 percent. Deficiency-frequency curves for the same efficiencies were also plotted. A deficiency-efficiency curve showing present average annual deficit and effects of conservation measures was plotted to complete the analysis.

Watershed B-7 The general supply-frequency curve was plotted using diversion records and the Deseret climatological station precipitation records. Specific supply-frequency curves for efficiencies of 40 percent, 50 percent, and 60 percent were plotted based on the water budget data. Deficiency-frequency curves for the same efficiencies were also plotted, areas measured, and the average annual supply deficits calculated. The deficiency-efficiency curve was plotted and the present average annual deficit indicated along with effects of conservation measures.

Watershed C-1 The general supply-frequency curve made for Watershed C-2 was used to represent conditions in Watershed C-1. Specific supply-frequency curves were drawn for efficiencies of 40 percent, 50 percent, 60 percent, and 29.5 percent (the present efficiency). Although water budgets indicate some loss to ground water from over-irrigation, the deficit-supply curve plots as a straight line.

Deficit-frequency curves were plotted for the above efficiencies as well as one for 41.4 percent (the expected efficiency with land leveling and canal lining). The effect of 10 wells in overcoming deficits at the 90 percent supply level was evaluated. The deficiency-efficiency curve was plotted. Present efficiency and deficits are shown in Table 5 for three efficiency conditions.

Watershed C-2 The general supply-frequency curve was made using diversion records and precipitation data from the Salina climatological station. Specific supply-frequency curves were plotted for 30 percent, 35 percent, 40 percent, and 45 percent efficiencies. Water budget calculations produce a curved supply-deficit relationship indicating an increasing loss to ground water as the deficit is reduced.

Deficiency-frequency curves corresponding to specific supply-frequency curves were plotted and the area under these curves measured. The deficiency-efficiency curve was plotted and the potential results of possible Agricultural Water Management measures were plotted.

Watershed C-3 The general supply-frequency curve used precipitation data from the Manti climatological station combined with estimated diversion records based on the water budget for average conditions and Clear Creek runoff data. Water budget calculations indicate no loss to ground water and the deficit-supply curve plots as a straight line.

Specific supply-frequency curves were plotted for efficiencies of 30, 40, and 41.9 percent (the expected efficiency with land leveling and canal lining) and 50 percent. The areas under these curves were measured and the average annual deficits calculated. The effect of wells in overcoming the deficit at the 90 percent supply level was also evaluated. The deficiency-efficiency curve was plotted, the present efficiency-deficiency noted, and the potential effects of conservation measures determined.

Watershed C-4 The general supply-frequency curve of Watershed C-3 was used to represent conditions of this watershed. Specific supply-frequency curves were plotted for efficiencies of 30, 40, and 50 percent. Deficit-frequency curves were drawn for 30, 40, 43.75 (efficiency with potential land leveling, ditch lining, and canal lining) and 50 percent. The areas under the curves were measured, the average annual deficits calculated, and the effect of wells in overcoming deficits at 90 percent supply level determined. The deficiency-efficiency curve was plotted, the present efficiency and average annual deficiency noted along with potential effects of possible conservation measures.

Watershed C-5 The general supply-frequency curve was made using estimated diversion records and data from the Salina climatological station. Diversions were estimated using the water budget for averaged conditions and the Ephraim Creek record.

Specific supply-frequency curves were plotted for efficiencies of 20, 28 and 40 percent. Although the water budgets calculated to determine the supply-deficiency relationship indicate a loss to ground water due to excess irrigation, the supply-deficit curve is straight.

Deficiency-frequency curves for efficiencies of 20, 28, 31, and 40 percent were drawn and corresponding average annual deficits determined. The deficiency-efficiency curve was plotted and the present deficiency-efficiency noted. Effects of land leveling were also evaluated. The effect of possible future sedimentation on the deficiency-efficiency for the watershed was also considered.

Watershed C-6 The slope of the general supply-frequency curve for Watershed C-3 and Watershed C-6 budget data was used to plot specific supply, frequency curves for efficiencies of 35, 43 and 50 percent. Deficiency-frequency curves were plotted for the above efficiencies, the area under the curve measured, and the corresponding average annual deficit calculated. The deficiency-efficiency curve was plotted and the average annual efficiency and deficit noted. No further analysis was made.

Watershed D-1 A general supply-frequency curve was made for Watersheds D-1 through D-5 using precipitation data from the Richfield climatological station and diversion records of the upper

Sevier River Water Commissioner. Specific supply-frequency curves for Watershed D-1 were made using the general supply-frequency curve to define the slope and water budget data to give amounts. Curves were plotted for efficiencies of 36, 45 and 50 percent. Deficiency-efficiency curves for efficiencies of 36, 42.2, 45 and 50 percent were plotted. Areas were measured and average annual deficits calculated. The effect of wells in overcoming deficits was evaluated. The deficiency-efficiency curve was plotted and effects of canal lining and land leveling were noted.

Watershed D-4 Specific supply-frequency curves were made in the same manner as for Watershed D-1 with the substitution of Watershed D-4 data. Curves were plotted for efficiencies of 30, 38, and 46 percent. The supply-deficiency relationship was assumed to be a straight line.

Deficiency-efficiency curves were plotted for the foregoing efficiencies. Areas under the curves were measured and average annual deficits calculated. The deficiency-efficiency curve was plotted and points corresponding to various potential measures indicated.

Watershed E-5 The general supply-frequency curve was made by using diversion records of the Tropic and East Fork Canal near Davis Hollow and precipitation data from the Tropic climatological station. Specific supply-frequency curves were plotted for efficiencies of 30, 40 and 50 percent.

The supply-deficiency calculated from a series of budgets is a slight curve. Deficiency-frequency curves were plotted for efficiencies of 30, 40, and 50 percent. Areas under the corresponding curve were measured and average annual deficits calculated. The analysis was completed by plotting the deficiency-efficiency curve and indicating points corresponding to project measures.

Watershed F-1 The general supply-frequency curve was made for the area covered by Watersheds F-1, D-6, D-7, and D-8. It was based on diversion records and precipitation data from the Piute Reservoir climatological station.

Specific supply-frequency curves were made for efficiencies of 25, 30, 35, and 40 percent. Also shown is a supply-frequency curve for a potential project involving irrigation of new land and conversion of wetlands to rotation croplands and with an efficiency considering a high level of land treatment and structural measures.

Supplemental water budget calculations were made to define the supply-deficiency curve. Two curves were plotted, one considering a loss to ground water (the present condition), and one without (project condition with additional wells).

Deficiency-frequency curves were plotted for the foregoing efficiencies. Areas under the curves were measured and corresponding average annual deficiencies calculated.

The analysis was completed by plotting the deficiency-frequency curve and indicating deficiency-efficiency points relating to present and project conditions. The effect of canal lining was figured from the point associated with land leveling.

Watershed F-2 The general supply-frequency curve was made to cover Watersheds F-2, 3, 4, and 5. It utilized precipitation data from the Panguitch climatological station and available diversion records.

Specific supply-frequency curves were plotted for the present overall efficiency of 30 percent on 6,250 acres presently irrigated land and an efficiency of 50 percent on the present land plus 6,000 acres of new land. It is estimated that 50 percent project efficiency could be achieved by a program of land treatment and structural measures. Land treatment measures including land leveling, on-farm ditch lining, and sprinkler irrigation. Structural works proposed include extensive lining of canals. Estimates indicate sufficient water for the 93 percent chance supply level. The analysis was not carried further.

Watershed F-3 The general supply-frequency curve was made as explained for Watershed F-2. Specific supply-frequency curves were plotted for efficiencies of 25, 30, 35, 43 and 50 percent. Deficiency-frequency curves were plotted for efficiencies of 25, 30 and 35 percent. Areas under the curves were measured and corresponding average annual deficits were calculated.

The deficiency-efficiency curve was plotted to complete the analysis.

TABLE 5.--Irrigated cropland water deficits by irrigation efficiency and frequency, Sevier River Basin

Watershed	Present overall efficiency	Present average deficit in acre-feet	20% Chance			50% Chance			80% Chance		
			Present efficiency	40% efficiency	50% efficiency	Present efficiency	40% efficiency	50% efficiency	Present efficiency	40% efficiency	50% efficiency
A-2	31.0	5,000	1,600	0	0	5,000	3,800	2,800	7,800	7,000	6,000
A-3	31.7	3,100	0	0	0	1,700	0	0	6,200	4,000	1,200
A-4	32.8	1,500	0	0	0	1,000	0	0	3,500	2,100	700
B-1	28.0	3,100	600	0	0	2,900	2,200	1,200	4,700	4,100	3,400
B-2a	25.9	1,250	0	0	0	900	200	0	2,400	1,800	1,300
B-2b	25.0	500	0	0	0	500	0	0	11,000	600	250
B-4	30.0	3,300	2,300	1,100	0	3,400	2,700	1,400	4,400	3,500	2,600
B-5	25.4	5,800	3,400	0	0	5,000	200	0	8,600	5,000	2,600
B-6	25.8	5,200	3,200	0	0	4,800	600	0	7,600	4,600	2,600
B-7	45.0	21,200	1,000	9,500	0	17,500	23,500	12,000	30,000	34,900	25,000
C-1	29.5	1,000	0	0	0	0	0	0	2,100	1,400	700
C-2	31.0	3,000	0	0	0	0	0	0	5,700	200	0
C-3	30.0	8,200	0	0	0	7,600	3,600	0	15,600	12,600	8,400
C-4	28.0	700	0	0	0	600	30	0	1,300	900	500
C-5	28.0	200	0	0	0	0	0	0	200	0	0
C-6	28.0	1,000	0	0	0	400	0	0	1,500	1,100	500
D-1	36.0	6,300	0	0	0	900	0	0	12,000	10,400	1,200
D-4	32.0	5,900	300	0	0	4,700	0	0	10,000	6,600	700
E-5	32.5	1,500	2,000	1,600	1,100	2,600	2,300	1,700	3,700	3,500	3,000
F-1	35.0	300	0	0	0	0	0	0	1,500	600	0
F-3	30.0	250	0	0	0	0	0	0	500	0	0

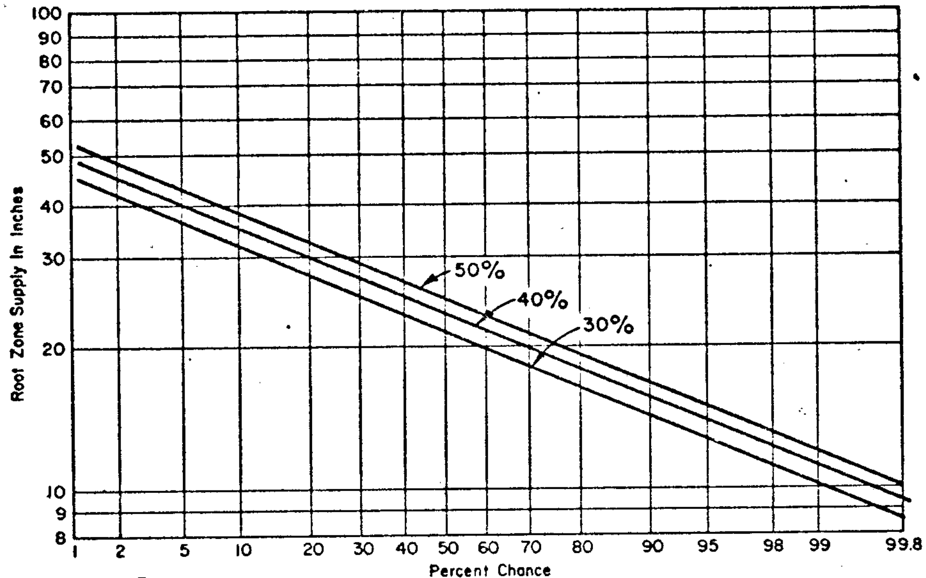


Figure 5 : Root Zone Supply vs. Frequency
Watershed A-2
Sevier River Basin Utah

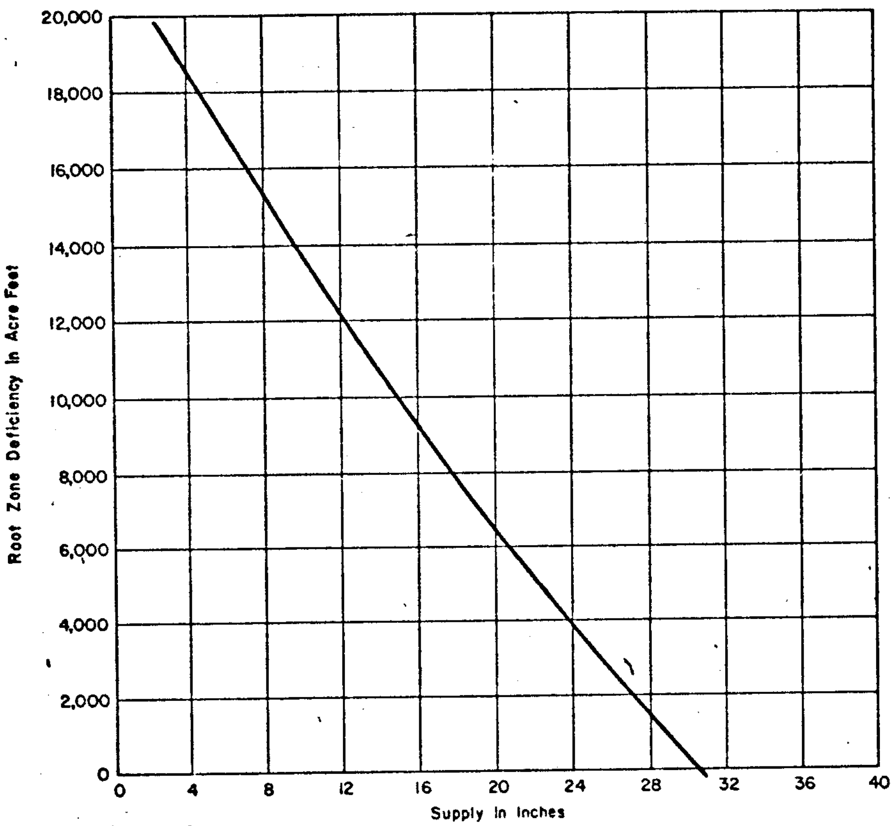


Figure 6 : Root Zone Deficiency vs. Supply
Watershed A-2
Sevier River Basin Utah

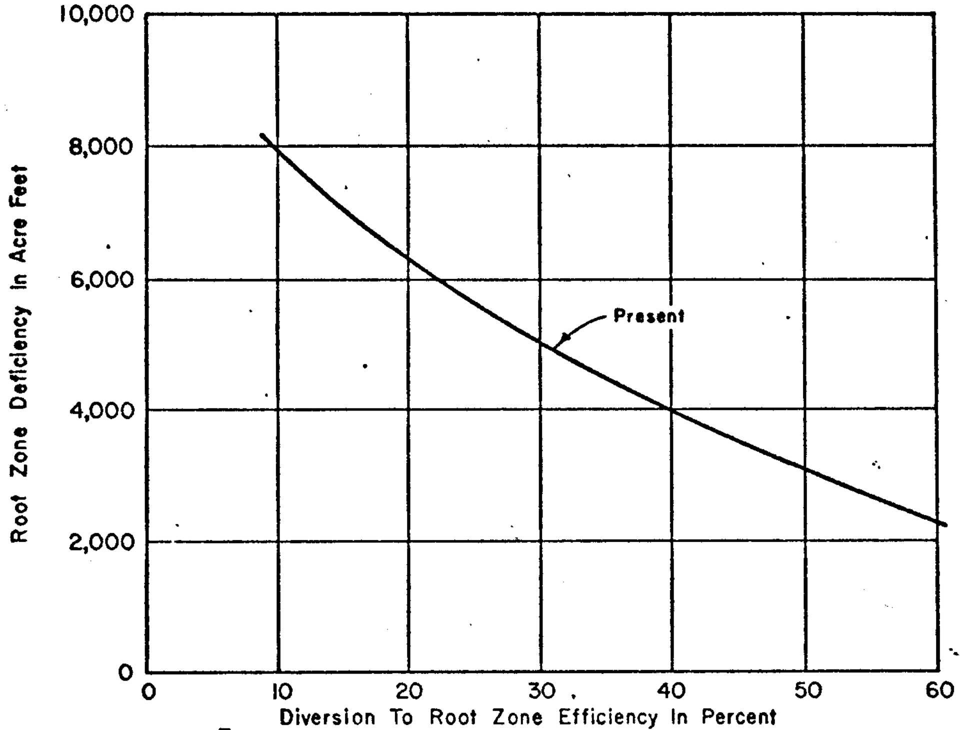


Figure 7 : Root Zone Deficiency vs. Efficiency
Watershed A-2
Sevier River Basin Utah

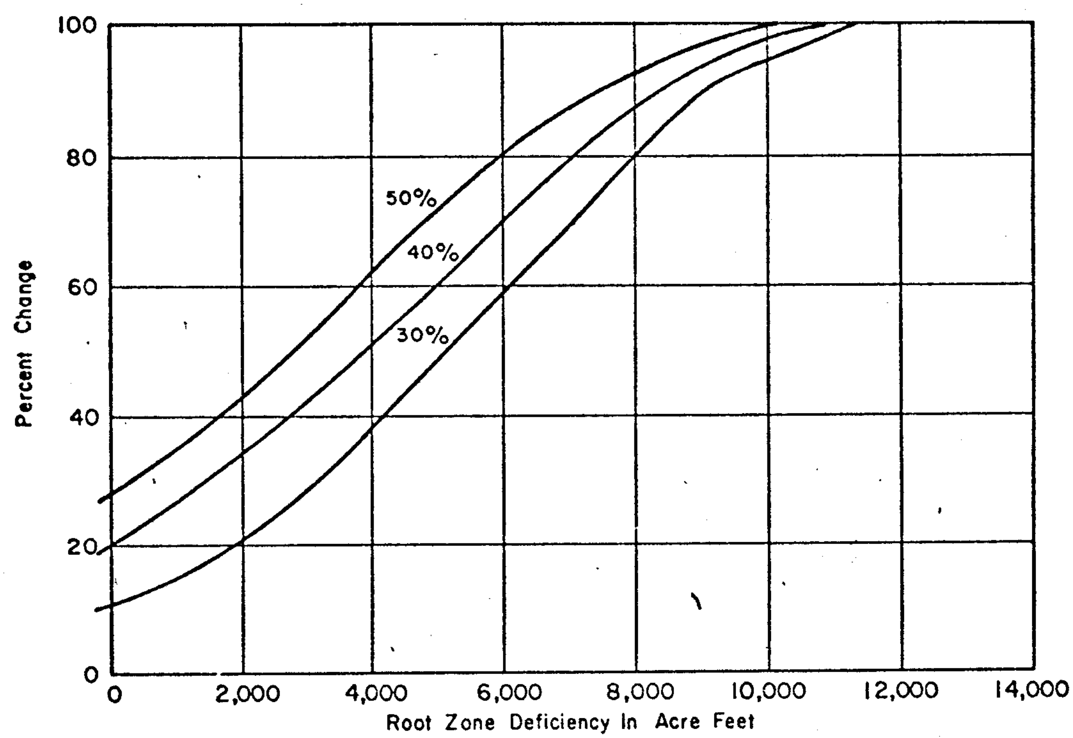


Figure 8 : Root Zone Deficiency vs. Frequency
Watershed A-2
Sevier River Basin Utah

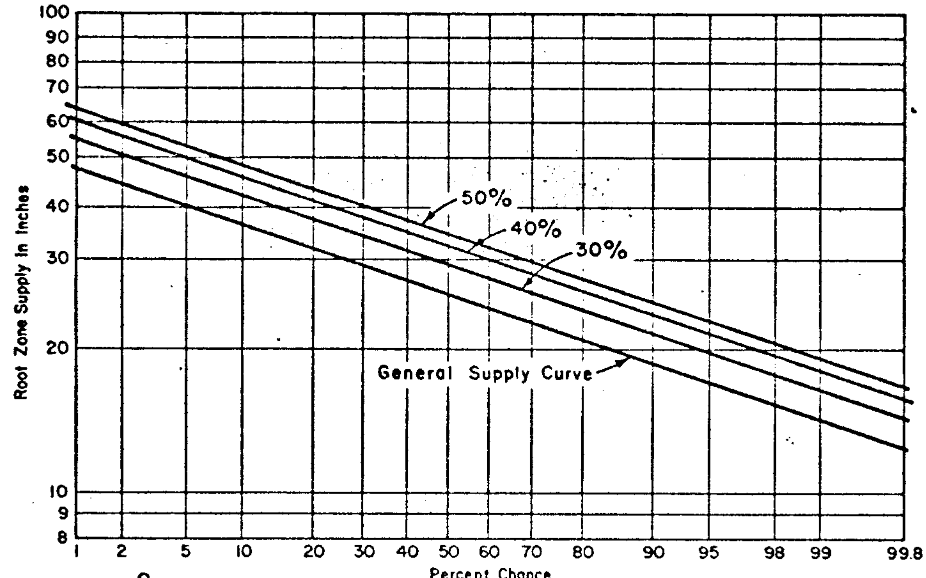


Figure 9 : Root Zone Supply vs. Frequency
Watershed A-3
Sevier River Basin Utah

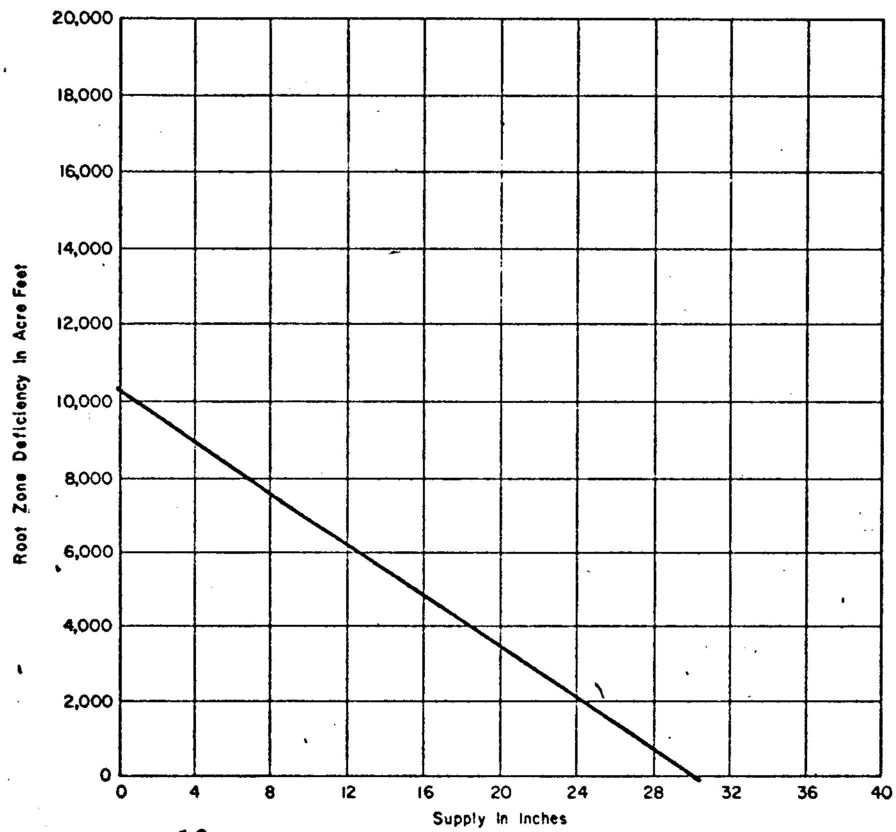


Figure 10: Root Zone Deficiency vs Supply
Watershed A-3
Sevier River Basin Utah

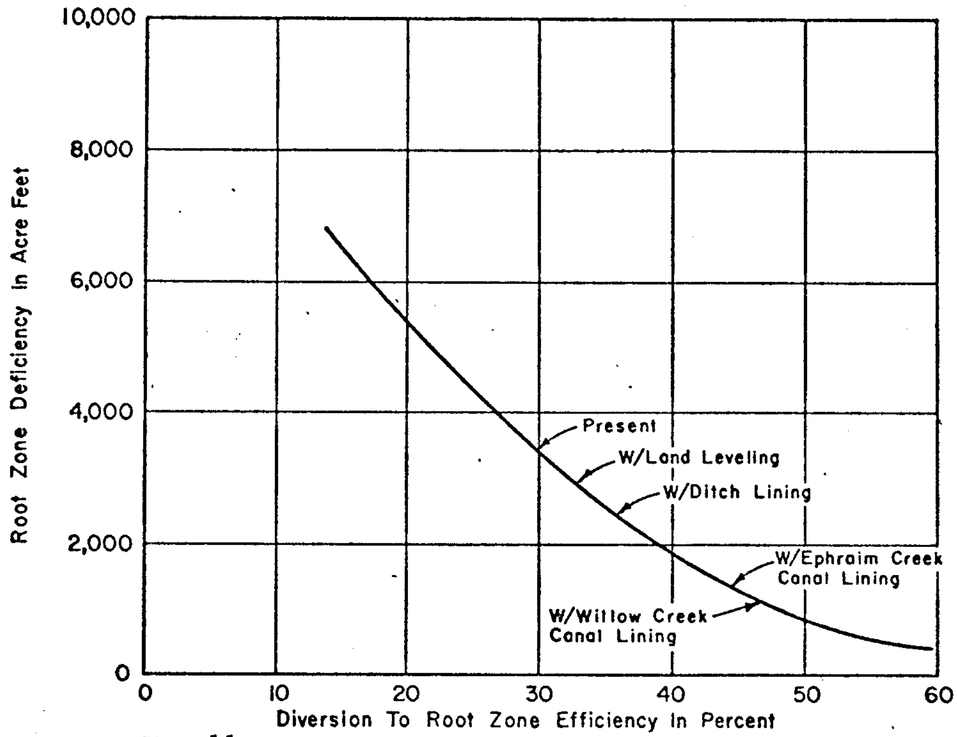


Figure 11: Root Zone Deficiency vs. Efficiency
Watershed A-3
Sevier River Basin Utah

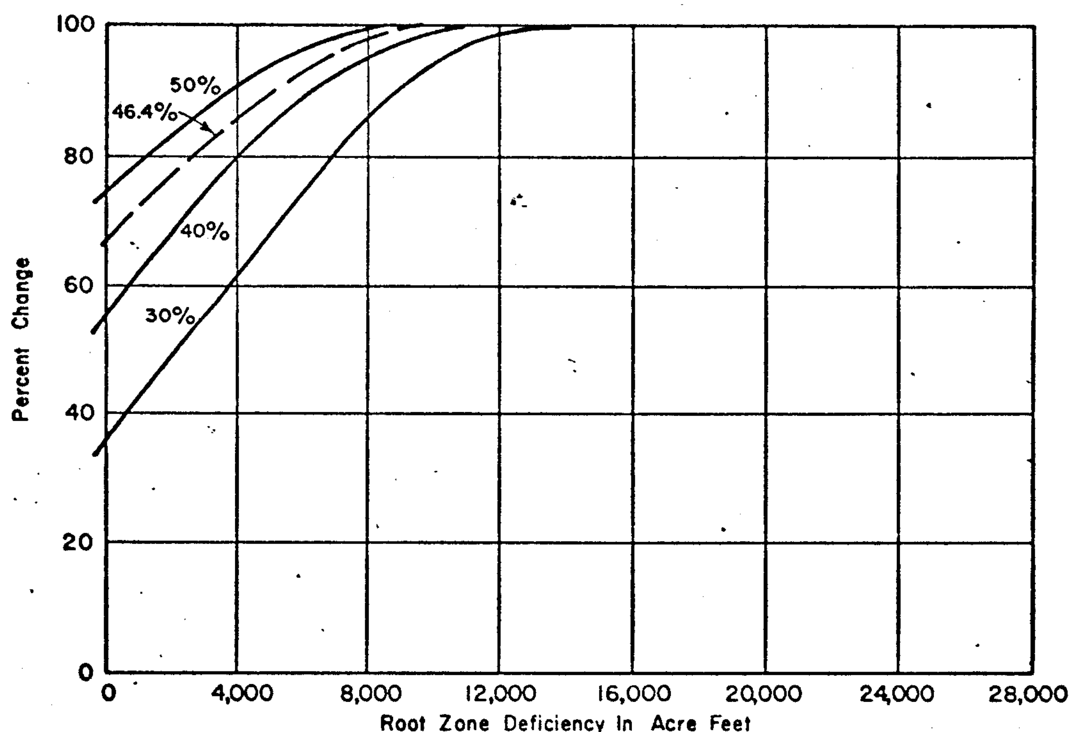


Figure 12: Root Zone Deficiency vs. Frequency
Watershed A-3
Sevier River Basin Utah

