THIEF VALLEY RESERVOIR
1992 SEDIMENTATION SURVEY

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16. ABSTRACT

Thief Valley Reservoir was surveyed in June 1992 to compile field data for developing a reservoir topographic map and computing a present storage-elevation relationship. The data were also used to estimate the volume of sediment that has accumulated in the reservoir since dam closure in February 1932. The 1992 bathymetric survey used sonic depth recording equipment interfaced with an automated microwave positioning system that gave continuous depth and sounding positions throughout the reservoir. The above-water reservoir area was calculated from close interval cross sections measured from aerial photography. A new reservoir contour map was developed by the computer graphics program Surface II using the collected data.

As of June 1992, at reservoir spillway crest elevation (feet) 3133.0, the surface area was 685.1 acres and the reservoir had a total capacity of 13,307 acre-feet. Since initial reservoir storage in February 1932, 1,798 acre-feet of sediment have been trapped in Thief Valley Reservoir, resulting in an 11.9-percent loss in reservoir capacity. The average annual rate of sediment accumulation since 1932 is 30.1 acre-feet.

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THIEF VALLEY RESERVOIR

1992 SEDIMENTATION SURVEY

by

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U.S. Department of the Interior
Mission Statement

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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INTRODUCTION

Thief Valley Dam and Reservoir forms one of the major storage features of the Baker Project. The dam is located on the Powder River in Union County, about 7 miles east of North Powder and 16 miles north of Baker, Oregon (fig. 1).

Thief Valley Reservoir provides a supplemental irrigation supply for the Lower Division of the Baker Project. The Lower Division of the Baker Project was approved by the President on March 18, 1931. The facilities are operated and maintained by the Lower Powder River Irrigation District. Other major facilities of the basin include Mason Dam and Phillips Lake, located on the Powder River 11 miles southwest of Baker, Oregon. Phillips Lake supplies supplemental irrigation water to the Upper Division of the Baker Project and is operated and maintained by the Baker Valley Irrigation District.

Construction of Thief Valley Dam and Reservoir started September 12, 1931, and was completed on May 6, 1932. Initial water storage began in February 1932. The dam is a reinforced concrete, slab and buttress (Ambursen) structure. At dam crest elevation 3143.0, Thief Valley Dam (fig. 2) has:

- a structural height* of 73 feet
- a hydraulic height of 48 feet
- a top crest width of 7 feet
- a crest length of 390 feet

The spillway is an uncontrolled overflow section located in the center of the dam and has a crest elevation of 3133.0 and a length of 268.0 feet. The spillway design flow is 35,000 cubic feet per second at maximum water surface elevation 3143.0.

The outlet works, located through the face of the dam's overflow section, are controlled by two 4.8- by 6-foot slide gates. The capacity of the outlet works is 2,440 cubic feet per second at reservoir elevation 3143.0.

The 1992 reservoir survey measured a total storage capacity of 13,307 acre-feet and a surface area of 685.1 acres at reservoir spillway crest elevation 3133.0. During the 59.7 years since dam closure (February 1932 to June 1992), the capacity loss caused by sediment accumulation in the reservoir was estimated to be 1,798 acre-feet.

* The definition of terms such as "structural height," "hydraulic height," etc., may be found in manuals such as Reclamation's *Design of Small Dams* and *Guide for Preparation of Standing Operating Procedures for Dams and Reservoirs*, or ASCE's *Nomenclature for Hydraulics*.

SUMMARY AND CONCLUSIONS

This report presents the 1992 results of the first extensive sedimentation survey of Thief Valley Reservoir by the Bureau of Reclamation. The primary objectives of the survey were to:

- gather data needed for developing new reservoir topography
- compute area-capacity relationships
- estimate storage depletion caused by sediment deposition since Thief Valley Dam closure.

Standard land surveying methods were used to establish horizontal and vertical control points for the aerial and hydrographic surveys. A local horizontal grid system was established for both surveys using monumented control points located on the center line of the dam axis overlooking the reservoir area. These monuments are Reclamation bench marks with 1929 National Geodetic Vertical Datums. The bathymetric survey was run using sonic depth recording equipment interfaced with an automated survey system consisting of a line-of-sight microwave positioning unit capable of determining sounding locations within the reservoir. The system continuously recorded reservoir depth and horizontal coordinates as the survey boat was steered across close spaced gridlines covering the reservoir area. The positioning system provided information to allow the boat operator to maintain course along these gridlines. Water surface elevations measured by the land surveyors at the time of data collection were used to convert the sonic depth measurements to true lake bottom elevations.

