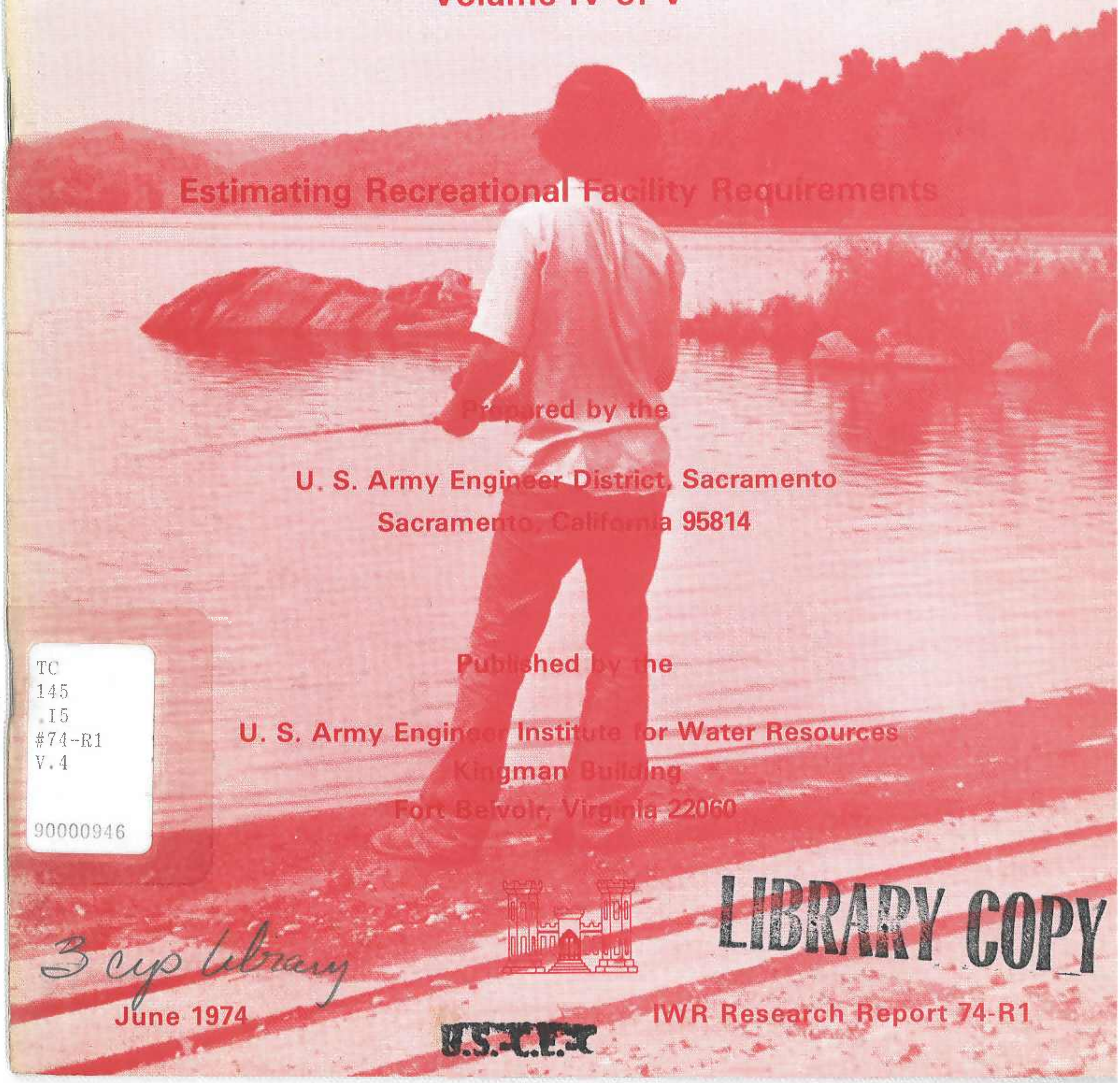
PLAN FORMULATION AND EVALUATION STUDIES — RECREATION

Volume IV of V



Estimating Recreational Facility Requirements

Prepared by the

U. S. Army Engineer District, Sacramento
Sacramento, California 95814

Published by the

U. S. Army Engineer Institute for Water Resources
Kingman Building
Fort Belvoir, Virginia 22060

June 1974

IWR Research Report 74-R1

PLAN FORMULATION AND EVALUATION STUDIES - RECREATION

Volume IV of V

Estimating Recreational Facility Requirements

A Report Submitted to the
Department of the Army
Office of the Chief of Engineers