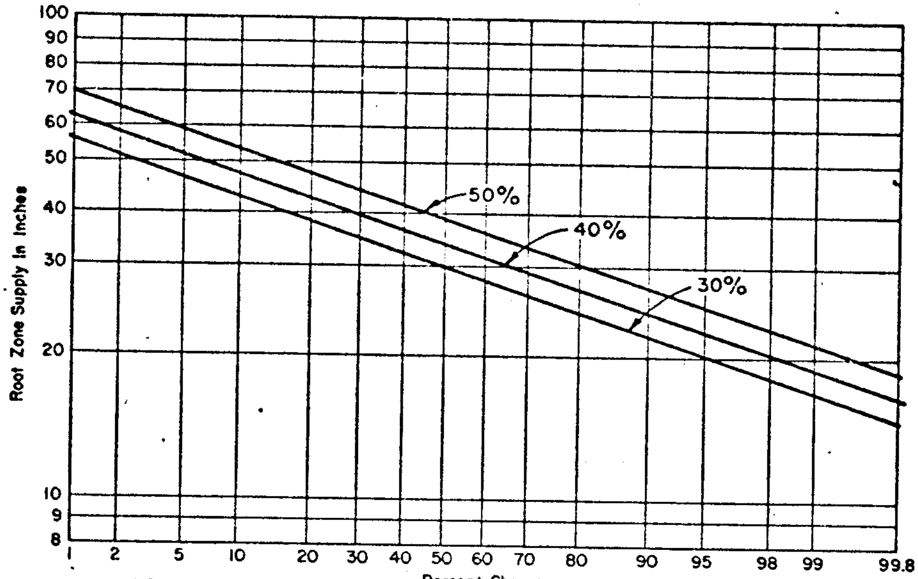


Figure 13: Root Zone Supply vs. Frequency
Watershed A-4
Sevier River Basin Utah

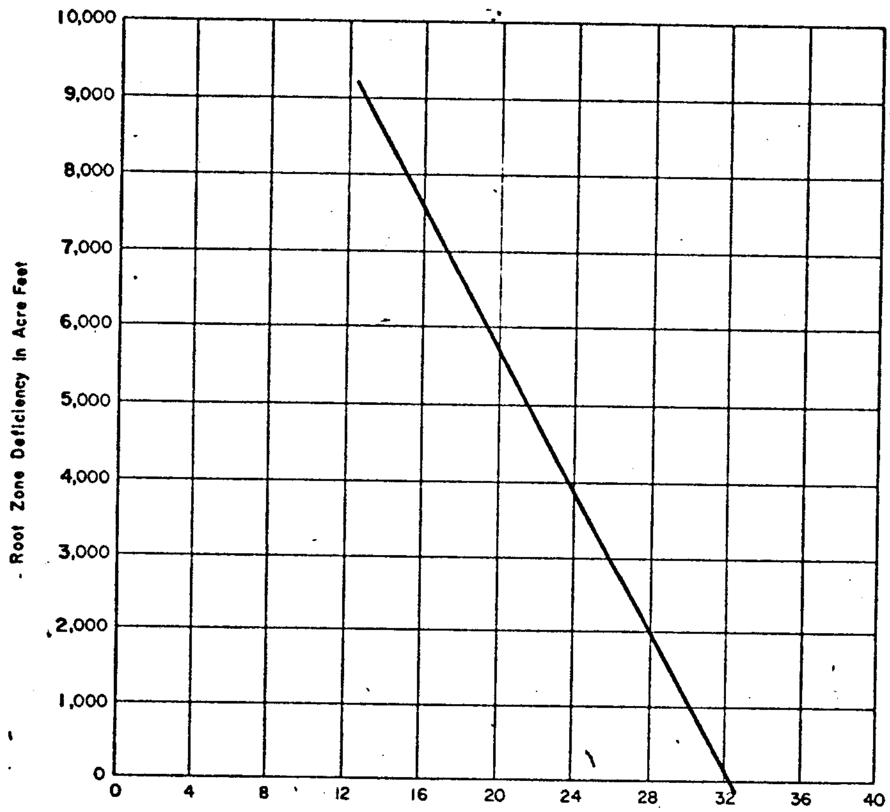


Figure 14 : Root Zone Deficiency vs. Supply
Watershed A-4
Sevier River Basin Utah

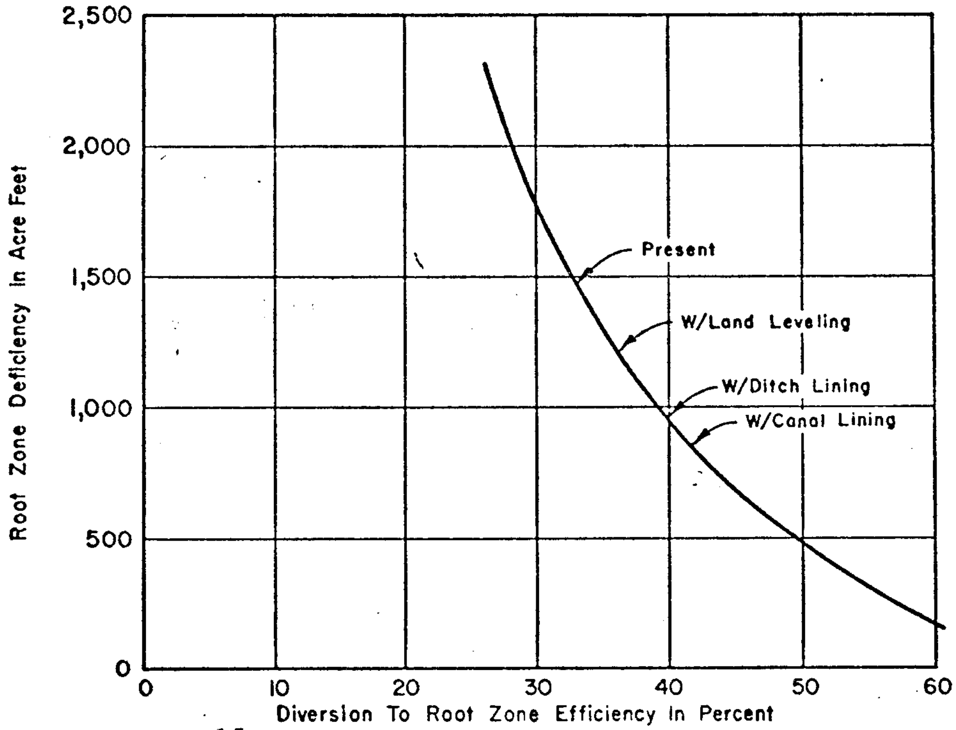


Figure 15: Root Zone Deficiency vs. Efficiency
Watershed A-4
Sevier River Basin Utah

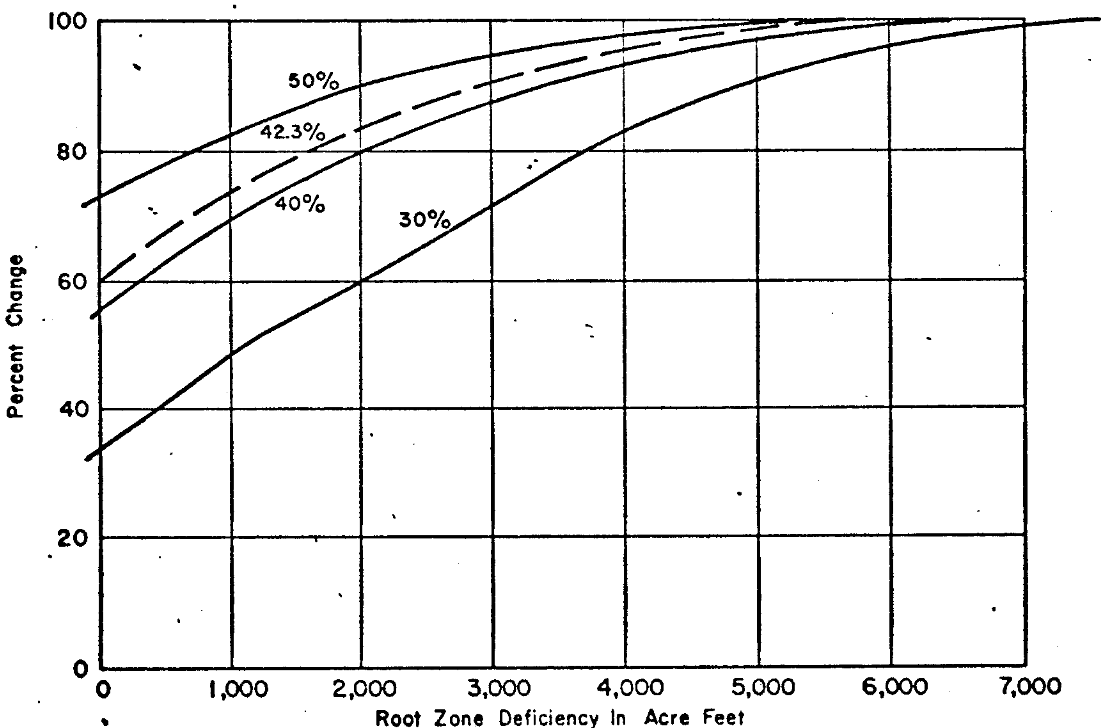


Figure 16: Root Zone Deficiency vs. Frequency
Watershed A-4
Sevier River Basin Utah

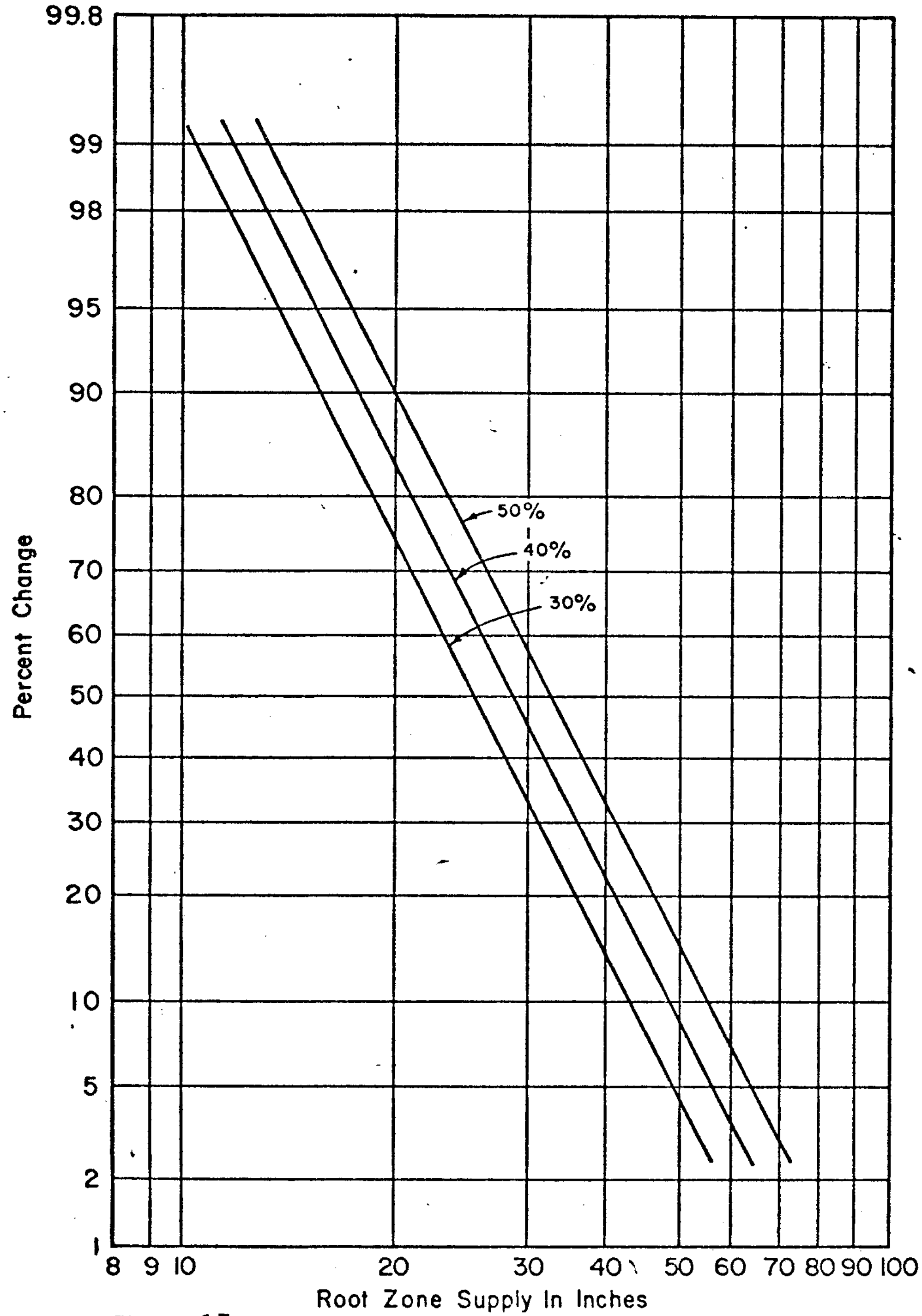


Figure 17 : Root Zone Supply vs. Frequency
Watershed B-1
Sevier River Basin Utah

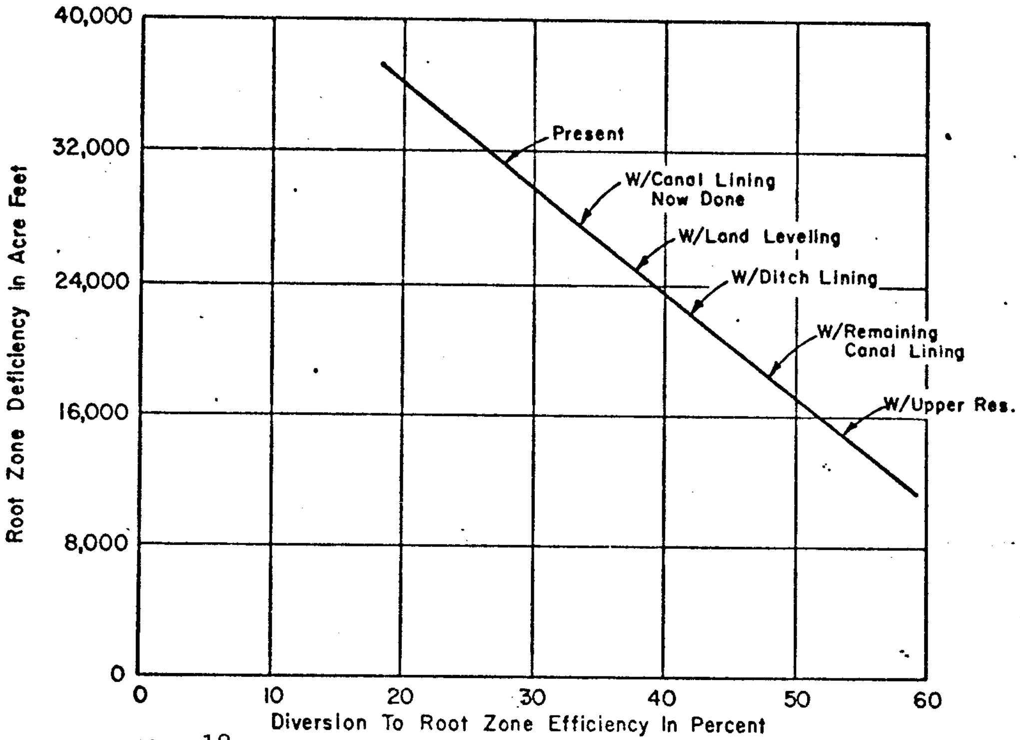


Figure 18 : Root Zone Deficiency vs. Efficiency
Watershed B-1
Sevier River Basin Utah

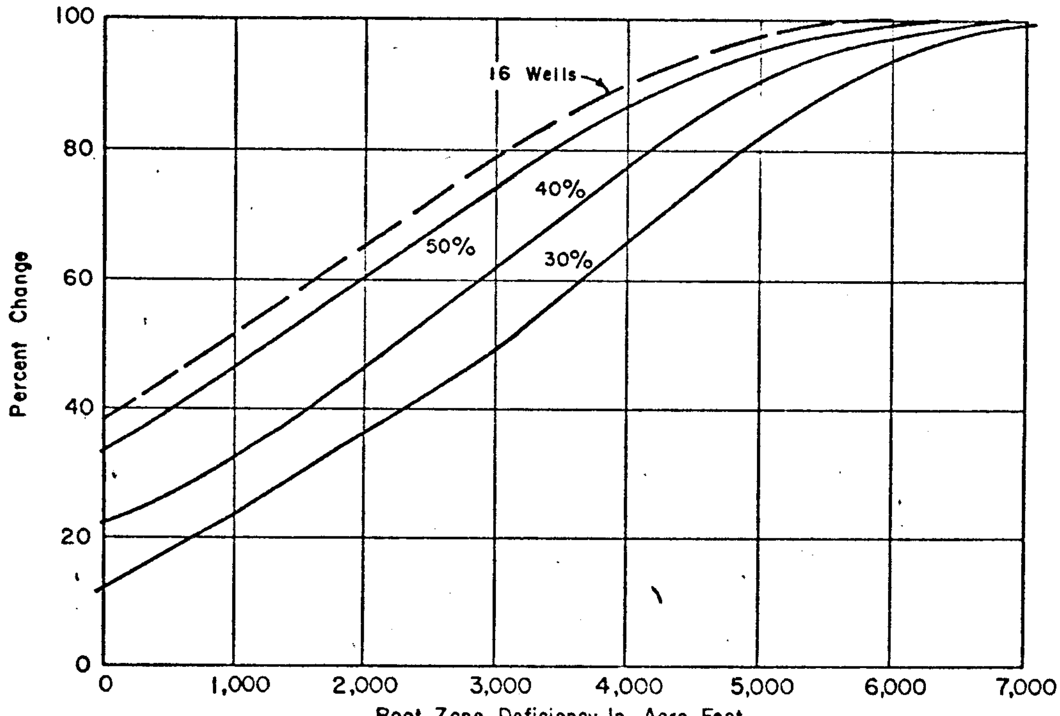


Figure 19 : Root Zone Deficiency vs. Frequency
Watershed B-1
Sevier River Basin Utah

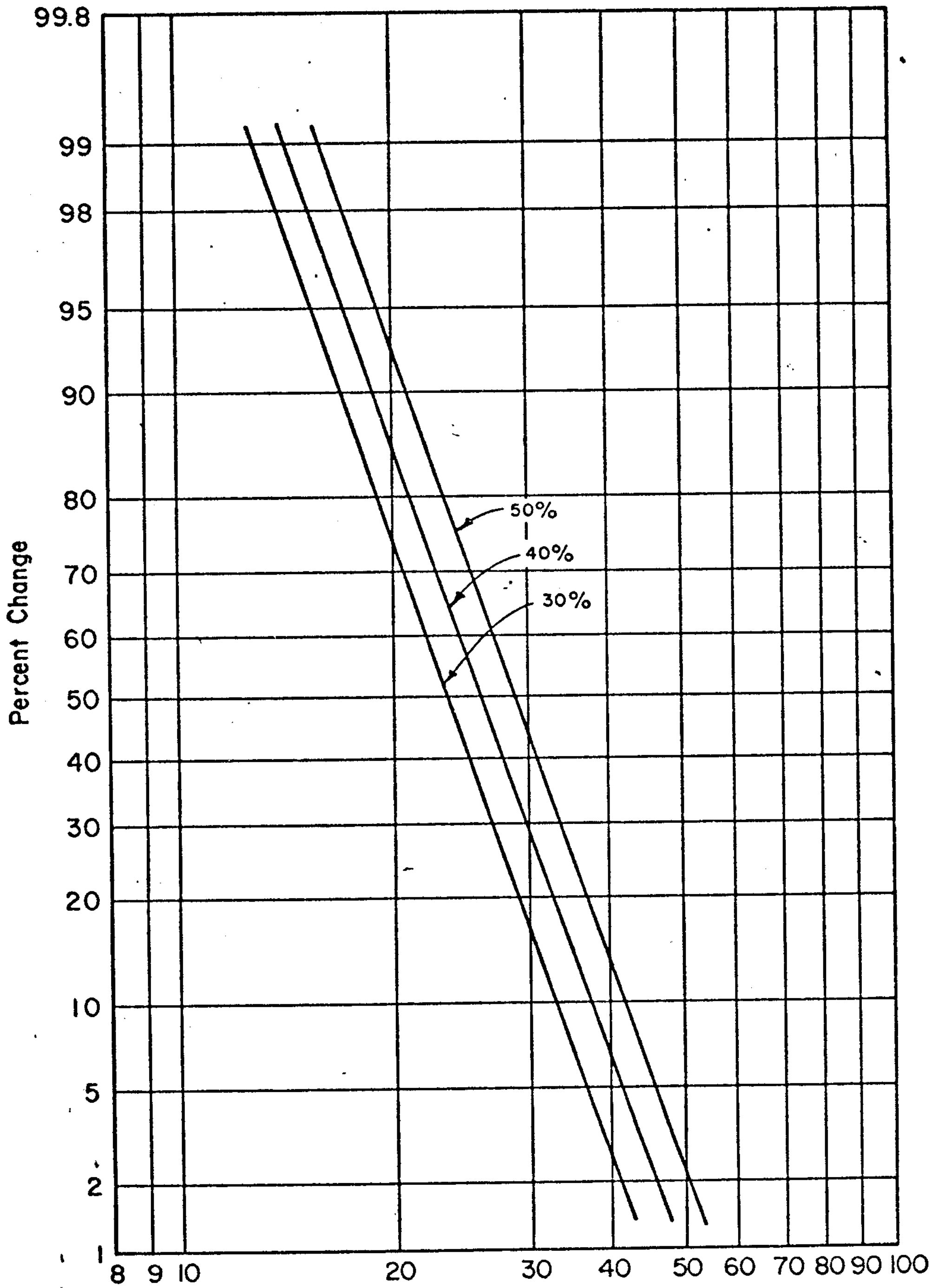


Figure 20 : Root Zone Supply vs. Frequency
Watershed B-2a
Sevier River Basin Utah

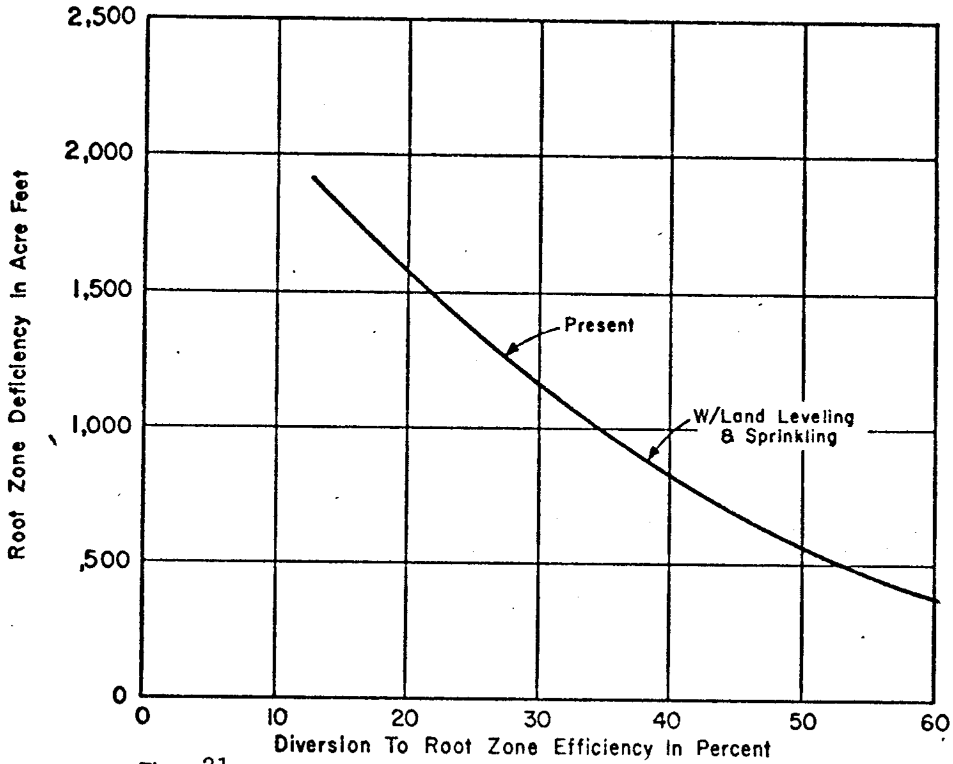


Figure 21 : Root Zone Deficiency vs. Efficiency
Watershed B-2a
Sevier River Basin Utah

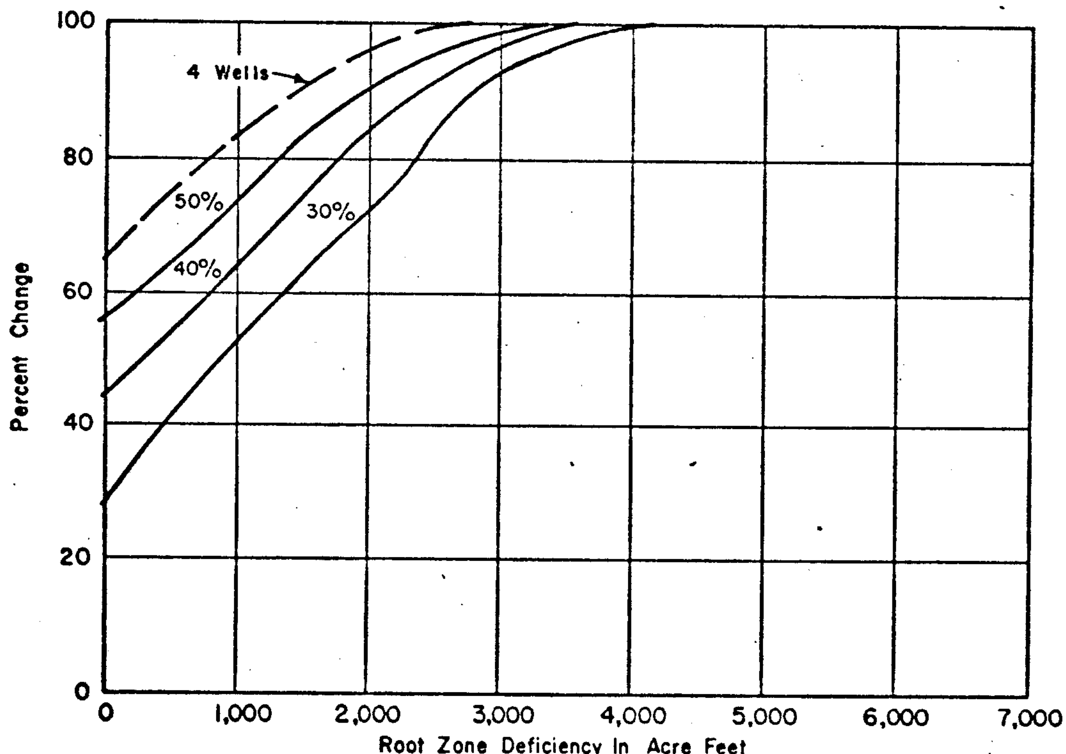


Figure 22 : Root Zone Deficiency vs. Freauency
Watershed B-2a
Sevier River Basin Utah

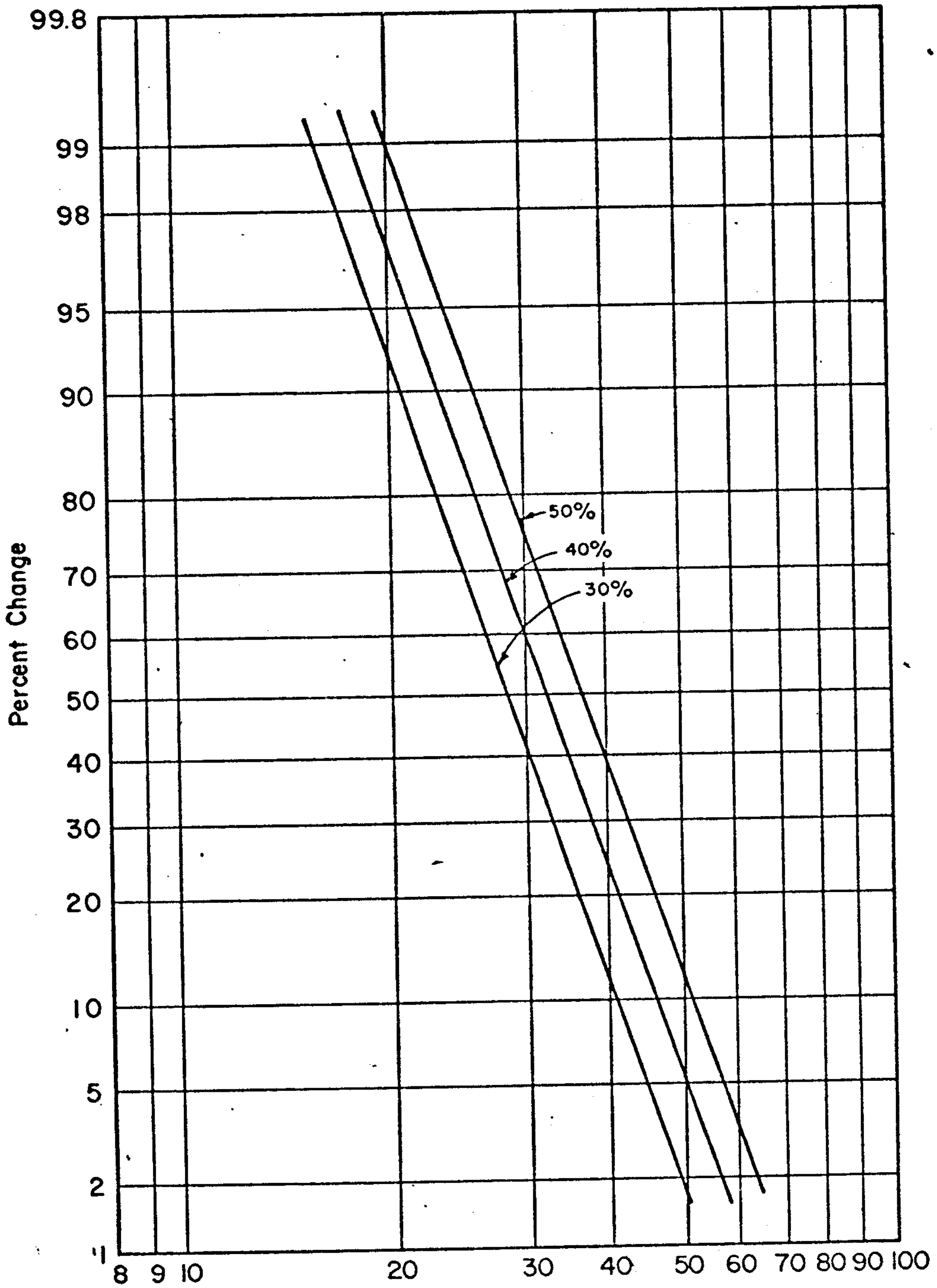


Figure 23 : Root Zone Supply vs. Frequency
Watershed B–2b
Sevier River Basin Utah

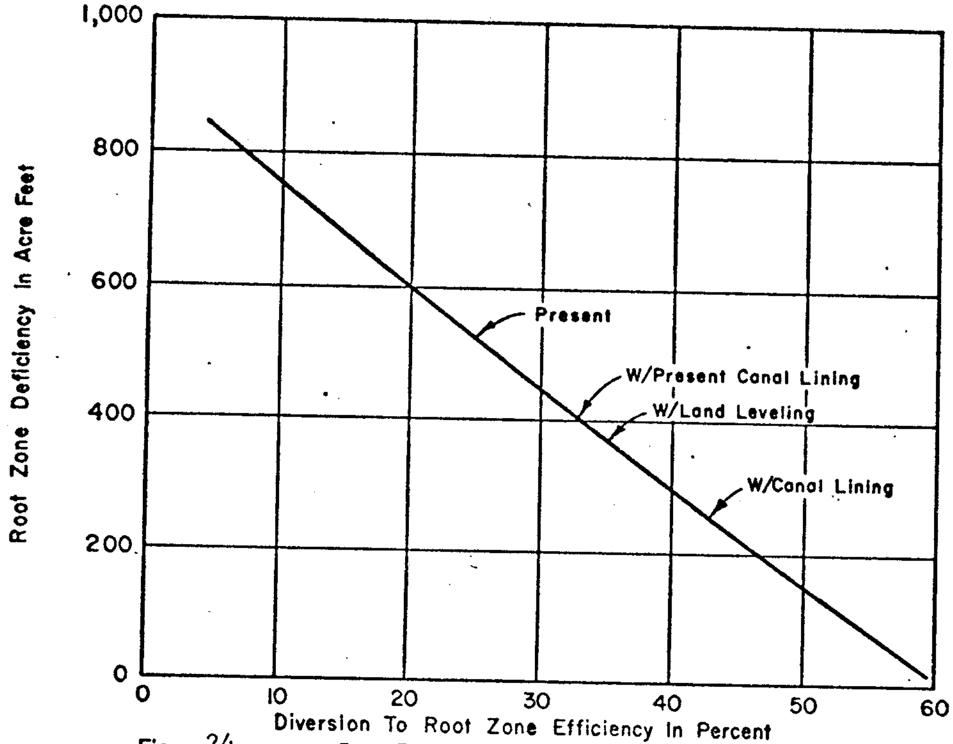


Figure 24 : Root Zone Deficiency vs. Efficiency
Watershed B-2b
Sevier River Basin Utah