The 1992 surface areas at predetermined 5-foot contour intervals were generated by a computer graphics program that produced a new contour map of the reservoir (fig. 3). The revised area and capacity tables were produced by a computer program that uses measured contour surface areas and a curve-fitting technique to compute area and capacity at prescribed elevation increments.

Table 1 contains a summary of reservoir watershed characteristics and sediment data for the 1992 survey. The 1992 survey determined that the reservoir has a storage capacity of 13,307 acre-feet and a surface area of 685.1 acres at spillway crest elevation 3133.0. Since closure in February 1932, the reservoir has accumulated an estimated volume of 1,798 acre-feet of sediment below spillway crest elevation 3133.0. This volume represents an 11.9-percent loss in total capacity and an average annual loss of 30.1 acre-feet. These figures indicate that a large amount of estimated sediment has accumulated in the reservoir since the original survey, but uncertainties with the original reservoir area data create questions regarding these sediment accumulation values. The 1992 survey established the present area-capacity of Thief Valley Reservoir, and a resurvey should not be necessary unless major sediment inflow occurs in the future.

DESCRIPTION OF WATERSHED

The Powder River that drains into Thief Valley Reservoir originates in northeastern Oregon along the eastern slopes of the Blue Mountains. The watershed above the dam has a drainage area of 910 square miles, of which a calculated 842 square miles contributed sediment inflow during the study period. Sediment from the remaining drainage area was trapped by Phillips Lake since water storage began in October 1967. The basin rises from elevation 3094.0 feet at the outlet works to about 9,000 feet along the Elkhorn Ridge, which forms the northeastern boundary of the Phillips Lake watershed.

The basin is elliptical in shape and lies in a south to north orientation. The western and southern portion of the basin is forested and steep. Tree cover consists of larch, pine, fir, and very little underbrush. The central portion consists of a rather broad open basin with relatively flat terrain. The valley consists of pasture, alfalfa fields, rolling sagebrush covered hills, and very few trees. Soils are loose and consist of a silty loam of moderate to deep depths.

RESERVOIR OPERATIONS

The reservoir is a multiuse facility having (following values are from June 1992 area-capacity tables):

- 7,488 acre-feet of exclusive flood control storage between elevations 3133.0 and 3143.0
- 13,307 acre-feet of active conservation storage between elevations 3094.0 and 3133.0
- 0 acre-feet of inactive storage below elevation 3094.0 (1992 survey measured a minimum elevation of 3093.8)

Records for Thief Valley Reservoir are very limited. The mean annual runoff of 177,500 acre-feet per year was obtained from Reclamation's project data book (Reclamation, 1981). Records of the reservoir operation were only available from 1961 and ranged from a minimum elevation of 3094.0 in 1961, 1966, 1967, and 1977 to a maximum elevation of 3134.8 in 1984. The limited inflow and end-of-month stage records in table 1 show the extreme annual fluctuation of the reservoir, and this type of operation is assumed to have occurred prior to 1961 also.

SURVEY METHOD AND EQUIPMENT

The Thief Valley Reservoir survey was completed using the contour method as outlined by Blanton (1982). The procedure involved collecting adequate coordinate data for developing a reliable contour map by photogrammetric and bathymetric survey methods. Columbia Basin Project Office personnel used standard land surveying methods to establish horizontal and vertical control points for both survey methods. A local horizontal grid system was established for both surveys using monumented points located in the reservoir area. The above water data were collected by aerial photography when the reservoir was nearly empty. The field survey work for the bathymetric survey involved establishing a triangulation network around the reservoir to provide horizontal and vertical control for all required grid lines and shore stations. No range lines were previously established on the lake and it was decided not to establish permanent range lines during this survey. Because of the size and shape of the reservoir, any future survey would also employ the contour method; therefore, permanent range line end markers were not necessary.

The hydrographic survey was run on June 4 and 5, 1992, with the reservoir at water surface elevation 3121.9 and 3122.2, respectively. The bathymetric survey was run using sonic depth recording equipment interfaced with an automated survey system consisting of a line-of-sight microwave positioning unit capable of determining sounding locations within the reservoir. This positioning system transmitted line-of-sight microwave signals to fixed shore stations and converted the reply time to range distances, which the system data logger used to compute the coordinate position of the sounding boat. The survey system continuously