Published by the
U. S. Army Engineer Institute for Water Resources
Kingman Building
Fort Belvoir, Virginia 22060

Prepared by

Richard E. Brown
Geoffrey Mueller

U. S. Army Engineer District, Sacramento
Sacramento, California 95814

June 1974

IWR Research Report 74-R1

This report was originally submitted to the Department of the Army, Office of the Chief of Engineers by the U. S. Army Engineer District, Sacramento. Its contents are not to be construed as necessarily representing the views of the federal government or of the U. S. Army Corps of Engineers.

ESTIMATING RECREATIONAL FACILITY REQUIREMENTS

TABLE OF CONTENTS

SUMMARY

This paper presents a general methodology for the determination of the number and type of recreation facilities needed to serve a given number of reservoir recreation days of use. It is a method synthesizing planner judgement, existing recreational use data, and the concepts of estimating annual recreational use employed by the Corps of Engineers. The data utilized was collected at 52 reservoirs over the period 1966 through 1969.

PART I: INTRODUCTION

1. Purpose and Scope. - The purpose of this report is to present a general methodology developed for estimating the number and type of principal recreational facilities (those facilities identified with a particular activity) needed to serve a given number of recreation days at a proposed reservoir. The planning procedure described utilizes existing recreational use survey data and the concepts of estimating annual recreational use employed by the Corps of Engineers.

2. References. - The planning procedure presented is a reasonably flexible tool which has been employed in coordination with the following regulations of the Chief of Engineers:

a. ER 1120-2-403, Procedure for Estimating Recreation Use.

b. ER 1130-2-312, Recreation Facilities Criteria for Design and Construction of Civil Works Projects.

c. ER 1165-2-400, Recreation Resources Planning.

3. General. - The Corps of Engineers began systematically collecting recreational use data in 1963 ". . . in order to meet our planning needs and to improve the administration of operating projects"[7]. In 1966 the Office of the Chief of Engineers (OCE) instituted an experimental program employing sampling techniques and centralized data analysis. Fifty-two reservoir projects in seven Corps of Engineers' districts (listed in

Table 1) conducted recreation use sample surveys from 1966 through 1969. The Sacramento District was designated repository for the data and, by OCE instructions of 29 March 1965, was assigned the following tasks:

a. Evaluate the data collection procedure and recommend methods for improving the accuracy of the output and for efficient Corps-wide application; see [4].

b. Develop methodology for estimating the recreational use which will occur at a reservoir project; see [3, 5, 6].

c. Develop methodology for estimating the benefits which will accrue as a result of this use; see [6].

d. Develop methodology for estimating the physical facilities required to efficiently sustain the value of this use; reported on herein.

4. The facility requirements planning methodology developed assumes the size of the proposed reservoir site has been determined and annual total recreational use estimates have been computed. The implication of this assumption is that the planning process under consideration is a process of accommodating recreational use. It is recognized that alternative investment levels can be used to inhibit or induce recreational use levels, but the purpose of the facility planning process is to respond to expected use levels, not to affect them. Typically, the annual total use estimates will reflect this purpose. The planning process can effectively employ annual use estimates derived in different ways, but familiarity with the concept of estimating from data on the "most similar

project(s)" is required. A previous report [5] details this concept and also contains activity participation statistics which are used in facility planning.