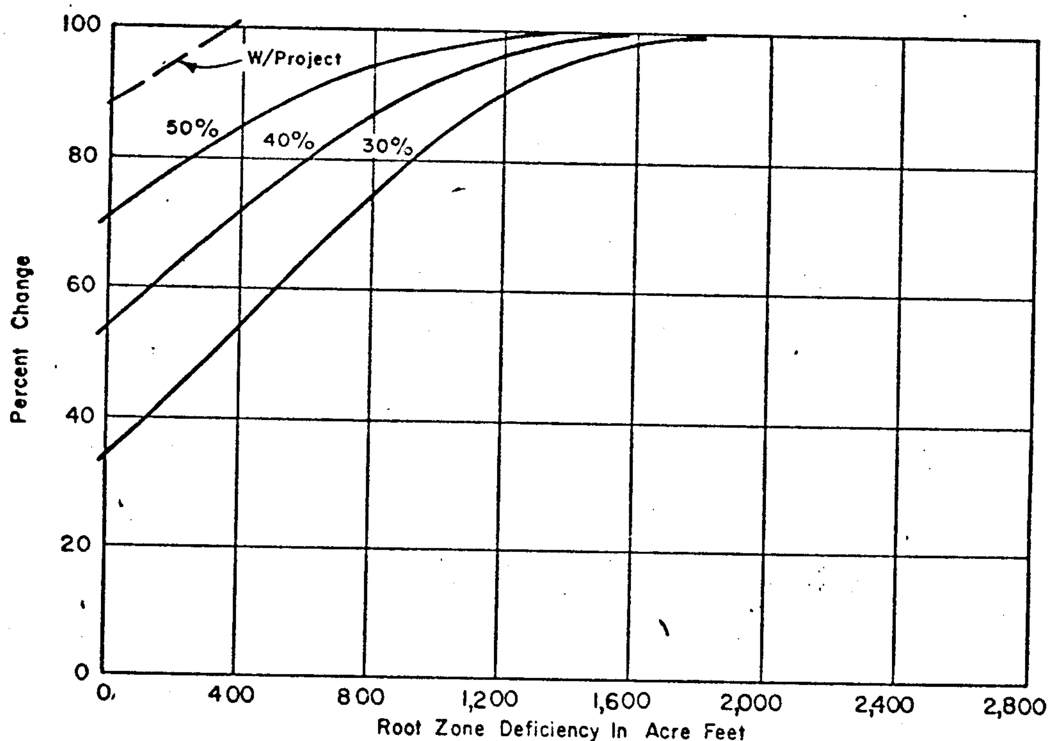


Figure 25 : Root Zone Deficiency vs. Frequency
Watershed B-2b
Sevier River Basin Utah

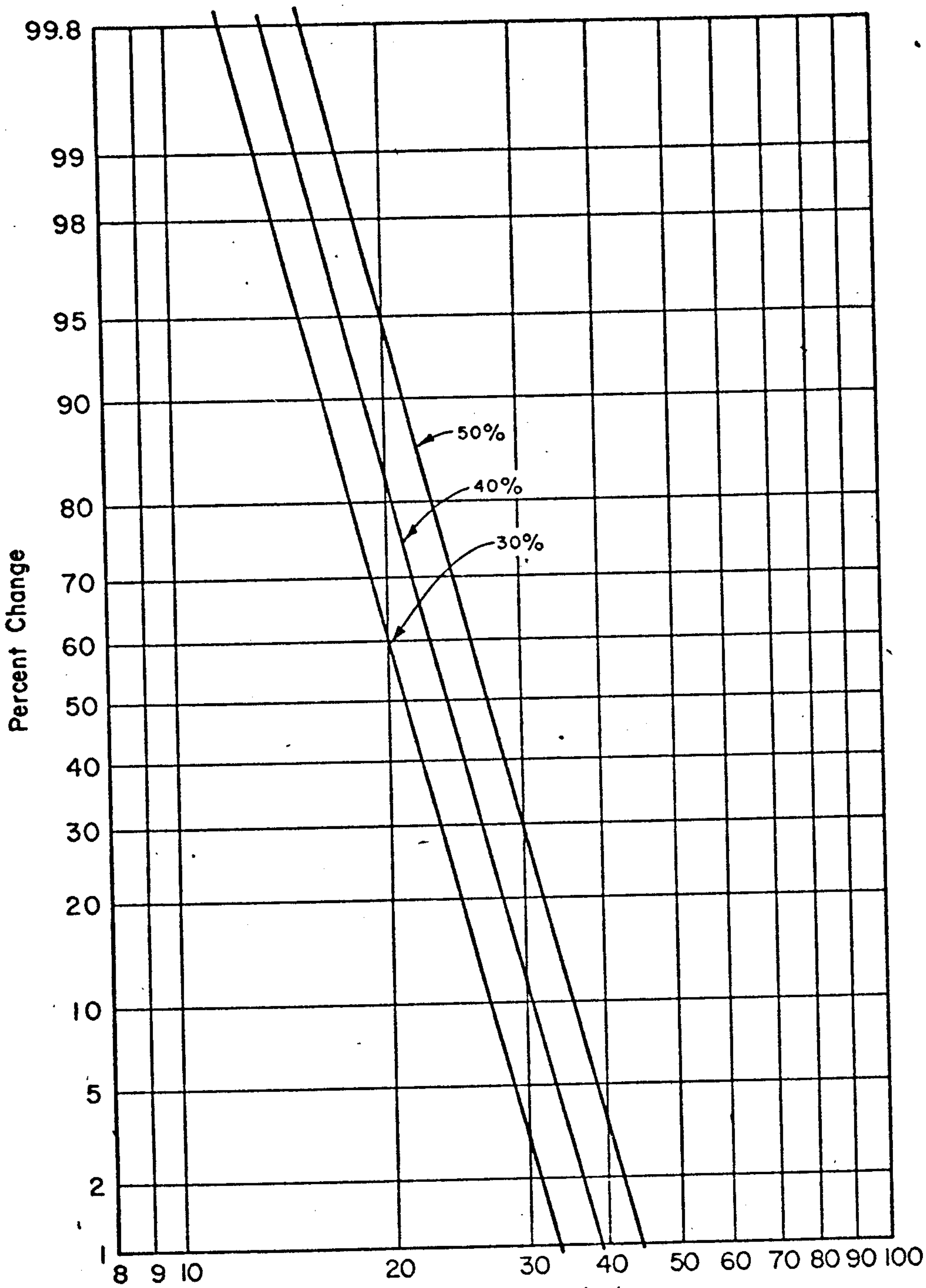


Figure 26 : Root Zone Supply vs. Freauency
Watershed B-4
Sevier River Basin Utah

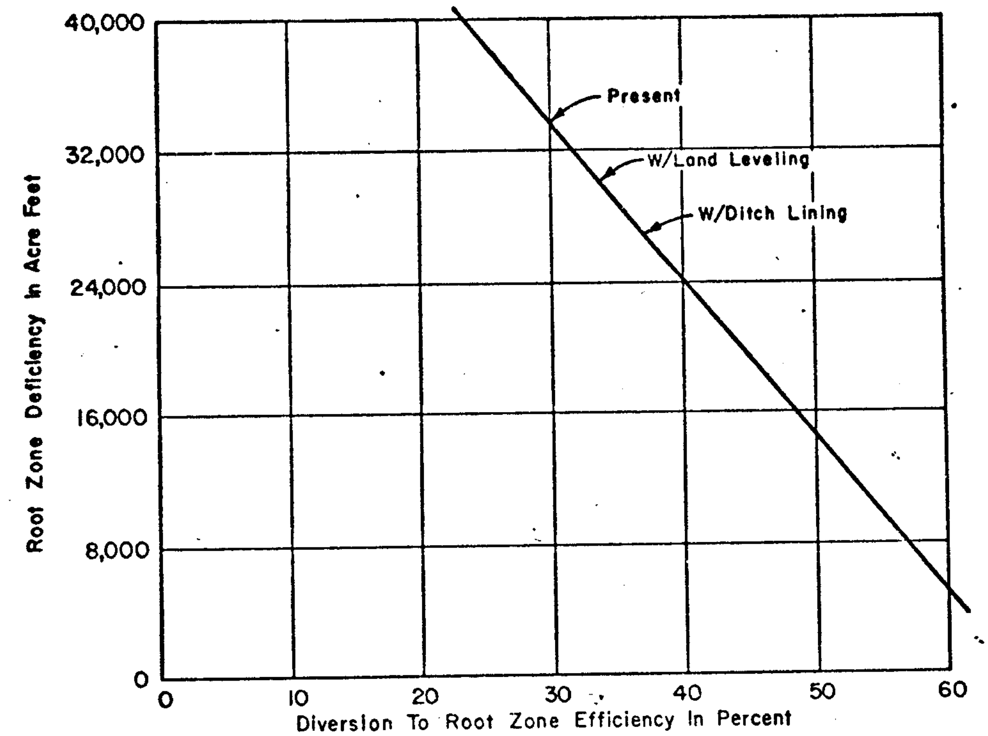


Figure 27 : Root Zone Deficiency vs. Efficiency
Watershed B-4
Sevier River Basin Utah

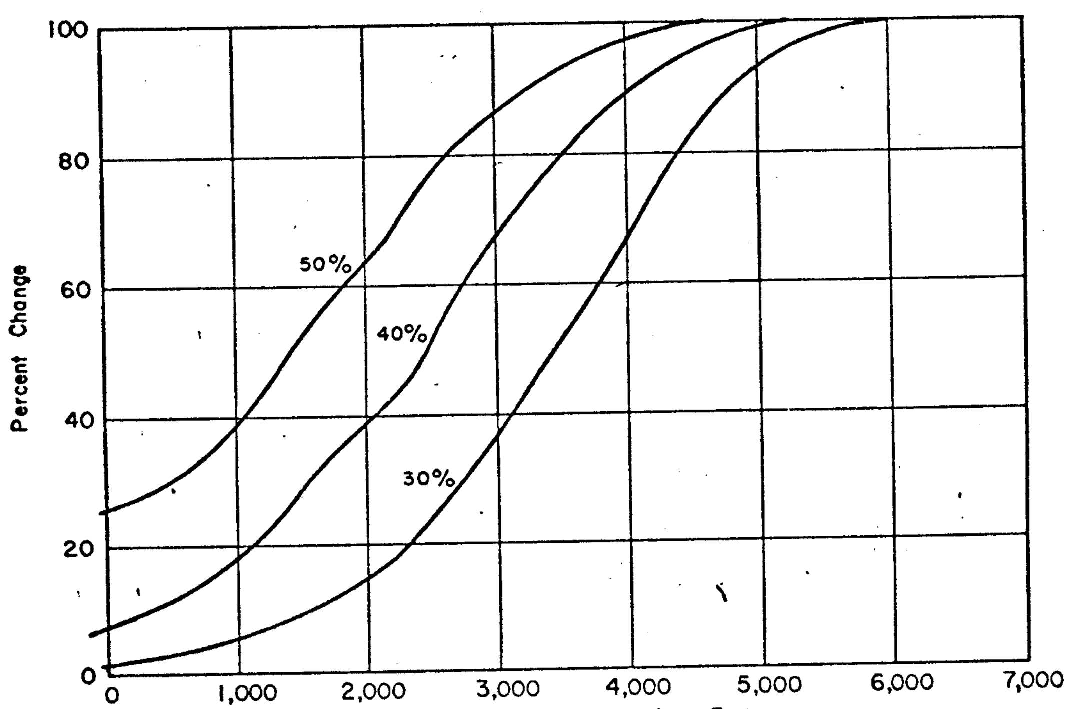


Figure 28 : Root Zone Deficiency vs. Frequency
Watershed B-4
Sevier River Basin Utah

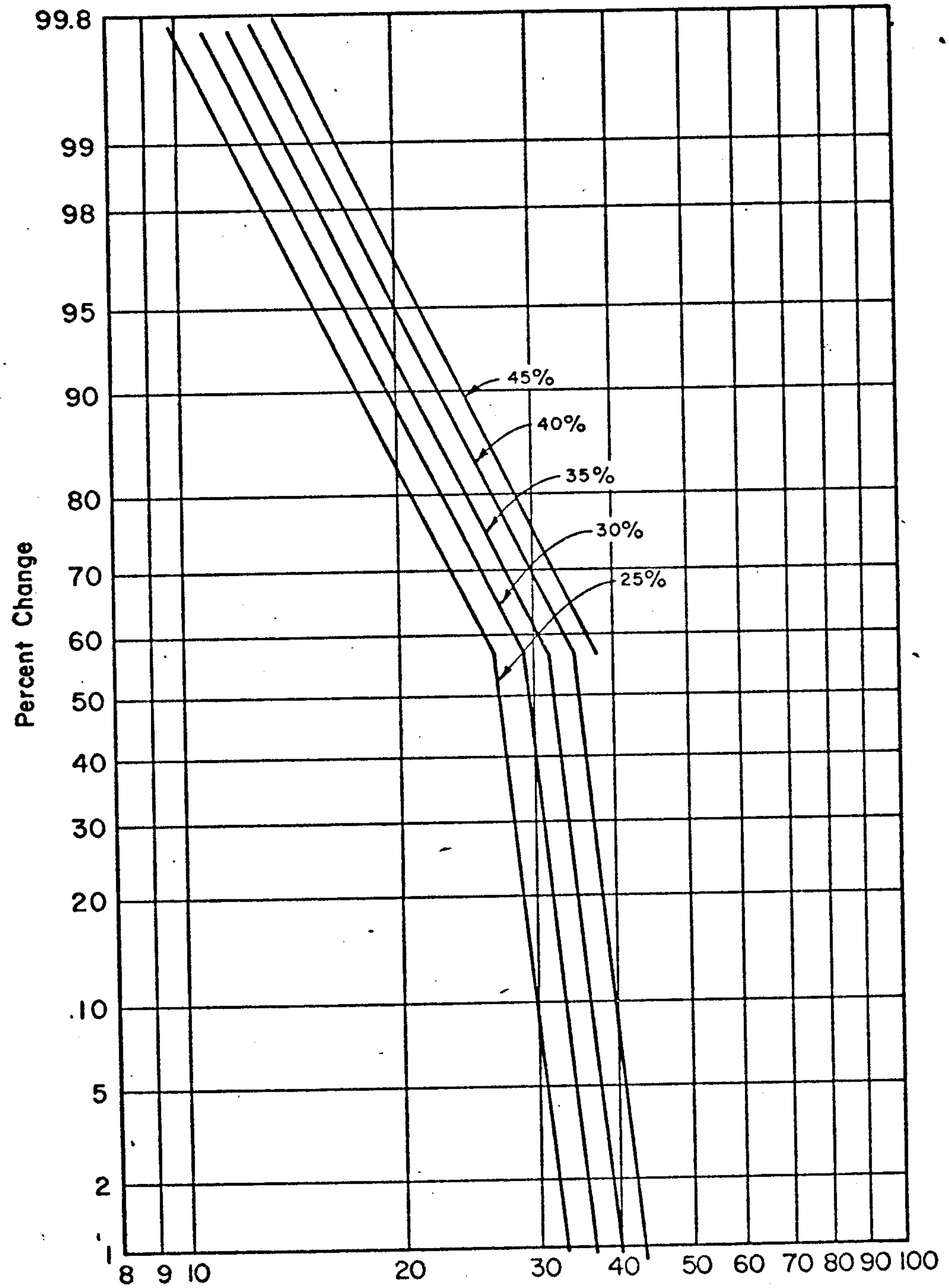


Figure 29 : Root Zone Supply vs. Frequency
Watershed B-5
Sevier River Basin Utah

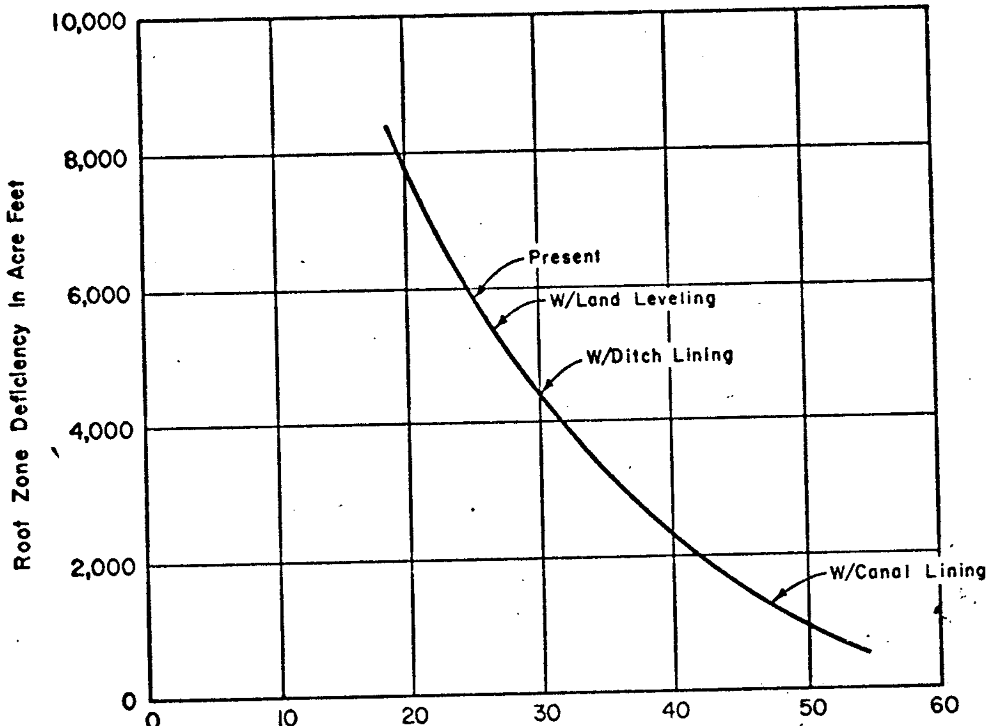


Figure 30 : Root Zone Deficiency vs. Efficiency
Watershed B–5
Sevier River Basin Utah

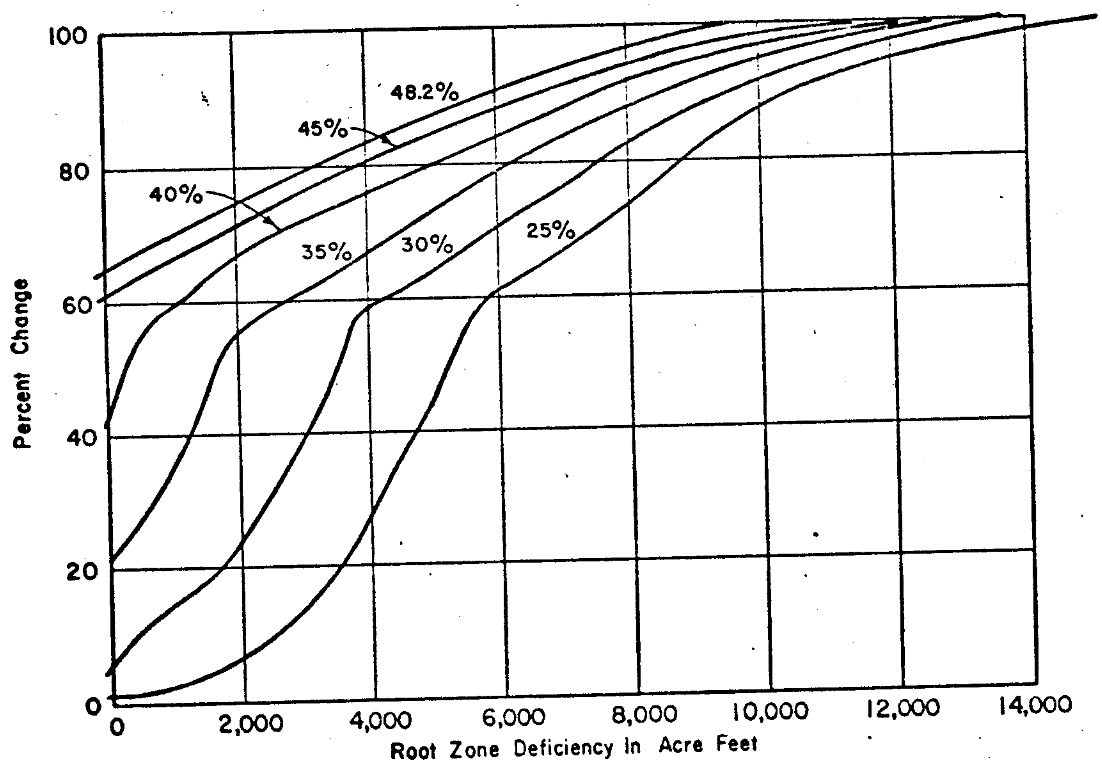


Figure 31 : Root Zone Deficiency vs. Frequency
Watershed B–5
Sevier River Basin Utah

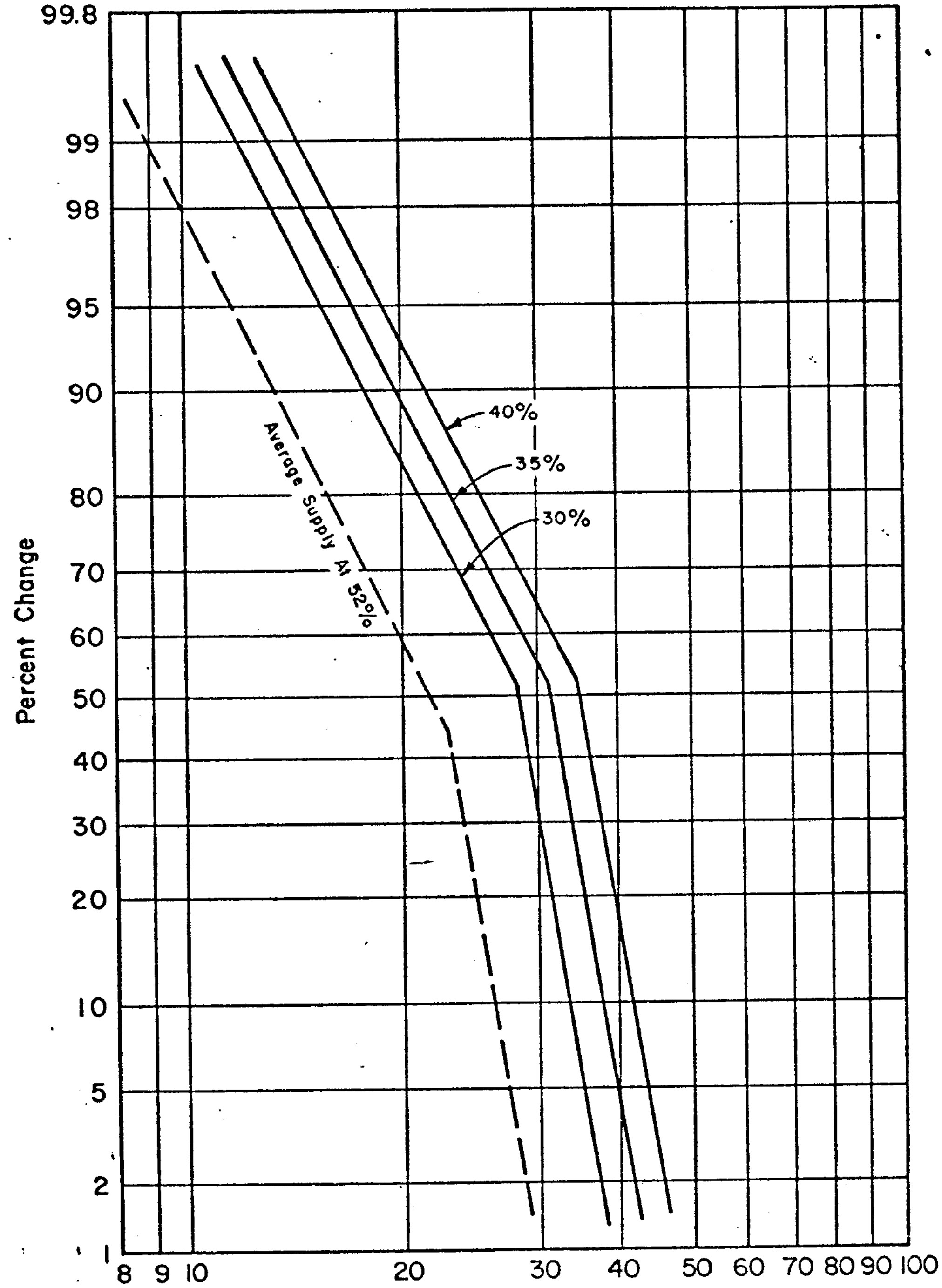


Figure 32 : Root Zone Supply vs. Frequency
Watershed B-6
Sevier River Basin Utah

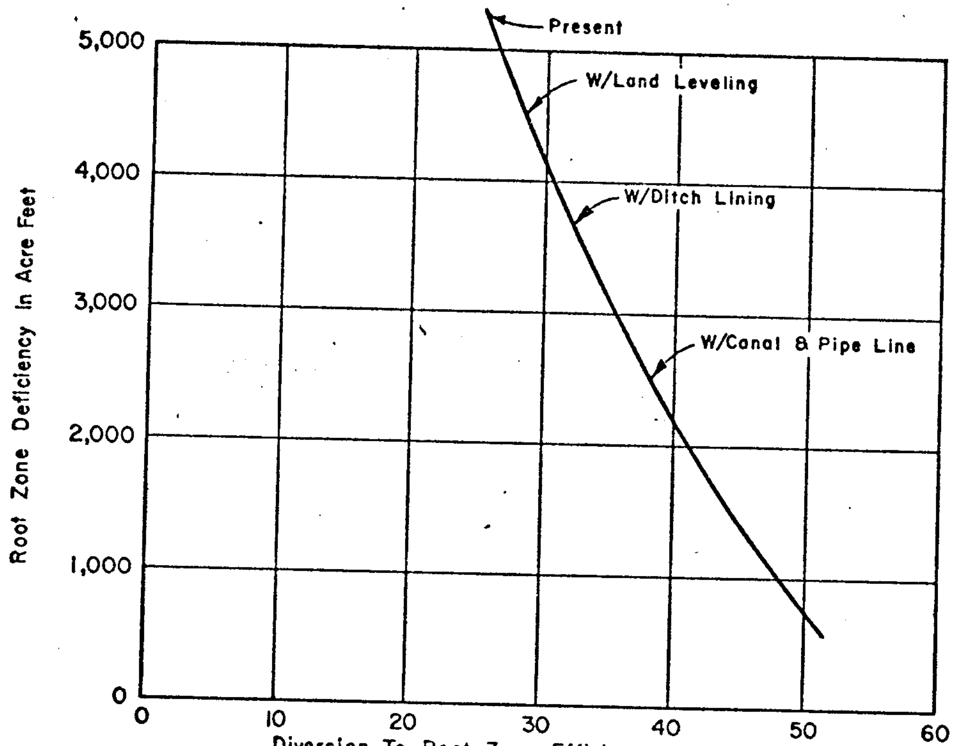


Figure 33: Root Zone Deficiency vs. Efficiency
Watershed B-6
Sevier River Basin Utah

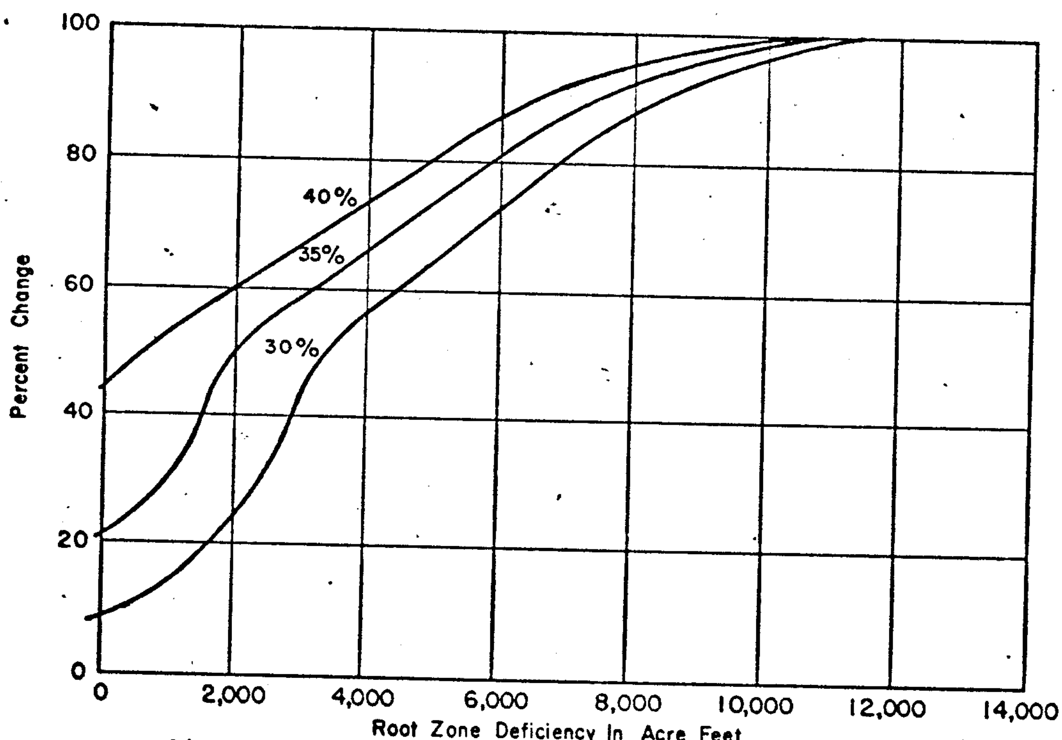


Figure 34: Root Zone Deficiency vs. Frequency
Watershed B-6
Sevier River Basin Utah