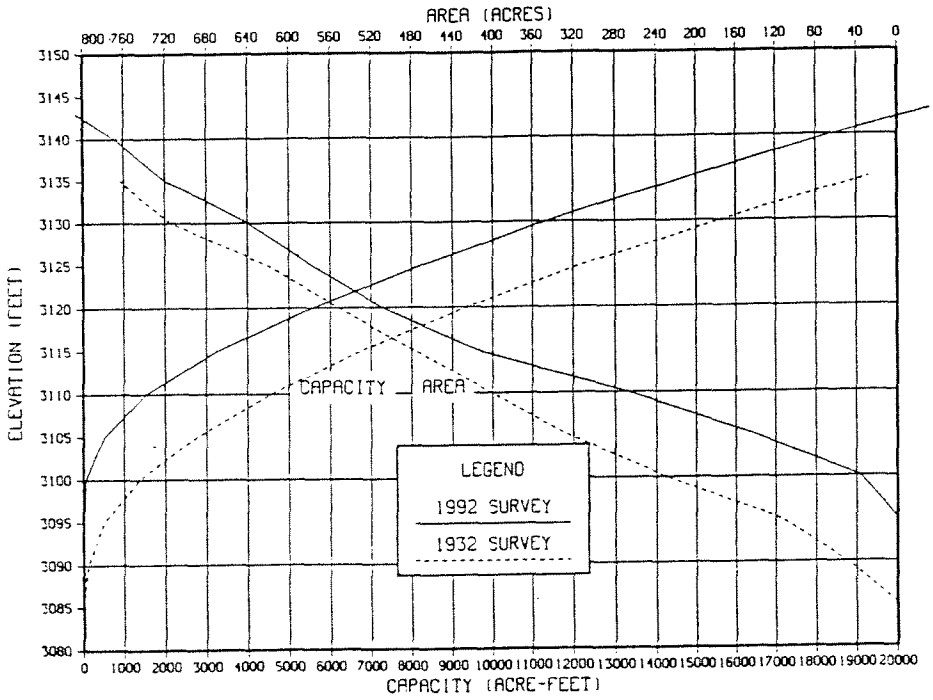
recorded reservoir depth and horizontal coordinates as the survey boat moved across close-spaced gridlines covering the reservoir area. To produce adequate data for developing contours of Thief Valley Reservoir, grid spacing of 150 to 200 feet was selected. The system gave directions to the boat operator to assist in maintaining course along the close-spaced gridlines. During each run, the depth and position data were recorded on a floppy disk for subsequent processing by Denver Office personnel. A graph plotter was used in the field to track the boat and ensure adequate coverage during the collection process. Water surface elevations surveyed at the time of collection were used to convert the sonic depth measurements to true lake bottom elevations.

RESERVOIR AREA AND CAPACITY

Original Capacity

The original (1932) total capacity of Thief Valley Reservoir was reported as 17,600 acre-feet with a surface area of 744.0 acres at spillway crest elevation 3133.0. The original values were obtained from the Thief Valley Reservoir area and capacity table dated June 29, 1949. The table indicated that the area values came from a acreage curve dated October 29, 1932.

Comparing the 1992 Thief Valley Reservoir surface area results with the original surface areas found differences in the upper elevations of the reservoir that could not be explained. The 1992 reservoir surface areas between elevations 3120.0 and 3133.0 were found to be around 9 percent smaller then the original reported areas, and elevation 3135.0 was found to be around 6 percent smaller. The field survey and operation of the reservoir gave no reason to believe that the upper reservoir area would have silted in since dam closure. The 1992 survey confirmed the reported dam crest elevation of 3143.0. A comparison plot of the 1932 original areas with the 1992 areas appeared to indicate an approximate 4-foot elevation shift between the two measurements.



Research of these differences found no clear answer that could explain them. For sediment computation purposes, the original datum was shifted 4 feet, and the original capacity was recalculated from the shifted area values. The original area of 763 acres at elevation 3135.0 became the area at elevation 3139.0. The elevation shift was completed for all of the original surface areas as listed in column (4) of table 2. The recalculated capacity values are listed in column (5) of table 2. The original stream bed elevation of 3085.0 was assumed to be the same.

Development of 1992 Contour Areas

The 1992 contour surface areas for Thief Valley Reservoir were developed by generating a contour map from the collected aerial and underwater coordinate data. Five-foot contour intervals of the lake area were created by a computer graphics software program SURFACE II (Kansas Geological Survey, 1978). A modification of this program by the Denver Office calculated surface areas of the closed contours of the generated map. The final reservoir map shown on figure 3 was prepared by the Denver Office Computer Drafting Unit of the Drafting Section. The map scale is 1 inch = 500 feet with a contour interval of five feet.