PART II: DESIGN DAY ANALYSIS

5. The Design Day. - The generally accepted definition of a design day is an average weekend day during the peak month of the design year. The expected number of people visiting a reservoir project on the design day is called the facility design day load. Principal recreation facilities are determined from the facility design day load, the expected participation on the design day in each activity requiring facilities, and the appropriate activity turnover rate.

6. There is a rational arbitrariness in the definition of a hypothetical design day. That it should be a weekend day is generally agreed upon, since more than half of reservoir use occurs on weekends. The rationale for an average weekend day rather than a peak weekend day is that the tolerance of crowding, and hence recreation capacity, is appreciably greater on peak weekend days [1]. The peak month is chosen to accommodate as many visitors as practicable. With this criterion most of the visitors can be accommodated with only minimal overcrowding occurring for short durations. (Efficiency of expenditure criterion is considered in Appendix A. If that criterion is used, the peak month may not be the basis for design.)

7. Facility Design Day Load Computation. - The computation of facility design day load is as follows:

$$\text{Facility design day load} = L = (A \times P \times E)/D \qquad (1)$$

Where A is the estimated annual attendance.

P is the average proportion of annual attendance expected during the peak month.

E is the proportion of peak month use expected on weekends.

D is the average number of weekend days during the peak month.

Hence L is the expected number of people visiting a reservoir project on an average weekend day during the peak month of use.

8. The values used in the computation can be derived as follows:

a. The estimated annual attendance, A, can be calculated in accordance with the methodology set forth in [5].

b. The peak month for the proposed project can be estimated by examination of the characteristics of the existing reservoirs that are used as similar projects and the attendance patterns at these reservoirs and others which are geographically close. The average monthly attendance percentages for the summer months of the years 1966-1969 for the 52 projects are shown in Table 1. These data are usually used in defining a peak month and for estimating P, the average percentage of annual attendance expected during the peak month. For reservoirs in the Sacramento District, the values ranged from 14 percent for Success Reservoir, with the months May or June used as the peak month, to 20 percent per month for Englebright with the month of July used as the peak month.

c. The average percentages of weekend use in summer for the years 1966-1969 at 50 of the projects are shown in Table 2. These data are used to estimate E, the percentage of peak month use expected on weekends. For the Sacramento District, the values range from 53 percent to 61 percent, and values used in the facility design day load calculations have been rounded to 50, 55 or 60 percent depending on the closeness of fit of the data for the proposed and existing projects.

d. The number of weekend days in the peak month is generally assumed to be nine.

9. Following are two examples of the calculation of the design load for a proposed project. In addition to indicating the relationship between the annual attendance and the design load figure, they show how use of different percentages for the peak month attendance (P) and the weekend attendance (E) can change the final design load. A comparison of the values may be a useful indication of the influence of these two factors upon the design load and subsequently upon the determination of the numbers of recreation facilities necessary to serve the attendance anticipated.

$$1{,}000{,}000 \times 0.20 \times 0.60 \;/\; 9 = 13{,}333$$

when P = 0.20 and E = 0.60, and

$$1{,}000{,}000 \times 0.15 \times 0.50 \;/\; 9 = 8{,}333$$

when P = 0.15 and E = 0.50.

10. Maximum Practical Use. - An estimate of annual capacity which accommodates expected use patterns, reflects observed tolerance of crowding, and is constrained by water surface acreage is called maximum practical use (MPU). Water oriented recreation at public works projects is inevitably a joint product, one of several water resource outputs. As a consequence, the water surface acres available for recreation is generally a function of output capacity for services other than recreation, e.g., flood control capacity. Therefore, recreation capacity is usually estimated for a level of water acreage independently determined. In addition, recreation capacity estimates are constrained by cyclic use distributions over time intervals. For a useful planning estimate, capacity must accommodate seasonal variation, weekend peaking and the expected distribution of use over recreational activities. It is recognized that use patterns can change. A shortening of the work week would change cyclic use patterns; a change in management and development policy would change activity use patterns. However, the timing, direction and magnitude of these changes are essentially unpredictable. Accordingly, existing use patterns at most similar projects are used to describe expected use patterns at proposed projects.