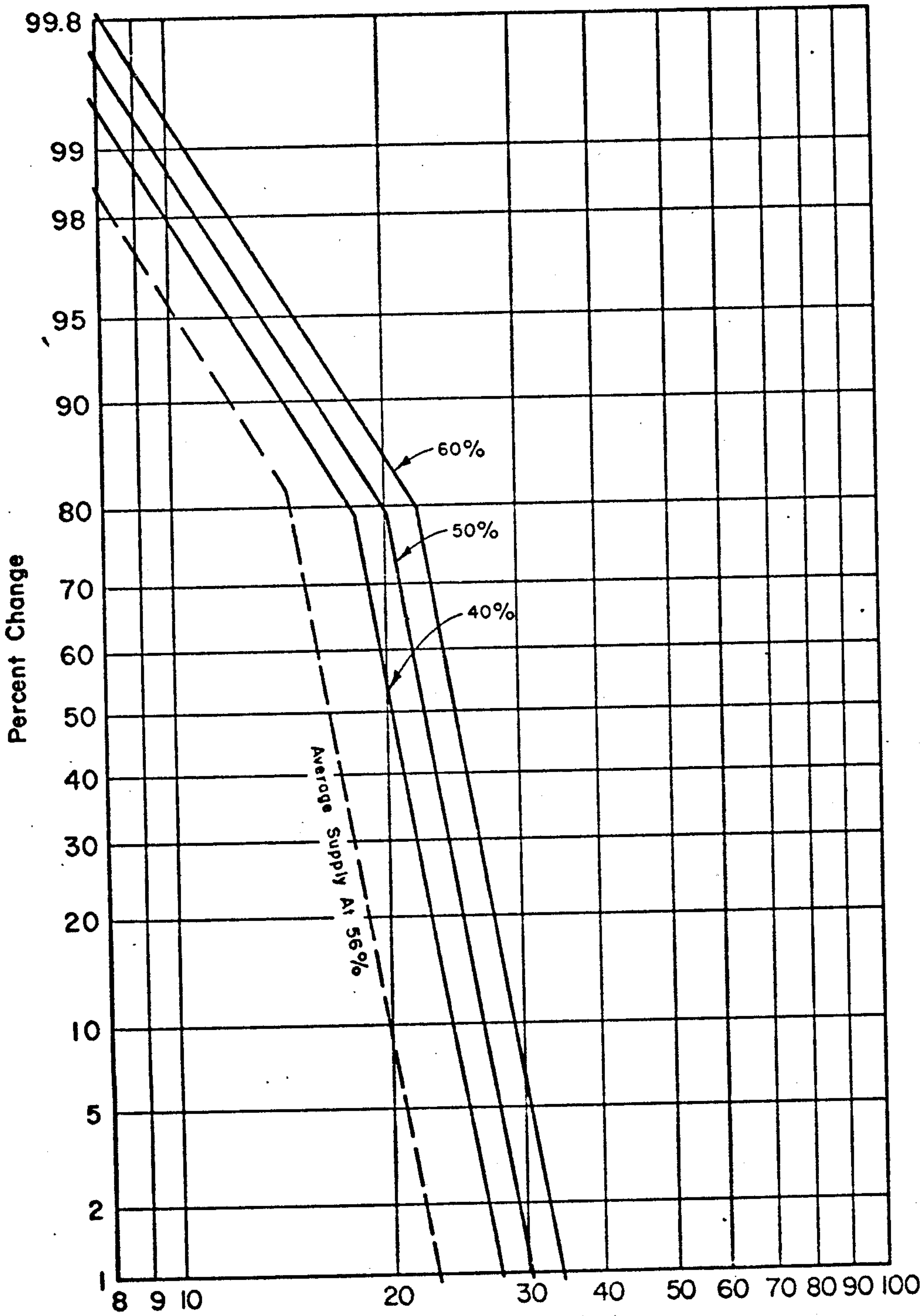


Figure 35 : Root Zone Supply vs. Frequency
Watershed B-7
Sevier River Basin Utah

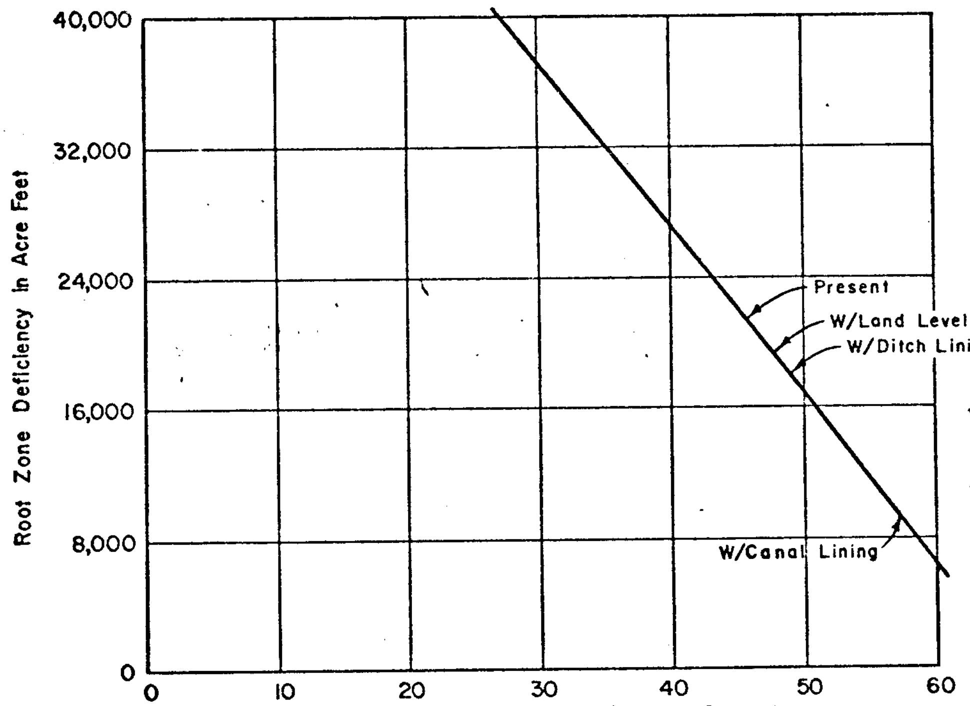


Figure 36 : Root Zone Deficiency vs. Efficiency
Watershed B-7
Sevier River Basin Utah

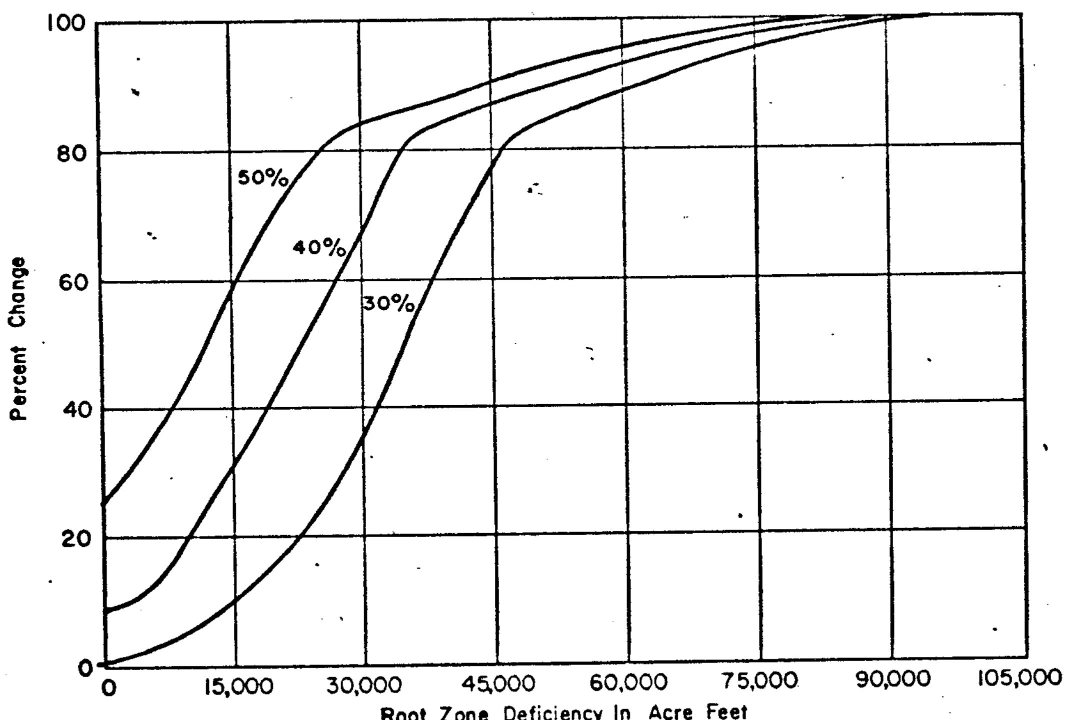


Figure 37 : Root Zone Deficiency vs. Frequency
Watershed B-7
Sevier River Basin Utah

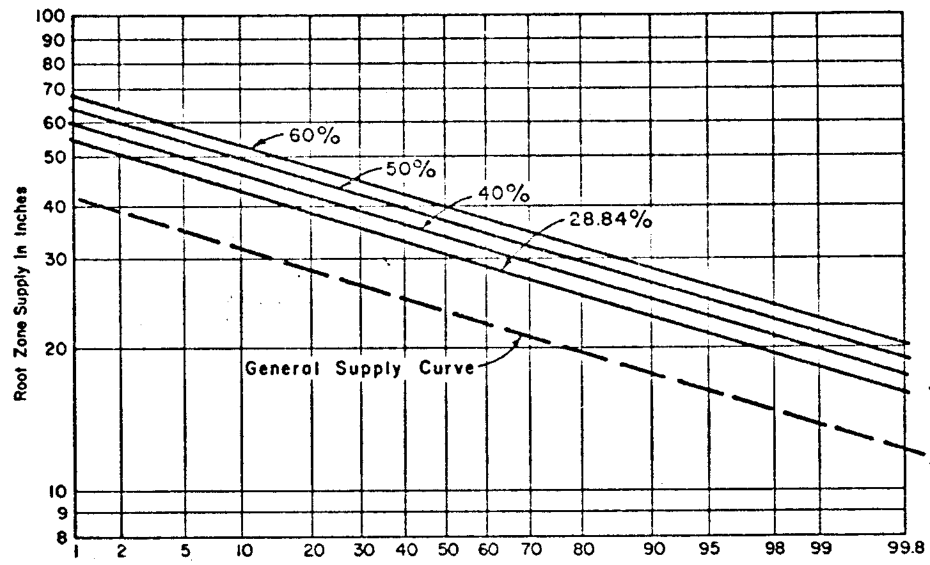


Figure 38 : Root Zone Supply vs. Frequency
Watershed C-1
Sevier River Basin Utah

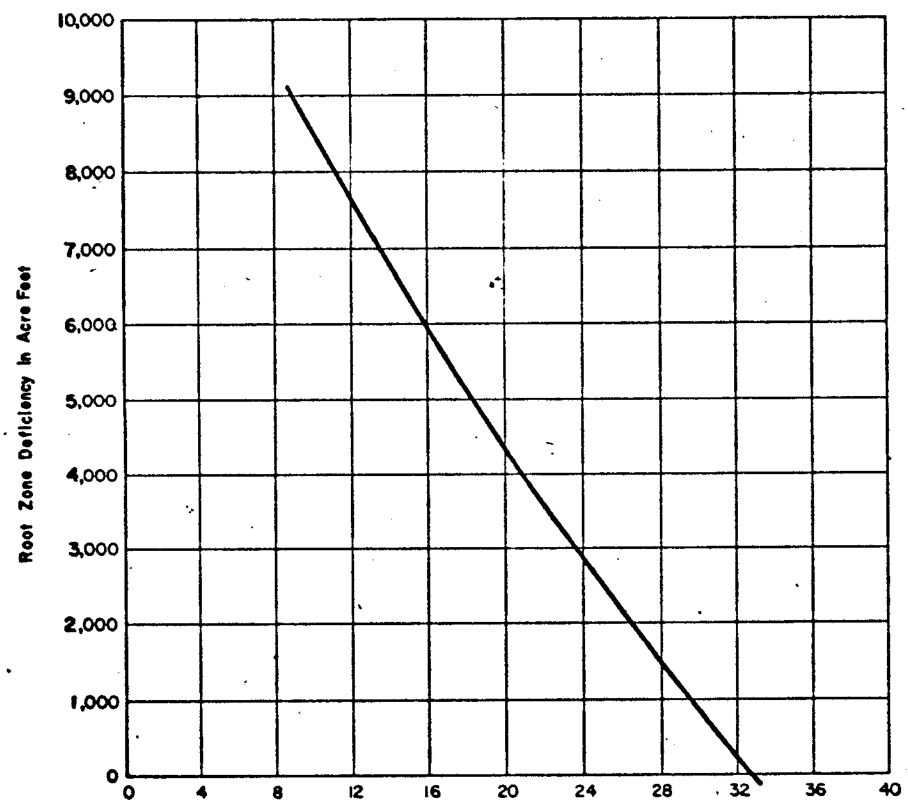


Figure 39 : Root Zone Deficiency vs Supply
Watershed C-1
Sevier River Basin Utah

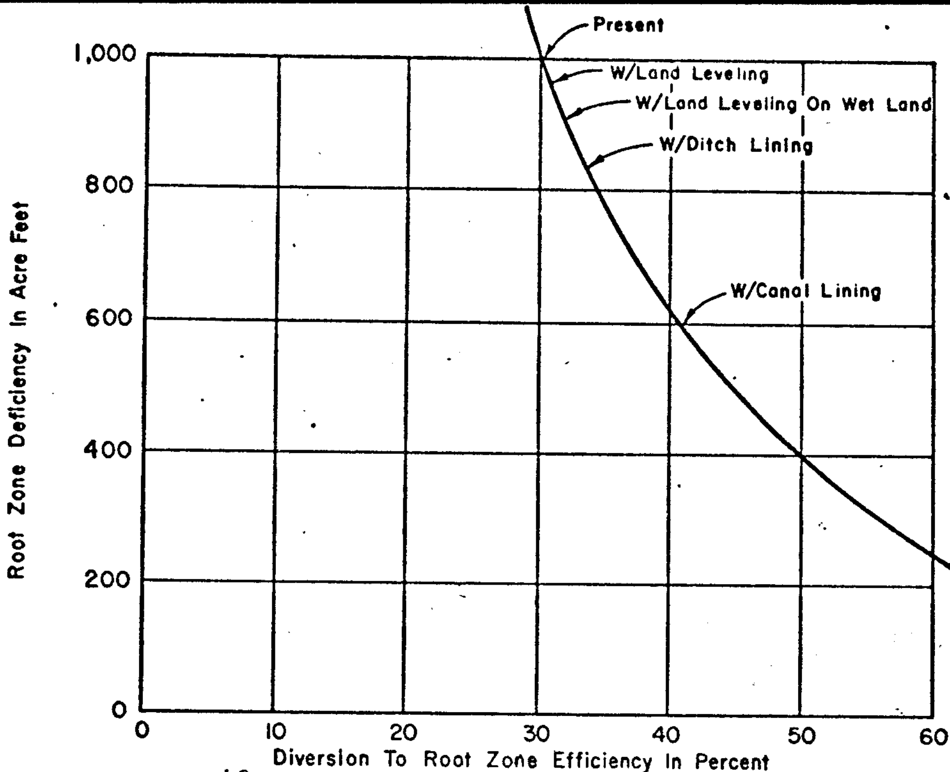


Figure 40 : Root Zone Deficiency vs. Efficiency
Watershed C-1
Sevier River Basin Utah

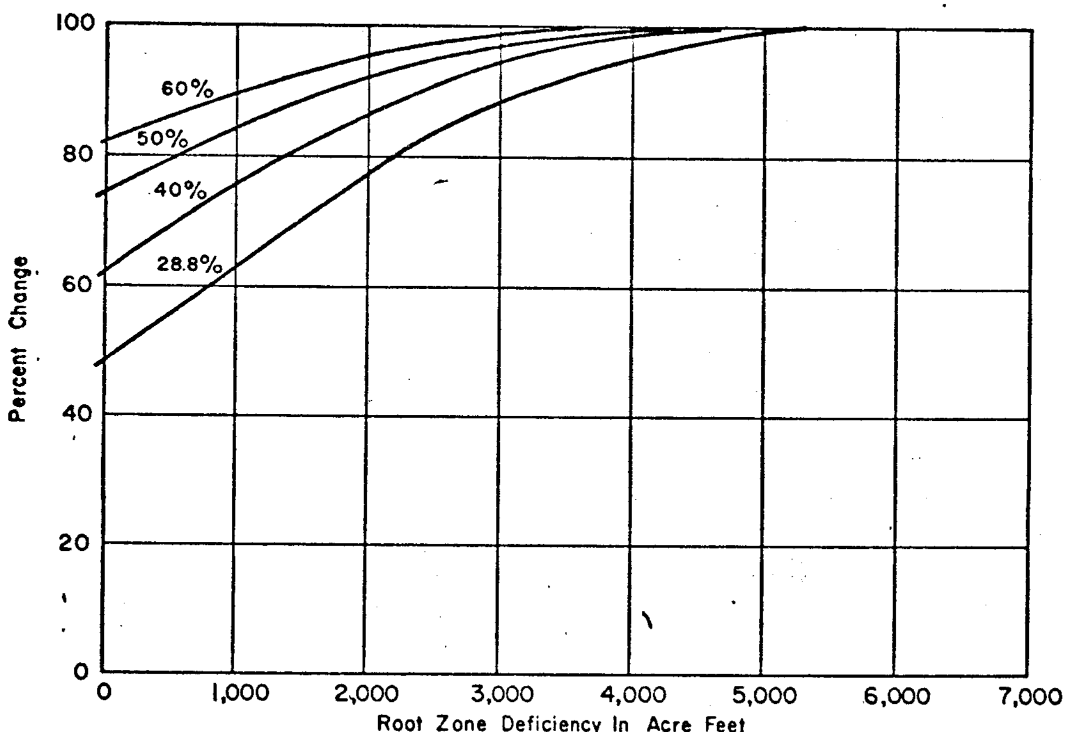


Figure 41 : Root Zone Deficiency vs. Frequency
Watershed C-1
Sevier River Basin Utah

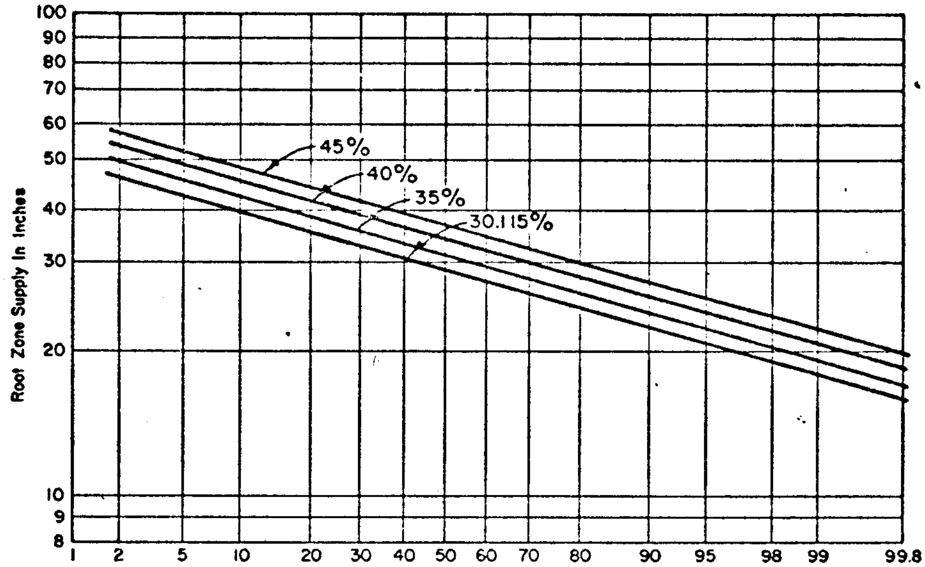


Figure 42: Root Zone Supply vs. Frequency
Watershed C-2
Sevier River Basin Utah

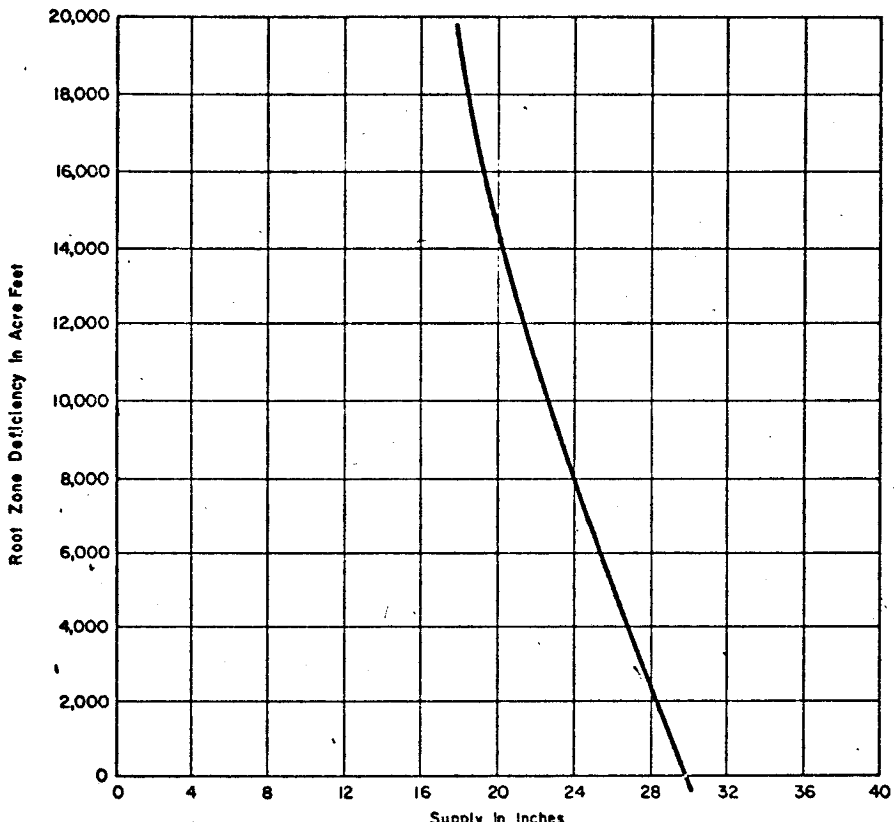


Figure 43: Root Zone Deficiency vs. Supply
Watershed C-2
Sevier River Basin Utah

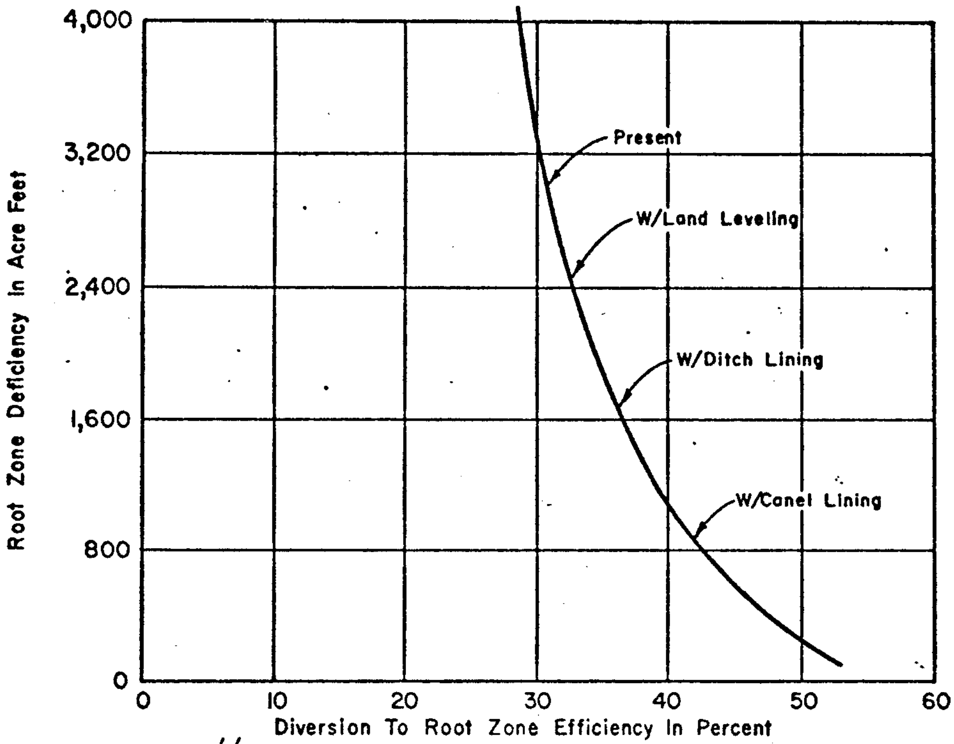


Figure 44 : Root Zone Deficiency vs. Efficiency
Watershed C-2
Sevier River Basin Utah

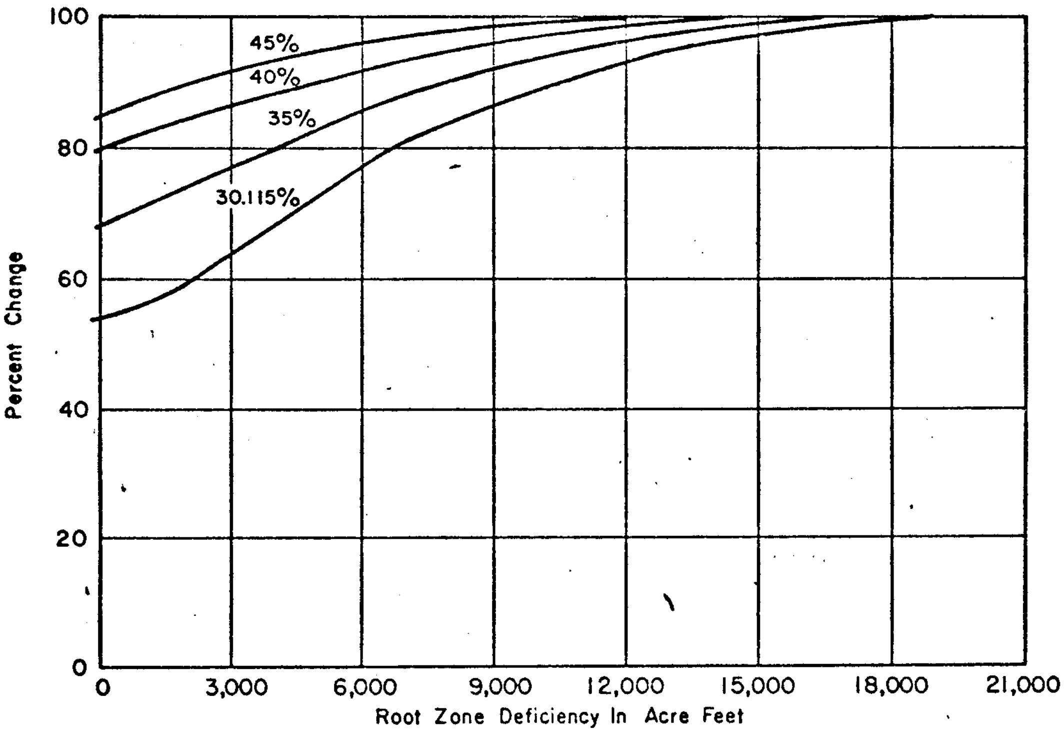


Figure 45 : Root Zone Deficiency vs. Frequency
Watershed C-2
Sevier River Basin Utah