1992 Revised Storage Capacity

The storage-elevation relationships based on the aerial and underwater survey data were developed using the area-capacity computer program ACAP85 (Reclamation, 1985). Surface areas at 5-foot contour intervals computed from aerial and underwater survey data were used as control parameters for computing reservoir capacity. The program computes an area at elevation increments of 0.01 to 1.0 foot by linear interpolation between the 5-foot contour intervals. The program begins by testing the initial capacity equation over successive intervals to ensure that the equation fits within an allowable error limit, which was set at 0.000001 for Thief Valley Reservoir. This capacity equation is then used over the full range of intervals fitting within this allowable error limit. For the first interval at which the initial allowable error limit is exceeded, a new capacity equation (integrated from the basic area curve over that interval) tests the fit until it also exceeds the error limit. Thus, the capacity curve is defined by a series of curves, each fitting a certain region of data. Final area equations are derived by differentiating the capacity equations, which are of second order polynomial form:

$$y = a + a_2x + a_3x^2$$

where:

y = capacity,
x = elevation above a reference base,
a = intercept, and
a_2 and a_3 = coefficients

Results of the 1992 Thief Valley Reservoir area and capacity computations are listed in table 1 and columns (6) and (7) of table 2. Listed in columns (4) and (5) of table 2 are the adjusted original surface areas and recomputed capacity values. A separate set of 1992 area and capacity tables has been published for the 0.01-, 0.1-, and 1-foot elevation increments (Reclamation, 1992). A description of the computations and coefficients output from the ACAP85 program is included with these tables. Both the original and 1992 area-capacity curves are plotted on figure 4. As of June 1992, at reservoir spillway crest elevation 3133.0, the surface area was 685.1 acres and the total capacity was 13,307 acre-feet.

SEDIMENT ANALYSES

Sediments have accumulated in Thief Valley Reservoir to a total volume of 1,798 acre-feet since dam closure in February 1932. This volume indicates a large amount of accumulated sediment since the original survey, but the problem with the original reservoir areas (see original capacity section) creates questions regarding the accumulation value. The average annual rate of sediment deposition between closure and June 1992 (59.7 years) was 30.1 acre-feet, or 0.0338 acre-foot per square mile from the sediment-contributing drainage area. The storage loss in terms of percent of original storage capacity was 11.9 percent. Table 1 and 2 summarize the Thief Valley Reservoir sediment accumulation and water storage data based on the 1992 resurvey.

The Powder River downstream from Thief Valley Dam is a Federal Wild and Scenic River and has a substantial rainbow trout fishery. In 1991, the Pacific Northwest Regional Office conducted studies on the sediment releases from Thief Valley Reservoir. The study measured the downstream water quality as the sediment deposits on the reservoir bottom were eroded during extreme reservoir drawdown. The study concluded that maintenance of a 2,200 acre-foot minimum pool would prevent the downstream sedimentation problems. This value was determined from the collected samples and the original capacity table.

The Sedimentation Section, using the 1991 samples and reservoir trap efficiency calculations, concluded that to maintain the downstream water quality, a maximum release along with a minimum pool elevation should be recommended. Also, the maintenance of the minimum pool will increase the reservoir trap efficiency and the sediment buildup within the reservoir. Over time, the sediment buildup within the reservoir will require the minimum pool elevation to be increased to maintain the good downstream water quality.

It is recommended, for maintaining downstream water quality releases, that the reservoir operation have a minimum pool elevation of 3104.5 feet and that the maximum discharge not exceed 75 cubic feet per second near the minimum pool level. It is also recommended that periodic water samples be taken downstream during low reservoir pool conditions. These samples will better determine the maximum discharge during these conditions plus monitor the need of increasing the minimum pool elevation. The 1992 survey established the present area-capacity of Thief Valley Reservoir, and a resurvey should not be necessary unless major sediment inflows occur in the future.

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RESERVOIR SEDIMENT
DATA SUMMARY