11. Maximum Practical Use Computation. - In computing MPU, the following assumptions are usually made:

a. An upper bound on the number of boaters on the design day exists as a function of boating patterns and total water surface acres.

b. The attainment of this upper bound, B_{max}, inhibits other activities on the design day proportionately. Accordingly, an upper bound on the facility design day load, L_{max}, can be computed.

c. The distribution over the year remains known from the similar projects and hence, a maximum annual attendance estimate, MPU, can be computed.

d. Maximum practical use may never be reached during the planning life of the project, or it may predictably be exceeded. In this sense, MPU is regarded as the amount of use which can exist without detriment to the quality of the recreational experience or the environmental resources.

12. An estimate of the number of persons boating on the design day can be computed as follows:

$$B = L \times (pb + ws + pf) \qquad (2)$$

Where: pb = proportion of total attendance pleasure boating.

ws = proportion of total attendance water skiing.

pf = proportion of total attendance fishing from a boat who will not also engage in water skiing or general pleasure boating.

pb and ws may be obtained from [5, Appendix C]; pf presently must be derived from the planner's judgement with consideration given to fishing characteristics at similar projects within the region and to the expected management of the fishing resource.[1/]

1/ The percent of boaters who are only fishing is unavailable from the existing survey data. However, this statistic will be available from any future surveys collected under the modified format [4].

The upper bound on boaters is estimated by:

$$B_{max} = (S \times R_b) \times W/w \qquad (3)$$

Where: S = average size of boating party.

R_b = the turnover rate for boating (this value is usually assumed equal to 2).

W = total water surface acres at average recreation pool.

w = water acres required per boat (this value is frequently assumed to be 6).

As an example, assume that the average pool size of a proposed reservoir during the peak period will be 3,000 acres and that the average boating party size will be three; that from the most similar project it has been determined that the expected percentages of pleasure boaters and water skiers will be 8 and 12 percent, respectively; and that it has been estimated that an additional 5 percent of the users will be fishing from a boat. Finally, from paragraph 9 assume that the design day load is expected to be 13,333. Then the estimate of the persons boating on the design day (equation (2)) is:

$$B = 13{,}333 \times (.08 + .12 + .05) = 3{,}333$$

and the upper bound on boaters (equation (3)) is:

$$B_{max} = (3 \times 2) \times 3000/6 = 3000.$$

13. If the number of boaters estimated from the design day load, B, is less than or equal to the estimated upper bound on boaters, B_{max}, then MPU has not been exceeded by the estimate of annual attendance, A.

However, if B is greater than B_{max}, then the design load L also exceeds its upper bound, L_{max}, where:

$$L_{max} = B_{max} / (pb + ws + pf). \qquad (4)$$

It follows then, that the attendance estimate, A, exceeds MPU where:

$$MPU = (L_{max} \times D) / (P \times E). \qquad (5)$$

Continuing the example of paragraphs 9 and 12 with A = 1,000,000, D = 9, P = 0.20, and E = 0.60, the upper bound of the design load is then:

$$L_{max} = 3,000 / (.08 + .12 + .05) = 12,000,$$

and the estimate of MPU is:

$$MPU = (12,000 \times 9) / (.20 \times .60) = 900,000.$$

In this example the estimated attendance, A, of 1,000,000 exceeds the estimate of MPU, 900,000. This implies that a deterioration of the quality of the recreational experience or of the environmental resources or both would occur unless some significant changes occurred in the expected distributions of the users over activities or some restraints were imposed to prevent the attendance from exceeding MPU.

14. It should be emphasized that the concept of maximum practical use can be employed even with relaxation of assumptions b. and c. of paragraph 11. Additional information may be available to the planner in any given situation which can enable more plausible assumptions regarding the distributions of recreational use over activities or over time. Under these circumstances, such projected changes in use distributions may be feasible and rational,

but they should be based on explicit planning assumptions (alternatives for b. and c.) regarding future use distributions. The advantage of MPU computations, as described, is the explicit incorporation of physical capacity constraints on estimates of reservoir recreational use.