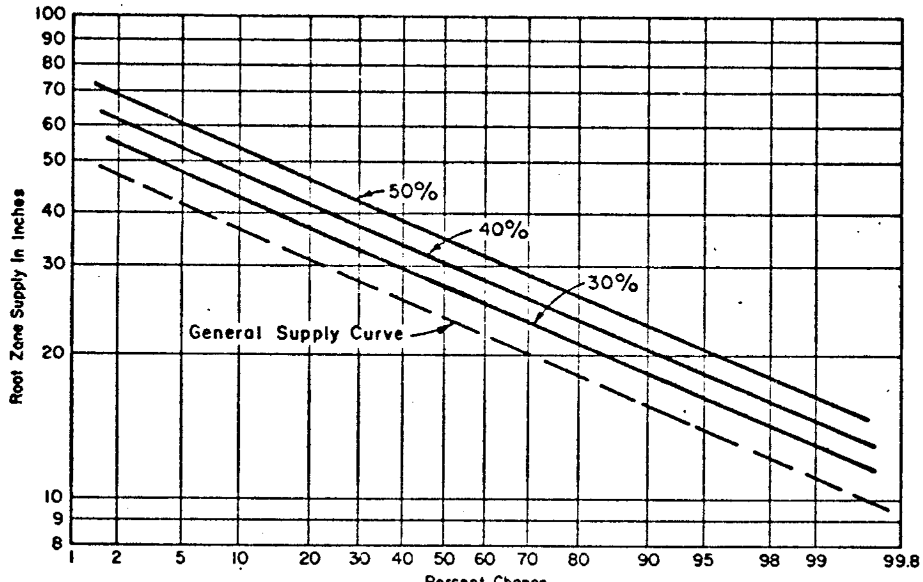


Figure 46: Root Zone Supply vs. Frequency
Watershed C-3
Sevier River Basin Utah

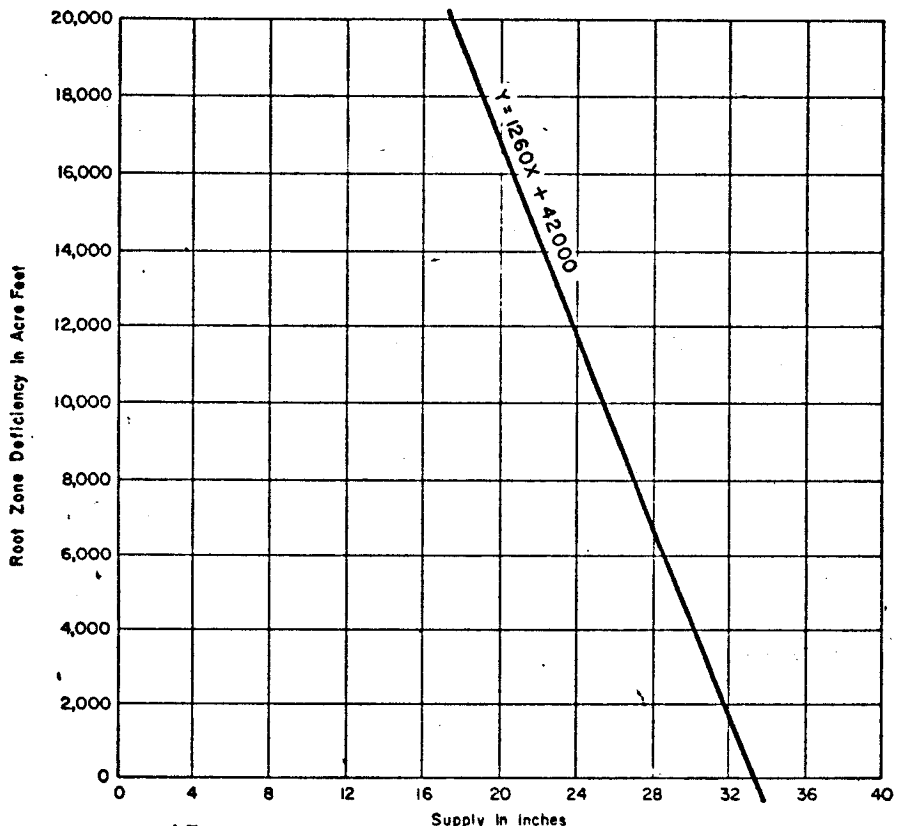


Figure 47: Root Zone Deficiency vs. Supply
Watershed C-3
Sevier River Basin Utah

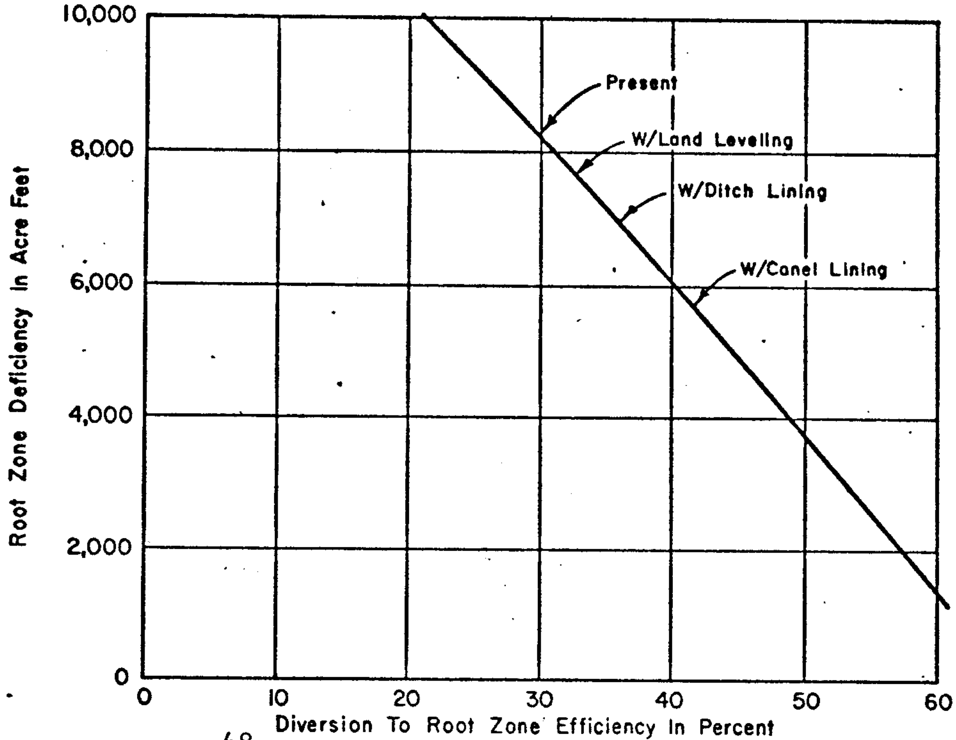


Figure 48 : Root Zone Deficiency vs. Efficiency
Watershed C-3
Sevier River Basin Utah

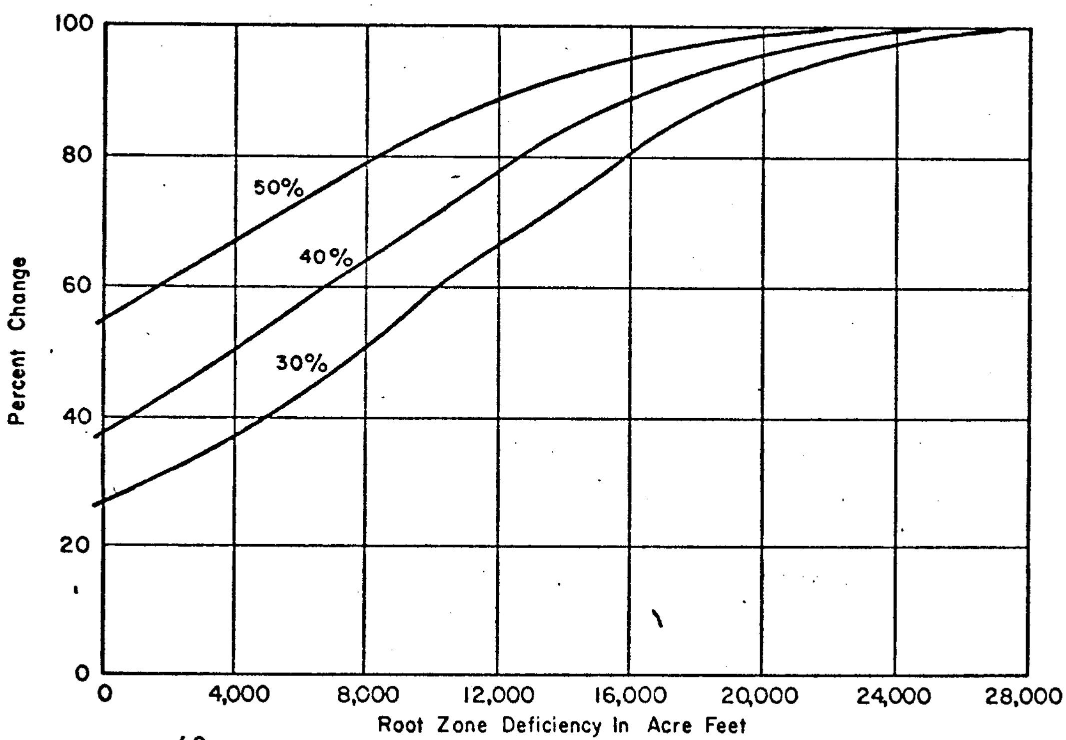


Figure 49 : Root Zone Deficiency vs. Frequency
Watershed C-3
Sevier River Basin Utah

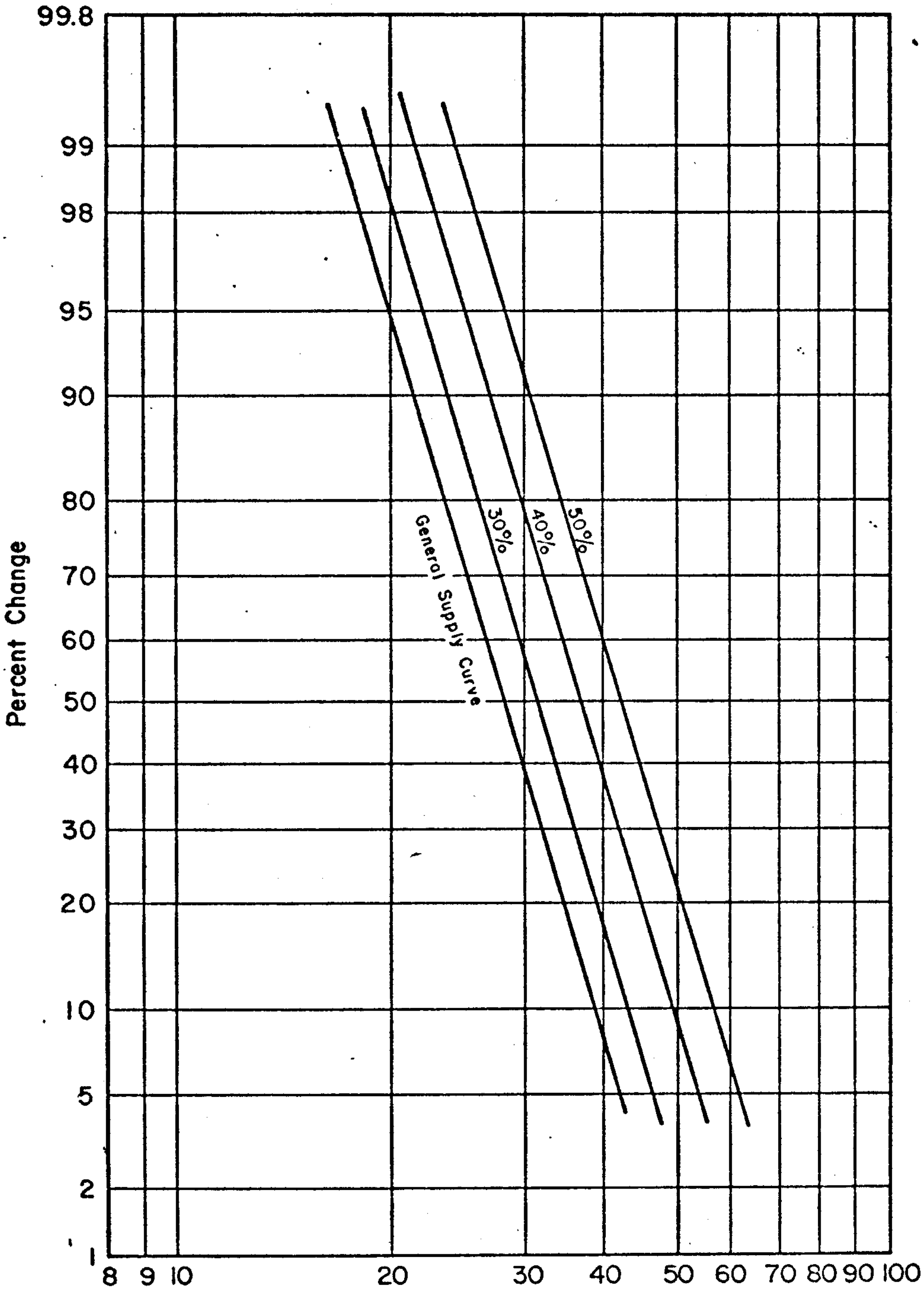


Figure 50 : Root Zone Supply vs. Frequency
Watershed C-4
Sevier River Basin Utah

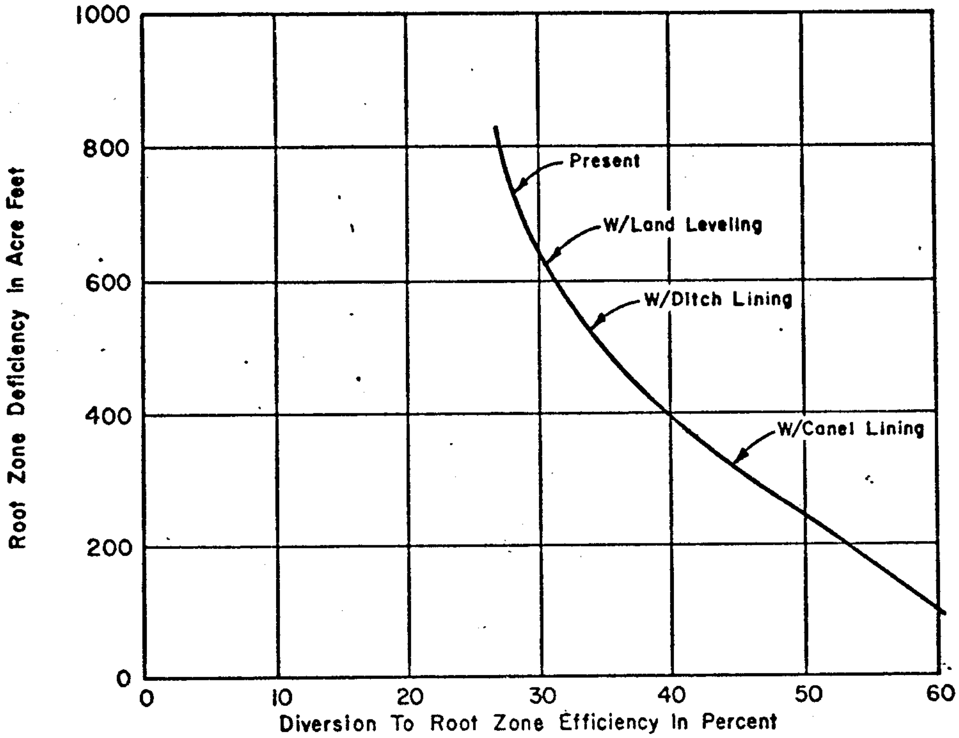


Figure 51 : Root Zone Deficiency vs. Efficiency
Watershed C-4
Sevier River Basin Utah

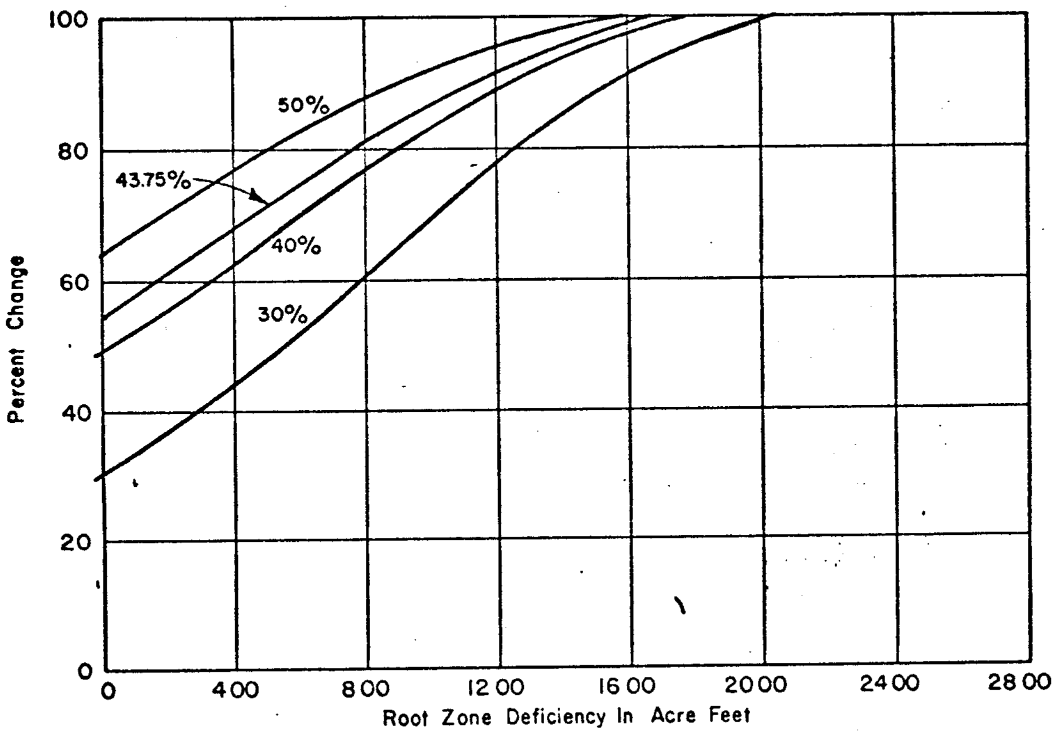


Figure 52 : Root Zone Deficiency vs. Frequency
Watershed C-4
Sevier River Basin Utah

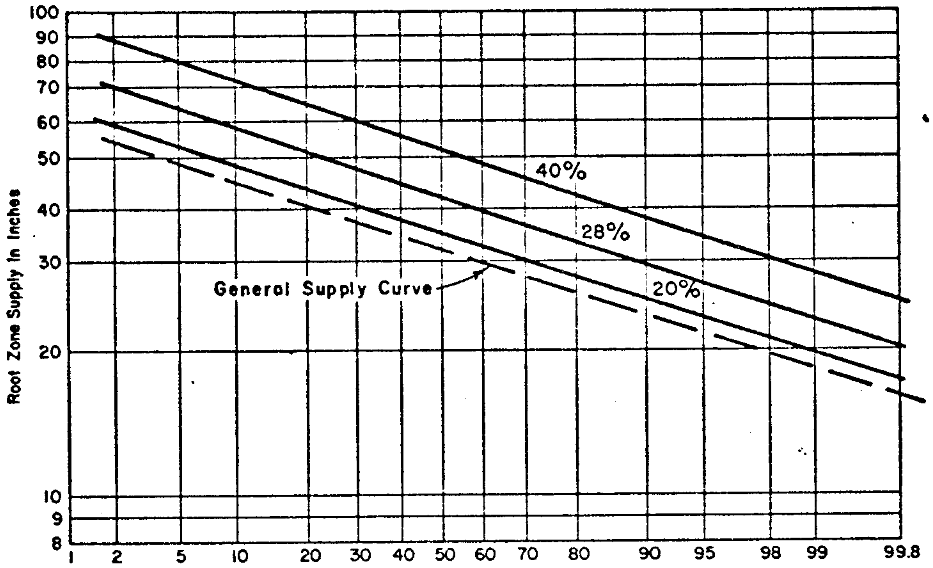


Figure 53: Root Zone Supply vs. Frequency
Watershed C-5
Sevier River Basin Utah

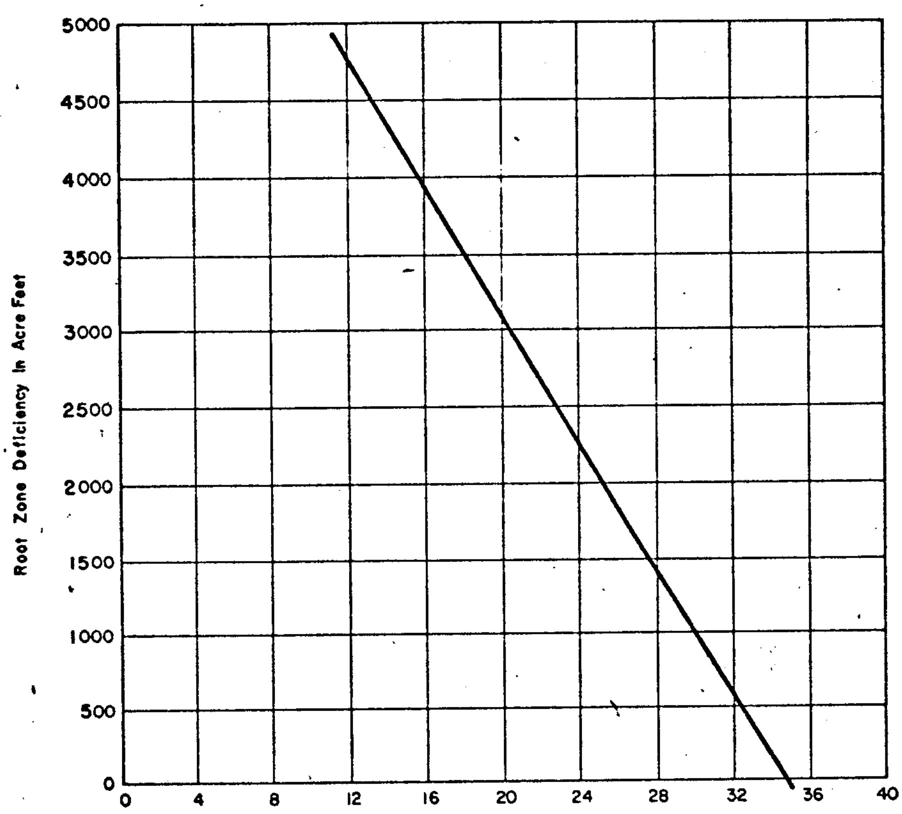


Figure 54: Root Zone Deficiency vs. Supply
Watershed C-5
Sevier River Basin Utah

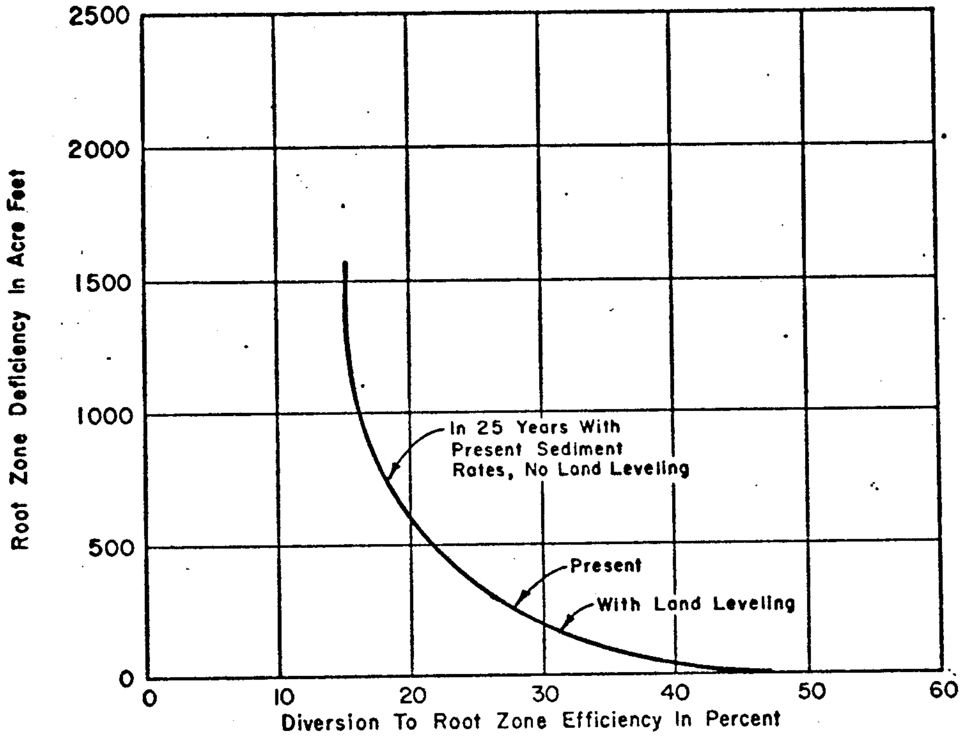


Figure 55: Root Zone Deficiency vs. Efficiency
Watershed C-5
Sevier River Basin Utah

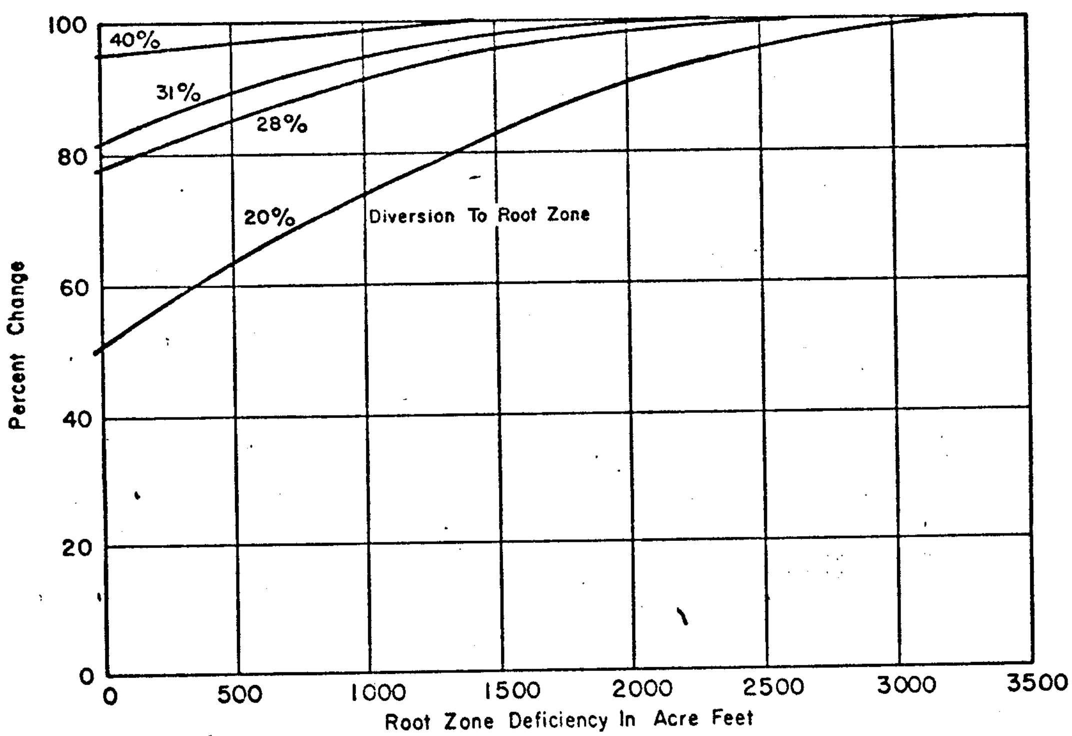


Figure 56: Root Zone Deficiency vs. Frequency
Watershed C-5
Sevier River Basin Utah

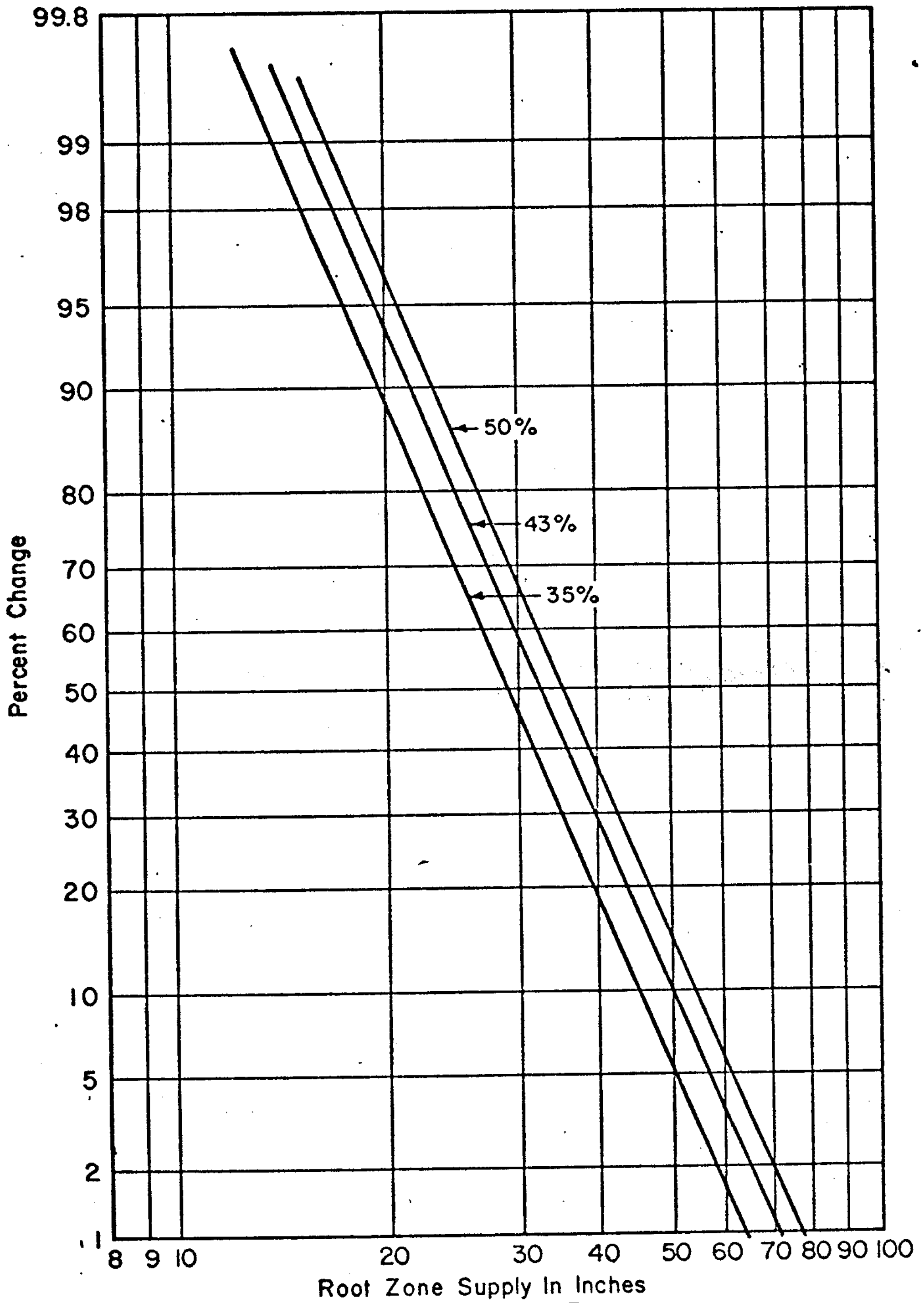


Figure 57 : Root Zone Supply vs. Frequency
Watershed C-6
Sevier River Basin Utah

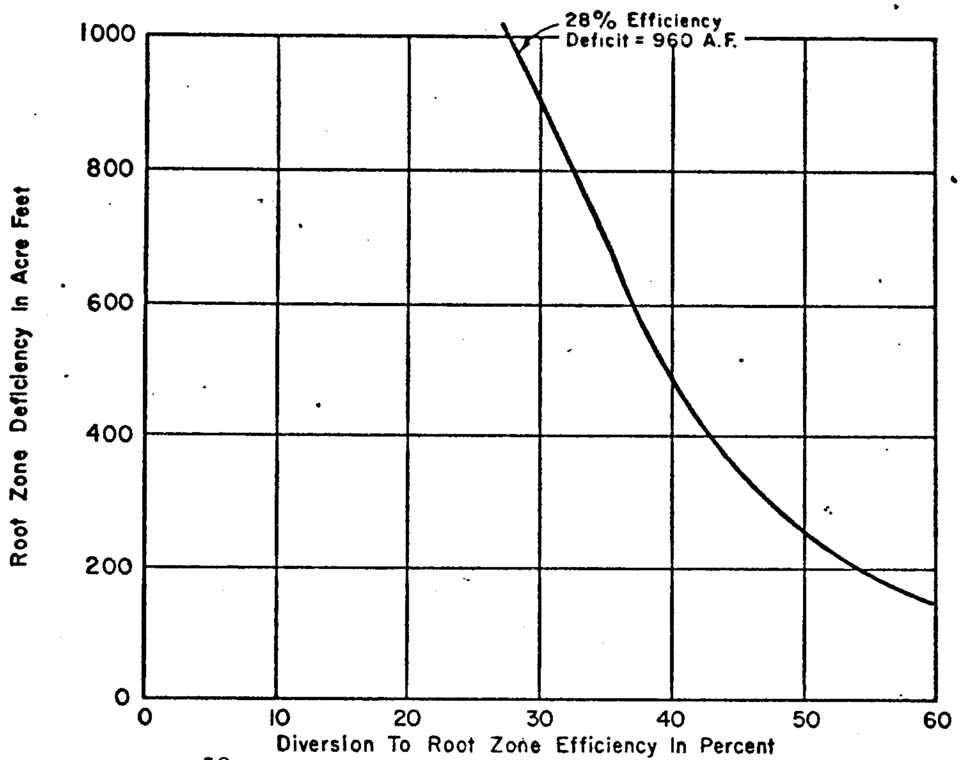


Figure 58 : Root Zone Deficiency vs. Efficiency
Watershed C-6
Sevier River Basin Utah