Thief Valley Reservoir
NAME OF RESERVOIR

1
DATA SHEET NO.

DAM	1. OWNER Bureau of Reclamation[1]		2. STREAM Powder River		3. STATE Oregon	
	4. SEC. 26 TWP. 6 S. RANGE 40 E.		5. NEAREST P.O. North Powder		6. COUNTY Baker	
	7. LAT 45° 00' 45" LONG 117° 46' 50"		8. TOP OF DAM ELEVATION 3143.0[2]		9. SPILLWAY CREST ELEV. 3133.0	
RESERVOIR	10. STORAGE ALLOCATION	11. ELEVATION TOP OF POOL	12. ORIGINAL SURFACE AREA, Ac	13. ORIGINAL CAPACITY, AF	14. GROSS STORAGE ACRE- FEET	15. DATE STORAGE BEGAN
	a. FLOOD CONTROL	3143.0	895[3]	8,400	26,000	2/32
	b. MULTIPLE USE					
	c. POWER					
	d. WATER SUPPLY					16. DATE NORMAL OPERATION BEGAN
	e. IRRIGATION					
	f. CONSERVATION	3133.0	740	17,400	17,600	
	g. INACTIVE	3094.0	90	200	200	2/32
	17. LENGTH OF RESERVOIR 3.8[4] MILES			AVG. WIDTH OF RESERVOIR 0.28 MILES		
BASIN	18. TOTAL DRAINAGE AREA 910 SQUARE MILES			22. MEAN ANNUAL PRECIPITATION 10.5[5] INCHES		
	19. NET SEDIMENT CONTRIBUTING AREA 843[6] SQUARE MILES			23. MEAN ANNUAL RUNOFF [5] INCHES		
	20. LENGTH MILES	AV. WIDTH MILES		24. MEAN ANNUAL RUNOFF 177,500[5] ACRE-FEET		
	21. MAX. ELEVATION 9000+	MIN. ELEVATION 3094		25. ANNUAL TEMP. MEAN 46°F RANGE -22°F to 102°F		

SURVEY DATA

26. DATE OF SURVEY	27. PER. YRS.	28. ACCL. YRS.	29. TYPE OF SURVEY	30. NO. OF RANGES OR INTERVAL	31. SURFACE AREA, AC.	32. CAPACITY ACRE-FEET	33. C/I RATIO AF/AF
2/32			[3]	[3]	699.8[7]	15,105[7]	.08
6/92	60.3	60.3	Contour (D)	5-FT	685.1	13,307	.07

26. DATE OF SURVEY	34. PERIOD ANNUAL PRECIP.	35. PERIOD WATER INFLOW, ACRE FEET			WATER INFLOW TO DATE, AF	
		a. MEAN ANN.	b. MAX. ANN.	c. TOTAL	a. MEAN ANN.	b. TOTAL
2/32	10.5	177,500[5]	269,700[5]	-	-	-

26. DATE OF SURVEY	37. PERIOD CAPACITY LOSS, ACRE-FEET			38. TOTAL SEDIMENT DEPOSITS TO DATE, AF		
	a. TOTAL	b. AV. ANN.	c. /MI.²-YR.	a. TOTAL	b. AV. ANNUAL	c. /MI.²-YR.
2/32	1,798	30.1	0.034[8]	1,798	30.1	0.034[8]

26. DATE OF SURVEY	39. AV. DRY WT. (#/FT³)	40. SED. DEP. TONS/MI.²-YR.		41. STORAGE LOSS, PCT.		42. SEDIMENT INFLOW, PPM	
		a. PERIOD	b. TOTAL TO DATE	a. AV. ANNUAL	b. TOTAL TO DATE	a. PER.	b. TOT.
2/32				0.20[9]	11.9[9]		

26. DATE OF SURVEY	43. DEPTH DESIGNATION RANGE IN FEET BELOW TOP OF CONSERVATION (ELEVATION)											
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION											

26. DATE OF SURVEY	44. REACH DESIGNATION PERCENT OF TOTAL ORIGINAL LENGTH OF RESERVOIR														
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-105	105-110	110-115	115-120	120-125
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN REACH DESIGNATION														
	N/A														

Table 1. - Reservoir sediment data summary (page 1 of 2).

45. RANGE IN RESERVOIR OPERATION [10]

WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AF	WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AF
1961	3133.0	3094.0	-	1962	3133.0	-	-
1963	3133.0	-	-	1964	-	-	-
1965	3133.0	3096.0	-	1966	3133.0	3094.0	-
1967	3133.0	3094.0	-	1968	3133.0	3102.0	-
1969	3133.0	3105.4	-	1970	3133.0	3110.0	-
1971	3133.0	3114.0	-	1972	3133.0	3114.5	-
1973	3133.0	3104.0	-	1974	3133.0	3104.8	-
1975	3133.0	3111.7	-	1976	3133.0	3127.3	-
1977	3133.0	3094.0	-	1978	3133.0	3108.0	-
1979	3133.0	3110.0	124,210	1980	3133.0	3115.0	119,120
1981	3133.9	3109.6	138,410	1982	3134.4	3113.2	307,420
1983	3134.5	3128.1	306,770	1984	3134.8	3129.2	345,670
1985	3133.5	3114.4	161,200	1986	3134.2	3112.0	174,200
1987	3133.3	3097.5	53,920	1988	3133.4	3101.5	-
1989	3133.8	3106.0	-	1990	3133.5	3096.5	52,930
1991	3133.8	3101.6	64,910	1992	3133.4	3096.6 8/92	34,820 6/92