PART III: FACILITY COMPUTATION

15. Facility Computation Factors. - A number of factors are applied to the previously calculated design day load value, either L or L_{max}, to obtain the numbers of facilities necessary to support that level of recreation use. The average number of persons in each group is utilized in changing number of visitors to number of parties. For calculating the distribution of parties over various activities, the percentages of participation in the different activities are used. For some activities a factor representing the percentage that wish to use developed facilities is used. For activities that involve facility use by more than one party during the day, "turnover rates" are used that express the average number of parties using the facility.

For determining the facilities necessary, the more important percentages are those for picnicking, camping, and vehicles with boat trailers. Applying these values to the design day load gives the number of persons picnicking, camping and using launching ramps, as shown in the following example.

The design load is 10,000 and selected activity percentages are: picnicking - 20%, camping - 30%, and vehicles with boat trailers - 10%. The number of persons picnicking is therefore 10,000 x 20%, or 2,000. The number of campers is 10,000 x 30%, or 3,000 while the number of boaters with a trailered boat is 10,000 x 10%, or 1,000.

16. The data show that the average number of persons per vehicle in summer has varied from 2.4 to 4.3 at single projects, with the district weighted averages ranging from 3.0 to 3.7, and with an overall average of 3.4 [5]. For Sacramento District the range is from 2.9 to 3.9, with an average of 3.4. Below is a demonstration of how persons per vehicle is used in facility computation, using a factor of 3.4:

2,000 picnickers / 3.4 = 588 parties picnicking.

3,000 campers / 3.4 = 882 parties camping.

1,000 boaters / 3.4 = 294 parties with trailered boats.

Of these three figures, the only one that can be directly translated into facilities is the number of camping parties, which shows a need for 880 campsites after rounding.

17. The number of picnickers that indicate they do not intend to use facilities is very large. This partially results from the fact that the number of picnickers includes those picnickers engaged in other activities, such as fishing or boating, for which only a small percentage would be expected to desire facilities. Tentative results indicate that on the average about 60 percent of picnickers in the Sacramento District do not intend to use facilities. A facility computation factor of 40 percent has therefore been used in the Sacramento District and should be appropriate in the remaining districts. Continuing the example in paragraph 16,

588 x 40% = 235 parties desiring picnic facilities.

18. More than one group can be expected to use certain facilities in the course of one day, and turnover rates are used to express this. For example, if on the average each picnic site is used by two families per day, picnic facilities are said to have a turnover rate of 2.0. In the Sacramento District, the turnover rates seem to depend on the origin of the day use. If a large majority of the use originates from areas close by the project (within 25 miles), a comparatively high turnover rate (on the order of 2.0) can be anticipated. If, on the other hand, the day use is principally from far away, a low rate (1.0) can be expected. Interim results of research show that turnover rates at Sacramento District reservoirs range from 1.0 to 1.9, with an average of 1.4. Using this figure in the above example we get:

> 235 picnicking parties desiring facilities / 1.4 parties per site
> = 168 sites.

This figure would be rounded to 170 sites.

19. For computing the necessary number of boat launching facilities an estimate of the daily capacity of each boat launching lane is used. This capacity is in effect a turnover rate for boat launching and, assuming a reasonable waiting time, depends on a number of use characteristics, including type of boating use, origin of use, daylight hours, and relationships to other facilities. Observation of launching use in Sacramento District, particularly under overcrowded conditions, has led to the use of an interim launch lane rate of 40 boats per day, based on fairly continuous use during

most of the day, with an average waiting time of about 5 minutes. Computation of required number of launch lanes in the example would be:

294 parties boating / 40 boats per lane = 7.35 lanes.

This would probably be rounded upward to 8 lanes. Additional information, such as the extent of marina or rental facilities, may be used to modify the number of launching lanes required.