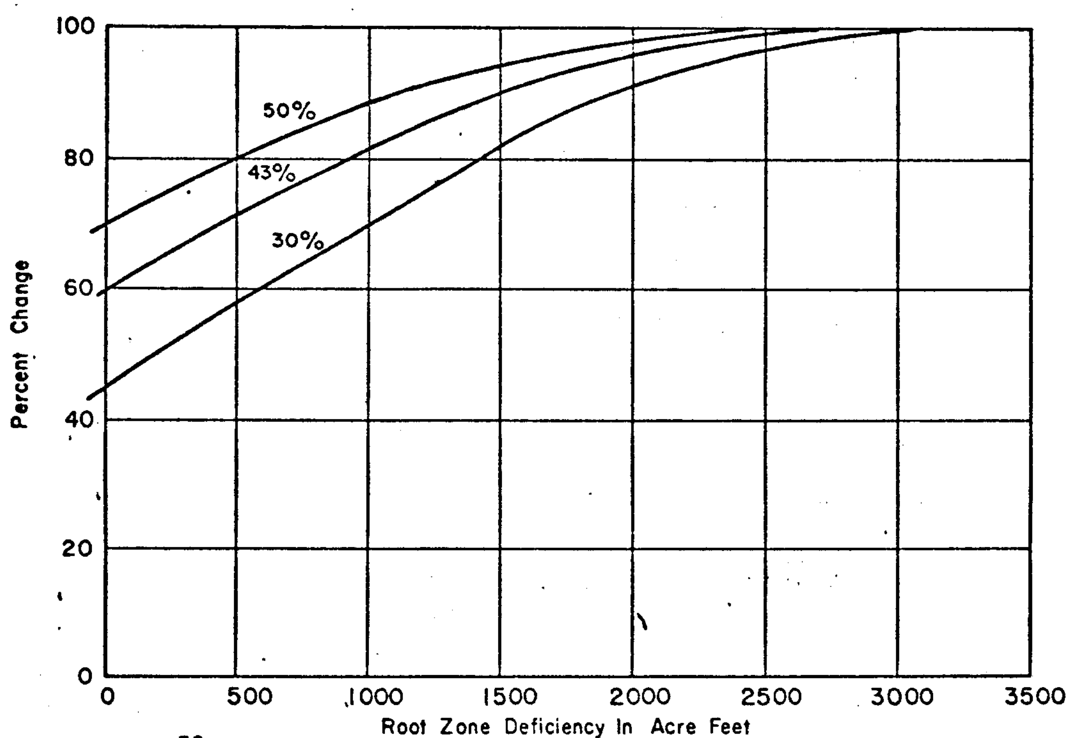


Figure 59 : Root Zone Deficiency vs. Frequency
Watershed C-6
Sevier River Basin Utah

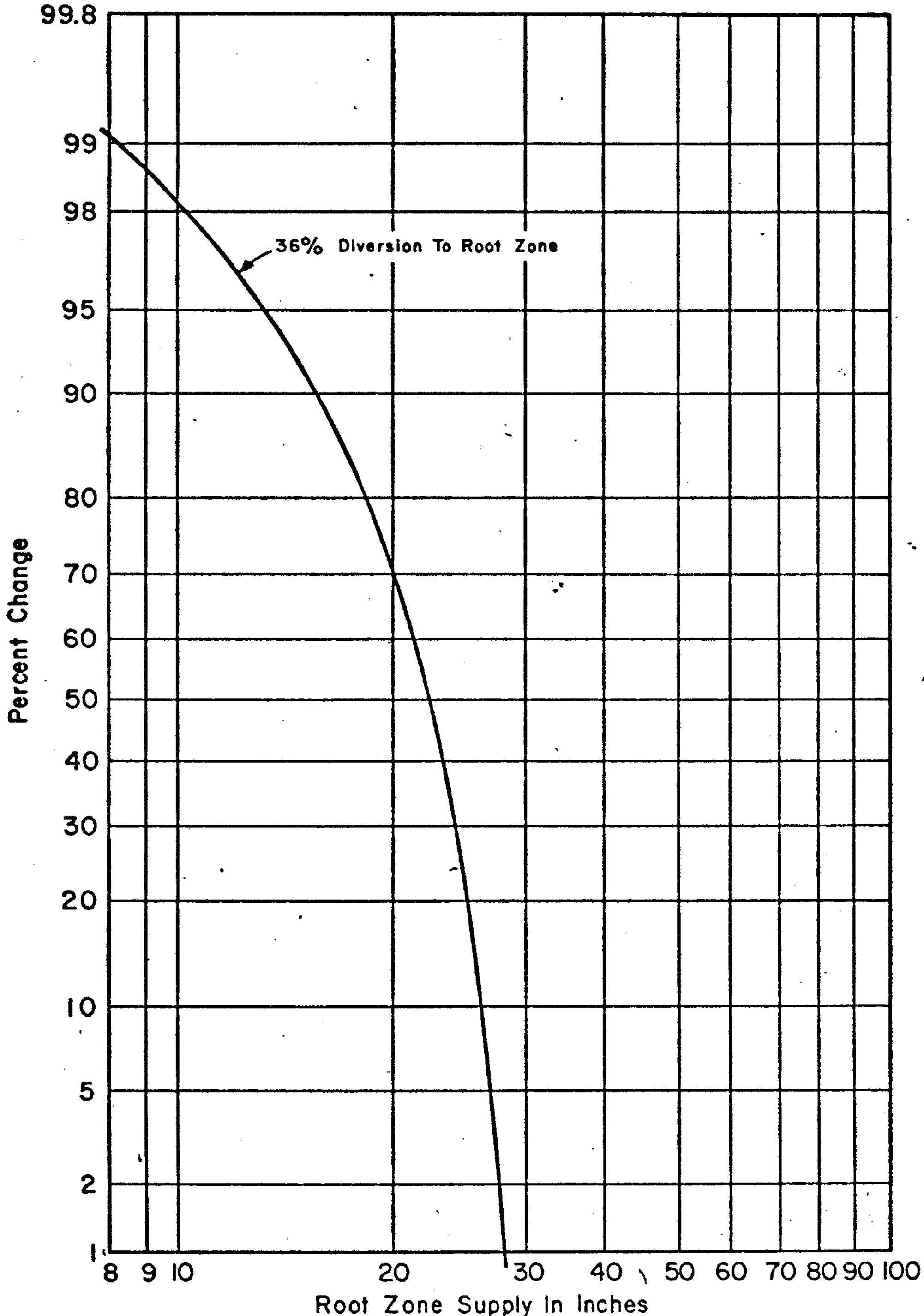


Figure 60: Root Zone Supply vs. Frequency
Watershed D-1 Thru D-5
Sevier River Basin Utah

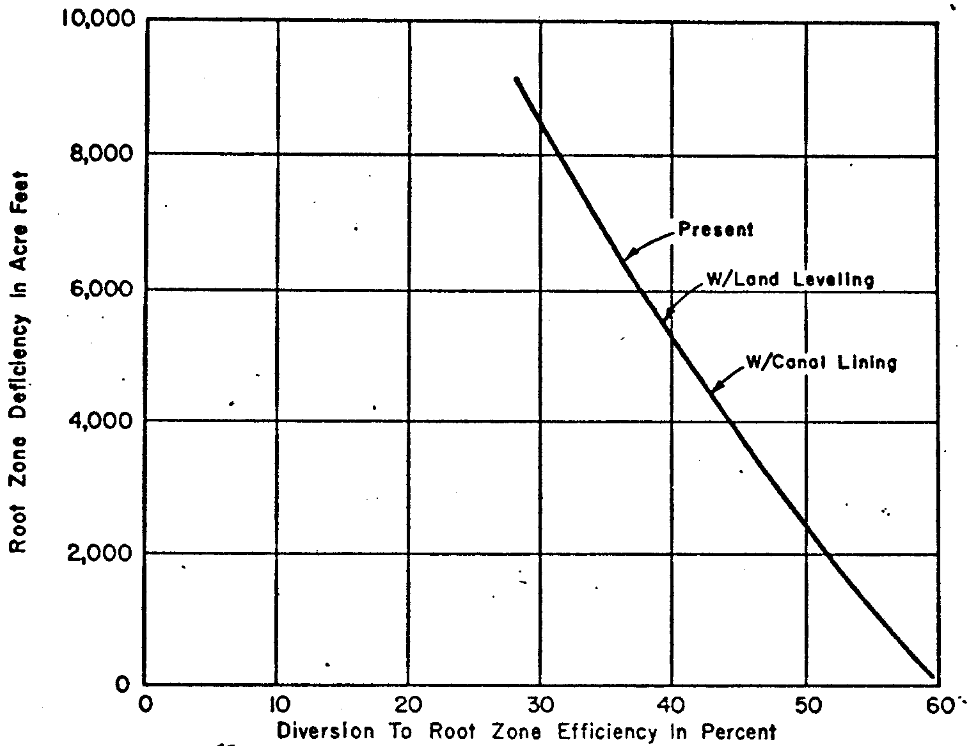


Figure 61: Root Zone Deficiency vs. Efficiency
Watershed D-1
Sevier River Basin Utah

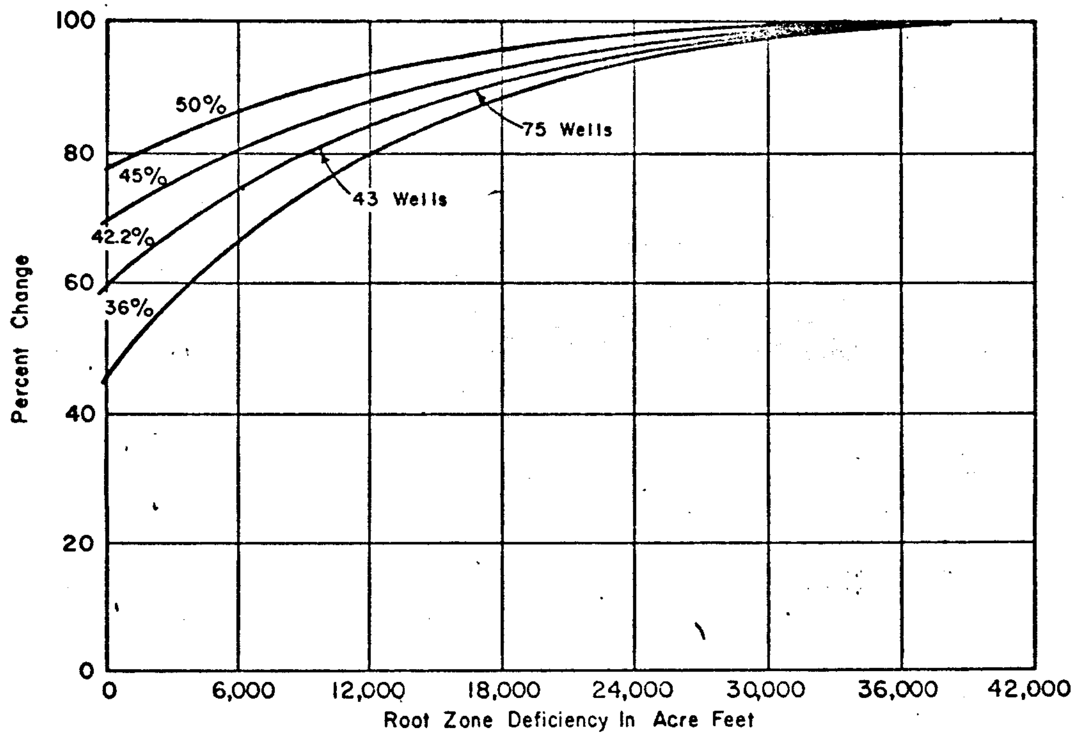


Figure 62: Root Zone Deficiency vs. Frequency
Watershed D-1
Sevier River Basin Utah

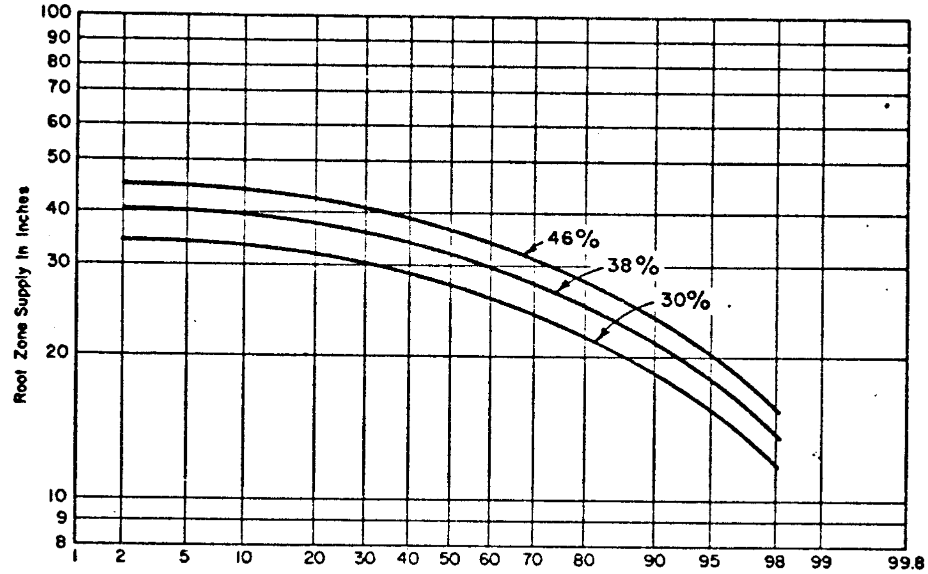


Figure 63: Root Zone Supply vs. Frequency
Watershed D-4
Sevier River Basin Utah

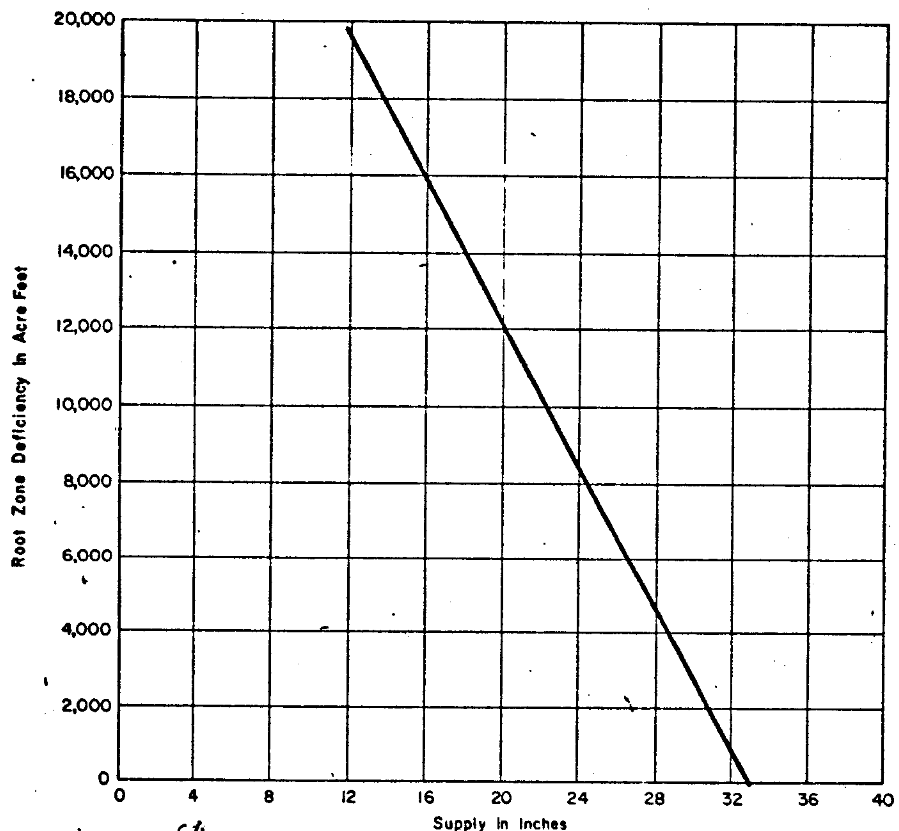


Figure 64: Root Zone Deficiency vs. Supply
Watershed D-4
Sevier River Basin Utah

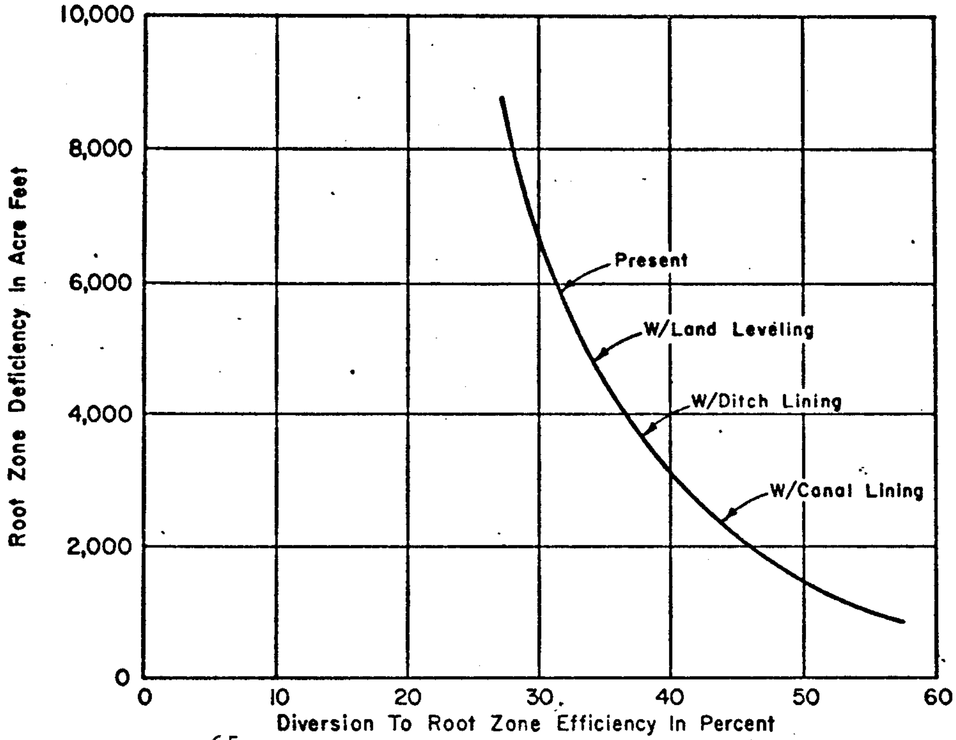


Figure 65: Root Zone Deficiency vs. Efficiency
Watershed D-4
Sevier River Basin Utah

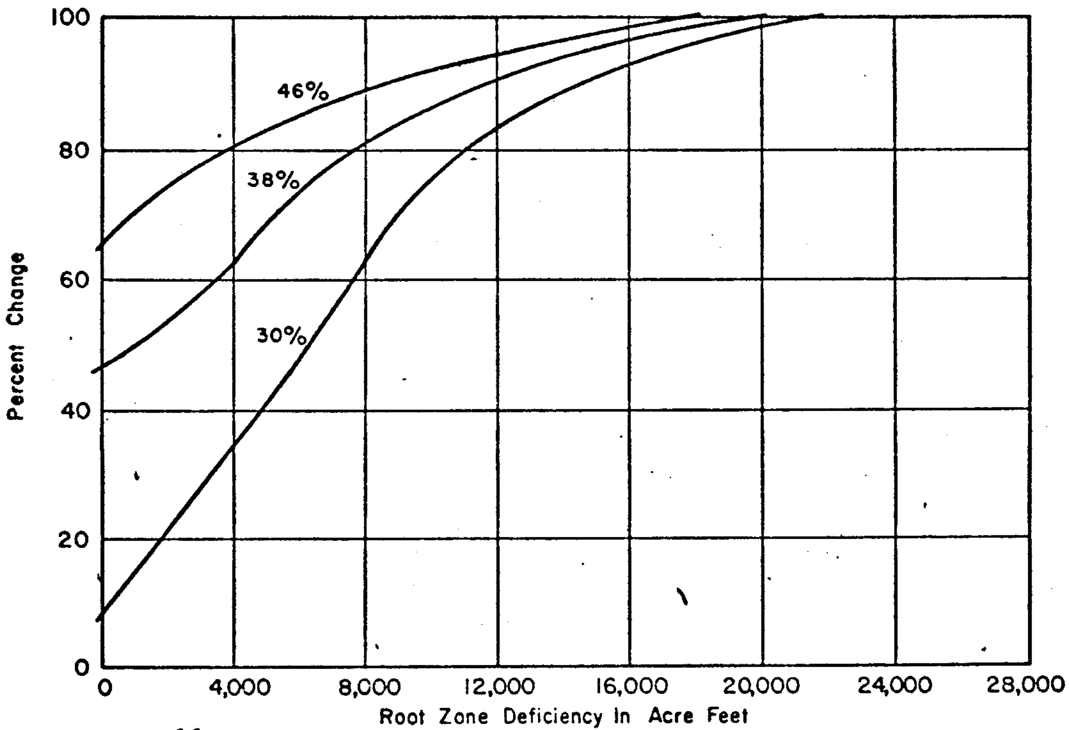


Figure 66: Root Zone Deficiency vs. Frequency
Watershed D-4
Sevier River Basin Utah

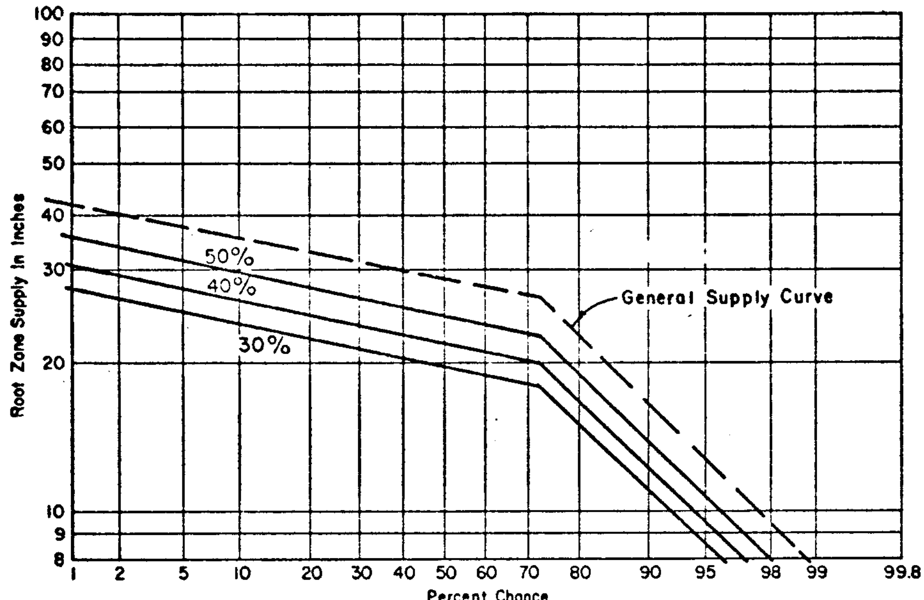


Figure 67: Root Zone Supply vs. Frequency
Watershed E-5
Sevier River Basin Utah

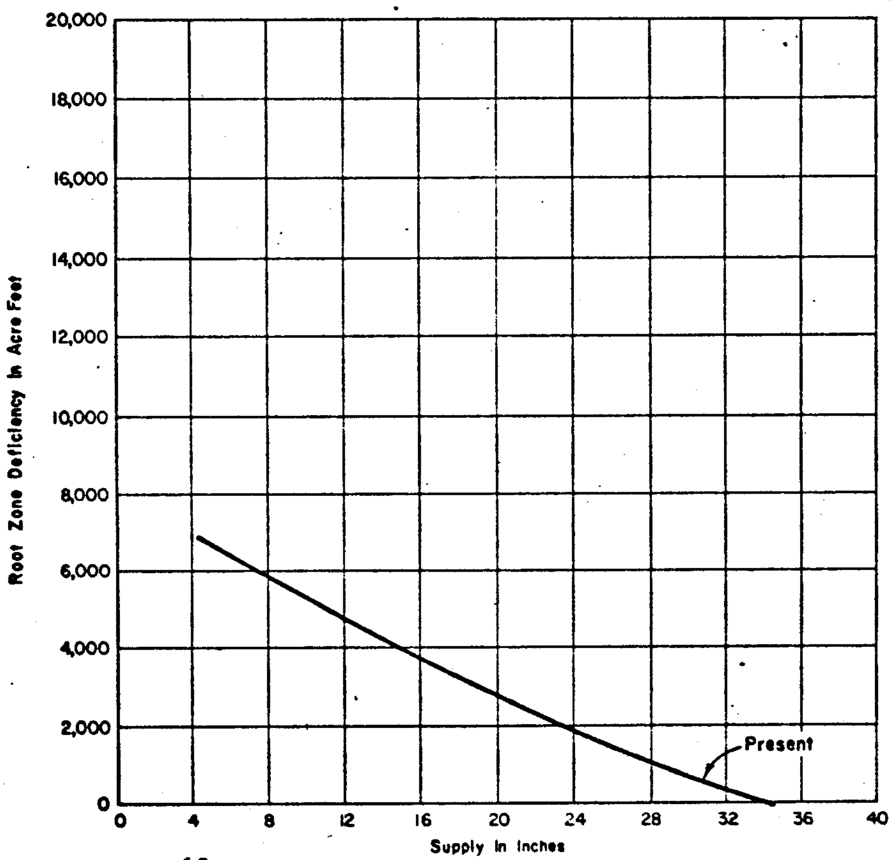


Figure 68: Root Zone Deficiency vs. Supply
Watershed E-5
Sevier River Basin Utah

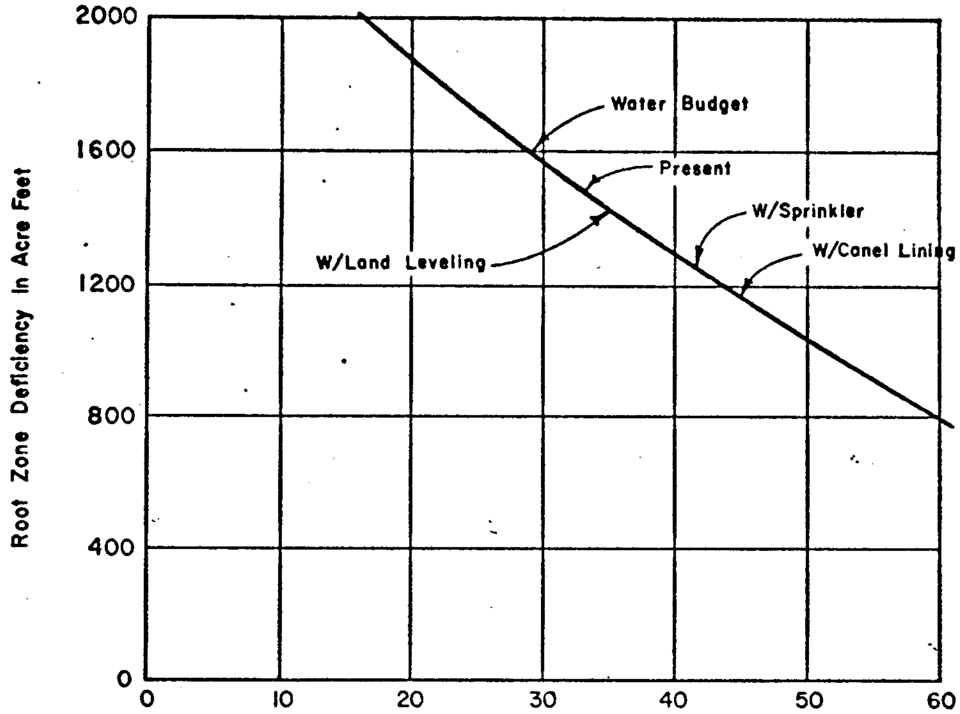


Figure 69 : Root Zone Deficiency vs. Efficiency
Watershed E-5
Sevier River Basin Utah

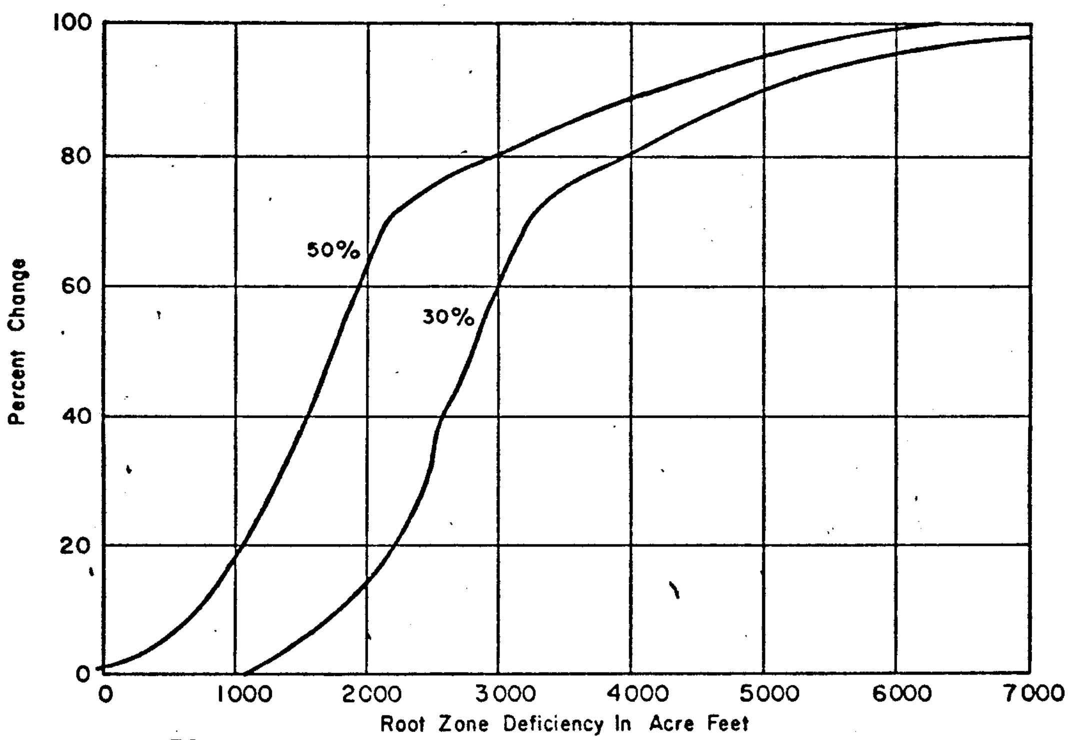


Figure 70 : Root Zone Deficiency vs. Frequency
Watershed E-5
Sevier River Basin Utah