46. ELEVATION - AREA - CAPACITY DATA FOR ORIGINAL CAPACITY [11]

ELEV.	AREA	CAP.	ELEV.	AREA	CAP.	ELEV.	AREA	CAP.
3085	0	0	3100	401.0	4,576	3130	714.1	15,616
3095	113.7	507	3115	478.0	6,774	3133	740.0	17,803
3100	231.1	1,369	3120	552.3	9,349	3135	763.0	19,310
3105	325.4	2,760	3125	620.1	12,280			

46. ELEVATION - AREA - CAPACITY DATA FOR 1992 TOTAL CAPACITY

ELEV.	AREA	CAP.	ELEV.	AREA	CAP.	ELEV.	AREA	CAP.
3093.8	0	0	3105	143.2	514	3130	639.4	11,320
3100	35.8	66	3110	268.0	1,542	3133	685.1	13,307
3105	143.2	514	3115	415.9	3,251	3135	720.3	14,712
3110	268.0	1,542	3120	508.6	5,563	3140	767.9	18,433
			3125	577.5	8,278	3143	806.9	20,795

47. REMARKS AND REFERENCES

[1] Operated by Lower Powder River Irrigation District.

[2] Top of parapet wall is elevation 3146.0.

[3] Original area and capacity values estimated from drawing No. 115-100-2, Thief Valley Reservoir Area and Capacity curves. Original topography not located.

[4] Length and width of reservoir at elevation 3133.0.

[5] Limited records available. Presented values from Reclamation's project data book.

[6] Represents loss of contributing area since dam closure at Phillips Lake in October 1967. Total drainage area of above Phillips Lake Dam is 165 mi^2. Net contributing area 843 mi^2 = 910 mi^2 - 165mi^2 (24.6 yrs/60.3 yrs).

[7] Research concluded the original elevation versus area values should be adjusted (-) 4.0 feet to better represent the original reservoir conditions and for sediment computations. Adjusted original capacity at elevation 3133.0 of 15,105 was computed by ACAP85 using adjusted surface area values.

[8] 1798 acre-feet = 910 mi^2 (35.7yrs)X + 843 mi^2 (24.6yrs)X.
X = 0.03378 AF/mi^2-yr.

35.7 years of operation before Phillips Lake and 24.6 years after for a total of 60.3 years of operation.

[9] Average annual and total sediment deposits of 30.1 and 1,798 respectfully divided by 15,105 AF (recalulated total capacity at El. 3133 using adjusted surface area, see remark number 7.

[10] Limited records available. End of month values.

[11] Original area-capacity table reported by Bureau of Reclamation.

48. AGENCY MAKING SURVEY Bureau of Reclamation
49. AGENCY SUPPLYING DATA Bureau of Reclamation | DATE August 1993

Table 1. - Reservoir sediment data summary (page 2 of 2).

(1) Elevation (ft)	(2) Original Area (acres)	(3) Original Capacity (acre-ft)	(4) Adjusted Original Area (acres)	(5) Adjusted Original Capacity (acre-ft)	(6) 1992 Area (acres)	(7) 1992 Capacity (acre-ft)	(8) Measured Sediment Volume (acre-ft)	(9) Percent Measured Sediment	(10) Percent Reservoir Depth
3143	-	-	-	-	806.9	20,795	-	-	-
3140	-	-	-	-	767.9	18,433	-	-	-
3139	-	-	763.0	19,506	(758)	17,670	-	-	-
3135	763.0	19,310	725.2	16,530	720.3	14,712	-	-	-
3133	744.0	17,803	699.8	15,105	685.1	13,307	1,798	100.0	100.0
3130	714.1	15,616	638.8	13,097	639.4	11,320	1,777	100.0	93.8
3125	620.1	12,280	565.0	10,087	577.5	8,278	1,809	100.0	83.3
3120	552.3	9,349	493.6	7,441	508.6	5,563	1,878	100.0	72.9
3115	478.0	6,774	416.3	5,166	415.9	3,251	1,915	100.0	62.5
3110	401.0	4,576	341.4	3,272	268.0	1,542	1,730	96.2	52.1
3105	325.4	2,760	252.5	1,787	143.2	514	1,273	70.8	41.7
3100	231.1	1,369	137.4	812	35.8	66	746	41.5	31.2
3095	113.7	507	(69)	346	(2)	1	345	19.2	20.8
3093.8	(88)[1]	387	(61)	(268)	0	0	268	14.9	18.3
3090	(50)	125	(35)	87	0	0	87	4.8	10.4
3085	0	0	0	0	0	0	0	0.0	0.0