20. Facility Design Day Estimators. - The formulas for deriving the facility requirements are described below.

$$\text{Picnic Tables} = \frac{L \times p \times f}{S \times R_p} \tag{6}$$

where: L = facility design day load.

p = proportion of total use picnicking.

f = proportion of picnickers using tables.

S = average party size.

R_p = picnic table turnover rate.

$$\text{Camp Sites} = \frac{L \times c}{S} \tag{7}$$

where: c = proportion of total use camping.

$$\text{Boat Lanes} = \frac{L \times bt}{S \times R_b} \tag{8}$$

where: bt = proportion of visitors with boat trailers.

R_b = boat lane turnover rate.

TABLE 1

Average Monthly Attendance Percentages 1966-1969

District	Project	May	June	July	August
			Months		
Fort Worth	Belton	12.3	14.7	14.7	13.1
	Benbrook	13.1	14.4	17.7	11.1
	Dam B	10.8	16.9	17.0	13.3
	Grapevine	13.5	16.1	19.2	13.7
	Hords Creek	11.8	17.4	21.1	17.6
	Lavon	10.8	12.5	14.2	10.1
	Garza-Little Elm	11.5	14.4	14.1	14.0
	Navarro Mills	11.1	13.3	15.0	12.4
	Proctor	14.3	13.9	16.7	13.2
	San Angelo	12.4	10.2	10.4	9.0
	Whitney	9.9	15.5	13.5	11.9
	Canyon	10.2	12.2	16.4	12.1
Little Rock	Beaver	11.5	14.1	15.1	14.2
	Bull Shoals	10.4	13.7	16.7	14.9
	Greers Ferry	12.5	17.3	20.8	16.5
	Norfork	10.2	15.9	18.9	15.0
	Table Rock	10.0	16.1	18.6	17.1
Nashville	Center Hill	12.6	16.1	17.6	13.3
	Cheatham	12.4	12.2	12.8	11.2
	Dale Hollow	11.5	16.8	22.1	14.2
	Lake Cumberland	12.5	16.3	21.9	14.6
	Old Hickory	13.9	18.8	17.9	13.3
Portland	Cottage Grove	10.8	18.7	30.9	21.4
	Detroit	11.1	17.1	22.4	22.5
	Dorena	11.3	14.0	21.1	14.7
	Fern Ridge	12.0	18.2	24.0	17.7
	Hills Creek	12.5	13.5	21.7	20.1
	Lookout Point	7.9	17.7	22.9	17.2
	The Dalles	10.4	15.3	19.4	18.4
Sacramento	Black Butte	13.8	13.8	15.8	10.3
	Englebright	11.7	16.1	20.2	15.1
	Isabella	17.3	13.2	17.8	14.5
	New Hogan	15.7	14.4	15.5	12.3
	Pine Flat	14.3	17.0	15.7	14.4
	Success	13.6	13.6	12.7	11.1
	Terminus	15.9	12.9	12.4	14.1

District	Project	May	June	July	August
		Months			
Savannah	Clark Hill	12.1	16.2	18.7	13.2
	Hartwell	12.5	14.9	16.8	11.0
Tulsa	Canton	15.1	15.5	17.7	14.6
	Denison	10.7	14.9	16.8	11.0
	Eufaula	12.0	12.7	16.0	14.2
	Fall River	12.6	13.5	16.9	14.5
	Fort Gibson	9.8	13.0	16.7	13.7
	Fort Supply	15.1	14.6	15.7	13.2
	Great Salt Plains	16.0	16.4	18.8	13.7
	Heyburn	9.5	16.2	18.5	15.2
	Hulah	13.2	14.0	16.2	13.6
	Keystone	13.6	14.8	17.0	13.5
	Oologah	12.1	13.7	15.2	11.7
	Tenkiller	10.0	14.0	17.6	16.2
	Toronto	10.9	16.4	18.8	12.3
	Wister	12.8	13.0	10.8	10.7