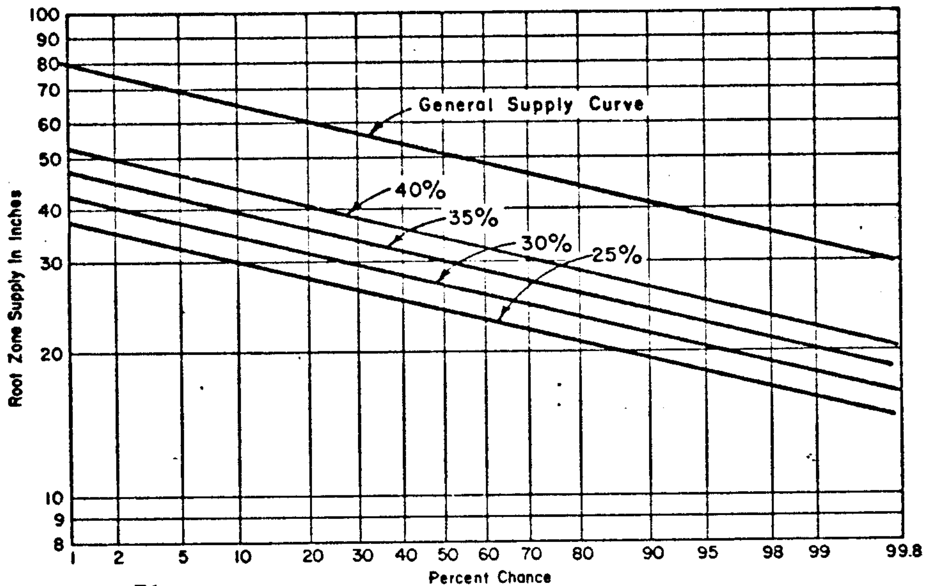


Figure 71: Root Zone Supply vs. Frequency
Watershed F-1
Sevier River Basin Utah

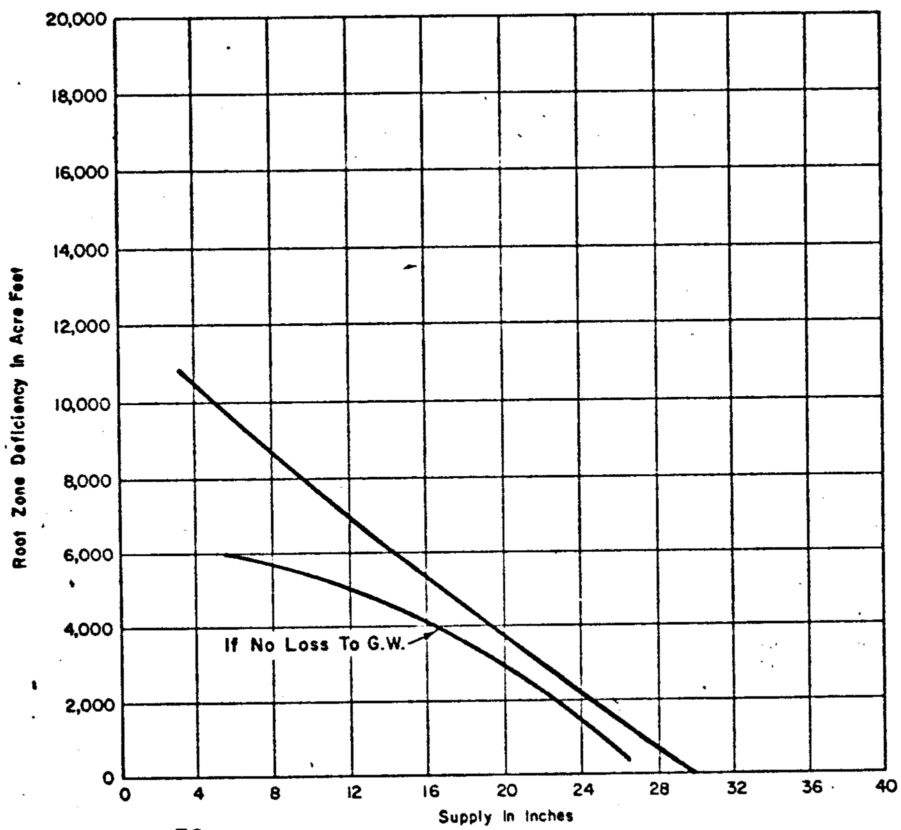


Figure 72 : Root Zone Deficiency vs. Supply
Watershed F-1
Sevier River Basin Utah

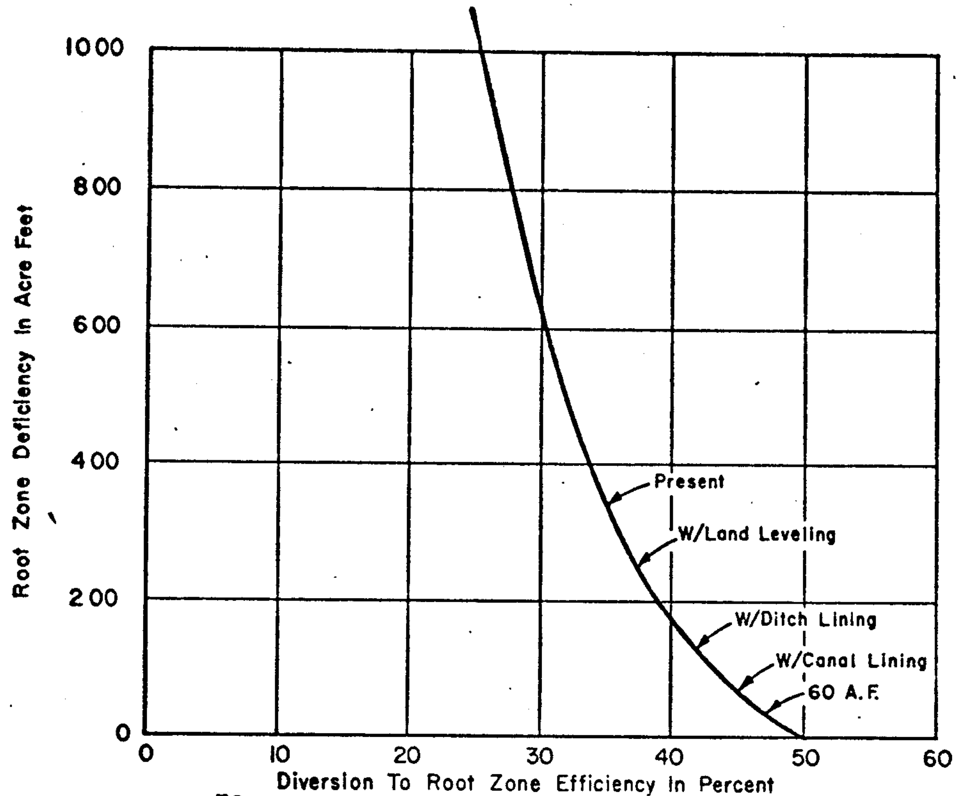


Figure 73: Root Zone Deficiency vs. Efficiency
Watershed F-1
Sevier River Basin Utah

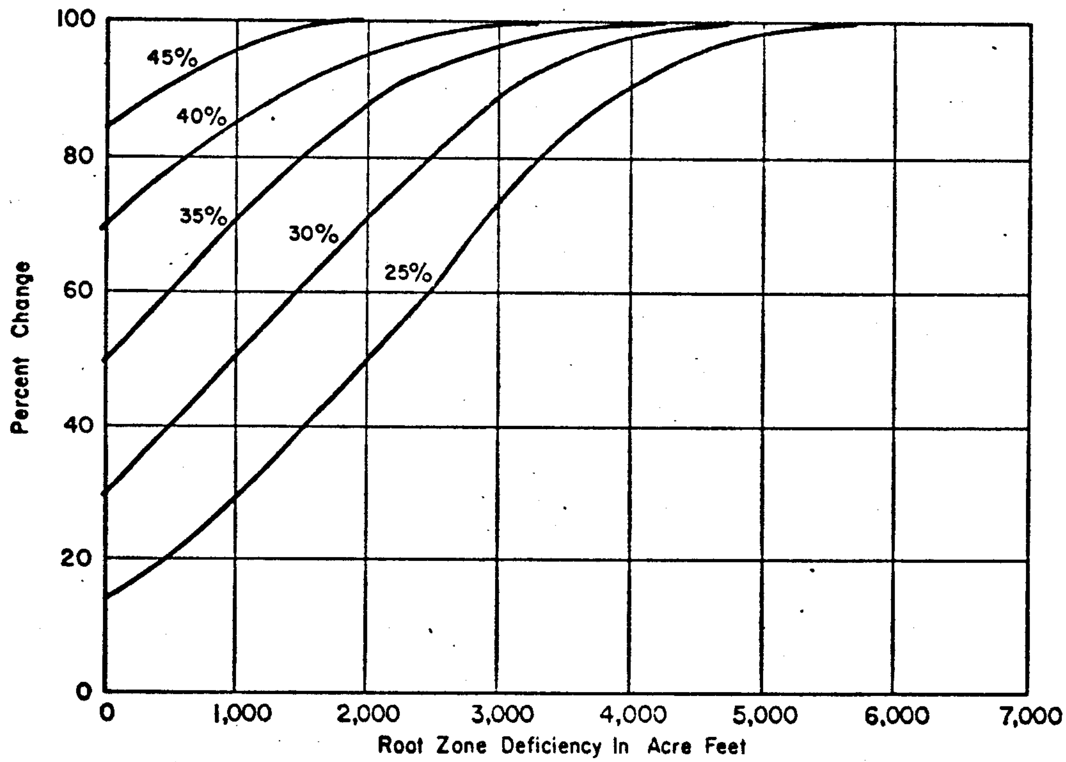


Figure 74: Root Zone Deficiency vs. Frequency
Watershed F-1
Sevier River Basin Utah

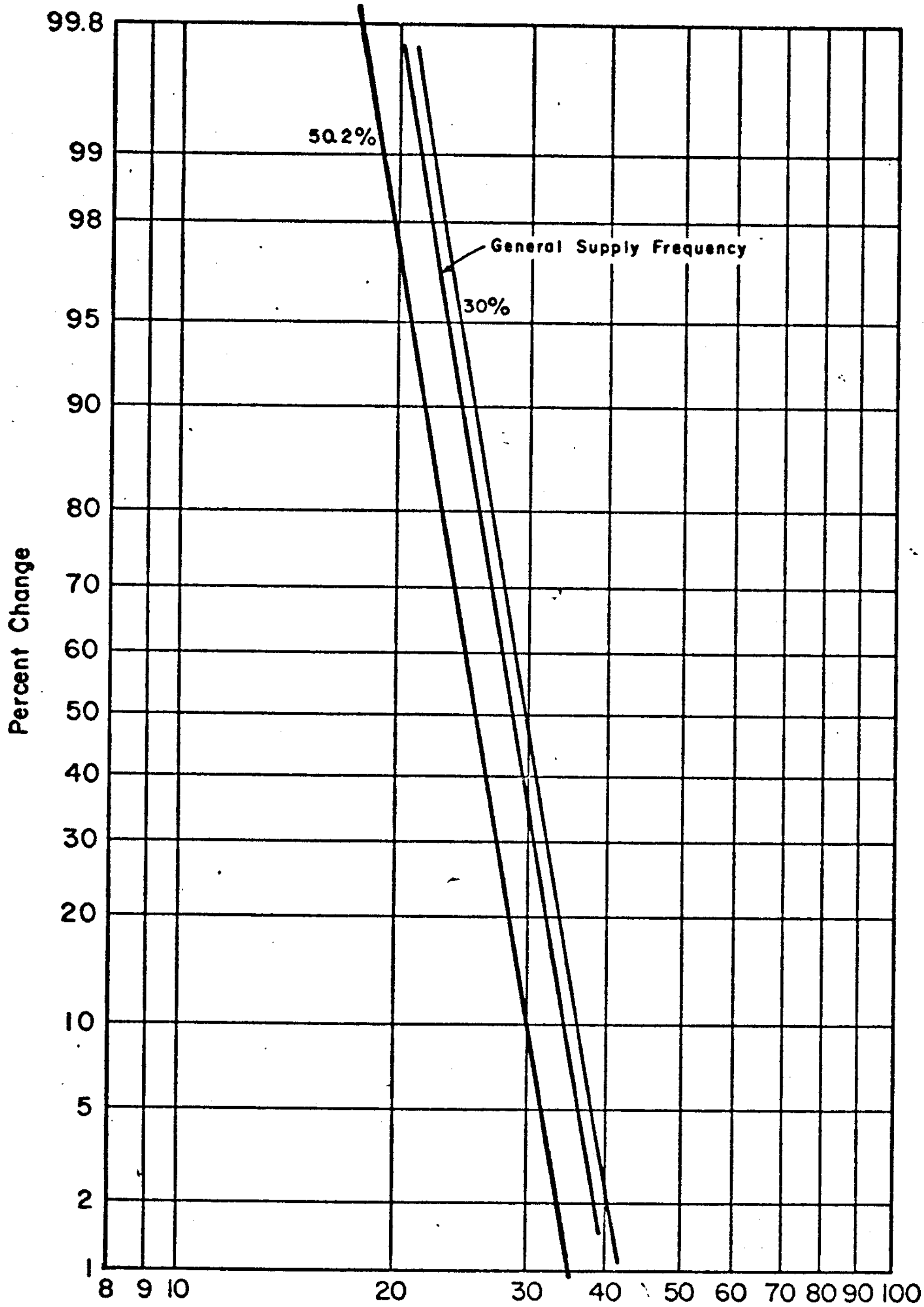


Figure 75: Root Zone Supply vs. Frequency

Watershed F-2

Sevier River Basin Utah

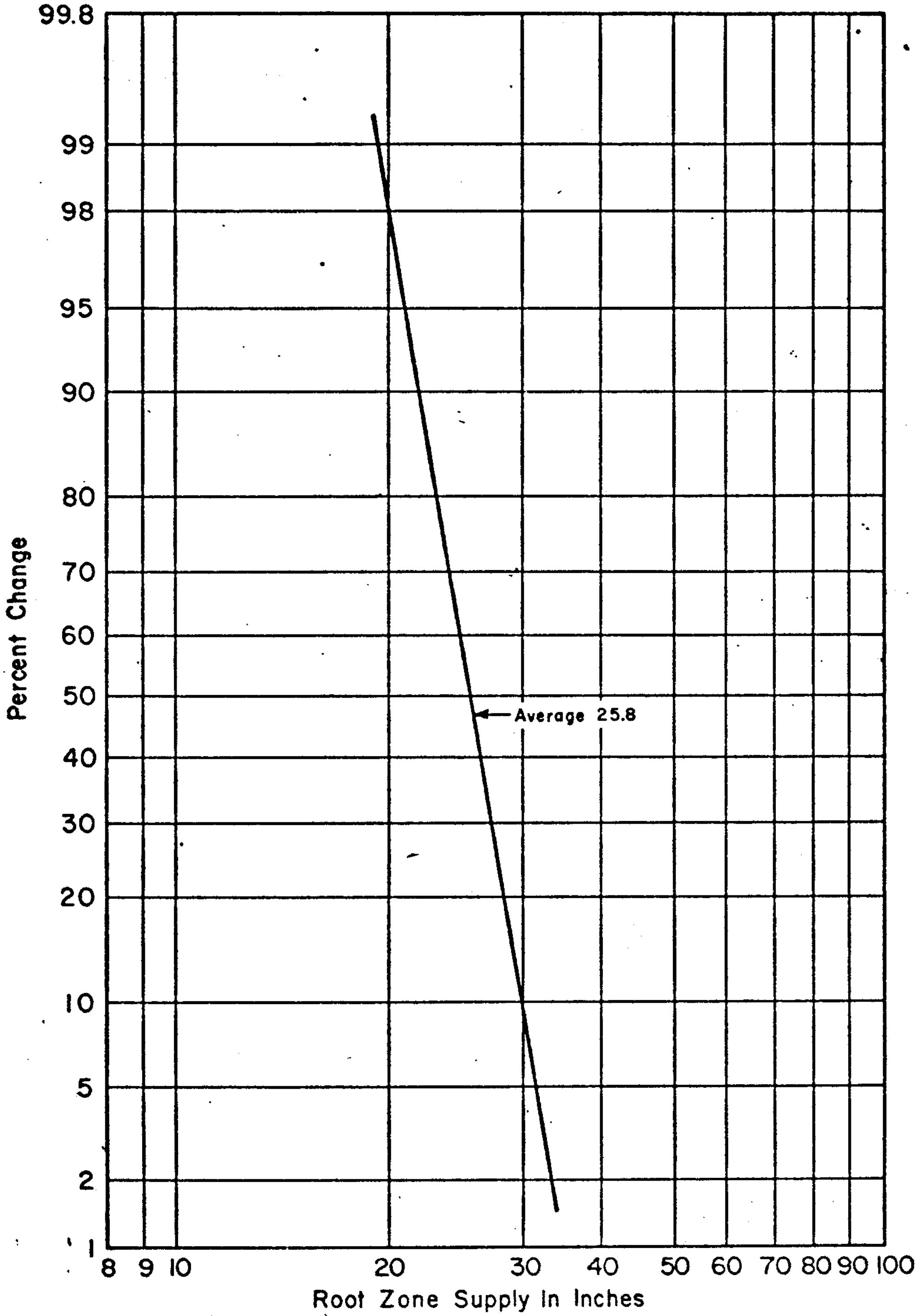


Figure 76 : Root Zone Supply vs. Frequency
Watershed F-2,3, 4 & 5
Sevier River Basin Utah

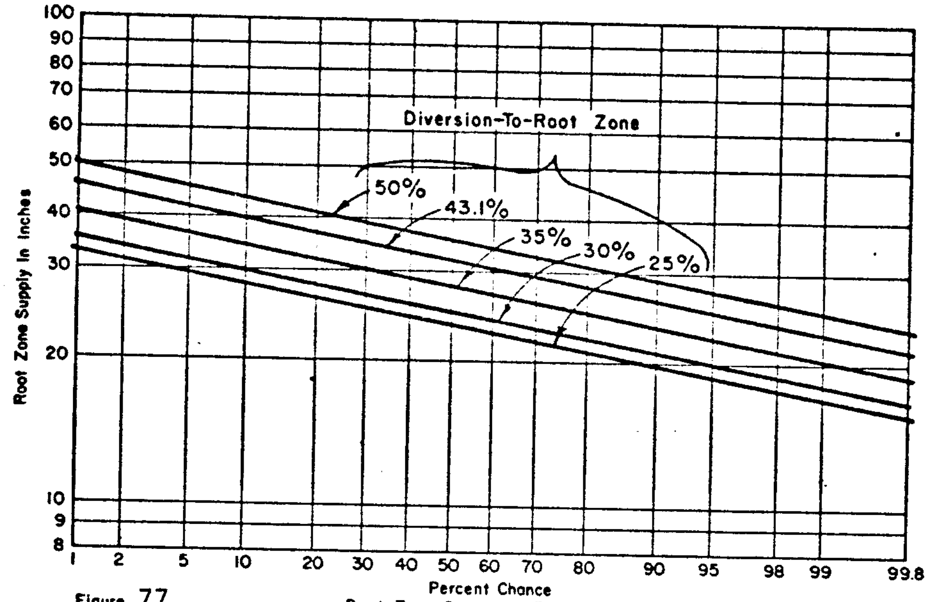


Figure 77

Root Zone Supply vs. Frequency
Watershed F-3
Sevier River Basin Utah

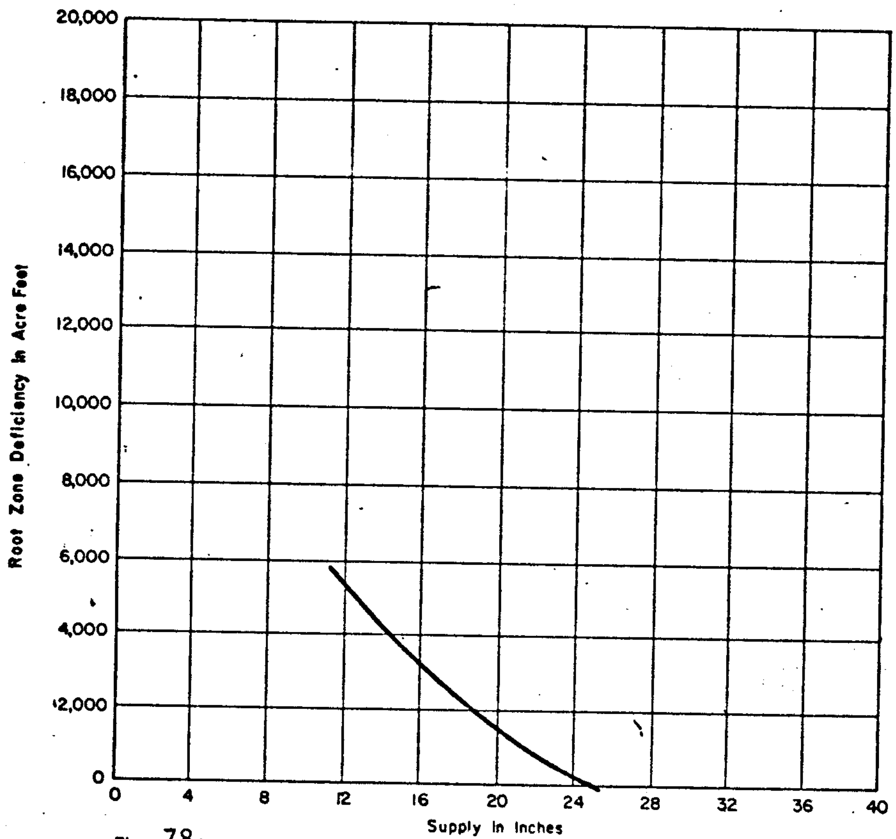


Figure 78:

Root Zone Deficiency vs. Supply
Watershed F-3
Sevier River Basin Utah

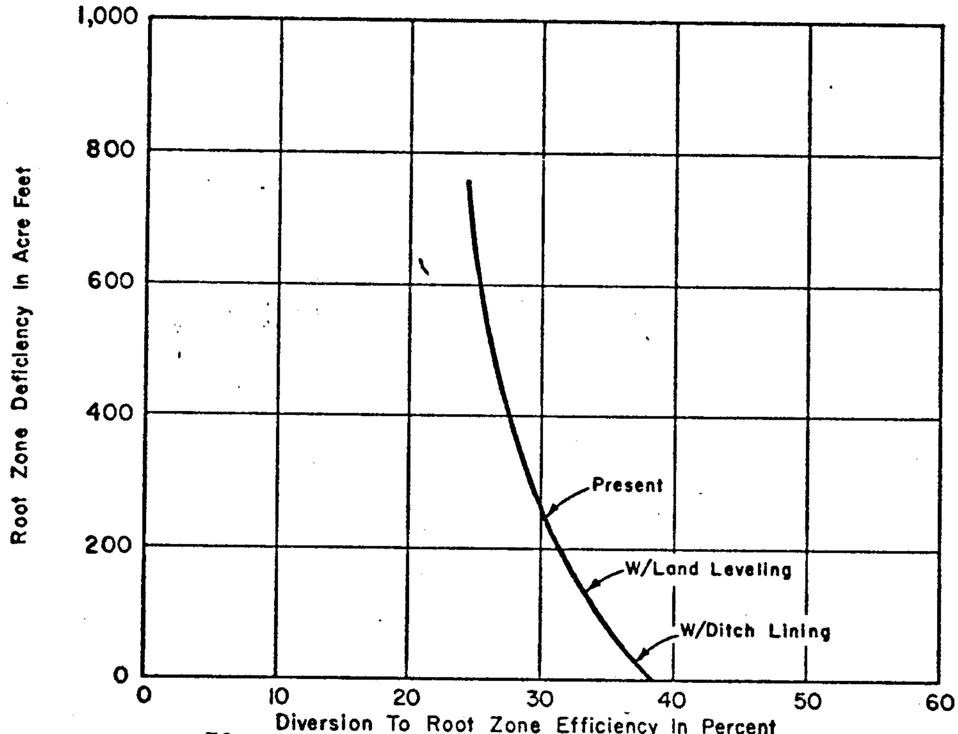


Figure 79: Root Zone Deficiency vs. Efficiency
Watershed F-3
Sevier River Basin Utah

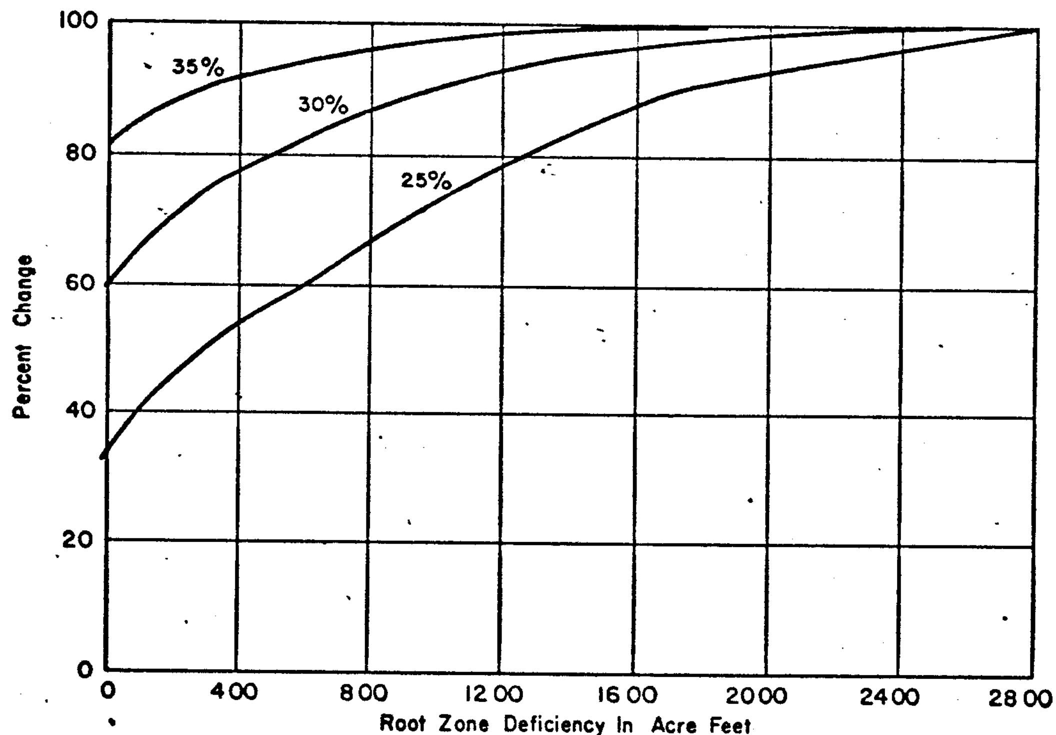


Figure 80: Root Zone Deficiency vs. Frequency
Watershed F-3
Sevier River Basin Utah

MONETARY VALUES OF IRRIGATION WATER

Planners are frequently required to make economic evaluations of water resource developments or of conservation measures which affect the soil moisture regime. However, there are few general analytical tools or simple methods available for this purpose. It is the objective of this discussion to describe a rather simple way of determining the direct monetary benefits of water resource developments and to outline the concepts underlying the method.

Of the various physical, economic, and human factors affecting crop production, climate (the amount of heat available for crop production) is the ultimate limiting factor. Exceptions to this broad generalization would include severely limiting soil conditions, or any other inherent physical hindrance to full use of other available resources. Regardless of the nature or magnitude of any inhibiting factor, all non-climatic limitations operate within the range of the climatic environment. Because climate does play such a dominant role in crop production, climatic "zones" have been set up as part of the soil classification system. These zones are an important tool in determining and describing the total environment in which crops are produced.

Climatic zone #1 covers a substantial portion of the irrigated farming area of Utah. The range of development units (5,000-7,000)[1/] is adequate for successful production of a number of temperate region crops such as corn, small grain, sugar beets, potatoes, beans, truck

---

1/ 1 cc PET = 100 development units. This unit is expressed for the frost-free period.

crops, fruits, seed crops, alfalfa, pasture, and other crops. Development units in this zone are adequate for three cuttings of alfalfa and in the upper part of the range, additional production of from 5% to 15% of the three crop tonnage provides an increment of yield which is mostly utilized as aftermath grazing for cattle or sheep. In the discussion which follows, production, consumptive use, and net return data are based on a normal range of full water supply yields for climatic zone #1. It is probable that both higher and lower yields may be found in this zone. However, the 3, 4, 5, 6, and 7-ton and the 9, 12, and 15 AUM-yields for alfalfa and pasture respectively are assumed to include the extreme range in yields prevailing in this zone.

Crop Priorities for Irrigation

In most water-short irrigated areas, farmers adjust their cropping pattern to a deficient and sometimes erratic supply. The limiting effect of the 70 percent to 80 percent chance dependable farm supply sets the general acreage of crops such as sugar beets, potatoes, corn, fruit, and other late-maturing crops. Because these crops require a full season supply to attain maturity, a major portion of the scarce supply is pre-empted by them and they thereby occupy a position of first priority among all the crops on the farm needing water.

In many parts of Utah, alfalfa and pasture are in a secondary position in the farm cropping pattern in respect to scarce water. In some places, small grain is a second priority crop. In this discussion, alfalfa is identified as the principal second priority crop. Any water resource development or conservation measure which will change the seasonal distribution or amount of available soil moisture will usually have a primary effect on the production of second priority crops. If the net amount of useable soil moisture is increased, there will be a positive (but not necessarily proportional) change in the yield of alfalfa or pasture. Typical growth schedules for alfalfa and pasture are shown in Figures 81 and 82 for climatic zone #1. These show the cumulative average growth of these two crops through a normal season. The variation in yield response per unit of water through the growing season is illustrated by a typical production and consumptive use schedule for alfalfa in the eastern part of Box Elder County.

Month	Alfalfa Yield Tons	C.U. 1/ Inches	Alfalfa Yield Tons Per Acre Inch
April	.238	1.07	.222
May	.837	4.26	.196
June	1.050	6.24	.168
July	1.250	8.32	.150
August	.950	6.88	.138
September	.525	4.07	.129
October	.150	1.24	.121
TOTALS	5.000	32.08	.150 (Mean)

1/ Calculated consumptive use for normal season.

It can be seen in the foregoing tabulation that the biggest per-unit response occurs in April with a progressive decrease through the remaining periods. With this typical pattern of response, a unit of water consumptively used in April will produce larger gross monetary values than will a unit consumed in July.