(1) Elevation of reservoir water surface.
(2) Original reservoir surface area values estimated from 1932 area curves (Drawing 115-100-2).
(3) Original reservoir capacity recomputed using ACAP85.
(4) Original reservoir surface area values with a 4-foot datum adjustment to better represent original conditions.
(5) Original reservoir capacity computed by ACAP85 using adjusted original areas.
(6) Reservoir surface area from 1992 survey.
(7) 1992 calculated reservoir capacity from 1992 survey data.
(8) Measured sediment volume = column (5) - column (7).
(9) Measured sediment expressed in percentage of total sediment (1,798), measured at spillway crest El. 3133.0. 100% measured from El. 3115.0 and above. 1992 areas measured slightly greater then original at El. 3120, 3125, and 3130 probably because of difference in survey methods and bank erosion.
(10) Depth of reservoir expressed in percentage of total depth (48 feet).

[1] Areas in ( ) computed by ACAP85.

Table 2. - Summary of 1992 survey results.

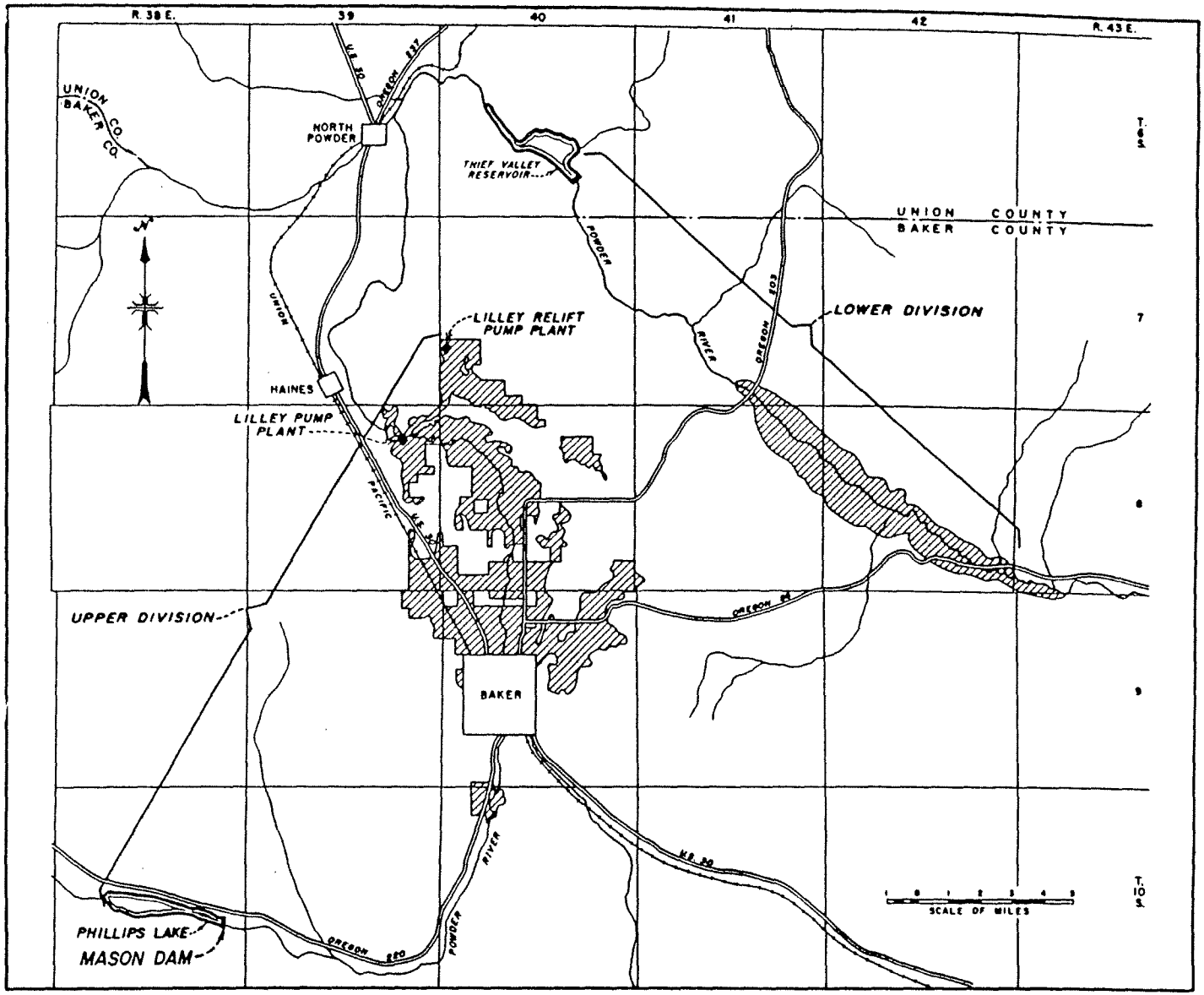

Figure 1. - Mann Creek location map.