TABLE 2
Average Summer Weekend Use Percentages

District	Project	Range	Average
Fort Worth	Belton	47-74	65
	Benbrook	53-72	61
	Dam B	52-63	57
	Grapevine	57-70	65
	Hords Creek	55-64	61
	Lavon	63-72	69
	Garza-Little Elm	65-76	71
	Navarro Mills	60-69	65
	Proctor	42-63	56
	San Angelo	55-59	57
	Whitney	49-70	57
	Canyon	64-71	68
Little Rock	Beaver	33-45	38
	Bull Shoals	45-51	47
	Greers Ferry	50-62	58
	Norfork	43-52	48
	Table Rock	46-50	48
Nashville	Center Hill	37-63	52
	Cheatham	51-66	59
	Dale Hollow	40-54	46
	Lake Cumberland	46-54	50
	Old Hickory	53-64	60
Portland	Cottage Grove	54-74	60
	Detroit	54-58	56
	Dorena	51-65	59
	Fern Ridge	43-58	51
	Hills Creek	51-81	62
	Lookout Point	49-58	54
	The Dalles	43-52	48
Sacramento	Black Butte	44-56	53
	Englebright	40-68	55
	Isabella	53-70	61
	New Hogan	55-66	60
	Pine Flat	49-68	61
	Success	51-71	60
	Terminus	52-62	56

District	Project	Range	Average
Tulsa	Canton	62-64	63
	Denison	57-65	62
	Eufaula	56-66	59
	Fall River	67-83	74
	Fort Gibson	59-76	65
	Fort Supply	55-70	62
	Great Salt Plains	63-82	70
	Heyburn	53-63	57
	Hulah	47-75	60
	Keystone	52-78	61
	Oologah	57-65	61
	Tenkiller	55-68	64
	Toronto	55-71	65
	Wister	49-64	58

REFERENCES

[1] James, L. D., "Economic Optimization and Reservoir Recreation," Journal of Leisure Research, Vol. 2, No. 1, Winter 1970, pp. 16-29.

[2] Goldin, K. D., "Recreational Parks and Beaches: Peak Demand, Quality and Management," Journal of Leisure Research, Vol. 3, No. 2, Spring 1971, pp. 81-107.

[3] Pankey, V. S. and W. E. Johnston, "Analysis of Recreation Use of Selected Reservoirs in California," Plan Formulation and Evaluation Studies - Recreation, Contract Report No. 1, U. S. Army Corps of Engineers, July 1969.

[4] U. S. Army Corps of Engineers, "Evaluation of Recreation Use Survey Procedures," Plan Formulation and Evaluation Studies - Recreation, Technical Report No. 1, October 1969.

[5] U. S. Army Corps of Engineers, "Estimating Initial Reservoir Recreation Use," Plan Formulation and Evaluation Studies - Recreation, Technical Report No. 2, October 1969.

[6] U. S. Army Corps of Engineers, "A Preliminary Analysis of Day Use Recreation and Benefit Estimation Models for Selected Reservoirs," Plan Formulation and Evaluation Studies - Recreation, Technical Report No. 3.

[7] U. S. Army Corps of Engineers, Office of the Chief of Engineers letter, subject: Public Use Visitation Data at Civil Works Projects, dated 19 December 1962.

APPENDIX A
BENEFIT-COST ANALYSIS

1. Efficiency of Expenditure Criterion. - Incremental benefit-cost analysis assists the design of the reservoir projects covered by the facility design day planning procedure. It is therefore appropriate to consider similar analysis of recreational facility investments. Theoretically, incremental benefits derived from additional primary facilities decrease as the amount of facilities already provided increases. An initial set of facilities may be used much of the year, but as facilities are added they will tend to be less used during off peak periods.[1/] On the other hand, incremental costs of additional facilities can be expected to increase as the more readily developed sites are used up. Eventually, the benefits derived from the use of increased facilities will be less than the cost of providing them. Under the efficiency of expenditure criterion, recreation facilities should be provided up to the point where the unit benefit attributable to the last facility equaled its cost.