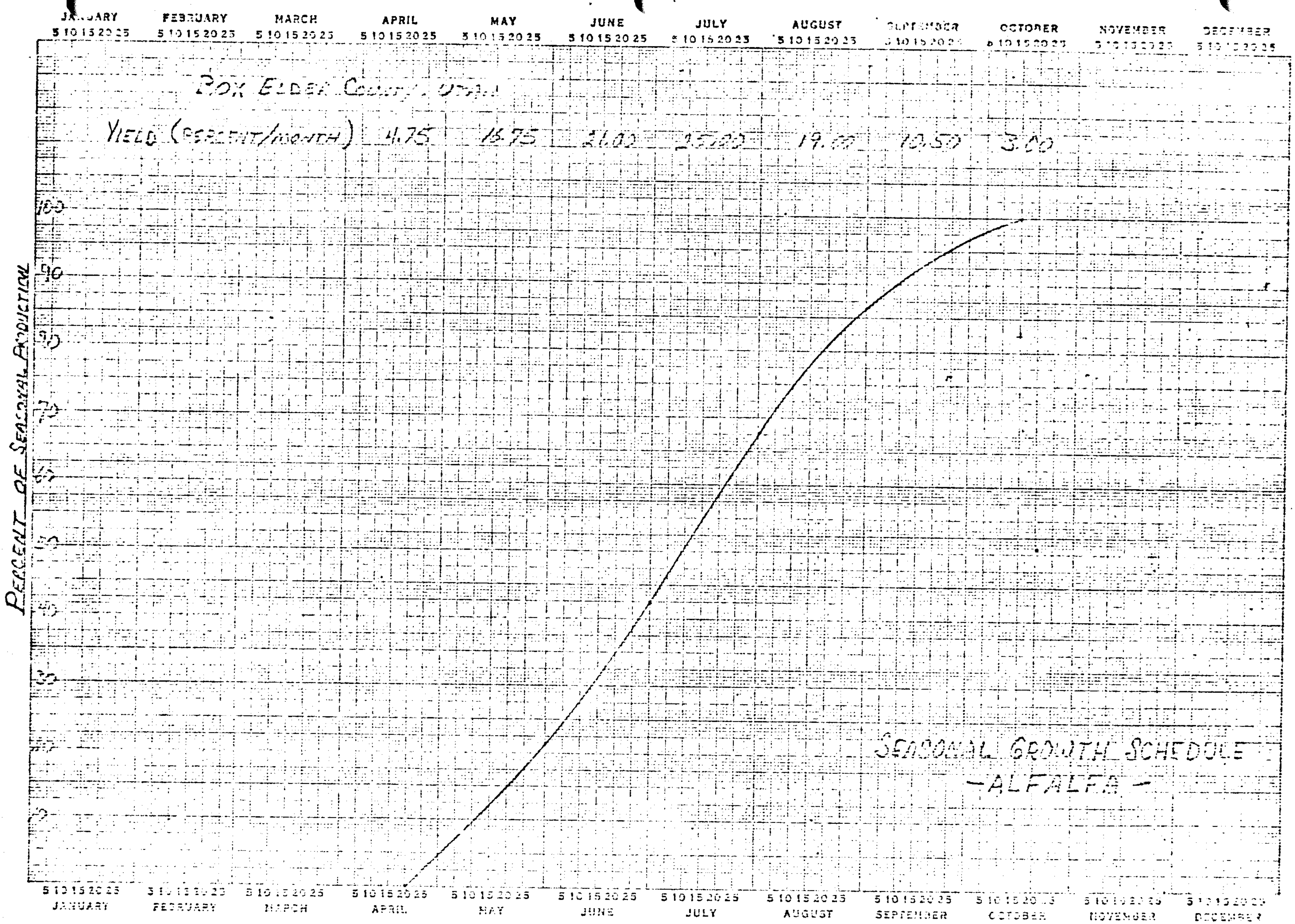

Box Elder County, Utah
Yield (percent/month) 4.75 15.75 21.00 10.50 3.00
Percent of Seasonal Production
100
90
80
70
60
50
40
30
20
10
January
February
March
April
May
June
July
August
September
October
November
December
Seasonal Growth Schedule
- Alfalfa -

Figure 81

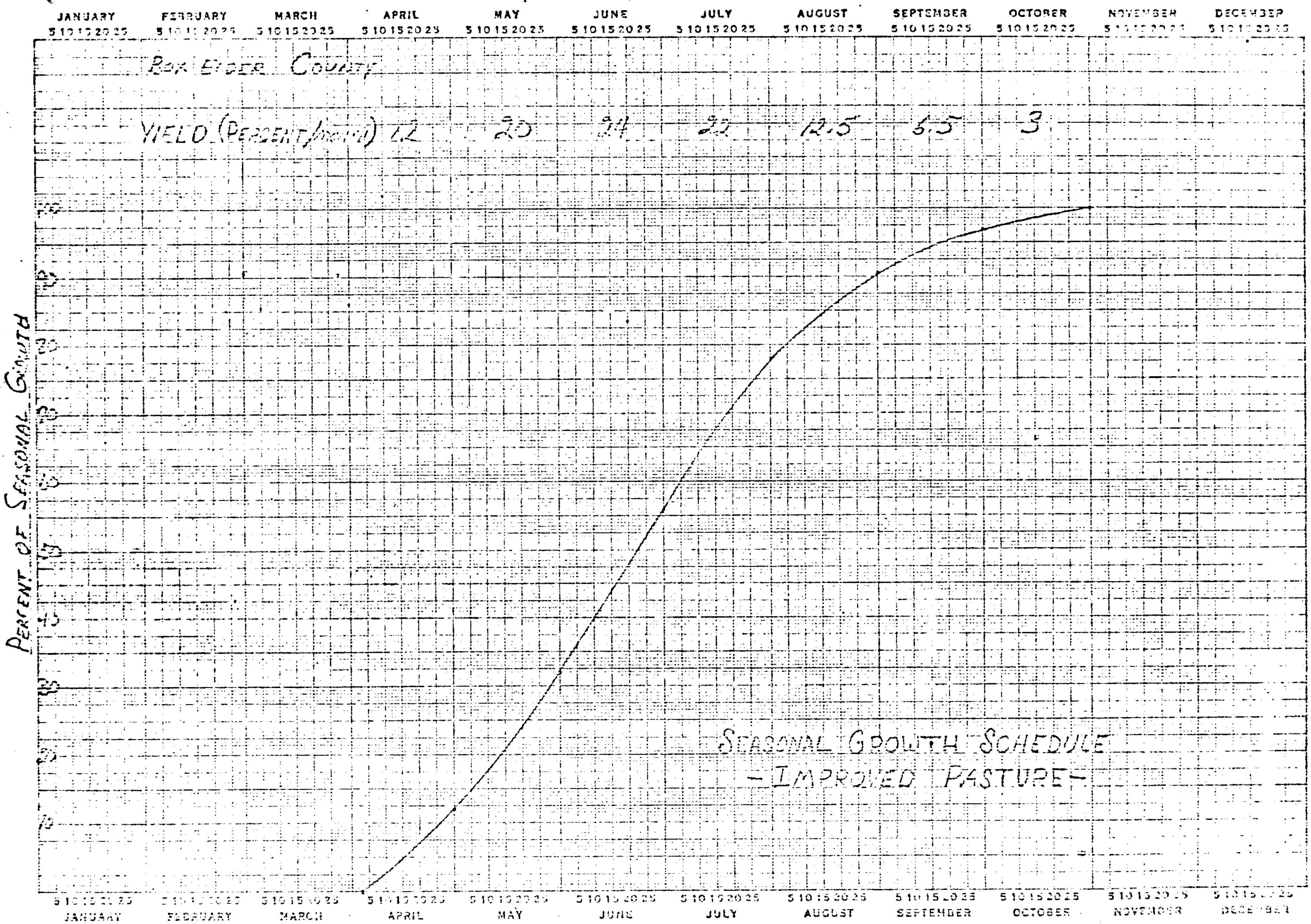

Box Elder County
Yield (Percent/month) 12 20 24 22 12.5 6.5 3
Seasonal Growth Schedule
- Improved Pasture -
Percent of Seasonal Growth
January
February
March
April
May
June
July
August
September
October
November
December

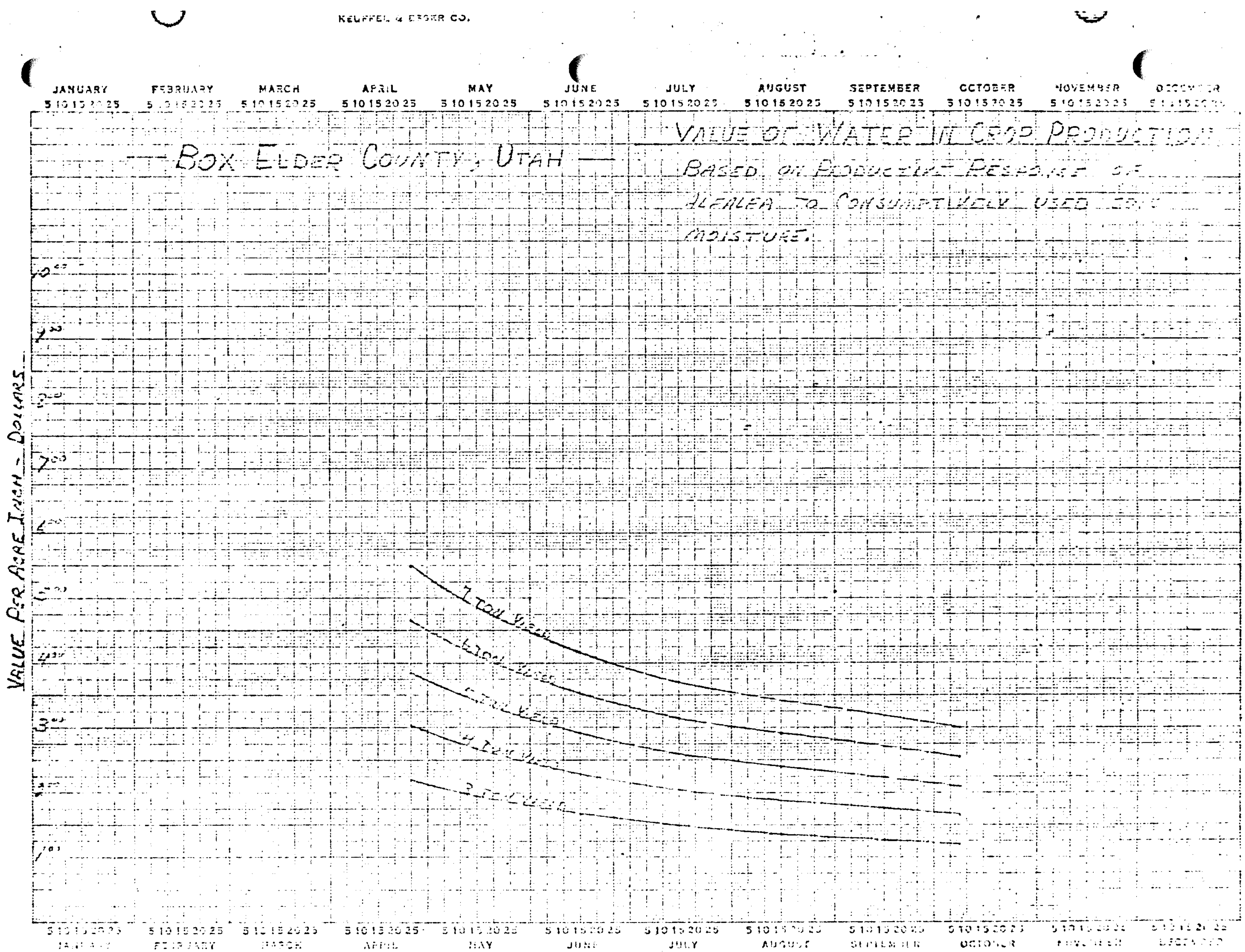
Figure #82

Yield Levels

The five levels of yields shown on Figure 83 and the three levels on Figure 84 are possible variations within the broad limitations of climatic zone #1 and reflect limitations on yield which may be imposed by soil characteristics, management, needed land treatment, or other physical factors. For evaluation purposes, the normal full supply yield at any specific location is determined and the appropriate curve used to derive the monthly values. The planner's knowledge of soils and other conditions affecting production in the area will dictate the yield curve to be used. Because these curves are constructed from generalized yield, consumptive use, and production cost information, the mid-month values should be used for evaluation. Values for yields falling between the curves may be determined through interpolation.

Use of Median Monthly Values

In most water resource developments, the available supply records are summarized by months. The monthly pattern of supply is also used as the basis for determining the "with" project supply. These records can also provide the base for estimating the amount of supply which is placed in the root zone for consumptive use. The curves reflect values which arise from consumptively used (root zone) moisture. They also reflect a continually changing increment of production through each month. Values are reduced to a monthly median so they can be applied to changes in monthly deficiencies produced by project measures. Diversion or farm headgate supplies must be reduced to root zone supplies by applying an appropriate efficiency factor.



KEUFFEL & ESSER CO.
— BOX ELDER COUNTY, UTAH —
VALUE OF WATER IN CROP PRODUCTION
BASED ON PRODUCTION RESPONSE OF ALFALFA TO CONSUMPTIVELY USED SOIL MOISTURE.
VALUE PER ACRE INCH - DOLLARS
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

FIGURE #83

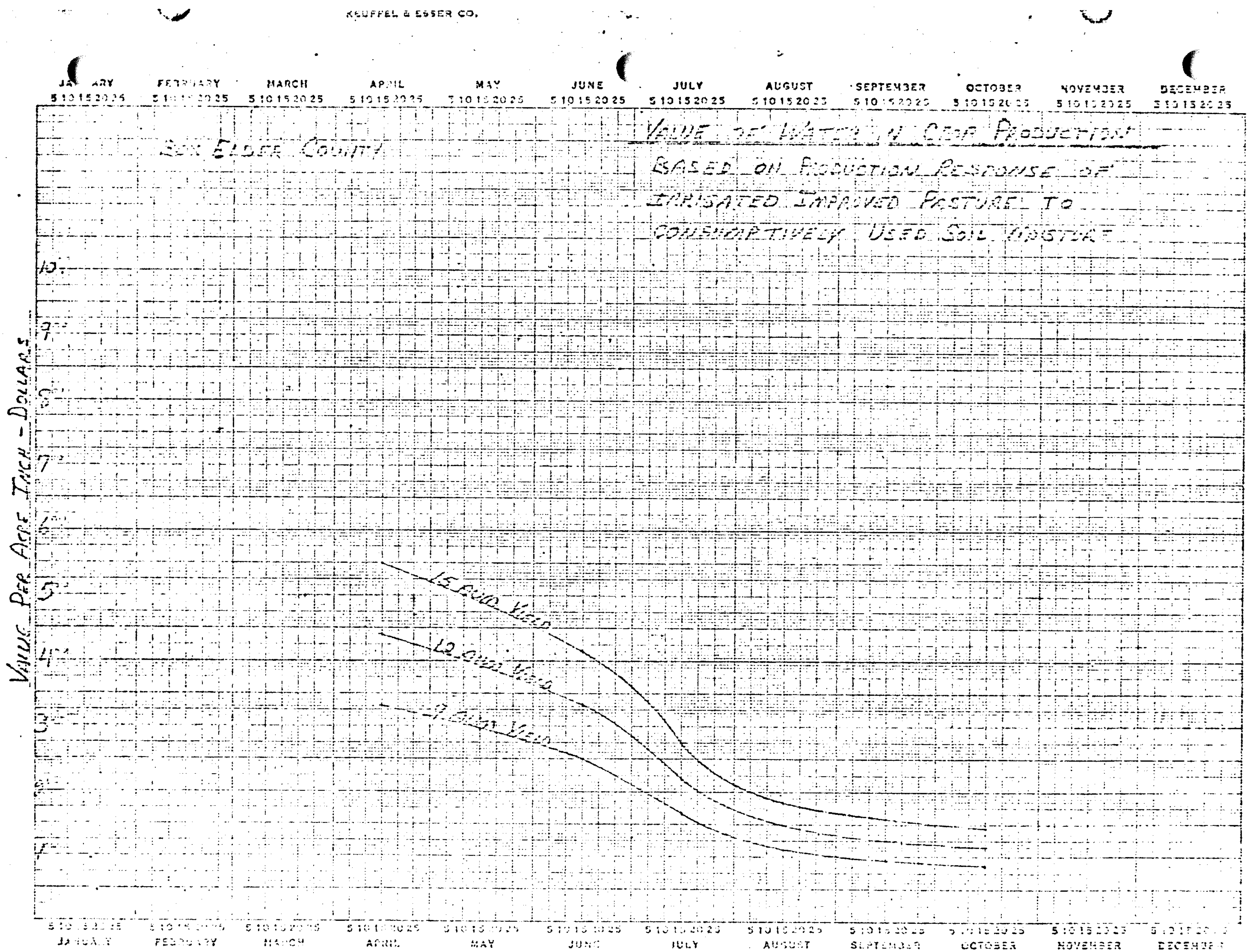

KEUFFEL & ESSER CO.
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER
BOX ELDER COUNTY
VALUE OF WATER IN CROP PRODUCTION
BASED ON PRODUCTION RESPONSE OF
IRRIGATED IMPROVED PASTURE TO
CONSUMPTIVELY USED SOIL MOISTURE
VALUE PER ACRE INCH - DOLLARS
10
9
8
7
6
5
4
3
2
1

FIGURE # 84

It will be observed that the curves establish median monthly values through the entire season. In a relative sense, these values are valid throughout. Because of the normal patterns of soil moisture deficiency which usually develop under conditions of an uncontrolled supply, the values for July, August, and September will be the ones most often used.

Use of Curves in Evaluation

As an illustration of the way in which the curves may be used for evaluation purposes, the following example is given:

A canal conveying irrigation water is losing a substantial percentage of water through seepage and is being considered for lining. The change in root zone deficiencies is the physical measure of the benefit. Because alfalfa is the second priority crop and the satisfaction of soil moisture deficiencies will occur on this acreage, the value curve for the appropriate alfalfa yield will be used to obtain values per acre inch (converted to acre feet) which can be applied to the change in deficiencies produced by project measures. The data in Tables 6 and 7 are developed for evaluation purposes.

TABLE 6.-- Root zone supply for present and project conditions

Month	Diversions 1/	R.Z. 2/ requirement	Present: Efficiency 3/	Present: R.Z. supply	Present: Soil moisture balance	Present: R.Z. deficit	With Project: R.Z. 4/ Efficiency	With Project: R.Z. supply	With Project: Soil moisture balance	With Project: R.Z. deficit
	Acre-feet	Acre-feet	Percent	Acre-feet	Acre-feet	Acre-feet	Percent	Acre-feet	Acre-feet	Acre-feet
April	2,900	900	35	1,015	4,166 5/	--	45	1,305	4,166	--
May	9,700	3,550	35	3,395	4,011	--	45	4,365	4,166	--
June	12,200	5,200	35	4,270	3,081	--	45	5,490	4,166	--
July	9,100	6,933	35	3,185	--	667	45	4,095	1,328	--
Aug.	8,000	5,733	35	2,800	--	2,933	45	3,600	--	805
Sept.	6,400	3,400	35	2,240	--	1,160	45	2,880	--	520
Oct.	6,000	1,033	35	2,100	--	--	45	2,700	--	--

1/ Net 2nd priority supply.
2/ Based on 10,000 acres.
3/ Transmission efficiency 70% and farm efficiency 50%.
4/ Transmission efficiency 90% and farm efficiency 50%.
5/ Combination of stored winter moisture and surplus spring supply. Assumed useable soil moisture is 5 inches.

TABLE 7.-- Change in root zone water deficiencies produced by project

Month	Deficiencies: Present	Deficiencies: Project	Change in deficiency	Value per 1/ acre foot	Annual benefit
	acre-feet	acre-feet	acre-feet	dollars	dollars
April	--	--	--	46.20	--
May	--	--	--	40.80	--
June	--	--	--	35.04	--
July	667	--	667	31.20	20,810
August	2,933	805	2,128	28.68	61,030
September	1,160	520	640	26.88	17,200
October	--	--	--	25.20	--
				Total primary benefits	99,040

1/ Net value curves - Box Elder County (5 ton)

ECONOMIC VALUE OF SEMI-IRRIGATED AND MEADOW PASTURE

In order to gain a perspective of the uses and the economics involved in the production of grass and/or legume forage in Subbasin A, an informal study of grassland was made in 1963 and 1964. Interviews of 15 farmers at selected locations gave information on hay and grazing produced under widely varying water supply, soils, and vegetative conditions. This survey covered approximately 1,200 acres and inventoried inputs of labor, water, land, and capital items used in production. Yield data for the various types of pasture were also obtained. The information collected was tabulated, organized, and analyzed, and is the basis of conclusions set forth in the following paragraphs.

Classes of Irrigated and Sub-Irrigated Grassland

The survey covers non-rotation grassland only. Some improved rotation pasture exists, but is not discussed here.

Examination of these lands indicates they may be subdivided into three general categories. The general nature of these categories is emphasized by the variance in water supply and water table conditions within each group. Their classification into separate categories is chiefly based on generally recognized similarities in vegetative type, labor, capital inputs, management and treatment measures, and yield levels. On the basis of the general criteria, the grasslands may be classified as:

1. Salt grass pasture: This class is characterized by the dominance of salt grass (and associated plants) and a rather widely fluctuating water table which is usually highest during

the early growing season. Soils are frequently salty, although salinity is not a determining factor. Some surface water may be present in the early season.

2. Wet meadow: These sites are distinguished by the dominance of sedges, wire grass, and other native hydrophytic plants. The water table is usually shallow, and is more or less static at from 0.5 to 1.5 feet. Little or no irrigation water is applied. Most of the forage production from these areas is harvested by grazing.

3. Irrigated grass meadows: These grasslands are composed of native and introduced grasses and legumes and derive a substantial amount of their moisture requirement from surface applied irrigation water. In nearly all cases there is a water table which fluctuates between 2 and 5 feet and furnishes part of the seasonal water requirement. The irrigation water supply varies widely and production on nearly all of these grasslands is limited in some degree by water supply. These lands are maintained in grass over long periods of time and can therefore, be considered as non-rotation pasture. Most of the meadow hay is produced on this type of grassland.

Production Potential

Although production is limited by soils, water supply, and climatic factors, most of these grasslands respond to fertilizer, grazing management, pasture renovation, and conservation treatment. In general, the improved practices are being applied in the greatest intensity to the

3rd category of grassland, and cost-return analysis demonstrates the economic feasibility of most of the practices. Especially good response to improved water management and fertilizer has been observed in this category and in many similar areas throughout the mountain west. Increases of 150-250 percent in production in response to improved irrigation and fertilizer practices are commonplace.

The potential for the salt grass type of grassland is sharply restricted by the inherently low productive capacity of the grass and by the generally limited water supply. Where the water supply is not too sharply limiting, however, lesser but economically feasible increases can result from fertilizer applications and other simple practices.

Economic Effects of Pasture Improvement

Salt Grass - In general, there are areas of low production and the amounts of labor, capital and water utilized in achieving production is also at a minimum. On the areas surveyed, production ranged from .93 to 2.15 aum per acre. The higher production was produced by application of fertilizer (both turkey manure and commerical fertilizer) and some added early water.

In practice, the intensity and feasibility of conservation treatment is limited by the water supply and to a lesser extent by soil conditions. Improvement of the irrigation distribution system under existing topographic limitations and the application of fertilizer to limits permitted by the water supply are the major practices carried out.

Table 8.--Saltgrass response to fertilizer and improved management, Sevier River Basin

	Without Improvement	With Improvement
Production	1.2 aum/acre	2.5 aum/acre
Surveyed Production 427 acres	(512 aum)	(1,068 aum)
Value @ $6.25/aum	$3,200	$6,675
Inputs:		
93 acres	$ 49.30	$ 477.10 1/
334 acres	210.40	1,746.80
Totals	$259.70	$2,223.90
Cost Per AUM	$.51	$2.08
Added Increments of:		
Costs	$1,964.00	
Benefits	$3,475.00	
Benefit-Cost Ratio	1.8 to 1	

1/ Represents cost of 25# N/Acre @ 14¢ + $1.10/yr. increased water cost.

Table 8 illustrates a beneficial effect derived from improved management and fertilizer application while leaving saltgrass pasture in this same use. An additional benefit can be derived by converting saltgrass pasture to improved irrigated pasture. Physical limitations need further investigation before estimated project benefits can be reasonably assured. For this analysis, shallow irrigation wells placed in strategic wet areas are planned to lower the present water table; hence, fields producing saltgrass pasture can be converted to an improved pasture without incurring lateral tile or open drain expenses. These wells can pump excess water from the soil profile into the river system. Water developed in excess of present crop needs can be stored in existing reservoirs for later use. Water flow exchanges allowing direct flow diversion in exchange for well water can provide sufficient irrigation water to adequately irrigate these saltgrass pastures.

Present and project yields listed in Table 9 at 1.2 AUMs and 9 AUMs respectively for subbasins A, C, D, E, and F were based on sample interviews. These are average values. Soils in restricted areas contain excessive salts and limiting soil characteristics such that they are generally nonreclaimable. Project yields are adjusted to reflect these limitations. Subbasin B is shown with greater yields than the other subbasins intended to reflect the difference in growing season.

These converted acres can be irrigated by sprinkler application or by furrow irrigation. If the sprinkler system is used, less water will need to be pumped, saving power and other maintenance costs as well as land leveling costs will be eliminated. Additional on-farm costs stemming from converting saltgrass to improved pasture tabulated in Table 10 and 11 include costs for sprinkling pipe or land leveling, whichever the case may be in order to net out associated project costs before project benefits are determined. Supplemental irrigation water planned to irrigate this acreage will be from irrigation wells, either as direct application or through exchange. Relatively little expense would need to be expended to irrigate under a sprinkler system which results in a better benefit-cost ratio than the furrow application system.

Table 9.-- Benefits from converting saltgrass to improved pasture using drainage and sprinkler irrigation, Sevier River Basin, 1968

	Subbasins					
	A	B	C	D	E	F
Acres	2,910	28,410	1,480	3,360	350	1,480
Present production level - AUMs	1.2	3	1.2	1.2	1.2	1.2
Project production level - AUMs	9	15	9	9	9	9
Value of increased production @ $6.25/AUM	141,862	2,130,750	72,150	163,800	17,062	72,150
Increased on-farm costs @ $26.10/acre[1/]	75,951	1,082,421	38,628	87,696	9,135	38,628
Net benefits stemming from project measures	65,911	1,048,329	33,522	76,104	7,927	33,522
Wells and main line costs @ $9.90/acre[2/]	28,809	281,259	14,652	33,264	3,465	14,652
Benefit-cost ratio	2.3:1	3.7:1	2.3:1	2.3:1	2.3:1	2.3:1

1/ Portable sprinkler pipe @ $3.00/acre; labor to irrigate 6 times @ $7.50/acre; fences, fertilizer, etc. $15.60/acre (Subbasin B - $38.10/acre)

2/ Estimated costs taken from Vernon Watershed Work Plan

Table 10.--Benefits from converting saltgrass to improved pasture using drainage and furrow irrigation, Sevier River Basin

	Subbasins					
	A	B	C	D	E	F
Acres	2,910	28,410	1,480	3,360	350	1,480
Present production level - AUMs	1.2	3	1.2	1.2	1.2	1.2
Project production level - AUMs	9	15	9	9	9	9
Value of increased production @ $6.25/AUM	141,862	2,130,750	72,150	163,800	17,062	72,150
Increased on-farm costs @ $29.35/acre[1/]	85,408	1,174,754	43,438	98,816	10,272	43,438
Net benefits stemming from project measures	56,454	955,996	28,712	64,984	6,790	28,712
Wells and distribution canal @ $8.70/acre[2/]	25,317	247,167	12,876	29,232	3,045	12,876
Benefit-cost ratio	2.2:1	3.9:1	2.2:1	2.2:1	2.2:1	2.2:1

1/ Labor costs to irrigate 6 X @ $3.75/ac.; amortized costs for 10 years at 6 percent interest to convert saltgrass to improved pasture including land leveling, ditches, etc. @ $9.50/ac.; ditches, fences, fertilizer, etc. @ $16.10/ac. (Subbasin B - @ $41.35/ac.)

2/ Well costs including pumping costs @ $6.70/ac.; estimated lateral and main canal costs @ $2.00/ac.

Table 14.--Benefits from converting wet meadows to irrigated pastures, drainage facilities installed on-farm and a full water supply from irrigation wells, Sevier River Basin, Utah, 1968

	Subbasins					
	A	B	C	D	E	F
Acres	18,830	22,535	4,265	3,635	1,795	1,985
Present production level - AUMs	2.5	3	2.5	2.5	2.5	2.5
Project production level - AUMs	11	15	11	11	11	11
Value of increased production @ $6.25/AUM	1,000,438	1,690,012	226,600	193,128	95,368	105,462
Increased on-farm costs @ $34.30/acre	645,870	964,498	146,290	124,680	61,568	68,086
Net benefits stemming from project measures	354,568	725,514	80,310	68,448	33,800	37,376
Wells and distribution canal @ $8.70/acre	163,820	196,054	37,106	31,624	15,616	17,270
Benefit-cost ratio	2.2:1	3.7:1	2.2:1	2.2:1	2.2:1	2.2:1

Individual preferences may determine which application method is used.

The heavy saltgrass sod typical of this grass requires intensive tillage operations for three or more years before an improved pasture can be established. Under the sprinkler application system, costs associated with converting this acreage to improved pasture were assumed paid by the grain crop grown, harvested either as grain or as forage. The costs applicable in order to make this conversion are the variable costs such as grain seed, fuel, oil, labor, and repairs. Fixed ownership costs per acre are not affected by the additional saltgrass tillage operations and are not associated costs in converting these acres.

Saltgrass fields irrigated by furrow irrigation require land leveling and delivery ditches. Since these are generally one-time expenditures, followed by maintenance, total costs are amortized over a ten year period.

The benefit-cost ratio stemming from project measures for subbasins A,C,D,E, and F is 2.3:1 when applying irrigation water by a sprinkler system. Subbasin B has a benefit-cost ratio of 3.7:1.

A slightly lower benefit-cost ratio results when irrigation water is applied by furrow irrigation system. Subbasin A, C, D, E, and F has a benefit-cost ratio of 2.2:1. Subbasin B has a benefit-cost ratio of 3.9:1.

Another sizable benefit can be realized by converting wet meadows to improved pasture. Some beneficial affect to these lands will be realized once project irrigation wells are drilled and begin operation.

Due to the location of these lands, an additional drainage and land leveling per acre cost was computed in order to achieve project yields, ignoring any lowering of the groundwater table with the wells. Additional on-farm cost associated with project measures were netted out and equal benefits before project benefits were determined. The benefit-cost ratio for project measures for subbasin A, C, D, E, and F is 2.2:1, whereas the benefit-cost ratio for subbasin B is 3.7:1.