Space intentionally left blank due to security concerns

Thief Valley Dam
Crest El. 3143

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UNITED STATES
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BUREAU OF RECLAMATION

BAKER PROJECT – OREGON

THIEF VALLEY RESERVOIR

TOPOGRAPHY

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CADD SYSTEM AUTOCAD-R12	CADD FILENAME 184-DWG	DATE AND TIME PLOTTED 8-11-93/11:30
DENVER, COLORADO	AUGUST 11, 1993	115-D-184

Figure 3. - Thief Valley Reservoir topographic map.

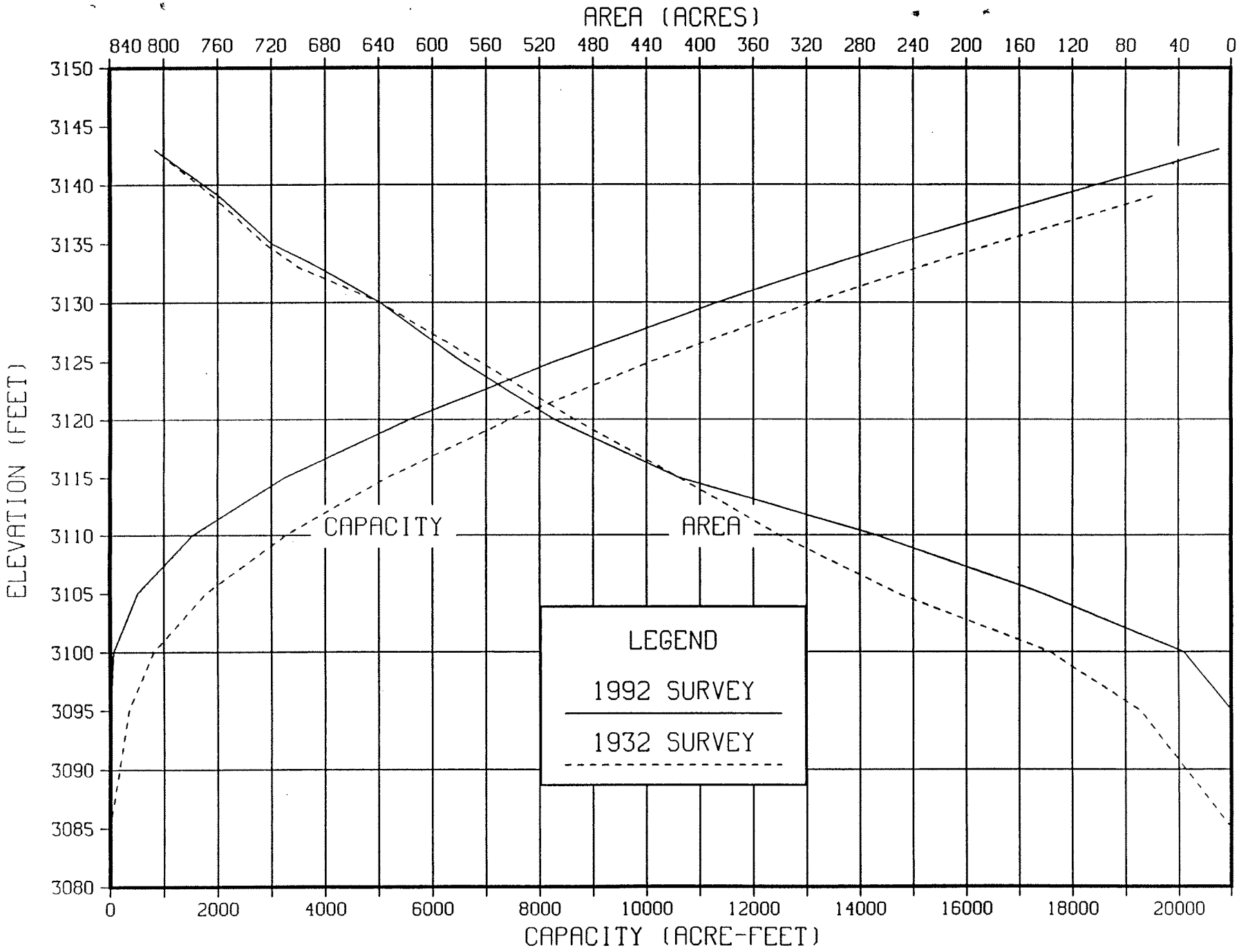

Figure 4. - 1992 area and capacity curves.

Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American Public.