2. A Campsite Example. - For an example, consider a proposed project campground which has an estimated physical capacity of 300 campsites, and assume the following data apply.

a. Costs. - Incremental costs for campsites and appurtenances are constant and amortized at $200 per year per site.

1/ For an elaboration of this, see [2].

b. Benefits. - Incremental benefits derived from additional sites decrease only due to reduced annual use of succeeding sites. The benefit derived by a camping party from a developed site is constant and equals $4.00 per night.

c. Expected Use. - If all camping were accommodated, it is estimated that use at the campground would be equivalent to 16,650 parties camping one night each. Peak period occupancy on weekends and holidays for the months April through September is expected to be as follows:

	Apr	May	Jun	Jul	Aug	Sep
Maximum sites used in month	165	210	210	210	195	135
Number of nights that maximum is utilized	10	10	10	10	10	10

For the remaining nights of the year, a 135-site campground would never be full and the average utilization would be 40 nights per site.

3. If 135 campsites are developed they will all be occupied on 60 nights during the peak nights and average an additional 40 nights occupancy during the year. The average benefit per campsite will equal 100 nights x $4.00/night = $400. The incremental benefit derived from the last site will equal 60 nights x $4.00/night = $240. If an additional 30 campsites are provided, they will be occupied 50 nights, and the benefit derived per site will equal $200. However, if five more sites are developed, they will only be occupied 40 nights, and the benefit derived per site will equal $160, which is less than the $200 cost of providing the site.

Campsites	Total $Benefits	Total $Costs	Benefits/ Costs	Incremental Benefits/ Incremental Costs
135	54,000	27,000	2.00	1.20
165	60,000	33,000	1.81	1.00
170	60,800	34,000	1.78	0.80

In this example, the optimal number of campsites would be 165. For the design day analysis solution, the appropriate values would be:

210	66,600	42,000	1.58	0.60

4. Qualifications. - The use of incremental benefit-cost analysis as a recreation facility planning tool is constrained by the imprecision of required input. In the campsite example, this constraint was resolved by the set of initial assumptions, which although reasonable, oversimplify a number of considerations. Any use of benefit-cost analysis as a supplement to design day analysis should explicitly accommodate these considerations.

a. Current assessment of value or benefit derived by a visitor is without regard to activity participation. An average unit value is estimated per recreation day. Benefits are therefore independent of facilities and assumed to be the same for a picnic site or for a campsite or for a boat launching ramp.

b. The benefit derived from the facilities is not the total willingness to pay for the visit which includes use of these facilities. The value of primary facilities is an incremental benefit due to increased quality or convenience. The absence of facilities may inhibit but will not prohibit the derivation of benefit from the basic resources, namely, the reservoir and adjacent lands.

c. An insufficient supply of facilities during peak periods yields two kinds of adverse effects. The first is the loss to the visitors from unmet expectations of public projects. Possibly more important, however, is the potential deterioration of the environmental resources from unplanned and unmanaged recreational use over a prolonged period of time.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER IWR Research Report 74-R1	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Plan Formulation and Evaluation Studies - Recreation "Estimating Recreational Facility Requirements, Volume IV of V"		5. TYPE OF REPORT & PERIOD COVERED Technical Report IV 1963 - 1973
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Richard E. Brown Geoffrey Mueller		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Engineer District, Sacramento 650 Capitol Mall Sacramento, California 95814		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DA, Office of the Chief of Engineers Forrestal Building Washington, D. C. 20314		12. REPORT DATE June 1974
		13. NUMBER OF PAGES 28
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) US Army Engineer Institute for Water Resources Kingman Building Fort Belvoir, Virginia 22060		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release.
Distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Recreation Benefits; Recreation Day Use of Reservoirs; Estimating Recreation Demand

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This paper presents a general methodology for the determination of the number and type of recreation facilities needed to serve a given number of reservoir recreation days of use. It is a method synthesizing planner judgment, existing recreation use data, and the concepts of estimating annual recreational use employed by the Corps of Engineers. The data utilized was collected at 52 reservoirs over the period 1966 through 1969.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)